TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS FOR SUPPORT MAINTENANCE GUIDED MISSILE SYSTEM SHOP EQUIPMENT AN/TSM-96: DIGITAL MULTIMETER, FLUKE MODEL 8375A/CF NSN 4935-01-084-1426

CHAPARRAL AIR DEFENSE GUIDED MISSILE SYSTEM

DEPARTMENT OF THE ARMY **FEBRUARY 1982**

WARNING

DANGEROUS VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation red hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

WARNING

Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration, refer to FM 21-11.

EXTREMELY DANGEROUS POTENTIALS

greater than 500 volts exist in the following units:

Technical Manual
No. 9-6625-586-14/2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 2 February 1982

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS) FOR SUPPORT MAINTENANCE GUIDED MISSILE SYSTEM SHOP EQUIPMENT AN/TSM-96: DIGITAL MULTIMETER, FLUKE MODEL 8375A/CF (NSN 6625-00-908-8790)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to Commander, US Army Missile Command, ATTN: DRSMI-SNPM, Redstone Arsenal, Alabama 35898. A reply will be furnished to you.

TABLE OF CONTENTS

This manual is an authentication of the manufacturer's commercial literature which, through usage, has been found to cover the data required to operate and maintain this equipment. Since the manual was not prepared in accordance with military specifications, the format has not been structured to consider levels of maintenance.

LIST OF ILLUSTRATIONS

LIST OF TABLES

Section O. INTRODUCTION

0-1. Scope. This manual contains instructions for the operation and organizational, direct support and general support maintenance of Digital Voltmeter, Fluke Model 8375A/CF. Throughout this manual, Digital Voltmeter, Fluke Model 8375A/CF is referred to as the 8375A.

0-2. Indexes of Publications.

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

0-3. Forms, Records, and Reports.

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 735-11-2/NAVSUPINST 4440.127E/AFR 400-54/MCO 4430.3E and DSAR 4140.55.

c. *Discrepancy in Shipment Report* (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/-NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

0-4. Reporting Equipment Improvement Recommendations (EIR). If your 8375A needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Missile Command, ATTN: DRSMI-SNEM, Redstone Arsenal, Alabama 35898. We'll send you a reply.

0-5. Administrative Storage. To prepare the 8375A for administrative storage, perform the procedures described in Section 4, Maintenance and Calibration. Upon removal from administrative storage, perform the procedures described in Section 4, Maintenance and Calibration, to determine that the equipment is fully operational.

0-6. Destruction of Army Electronics Materiel. Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 9-1425-585-14.

Section 1
Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 8375A is a versatile digital multimeter with five full decades of digits plus a sixth digit for 20% overrange. The instrument offers five ranges of dc voltage measurement including autorange, autopolarity, and switchable active filtering. Four ranges of true rms ac voltage measurement and seven ranges of resistance measurement are also included.

1-3. Fluke's Recirculating-Remainder A/D conversion technique is used in the 8375A. This conversion circuitry periodically samples the input and serially digitizes the sample, providing a reliable instrument with high long-term accuracy and linearity plus superior environmental characteristics.

1-4. DC voltages are measured on five ranges with up to one microvolt of resolution. Overranging of 20% with 1100 volt overload capability further characterizes these ranges. A non-blinking readout contains an in-line readout tube display showing polarity, overrange digit, and five full decades of digits followed by a lighted function annunciator. The speed at which the readout updates is controlled by a sample rate control.

1-5. True-rms ac voltages to 1100 volts are measured on four ranges over a frequency domain of 10 Hz to 100 kHz with up to 10 microvolts resolution. Also, proper measurement of waveforms with high distortion and high crest factor characteristics can be made with this true-rms converter.

1-6. True four-terminal resistance measurements on the 10-ohm through 10K-ohm ranges are made with low power dissipation in the unknown resistor. The instrument autoranges through all resistance ranges, from 10 ohms to 10 megaohms, with up to 100 microohms resolution.

1-7. Pushbutton selection, 1000-volt guarding, full autoranging, instantaneous auto-polarity, and calibration of all functions through the top guard cover are standard features of the 8375A.

1-8. Isolated four-terminal DC/DC ratios are measured in real time via the DC External Reference option. The Reference input LO terminal may be elevated by as much as + 13V from the input LO terminal without loss of ratio accuracy. Furthermore, the standard reference voltage span of +IV to +10.5V permits measurement of ratios from a wide number of sources. Special reference voltage ranges are available on request.

1-9. Isolated Data Output and Isolated Remote Control options use guarded toroids to transfer data and commands to and from the 8375A with no degradation of common-mode rejection specifications. These options are also DTL/TTL compatible and are designed to permit multiplexing of several 8375A's on common sets of control and data output lines. Moreover, they are buffered to prevent interaction between the DMM and the acquisition/control devices.

1-10. External Triggering of the 8375A is accomplished via its Data Output Unit, and resulting data may be acquired fully in parallel BCD format or serially by character in multiples of four bits. A single control line enables automatic time delays that allow for full settling of the analog input prior to digitization of the data transferred. Five flags provide continuous measurement status information for the acquisition device.

1-11. Remote Control is exerted by contact closures or logic levels. The 8375A's Control Command Storage feature permits the 8375A to latch on commands, which may be later removed from inputs while the 8375A retains the commanded function and range in internal memory.

1-12. SPECIFICATIONS

DC VOLTS

RANGES .... ±0.1V, ±1V, ±10V, ±100V, ±1000V (automatic polarity selection)

Note The 8375A will autorange through all voltage ranges.

Resolution .... ±0.001% of range, (1µV maximum on ±0.lV range)

Overrange .... 20%, +1100V maximum input on ±1000V range

Overload. .... ±1100V DC or RMS (±1500V peak) may be continuously applied .... to any range without damage

ACCURACY (To 120% of range or ±1100V maximum input)

24 hours	±10V, ±100V, ±1000V ranges.	±(0.002% of input + 0.001% of range)
(23°C ± 1°C)	±1 V range	±(0.003% of input + 0.002% of range)
	±0.1 V range........	±(0.003% of input + 0.005% of range)
90 days	±10V, ±100V, ±1000V ranges.	±(0.004% of input + 0.001% of range)
(18°C to 28°C)	±1 V range	±(0.005% of input + 0.002% of range)
	±0.1V range........	±(0.005% of input + 0.005% of range)
1 year	±10V, +100V, ±1000V ranges.	±(0.01% of input + 0.001% of range)
(18°C to 28°C)	±1V range.	±(0.02% of input + 0.002% of range)
	±0.1V range	±(0.02% of input + 0.005% of range)

Temperature Coefficients (0°C to 18°C and 28°C to 50°C)

±10V, ±100V, ±1000V ranges........ ±(0.0003% of input + 0.0001% of range)/C

±1 V range .... ±(0.0004% of input + 0.0002% of range)/°C

±0.1V range .... ±(0.0005% of input + 0.0006% of range)/°C

Input Impedance's
- ±10V range........ 10,000 megaohms
- ±1V range .... 1000 megaohms
- ±0.1V range........ 100 megaohms
- ±100V, ±1000V range .. 10 megaohms

} shunted by less than 100 p.f.

Offset Current at 23°C ± 1 °C. .... Less than ±5 pa. on any range.

Temperature Coefficient .... Less than ±1 pa./°C on any range

Zero Stability .... Better than 5µV for 90 days after a one hour warmup

NOISE REJECTION

Normal Mode (filtered)........ Greater than 65 db @ 60 Hz (60 db @ 50 Hz)

Maximum superimposed AC Voltage........ 50% of range peak AC, maximum

NOTE: The Normal Mode and Common Mode Rejection are not 60 Hz harmonic oriented due to the broadband response of the active 4 pole filter (80 db per decade attenuation) and therefore will reject random noise at any frequency.

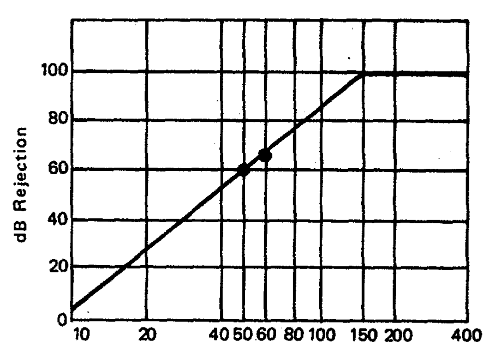
Common Mode (with up to 1 K unbalance in either lead)

DC .... Greater than 140 db

AC to 60 Hz, Filter "in" .... Greater than. 140 db

Filter "out" .... Greater than 100 db

Typical 8375A, Normal Mode Noise Rejection, Filter In.



Frequency (Hz)

The Fluke 8375A is not dependent on 60 Hz harmonics and therefore will reject random noise at any frequency. The same applies to

NOTE: Common Mode Rejection specifications are maintained with any combination of options installed and are unaffected when grounded devices are used in conjunction with the remote control or data output options.

RESPONSE TIME (from an input step change to a completed reading within 0.005% of the change when externally triggered)

Filter "out" .... ≤33ms on 10V, 100V an 1000V ranges, ≤ 39 ms on 1V range, ≤ 129 ms on 0.1V range.
Filter "in" . ... 500 milliseconds on all ranges.

TRUE RMS AC VOLTS

For Measurement of DC-Coupled (AC+DC) Voltages or AC-Coupled (AC only)(3)

RANGES .... 1, 10, 100, 1000 VAC
Overrange . ... 20%, 1100V RMS maximum on 1000V range
Resolution . ... 0.001% range (10µV on 1V range)
Overload ... . 1100V RMS any range (1500V peak AC)
Superimposed DC (AC only) . ... 1100V DC (Peak AC plus DC may not exceed ± 1500V)

Max. Crest Factor . . . . **7 at full-scale and increasing down scale per:** $7X\sqrt{\dfrac{\text{V Range}}{\text{V Input}}}$

ACCURACY SPECIFICATIONS 23°C ± 5°C, 0.001V - 1100V *(2)* **± (% of input + % of range)**

	AC + DC (90 days)	AC Only (90 days)	AC + DC (1 year)	AC Only (1 year)
DC	± (0.1 + 0.03)		± (0.13 + 0.07)	
10Hz-20Hz	± (1.0 + 0.06)	± (1.0 + 0.04)	± (1.3 + 0.1)	± (1.3 + 0.06)
20Hz-50Hz	± (0.5 + 0.03)	± (0.5 + 0.012)	± (0.65 + 0.07)	± (0.65 + 0.032)
50Hz-10kHz *(1)*	± (0.1 + 0.03)	± (0.1 + 0.02)	± (0.13 + 0.07)	± (0.13 + 0.04)
10kHz-30kHz	± (0.2 + 0.06)	± (0.2 + 0.04)	± (0.26 + 0.1)	± (0.26 + 0.06)
30kHz-50Hz	± (0.3 + 0.12)	± (0.3 + 0.1)	± (0.39 + 0.16)	± (0.39 + 0.12)
50kHz-100kHz	± (1.5 + 0.4)	± (1.5 + 0.4)	± (1.95 + 0.4)	± (1.95 + 0.4)
100kHz-300kHz	± (4.0 + 1.0)	± (4.0 + 1.0)	± (5.0 + 1.0)	± (5.0 + 1.0)
Temperature Coefficients *(3)*	± (0.004 + 0.004) /°C	± (0.004 + 0.001) /°C	± (0.004 + 0.004) /°C	± (0.004 + 0.001) /°C

(1) With inputs above 500V multiply accuracy by $\left[\dfrac{2000V + V\,input}{2000V}\right]$ *(3) 0°C to 50°C, to 10KHz*

(2) Input volt x hertz, product should not exceed 2×10^7

Temperature Coefficients (0°C to 18°C and 28°C to 50°C)
DC and 10 Hz - 10 kHz (AC + DC) ±(0.004% Inp. +0.004% Range)
10 Hz- 10kHz (AC only).................. ±(0.004% lnp. +0.001% Range)
Input Impedance . ... 1 Megaohm, shunted by less than 150 pf.

NOISE REJECTION

Common Mode (with up to 100Ω unbalance in either lead)
DC to 60 Hz .... Greater than 120 db

RESPONSE TIME (to a reading within 0.1% of range when measuring step change inputs and using external trigger)

Filter "out... 100 milliseconds maximum(4)
Filter "in". .... 500 milliseconds maximum
(For readings less than 10% Range, double indicated times).
(4) Above 400Hz for rated accuracies.

RESISTANCE

RANGES 10Ω, 100Ω, 1000Ω, 10,000Ω, 100KΩ, 1000KΩ, 10,000KΩ
NOTE: Model 83 75A will autorange through all resistance ranges.
Resolution .... 0.001% of range, (100uΩ maximum on 10Ω range)
Overrange .... 20%, 12 megaohms maximum on 10,000K range
Overload, 10Ω - 10,000Ω ranges............... 20V RMS (fused-spare supplied)
100KΩ - 10,000KΩ ranges. .... Up to 250V RMS may be continuously applied without damage.

ACCURACY (To 120% of range)

90 Days,	100kΩ - 1000kΩ ranges	±(0.01% of input + 0.002% of range)
(18°C to 28°C)	100Ω .- 10,000Ω ranges	±(0.01% of input + 0.003% of range)
	10Ω range	±(0.01 % of input + 0.01% of range)
	10,000kΩ range	±(0.05% of input + 0.002% of range)

Temperature Coefficients (0° to 18°C and 28° to 50°C)

100kΩ, 1000kΩ ranges	±(0.0007% of input + 0.0001% of range)/°C
10,000kΩ range	±(0.003% of input + 0.0001% of range)/°C
100Ω- 10,000Ω ranges	±(0.001% of input + 0.0002% of range)/°C
10Ω range	±(0.001% of input + 0.0005% of range)/°C
CONFIGURATION	True 4-terminal through 10,000Ω range and 2 terminal on the 100KΩ through 10,000KΩ ranges.

Current through R measured

Range	10Ω	100Ω	1000Ω	10,000gΩ	100KΩ	1000KΩ	10,000KΩ
Current	10 ma		1 ma		100µa	10µa	1 µa

Maximum Lead Resistance (for less than 0.001% of range effect on accuracy)

4 terminal mode, Current Leads	10Ω in both leads on 10Ω range and 100Ω on all other ranges
Voltage Leads	1 KΩ in either lead on all ranges
2 terminal mode	Less than 0.001 % of range lead resistance

RESPONSE TIME (From an input step change to a completed reading within 0.01% of the change when externally triggered)

Filter "out"	≤33 ms on 100k and 1000kΩ ranges, ≤ 39 ms on 100, 1000, and 10,000Ω ranges, ≤ 129 ms on 10Ω range, 33 to 60 ms on 10,000kΩ range.
Filter "in"	500 milliseconds on all ranges

GENERAL

Total Digitizing Time	18 milliseconds
Sample Aperture.	3 milliseconds
Autozero	3 milliseconds
Sample Rate	Up to 30 readings per second, when externally triggered via Data Output Option, 8375A-03. Manually variable from 13 per second to one per 4.5 seconds via front panel sample rate control.
Autorange Time Filter "out"	50 milliseconds per range change
Filter "in"	280 milliseconds per range change
Filter	4-pole active filter for use with DC volts, AC volts, and Resistance measurements
Range Selection	Manual, Automatic Standard; Remote Optional
Function Selection	Manual Standard, Remote Optional, Autoranges from Ω to KΩ
Display	In-line neon-tube display of polarity, overrange digit and 5 full decades of digits, with automatic decimal placement plus an illuminated function annunciator.

Overload Limits (maximum voltage that may be continuously applied without damage)

"Hi" to "Lo".	See individual function under "range", & "overload"
"Lo" to "Guard"	±100V DC or peak AC
"Guard" to "Chassis"	±1000V DC or peak AC maximum Common Mode Voltage

Temperature Range,	Operating	0°C to +50°C
	Non-Operating	-40°C to +75°C
Humidity Range	00°C to +25°C	Less than 80% relative Humidity
	+25°C to +50°C	less than 70% relative Humidity
Altitude Range	Operating	To 10,000 feet (3,048 kM)
	Non-Operating	To 50,000 feet (15,25 kM)
Shock and Vibration		Meets requirements of MIL-T-21200H and MIL-E-16400F
Operating Power (including options)		115/230 VAC ± 10%, 50 to 440 Hz, Less than 25W

Weight (including Options)....... .... Less than 20 pounds (9.08 kg)
Size . ... 3Ya H x 17" W x 17.2" D (88,lmm x 432mm x 436,9mm)
Warm-up Time. .... 20 minutes to 1 year accuracy, 1 hour to full accuracy
MTBF .... 10,000 hours

ISOLATED DATA OUTPUT (Using Option 8375A-03)

NOTE: Two mating connectors are supplied.

Data Available... Digits, polarity, range, functions
Coding .... 8 4 2 1 BCD, digits and range
Logic Levels.......... .... 1 = +5V, 0 = 0V (Series 930 DTL with 6K pullup)
Maximum Trigger Rate................................... 30 per second
Flags .... Digitizing, Remotely Controlled, Remotely Triggered, Busy, Overload, Sample Sync
Acquisition . ... Full parallel or serial by character in multiples of 4 bits
Automatic Adaptive Timeouts.......................... Automatic delays to allow for settling time of all analog inputs are enabled via a single logic input line

ISOLATED REMOTE CONTROL (Using Option 8375A-04)

NOTE: Mating connector is supplied

Control Levels .... 0 = function call, 1 = function inactive
Logic Levels .... 0 = Contact closure or 0V, 1 = open or +5V
Input Definition .... Series 930 DTL
Control Command Storage...... .... Continuous or addressed remote control of instrument. Triggered address control allows the 8375A to "latch" to input commands. Following latch, the commands may be removed but the functions and ranges commanded will continue to be in effect until the next address trigger.
Interlocks.. Incompatible function or simultaneous ranges cannot be called.
No Call . ... Volts DC and autorange called
Flag .... Remotely control Flag in Data Output Unit

NOTE: Requires +5Vpower (150SOmA)from Data Output Unit or external power supply which can be supplied as a special item Contact factory for further details.

ISOLATED DC EXTERNAL REFERENCE (4-Wire DC/DC Ratio using Options 8375A-05 and 8375A-07)

NOTE: Mating connector is supplied

REFERENCE INPUT

Type.. True 4-Wire, Real Time
Voltage Range .... +1V to +10.5V
Input Resistance .... 1 megaohm ±0.1%
Isolation of Reference and Input Commons .... Input Hi to Reference Lo difference not to exceed ±1 3V on 10V
NOTE: Fused to prevent damage................... and lower DC Voltage ranges

RATIO RANGES.. ±0.01:1, ±0.1:1, ±1:1, ±10:1, ±100:1
Resolution . ... ±0.001% of DC Voltage range, (0.000001: 1 maximum on ±0.01: 1 ratio range)
Overrange... 20%, 110: 1 maximum input on 100: 1 range

NOTE: $\frac{\text{\% Input Voltage Range}}{\text{\% Reference Voltage Range}}$ *must be less than 1.2 for a non-overrange reading.*

Overload .... ±1100V DC or RMS (±1500V peak) may be continuously
.... applied to the numerator (input) terminals without damage.
Reading vs. Ratio .... 10 x Ratio

ACCURACY (To 120% of ratio range)

	±1:1, ±10:1, ±100:1 ratio ranges....	±(0.005% of Reading + 0.002% x (10V/Vref)of DC Voltage range)
90 days (18°C to 28°C)	±0.0:1 ratio range	±(0.005% of Reading + 0.004% x (10V/Vref)of DC Voltage range)
	±0.01:1 ratio range	±(0.005% of Reading + 0.01% x (10V/Vref)of DC Voltage range)

NOTE: 24 hour and I year specifications available upon request.

Temperature Coefficients (0°C to 18°C and 28°C to 50°C)

±1:1, +10:1, ±100:1 ratio ranges.....	±(0.0003% of Reading + 0.0001% x (10V/Vref) of DC Voltage range)°/C
±0.1:1 ratio range...........................	±(0.0004% of Reading + 0.0002% x (10V/Vref) of DC Voltage range)/°C
±0.01:1 ratio range	±(0.0005% of Reading + 0.0006% x (10V/Vref) of DC Voltage range)/C

NOISE REJECTION (At Reference Input)

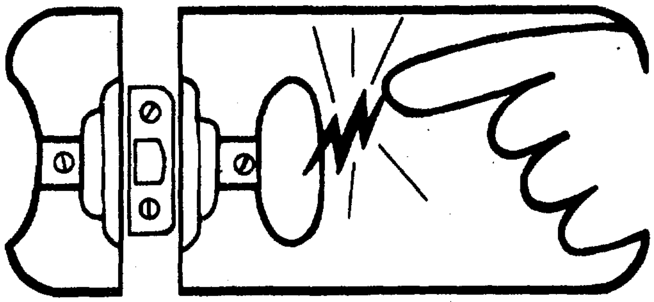
Normal Mode... 30 db @ 60 Hz

Common Mode (with up to 1K unbalance) ...... 120 db with a +10V Reference

REFERENCE SETTLING TIME .... 2 seconds

(To 0.01% of range following a step change of reference voltage. Numerator response time same as "dc volts".)

static awareness

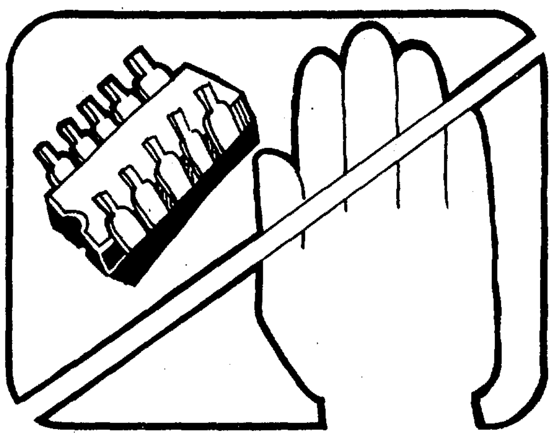


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

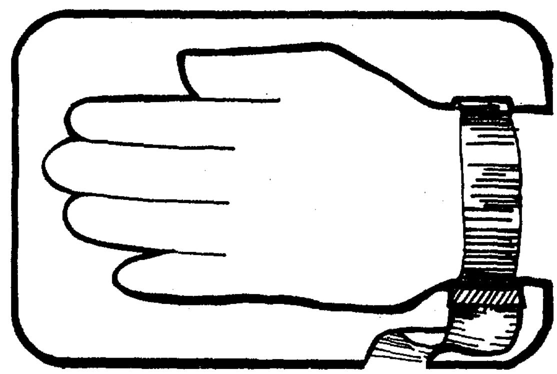
1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

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

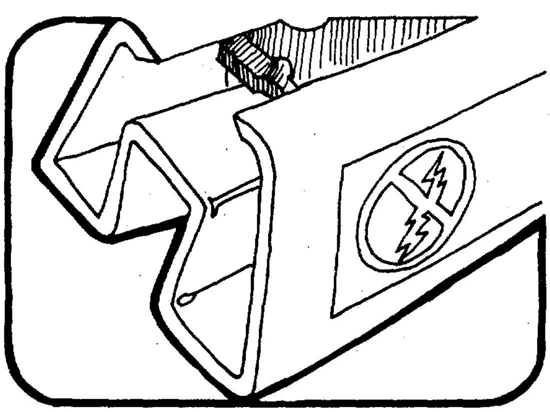
The following practices should be followed to minimize damage to S.S. devices.



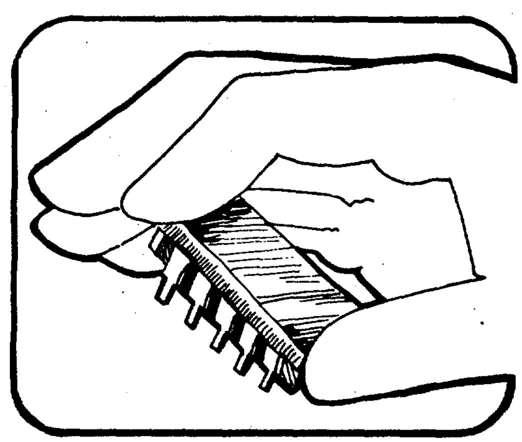
1. MINIMIZE HANDLING



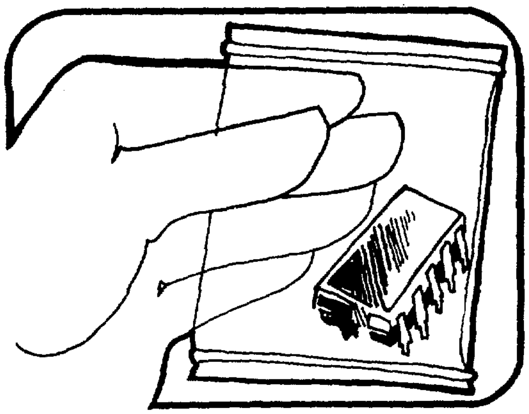
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



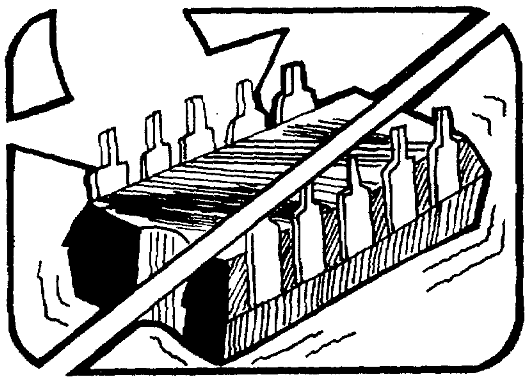
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



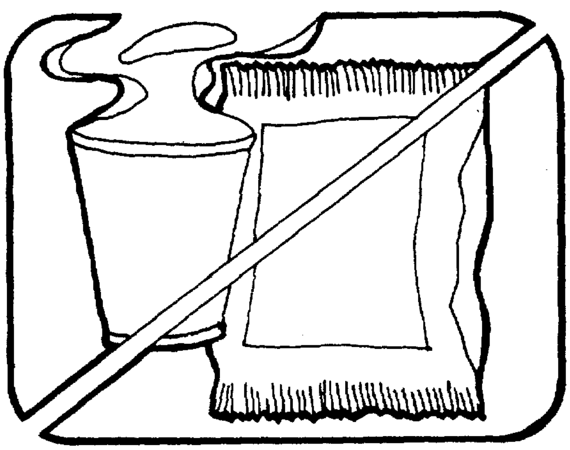
4. HANDLE S.S. DEVICES BY THE BODY



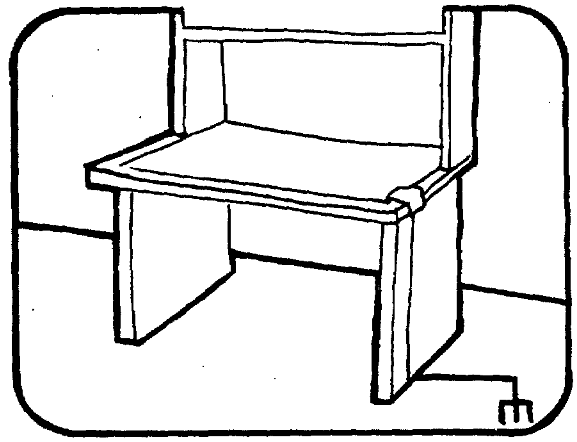
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



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



7. AVOID PLASTIC, VINYL AND STYROFOAM IN WORK AREA



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

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Bag Size
453522	6" x 8"
453530	8" x 12"
453548	16" x 24"
454025	12" x 15"

Section 2
Operating instructions

2-1. INTRODUCTION

2-2. This section contains operating instructions for the Model 8375A Digital Multimeter. If any problem is encountered in operating the instrument, contact the nearest John Fluke Sales Representative or write directly to the John Fluke Mfg. Co., Inc. Please include the instrument serial number when writing.

2-3. INSTALLATION

2-4. The 8375A is supplied with non-marring feet and tilt-down bail for bench or field use. A rack-mounting kit and rack-slide kits for installation of the instrument in a standard 19-inch rack are available. These accessories are described in Section 6 of the manual.

2-5. REPACKAGING FOR SHIPMENT

2-6. This instrument was packed and shipped in a foam-packed cardboard carton. If reshipment is required, use the original container or request a new container from the John Fluke Mfg. Co., Inc. Please include instrument model number with your request.

2-7. OPTIONS AND ACCESSORIES

2-8. Model 8375A options and accessories are listed in Table 2-1. They are fully described in Section 6 of the manual.

Table 2-1. OPTIONS AND ACCESSORIES

OPTION NO	NAME
8375A-03	Data Output
8375A-04	Remote Control
8375A-05	External Reference
8375A-07	Rear Input

Note: -07 option required with -05 option.

ACCESSORY NO.	NAME
M03-205-600	Rack Mounting Kit
M00-280-610	24-in. Rack Slide Kit
321687	Connector, DOU, RCU
321679	Connector, Ext. Reference
321661	Connector, Rear Input
298265	Extender Card (Required for servicing pcb's)
A90	Current Shunts
80F-5	High Voltage Probe
80F-15	High Voltage Probe
80 RF	High Frequency Probe

2-9. INPUT POWER REQUIREMENTS

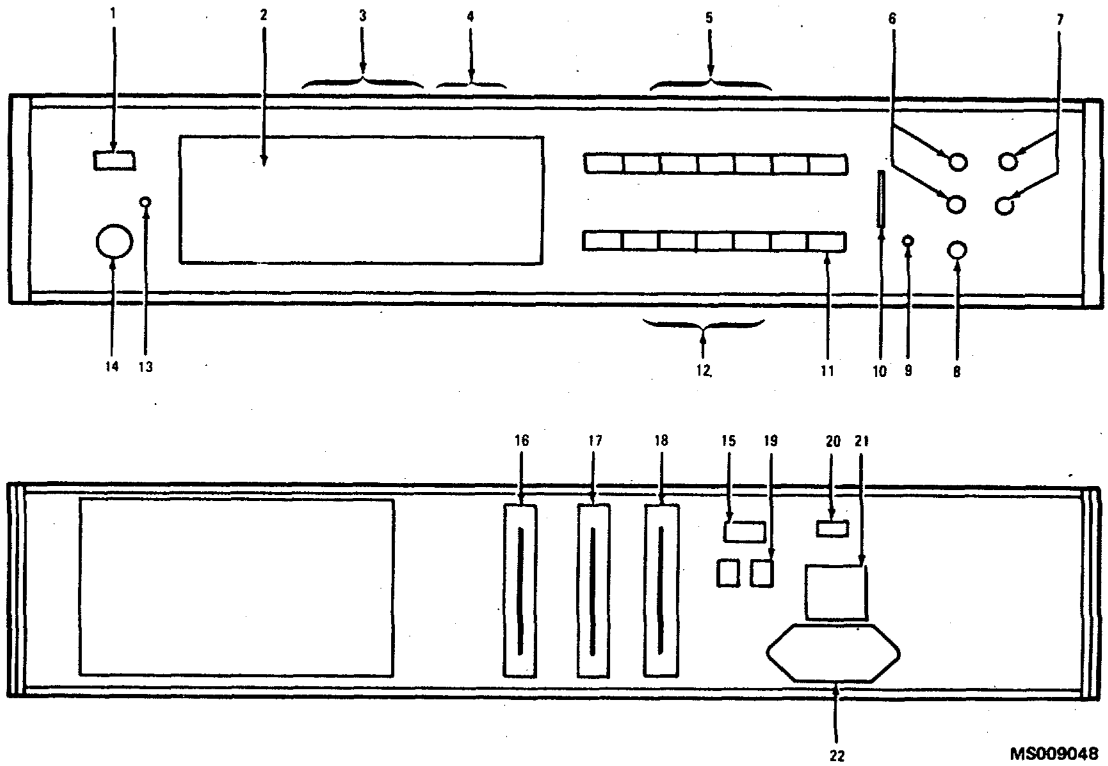
2-10. The 8375A operates on 115 or 230 volts, 50 Hz to 440 Hz ac power. Before applying power to the instrument, note the position of the 115/230 volt slide switch at the rear of the instrument (Figure 2-1). If the switch does not indicate the desired operating voltage, place it in the correct position.

WARNINGI

Ensure that the instrument case is connected to a high quality earth ground, either through the polarized line plug or through a separately connected ground wire.

2-11. OPERATING FEATURES

2-12. The name and function of front and rear panel controls, terminals and indicators are shown in Figure 2-1.



REF. NO.	NAME	FUNCTION
1	POWER Switch	Controls application of input power.
2	Polarity Indicator	Automatic indication of input polarity for dc voltage: "+" for positive input voltages and "–" for negative input voltages.
3	Readout Tubes	Display DMM readout from left to right, with overrange digit displayed in left-most tube. All tubes display a decimal point, depending on range. Full overrange readout on each range would appear as follows:

RANGE	READOUT
.1	.119999
1	1.19999
10	11.9999
100	119.999
1000	1199.99
10K	11999.9

Figure 2-1. CONTROLS, TERMINALS, AND INDICATORS (Sheet 1 of 3)

REF. NO.	NAME	FUNCTION
4	Function/Status Annunciator	Indicate instrument function and status as follows: KΩ . . . . *DMM operating in kilohm mode.* AC . . . . DMM operating in ac voltage mode. DC . . . . DMM operating in dc voltage mode. Ω . . . . DMM operating in ohms mode. X REF . . . DMM operating in External Reference mode. FILT . . . . Active 4-pole filter called for maximum noise rejection. OVER. . . . DMM input is over the 20% overrange capability.
5	FUNCTION Switches	Select desired DMM operating mode: EXT REF. . . Enables substitution of isolated external reference voltage for internal reference. FILT . . . . *Functional for dc voltage, ac voltages below 400 Hz and resistance measurements.* VDC . . . . Places DMM in dc voltage mode with full-scale ranges of .1,1, 10, 100 and 1000. VAC . . . . Places DMM in ac voltage mode with full-scale ranges of 1, 10, 100 and 1000. Ω . . . . Places DMM in ohms mode with full-scale ranges of 10, 100, 1000 and 10K if available range is called; otherwise, DMM autofunctions to KΩ. KΩ . . . . Places DMM in kilohms mode with full-scale ranges of 100, 1000 and 10K if available range is called; otherwise, DMM autofunctions to Ω. REMOTE. . . Places DMM in remote mode, enabling DMM function and range to be controlled remotely via the Remote Control Unit.
6	INPUT Terminals	HI, LO input connections for dc and ac voltage measurement.
7	Ω SOURCE Terminals	Current source for all resistance measurements.
8	GD (Guard) Terminal	Connects to internal guard chassis. When properly connected externally, provides maximum common mode rejection.
9	DC ZERO Control	Adjusted for .000000 ± 1 with VDC, Filter, and .1 Range called and INPUT terminals shorted.
10	TEST Switch	Permits self-test of instrument in VDC, VAC, and OHMS modes.
11	AUTO RANGE Switch	Places instrument in autorange mode, providing automatic ranging for each function and its range complement.

Figure 2-1. CONTROLS, TERMINALS, AND INDICATORS (Sheet 2 of 3)

REF. NO.	NAME	FUNCTION
12	Manual RANGE	Enable manual selection of range. Not calling a range automatically places DMM in autorange mode.
13	Sample Rate Indicator	Visual indication of sample rate.
14	SAMPLE RATE Control	Permits variation of sample rate from 13 readings per second to 1 reading per 4.5 seconds. In EXT position (fully counterclockwise), sample rate control is transferred to remote control point via the Data Output Unit. If the Data Output option is not installed and the control is turned to EXT, the instrument will read out and display from its internal storage circuitry indefinitely, with readout corresponding to value of last measurement sample.
15	Rear Input Connector	Provides connections for rear input to instrument (Option –07).
16	Data Output Unit Connector (No. 1)	Provides connections for Data Output Unit (Option –03).
17	Data Output Unit Connector (No. 2)	Provides connections for Data Output Unit (Option –03).
18	Remote Control Connector	Provides connections for Remote Control (Option –04).
19	DC External Reference Connector	Provides connections for DC External Reference Unit (Option –05).
20	115/230 Volt Input Power Switch	Selects either 115 or 230 volt ac line operation.
21	Line FUSE	Protects instrument from overloads. Fuse rating is AGC ½ ampere.
23	AC Line Voltage Connector	Mates with polarized 3-wire power cord for connection to 115/230 volt, 50 Hz to 440 Hz, ac line.

Figure 2-1. CONTROLS, TERMINALS, AND INDICATORS (Sheet 3 of 3)

2-13. TEST SWITCH OPERATION

2-14. Information for operation of the TEST switch is given in Table 2-2. For each position of the TEST switch, perform the following:

1. Depress indicated FUNCTION switch.
2. Depress "100" RANGE switch.
3. Select TEST switch position.
4. Observe readout according to Table 2-2.

Table 2-2. TEST SWITCH OPERATION

TEST SWITCH POSITION	FUNCTION SWITCH	INSTRUMENT READOUT
OFF	--	--
VDC	VDC	20.000 ± .100
VAC	VAC	13.000 ± 2.000
Ω2	Ω	100.000 ± .200

2-15. MEASUREMENT INSTRUCTIONS

2-16. Measurement instructions for basic DMM functions are given in Table

Table 2-3. 8375A MEASUREMENT INSTRUCTIONS

MEASUREMENT	8375A			REMARKS
	FUNCTION	RANGE	INPUT CONNECTIONS	
±DC Voltage	VDC	.1, 1, 10, 100, 1000, AUTO	Front panel HI, LO terminals or rear in put terminals if equipped with Rear Input option.	Instrument autoranges automatically if range is not manually called or if a range is called that is not compatible with the selected function.
AC Voltage*	VAC	1, 10, 100, 1000, AUTO		Use four-terminal ohms measurement, if desired, on 10Ω through 10,000Ω ranges.
Ohms	Ω	10, 100, 1000, 10K, AUTO		SOURCE terminals must be connected either remotely or with shorting links at INPUT binding posts, for all resistance measurements.
Kilohms	KΩ	100, 1000, 10K, AUTO		
DVM Zero Adjustment	VDC, Filter	.1	Short INPUT terminals together. Use a low-thermal shorting link.	Adjust front panel DC ZERO control for readout of .000000 ±1.
*Input coupling selection (AC or DC) is accomplished by removing the top dust cover and setting the INPUT COUPLING switch, through the access hole provided, to either AC or DC.				

2-17. EXTERNAL REFERENCE

2-18. General

2-19. The DC External Reference option enables the user to substitute an external dc voltage for the internal reference voltage. The principal use of the instrument when operated in this manner is for voltage ratio measurements. Another important use is to allow substitution of a system voltage for the 8375A reference voltage. By this means, variables in systems measurements may be reduced.

2-20. The DC External Reference Unit makes four-terminal voltage ratio measurements: ± dc to dc. Separate rear panel input connectors are provided for reference voltage inputs. The pin connection diagram for each connector is shown on a rear panel decal.

2-21. Operation

2-22. The following steps describe the basic operating procedure for ratio measurements using the External Reference options:

a. Select 8375A voltage range as desired according to the ratio range and corresponding readout, as shown in Table 24.

b. Connect reference voltage to rear input terminals.

c. Press EXT REF switch on the front panel.

d. Press VDC switch for dc-to-dc voltage ratios.

2-23. Installation, theory of operation, and maintenance instructions for the External Reference option is covered in Section 6 of the manual.

2-24. REMOTE CONTROL UNIT

2-25. General

2-26. The Remote Control Unit (RCU) enables the 8375A to be programmed or controlled remotely. RCU inputs interface directly with DTL/TTL logic. Control by discrete transistors or contact switches is also possible. Operating power for the RCU must be supplied from an external +5 volt source having a current capability of at least 150 milliamps. Power may be obtained from the Data Output Unit option if the instrument is so equipped.

Table 2-4. EXTERNAL REFERENCE RATIO RANGES

MODE	RATIO RANGE (V_{INPUT}/V_{REF})	READOUT	REFERENCE INPUT
DC/DC X 10	0 to ±0.0119999 0 to ±0. 119999 0 to +1.19999 0 to .1 1.9999 0 to ± 100.00	0 to:.119999 0 to +1.19999 0 to ±11.9999 0 to 1 19.999 0 to. 1000.00	+1V to +10.5V

2-27. The RCU provides the capability of controlling all that incompatible functions or simultaneous ranges cannot functions and ranges, with logic interlocking provided so be called. Acceptable combinations are shown in Table 2-5.

Table 2-5. REMOTE CONTROL UNIT LOGIC INTERLOCKING

FUNCTION CALLED	RANGE CALLED							FILTER	RATIO
	.1	1	10	100	1000	10K	NONE		
VDC	.1	1	10	100	1000	10K	AUTO	YES	YES
VAC	AUTO	1	10	100	1000	AUTO	AUTO	YES	YES
Ω	AUTO	AUTO	10	100	1000	10K	AUTO	YES	NO
KΩ	AUTO	AUTO	AUTO	100	1000	10OK	AUTO	YES	NO

NOTE: 1. If function and range are not called, DVM goes to VDC mode and autoranges (providing REMOTE button is pressed).

2. When ranges are selected manually, D VM will autofunction between Ω and KΩ if the selected range does not agree with the called function.

2-28. RCU Command Triggering

2-29. The RCU has two operating modes which control entry of external commands into the unit: continuous command mode and triggered command mode.

2-30. In continuous command mode, the RCU requires no external triggering. The instrument always reflects present state of command inputs in continuous mode. To achieve this mode of operation, hold pin 35 (Auto Command Entry Defeat) and pin 33 (External Command Entry) at logical I (+5v) or open.

2-31. In triggered command mode, the RCU will only respond to programming inputs after application of an external trigger and will memorize input commands within 16 microseconds of trigger application. Following the storage operation, programming inputs may be changed or removed without affecting stored information. To achieve this mode of operation, hold pin 35 (Auto Command Entry Defeat) low by application of logical 0 or contact closure and apply the external trigger to pin 33 (External Command Entry). RCU connector location is shown in Figure 2-1. Pin assignments are given in Table 2-6. Trigger requirements (External Command Entry) are given in Figure 2-2.

2-32. Operation

2-33. To place DMM in remote operation, proceed as follows:

a. Press REMOTE FUNCTION switch to transfer control of DMM function and range to the remote control point.

b. If remote control of DMM sample rate is desired, turn SAMPLE RATE control to its extreme CCW position (EXT). In EXT position, the internal sample rate oscillator is disabled and the sample command is applied via the Data Output Unit. If the Data Output Unit is not installed and the control is turned to EXT, the DMM will readout and display from analog storage indefinitely. The readout will correspond to the value of the last measurement.

Table 2-6. REMOTE CONTROL UNIT PIN ASSIGNMENTS

FUNCTION	PIN NO.	FUNCTION	PIN NO.
Common	*2	$\overline{\text{VAC}}$	17
Common	*4	$\overline{\text{K}\Omega}$	19
Common	*6	$\overline{\Omega}$	23
$\overline{\text{0.1 Range}}$	7	$\overline{\text{1 Range}}$	25
Common	*8	$\overline{\text{100 Range}}$	27
+5V Input	**9	$\overline{\text{External Reference}}$	29
$\overline{\text{1000 Range}}$	11	$\overline{\text{Filter}}$	31
$\overline{\text{10K Range}}$	13	External Command Entry	***33
$\overline{\text{10 Range}}$	15	Auto Command Defeat	***35

Spare Pins: 1, 3, 5, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36

LOGIC LEVELS

LOGIC 1 = +5V OR OPEN
(INPUT DEVICE MUST BE ABLE TO SOURCE 40μAMP AT 2.6V)

LOGIC 0 = 0V OR CONTACT CLOSURE
(INPUT DEVICE MUST BE ABLE TO SINK AT 1.6 MA AT 0V)

TRUTH TABLE

1 - FUNCTION NOT CALLED
0 = FUNCTION CALLED

NOTES:

* *Isolated from Input "LO" and chassis*

** *+5V Input: Maximum current requirement = 150 milliamperes. (Available from DOU)*

*** *Used only in Control Command Storage mode of operation. No connections are required when RCU is controlled with continuously applied commands.*

c. Command a function or range via a contact closure or a zero-volt logic level between the appropriate pin and common. For example, to program 10k ohms, filtered operation, command pins 13, 23 and 31 via contact closure or zero volts to pin 2, 4, or 6 (commons).

2-34. Installation, theory of operation, and maintenance instructions for the Remote Control Unit are covered in Section 6 of the manual.

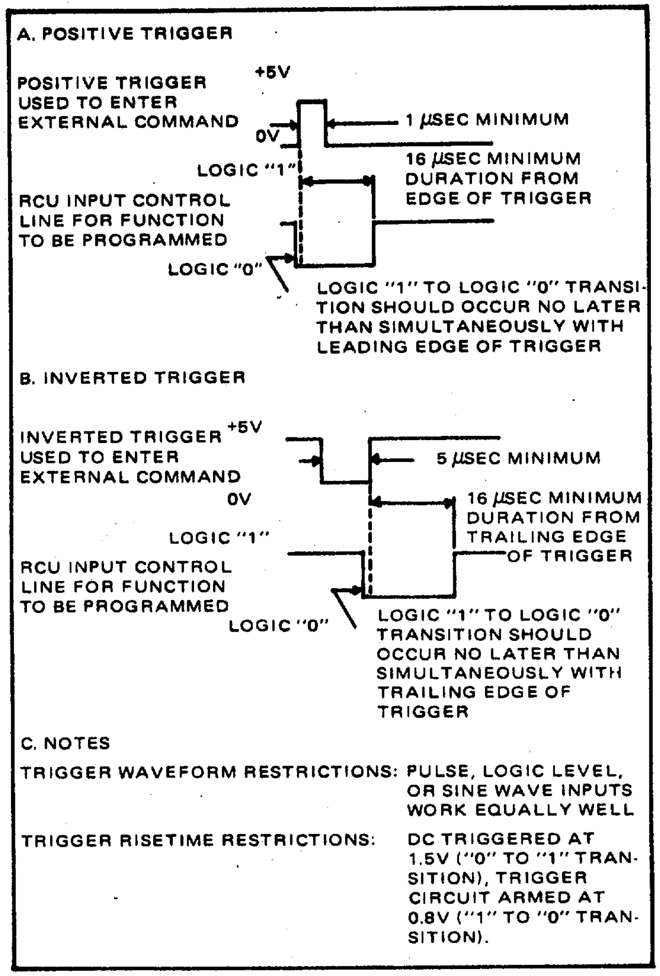


Figure 2-2. REMOTE CONTROL UNIT TRIGGER REQUIREMENTS (EXTERNAL COMMAND ENTRY)

2-35. DATA OUTPUT UNIT

2-36. General

2-37. DOU access is by means of two card-edge connectors located at the rear of the instrument (Figure 2-1). Data may be acquired fully in parallel BCD format or serially by character in multiples of four-bits. The Programmed OneShot (POS) line enables automatic time delays that allow for full settling of analog input circuitry prior to data transfer.

2-38. The DOU is self-powered and provides +5V (150 milliamperes maximum) output for operation of the Remote Control Unit (Option -02) or other logic circuitry. The truth tables, logic levels and functional pin connections for the DOU are given in Table 2-7.

Table 2-7. DATA OUTPUT UNIT FUNCTIONAL PIN CONNECTIONS

DATA	CONNECTOR PIN NO.		REMARKS
	DOU NO. 1	DOU NO. 2	
Range (coded)			See range code table below
b	33		
c	31		
d	32		
GR (gate)	36		
Overrange			
1	34		
GOR (gate)	35		
1st Decade (MSD)			Apply logic 0 to gates to inhibit decade data outputs.
8	27		
4	29		
2	28		
1	30		
G1 (gate)	25		
2nd Decade			
8	21		
4	23		
2	22		
1	24		
G2 (gate)	19		
3rd Decade			
8	15		
4	17		
2	16		
1	18		
G3 (gate)	13		
4th Decade			
8	9		
4	11		
2	10		
1	12		
G4 (gate)	5		
5th Decade			
8	3		
4	6		
2	2		
1	4		
G5 (gate)	1		

RANGE	LINE		
	b	c	d
10000	0	0	0
1000	0	0	1
100	0	1	0
10	0	1	1
1	1	0	0
.1	1	0	1

Note:
Logic 1 = +5V
Logic 0 = 0 to 0.5V

DATA	CONNECTOR PIN NO.		REMARKS
	DOU NO. 1	DOU NO. 2	
Control Inputs			
Ext. Trig.		3	
Ext. Trig. Inhibit		1	
Programmed One-Shot		2	
Primary Function Flags			Apply logic 0 to gates to inhibit function data outputs.
VDC		6	Logic 1: Function active Negative polarity
VAC		4	Logic 0: Function inactive Positive polarity
Ω		12	
KΩ		10	
GPF (gate)		26	
Secondary Function Flags			
Polarity		18	
Filter		20	
Ext. Ref.		16	
Remote		14	
GSF (gate)		22	
Flags:			Logic 1: / Logic 0:
Busy		8	Busy / Not Busy
Sample Sync		31	No Sam.Sync / Sam.Sync
Overload		13	Overload / No overload
Trigger		15	Triggered / Not Triggered
GOL (gate)		17	
Power Output			Maximum output: 150 milliamperes at +5 vdc.
+5 vdc	20	36,34	
Common		33,35	
Code Conversion Terminals			See paragraph 2-44 for code conversion information.
Z_{out}		9	
Z_1		30	
Z_{in}		25	
Y_{out}		5	
Y_1		32	
Y_{in}		21	
X_{out}		7	
X_1		29	
X_{in}		23	
W_{out}		11	
W_1		24	
W_{in}		19	

2-39. Control Signals

2-40. DOU control inputs consist of External Trigger, External Trigger Inhibit, and Programmed One-Shot. The External Trigger may be a positive or negative-going signal, as shown in Figure 2-3. The External Trigger Inhibit input must be a logical 0 to inhibit and a logical 1 to enable. The Programmed One-Shot input must be a logical I for fast operation (timeouts defeated) and a logical 0 for normal operation (programmed timeouts).

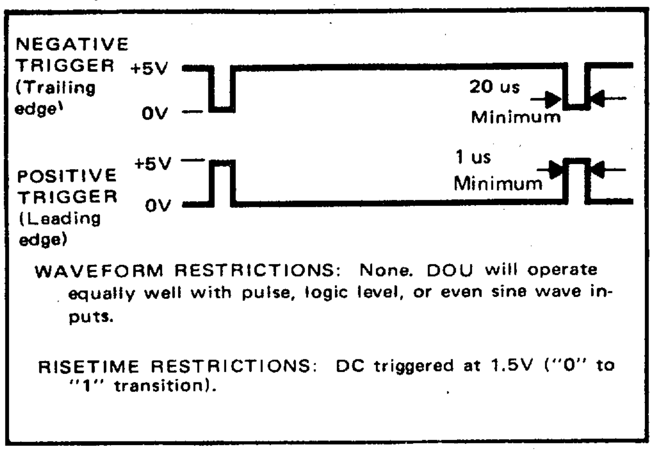


Figure 2-3. DATA OUTPUT UNIT TRIGGER REQUIREMENTS

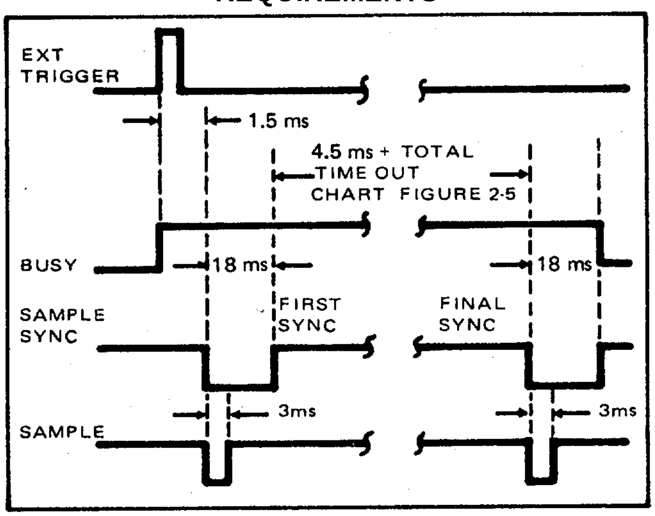


Figure 2-4. SAMPLE SYNC. SIGNAL TIMING (AUTOMATIC ADAPTIVE TIMEOUTS ENABLED).

2-41. The Sample Sync signal corresponds in timing to the DMM sample periods occurring in each measurement period, as shown in Figure 24. During the time the DMM is busy processing a request for data, the time of occurrence of the second or final sample period is subject to a number of delays, depending on DMM operating mode, autoranging delays, etc. The purpose of the Sample Sync signal is to inform the DMM input signal acquisition device (scanner) when the final sample is taken by the DMM. This information is useful when the DMM is used in a scanning system, where it is desirable that inputs be changed at the earliest possible time without altering the previous sample.

2-42. Programmed One-Shot

2-43. The response of the 8375A Data Output Unit to a data request consists of a function-dependent series of delays. When enabled, the Programmed One-Shot circuit in the DOU automatically sequences the delay series to provide data within specified accuracy in the minimum possible time. If settling time is not a problem in specific applications, convenience is enhanced by provision for defeat of the POS, allowing sample rates as high as 30 per second. Application of +5v logic level or open circuit to pin 2 defeats the POS (Fast Sample); application of logic zero or contact closure to pin 2 enables the POS (Normal Sample). Figure 2-5 illustrates the timing of the events that occur during the busy flag.

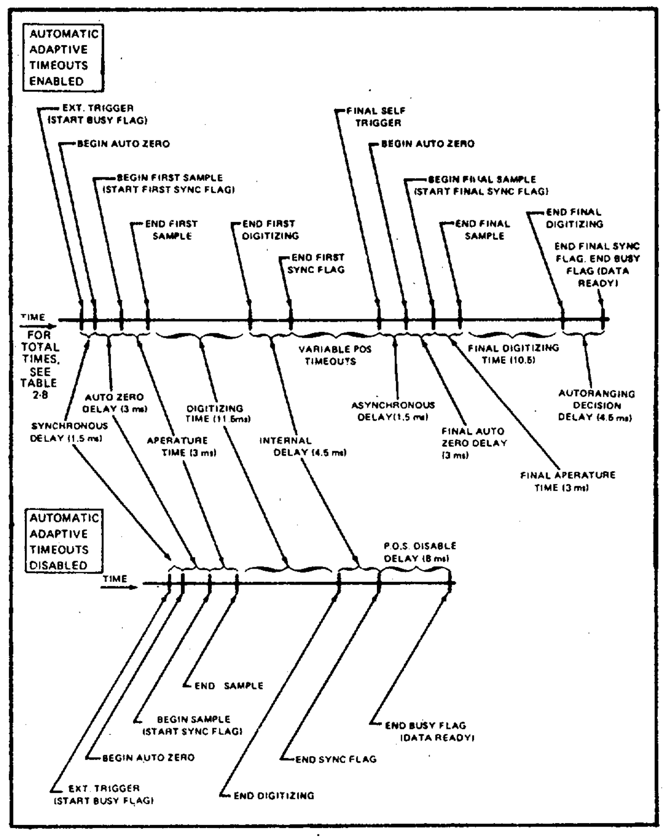
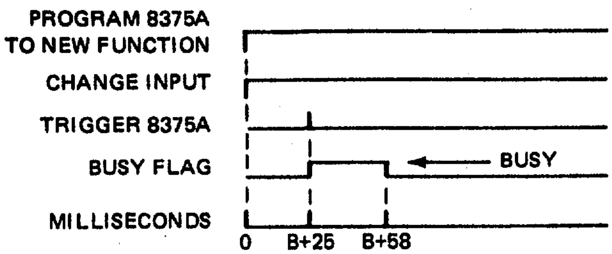


Figure 2-5. 8375A MEASUREMENT CYCLE TIMING DIAGRAM

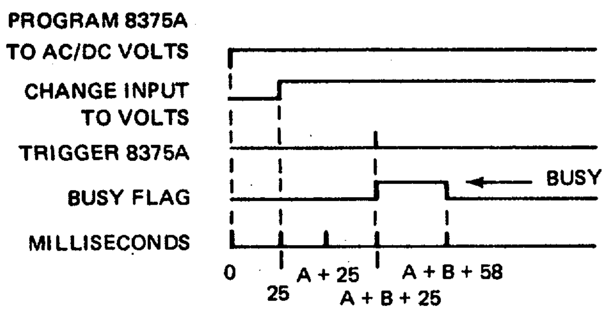
The total busy flag time when the automatic adaptive timeouts are enabled, is given in Table 2-8.

1. WITH PROGRAMMED FUNCTION AND/ OR RANGE CHANGE - AUTORANGING NOT ALLOWED.



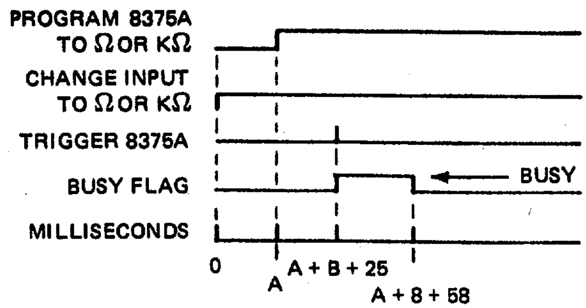
B = BUFFER SETTLING TIME FROM TABLE D
25 = TIME TO SWITCH 8375A INTERNAL RELAYS

a. SIMULTANEOUSLY CHANGE INPUT AND PROGRAM FROM A FORMER FUNCTION TO A NEW ONE WHEN FORMER INPUT DOES NOT CAUSE OVERLOAD CONDITION FOR NEW FUNCTION, OR NEW INPUT WOULD NOT CAUSE OVERLOAD CONDITION FOR OLD FUNCTION. (SEE SPECIFICATIONS ON DATA SHEET).



B = BUFFER SETTLING TIME FROM TABLE D
A = TIME TO SWITCH INPUT
25 = TIME TO SWITCH 8375A INTERNAL RELAYS

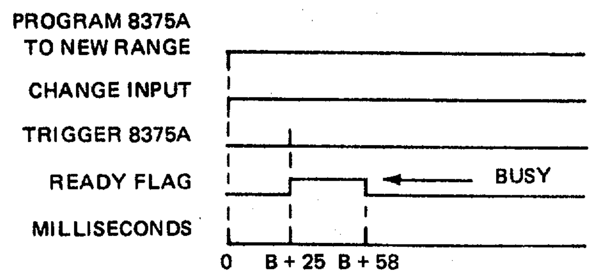
b. PROGRAM 8375A TO AC OR DC VOLTS FROM Ω OR KΩ, THEN APPLY A VOLTAGE INPUT GREATER THAN SPECIFIED Ω OR KΩ "OVERLOAD" INPUT. (SEE SPECIFI CATIONS ON DATA SHEET)



B = BUFFER SETTLING TIME FROM TABLE D
A = TIME TO SWITCH INPUT
25 = TIME TO SWITCH 8375A INTERNAL RELAYS

c. PROGRAM 8375A TO Ω OR KΩ FROM AC OR DC VOLTS WHEN INPUT VOLTAGE IS GREATER THAN SPECIFIED OVERLOAD FOR Ω OR KΩ INPUTS. (SEE SPECIFICATIONS ON DATA SHEET).

2. WITH PROGRAMMED RANGE CHANGE BUT NO FUNCTION CHANGE.



B = BUFFER SETTLING TIME FROM TABLE D
25 = TIME TO SWITCH 8375A INTERNAL RELAYS

TABLE D

BUFFER SETTLING TIME TABLE

FUNCTION	RANGE	BUFFER SETTLING TIME IN MILLISECONDS FILTER "OUT"	FILTER "IN"
DCV	.1V	100	500
	1,10,100	33	500
	1000	33	500
ACV	ALL	33	500
Ω	10	100	500
	100,1000	33	500
	10,000	33	500
KΩ	100	33	500
	1000,1000	33	500

Figure 2-6. SINGLE READING TIMING REQUIREMENTS WHEN D.O.U.'S AUTOMATIC ADAPTIVE TIMEOUTS ARE NOT ENABLED.

Table 2-8. TOTAL BUSY FLAG TIME OUT (Automatic Adaptive Timeouts Enabled)

FUNCTION RANGE	TOTAL TIME IN ms FILTER OUT	FILTER IN
VDC-10, 100, 1000	59 ±3	523 ±42
VDC-0.1, 1.0	123 ±10	523 ±42
VAC all ranges	123 ±10	523 ±42
Ω all ranges	123 ±10	523 ±42
kΩ all ranges	73 ±6	523 ±42
Autorange per range change	Add 50	Add 280

2-44. Figure 2-6 contains comprehensive timing diagrams for measuring both switched and continuously applied inputs when the D.O.U.'s automatic adaptive timeouts are not enabled.

2-45. Output Flags

2-46. Besides the Busy Flag (Data Not Ready), there is also a Sample Sync Flag. This flag goes to logic "1" when the DMM starts sampling the input signal (aperture window opening). By using the Sample Sync Flag (negative transition leading edge), plus an external 3 millisecond, one-shot delay, total data acquisition time can be decreased when using input scanners or a changing input signal which require long settling times. This will take advantage of the fact that the aperture window is only open for 3 milliseconds allowing the input signal to be changed and to be settled before the-next sample aperture occurs. When the Automatic Timeouts are enabled, the final sample sync flag must be used instead of the initial or intermediate sync flags. See Figure 2-5 for timing of the sample sync flag.

2-47. The trigger flag indicates if the DMM is being triggered internally or externally. Other flags are the overload, Volts DC, Volts AC, Ohms, Kilohms, Polarity, Filter, External Reference and Remote Flags which are self-explanatory. Refer to Table 2-7 for pin connections and level information.

2-48. Code Conversion

2-49. The 8-4-2-1 BCD code (standard) used in the 8375A may be converted to some other code, using the convenient code conversion terminals provided at the output connector on DOU No. 2. To convert to another code remove the jumpers and connect the code conversion network, as shown in Figure 2-7. Usually only two integrated circuits are required in the network, versus about twelve for parallel conversion at the outputs, so a considerable saving may be realized.

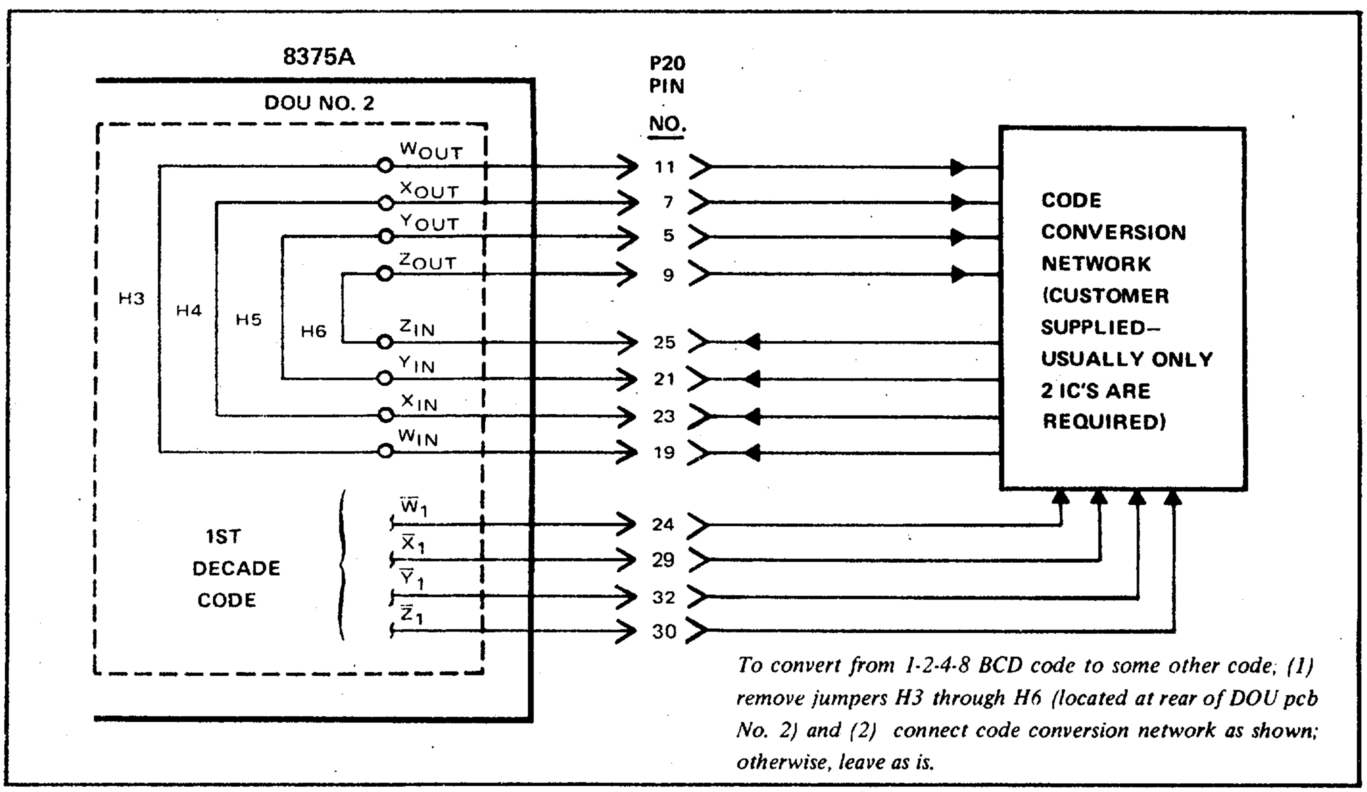


Figure 2-7. CODE CONVERSION

2-50. Completely Parallel Data Acquisition

2-51. For completely parallel data acquisition, perform the following steps:

a. Determine the BCD code to be used and wire accordingly (see paragraph 2-48 for code conversion information).

NOTE!

84-2-1 BCD is supplied in standard 8375A.

b. Acquire full digits data by connection to the decade outputs. Leave inhibit lines associated with each decade open.

c. Acquire function, range, overrange and polarity data as desired. Leave associated inhibit lines open.

d. If data output is to be applied to a printer, the foregoing data could be grouped for presentation in several printer columns, with each column weighted as desired.

e. Acquire busy, overload, and trigger flags for use as desired.

2-52. Serial Character, Parallel Bit Acquisition

2-53. For serial character, parallel bit acquisition, perform the following steps:

a. Determine the BCD code to be used and wire accordingly (see paragraph 2-48 for code conversion information).

b. Connect function, range, polarity, and digit outputs, in parallel, as shown in Figure 2-8 or in groups of 8, 12, 16 bits, etc., as desired.

c. User supplied clock controls inhibit lines to determine the sequence of character acquisition. Data is transferred to the output lines when the associated inhibit lines are high. Truth tables and acquisition format are also shown in Figure 2-8.

2-54. Minimum Lines Acquisition 2-55. Minimum lines acquisition is a practical application of serial character, parallel bit acquisition, in which a user-supplied clock is placed near the 8375A to sequentially control the inhibit lines. Proceed as follows:

a. Place a customer fabricated 9-segment ring counter near the 8375A and interface as shown in Figure 2-9.

b. Trigger the 8375A. (The Sample Time line may be programmed via interface or it may be hardwired.)

c. When data is ready, transition of the 8375A BUSY signal will start the ring counter. A synchronizing pulse, sent from the ring counter's advance line, will allow the acquisition device to recognize the character being acquired on the four output lines.

d. An OVERLOAD line is available to serve as an alarm or priority interrupt.

2-56. Installation, theory of operation, and maintenance instructions for the Data Output Unit are covered in Section 6 of the manual.

2-57. OPERATING NOTES

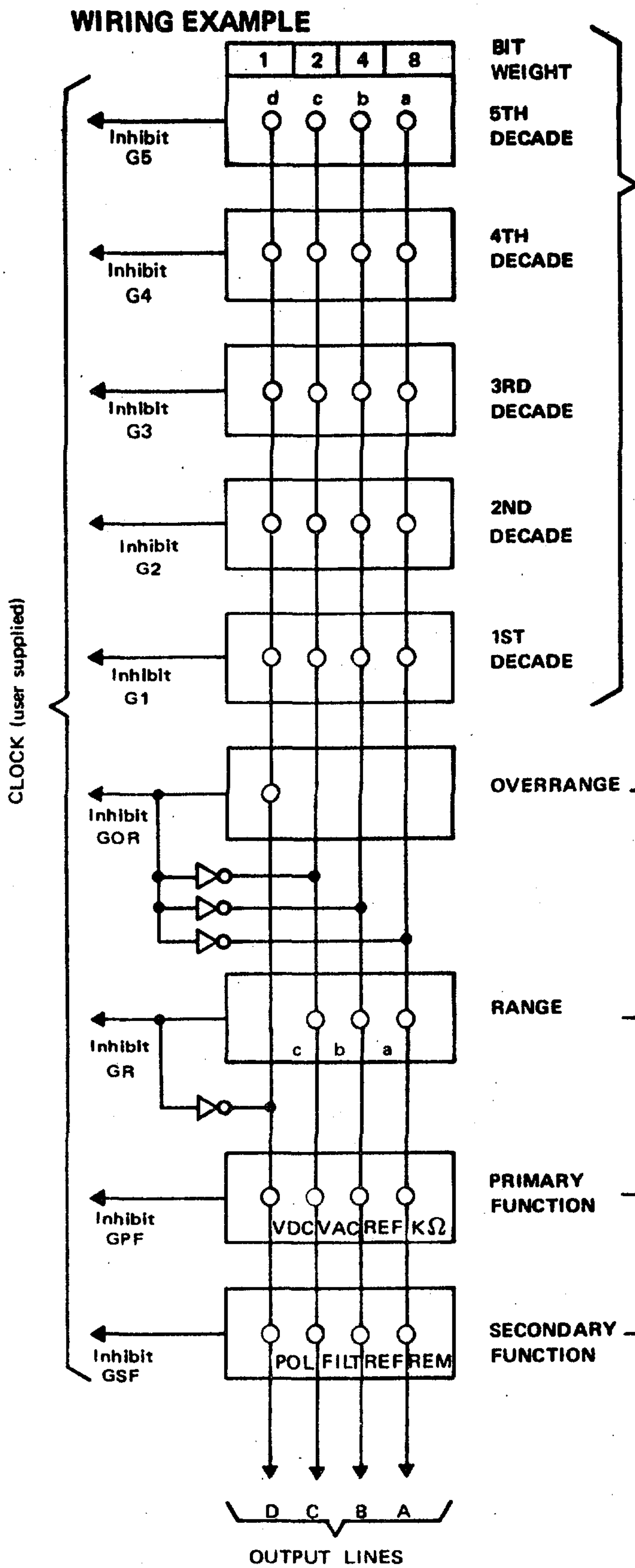
2-58. Overload Protection

2-59. The 8375A is protected against overload in each function and on all ranges. Table 2-9 lists the maximum voltages that may safely be applied to the DMM on all ranges.

2-60. Guarded Measurements

2-61. The 8375A employs a system of shields and guards that function (when properly connected) to 'minimize common mode-to-normal mode signal conversion and induced noise, thereby providing the user with a versatile systems DMM capable of fully-floating measurements without significant degradation of accuracy.

2-62. Non-floating measurements will likely be made with the 8375A. Under these conditions, it is satisfactory to strap the front panel guard (GD) terminal to the LO input terminal using the shorting link provided.



ACQUISITION FORMAT

BIT	0	1	2	3	4	5	6	7	8	9
d	0	1	0	1	0	1	0	1	0	1
c	0	0	1	1	0	0	1	1	0	0
b	0	0	0	0	1	1	1	1	0	0
a	0	0	0	0	0	0	0	0	1	1

BIT	0	1
d	0	1
c	0	0
b	0	0
a	0	0

RANGE	BIT			
	a	b	c	d
10K	0	0	0	0
1000	0	0	1	0
100	0	1	0	0
10	0	1	1	0
1	1	0	0	0
.1	1	0	1	0

FUNCTION	BIT			
	a	b	c	d
VDC	0	0	0	1
VAC	0	0	1	0
Ω	0	1	0	0
KΩ	1	0	0	0

FUNCTION	BIT			
	a	b	c	d
POL	0	0	0	1
FILT	0	0	1	0
REF	0	1	0	0
REM	1	0	0	0

Figure 2-8. WIRING EXAMPLE, ACQUISITION FORMAT, AND TRUTH TABLES FOR SERIAL CHARACTER, PARALLEL BIT ACQUISITION

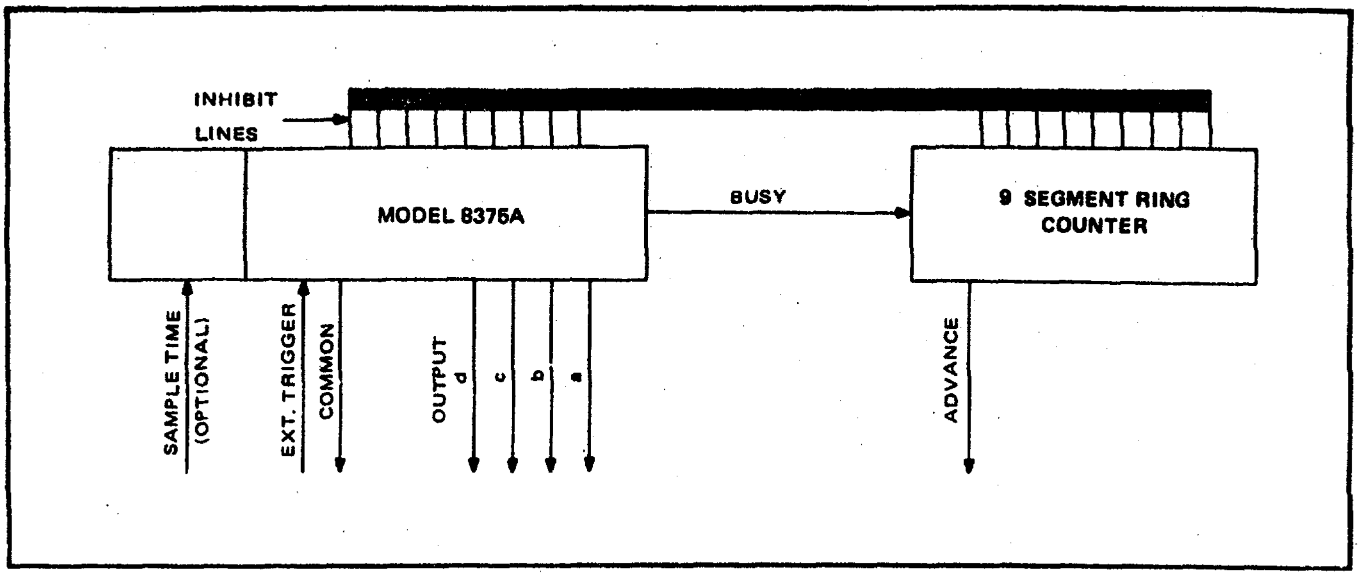


Figure 2-9. MINIMUM LINES ACQUISITION

Table 2-9. OVERLOAD PROTECTION CHARACTERISTICS

FUNCTION	MAXIMUM SAFE INPUT	FORM OF PROTECTION
VDC	±11000V dc or RMS (± 500V peak) continuously on any range.	Circuit Design
VAC	1100V RMS continuously on any range.	
RESISTANCE: 10Ω - 10,000KΩ ranges	20V RMS	FUSE: 15 ma fuse (with spare) located on Ohms Converter PCB
100 KΩ - 10,000 KΩ ranges	250V RMS continuously	Circuit Design
DC EXTERNAL REFERENCE	±10.5 (Note: The algebraic sum of the DVM input voltage and the common difference voltage should not exceed 13 volts dc or peak ac).	FUSE: 15 ma fuse located on DC - External Reference Converter PCB protects mainframe if maximum - common difference voltage is exceeded.

NOTE: Re-Calibration not necessary when fuses are replaced.

CAUTION!

If guarded measurement is not needed, the DMM guard terminal should be connected to the INPUT LO terminal at the front panel to preclude possible damage to the instrument.

2-63. In general, guarded voltage and resistance measurements will be necessary under the following conditions:

a. When long signal leads are used and signal source impedance is high.

b. When floating measurements are made and the common mode voltage is a high potential, high frequency, or both.

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

2-64. Figure 2-10 shows two methods for making guarded voltage measurements where reduction of common mode-to-normal signal conversion is desired. Figure 2-11 shows two methods for connection of the guard terminal when making ohms measurements.

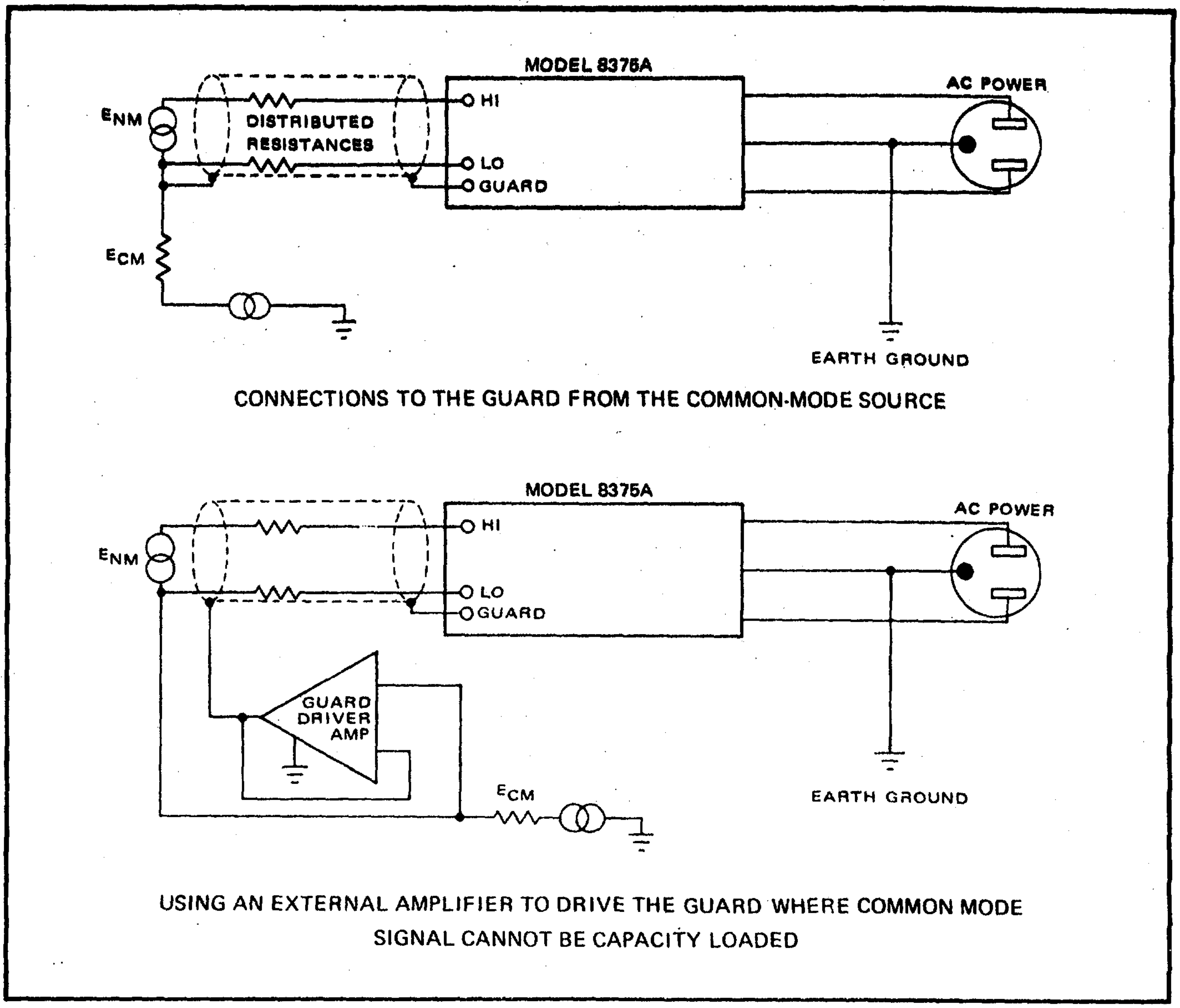


Figure 2-10. SUGGESTED GUARD CONNECTIONS FOR REDUCTION OF COMMON MODE-TO-NORMAL MODE SIGNAL CONVERSION

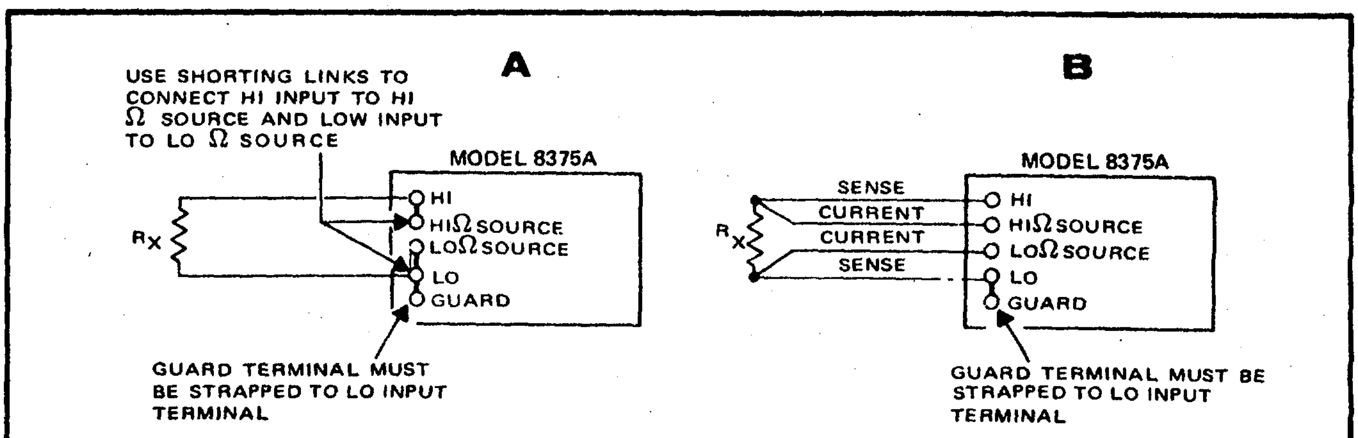


Figure 2-11. PROPER GUARD CONNECTIONS FOR (A) 2-TERMINAL ê MEASUREMENTS WHEN SIGNAL LEADS ARE SHORT AND (B) 4-TERMINAL ê MEASUREMENTS ON 10ê THROUGH 10,000ê RANGES

Section 3

Theory of Operation

3-1. INTRODUCTION

3-2. This section describes the theory of operation of the Model 8375A. The information is arranged under headings of "BLOCK DIAGRAM ANALYSIS" and "CIRCUIT DESCRIPTIONS." Simplified block diagrams and circuits are included with the text information. Schematic diagrams are located at the rear of the manual.

33. BLOCK DIAGRAM ANALYSIS

3-4. Buffer (A11)

3-5. The Buffer (Al 1) receives the dc input voltage and scales it up or down so that a full-scale input produces a full-scale 10V output to the active filter. (Refer to Figure 31.) When the 0.1 or 1V range is selected, the Buffer is configured as an amplifier having a gain of 100 or 10, respectively. In the 10, 100 or 1000V range, the All Buffer has a fixed unity gain and the input is scaled using a divider to provide the full-scale +1OV output.

3-6. Active Filter (A10)

3-7. The A10 Active Filter suppresses ac noise present in the Buffer output. It consists of a voltage follower and a four-pole filter. Filtering is in effect when the FILTER switch on the front panel is pressed. If this switch is not pressed , the tour-pole filter is bypassed and the circuit functions as a voltage follower. The resulting filtered or unfiltered output is applied to the A9 A/D Converter.

3-8. Logic (A8)

3-9. The A8 Logic produces the master timing signals from which the measurement period in the instrument are established. It also produces the reference voltage upon which the accuracy and stability is based. The circuitry consists of a master clock, a six-state shift register, a current controlled oscillator (CCO), a four-bit binary counter, and a +7V reference supply. The master clock produces gating signals that synchronize all timing circuitry in the instrument. The shift register is driven by the clock signals and produces digit cycle control signals for the A9 A/D Converter. Any output from the A/D amplifier produces an output from the analog comparator which enables the CCO to send output pulses to the binary counter. The binary counter selects the appropriate steps in the A9 A/D Converter ladder such that the CCO output is ultimately disabled. The resulting state of the binary counter is also applied to the A14 Display and decoded to indicate the measured value. The +7V reference supply output is applied to the ladder in the A9 A/ID Converter.

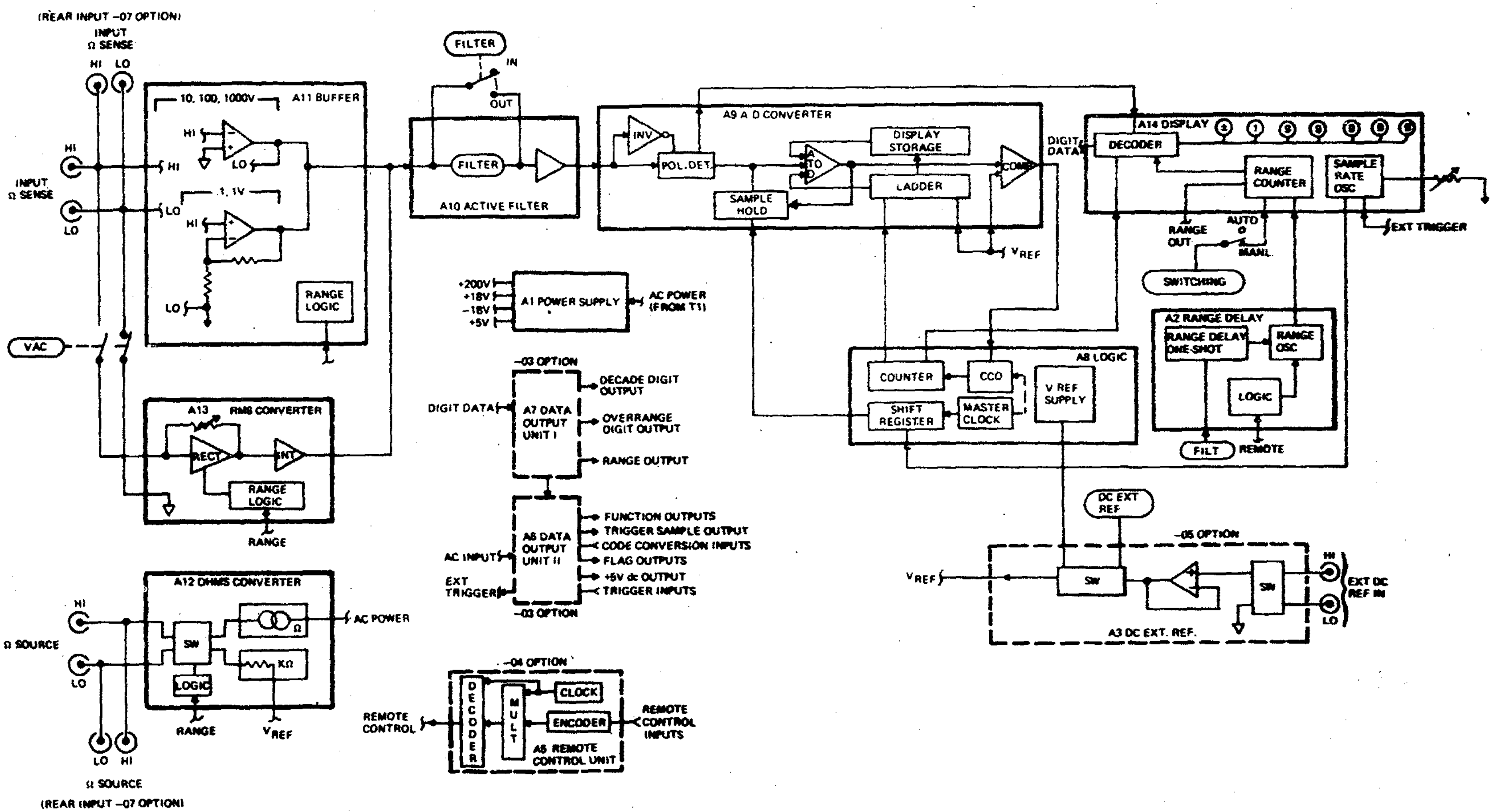


Figure 3-1. MODEL 8375A BLOCK DIAGRAM

3-10. A/D Converter (A9)

3-11. The A9 A/D Converter receives the output from the Active Filter, determines the polarity, and serially digitizes the input voltage. The digitizing process is controlled through commands from the A8 Logic assembly. The circuitry consists of an inverting amplifier, polarity detector, sample and hold, A/D amplifier, ladder switches, and an analog comparator amplifier. The inverting amplifier receives the positive or negative outputs of the A10 Active Filter and inverts the positive output so that the input to the A/D amplifier is always negative. Polarity of this signal is sensed by the polarity detector and applied to the A14 Display section. Any output voltage from the AID amplifier, greater than Vref, produces an output from the analog comparator which then enables the CCO to send output pulses to the binary counter. The binary counter pulses gate the appropriate ladder switches in the A/D converter to produce a voltage across the primary ladder resistors. The resulting voltage is equal in value, but opposite in polarity, to that portion of the A/D amplifier input voltage that caused the amplifier output to be greater than Vref. As the degenerative affect of the primary ladder voltage causes the A/D amplifier output to fall below Vref, the analog amplifier will no longer enable the CCO to send output pulses to the ladder switches. At this point the digitizing process for the most significant digit of the unit input voltage is complete. The voltage level remaining at the output of the A/D amplifier, representing the 8375A input voltage minus the most significant digit, is stored in the sample and hold circuit until the logic control gates it out to the input of the A/D amplifier. Each decade of the recirculated remainder is digitized in a similar fashion with one exception; the recirculated remainder voltage (now the AID amplifier -input voltage) and the primary ladder voltage are now the same polarity, because they are applied to opposite sides of the dual feed input transistor.

3-12. Display (A14)

3-13. The A14 Display decodes and digitally displays the input voltage magnitude and polarity. It also provides a variable sample rate for control of the measurement cycle. The circuitry consists of a sample rate oscillator, range counter, decoder, and display indicators. The sample rate oscillator frequency is controlled by a SAMPLE RATE control on the front panel and determines the rate at which the input to the instrument is sampled. The range counter receives auto-range commands from the A2 Range Delay and manual range commands from the front panel switches. The range counter applies range information to the decoder and all input signal conditioning circuitry. Range, polarity, and digit information is processed in the decoder, which then produces the correct display condition in the indicators.

3-14. Range Delay (A2)

3-15. The A2 Range Delay processes switching inputs from the front panel and produces control commands for the decoder in the A14 Display. It also produces up/down autorange commands for the range counter, The circuit consists of logic, range delay one-shot, and a pulse generator. The logic circuitry produces control signals for the pulse generator and the decoder in the A14 Display. A clock signal for the range counter in the A 4 Display is produced by the pulse generator. This clock signal is required for the autorange feature. The range delay one-shot produces a programmed time delay after any range change to allow for settling time of analog signal conditioners which process the input.

3-16. Power Supply (Al)

3-17. Operating voltages for the instrument are produced in the Al Power Supply. The voltages producedare+200V, +18V and +SV. Each voltage is derived from the ac input using a series regulator.

3-18. True RMS Converter (A13)

3-19. The True RMS Converter allows measurement of dc-coupled or ac voltages to 1100 volts rms at frequencies from 10 Hz to 300 kHz. The Converter provides a rms to dc transfer function for measurement of waveforms with high distortion and high crest factor characteristics. It also provides fast response time and excellent low-level accuracy. The circuitry consists of range logic, scaling amplifier, operational rectifier, squaring amplifier, square root amplifier, and DC integrator/filter amplifier. Range commands are processed in the range logic whose output then establishes a fixed scaling factor for the operational rectifier. The resulting full-scale +O1V dc output from the DC integrator/ filter amplifier is applied to the A10 Active Filter.

3-20. Ohms Converter (A12)

3-21. The Al 2 Ohms Converter allows resistance measurements from 100æê to 12Mê. Resistance measurements in ohms ranges are true, four-terminal. Measurements in K ohm ranges are conventional two-terminal. The circuitry consists of a constant current generator, a current source, switching circuitry, and logic. When the ohm function is selected, the constant current generator output is made available to the . SOURCE terminals. Since both the E2 SOURCE and SENSE terminals are connected to the unknown resistance, the Al Buffer input voltage is directly proportional to the resistance value. The All I Buffer output is then serially digitized and displayed as described previously to indicate the resistance value. In the K ohm ranges, a range dependent scaling resistor is placed between the master +7V reference supply and the III SOURCE terminal. A voltage proportional to the unknown resistance (Rx) is available at the buffer output. Since the voltage drop in the lead resistance of the unknown also appears at the voltage measuring terminals, true four terminal measurement is not available. Simplified diagrams of the four terminal and conventional resistance configurations are shown in Figure 3-2.

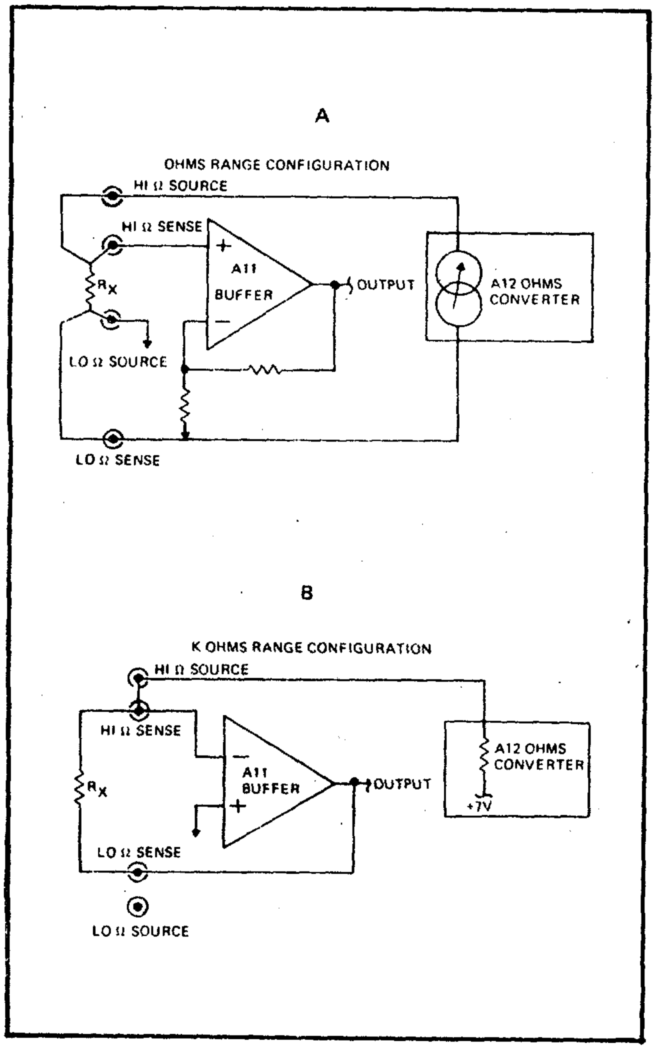


Figure 3-2. OHMS AND K OHMS RANGE CONFIGURATION

3-22. Data Output (A6/A7)

3-23. The A6 and A7 Data Output Units provide parallel, isolated, coded outputs of digit, polarity, range, and function. It also provides a +5V dc output for external equipment as well as input lines for external triggering and control of the measurement cycle. The circuitry is contained on two separate assemblies. Digit and range outputs are available from the Data Output Unit I. Function indications, flag outputs and +5 dc outputs in addition to triggering and code conversion inputs are available in the Data Output Unit II.

3-24. Remote Control (A5)

3-25. The A5 Remote Control Unit allows remote control of mode, instrument range, and functions. Input requirements are compatible with DTL or TTL logic levels. The circuitry consists of a clock generator, encoder, multiplexer, and decoder. The clock generator produces a clock signal which gates the multiplexer and decoder. Inputs are coded in the encoder and applied to the multiplexer. The multiplexer output is then serially transferred to the decoder at the clock rate. Serial to parallel conversion takes place in the decoder and the resulting commands used to control the range and function.

3-26. DC External Reference (A3)

3-27. The A3 DC External Reference allows dc/dc and ac/dc ratio measurements using an external dc reference voltage. Input reference voltage can be from +1 to +10.5V dc. The circuitry consists of a differential amplifier and a switching circuit. The external reference input is buffered by the differential amplifier. Application of internal or external reference voltage to the VREF line is done through the switching circuit.

3-28. CIRCUIT DESCRIPTIONS

3-29. All Buffer

3-29A. The Al I Buffer (Drawing No. 8375A-1005) provides a full-scale dc voltage of 10V, which is isolated from the input under measurement. It consists of four basic elements: input voltage divider, output voltage divider, amplifiers, and control logic. The circuitry has two operation configurations or modes determined by the voltage range selected: a low volts mode and a high volts mode. In the low volts mode (0.2 and 1.0 volt range) some amplification of the input occurs. In the high volts mode (10, 100 and 1000 volts range) input attenuation occurs, except in the 10 volts range when the input is processed without attenuation or amplification. Both modes are shown in block form in Figure 3-3. The A portion of the ' figure depicts the low volts mode, and the B portion of the figure depicts the high volts mode.

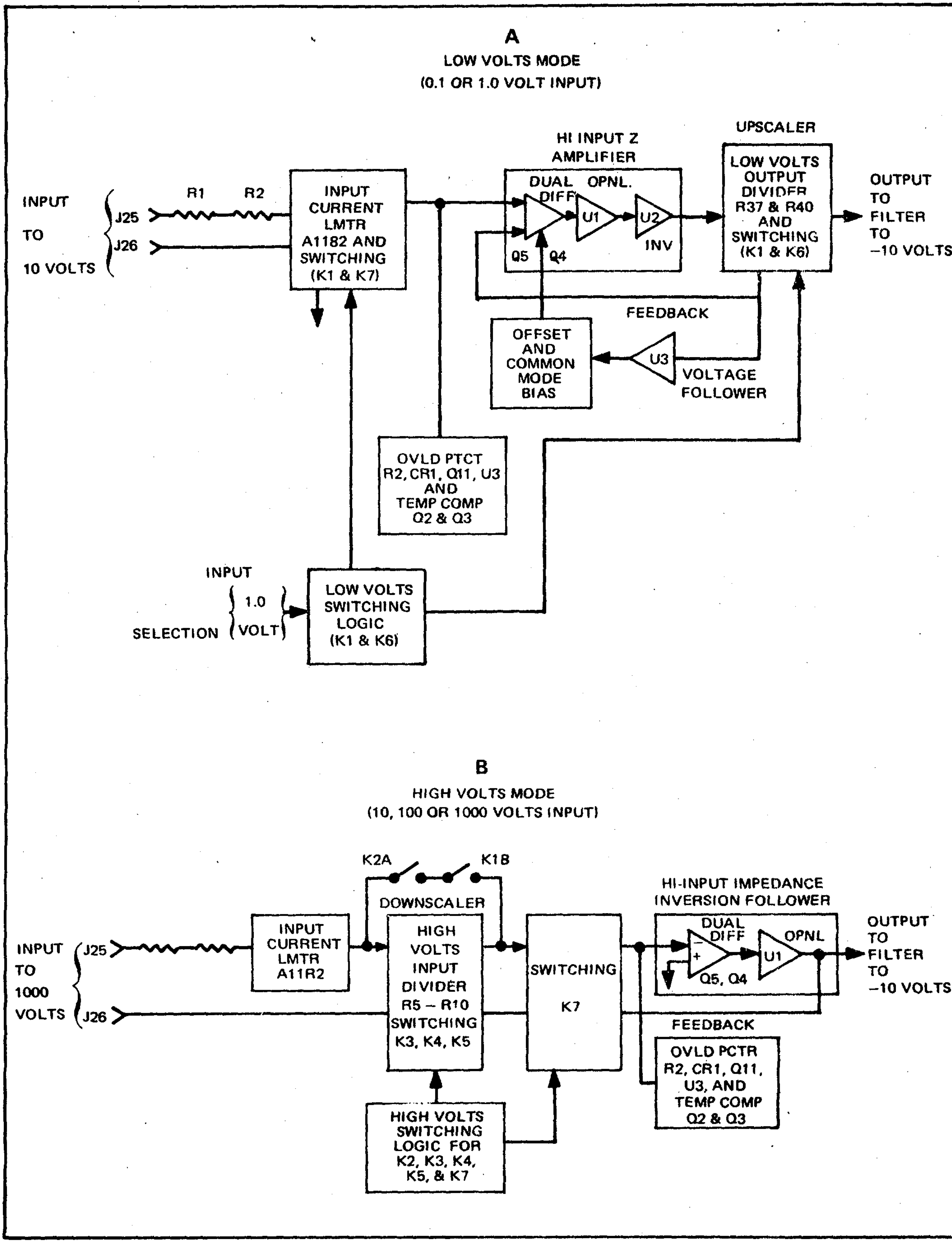


Figure 3-3. Buffer AMPLIFIER BLOCK DIAGRAM

3-30. The input to the All Buffer comes from input jacks J25 and J26, both jacks being shown on the block and system wiring diagrams. Buffer input current limiting resistors (RI and R2 physically located on the front panel) are also shown on the system diagram.

3-31. Figure 3-3A shows the high input applied across current limiting resistor R2, through the contacts of KI (A and B), to the high input impedance amplifier composed of three separate amplifiers: dual differential amplifier (Q5 and Q4), operational amplifier (Ul), and inverter (U2).

3-32. The output of the amplifier is applied in parallel to the A 10 Active Filter and to a gain determining network, R37 through R40, through contacts of relay KI (C and D). The resistance ratios in the gain determining network are such that the feedback through the bootstrap amplifier (U3) will cause the amplifier output to be 100 times the input in the 0.1 volt range, and 10 times the input in the 1 volt range. Thus, the A11 Buffer can produce the required 10 volt output for a full scale input in either the 0.1 volt or 1 volt mode.

3-33. In the high volts mode of operation, shown in Figure 3-3B, the buffer input voltages are either used directly, in the 10 volt range, or divided by a resistor network in the 100 volt and 1000 volt range. In the 10 volt range the input voltage is directly applied to the high input impedance inversion follower via K2A, K2B, and K7A. In the 100 volt and 1000 volt ranges K3 will direct the input voltages across a voltage divider network. Relay K4 closes, when the 100 volt range is selected, and applies 1/10 of the input voltage to the inversion follower. The 1000 volt range closes K5 and applies 1/100 of the input voltage to the inversion follower.

3-34. Overload protection for the dual differential amplifier Q5 is afforded by the combination of components R2, CR1, Q11, and the current limiting resistors RI and R2 shown on the system wiring diagram. Positive overvoltage protection is afforded by transistor QI 1 which clamps the amplifier output to 1.7 volts. Negative overvoltage protection is afforded by diode CR1 which clamps the input to -1.7 volts.

3-35. A10 Active Filter

3-36. The AIO0 Active Filter (Drawing No. 8375A-1015) consists of a voltage follower preceded by four poles of low pass filtering. These four poles attenuate undesirable AC signals which may be present in the dc input signal. Filtering occurs after the FILT button on the front panel of the DMM is depressed. A block diagram of the active filter is shown in Figure 34. Also. shown is the response curve of the active filter which plots attenuation in decibels against a log scale of frequency in Hertz.

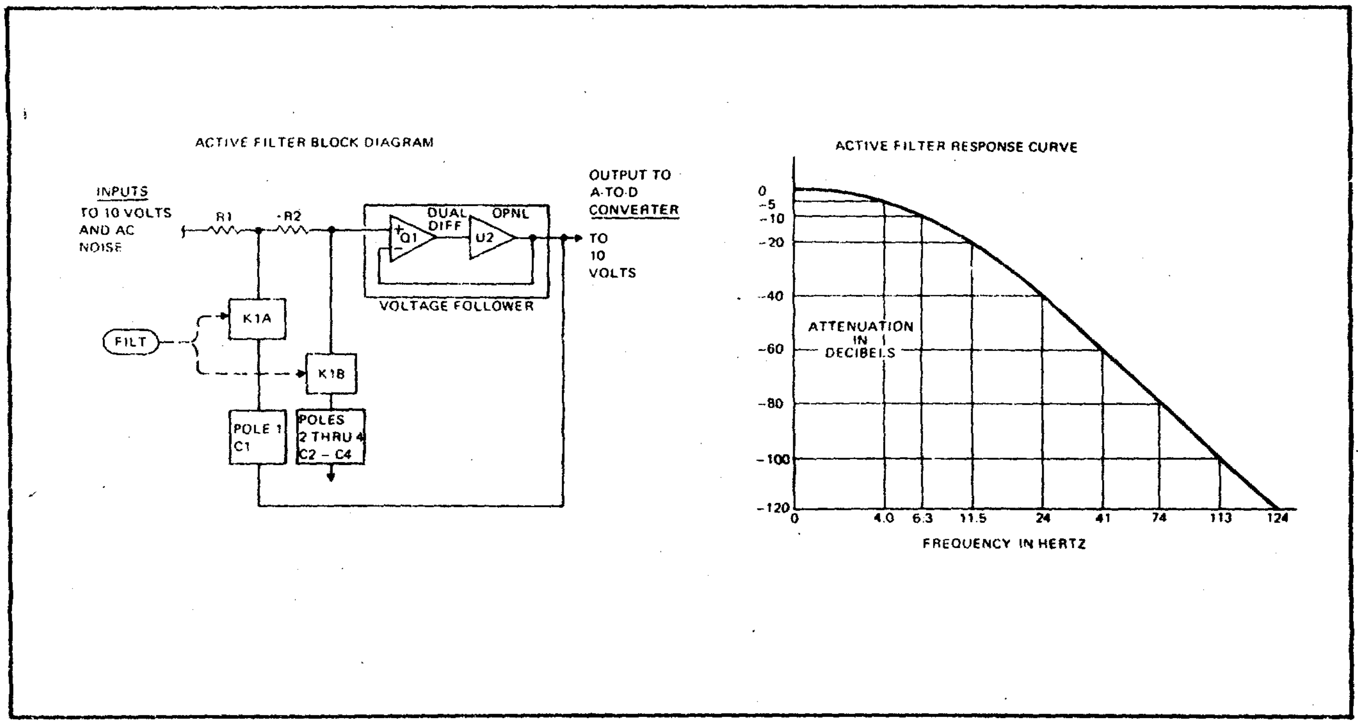


Figure 3-4. ACTIVE FILTER

3-37. A9 A-to-D Converter and A8 Logic

3-38. The A9 A-to-D Converter and A8 Logic circuits (respectively, Drawings No. 8375A-1003 and -1004) are discussed together in the following paragraphs, since any discussion of the analog-to-digital (A-to-D) conversion process must include elements of both circuits. The basic conversion and logic circuitry involved in the conversion process is shown in Figure 3-5. Also shown is an arbitrary input voltage that is the equivalent to the inverted voltage applied across the input jacks of the DMM. The basic purpose of the combined converter-logic circuitry is to convert the analog voltage input (given as +6.3524 dc volts in Figure 3-5) to binary coded bit groups, one bit group per decade.

3-39. The inverting amplifier consists of input switch Q3, dual FET input amplifier Q4, operational amplifier U1, and associated circuitry. Once every 18 milliseconds, during the C sub-period the inverting amplifier switch Q6 is switched on by the S5 Logic Signal, to zero the inverting amplifier. The automatic zero circuit consists of transistors Q5 and Q6 and capacitor C2. The drive circuit also supplies a turn-off signal to transistor Q3, thereby removing the input to the inverting amplifier during the C sub-period.

3-40. The polarity detector consists of flip-flop QI0, Q1 I and associated circuitry. The flip-flop employs base triggering, which is applied through diode CR6 to the base of Q 10. The gate signal, gate 4, is applied to the emitters of Q10 and QI 1 and enables the detector during A sub-period.

During the remainder of the measure period, the plus and minus gates (Q8 and Q7, respectively) are turned off and the polarity information is retained by the display circuitry.

3-41. The A/D amplifier consists of dual FET Q20, operational amplifier U2, and associated components. The A/D amplifier ZERO (0) circuit is comprised of transistors Q23 and Q24 and capacitor C7. Switch Q24 is turned on during the ZERO (0) sub-period of the measurement period by a ZERO signal from the Logic Circuit. This signal also controls switches Q19 and Q31, which are turned on during the ZERO sub-period, and switch Q30, which is turned off during the ZERO sub-period to disconnect the amplifier output from the ladder. Transistor Q29 and resistor R54 constitute a clamp, which prevent amplifier U2 from saturating while its output is above 7 volts.

3-42. The analog comparator, consisting of transistors Q35, Q32, Q33, Q34 and associated components, is a voltage comparator. Differential amplifier stage Q35 compares the A/D amplifier output voltage with the +7 volts reference, and Q33 and Q34 supply the outputs to the current controlled oscillator (CCO). Transistor Q32 operates as a second comparator, which responds quickly to high voltage levels, thereby allowing maximum time for resolution of the least significant digit.

3-43. The sample and hold circuit consists of transistors Q25 through Q28 and capacitors C9 and C 10. The sequence of operation for the sample and hold circuit is shown in Figure 3-6.

3-44. The ladder switches of Q37 through Q44 are controlled by drivers Q19 through Q22 on the A8 logic board. The outputs of the ladder switches are applied to two ladders. Each ladder comprises a 4-bit, weighted resistor, digital-to-analog converter. The primary ladder consists of resistors R44 through R50 and produces an output voltage that corresponds to the actual value of each digit of the input. The secondary ladder, which drives only the display storage circuit through buffer amplifier U3, consists of resistors. R40 through R43 and produces an output that closely approximates the actual value of the digital input. A half-digit bias is produced by R38 and R39 in conjunction with the secondary ladder resistors and adds the voltage equivalent of a half-digit to the output of the secondary ladder. This ensures proper display storage readout by compensating for the effects of voltage decay in the storage unit.

3-45. The display storage circuit consists of FET switches Q13 through Q17, capacitors C11 through C15, and FET switches Q12 and Q18. The buffered output of the secondary ladder is supplied to the appropriate storage capacitor through Q18, which is switched on during the second half (display time) of each sub-period. The first (most significant) digit is stored on C 13, the second on C 11, etc. When the cycle change circuitry switches to storage mode, Q12 is turned on and the analog voltages stored on the storage capacitors are serially applied to the input of the A/D amplifier. Thus, the same reading is continually digitized and displayed until a new sample is taken.

3-46. The 333 Hz clock signal is produced by transistor Q1 on the A8 Logic board. The clock frequency is determined by the RC time constant of resistor R1 and capacitor C1. The output of Q1 is applied to the clock input of flip-flop U1B. The F output of UIB is inverted in Q4 and becomes the H signal. The F, F and f signals are used by the logic to generate control signals.

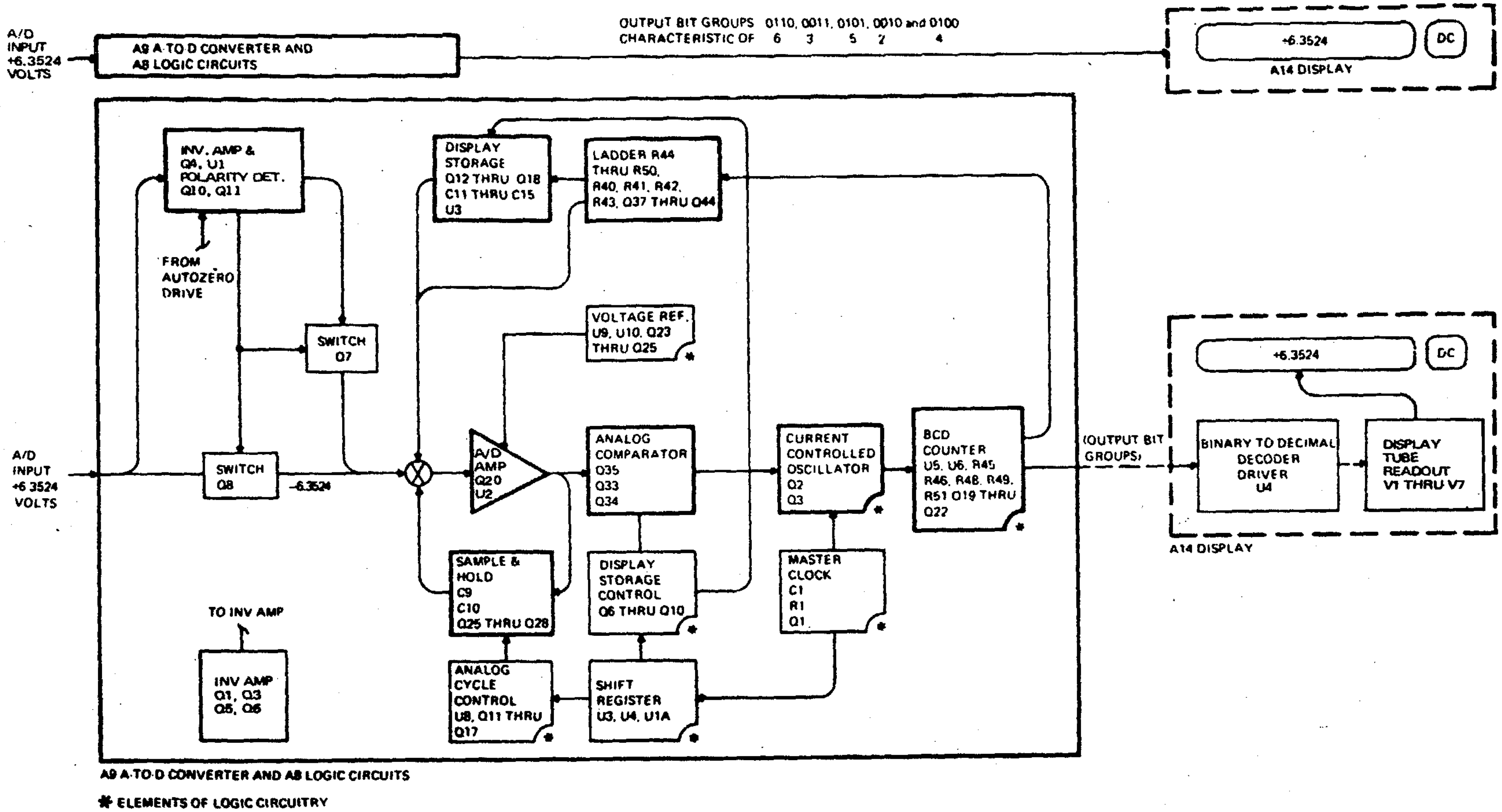


Figure 3-5. A-TO-D CONVERTER AND LOGIC BLOCK DIAGRAM

MEASURE PERIOD SUBPERIODS	SWITCHES ON	VOLTAGES STORED ON SAMPLE AND HOLD CAPACITORS	
		C9	C10
A	Q26, Q22	3.524	0
B	Q25, Q28	3.524	5.24
C	Q27, Q26	2.4	5.24
D	Q25, Q28	2.4	4.0
E	Q27	0	4.0
ZERO (Ø)	Q19, Q31, Q24	0	?

1 VOLTAGES SHOWN ARE ONLY PROPORTIONAL TO ACTUAL VOLTAGES.

Figure 3-6. SAMPLE AND HOLD SWITCHING

347. The six-state shift register consists of J-K flip-flops U3A, U3B, U4A, U4B and UIA. Error correction gate U2B controls the input to flip-flop U3B to ensure proper operation of the shift register. At the end of a typical digitizing cycle, flip-flop U1A reverts to the Logic zero condition upon receiving the H clock pulse. Since all the flip-flops are now in the Logic zero condition, the output of U2B goes low, thereby defining the start of the ZERO sub-period as shown in the timing diagram of Figure 3-9. The ZERO sub-period is terminated by the next H clock pulse, which sets flip-flop U3B high because its J input was high and its K input was low when the clock pulse was received. Subsequent clock pulses set the flip-flop outputs as shown in Figure 3-7.

SUBPERIOD	SHIFT REGISTER FLIP FLOP AND ZERO GATE OUTPUT STATES					
	U3B	U3A	U4A	U4B	U1A	U2B
ZERO	0	0	0	0	0	0
A	1	0	0	0	0	1
B	0	1	0	0	0	1
C	0	0	1	0	0	1
D	0	0	0	1	0	1
E	0	0	0	0	1	1

Figure 3-7. SHIFT REGISTER OUTPUTS

348. The sixteen-state binary counter consists of J-K flip-flop U5B, U5A, U6A and U6B. The counter is set to zero at the beginning of each sub-period in the measurement period by the H clock pulse. During each sub-period of the digitizing cycle, the output pulses from the CCO, which are applied to the clock input of flip-flop U5B, are counted. The truth table for the flip-flops in the binary counter is shown in Figure 3-8. The binary counter is disabled by gate U2A if the count of 11 is attained.

CCO PULSE COUNT	SIXTEEN-STATE BINARY COUNTER			
	U5B Z	U5A Y	U6A X	U6B W
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1
10	0	1	0	1
11	1	1	0	1

Figure 3-8. SIXTEEN-STATE BINARY COUNTER OUTPUT

3-49. The CCO consists of multivibrator Q2 and Q3. The CCO has no output until it is supplied current by the analog comparator and is enabled by the F output of the J-K flip-flop U I B. The CCO output is applied to the clock input of the 16-state binary counter. The 9's catcher gate U7A, disables the CCO at a count of nine, if the DMM is digitizing the second through fifth digits (sub-periods B through E).

3-50. The outputs of the six-state shift register, in conjunction with the H pulses, are applied to the display storage control circuit consisting of transistors Q6 through Q10 and related components. Outputs from this circuitry control the display storage circuit located on the A9 A-to-D Converter board.

3-51. The analog cycle control circuit produces the gating and control signals which are used to control the synchronization of events in the analog portion of the DVM, principally in the A-to-D Converter circuits. These signals, together with other control signals are shown in the DMM Timing and Synchrony Diagram, Figure 3-9. The analog cycle control circuit consists of NAND gates U8A through D driving transistors Q11 through Q17 and associated circuit elements.

3-52. The ladder switch driver circuitry (Q!9 through Q22 on A8 Logic board) receives 84-2-1 coded binary data from the sixteen-state binary counter and translates this to 4-4-2-1 coded binary data, which matches the weighting of the resistors in the ladder. Thus, the ladder output is proportional to the count in the binary counter. Each count applied to the ladder switches will cause the output voltage from the primary ladder to decrease the voltage level applied to the A/D amplifier by one digits worth. When the count produces sufficient voltage to exactly offset

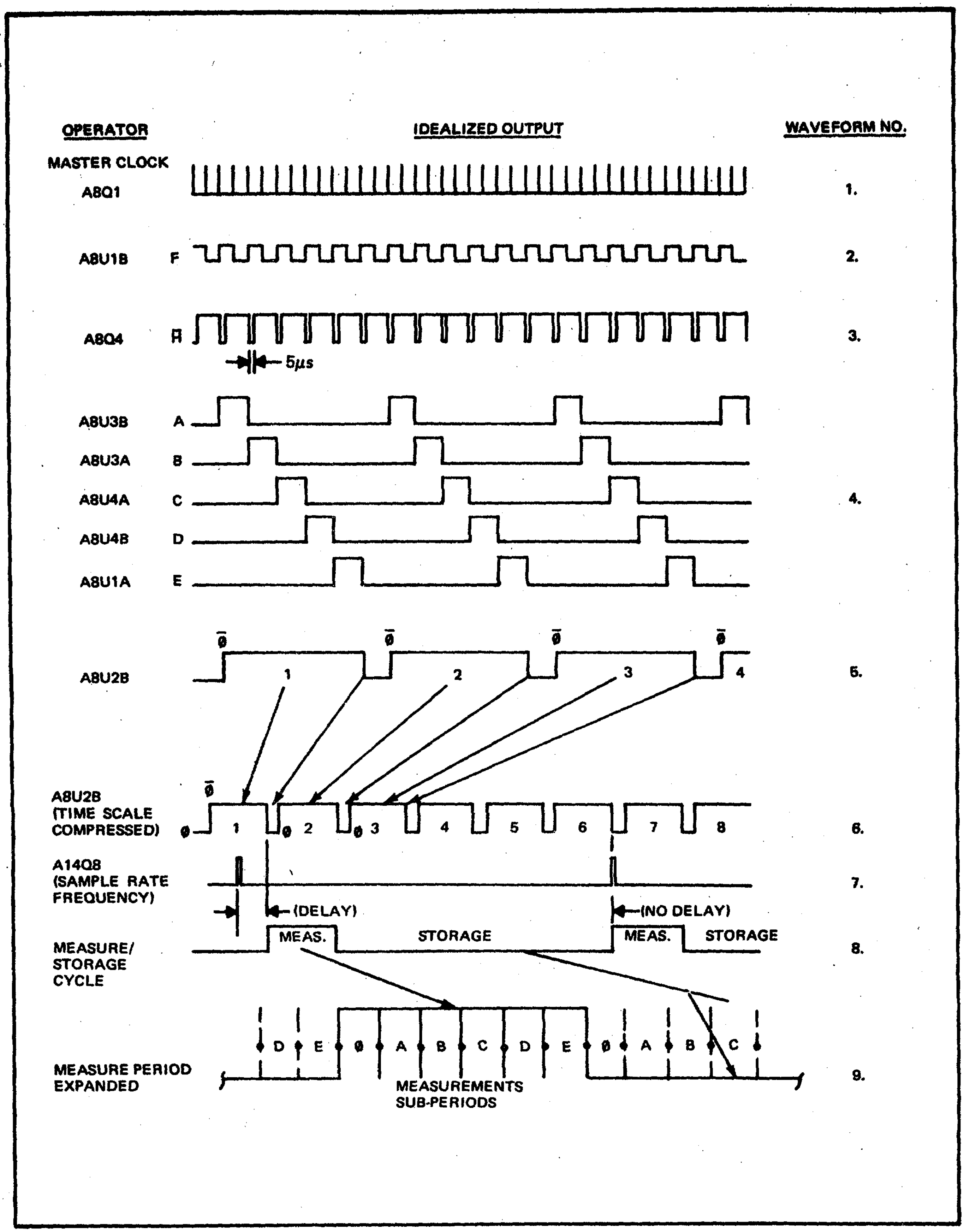


Figure 3-9. DMM TIMING AND SYNCHRONY DIAGRAM (SHEET 1)

the most significant digit of the A/D amplifier input voltage, the count for that particular sub-period will stop.

3-53. The +7 volts reference for the instrument is derived using reference amplifier U9 as a reference element. The reference voltage is produced using operational amplifier U 10 and emitter follower Q25, which presents a low source impedance at the reference point. Transistor Q24 disables the +7 volts reference in the event the user wishes to employ an external reference and the required option is installed. Transistor Q23, coupled with the zener in the reference amplifier, produces a reference voltage for the +18 volts regulator in the Al Power Supply.

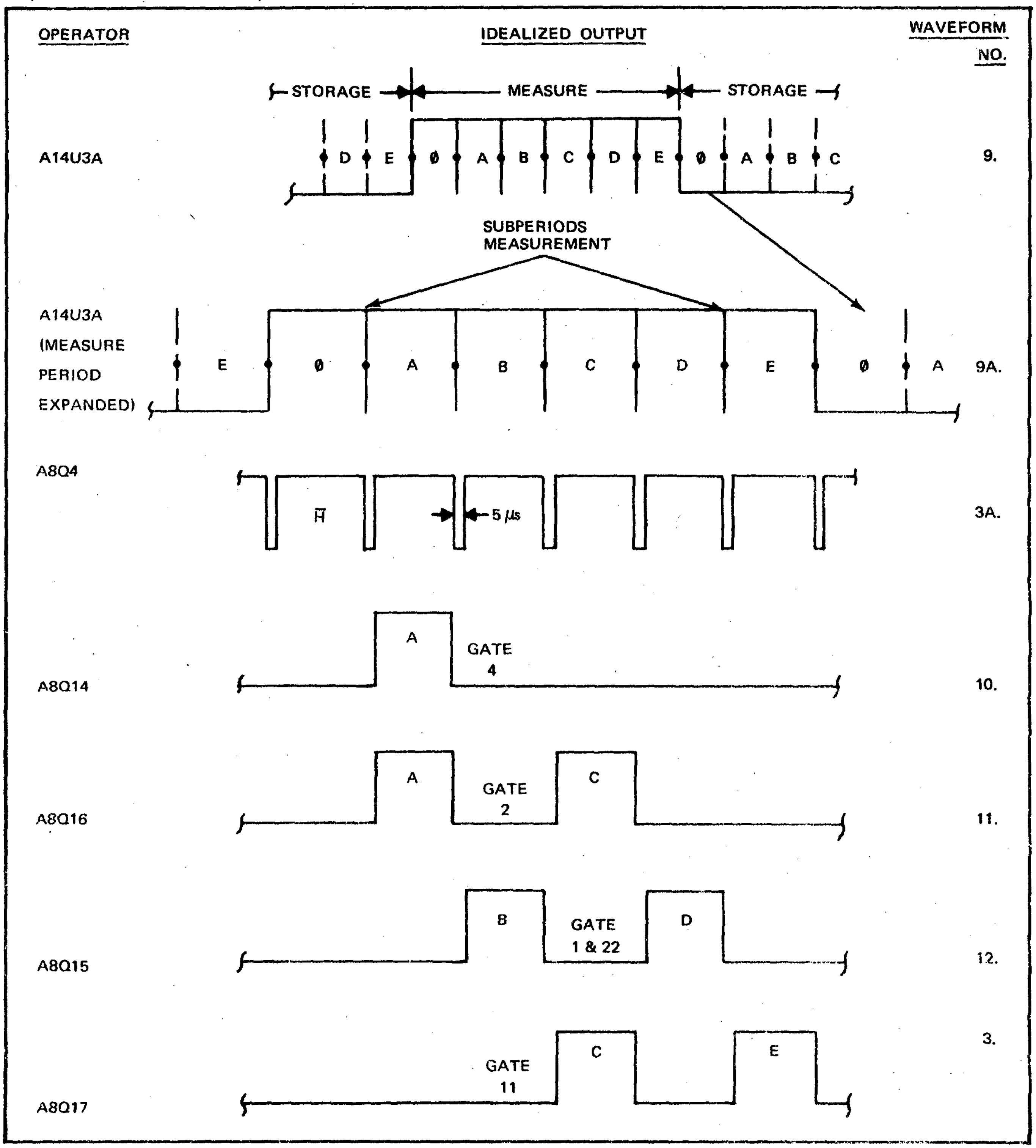


Figure 3-9. DMM TIMING AND SYNCHRONY DIAGRAM (SHEET 2)

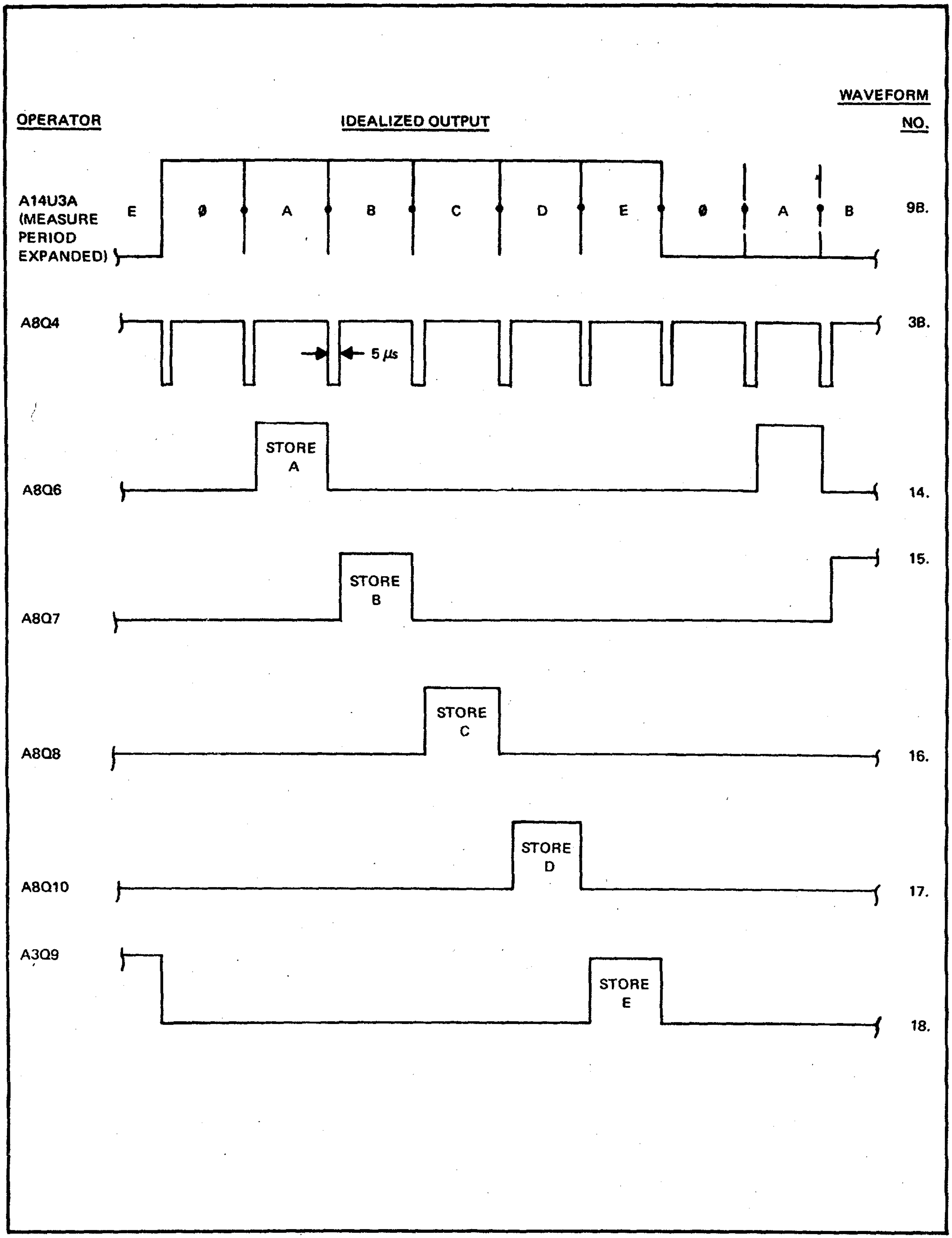


Figure 3-9. DMM TIMING AND SYNCHRONY DIAGRAM (SHEET 3)

3-54. A14 Display

3-55. The A14 Display circuits (Drawing No. 8375A1002) control the function/status indicators and the decimal indicators associated with the readout tubes. The K/I, AC, DC, Q1, OVER, FILT, and X REF indicators are controlled by the respective function control lines. They are illuminated when +5 volts dc is applied to the control line; however, the control lines are interlocked to the associated assembly so that the indicator remains extinguished unless the assembly is installed in the instrument. The OVER range indicator is operated by transistor Q5 in the OVER RANGE DRIVER circuit.

3-56. The polarity signs + and of tube V are controlled by a flip-flop consisting of transistors Q19, Q20, FET switches Q32, Q33, current source transistors Q9, Q10, and associated components. Inputs to this circuit are VDC, C, POL INFO A and B, and a. POL INFO A and B come from the polarity detector in the A-to-D Converter and determine which of the two polarity characters are illuminated. The (a)output, of the range counter reverses the effects of POL INFO A and B as a function of range to account for the fact that the polarity detector receives the input to the instrument in its true sense on the 0.1 and I volt ranges, but in its inverted sense on all other ranges. The decimal point indicators in tubes V2 through V7 are controlled by transistor switches Q11 through Q16, which, in turn, are controlled by the range counter status.

3-57. The switches Q22 through Q26 are the main elements of the anode strobing control circuit. They are turned on sequentially by shift register signals A through E, beginning with signal A. The F signal ensures that the transistors are turned on only during the second half of each sub-period as defined in Figure 3-9. The output of these switches controls switches Q27 through Q31, which apply +200 volts dc to the anode of each readout tube.

3-58. The overrange indicator V2 is operated by transistors Q17 and Q18. These transistors are controlled by the 6-state cycle control shift register, the 16-state binary counter, and the range counter. The zero character in this tube is illuminated only when the range counter commands the 0.1 or I range, and when the bount in the binary counter is less than 10. The one character is illuminated when the count in the binary counter is 10 or 11. The decoder driver U4 is a monolithic BCD to decimal decoder which accepts the 4-bit BCD output of the 16-state binary counter, decodes each digital word, and selects one of ten output drivers. The cathodes of readout tubes V3 through V7 are connected in parallel. These ten anodes are, in turn, connected to the ten available outputs of the decoder driver.

3-59. The sample command oscillator (SCO) consists of Programmable Unijunction Transistor (PUT) Q8 and surrounding circuitry shown in Figure 3-10 in its normal operating state. Resistors R12 and R14 provide a bias level for the gate of the PUT. When capacitor C3 charges to approximately 0.6 volt above the gate bias level, the PUT turns on and discharges C3 through RI 5. This generates an output pulse which commands the measure/storage cycle J-K flip-flop U3A to the measure period to take a sample, providing the end of a ZERO pulse is coincident at the clocked input to the flip-flop. If the sample results in a command to autorange, signal 3 from the A2 Range Delay one-shot turns off Q6 and disables the SCO to allow time for analog signal conditions to settle on the new range before another sample is taken. Capacitor C4 begins to recharge and the SCO cycle begins again. The oscillator frequency is dependent upon the time constant of R and C3, and the gate bias level. The frequency is varied by the adjustment of R through the front panel SAMPLE RATE control. Transistor Q7 and its base bias network (R 11 and R13) ensures that PUT Q8 is turned off by forcing the gate and anode to the same potential after C3 discharges.

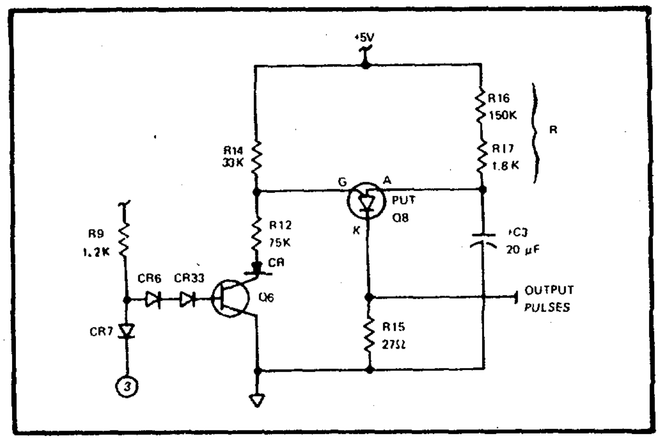


Figure 3-10. BASIC SAMPLE COMMAND OSCILLATOR

3-60. The remaining circuitry surrounding the SCO (See A14 Display schematic diagram) functions only when the SAMPLE RATE control is switched to the EXT position and samples are initiated through the external trigger input of the Data Output Unit (DOU) option. In this circumstance, the emitter of Q6 is normally high. Thus, the gate of PUT Q8 is near the supply voltage and the PUT Is disabled.

A trigger from the DOU, however, pulls the emitter of Q6 to ground. Its collector follows, causing the gate of Q8 to be more than 0.6 volt below the anode and the PUT fires once. If the corresponding sample results in a range change, the range delay one shot multivibrator will disable the SCO via 3 and CR7. This means that no samples may be commanded until the range delay one-shot times out. At the end of this time delay, the SCO is automatically retriggered via CR8 and 2 from the range delay one-shot. Diode CR9 and resistor R10 ensure that capacitor C3 is charged rapidly to ready the PUT for the next trigger pulse. Signal No. 8 interrupts the cycle control shift register on the A8 Logic board by forcing it directly to the E sub-period. This is done to minimize the time between the sample command (trigger) and actual sample.

3-61. The measure/storage cycle commands come from J-K flip-flop U3A on the A14 Display board. The clocked input of U3A is connected to ZERO through a bias and differentiating network composed of capacitor C4 and resistors Ri8, R19. When the M output of U3A is high, the instrument is in the measurement period of the measurement/storage cycle. When the M output from U3A is low, the storage period prevails. The clocked input is normally high as determined by the bias network, and since this is a master-slave type flip-flop, the master is connected directly to the J and K inputs and isolated from the outputs. If the SCO outputs a pulse, the J input goes high and causes the master to assume the true state. At the start of the next ZERO time, the clock pulses low causing the slave, and hence, the outputs, to assume the state of the master. That is to say, the output goes true and initiates a measure cycle. At the same time, the master is updated as a function of the new J and K inputs. Thus, at the start of the next ZERO time, the slave assumes the false state existing in the master, and the storage period is initiated. Not until the SCO pulses again will another measurement period be initiated. The idealized waveform output of the measure/ storage cycle J-K flip-flop waveform No. 8, and its-two input generating waveforms 6 and 7 are shown in Figure 3-9, Sheet 1.

3-62. The OVER RANGE DRIVER circuit is composed of programmable unijunction transistor (PUT) Q4, transistors Q4, Q5 and Q37, and associated circuitry. Transistor Q2, diode CR5, and resistors R2 and R4 are not part of the driver circuit but provide a delay in the speed at which the range delay one-shot multivibrator circuit, on the A2 Range Delay board, times out. The overrange driver PUT Q4 is turned on when its gate voltage is reduced about 0.6 volt relative to the anode voltage. The differential voltage developed across resistor R64, (tied between the gate and anode of the PUT) when the PUT conducts, causes transistor Q5 to turn on the OVER lamp in the function display annunciator. Q3 is turned on by the 12th output pulse from the CCO being applied to its base. Twelve output pulses from the CCO indicate greater than twenty percent overvoltage is being applied at the input of the instrument for a given range. However, even though turned on, 3-'4 transistor Q3 is ineffective In gating the PUT unless an enabling signal (UP) is applied through R6 to its emitter.
The source of the UP signal is the output of NAND gate U2A located on the A8 Logic board. Signal No. 7 is the UP range signal that is applied to NAND gate U3B on the A2 Range Delay board. It is generated at the emitter of transistor Q37 when this transistor is turned on by the PUT firing. After firing, the PUT is reset by the application of the positive-going edge of the M signal applied to its cathode through C 1.

3-63. The RANGE COUNTER circuit is composed of J-K flip-flops U2A, U2B and U3.B. The clocked input to the range counter is provided by J-K range flip-flop U3B; that has as its clocked input signal No. 6. This signal originates in the range oscillator on the A2 Range Delay board and is pulsed high everytime the range oscillator PUT fires. The J-K inputs to the range flip-flop U3B are tied together at the output of the measure/storage cycle J-K flip-flop U3A and go high every measurement period. The range counter is a divide-by-6 counter that provides the 6 possible binary states for range counting, 5 pulses being considered an up-range command and I pulse being considered a down-range command. Signal No. 6 applied to the clocked input of the range flip-flop U3B alters the 6 states of the range counter. Transistor Q35 is provided to pull the range counter out of an unallowed state that may occur at turn-on.

3-64. A2 Range Delay

3-65. The A2 Range Delay circuits (Drawing No. 8375A1006) consists of a series of gates, a range delay one-shot multivibrator, and a range oscillator. The gates allow the specified set of ranges to be attained, which is dependent upon the function called on the front panel. The range oscillator generates pulses which trigger the range delay one-shot while simultaneously causing the A14 range counter to change states. The range delay one-shot prevents further ranging for a specified time to allow the analog signal conditioners to settle in the new range.

3-66. The gates are U2A, U2B, U2C, U3A and U3B. Gates U2C and U3A are up range stops which pull down on the range-up enable line. Gate U2C prevents autoranging above the 10,000 range, while gate U3A prevents autoranging above the 1000 range on the VDC function. Gates U2A and U2B are down range stops which pull down on the range-down enable line. Gate U2A prevents autoranging below the 10 range in the 92 function, while gate U2B prevent autoranging below the 0.1 range in any function. Gate U3B is the master up-range control. It enables the range oscillator only if an up range is to be expected.

3-67. The three inverters U1D, U1E and U1F coupled with the range-up enable line provide one input for uprange control gate U3B. The result is that U3B is enabled for 1.5 milliseconds (the second half of the A sub-period of a measurement period) if an up-range is to be executed. Signals applied to diodes CR6 through 8 and 10, coupled with the range-down enable line provide a negative going signal to the range oscillator at the end of the A sub-period of a measurement period if a down-range is to be executed. Thus, there are two ways which can enable the range oscillator.

3-68. The range oscillator is composed of capacitor C4, resistors R14 and R18, and Programmable Unijunction Transistor (PUT) Q4, with the output of this oscillator appearing at the cathode of PUT Q4. The PUT is fired, discharging capacitor C4 through R15, when the gate is about -0.6 volt relative to the anode. Thus the PUT is fired to produce one output pulse by lowering gate voltage or by raising the anode voltage, such that the voltage difference between these elements is indicated above. The firing of PUT Q4 discharges capacitor C4 and reduces the anode and gate voltages. This causes Q3 to turn on and force the anode and gate of Q4 to the same potential. Q4 turns off and capacitor C4 charges through R14 and RIS. If the firing potential between the gate and anode of Q4 is established, Q4 again fires and the cycle is repeated to produce the second output pulse. The frequency of oscillations is set by the level of gate voltage applied and the charging time constant of R4, R18 and capacitor C4.

3-69. Control of the gate of PUT Q4 is effected by one of two mutually exclusive inputs. One of these is associated with ranging up and is identified on the A2 schematic as the output of gate U3B. The other of the two inputs is associated with ranging down and is identified as the range down enable line. In an up-range situation, the output of U3B pulls low for 1.5 milliseconds during which time the range oscillator outputs five pulses. In a down-range situation, the range-down enable line pulls low. This signal is capacitively coupled via C3 to the gate of PUT Q4 causing it to output one pulse. Five pulses counted by the A14 range counter commands a transition to the next higher range, while one pulse commands a transition to the next lower range. In either case, the first output pulse triggers the range delay one-shot to allow the analog signal conditioners to settle in the new range.

3-70. Transistors QI, Q2 and associated components make up the range delay one-shot multivibrator. A range change pulse from the range oscillator applied to the base of transistor Q2 turns this transistor on and transistor Q1 off, thereby placing the one-shot multivibrator into its unstable state. The RC charge time of combined capacitors C2, C6 and resistor RS, and the current through R16 determine how long the one-shot remains in its unstable state. With the filter selected, no current flows through R16 and the timeout is about 220 milliseconds. Without the filter selected, the timeout is decreased to about 25 milliseconds because some current slows through RI6. Signal No. 3 disables the sample command oscillator during the range delay time. Signal No. 2 re-triggers the SCO at the end of the range delay time.

3-71. Transistor Q5 and associated components is a circuit that prevents the instrument remaining in a disallowed range, as in 10,000 VDC, when turned on. When Q5 is turned on by the inputs of VDC and a. b. c., the collector of Q5 pulls down on the set line of the counter and thereby forces the instrument out of the 10,000 range.

3-72. A1 Power Supply

3-73. The Al Power Supply (Drawing No. 8375A-1001) consists of four regulators, a +18 and -18 volt regulator, a 200 volts regulator and a 5 volts regulator. The purpose of the power supply is to furnish, to the instrument, all of its required operating power.

3-74. The +18 and --18 volt regulators obtain filtered dc voltage from the full-wave rectifiers consisting of diodes CR5 through CR8 and filter capacitors C2 and C5. The + 18 volts regulator consists of operational amplifier U 1 and series pass transistor Q3. The voltage reference for the + 18 volts regulator is derived from reference amplifier U9 and temperature compensation transistor Q23 on the A8 Logic board. The -18 volts regulator consists of operational amplifier U2 and series pass transistor Q5. The -18 volt regulator is referenced to the +18 volts.

3-75. The +200 volt regulator is operated from a full wave bridge rectifier and filter consisting of diodes CRI through CR4 and capacitor C 1. The reference for the +200 volt regulator is the +18 volts. Voltage variations are amplified in transistor Q2 and applied to series pass transistor Q 1.

3-76. The +5 volt regulator is operated from a full-wave rectifier and filter consisting of CR10 through CR13 and capacitor C8. The reference for the +5 volt regulator is -18 volts. The series pass element is a compound-emitter follower composed of transistor Q8 driving power transistor Q6. Voltage variations which are detected by the sample string (R14, RI 5 and R17) are amplified by transistors Q7.

3-77. A12 Ohms Converter

3-78. The Ohms Converter (Drawing No. 8375A-1010) is operated in one of two configurations associated with the functions of OHMS and K OHMS. In the 92 function, the converter is a constant current source, and in the K92 function, the converter is a precision scaling resistor, which in conjunction with the Buffer Amplifier and the unknown resistor, produces a voltage proportional to the unknown resistor. The constant current source produces one of three currents depending upon the range selected. These currents are as follows:

OHMS RANGE	CURRENT
10	10 mA
100	10 mA
1000	1 mA
10K	100 æA

3-79. In the constant current generator, regulated dc voltage is developed by resistors R2, R4, R5, zener diode CR3, transistor Q1 and operational amplifier U1. Divider string, R6, R7 and R8, scales the zener reference voltage and applies it to U2. Range resistors RIO0 through R16, in conjunction with zener CR3, the regulated dc voltage, and amplifier U2, apply a range dependent, constant current to the emitter of a Darlington pair composed of Q2 and Q3. Fuse F1,.capacitor C6, and diodes CR2, CR4 are used as an overvoltage protection circuit for the current generator.

3-80. Resistors R17 through R22, and relay contacts KI-A, K2-A and K4 comprise the range scaling network. The relay contacts KI-A and K2-A are actuated by range selection on front panel. Relay K4 is actuated in the K12 function and connects one end of the scaling network to the HI SOURCE terminal on front panel.

3-81. In the range relay drive circuit, range control relay KI receives its commands from the All 1 BUFFER assembly, whereas relay K2 receives its call commands from the buffered A14 range counter. Function control relays K3 and K4 are controlled by transistors Q6 and Q5, respectively. A manual range condition is detected by Gate U5B which enables gates USC and U5D to control Q5 and Q6. In an autorange condition, gates USC and U5D are disabled and function control is transferred by gate U3B to RS flipflop U3A and U3C. The mutually exclusive outputs of this flip-flop, in turn, control switches Q5 and Q6. Gates U4A and U4B operate on the set and reset lines of the RS flipflop to enable an automatic change of functions in an autorange condition.

3-82. A13 True RMS Converter

3-83. The True RMS Converter (Drawing No. 8375A-1022) provides a dc voltage, proportional to the rms value of the applied INPUT voltage, to the A/D Converter for digitizing and subsequent display on the front panel readout. A simplified diagram of the circuits involved in the rms conversion process is illustrated in Figure 3-11. As shown in the diagram, the RMS Converter consists, basically, of a Range Amplifier and RMS Detector. The output voltage from the Range Amplifier is I volt rms ac, maximum, for a full scale INPUT voltage. A scaled output voltage from the Range Amplifier is applied to the RMS Detector's Balance Amplifier where any negative going signals are inverted. The output of the Balance Amplifier is summed with the output of the Range Amplifier at the summing junction of the Squaring Amplifier. This provides a rectified version of the Range Amplifier output. The rectified signal is processed by the Squaring Amplifier, Integrating Amplifier, and Square Root Amplifier, respectively. These three amplifiers perform squaring, integrating, and square rooting functions which result in a dc voltage proportional to the rms value of the INPUT voltage.

3-84. The Range Amplifier scales the applied input voltage to the Converter to I volt rms ac for a full scale input. Basically, the Range Amplifier is an inverting operational amplifier whose gain changes as the range changes. Voltage gains of -1, -10, -100 and -1000 correspond with the 1 through 1000 volt ranges, respectively. Active elements of the Range Amplifiers are Q1, Q2, Q5 and U3 with protection diodes CR6, CR7, CR18, CR20, CR21 and CR22. Transistor Q2 drives the guard at the summing point of the operational amplifier, and Q5 switches C5 into feedback path in the 10, 100 and 1000 volt ranges. Diode CR6, CR7, CR21 and CR22 provide clipping for input overload protection to QI. Diodes CR18 and CR20 provide overload clipping at the output of the Range Amplifier for protection of the following circuitry.

3-85. The Balance Amplifier is a rectifying amplifier with a gain of -1 that changes all negative going signals from the Range Amplifier output to positive voltages prior to summing with the Range Amplifier output from R33. Balance Gain adjustment (R32) controls the input to the Balance Amplifier, such that positive and negative signals at the summing junction of R31 and R33 will be equal in magnitude. Active components of the Balance Amplifier are CRI15, Q6, Q9, Q10 and U4. Balance Zero Adjustment, R42, is an adjustment for zeroing the input of U4. The primary, or low frequency signal path is through U4, CR! 5, and final output stage Q10. At frequencies above a few

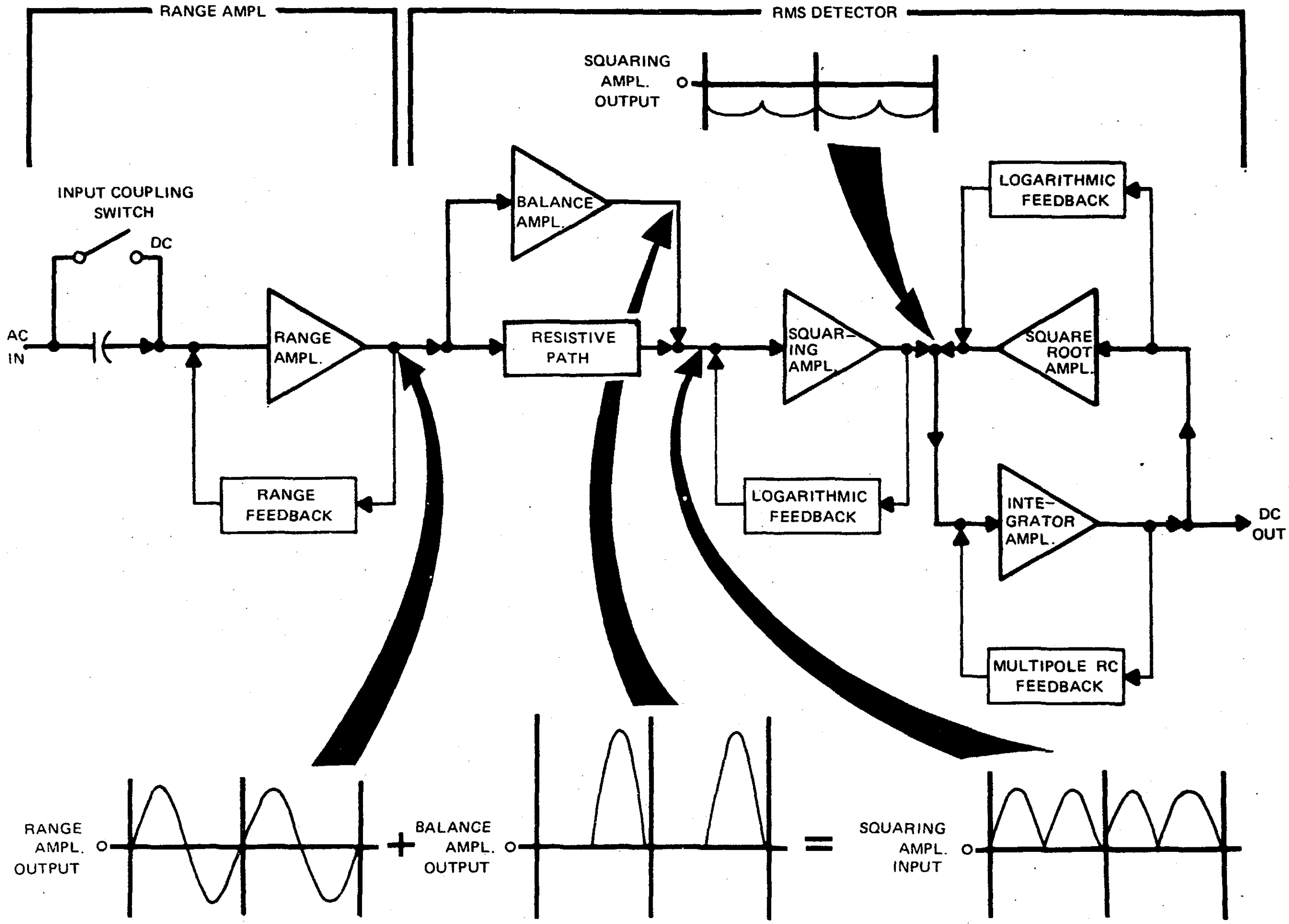


Figure 3-11. TRUE RMS CONVERTER BLOCK DIAGRAM

hundred kilohertz, amplification takes place through Q6 followed by Q10. The final output stage, Q10, has a current source load, CL1, which maintains a high amplifier output impedance for driving CR14 and CR16. Any stray capacitance in CR14 and CR16 is compensated by Q9. Transistor Q9 samples the waveform driving CR14 and CR16 and feeds back a capacitive charge through C17 to the input of the Balance Amplifier.

3-86. The Squaring Amplifier is an inverting operational amplifier with non-linear feedback through matched transistors Q8A and Q12AThese transistors transform : the input current into an output voltage that is the log of the input current. Since this operation is performed twice (by Q_{8A} and Q_{12A}), the output voltage is twice the log of the input current. Therefore, the amplifier essentially accomplishes a squaring operation (2 log X = X^2). U_5 is an integrated operational amplifier which is paralleled by Q7 by high frequencies in a manner similar to Q6 in the Balance Amplifier. AC Zero Adjustment, R43, provides for zeroing of US, and has the greatest effect of all other zero adjusts for overall converter zero. Both amplifying paths, U5 and Q7, share the common final output stage ,Q11. Output voltage from Q11 is sampled by Q12B which provides a current to the summing point of the Integrator Amplifier. Resistor R38 provides an adjustment for crest factor gain.

3-87. The Integrator Amplifier consists primarily of U7 and U8, and is a complex multipole integrator which acts as a three pole filter. Voltage at terminal 2 of U7 is held at zero, and all of the current applied is passed through the feedback elements R56, R65 and whichever feedback capacitors are switched into the circuit. Switchable capacitors are connected through FET's Q13, Q14, Q16 and Q17 by operation of the FILT switch on the instrument front panel. If the FILT switch is depressed, the FET's are turned on, and the capacitors are a part of the feedback circuitry. Since each switchable capacitor is paralleled by a non-switchable -capacitor, some filtering action takes place in the Integrator Amplifier whether the FILT -is depressed or not. Amplifier U7 and associated multipole feedback circuitry provides the integration for the Integrator Amplifier. Amplifier U8 is a unity gain, high input impedance, low output impedance amplifier. Three poles of feedback for U7 consists of C30, R68 and C32, and R69 and C33. Capacitor C29 can be switched in parallel with C30, C34 with C32, C35 with C33, and C28 with C27. Output from U8 is the output of the total Integrator Amplifier which is then applied to the A-to-D Converter and to the Square Root Amplifier.

3-88. The -Square 'Root Amplifier consists of the input resistor R57, the trimming and selection resistors R61, R62, R63, and R64, the feedback transistor Q8B, protection diode CR19, and amplifier U6. Diode CR19 acts as a feedback path to prevent saturation of U6 should input polarity to the amplifier reverse. The Square Root Amplifier uses logarithmetric feedback 'to produce a square root of the input in a manner similar to that used by the Squaring Amplifier. The square root process is accomplished by matched transistors Q8B and Q12B. Resistors R48, R79, and R80 are factory selected for overall converter TC and linearity. Some or none of these resistors may be installed.

3-89. Miscellaneous Circuitry

3-90. Input power to the instrument and interconnection of various assemblies is shown in the Wiring and Interconnect Diagrams (Drawing No. 8375A-1000 and 8375A-1 100). Line power is fused by F1 and applied through the contacts of POWER switch S1 and T1. The primary of T1 consists of two windings which are parallel or series connected through slide switch S2 to allow operation from either a 115 or 230V ac line. When S2 is set to 115, the primary windings of TI are connected in parallel. The 230 position of S2 connects the-windings in series. Secondary windings of T1 provide ac voltages to the A1 Power Supply and A6 Data Output Unit No. 2. Shielding between the primary and : secondary windings prevents coupling of any undesired line signals to the internal sections of the instrument.

3-91. TEST SWITCH

3-92. The Test. Switch allows a partial check of instrument operation in Ohms, VDC, and VAC functions. The performance tests outlined in. Section 4 of this manual give the procedures for a complete check of instrument operation for all ranges and function.

3-93. The Wiring Diagram (Drawing No. 8375A-1000) shows .the, connection for the Self Test Switch SI. The Test Switch positions, corresponding functions, and the expected readouts are listed in Table 2-2. The VDC ...position applies +18 volts dc from the Buffer to the Buffer input, the VAC position applies 13 volts ac from the Ohms Converter to the True RMS Converter input, and the Ohms position connects resistance across the Ohms Converter for measurement.

Section 4

Maintenance

4-1. INTRODUCTION

4-2. This section contains information and instructions concerning preventive and corrective maintenance for the Model 8375A Digital Multimeter. The information and instructions are arranged under headings of "SERVICE INFORMATION, GENERAL MAINTENANCE, PERFORMANCE TEST, CALIBRATION PROCEDURE, COMPENSATING COMPONENT SELECTION, and TROUBLESHOOTING."

4-3. A calibration interval of 90 days/i year is recommended to ensure instrument operation within the 90-day / I year specifications as stated in Section 1.

4-4. Table 4-1 lists the required test equipment. If the recommended equipment is not available, other equipment having equivalent specifications may be used.

4-5. SERVICE INFORMATION

4-6. Each instrument that is manufactured by the John Fluke Mfg. Co., Inc. is warranted for a period of one year upon delivery to the original purchaser. The WARRANTY is located at the front of the manual.

4-7. Factory authorized calibration and service for each Fluke product is available at various world-wide locations. A complete list of these authorized service centers is located at the rear of the manual. Shipping information is given in Section 2, paragraph 2-5. If requested, an estimate will be provided to the customer before any repair work is begun on instruments that are beyond the warranty period.

4-8. GENERAL MAINTENANCE

4-9. Access/Disassembly

4-10. The following procedure is used to gain access to the interior of the Model 8375A.

a. Remove top dust cover to gain access to calibration adjustments and test points.

b. Remove top guard chassis by removing the four screws which hold it in place. Access is now provided to the plug-in assemblies shown in Figure 4-1.

c. Remove bottom dust cover. By removing single screw securing bottom guard cover access can be gained to the bottom section of the Model 8375A.

Table 4-1. TEST EQUIPMENT

NOMENCLATURE	RECOMMENDED EQUIPMENT
AC Voltage Source	Fluke 5200A AC Calibrator and 5205A Power Amplifier
DC Voltage Source	Fluke 332D Voltage Standard
DC Differential Voltmeter	Fluke 885A Differential Voltmeter
RMS Differential Voltmeter	Fluke 931A True RMS Differential Voltmeter
Oscilloscope	Tektronix 544 with Type L Plug-In and Low Capacitance Probe
Pulse Generator	H—P 8003A Pulse Generator
Kelvin-Varley Divider	Fluke 720A Voltage Divider
Resistance Standard	General Radio Type 1440

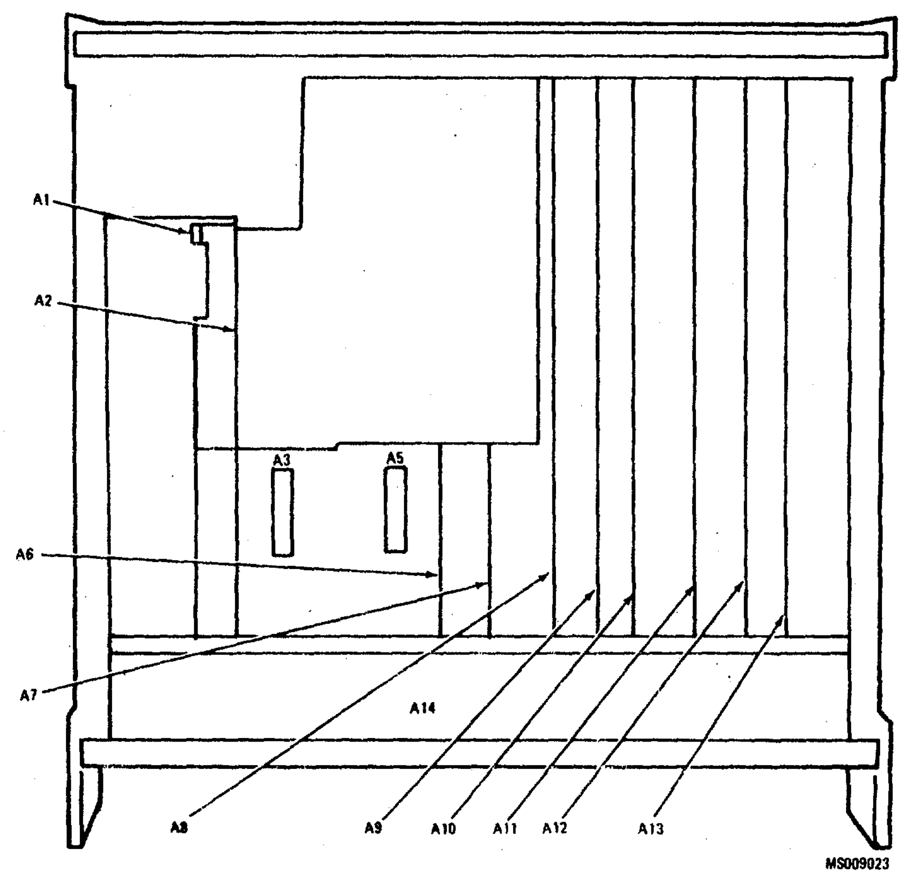


Figure 4-1. ASSEMBLY LOCATIONS

4-11. Cleaning

4-12. Clean the instrument periodically to remove dust, grease, and other contamination. Use the following procedure:

a. Clean the interior with clean, dry air at low pressure. When the printed circuit boards require cleaning, first spray them with Freon T.F.Degreaser (Miller Stephensen Company, Inc.)and then remove the dirt with clean, dry air at low pressure.

CAUTION!
Do not spray Freon T.F. on the component side of any PCB since damage to certain components may result.

b. Clean the front panel and exterior surfaces with 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.

4-13. Fuse Replacement

4-14. One fuse is located in the rear panel fuseholder. When replacement is necessary, install Bussman, TYPE AGC 1/2 as shown on Decal located on the rear panel.

4-15. The Ohms Converter contains two fuses, one of which prevents damage in the event large a(c or dc voltages are inadvertantly applied to the DMM input during ohms operation. The circuit will withstand a maximum applied voltage of 20 volts rms on 10ê through 10,000ê range before the fuse will blow. Up to 250V rms may continuously be applied to the 100kgl through 10,00kOOk ranges without damage. A spare fuse is located on the ohms converter pcb, next to the in-circuit fuse.

4-16. Lamp and Tube Replacement

4-17. The readout tubes (V1 through V7) and the Function Display Lamps are mounted behind the left portion of the front panel. These components are replaced without special tools using the following procedure:

4-18. FUNCTION/DISPLAY LAMPS

4-19. Replace the function/display lamps as follows:

a. Remove top and bottom dust covers and inner guard chassis covers.

b. To replace the function display lamps remove the function display assembly mounting screws. Access to these mounting screws is from the bottom of the instrument.

c. Remove the function display assembly from the top of the instrument. After removal of the plexiglass cover on the assembly, the defective lamp may be replaced by carefully unsoldering the old lamp, clearing the holes of solder, and soldering in the new lamp.

CAUTION!
Use a desoldering tool and exercise extreme caution to avoid lifting land patterns.

4-20. READOUT TUBE REPLACEMENT

4-21. To replace the readout tubes unsolder the base mounting pins and remove tube from the top of the instrument. The SAMPLE RATE indicator (DS) is located next to the SAMPLE RATE adjustment on front panel. Remove DSI by desoldering both leads from A14 assembly, and pull lamp out from holder. Install and solder new lamp.

4-22. Removal of Display PCB (A14)

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

b Set all switches to -the nondepressed position.

c. Remove shorting links from INPUT terminals on front panel.

d. Remove knob from the SAMPLE RATE potentiometer.

e. Unplug and remove all plug in circuit assemblies from instrument.

f. Remove decals from the side of handles.

g. Remove four (4) screws on side of each handle. Remove the front panel from the instrument.

h. Disconnect wires from terminal posts to terminal block at the terminal block, and pull SAMPLE RATE lamp out from its holder.

i. Remove four (4) screws which secure the front-sub-panel to the inner chassis and three (3) screws which secure DISPLAY PCB (A14) to front sub-panel. Remove front sub-panel.

j. Remove seven (7) mounting screws from the display PCB (A14).

k. Pull display PCB out from front of instrument.

Paragraphs 4-23 through 4-27 deleted.
Figures 4-2 through 4-6 deleted.

4-28. PERFORMANCE TEST

4-29. The performance tests should be conducted after
failure of the instrumentself-test (Test Switch) and prior to any instrument maintenance or calibration attempts. Known quantities are applied to the instrument input terminals on each of the functions and ranges, and proper operation of the circuitry is then checked. These tests are also suited to receiving inspection of new instruments. For proper conduction of the tests, an ambient temperature of 23°C +5°C, and a relative humidity of less than 70% is required.

NOTE!

**Tolerances are derived from the 90-day instrument specifications contained in Section 1 of
this manual.**

4-30. DC Voltage Test

4-31. In the following procedure, dc voltages are applied to the instrument at 10%o and 100% of full scale on the .1, 1, 10, 100 and 1000 volt ranges.

a. Connect the Model 8375A to the ac line and set the controls as follows:

POWER	ON
FUNCTION	VDC, FILT
RANGE	.1

b. Short the INPUT terminals.

c. Adjust the front panel ZERO control for a mini-mum reading on the Model 8375A display.

d. Connect equipment as shown in Figure 4-7.

e. Set the calibrator to 10.000V output on 10V range.

f. Refer to Table 4-2 for K-V divider settings and corresponding readout limits on Model 8375A.

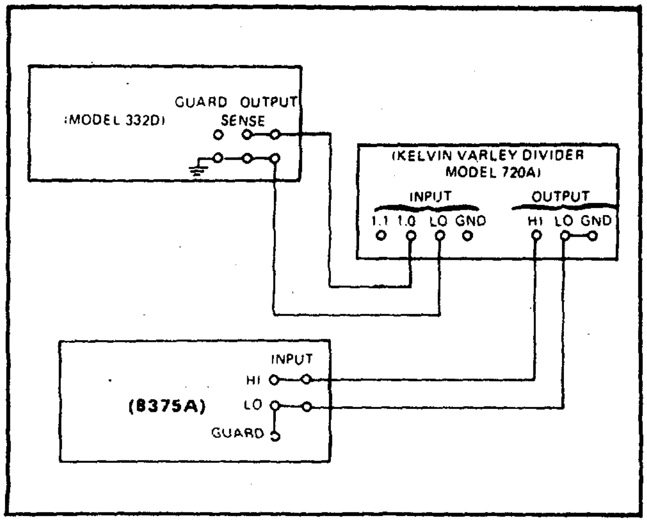


Figure 4-7. READOUT CHECK EQUIPMENT CONNECTION

Table 4-2. DC TEST REQUIREMENTS (.01V to 1V)

K-V DIVIDER SETTINGS	MODEL 8375A	
	RANGE	READOUT LIMITS
.0010000	.1	+.009994 to .010006
0100000	.1	+0.99989 to 1.00011
0100000	1	+0.09997 to 0.10003
1000000	1	+0.99992 to 1.00008
1000000	10	+0.9998 to 1.0002

g. Reverse input leads to Model 8375A.

h. Repeat step f. The DMM readout must be the same as for positive inputs, except that the polarity indication will be negative (-).

i. Disconnect equipment and connect calibrator to Model 8375A.

j. Apply each of the input voltages shown in Table 4-3 to the INPUT terminals of the Model 8375A. The readout must be as indicated.

k. Repeat step j with negative input voltages. The DMM readout must be the same as for positive inputs, except that the polarity indication will be negative (-).

l. Apply zero volts to the INPUT terminals of the DMM and depress the AUTO RANGE switch. The readout must be .000000 + .000005.

Table 4-3. DC TEST REQUIREMENTS (10V, 100V, AND 100OV)

INPUT (Volts DC)	MODEL 837A		
	RANGE	READOUT LIMITS	READOUT TOLER-ANCES
+10.0000	10	+9.9994 to 10.0006	±.0006
+10 0000	100	+09.998 to 10.002	±.002
+100.000	100	+99.994 to 100.006	±.006
+100.000	1000	+099.98 to 100.02	±.02
+1000.00	1000	+999.94 to 1000.06	±.06

m. Apply +1000.00 volts dc to the INPUT terminals. The DMM must range automatically and the readout must be +1000.00 + .05.

4-32. Kilohms Test

4-33. The kilohms function is checked at full scale on each of three ranges of the DMM. Connect each of the standard resistors shown in Table 44, in turn, to the INPUT terminals of the Model 8375A. Use short, lowresistance connecting leads. Set the DMM controls as shown in the Table. The readout should be as indicated.

Table 44. KILOHMS TEST REQUIREMENTS

STANDARD RESISTANCE	MODEL 8375A		
	FUNCTION	RANGE	READOUT LIMITS
100kê	kê	100	99.988 to 100.012
1000Kg	Kê	1000	999.88 to 1000.12
10Mê	Kê	10K	9994.8 to 10005.2

4-34. Ohms Test

4-35. The ohms function is checked at full scale on each of four ranges on the DMM. Connect equipment as shown in Figure 4-8. Connect each of the standard resistors in Table 4-5, observing the appropriate readout as indicated.

4-36. RMS Voltage Test

4-37. Refering to Table 4-6, apply each of the rms voltages from the ac voltage source (and at the specified frequencies) to the Model 8375A INPUT terminals. Observe the appropriate readout to be within the tolerance limits listed in Table 4-6.

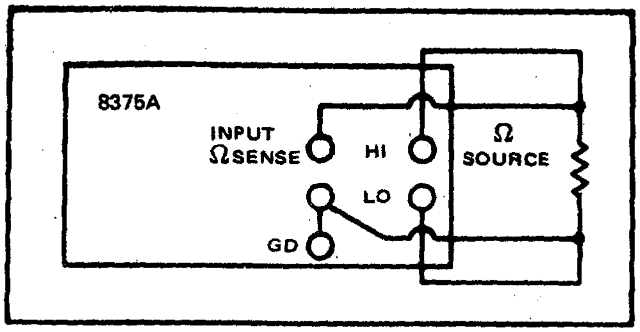


Figure 4-8. EQUIPMENT CONNECTIONS FOR OHMS TEST

Table 4-5. OHMS TEST REQUIREMENTS

STANDARD	MODEL 8375A		
RESISTANCE	FUNCTION	RANGE	READOUTLIMITS
10ê	ê	10	9,9980 to 10.0020
100ê	ê	100	99.987 to 100.013
1kê	ê	1000	999.87 to 1000.13
10kê	ê	10k	9998.7 to 10001.3

Table 4-6. RMS VOLTAGE TEST

INPUT			
VOLTAGE (RMS VOLTS)	FREQUENCY	RANGE	TOLERANCE
500.0	500Hz	1000	±0.7
500.0	50kHz	1000	±1.6
1.0000	500Hz	1	±0.0012
1.0000	50kHz	1	±0.004
10.000	50Hz	10	±0.012
10.000	50kHz	10	±0.04
100.00	500Hz	100	±0.12
100.00	50kHz	100	±0.4

4-38. CALIBRATION PROCEDURE

4-39. Introduction

4-40. The Model 8375A should be calibrated every 90 days/l year (see paragraph 4-3) or whenever repairs have been made. Calibration should be performed in an environment having an ambient temperature of 230C ±20C, and a relative humidity of less than 70%o. Refer to Table 4-1 for recommended test equipment. Adjustment and test point locations are labeled on the top inner guard cover. Figure 4-9 shows adjustments and test point locations on the top inner guard cover.

4-41. Preliminary Operations

a. Remove the top dust cover screws, but leave the cover in place.

b. Set the 115/230 volt switch on the rear panel to 115 and then connect line cord to the output of an autotransformer set to 11 5V ac.

c. Turn on the Model 8375A and allow one hour for warm-up.

4-42. Buffer Zero Adjustment

a. Remove the top dust cover.

b. Set the Model 8375A controls as follows:

FUNCTION	VDC, FILT
RANGE	.1

c.

d. Center front panel ZERO control (R42)

e. Adjust R28 for a display of .000000 +10 digits.

f. Adjust R42 for a display of .000000 +1 digit.

4-43. Bias Current Adjustment

a. Remove short across input terminals and replace with 1 megohm resistor in parallel with a .22æf capacitor.

b. Adjust BIAS (AllR17) on All for a zero +3 digit readout on the Model 8375A display.

c. Repeat the Buffer Zero Adjustment (para. 442).

4-44. Reference Voltage Adjustment

a. Connect the differential voltmeter to LO SENSE (A9TP7) and HI SENSE (A9TP5).

b. Adjust REF (A8R57) for a reading of 7.000V ñ251æV on the differential voltmeter. Remove short from the INPUT terminals.

4-45. A-D Zero Adjustment

a. Connect the HI input of the voltmeter to CAL OUT(A9TP3).

b. Set the differential voltmeter as follows:

RANGE 1V
NULL SENSE 1
READOUT .550000

c. Set the Model 8375A as follows:

FUNCTION VDC, FILTER
SAMPLE RATE FULL CW
RANGE 10

d. Connect test equipment as shown in Figure 4-9.

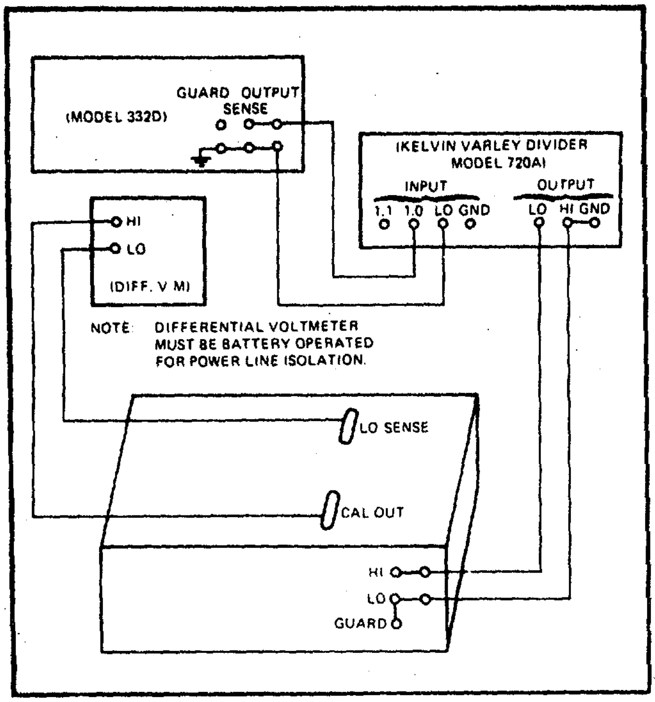


Figure 4-9. EQUIPMENT CONNECTION FOR CALIBRATION

e. Set the calibrator to 10.0000V output on 10V range and dial .00005 on 720A.

f. Adjust A-D ZERO (A11R37) for a readout of +0.0005V on the Model 8375A nixie display. Refine the adjustment for a null (zero) reading on the differential voltmeter. Reverse the input to the Model 8375A and observe -0.OOO5V on the display. The reading on the differential voltmeter should change less than +4 major divisions. If the change is greater than +4 major divisions refine the Filter Zero Adjustment using step g.

g. Filter Zero Adjustment

1. Remove inner guard cover
2. Press REMOTE switch on 8375A.
3. Connect differential voltmeter between A10TP3 and A10TP4 (common) on the Active Filter PCB.
4. Short A10TP4 to A10TP5 using ins clip lead.
5. Adjust R13 on A10 for a-10uV indication on the differential voltmeter.

4-46. Plus Cal Adjustment

a. Connect equipment as shown in Figure 4-9.

b. Adjust COMPARATOR LEVEL (A9R61) to full cw.

c. Dial .800052 on divider.

d. Adjust +CAL (A11R17) for a readout of +8.0005 on Model 8375A display.

e. Refine the adjustment for a null (zero) on the differential voltmeter.

4-47. Ladder Cal

a. Connect equipment as shown in Figure 4-9.

b. Apply the input voltages given in Table 4-7 and perform the associated adjustments that produce the required readout on the Model 8375A and differential voltmeter.

c. Repeat Plus Cal and Ladder Cal adjustments until interactions are eliminated.

Table 4-7. LADDER CALIBRATION

LADDER	MODEL 8375A			DIFF. V/M
NO.	K-V Divider	Adjustment	READOUT	READOUT
4	+.400052V	LADDER 4 (A9R45)	+4.0005V	NULL
2	+.200052V	LADDER 2 {A9R48)	+2.0005V	NULL
1	+.100052V	LADDER 1 (A9R50	+1.0005V	NULL

4-48. Minus Cal Adjustment

a. Set divider to .800052.

b. Reverse input to the Model 8375A.

c. Adjust -CAL (A9R14) for a display readout of -8.0005.

d. Refine the adjustment for a null (zero) on the differential voltmeter.

e. Check Plus Cal and Ladder Cal adjustments. If refinement is required, recheck Minus Cal.

4-49. Remainder Adjustment

a. Set COMPARATOR LEVEL (A9R61) full ccw.

b. Connect equipment as shown in Figure 4-9.

c. Apply the input voltages given in Table 4-8 and perform the associated adjustments that produce the required readout on the Model 8375A and differential voltmeter.

Table 4-8. COMPARATOR LEVEL ADJUSTMENT

DIGIT NO.	MODEL 8375A K-V Divider SETTING	Adjustment	READOUT	DIFF.V/M READOUT
2	+.090052V	2nd Digit Remainder (A9R58)	+0.9005	NULL
3	+.099052V	3rd Digit Remainder (A9R56)	+0.9905	NULL
4	+.099952V	-	+0.9995	ñ2 Major Divisions

4-50. Comparator Level Adjustment

a. Connect equipment as in Figure 4-9, but do not make the differential voltmeter connections.

b. Set divider to .099995.

c. Adjust COMPARATOR LEVEL (A9R61) so display readout alternates between +0.9999 and +1.0000.

d. Alternate a dc input to the Model 8375A between +1.9999V and +2.0000V dc and verify that the display readout corresponds.

4-51. RMS Converter Adjustment

4-52. RANGE AMPLIFIER ZERO

a. Short the HI and LO INPUT terminals. Select VAC, FILT, and 10 RANGE pushbuttons. Place AC-DC switch on RMS converter to DC. This switch is accessible through the top guard cover.

b. Connect high lead of a dc voltmeter to the body of C11 (10V 50kHz adjustment) via a 10k isolation resistor. Connect low lead to the 8375A LO INPUT terminal

c. Adjust R12 (Range Zero Adjust) for external voltmeter indication of 0 ñ 30æV.

d. Remove external voltmeter and INPUT short.

4-53 BALANCE AMPLIFIER ZERO

a. Apply -0.IV dc to INPUT terminals from dc voltage source. Note 8375A reading.

b. Reverse input voltage polarity to +0.lV dc.

c. Adjust R42 (Balance Zero Adjust) for reading noted in step a.

d. Repeat steps a and b until difference between readings for each polarity is within 10 digits.

4-54. BALANCE GAIN

a. Apply -10V de to INPUT terminals. Note 8375A reading.

b. Reverse input voltage polarity to +10V dc.

c. Adjust R32 (Balance Gain Adjust) for 8375A reading equivalent to step a.

d. Repeat steps a through c until difference between readings for each polarity is within 10 digits.

e. Remove dc voltage source.

4-55. AC ZERO

a. Select 1 RANGE and AC INPUT COUPLING. Apply 0.001 volts at 500Hz to INPUT terminals.

b. Adjust R45 (AC Zero Adjust) for reading of .00100 +3 digits.

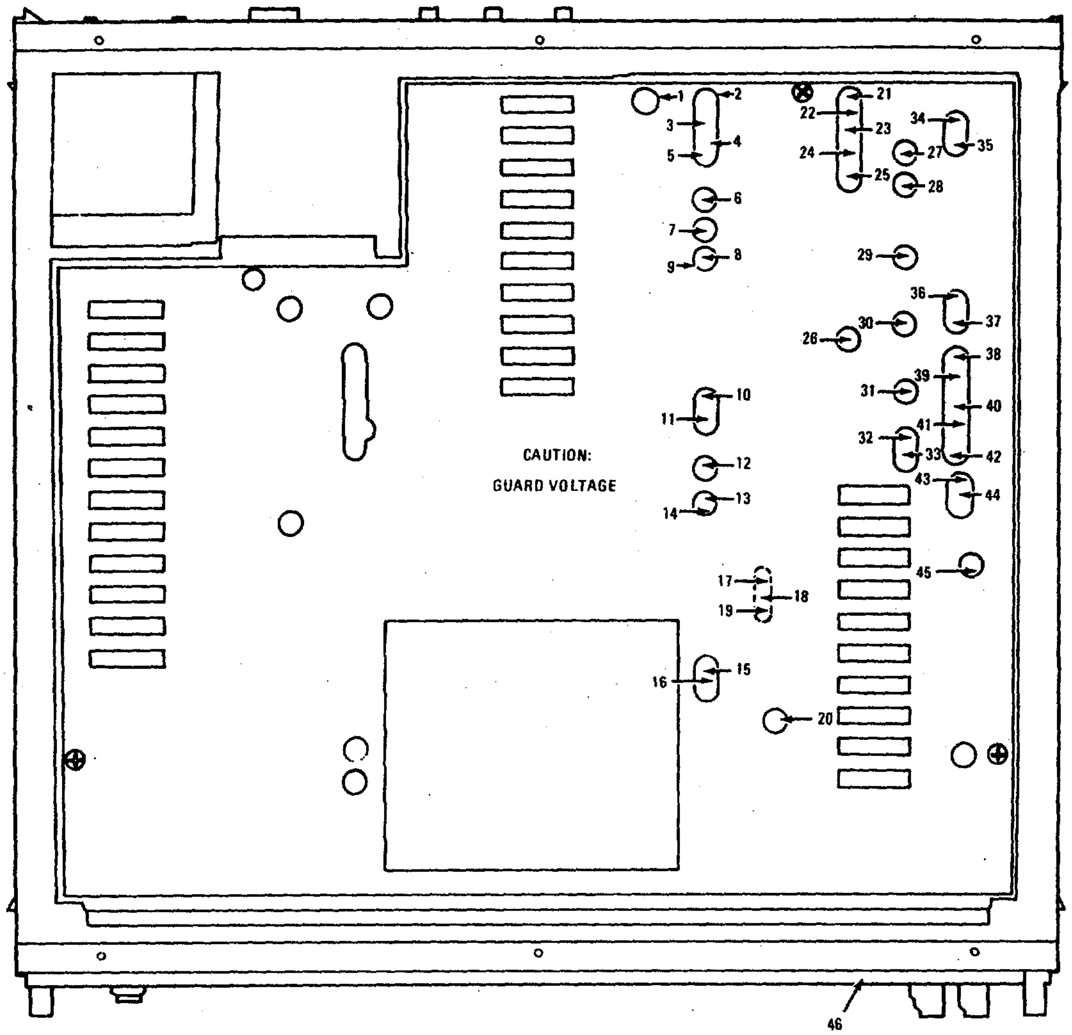
c. Remove ac input voltage.

4-56. CALIBRATION ADJUSTMENT/CHECK

4-57. Before performing calibration, allow one hour for warm-up with outer covers installed. Referring to Table 4-9 apply each of the rms voltages at the specified frequencies to the INPUT terminals and if necessary, perform the indicated adjustments to complete the calibration. If R64 (1000V, 500Hz adjustment) is not within adjustment range, refer to Course Calibration.

4-58. COURSE CALIBRATION

4-59. Perform the following procedure only when R64 is out of adjustment range.



LOGIC A8	A/D CONV. A9	ACTIVE FILTER A10	BUFFER A11	OHMS CONV. A12	ACV RMS A13	FRONT PANEL
R57 (1)	R14 (16)	R13 (20)	R8 (25)	R7 (27)	C4 (45)	R42 (46)
	R17 (15)	TP3 (19)	R9 (24)	R8 (28)	C9 (43)	
	R37 (11)	TP4 (18)	R17 (23)	R10 (29)	C11 (41)	
	R45 (8)	TP5 (17)	R28 (26)	R14 (30)	C14 (39)	
	R48 (7)		R36 (22)	R17 (33)	R12 (44)	
	R50 (6)		R38 (21)	R19 (32)	R14 (42)	
	R56 (12)			R21 (31)	R16 (40)	
	R58 (13)				R18 (38)	
	R61 (3)				R32 (37)	
	TP2 (14)				R42 (36)	
	TP3 (10)				R45 (35)	
	TP4 (9)				R64 (34)	
	TP5 (5)					
	TP6 (4)					
	TP7 (2)					

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Figure 4-10. ADJUSTMENT AND TEST POINT LOCATIONS.

Table 4-9 CALIBRATION ADJUSTMENT/CHECK

INPUT			ADJUSTMENT		TOLERANCE
VOLTAGE (RMS)	FREQUENCY	RANGE	NAME	REF DESIG.	
500.0	500Hz	1000	1000V 500Hz	R64	
500.0	50kHz	1000	1kV 50kHz	C4	
1.0000	500Hz	1	1V 500Hz	R14	
1.0000	50kHz	1'	1V 5OkHz	C9	ñ10 Digit
10.000	500Hz	10	10V 500Hz	R16	
10.000	50kHz	10	10V 50kHz	C11	
100.00	500Hz	100	100V 500Hz	R18	
100.00	50kHz	100	100V 50kHz	C14	

a. Connect any opened shorting links (1, 2 or 4) across course calibration resistors R61, R62 or R63.

b. Select the 1000 volt range and apply 500V at 50OHz to the INPUT terminals.

b. Adjust the "1000V, 5OOHz" control (R64) for a minimum reading.

d. Cut open the appropriate link or links as indicated below depending upon the 8375A reading.

READING	CUT LINKS
465.7 - 470.1	1,2,4
470.1 - 474.3	2,4
474.3 - 478.7	1, 4
478.7 - 482.5	4
482.5- 486.9	1,2
486.9- 491.1	2
491.1-494.5	1
495.5 - 500	NONE

e. Repeat the Calibration Adjustment/Check, paragraph 4-56 to complete calibration.

4-60. Buffer DC Calibration

a. Apply the dc input voltages given in Table 4-10 and adjust the associated control for a corresponding readout.

b. Disconnect test equipment.

Table 4-10. BUFFER CALIBRATION

DC INPUT	MODEL 8375A		
VOLTAGE	RANGE	ADJUSTMENT	READOUT
+100.000	100	100V (A11R8)	+100.000
+1000.00	1000	1000V (A11R9)	+1000.00
+1.00000	1	1V (A11R36)	+1.00000
+.100000	1	0.1V (Al 11R381)	+.100000

4-61. Ohms Converter Adjustments

4-62. PRELIMINARY OPERATIONS

a. Set the Model 8375A controls as follows:

FUNCTION	VDC, FIL.T
RANGE	.1
SAMPLE RATE	full clockwise

b. Connect the GUARD terminal to the LO INPUT terminal and the HI SOURCE terminal to the HI INPUT terminal, and the LO SOURCE terminal to the LO INPUT terminal using the shorting links provided with the instrument.

c. Short the INPUT terminals together.

d. Adjust the DC ZERO control on the front panel for a readout of zero + I digit.

4-63. KILOHMS CALIBRATION

a. Depress 10K and Kê buttons.

b. Remove the short between the INPUT terminals.

c. Connect the resistances indicated in Table 4-11 between the INPUT terminals and perform the corresponding adjustment.

NOTE!

The readout indicated in Table 4-11 should match the exact value of the calibration resistor, not the nominal value.

Table 4-11. K92 RANGE CALIBRATION

RESISTANCE	RANGE	ADJUSTMENT	READOUT
10M	10k	10000k (A12R17)	10000.0
1M	1000	1000k (A12R19)	1000.00
100k	100	100k (A12R21)	100.000

4-64. OHMS CALIBRATION

a. Remove shorting links between the INPUT HI and SOURCE HI binding posts, and between INPUT LO and SOURCE LO binding posts.
b. Connect equipment as shown in Figure 4-8.
c. Depress S2 and 10K buttons on Model 8375A.
d. Connect the resistance, indicated in Table 4-12, as shown in Figure 4-8 and perform the corresponding adjustment.
e. Re-install shorting links and disconnect all test equipment.
f. Replace top cover.

4-65. REPAIR PROCEDURES

4-66. Buffer PCB Assembly

4-67. The replacement of components Q5, U1 and R22 through R27 in the Buffer Assembly will cause a deterioration of the temperature coefficient specification. If one or all of these components is found to be faulty the Buffer Assembly PCB must be returned to the factory for repair and recalibration.

Table 4-12. OHIMS RANGE CALIBRATION

RESISTANCE	RANGE	ADJUSTMENT	READOUT
10k	10K	10K 0000(A12R7)	10000.0
1k	1000	1000(A12R14)	1000.00 100ê
	100	100ê(A12R10)	100.000
10ê	10	NONE	10.000±.0006*
NOTE* IF MORE THAN ± .0006 RESET VDC ZERO AND RECALIBRATE OHMS RANGES			

4-68. Active Filter PCB Assembly

4-69. If either Q1 or U2 are replaced in the Active Filter (A10), R11 or R12 may need to be selected in order to bring the required offset correction within the range of zero control R13. This is done as follows:

a. Depress VDC and 10 buttons on Model 8375A.
b. Short the 8375A INPUT terminals.
c. Short TP1 to TP2 on Active Filter PCB.
d. Install jumpers across RII and R12 in positions WI and W2.
e. Turn instrument on by depressing POWER button.

f. Observe the Model 8375A readout.

g. Select the proper offset resistor using Table 4-13.

h. Install resistor in location R 11 if readout polarity is positive (+) or R12 if readout polarity is negative (-). Remove only the jumper wire for location used.

Table 4-13. OFFSET CORRECTION RESISTOR SELECTION

8375A READOUT	RESISTANCE REQUIRED	JF PART NO.
0 - .0004	NONE	--
.0005 - .0012	6.81k	268417
.0013 - .0020	13.7k	236752
.0021 - .0028	21.0k	229484
.0029 - .0036	28.7k	235176
.0037 - .0044	35.7k	288480
.0045 - .0052	44.2k	271676

4-70. TROUBLESHOOTING

4-71. Introduction

4-72. The information in the following paragraphs is provided. to assist in locating troubles in the Model 8375A. Figure 4-10 shows assembly location by reference number

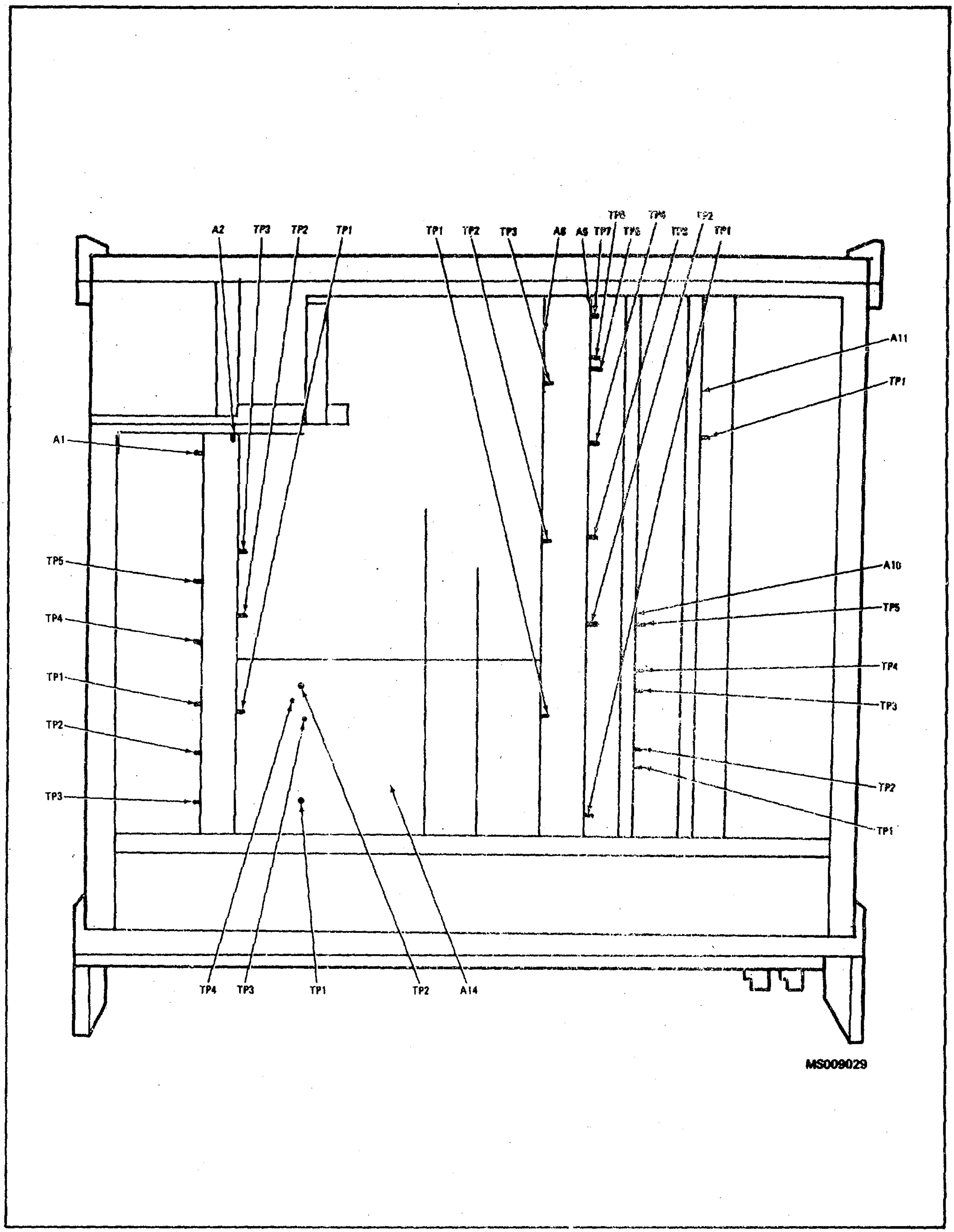


Figure 4-11. ASSEMBLY AND TEST POINT LOCATIONS

and test point locations. Since this instrument is somewhat complex, it is recommended that the theory of operation in Section 3 be understood before any attempt at troubleshooting is undertaken.

4-73. Initial Troubleshooting

4-74. Troubleshooting of the Model 8375A starts by firs, inspecting the instrument for improperly seated plug-in assemblies, loose wires, physically damaged parts, or other obvious problems. The next step is then to ensure that; t it is being operated correctly, but still fails to meet specifications. Performance checks designed for this purpose are given beginning at paragraph 4-28.

4-75. Section Localization

4-76. To aid in troubleshooting the Model 8375A, the basic instrument can be broken down into three major sections. An analog section consisting of the Buffer, Active Filter, Ohms Converter, and True RMS Converter supply a dc voltage from +10 to -10 volts, dependent upon the polarity and value of the input, to the digital section. The digital section, composed of the A-to-D Converter, Range Delay, and Display assemblies, converts the dc input from the analog section to a digital signal, then processes this signal through timing, storage, and display circuits for proper readout. The third section is a Power Supply Assembly which supplies operating voltages to the internal circuits of both the analog and digital sections.

4-77. Power Supply

4-78. The AI Power Supply can be checked for proper operation using a dc differential voltmeter and performing the voltage checks given in Table 4-14.

Table 4-14. POWER SUPPLY CHECKS

VOLTAGE TEST POINTS		DC VOLTS		
V/M Lo	V/M Hi	NOMINAL	LIMITS	ADJUSTMENT
A1TP4	A1TP2	+18V	±10mV	A1R11
A1TP4	A1TP3	-18V	±375mV	NONE
A1TP4	A1TP5	+5.25V	±25 mV	Remove R17 to increase
A1TP4	A1TP1	+200V	±5V	NONE

4-79. Analog Section

4.80. To determine if a trouble exists in the analog section, use the following checks:

a. Connect a battery powered differential voltmeter LO to (A10) TP4 and HI to (A10) TP3.

b. Depress VDC and 10 switches on Model 8375A.

c. Turn on the Model 8375A and apply +10V dc to INPUT terminals. The differential voltmeter should read -10V.

NOTE!

The differential voltmeter should read -10V for full range Inputs on the 10, 100, and 1000 volt ranges, and +10 V for full range inputs on the .1 and I volt ranges. For inputs less than full range, the differential voltmeter should read proportionately less.

(Example: +100V input on 100V range, the differential voltmeter will read -1V)

FAULT ANALYSIS

If voltmeter readings do not correspond to input voltages, the trouble exists in the analog section. If voltmeter readings do correspond to input voltages, the trouble exists in the digital section.

4-81. BUFFER CHECKS

4-82. Overload Check

a. Connect differential voltmeter HI to K1 pin 14 and LO to the Model 8375A HI (red) INPUT terminal.

b. Depress the I range, VDC, and FILT buttons. Set the SAMPLE RATE full cw.

c. Apply +3V ±1% to INPUT terminals of 8375A and observe readout of +1.19999. The differential voltmeter should read -.5V ± .25V.

FAULT ANALYSIS

If readings do not correspond, the probable cause is in the overload circuitry. The amplifier section may be a secondary cause.

4-83. Zero Check

a. Depress .1 range and VDC buttons on Model 8375A.

b. Short the INPUT terminals on front panel.

c. The display should indicate zero volts.

d. Adjusting the front panel DC Zero control in both directions should cause the display to vary from +.000030 to -.000030.

FAULT ANALYSIS

If the DC Zero control will not swing through Absolute Zero, adjustment of course DC Zero (A11R28) is indicated. If this is necessary, the amplifier section of the buffer could be faulty.

NOTE!

The BUFFER assembly must be returned to factory for replacement of faulty parts within the amplifier circuitry. Refer to paragraph 4-61 for critical components.

4-84. Gain Check

a. Depress the 10 range and VDC buttons on Model 8375A.

b. Connect a battery powered differential voltmeter as follows:

HI to INPUT HI on Model 8375A
LO to A I1TP2

c. Apply -12.5V ± .5V to INPUT terminals of the 8375A.

d. The 8375A display should be -11.9999.

e. Differentially measure the voltage level between AIITP2 and INPUT HI.

f. Reverse the polarity of the input voltage and observe the following:

1. The 8375A readout is now +11.9999.

2. The differential voltmeter reading has changed less than +25µV.

FAULT ANALYSIS

If the Buffer checks are ok, the analog problem can be in the active filter circuitry.

4-85. ACTIVE FILTER CHECKS

4-86. Gain Checks

NOTE!

Remove the Remote Control Unit (-04 option) if the 8375A is so equipped

a. Depress the REMOTE button on the 8375A.

b. Connect a battery powered differential voltmeter LO input lead to A1OTP5 and HI lead to A1OTP3.

c. Differentially measure the voltage level.

d. Apply +10V dc +1V between AIOTP4 (common) and AIOTP5. The differential voltmeter indication should not change more than 100t1V.

e. Reverse the polarity of input voltage and note, the differential voltmeter indication should not change more than 100OV.

4-87. AC Rejection

a. Depress the 10 range, VDC, and FILT buttons.

b. Apply a 3V rms ±1%, 60 Hz signal to the INPUT terminals of the 8375A.

c. Adjust the SAMPLE RATE control for a display update about twice a second.

d. The Model 8375A readout should be less than 20 digits.

4-88. OHMS CONVERTER CHECKS

a. Depress the 1000 range, K92, and FILT buttons on the 8375A.

b. Place a 1 meg ±0.1% resistor across the INPUT terminals and readout 1000.00 +.10.

FAULT ANALYSIS

If, the readout is bad, check the reference voltage, R17, R18, R19, and R29, or relay K1I.

c. Depress the 100 range button.

d. Place a 100k ±.01% resistor across INPUT terminals and readout 100.000±.010.

FAULT ANALYSIS

If the readout in step d. is bad, check resistors R21 and R22, or relay K2.

e. Depress the Q2 and 1000 range buttons.

f. Measure a 1000 +.01% resistor using the four-terminal measurement technique (See Figure 4-8).

g. The display should indicate 1000.00+.1 0.

FAULT ANALYSIS

If the readout is incorrect, the resistor network R10, R1 , R12, the regulated supply, or K2 may be faulty.

h. Depress the 100 range button.

i. Using the modified four-terminal technique measure a 100 ±.01% resistor.

j. The display should indicate 100.000 +.010.

FAULT ANALYSIS

If the readout is bad, relay KI, resistors R13, R14, R15, and R16, or the regulated supply may be faulty.

4-89. TRUE RMS CONVERTER CHECKS

a. Depress the VAC and any range button.

b. Connect a DC voltmeter between TP4 and common (shield).

c. Short the HI to LO INPUT terminals together. The DC voltmeter should indicate 0.0 VDC +0.1 volts.

FAULT ANALYSIS

If the indication is incorrect, go to step e.

d. Remove the input terminal short and apply a full range voltage (for the range selected in step a.) at 500 Hz. The dc voltmeter should indicate 10 VDC ±0.5 volts.

FAULT ANALYSIS

If the indication is incorrect, go to step i.

e. Remove any INPUT voltage or short. Short TPI to common (shield).

FAULT ANALYSIS

If dc voltmeter indication is within 100 millivolts of zero, go to step i.

f. Short TP1 and TP2 to TP5.

g. Connect the dc voltmeter high lead to TP4. The DC voltmeter should indicate within 100 microvolts of zero and be adjustable using R66 (Integrator Amplifier Zero Adjust).

FAULT ANALYSIS

If the indication is incorrect, troubleshoot the Integrator Amplifier circuit.

h. Remove short on TP2 (maintain short between TP1 and TPS) and connect the high lead of the dc voltmeter to TP2. The voltmeter should indicate 0.0 VDC ±0.2 volts and be adjustable using R55 (Square Root Amplifier Zero Adjust).

FAULT ANALYSIS

If the indication is incorrect, troubleshoot the Square Root Amplifier circuit.

i. Remove any input voltage and disconnect the dc voltmeter and all shorts.

j. Connect a dc coupled scope, using a low capacitance probe, between the threaded body of C11 (10V 50 kHz adjust) and common.

k. With no input voltage applied to the 8375A, the scope should indicate zero volts. With a full range voltage at 500 Hz applied, the scope should indicate a clean sinewave of 2.8 volts peak-to-peak.

FAULT ANALYSIS

If the scope indication is incorrect, troubleshoot the Range Amplifier circuit.

l. Move the scope probe to the cathode of CR16 or anode of CR14.

m. With no input voltage applied, the scope should indicate 0.0 VDC ±0.1 volts. With a full range voltage at 500 Hz applied, the scope should indicate a clean halfwave rectified signal of 1.4 volts peak.

FAULT ANALYSIS

If the scope indication is incorrect, troubleshoot the Balance Amplifier circuit.

n. Move the scope probe to TP1.

o. With no input voltage applied, the scope should indicate 0.0 VDC ±0.1 volts. With full range voltage at 500 Hz applied, the scope should indicate approximately -1.2 volts dc with a clean ac "scallop" superimposed.

FAULT ANALYSIS

If the scope indication is incorrect, troubleshoot Squaring Amplifier.

4-90. Refer to Figure 4-13 for locations of adjustments and test points.

4-90. PRE-CALIBRATION ADJUSTMENTS

4-91. Three adjustments within the RMS Converter are not readjusted during routine calibration. These adjustments are the Square Root Zero, Integrator Zero, and Crest Factor. It is recommended that these three adjustments be attempted only if previously moved or if components are replaced within the converter. Procedure for performing these adjustments is as follows:

a. With power-off, extend the RMS Converter from the 8375A mainframe and remove shield from converter. Turn the power on and allow the instrument 10 minutes to stabilize.

b. Short the INPUT terminals. Short TPI and TP2 to common (shield). Connect the dc voltmeter (Table 6-1) between TP4 (+) and TP5 (--).

c. Adjust R66, Integrator Zero Adjust, for 0 volts ±100 microvolts.

d. Remove the short from TP2 and connect the dc voltmeter (+) lead to TP2.

e. Adjust R55, Square Root Zero, for 0 volts ±200 millivolts.

f. Remove the short from 1PI1 and disconnect the dc voltmeter.

g. Complete the RMS Converter Adjustments in paragraphs 4-51 through 4-55.

h. Connect equipment as diagramed in Figure. 4-12. Set the RMS Converter switch SSI to ac coupling and depress the autorange switch on the front panel.

NOTE!

The following adjustment procedure is for crest factor. Crest factor (cf) is the relationship between the peak and rms value, such that ^{cf} = ^{V}Peakl^{V} RMS.

i. Adjust the generator repetition rate for 100 pulses per second (10 msec) and the pulse width for a maximum indication on Model 931. (This will be a symmetrical waveform.)

j. Adjust the generator negative output amplitude control for a I volt rms indication on 931. This establishes a waveform with a crest factor of 1. Note the 8375A front panel voltage reading.

k. Adjust the generator amplitude control for a 4 volts peak-to-peak indication on scope, and the pulse width control for I volt RMS indication Model 931. This establishes a waveform with a crest factor of 4.

I. Adjust R38 (Crest Factor Adjust) for front panel indication noted in step j.

m. Repeat steps i through I until the difference between readings for crest factors of 1 and 4 is less than 10 digits.

n. Check the positive polarity pulse with a crest factor of 4 by connecting the equipment to the pulse generator positive output and making the adjustments described in step k.

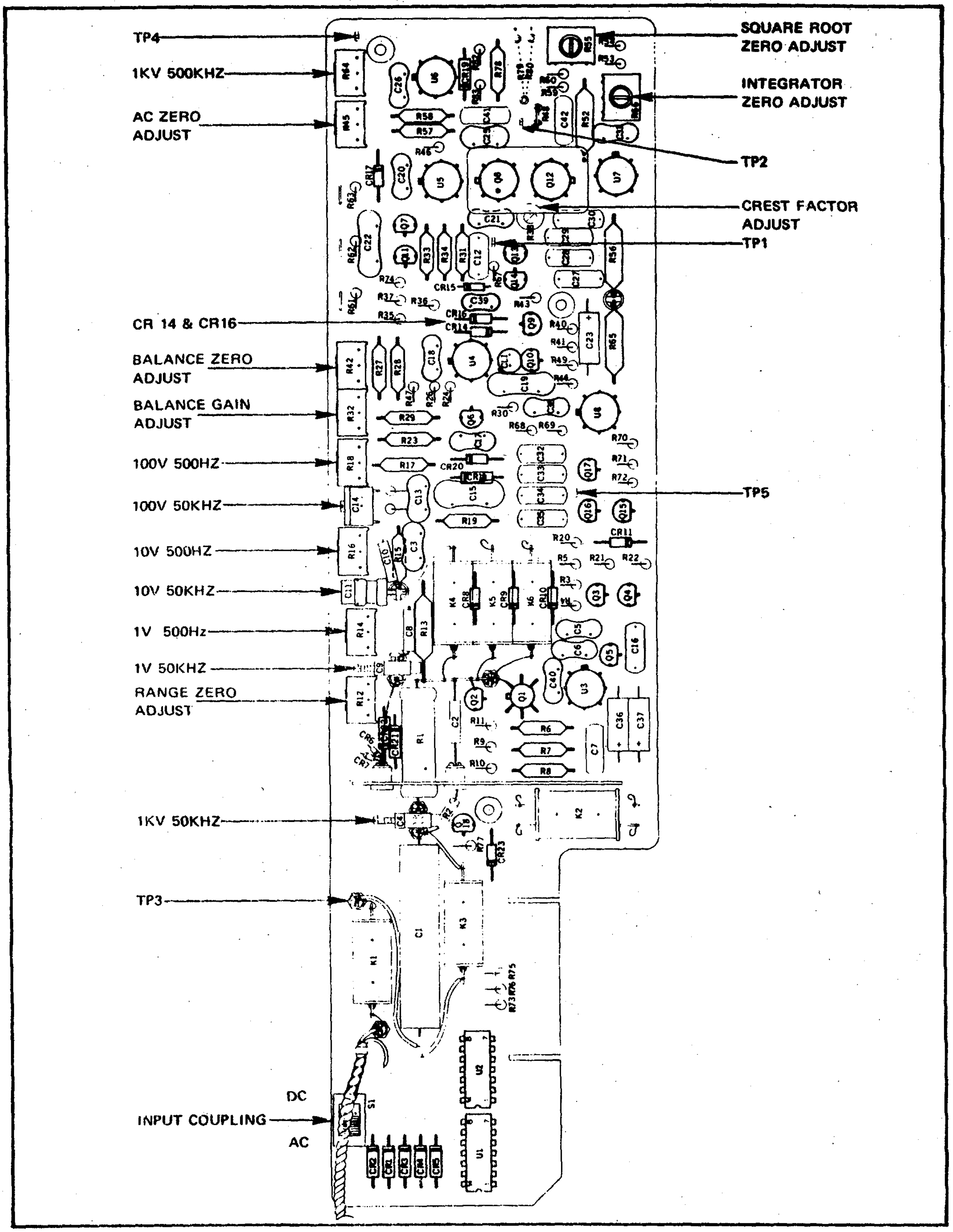


Figure 4-12. RMS CONVERTER ADJUSTMENTS AND TEST POINTS

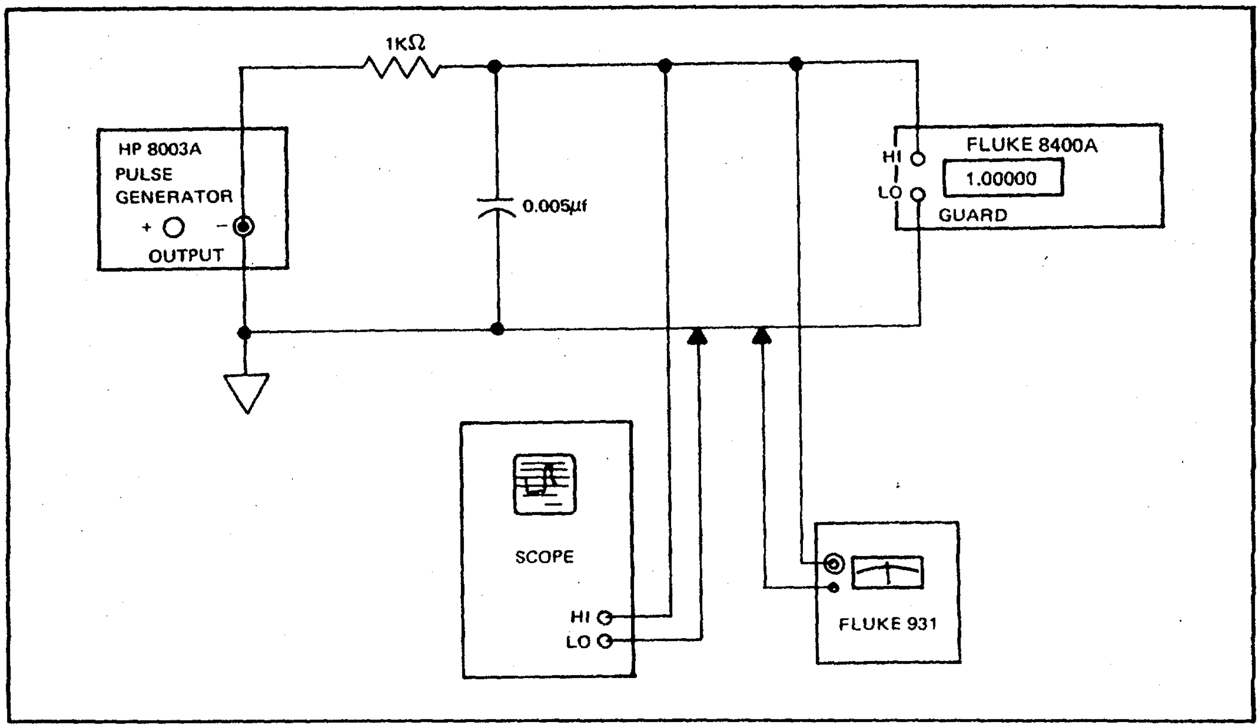


Figure 4-13. EQUIPMENT CONNECTIONS FOR CREST FACTOR ADJUST

o. The 8375A indication should be within 30 digits of the finalized value noted in step j.

p. Turn the power off. Disconnect all test equipment from the 8375A. Re-install the shield on the RMS Converter and install the converter in the mainframe. Install the top guard and dust cover. Turn on the instrument and allow it to "warm-up" for one hour before performing, Calibration Adjustment/Check, paragraph 4-56.

4-92. Digital Section

4-93. The digital section maybe divided into a number of somewhat independent sections for trouble analysis. These digital sections and their locations are as follows:

LOCATION	DIGITAL SECTIONS
A14 - Display	Range Counter
	Sample Command Oscillator
	Readout Tubes and Controls
A9 - A-to-D Converter	A/D Amplifier
	Sample and Hold
	Analog Comparator
	Ladder (Primary and Secondary)
	Display Storage
A8 - Logic	Master Clock
	CCO
	Analog Cycle Control
	Display Storage Control
	6-Sate Shift Register
	16-State Binary Counter

4-94. Generally troubleshooting the digital section is more difficult than the analog section; therefore, troubleshooting guides (Figure 4-13 and 4-14) are important aids for localizing troubles to sections.

NOTE!

The storage cycle can be bypassed if there is a suspicion that the storage circuitry is faulty, (a FAULTY storage cycle is usually seen as flashing digits) by jumpering A1TPS (+5V) to A14TP2 (M), the Model 8375A is placed into a continuous measurement mode.

4-95. Figure 4-15 through 4-18 are idealized waveforms from significant locations showing relationship of each waveform to the others and to the measure period. Analysis of these waveforms and a comparison to waveforms present at the same points will assist in localizing troubles. All waveforms are as shown when Model 8375A is placed in the continuous measurement condition.

FAULT ANALYSIS

If, after placing the Model 8375A into the continuous measurement condition, the readout is correct, the fault lies in the storage circuitry. If readout is still incorrect the fault lies elsewhere.

4-96. Figure 4-20 through 4-22 show waveforms that are present at A9TP2 with Model 8375A in continuous measure ment condition. Analysis of these waveforms to those present under trouble conditions will assist in troubleshooting the digital section.

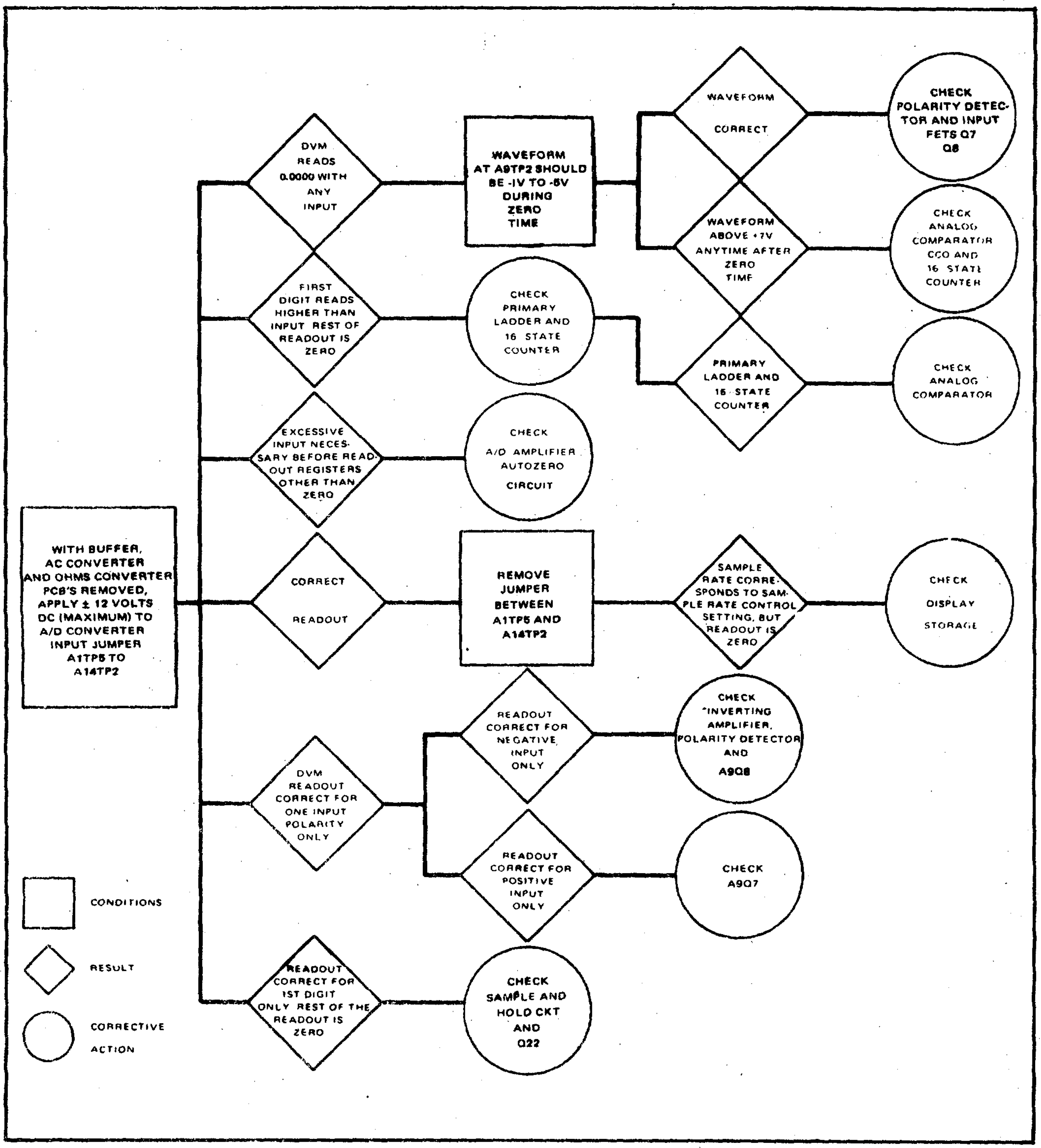


Figure 4-14. TROUBLESHOOTING DVM DIGITAL SECTION

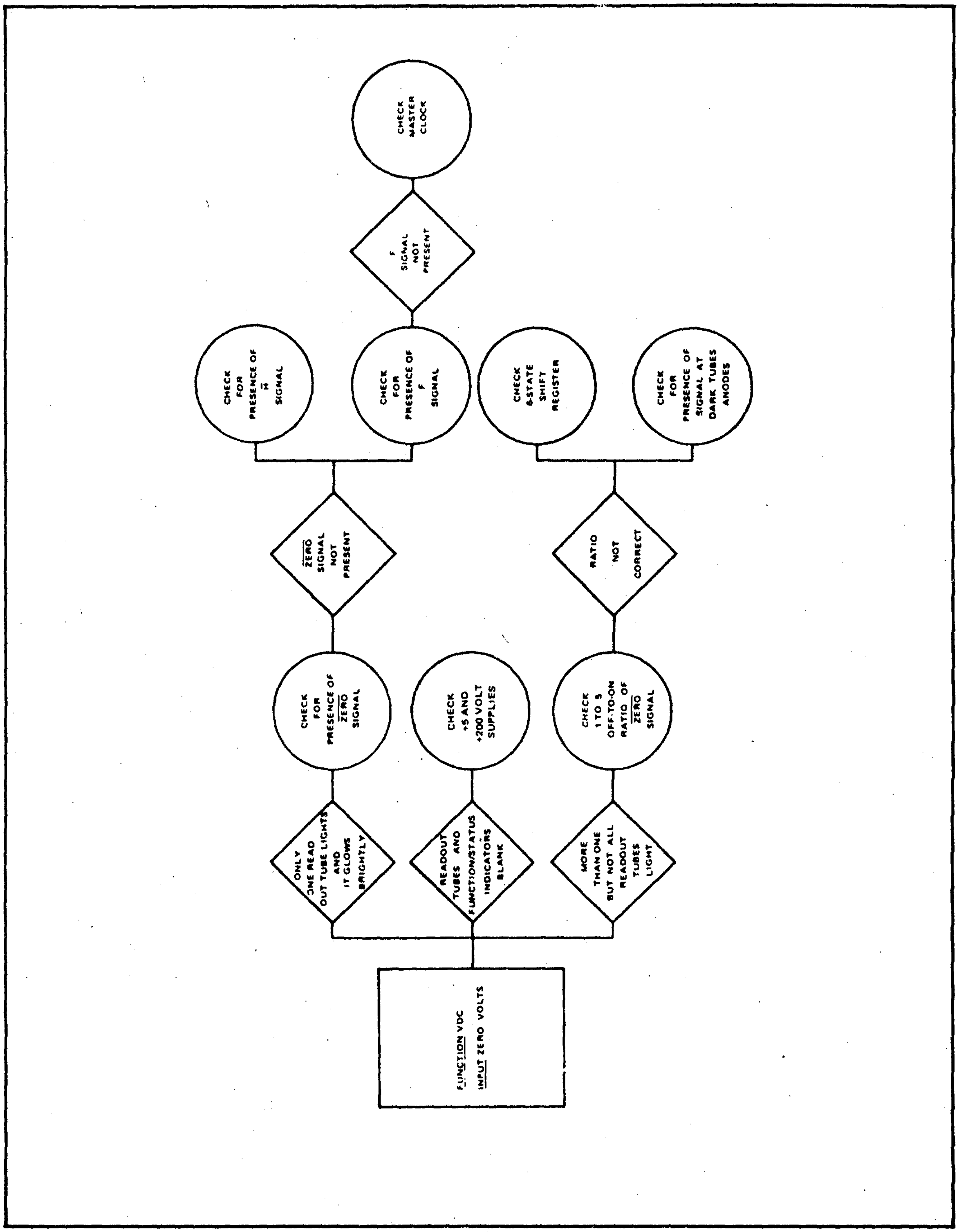


Figure 4-15. TROUBLESHOOTING DVM DISPLAY

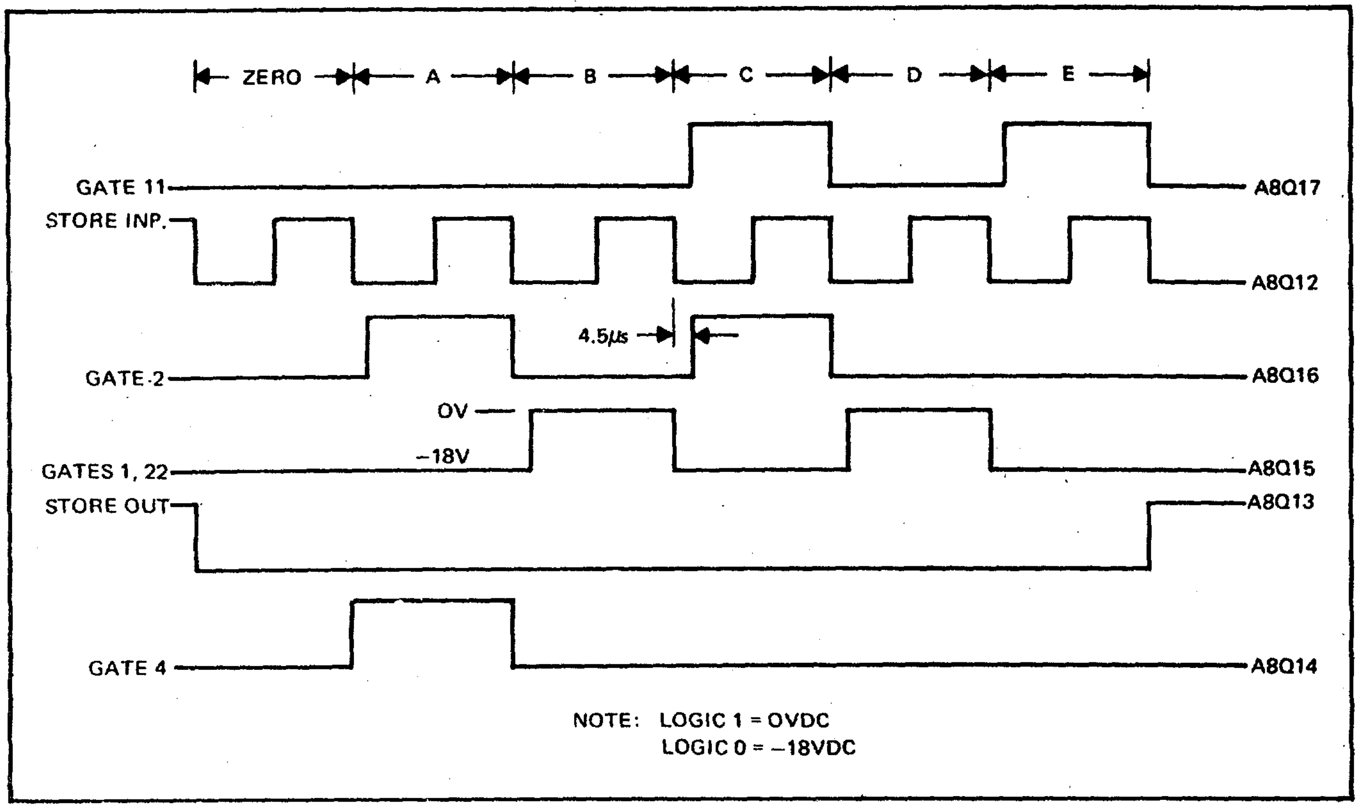


Figure 4-16. A/D CONVERTER CONTROL

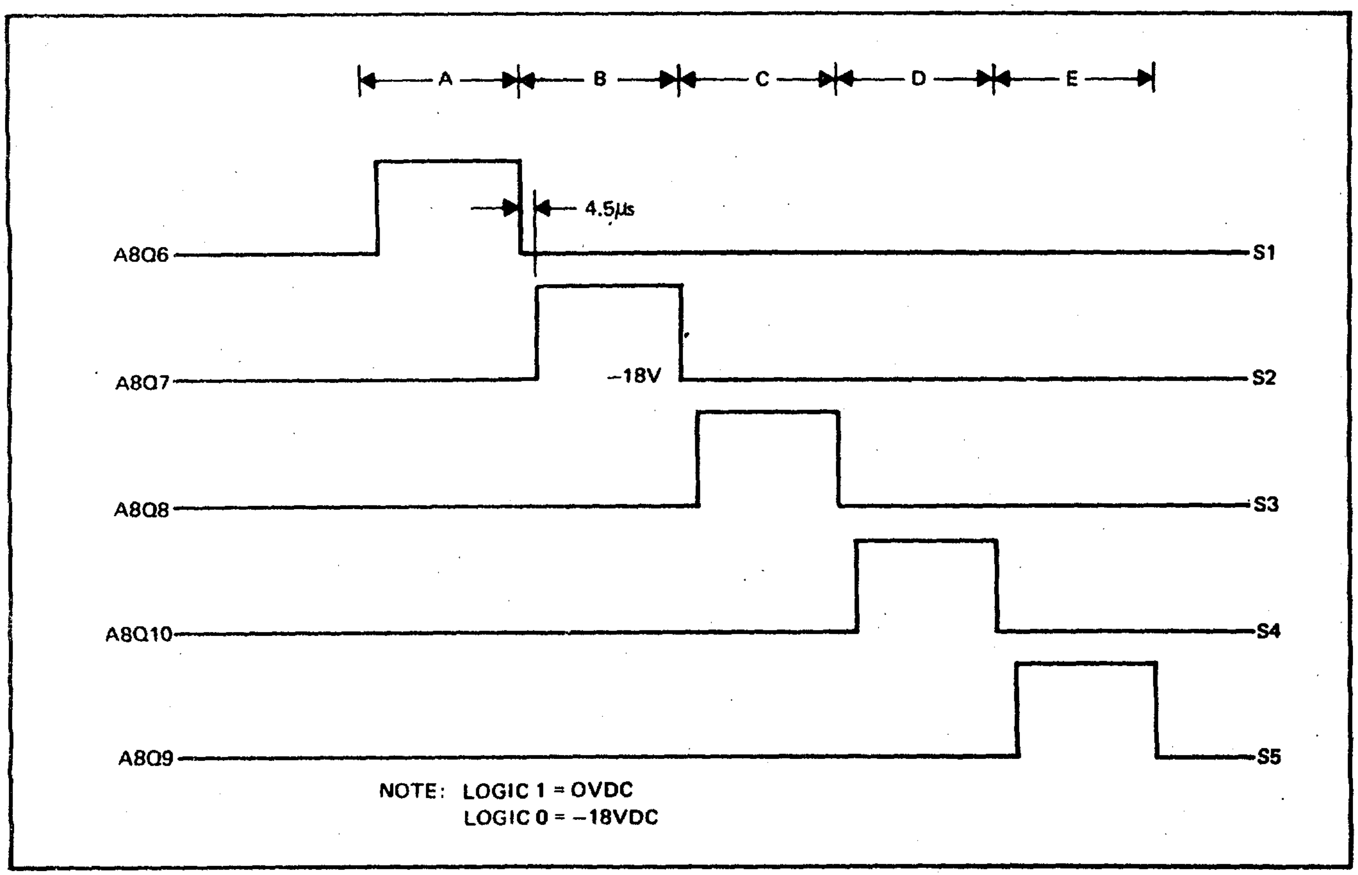


Figure 4-17. ANALOG STORAGE CONTROL

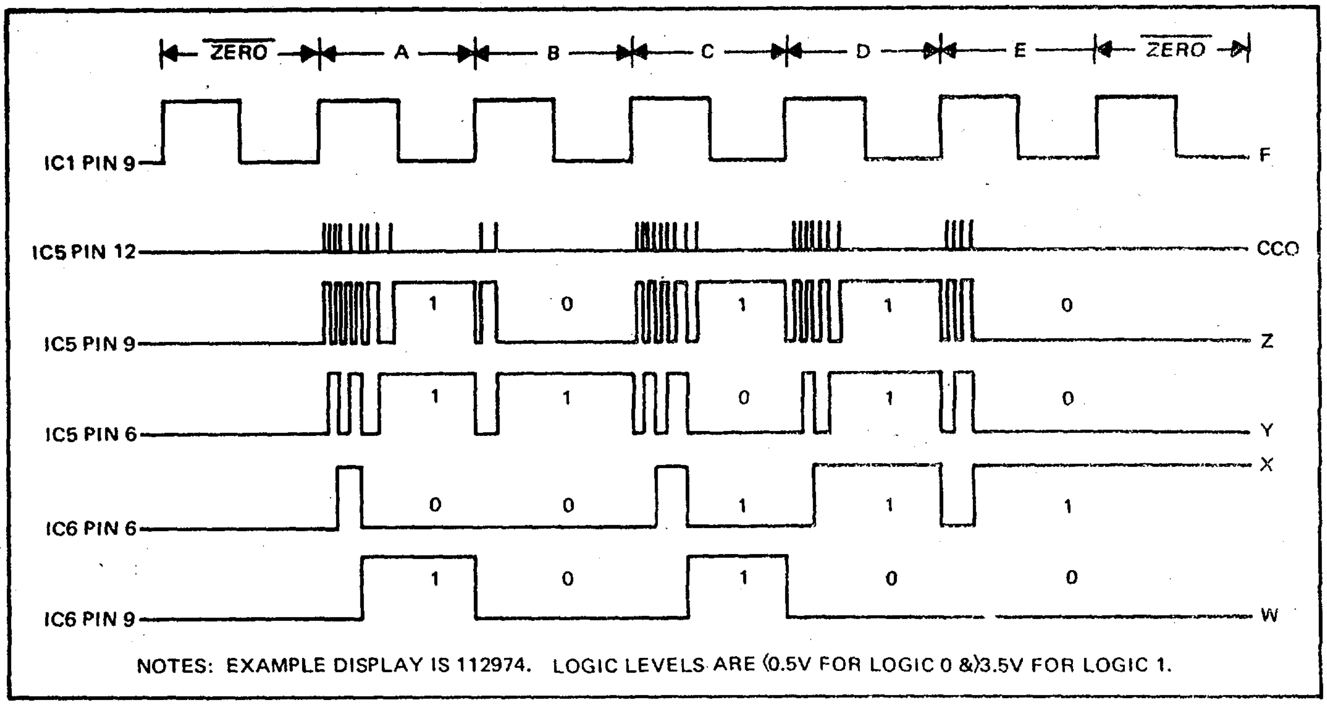


Figure 4-18. COUNTER OPERATION

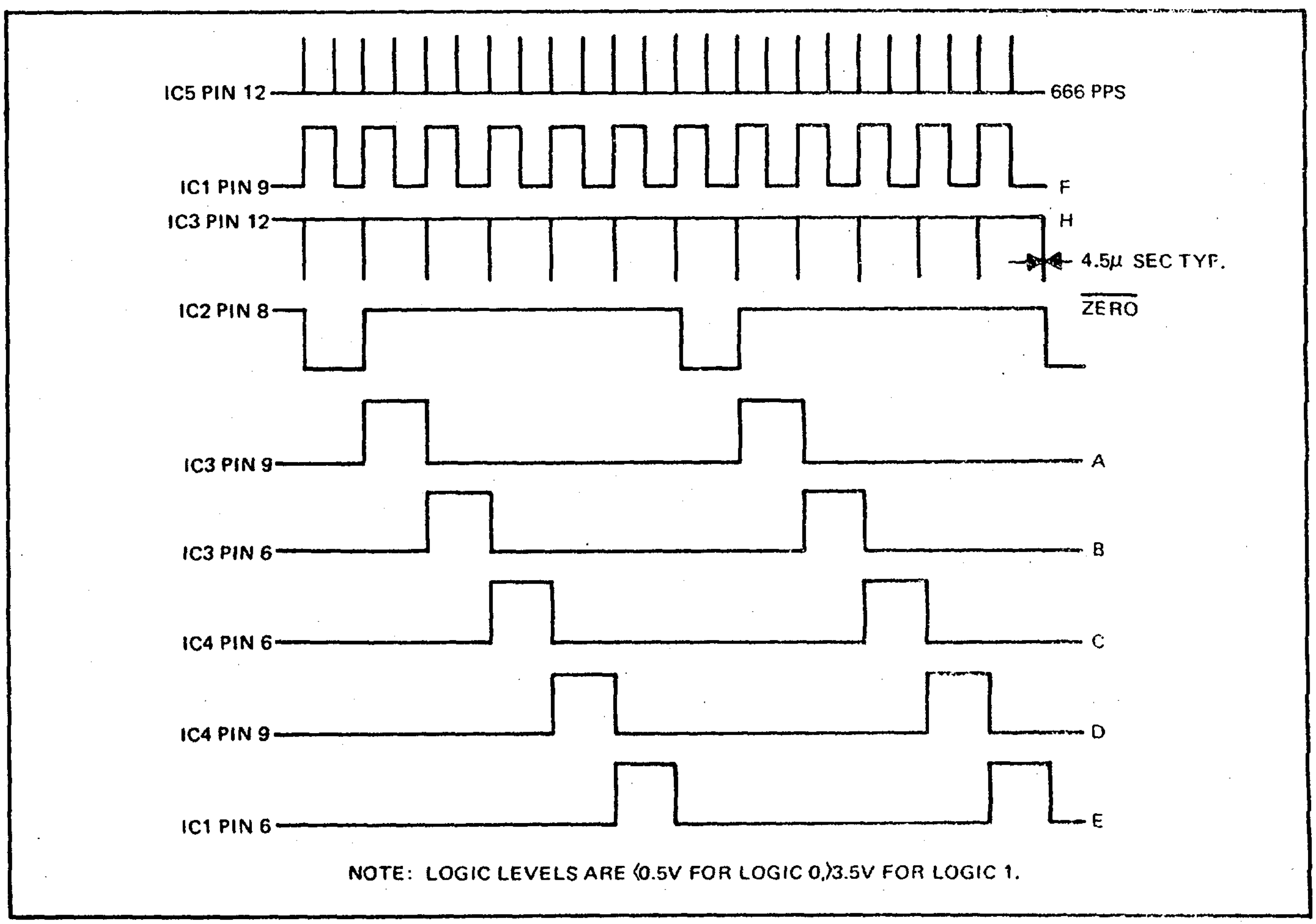


Figure 4-19. SHIFT REGISTER OPERATION

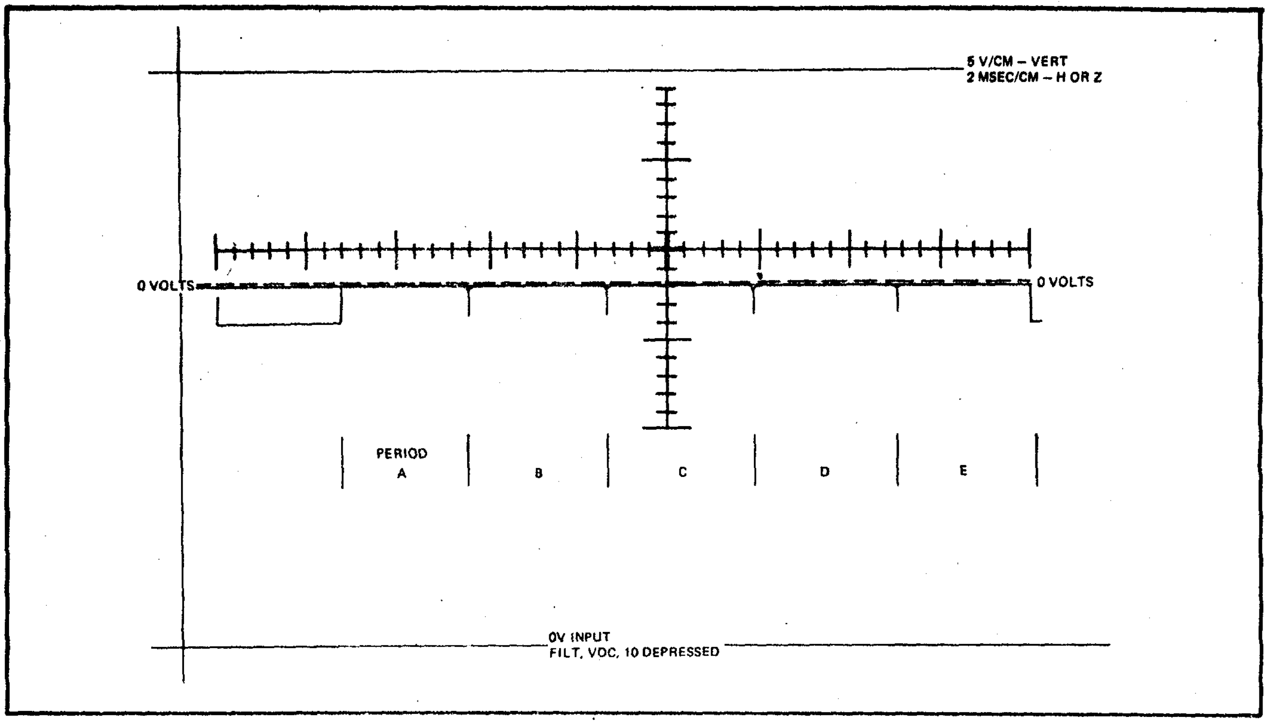


Figure 4-20. A9TP2 WAVEFORMS

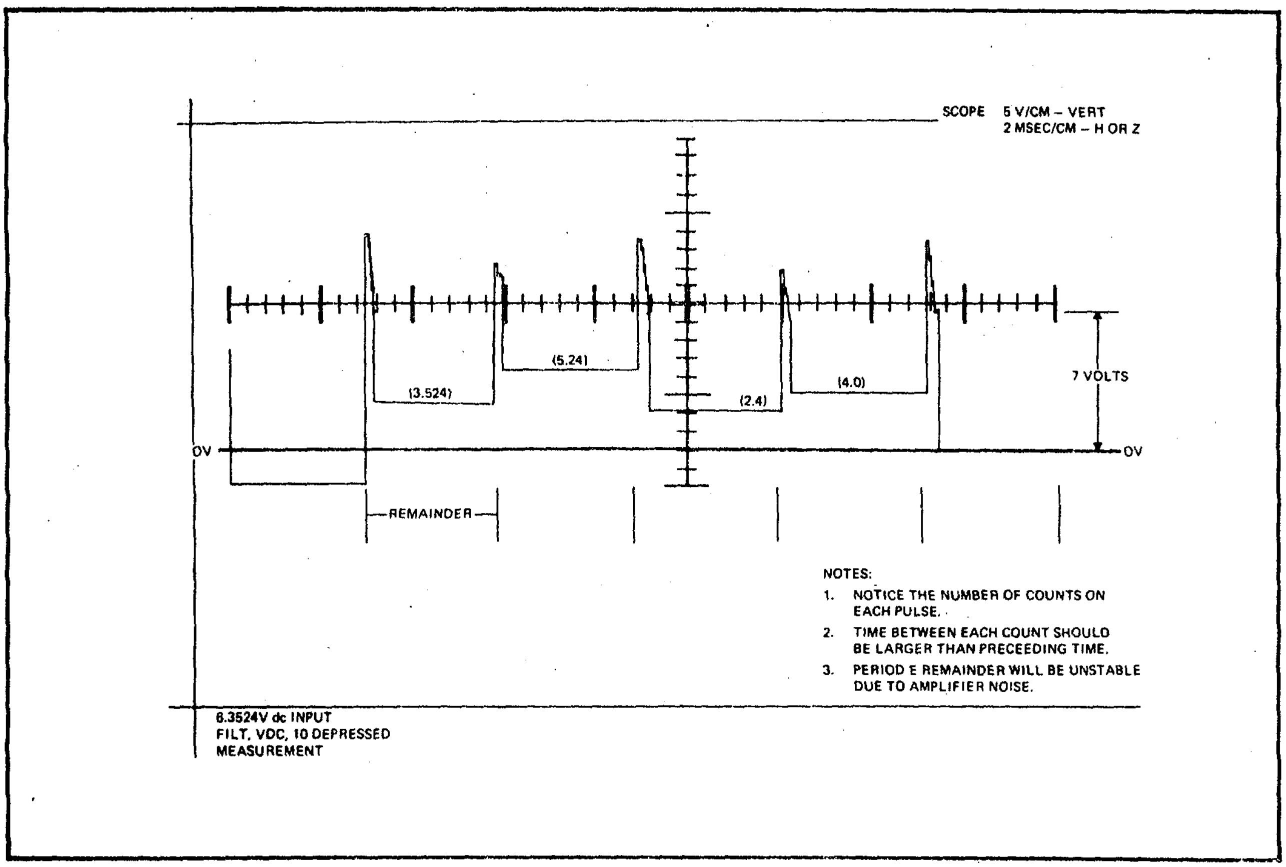


Figure 4-21. A9TP2 WAVEFORMS

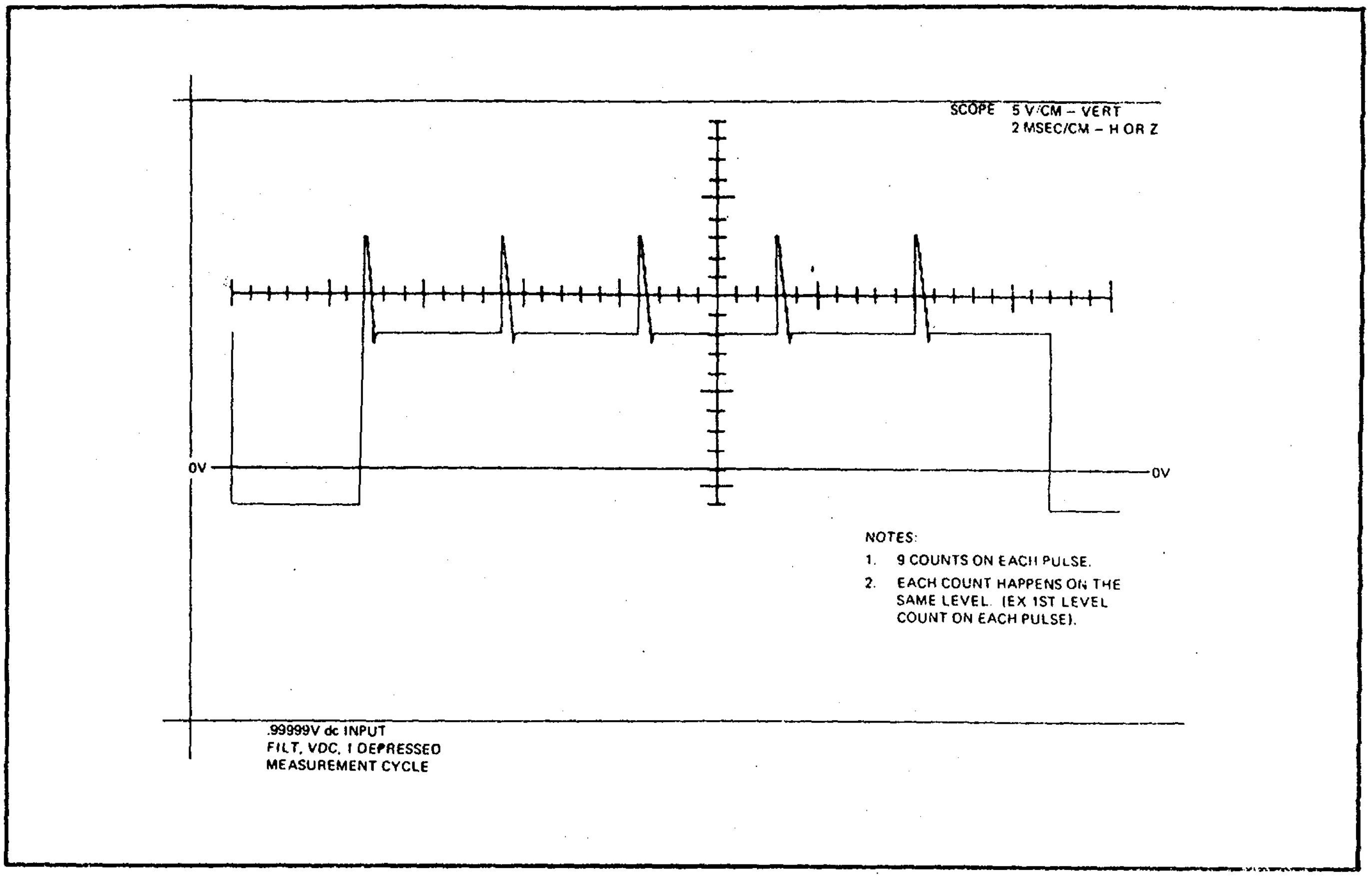


Figure 4-22. A9TP2 WAVEFORMS

Section 5
List of Replaceable Parts

5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown list of the instrument and a Cross Reference List of FLUKE stock numbers to original MANUFACTURERS' part numbers. It also lists recommended spare parts and contains part ordering information. The starting page number of each major listing is given in the Table of Contents.

5-3. The parts list shows the location of all assemblies and the replaceable components. Major assemblies are identified by a designation beginning with the letter A followed by a number (e.g., A1 etc). Subassemblies are identified in the same manner; however, the parent assembly designator precedes this designator (e.g., A1A1 etc.). Electrical components are identified by their schematic diagram designator and listed hardware parts are identified by the FLUKE stock number. All listed components are described, and the FLUKE stock number is given. The original MANUFACTURER'S part number for each listed item is given in the Cross Reference List at the rear of this section.

5-4. PARTS LIST COLUMN DESCRIPTIONS

a. The REF DESIG column indexes 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 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., Inc. is listed in the STOCK NO. column. Use this number when ordering parts from the factory or authorized representatives. In the case where a flag note is used, special ordering is required. Flag note explanations are located as close as possible to the flag note.

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

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 each assembly 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.

f. The USE CODE column identifies certain parts which have been added, deleted or modified during the production of the instrument. Sometimes when a part is changed, the new part can and should be used as a replacement for the original part.

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., Inc. 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 Appendix A.

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 whenever 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., Inc. factory or authorized representative by using the FLUKE stock 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., Inc. if you include the following information:

a. Quantity.

b. FLUKE Stock Number.

c. Description.

d. Reference Designation.

e. Instrument model and serial number.

Example: 2 each, 215897, Transistor, 2N4126 A2A1Q1 & Q2 for 645A, 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 helpful.

MODEL 8375A, FINAL ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
	MODEL 8375A, DIGITAL MULTIMETER See Figure 5-1	8375A			
A1	Power Supply PCB Assembly	288159	1		
A2	Range Delay PCB Assembly	288209	1		
A3	DC External Reference PCB Assembly (-05 Option)	8375A-05			
A5	Remote Control PCB Assembly (--04 Option	8375A-04			
A6/A7	Data Output Unit (-03 Option)	8375A-03			
A16	Rear Input Assembly (-07 Option)	8375A-07			
	A/D Converter Assembly	303461	1		
A8	Logic PCB Assembly	288183	1		
A9	A/D Converter PCB Assembly	288175	1		
	Connector Cover (P23 and P24)	295329	2		
	Cable, ribbon	291807	6 in		
A10	Active Filter PCB Assembly	290346	1		
A11	Buffer PCB Assembly	288191	1		
A12	Ohms Converter PCB Assembly	288217	1		
A13	RMS Converter PCB Assembly	339309	1		
A14	Front Panel Assembly	356139	1		
A15	Rear Panel Assembly	301374	1		
R1, R2	Res, ww, 50K ±0.25%	307298	2		
S2	Switch, Power	291526	1		
TB1	Terminal Board Assembly	--	1		
	Insulator	297846	4		
	Terminal, double	301382	4		
	Terminal, single	301390	3		
TB2	Terminal Board Assembly	--	1		
	Insulator	297846	2		
	Terminal, double	301382	2		
	Bottom Cover, outer	298554	1		
	Corner Handle, front	394296	2		
	Pushbutton, Green	268862	1		
	Line Cord, AC	284174	1		
	Stand, Bail	231407	1		
	Foot, Plastic	292870	4		
	Test Instruction Plate	362806	1		
	Guard Cover	356253	1		
	Top Cover, outer	311746	1		
	Decal, handle trim	295485	2		

MODEL 8375A, FINAL ASSEMBLY

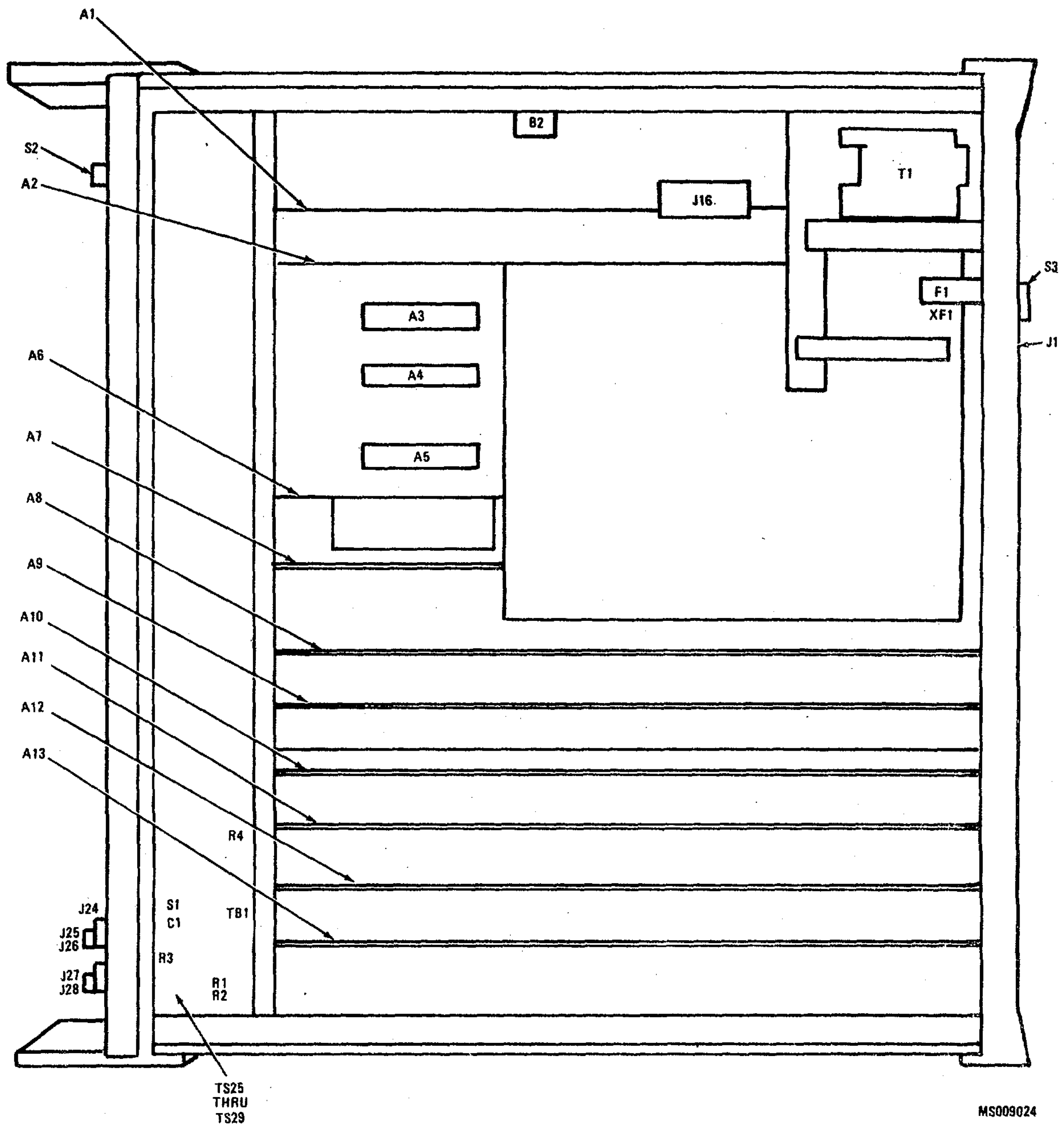


Figure 5-1. MODEL 8375A FINAL ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A1	**POWER SUPPLY PCB ASSEMBLY (8400A-4001) Figure 5-2**	288159	REF		
C1	Cap, elect, 8 uf +50/-10%, 350V	275792	1		
C2, C5	Cap, elect, 250 uf +50/-10%, 40V	178616	2		
C3, C7	Cap, mica, 33 pf ±5%, 500V	160317	2		
C4, C6	Cap, elect, 50 uf +50/-10%, 25V	168823	2		
C8	Cap, elect, 7100 uf+75/-10%, 10V	295196	1		
CR1 thru CR4	Diode, silicon, 1 amp, 600 piv	112383	4		
CR5 thru CR8, CR10 thru CR13	Diode, silicon, 1 amp, 100 piv	116111	8		
CR9	Diode, zener, 12V	249052	1		
Q1, Q2	Tstr, silicon, NPN	218511	2		
Q3, Q8	Tstr, silicon, NPN	150359	2		
Q4	Not used				
Q5	Tstr, silicon, PNP	269076	1		
Q6	Tstr, silicon, NPN	288381	1		
Q7	Tstr, silicon, NPN	218396	1		
R1	Res, comp, 510Ω ±5%, 1/2w	108951	1		
R2	Res, comp, 68k ±5%, 1/4w	148171	1		
R3	Res, met flm, 383k ±1%, 1/8w	288498	1		
R4, R15	Res, met flm, 40.2k ±1%, 1/8w	235333	2		
R5, R8	Res, comp, 51Ω ±5%, 1/2w	144717	2		
R6	Res, ww, 7.2k ±0.1%, 1/4w	295121	1		
R7	Not used				
R9	Res, ww, 4.02k ±0.1%, 1/4w	240937	1		
R10, R12	Res, met flm, 10k ±1%, 1/8w	168260	2		
RI 1	Res, var, cer met, 500Ω ± 10%, 1w	291120	1		
R13, R16	Res, comp, 5.6k ±5%, 1/4w	148080	2		
R14	Res, met flm, 9.53k ±1%, 1/8w	288563	1		
R17	Res, comp, 220k ±5%, 1/4w	160937	1		
U1, U2,	IC, operational amplifier	271502	2		

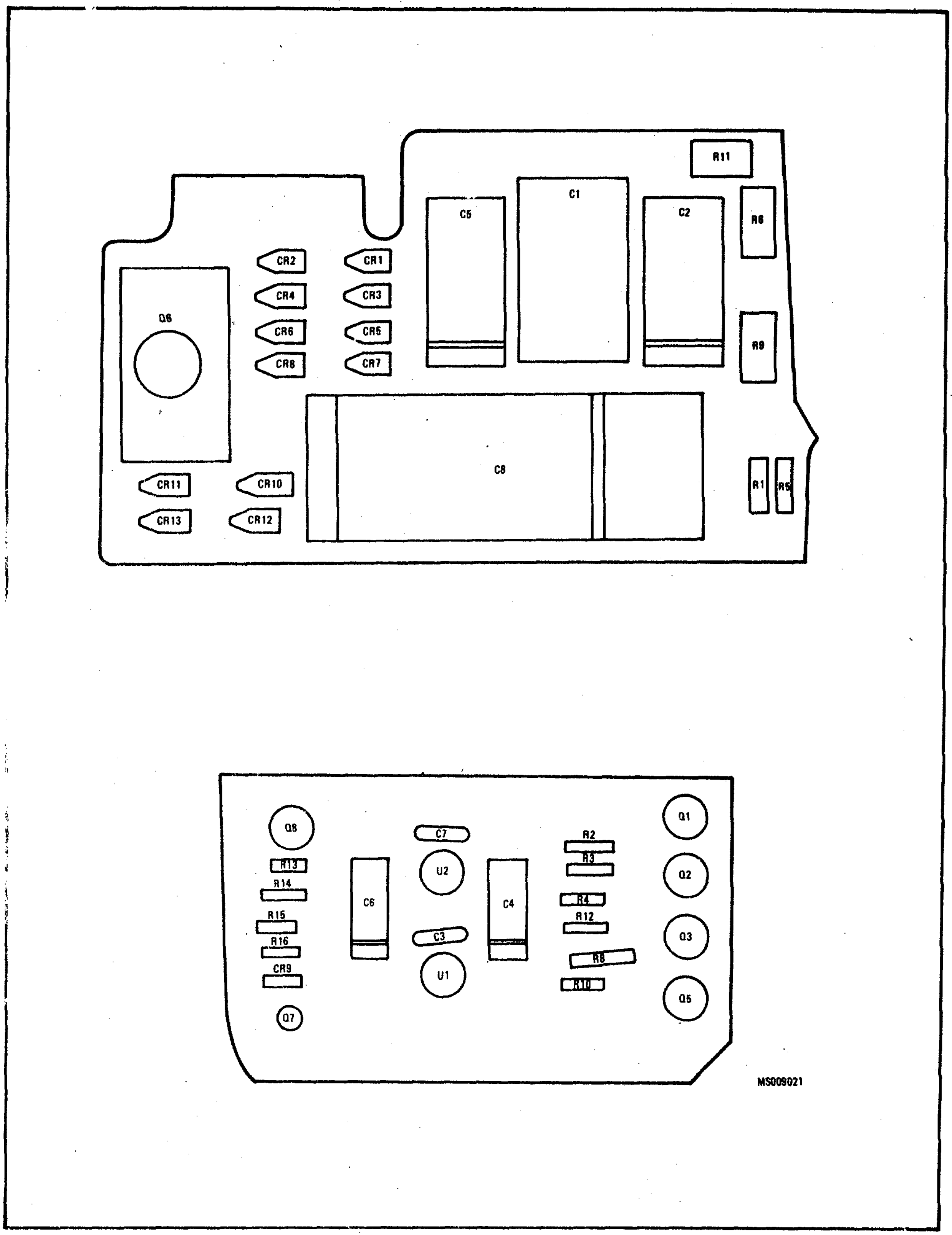


Figure 5-2. POWER SUPPLY PCB ASSEMBLY

A2, RANGE DELAY PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A2	**RANGE DELAY PCB. ASSEMBLY (8400A-4006) Figure 5-3**	288209	REF		
C1, C3	Cap, cer, 0.025 uf :20%o, 100V	168435	2		
C2, C6	Cap, Ta, 3.3 uf ±5%, 20V	271320	2		
C4	Cap, mica, 0.01 uf ±1%, 300V	152470	1		
C5	Cap, elect, 200 uf +50/-10%, 10V	236935	1		
CR1, CR3, CR9, CR1I	Diode, silicon 150 mA	203323	4		
CR2, CR6, CR7, CR8, CR10	Diode, germanium, 80 mA, 100 piv	149187	5		
CR4, CR5	Diode, fast switching germanium, 50 piv	180505	2		
CR12, CR13 CR14, CR15	Diode, germanium, 80 mA, 100 piv	149187	4		
CR16	Diode, silicon, 150 mA	203323	1		
Q1, Q2	Tstr, silicon, NPN	168708	2		
Q3	Tstr, silicon, NPN	218396	1		
Q4	Tstr, silicon, unijunction	268110	1		
Q5	Tstr, silicon, NPN	218396	1		
RI, R6. R15	Res. comp, 220Ω ±5%F, 1/4w	147959	3		
R2	Res, comp, 22k ±5%, 1/4w	148130	1		
R3, R7	Res, comp, 4.7k ±5%, 1/4w	148072	2		
R4, R17	Res, comp, 27k ±5%, 1/4w	148148	2		
RS	Res, comp, 51k ±5%, 1/4w	193334	1		
R8	Res, met flm, 27.4 ±1%, 118w	241471	1		
R9	Res, met flm, 15.4k ±1%, 1/8w	261651	1		
R1	O Res, comp, 47k ±5%, 1/4w	148163	1		
RII	Res, comp, 10k ±5%, 1/4w	148106	1		
R12	Res, met flm, 10k ±1%, 1/8w	168260	1		
R13	Res, met flm, 36.5k ±1%, 1/8w	235309	1		
R14					
	Res, met flm, 16.9k ±1%, 1/8w	267146	1		
R16	Res, comp, 5.1k ±5%, 1/4w	193342	1		

A2, RANGE DELAY PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R18	Res, var, cer met, 10k ±10%, 1/2w	285171	1		
R19	Res, comp, 10k ±5%, 1/4w	148106	1		
U1	IC, DTL, Hex Inverter	268367	1		
U2	IC, DTL, Triple 3-Input Nand Gate	266312	1		
U3	IC, DTL, dual 4-Input Nand	268383	1		

A2, RANGE DELAY PCB ASSEMBLY

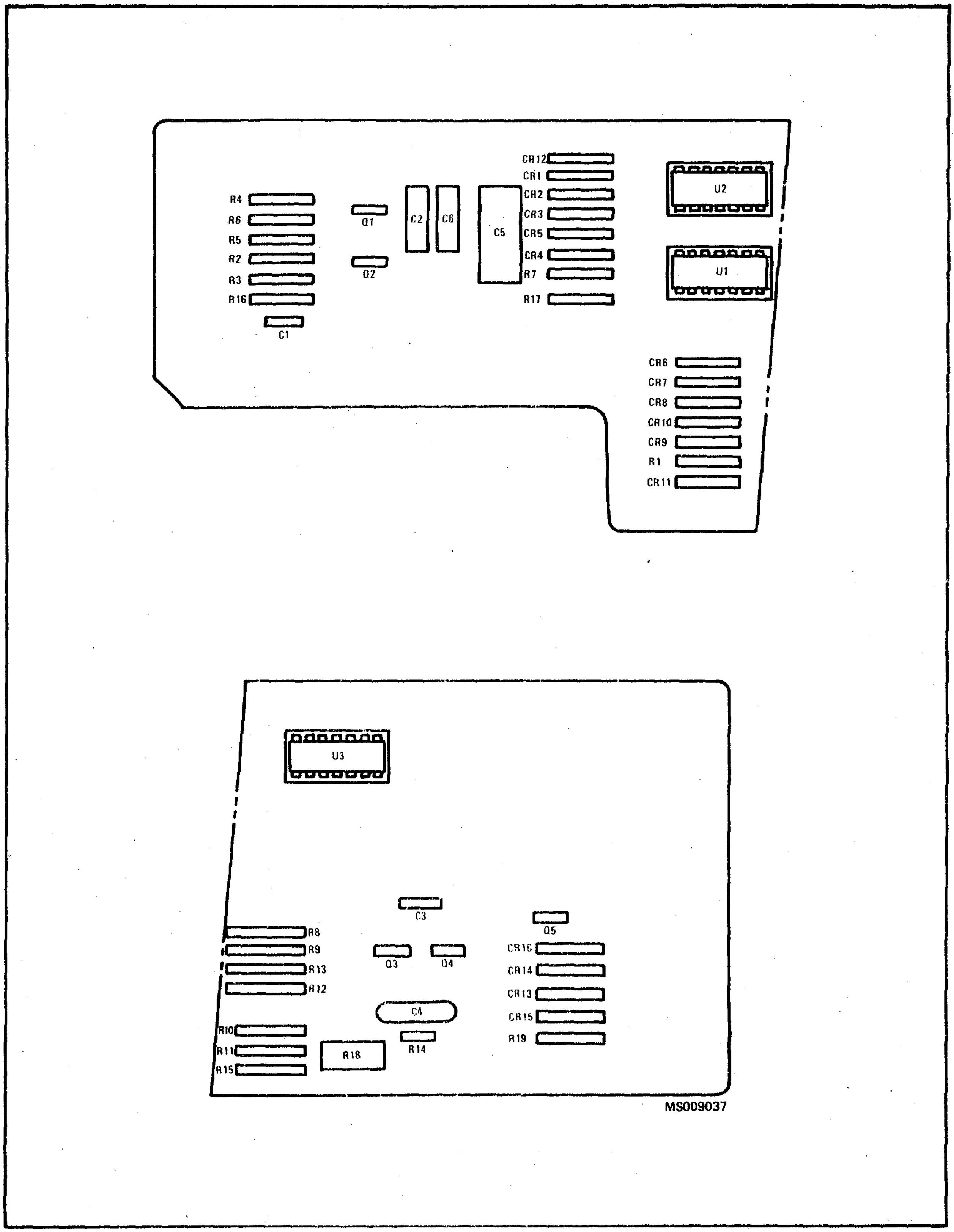


Figure 5-3. RANGE DELAY PCB ASSEMBLY

A8, LOGIC PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A8	**LOGIC PCB ASSEMBLY (8400A-4004)** **Figure 5-4**	288183	REF		
C1	Cap, mica, 5600 pf ± 2%, 500V	182873	1		
C2	Cap, mica, 1500 pf ±5%, 500V	148361	1		
C3	Cap, cer, 180 pf ±10%, 1kV	105890	1		
C4	Cap, mica, 470 pf ±5% %, 500V	148429	1		
C5	Cap, cer 2200 pf ±10%, 500V	268425	1		
C6	Cap, mica, 33 pf ± 5%, 500V	160317	1		
C7	Cap, mica, 270 pf ±5%, 500V	148452	1		
CR1,CR2, CR5,CR6, CR7,CR10, CR11	Diode, silicon, 150 mA	203323	7		
CR3	Diode, silicon, 1 amp, 100 piv	116111	1		
CR4,CR8, CR9	Diode, germanium, 80 mA, 100 piv	149187	3		
P23	Connector Body, PCB to ribbon cable	295337	1		
Q1	Tstr, silicon, unijunction	268110	1		
Q2 thru Q5 Q19 thru Q22 Q24,Q26	Tstr, silicon, NPN	218396	10		
Q6 thru Q17	Tstr, silicon PNP	195974	12		
Q18	Tstr, germanium, PNP	148619	1		
Q23	Tstr, silicon, NPN	168716	1		
Q25	Tstr, silicon, NPN	168708	1		
R1	Res, met flm, 750k ±1%, 1/2w	155192	1		
R2	Res, met flm, 110k ±1%, 1/8w	234708	1		
R3	Res, comp, 47Q2 ±5%, 1/4w	147892	1		
R4	Res, met flm, 46.4k ±1%, 1/8w	188375	1		
R5,R19	Res, comp, 2.7k ±5%, 1/4w	170720	2		
R6,R21, R28,R29, R31,R32, R33	Res, comp, 1.5k ±5%, 1/4w	148031	7		
R7	Res, comp, 8202 + 5%, 1/4w	148015	1		

A8, LOGIC PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R8,R59 R60	Res, comp, 10k ±5%, 1/4w	148106	3		
R9	Res, comp, 27k ±5%, 1/4w	148148	1		
R10	Res, comp, 1k ±5%, 1/4w	148023	1		
R11,R20, R37	Not Used				
R12,R40	Res, comp, 4.7k ±5%, 1/4w	148072	2		
R13,R25, R26,R27	Res, comp, 8.2k ±5%, 1/4w	160796	4		
R14 thru R16,R18	Res, comp, 51k ±5%, 1/4w	193334	4		
R22,R23	Res, comp, 2.2k ±5%, 1/4w	148049	2		
R24,R64	Res, comp, 1.8k ±5%, 1/4w	175042	2		
R30	Res, comp, 6802 ±5%, 1/4w	148007	1		
R34,R35, R36,R38, R39	Res, comp, 22k ±5%, 1/4w	148130	5		
R42	Res, comp, 33k ±5%, 1/4w	i48155	1		
R43,R66, R67	Res, comp, 47k ±5%, 1/4w	148163	3		
R44,R50, R52	Res, comp, 2201 ±5%, 1/4w	160937	3		
R45,R46, R48,R49, R51,R65	Res, comp, 1lk ±5%, 1/4w	221580	6		
R47	Res, comp, 39k ±5%, 1/4w	188466	1		
R53	Res, met flm, 182k ±1%, 1/8w	241091	1		
R54	Res, met flm, 3.74k ±1%, 1/8w	260547	1		
R57	Res, var, cer met, 20Ω ±20%, 1/2w	261180	1		
R58	Res, ww, 14k ±0.1%, 1/4w	275321	1		
R61	Res, comp, 1.2k ±5%, 1/4w	190371	1		
R63	Res, met flm, 3.74k ±1%, 1/8w	272096	1		
U1,U3 thru U6	IC, TTL, dual J-K flip flop268441	5			
U2	IC, DTL, dual 4-Input Nand	268383	1		

A8, LOGIC PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
U7	IC, TTL, dual 4-Input Expandable Nor Gate	268557	1		
U8	IC, DTL, Quad 2-Input Nand Gate	268375	1		
U9,R55, R56,R62	Matched Reference Amplifier Set	290650	1		
U10	IC, Operational Amplifier	284760	1		
	Socket, IC, 16 contact, U1, U3, U4	276535	3		

A8, LOGIC PCB ASSEMBLY

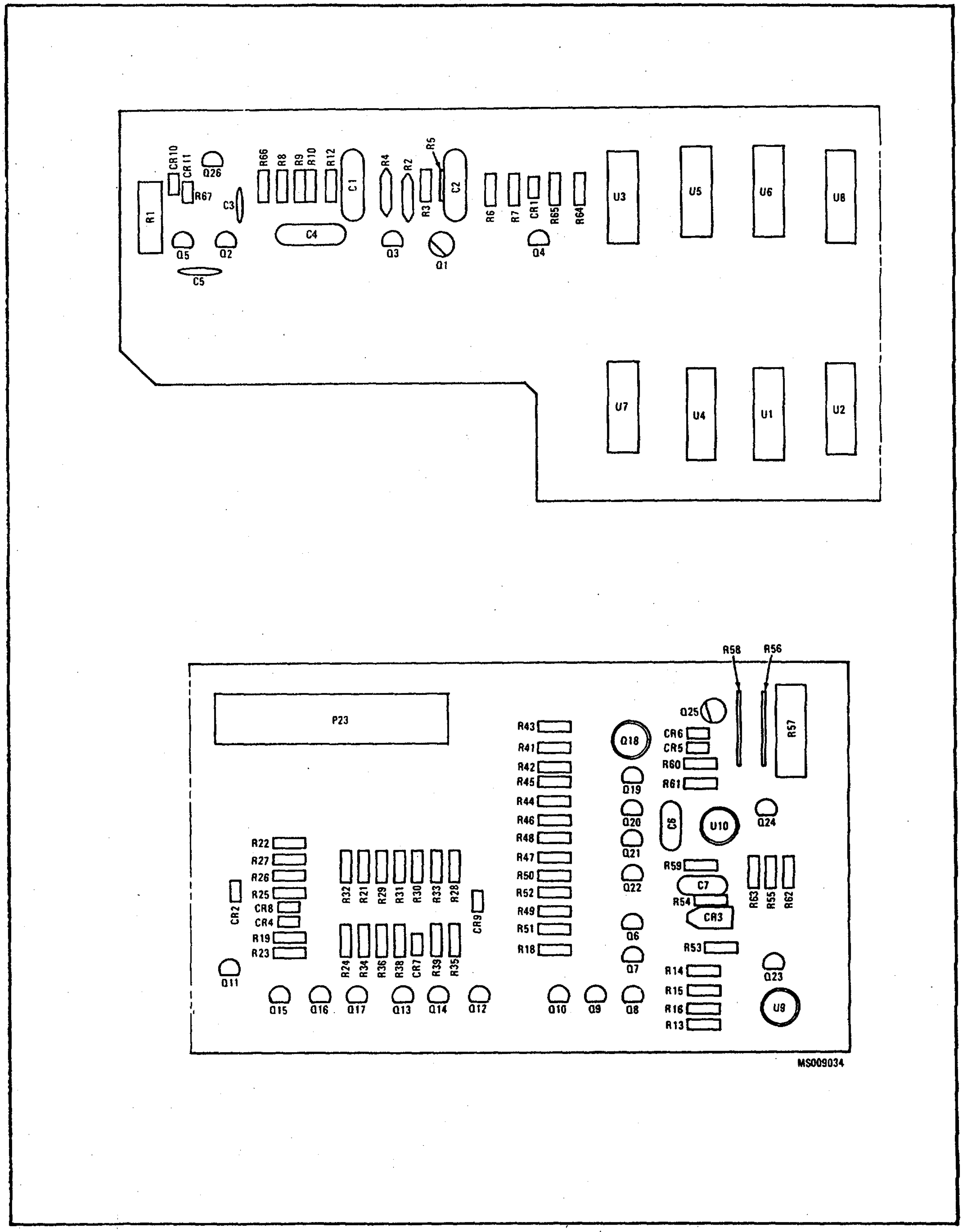


Figure 5-4. LOGIC PCB ASSEMBLY

A9, A/D CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A9	**A/D CONVERTER PCB ASSEMBLY (8400A-4019) Figure 5-5**	288175	REF		
C1,C3, C4,C5	Cap, mica, 390 pf ±5%, 500V	148437	4		
C2,C7	Cap, plstc, 0.47μf ±10%, 250V	184366	2		
C6,C16, C18,C19	Cap, mica, 33 pf ±5%, 500V	160317	4		
C8	Cap, cer, 15 pf ±10%, 500V	159947	1		
C9,C10	Cap,.plstc, 0.047μf ± 10%, 120V	260562	2		
C11 thru C15	Cap, cer, 0.01μf ± 20%, 100V	149153	5		
C17	Cap, plstc, 0.047μf ±10%, 250V	162008	1		
C20	Cap, mica, 2 pf ± 10%, 500V	175208	1		
C21	Cap, mica, 1000 pf ± 5%, 500V	148387	1		
CR1,CR2, CR16, CR19	Diode, silicon, 150 mA, 125 piv	272252	4		
CR3,CR4, CR5,CR7, thru CR10, CR15	Diode, silicon, 15 mA	203323	8		
CR6,CR20	Diode, germanium, 80mA, 100 piv	149187	2		
CR17	Diode silicon, 75mA, 90 piv	260554	1		
CR18	Diode, zener, 6.8V	187195	1		
P24	Connector Body, PCB to ribbon cable	295337	1		
Q1,Q21, Q45	Tstr, silicon, NPN	218396	3		
Q32	Tstr, silicon, PNP	195974	1		
Q3,Q6, Q19,Q22, Q23,Q24	Tstr, FET, N-channel	271924	6		
Q4	Tstr, FET, dual, N-channel	257501	1		
Q5,Q13 thru Q17, Q31,Q36	Tstr, FET, N-channel	288324	7		
Q7,Q8,Q9	Tstr, FET, N-channel, Matched Set (must be replaced as a set)	274795	1		

A9, A/D CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
Q10,Q11, Q29,Q33, Q34	Tstr, silicon, PNP	288761	5		
Q30	Tstr, silicon, PNP	321398	5		
Q12,Q18, Q25 thru Q28	Tstr, FET, N-channel	261388	6		
Q20	Tstr, FET, dual, N-channel	267963	1		
Q35	Tstr, silicon, NPN, dual, monolithic	295717	1		
Q37,Q39, Q41,Q43	Tstr, germanium, NPN	428771	4		
Q38,Q40, Q42,Q44	Tstr, germanium, PNP	321398	4		
R4	Res, comp, 4.7k ±5%, 1/4w	148072	1		
R2,R3	Res, comp, 47k ±5%, 1/4w	148163	2		
R5,R34, R53,R62, R63,R80	Res, comp, l00k ± 5%, 1/4w	148189	6		
R6,R36, R59,R64.	Res, comp, 10k ±5%, 1/4w	148106	4		
R7,R13	Res, ww, 10k, Matched Set	291690	1		
R8,R9,R31	Res, met flm, 45.3k ±1%o, 1/8w	234971	3		
R10	Res, met flm, 49.9k ±1%, 1/8w	268821	1		
R11	Res, comp, 68k ±5%, 1/4w	148171	1		
R12	Res, comp, 220Ω ± 5%, 1/4w	147959	1		
R14,R17 R45	Res, var, cer met, 20f/ ±20,%, 1/2w	261180	3		
R15,R16	Res, ww, 28.578k } Matched Set	285239	1		
R44,R46	Res, ww, 50k				
R47	Res, ww, 100k				
R49	Res, ww, 200k				
RS1	Res, ww, 199.98k				
R19,R.22	Res, comp, 33.2k .0, -5%, 1/8w	334102	2		
R20,R21	Res, comp, 22k ±5%, 1/4w	148130	2		
R23,R18	Res, met flm, 4.99k 0.1%, 1/8w	334110	2		
R24,R25, R35	Res, comp,.220k ±5%, 1/4w	160937	3		

A9, A/D CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R26	Res, comp, 82Ω ± 5%, 1/4w	149484	1		
R27	Res, met flm, 21.5k +1%, i/8w	168278	1		
R28,R78	Res, comp, 27k 5%, 1/4w	148148	2		
R29	Res, met flm, 22.1k +1%, 1/8w	235234	1		
R30	Res, comp, 820k +5%, 1/4w	220541	1		
R32,R79	Res, comp, 15k +5%, 1/4w	148114	2		
R33	Res, comp, 1k +5%, 1/4w	148023	1		
R37	Res, var, cer met, 10k ± 10%, 1w	285171	1		
R38,R39	Res, comp, 6.2M +5%, 1/4w	221960	2		
R40,R41	Res, met flm, 750k +1%, 1/8w	271361	2		
R42	Res, met flm, 1.5M +1%, 1/4w	284976	1		
R43	Res, comp, 3M +5%, 1/4w	221952	1		
R48	Res, var, cer met, 50Ω +10%, 1w	285122	1		
R50	Res, var, cer met, 100Ω +10%, 1w	285130	1		
R52	Res, comp, (nominally 22Ω +5%, 1/4w)	147884	1		
R54	Res, comp, 18k ± 5%, 1/4w	148122	1		
R55	Res, ww, 1.022k + 0.05%, 1/4w	288654	1		
R56	Res, var, cer met, 20Ω ± 20%, 1w	285114	1		
R57	Res, ww, 5k ± 0.05%, 1/4w	288647	1		
R58	Res, var, cer met, 200Ω +20%, 1/2w	284711	1		
R60	Res, comp, 150k ± 5%, 1/4w	182212	1		
R61	Res, var, cer met, 200Ω ± 10%, 1w	285148	1		
R65	Res, comp, 510k ± 5%, 1/4w	275685	1		
R66,R68, R70,R72	Res, met flm, 4.99k ± 1%, 1/8w	168252	4		
R67,R69, R71,R73	Res, met flm, 32.4k ± 1%, 1/8w	182956	4		
R74	Res, met flm, 6.04k ± %, 1/8w	285189	1		
R75	Res, met flm, 1k +1%, 1/8w	168229	1		
R76	Res, comp, 270k +5%, 1/4w	220061	1		
R77	Res, met flm, 16.92 ± 1%, 1/8w	281790	1		

A9, A/D CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R81	Res, comp, 4.7M ± 5%, 1/4w	220046	1		
U1 thru U4	IC, operational amplifier	271502	4		

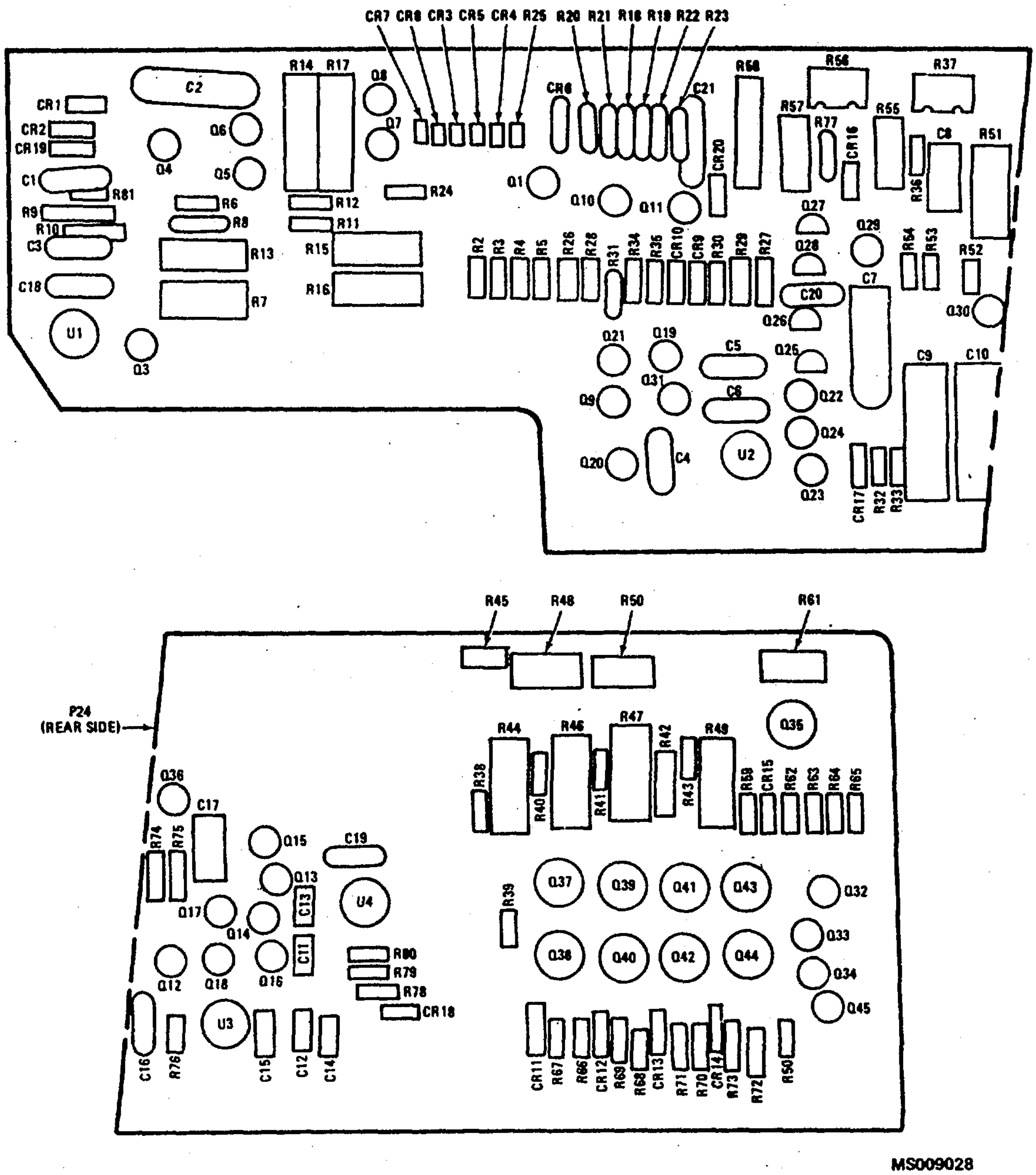


Figure 5-5. A TO D CONVERTER PCB ASSEMBLY

A10, ACTIVE FILTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A10	**ACTIVE FILTER PCB ASSEMBLY (8400A-4015)** **Figure 5-6**	290346	REF		
C1 thru C4	Cap, plstc, 0.47 uf ±20%, 120V	190553	4		
C5, C8	Cap, mica, 33 pf ±5%, 500V	160317	2		
C6, C7	Cap, mica, 150 pf ±5%, 500V	148478	2		
CR1, CR2	Diode, silicon, 10 mA, 2 piv	180554	2		
CR3	Diode, silicon, 150 mA	203323	1		
K1	Relay, reed switch	219097	2		
Coil, relay		272070	1		
Q1	Tstr, silicon, NPN, Super beta dual monolithic	284075	1		
Q2	Tstr, silicon, NPN	218396	1		
Q3	Tstr, silicon, PNP	195974	1		
RI, R2, R4, R5	Res, met flm, 46.4k ±1%, 1/8w	188375	4		
R3	Res, comp, 6.8k i5%, 1/4w	148098	1		
R6	Res, met flm, 140k ± 1%, 1/8w	289439	1		
R7	Res, comp, 100k ±5%, 1/4w	148189	1		
R8	Res, met flm, 8.66k 1%, 1/8w	260364	1		
R9, R10	Res, met flm, 215k 1%, 1/8w	289470	2		
R11, RI 2	Res, factory selected value				
R13	Res, var, cer met, 5k ±20%, 1/2w	267872	1		
R14	Res, met flm, 100k ±1%, 1/8w	248807	1		
R15	Res, met flm, 2.49k ±1%, 1/8w	226209	1		
R16	Res, met flm, 82.5k ±1%, 1/8w	246223	1		
R17	Res, met flm, 2k ± 1%, 1/8w	235226	1		
R18	Res, met flm, 7.15k ±1%, 1/8w	260356	1		
U1, U2	IC, operational amplifier	271502	2		

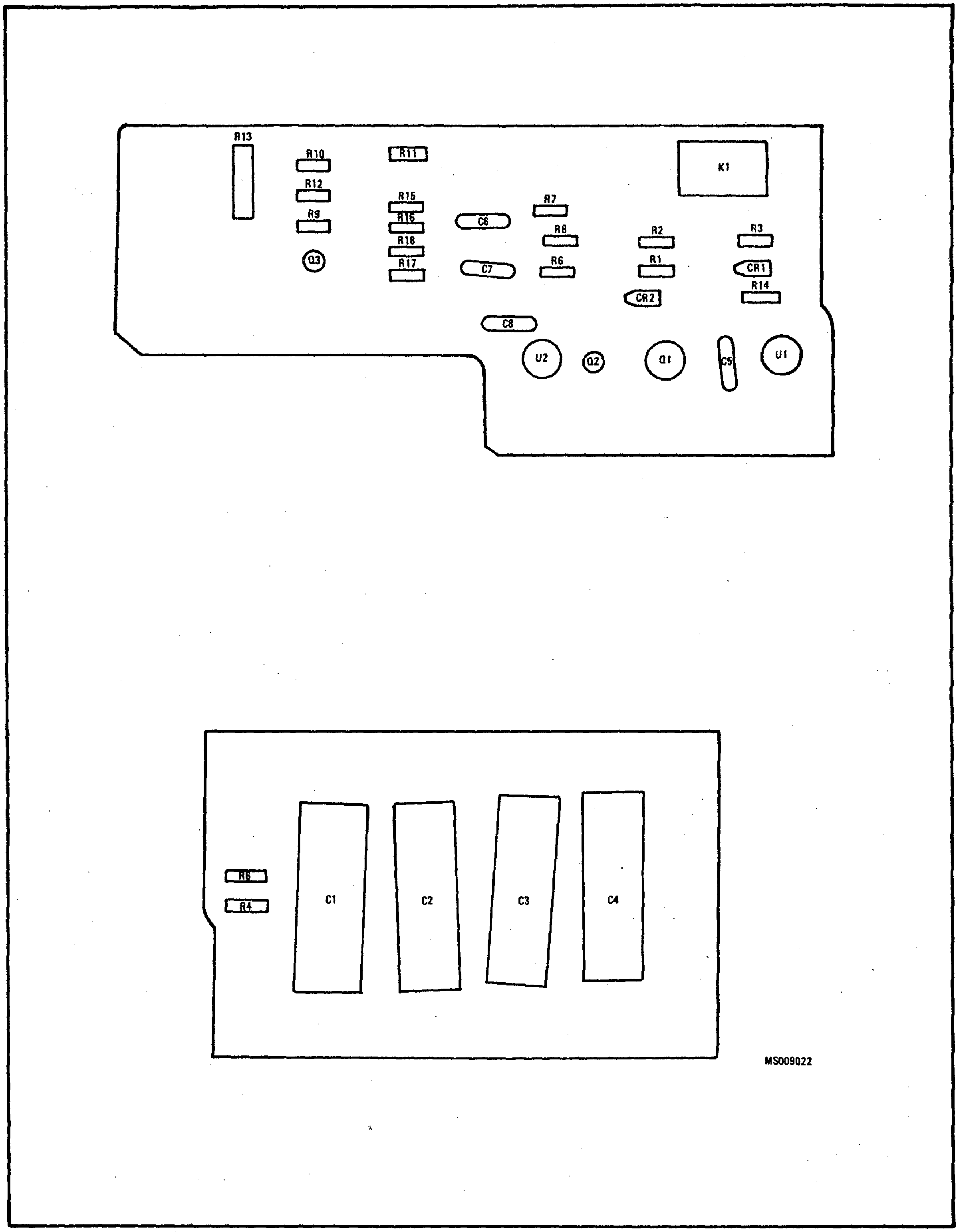


Figure 5-6. ACTIVE FILTER PCB ASSEMBLY

A11, BUFFER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
All	**BUFFER PCB ASSEMBLY (8400A-4005)** **Figure 5-7**	288191	REF		
C1, C3	Cap, mica, 100 pf ±5%, 500V	148494	2		
C2, C4	Cap, mica, 33 pf ±5%, 500V	160317	2		
C5	Cap, mica, 270 pf ±5%, 500V	148452	1		
C6, C7	Cap, cer, 0.05 uf ±20%, 100V	149161	2		
C8	Cap, plstc, 0.1 uf ±5%, 100V	167460	1		
C9, C10	Not Used				
C11	Cap, mica, 2200 pf ±5%, 500V	148346	1		
CRI,	Diode, silicon, 10 mA, 2 piv	180554	1		
CR3	Diode, zener, 6.8V	166199	1		
CR4 thru CR8	Diode, silicon, 200 mA, 25 piv	190272	5		
CR9 thru CR17	Diode, gremanium, 80 mA, 100 piv	149187	9		
CR18 thru CR24	Diode, silicon, 150 mA	203323	7		
K1, K7	Relay, 4 PDT, 5V coil	272716	2		
K2	Relay, reed switch	284091	2		
Coil, relay		272070	1		
K3	Relay, reed switch	284091	REF		
Coil, relay		269019	4		
K4, K5, K6	Relay, reed switch	289850	3		
Coil, relay		269019	REF		
Q1, Q8	Tstr, silicon, PNP	195974	2		
Q2	Tstr, germanium, PNP	148643	1		
Q3	Tstr, silicon, NPN	168716	1		
Q4	Tstr, silicon, NPN, dual, monolithic	295717	1		
QS	Tstr, silicon, NPN, Super beta dual monolithic ▷1	284075			
Q6, Q7	Tstr, silicon, PNP, selected	280198	2		
Q9	Not Used				
Q10					
Ql1	Tstr, selected	321638	1		
R1	Res, comp, IM ±5%, 1/4w	182204	1		
R2	Res, comp, 47k ±5%, 1/2w	150219	1		
R4	Not Used				

A11, BUFFER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R3	Res, comp, 910k ± 5%, 2w	110171	1		
R5, R6	Res, ww, 4.45M				
R7	Res, ww, 899.55k — Matched Input Divider Set	284505	1		
R10	Res, ww, 99.95k				
R8	Res, var, cer met, 1k ± 20%, ½ w	267856	1		
R9	Res, var, cer met, 100 ± 20%, ½ w	267823	1		
R10	Res, met flm, 10k ± 1%, 1/8w	168260	1		
R12	Res, met flm, 13.7k 1%, 1/8w	236752	1		
R13	Res, met fm, 34k ± 1%, 1/8w	261602	1		
R14	Res, met flm, 2.61k iIl%, 1/8w	289983	1		
R15	Res, met flm, 232 iS±5%, 1/8w	289975	1		
R16	Res, met flm, 84.5k	229492	1		
R17	Res, var, cer met, 100k ±20/o, 1/2w	268581	1		
R18, R19	Res, comp, 1OOM ilO%, 1/2w	190520	2		
R20, R33	Res, comp, 10Ok ±5%, 1/4w	148106	2		
R21	Res, comp, 270k ±5%, 1/4w	220061	1		
R22, R23,	Res, met flm, factory selected value (may not be installed)				
R25, R26					
R24, R27	Res, met flm, 2M, Matched Set	290320	1		
R28	Res, var, cer met, 10k ± 10%, 1w	285171	1		
R29	Res, met flm, 3.83M ±1%, 1/2w	289660	1		
R30, R31	Res, comp, 22k ±5%, 1/4w	148130	2		
R32	Res, comp, 470 +i5%, 1/4w	147983	1		
R34	Res, comp, 3.3k i5%, 1/4w	148056	1		
R35	Res, ww, 90k				
R37	Res, ww, 9k — Matched Output Divider Set	289686	1		
R39	Res, ww, 1k				
R36	Res, var, cer met, 200Q i±20%, 1/2w	284711	1		
R38	Res, var, cer met, 2012 i20%, 1/2w	261180	1		
R40	Res, comp, Ii ±5%, 1/2w	218693	1		
R41	Res, met flm, 499k, 1%, 1/8w	268813	1		
R42	Res, comp, 1k i5%, 1/4w	148023	1		

A11, BUFFER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R43, R44	Res, comp, 330Ω±5%, 1/4w	147967	2		
U1	IC, operational amplifier [1]	284760	1		
U2	IC, operational amplifier	271502	1		
U3	IC, voltage follower	288365	1		
U4	IC, DTL, Quad 2-Input Nand Power Gate	288597	1		
	Cover (not shown)	298893	1		
	[1] Replacement of this part requires factory recalibration. Return A11 Buffer PCB only.				

A11, BUFFER PCB ASSEMBLY

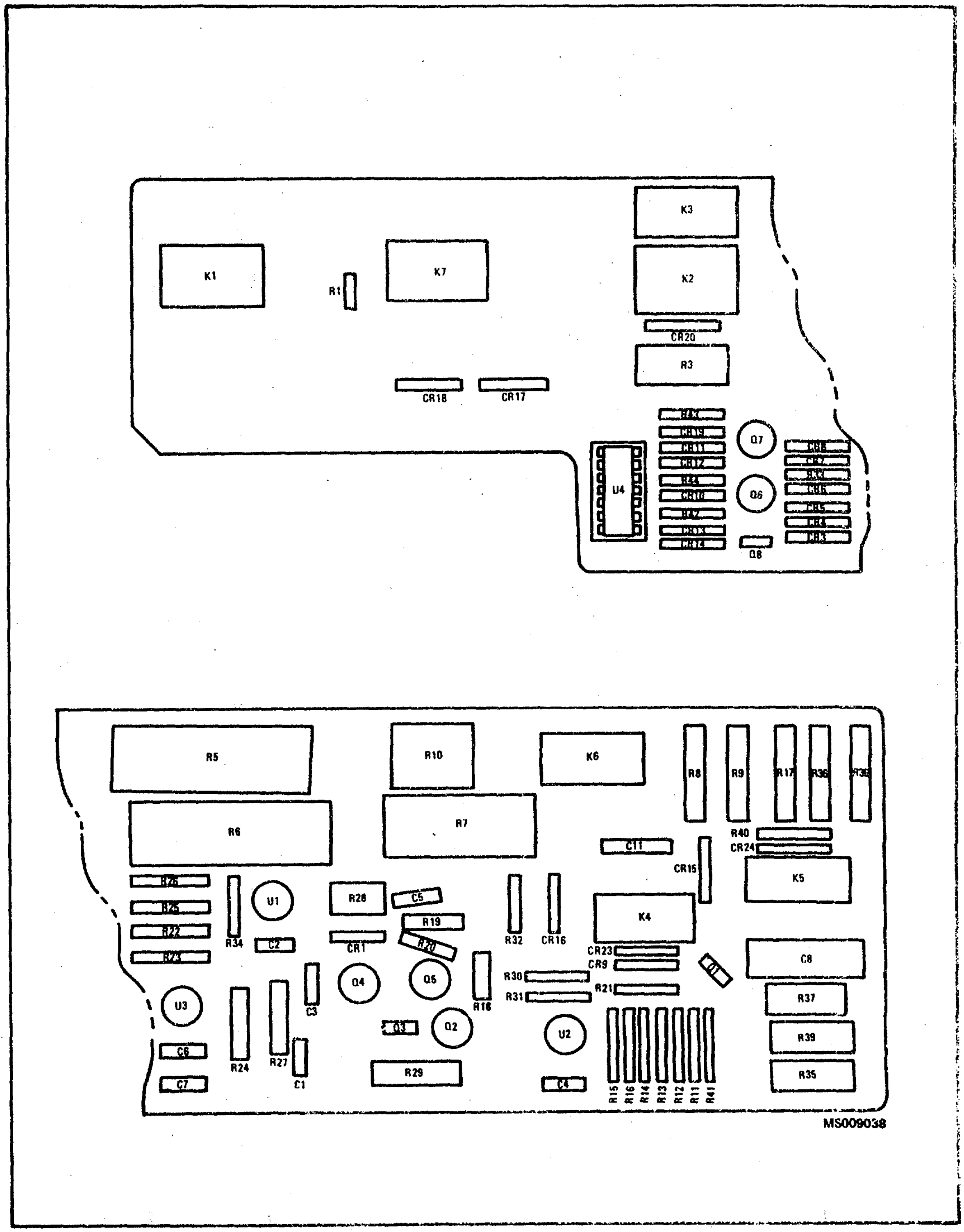


Figure 5-7. BUFFER AMPLIFIER PCB ASSEMBLY

A12, OHMS CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A12	**OHMS CONVERTER PCB ASSEMBLY (8400A-4010) Figure 5-8**	288217	REF		
C1	Cap, elect, 160 uf +50/-10%, 25V	236901	1		
C2,C7,C9	Cap, cer, 0.01 uf±20%, 100V	149153	3		
C3, C4	Cap, mica, 33 pf ±15, 500V	160317	2		
CS	Cap, Ta, 1.0 uf ±20%, 35V	161919	1		
C6	Cap, mica, 470 pf ±5%, 500V	148429	1		
CR1	Diode, silicon, 1 amp, 100 piv	116111	.		
CR2	Diode, zener, 20V	180463	1		
CR3	Diode, zener, 6.3V, selected & tested	288043	1		
CR4	Diode, silicon, 150 mA, 125 piv	272252	1		
CR5	Diode, zener, 10V	180406	1		
CR6 thru CR13, CR16 thru CR20	Diode, silicon, 150 mA	203323	13		
CR14	Diode, silicon, 1 amp, 600 piv	112383	1		
CR15	Diode, germanium, 80 mA, 100 piv	149187	1		
F1	Fuse, pigtail, 15 mA, 125V (one fuse provided as a spare)	285031	2		
K1	Relay, reed switch	219097	2		
	Coil, relay	272070	1		
K2	Relay, armature, DPDT, 115V Coil	268995	1		
K3, K4	Relay, reed switch	284091	2		
	Coil, relay	269019	2		
Q1	Tstr, silicon, NPN	150359	1		
Q2, Q3	Tstr, silicon, PNP	225599	2		
Q4,Q7,Q9	Tstr, silicon, NPN	218396	3		
QS, Q6	Tstr, silicon, PNP, selected	280198	2		
Q8 .Q10	Tstr, silicon, PNP	195974	2		
R1, R9	Res, comp, 10k ±5%, ¼w	148106	2		
R2, R4	Res, met flm, 10k ±1%, 1/8w	168260	2		
R3	Res, comp, 2.2k ±5%, ¼ w	148049	1		

A12, OHMS CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R5	Res, met flm, 953Ω±1%, ½ w	288555	1		
R6	Res, met flm, 619k ±1%, 1/8w	288639	1		
R7, R19	Res, var, cer met, 1k ±20%, ½ w	267856	2		
R8, R17	Res, var, cer met, 25k ±20%, ½ w	285213	2		
R10	Res, var, cer met, 10k ±20%,w	267880	1		
R11	Res, met flm, 46.4k ±1%, 1/8w	188375	1		
R12	Res, ww, 634.13Ω ±0.05%, ¼ w	292888	1		
R13	Res, met flm, 464k ± 1%, 1/8w	271908	1		
R14	Res, var, cer met, 100k ±20%, ½ w	268581	1		
RI 5	Res, ww, 6.983k ±O.05%, ¼ w	292896	1		
R16	Res, ww, 62k ±0.05%, ¼ w	292904	1		
R18	Res, met flm, 6.99M ±0.1%, 2w	284968	1		
R20	Res, ww, 777.15k ±0.05%, 3/4w	277913	1		
R21	Res, var, cer met, 100Ω ±20%, ½ w	267823	1		
R22	Res, ww, 70.555k ±0.05%, ½ w	277905	1		
R23	Res, met flm, 100Ω±1%, 1/8 w	168195	1		
R24, R25	Res, comp, 390Ω ±5%, ¼ w	147975	2		
R26	Res, comp, 8.2k ±5%, ¼ w	160796	1		
R27	Res, comp, 4.7k ±5%, ¼ w	148072	1		
R28, R33	Res, comp, 1k ±5%, ¼ w	148023	2		
R30, R31	Res, comp, 560Ω ±5%, ¼ w	147991	2		
R32	Res, comp, 220Ω ±5%, ¼ w	147959	1		
U1	IC, operational amplifier	271502	1		
U2	IC, operational amplifier	284760	1		
U3	IC, DTL, triple 3-Input Nand Gate	26.6312	1		
U4	IC, DTL, dual 4-Input Nand	268383	1		
U5	IC, DTL, Quad 2-Input Nand Gate	268375	1		
	Fuse holder	296582	2		
R34,R35	Res, comp, 22k ±5%, ¼ W	160796	2		
R36					
R37	Res, comp IM ±5%, ¼ W	182204	1		

A12, OHMS CONVERTER PCB ASSEMBLY

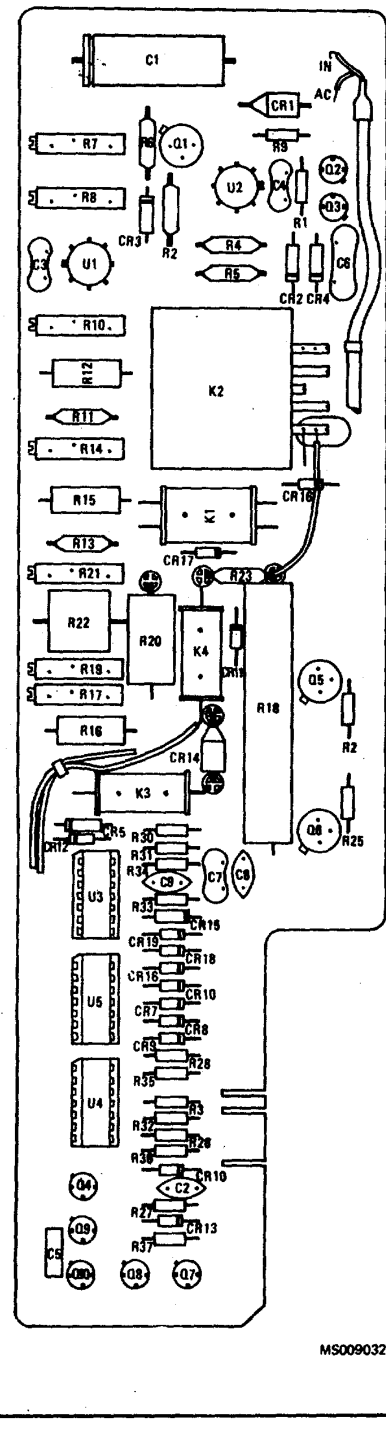


Figure 5-8. OHMS CONVERTER PCB ASSEMBLY

A13, TRUE RMS CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A13	**RMS CONVERTER PCB ASSEMBLY (8400OA-4022)**	339309	REF		
	Figure 5-9				
C1	Cap, plstc, 0.22 uf ± 20%, 1200V	268904	1		
C2	Cap, porc, 2.7 pf ±0.25 pf, 1700V	340745	1		
C3	Cap, mica, 220 pf ± 5%, 500V	170423	1		
C4,C9	Cap, var, teflon, 0.25 - 1.5 pf, 2kV	218206	2		
C5	Cap, mica, 22 pf ± 5%, 500V	148551	1		
C6	Cap, mica, 8 pf ±10%, 500V	216986	1		
C7,C34	Cap, plstc, 0.1 uf ± 10%, 250V	161992	2		
C8	Cap, porc, 2.2 pf ± 0.25 pf, 1700V	340273	1		
C10	Cap, porc, 27 pf ± 5%, 500V	344283	1		
C11	Cap, var, air, 0.8 - 10 pf, 250V	229930	1		
C12,C16, C41	Cap, plstc, 0.047 uf ± 10%, 250V	162008	3		
C13	Cap, mica, 330 pf ± 1%, 500V	226142	1		
C14	Cap, var, cer, 9 - 35 pf, 350V	289637	1		
C15	Cap, mica, 3600 pf ± 2%, 500V	176644	1		
C17	Cap, mica, 15 pf ± 5%, 500V	148569	1		
C18,C20	Cap, mica, 27 pf ± 5%, 500V	177998	2		
C19,C22	Cap, mica, 1000 pf ± 5%, 500V	178387	2		
C21,C40	Cap, mica, 2 pf ± 0.5 pf, 500V	175208	2		
C23,C36, C37	Cap, Ta, 15 uf ± 10%, 20V	153056	3		
C24	Not Used				
C25	Cap, mica, 390 pf ± 5%, 500V	148437	1		
C26,C31, C38	Cap, mica, 33 pf ± 5%, 500V	160317	3		
C27,C30,C42	Cap, plstc, 6800 pf ± 10%, 250V	342881	3		
C28,C29	Cap, plstc, 0.022 uf ± 10%, 250V	234484	2		
C32,C35	Cap, plstc, 0.033 uf ± 10%, 250V	234492	2		
C33	Cap, plstc, 4700 pf ± 10%, 250V	342873	1		

A13, TRUE RMS CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
C39	Not Used				
CL1	Current regulator FET	285106	1		
CR1 thru	Diode, germanium, 80 mA, 100 piv	149187	5		
CR5					
CR6,CR7,	Diode, silicon, 100 mA at 1.5V	261370	3		
CR20					
CR8,CR9,	Diode, silicon, 150 mA	203323	6		
CR10,CR11,					
CR17,CR23					
CR12,CR13	Not Used				
CR14,CR16	Diode, silicon, 100 mA at 1.5V	161810	2		
CR15S,CR18	Diode, zener, 10V	246611	2		
CR19	Diode, silicon, 10 mA, 2 piv	180554	1		
CR21,CR22	Diode, zener, 6.8V	260695	2		
K1,K3	Relay, reed switch	284091	2		
	Coil, relay	269019	5		
	Foil wrap	313833	2		
K2A,K2B,	Relay reed switch	289850	5		
K4,K5,K6	Coil, relay (K2)	272070	1		
	Coil, relay (K4,K5,K6)	269019	REF		
	Foil wrap (K4,K5,K6)	280008	3		
Q1	Tstr, FET, dual, N-channel	267963	1		
Q2,Q6,Q7	Tstr, FET, N-channel	343103	3		
Q3,Q9,QO1,	Tstr, silicon, NPN	218396	4		
Q18					
Q4,Q11,Q15	Tstr, silicon; PNP	195974	3		
Q5,Q13,Q14	Tstr, FET, N-channel	288324	5		
Q16,Q17					
Q8,Q 12	Part of matched set	1	1		
R1	Res, met flm, 1M ± 0.1%, 1w	340265	1		
R2,R11	Res, comp, 12k ± 5%, ¼ w	159731	2		
R3,R4,R5,	Res, comp, 51k ± 5%, ¼ w	193334	4		
R47					
R6,R7,R31	Res, met flm, 50k ± 0.1%, 1/8w	340257	3		

A13, TRUE RMS CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R8	Res, met flm, 48.7k ± 1%, 1/8w	267385	1		
R9,R20, R35,R53, R59,R67, R70	Res, comp, 1M ± 5%, 1/4w	182204	7		
R10	Res, comp, 390Ω ± 5%, ¼ w	147975	1		
R12,R42, R45	Res, var, cermet, 1M ± 10%, ½ w	334722	3		
R13	Res, met flm, 995k ± 0.1%, ½ w	340158	1		
R14,R64	Res, var, cermet, 10 k ± 10%, ½ w	285171	2		
R15	Res, met firm, 110.6k ± 0.1%, 1/8w	340224	1		
R16	Res, var, cermet, 1k ± 10 %, ½ w	285155	1		
R17	Res, met flm, 10.05k ± 0.1%, 1/8w	340216	1		
R18	Res, var, cermet, 100Ω + 10%, ½ w	285130	1		
R19	Res, met flm, 1.001k ± 0.1%, 1/8w	340208	1		
R21,R72, R75	Res, comp, 22k ± 5%, ¼w	148130	3		
R22	Res, comp, 300k ± 5%, 1/4w	234682	1		
R23	Res, met flm, 4.975k + 0.1%, 1/8w	340232	1		
R24	Res, comp, 5.1k + 5%, ¼ w	193342	1		
R25	Not Used				
R26	Res, comp, 3.9k ± 5%, ¼ w	148064	1		
R27	Res, met flm, 1M ± 1%, 1/8w	268797	1		
R28	Res, met flm, 100Ω ±1%, 1/8w	168195	1		
R29	Res, met flm, 5k ± 0.1%, 1/8w	340240	1		
R30,R37	Res, comp, 6.8k ± 5%, ¼ w	148098	2		
R32	Res, var, cermet, 50Ω ± 10%, ½ w	285122	1		
R33	Res, met flm, 100k ± 0.1%, 1/8w	340166	1		
R34	Res, met flm, 35.7k ± 1%, 18w	288480	1		
R36	Res, comp, 68Ω ± 5%, ¼ w	247918	1		
R38	Res, var, cermet, 3Ω ± 25% ½ w	347963			
R39	Not Used				

A13, TRUE RMS CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R40	Res, comp, 5.6k ± 5%, ¼ w	148080	1		
R41	Res, romp, 56k ± 5%, ¼ w	170738	1		
R43,R82	Res, comp, 1k ± 5%, ¼ w	148023	2		
R44	Res, comp. 9.1k ± 5%, ¼ w	193318	1		
R46	Res, comp, 560Ω ± 5%, ¼ w	147991	1		
R48	Part of matched set, may not be installed	1	1		
R49,R83	Res, comp, 330Ω ± 5%, ¼ w	147967	2		
R50	Res, romp, 100Ω ± 5%, ¼ w	147926	1		
R51,R77	Res, comp, 82k ± 5%, ¼ w	188458	2		
R52	Res, met flm, 2M ± 1%, ¼ w.	340323	1		
R54,R60	Res, comp, 470Ω ± 5% ¼ w	147983	2		
R55,R66	Res, var, cermet, IM ± 10%, ½w	276691	2		
R56,R65	Res, met flm, IM ± 0.25%, ¼ w	340133	2		
R57	Res, met flm, 465k ± 0.25%, 1/8w	340315	1		
R58	Res, met flm, 499k ± 1%, 1/8w	268813	1		
R61	Res, met flm, 8.87k ± 1%, 1/8w	294967	1		
R62	Res, met flm, 17k ± 1%, 1/8w	236802	1		
R63	Res, met flm, 34k ± 1%, 1/8w	261602	1		
R68	Res, comp, 200k ± 5%, ¼ w	248781	1		
R69	Res, comp, 750k ± 5%, ¼4w	221937	1		
R71	Res, comp, 470k ± 5%, ¼ w	188441	1		
R73	Res, comp, 47k ± 5%, ¼ w	148163	1		
R74	Res, comp, 20k ± 5%, ¼ w	221614	1		
R76	Res, comp, 180k ± 5%, ¼w	193441	1		
R78	Res, met flm, 10Ω ± 1%, 1/8w	268789	1		
R79,R80	Part of matched set, one or none may be installed	1			
R81	Not Used				
S1	Switch, slide SPDT	271478	1		
U1	IC, DTL, triple 3-Input Nand Gate	266312	1		
U2	IC, DTL, Quad 2-input Nand Gate	288597	1		

A13, TRUE RMS CONVERTER PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
U3	IC, operational amplifier	329912	1		
U4	IC, operational amplifier	225961	1		
U5	IC, operational amplifier	288928	1		
U6,U7	IC, operational amplifier	284760	2		
U8	IC, operational amplifier	271502	1		
	Cable, Input	304048	1		
	Heat dissipater	347732	1		
	Cover, pcb	339366	1		
	1 Q8, Q12, R48, R79, and R80 form a factory matched set. If any of these components require replacement, complete set must be installed. Order "TC Matched Set" part number 361048.				

A13, TRUE RMS CONVERTER PCB ASSEMBLY

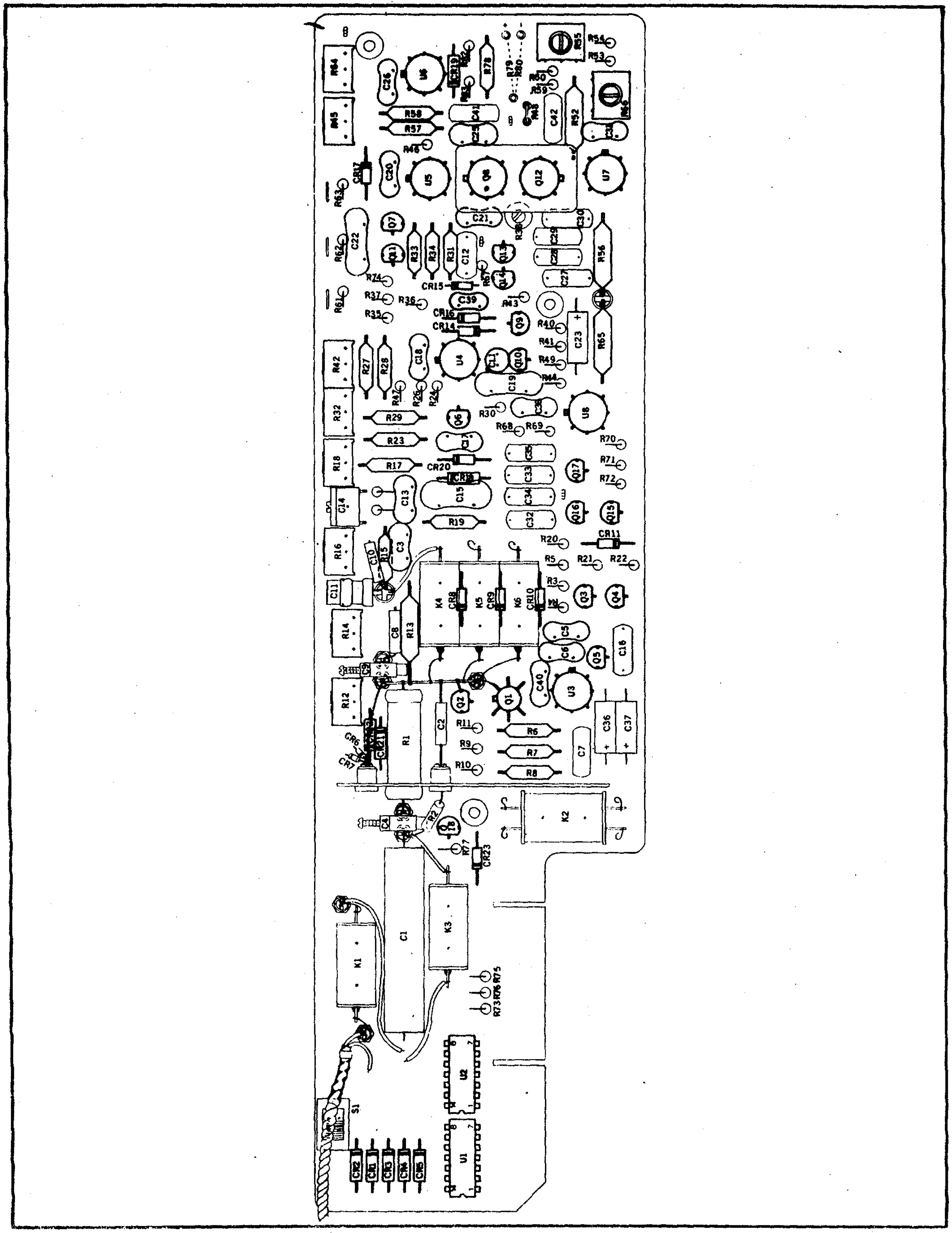


Figure 5-9. TRUE RMS CONVERTER PCB ASSEMBLY

A14, FRONT PANEL ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A14	**FRONT PANEL ASSEMBLY (8375A-4051)**	356139	REF		
	See Figure 5-1				
A14AI	Display PCB Assembly	356568	1		
S1	Switch Lever	357590	1		
R4	Res, metal film, 100 ± 0.1%, 1/8W	357400	1		
R3	Res, comp, 10M ± 10%, 1/2W	108142	1		
J26, J27	Binding Post, Red	275552	2		
J25, J28	Binding Post, Black	275560	2		
J24	Binding Post, Blue	275578	1		
	Lens, decimal lamp	194597	1		
TS25 thru					
TS29	Terminal Strip, binding post	305284	5		
	Lens, display	365113	1		
	Shorting link, binding post	101220	3		
	Lens, sample rate lamp	194597	1		
	Button, lever switch S1	362913	1		

A14A1, DISPLAY PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A14A1	**DISPLAY PCB ASSEMBLY (8375A-4002)** **Figure 5-10**	356568	REF		
A14A1A1	Function Display Assembly	415240	1		
A14A1A2	Function Switch Assembly, S8 thru S14	355396 .	1		
	Flex Cable	307504	1		
	Buttons, switch, plastic	355263	14		
C1	Cap, cer, 0.05µf ±20%, 50V	149161	1		
C2,C100	Cap, cer, 1200 pf ± 10Oo, 500V	106732	2		
C3	Cap, elect, 20µf ±50/-10%, 16V	241356	1		
C4	Cap, cer, 0.025,µf ± 20%, 50V	168435	1		
C5	Cap, cer, 2200 pf ± 10%, 500V	268425	1		
C6,C103	Cap, cer, 0.01 µf ± 20%o, 100V	149153	2		
C101	Cap, cer, 500 pf ± 10%, 500V	105692	1		
C102	Cap, cer, 0.025,µf ± 20%, 50V	175232	1		
CR1,CR2, CR7,CR10, CR12,CR16 CR18,CR19 CR25 thru CR30,CR32	Diode, germanium, 80mA, 100 piv	149187	15		
CR5,CR6, CR8,CR9, CR11,CR13, thru CR15, CR31 ,CR33. CR34	Diode, silicon, 150mA	203323	11		
DS1	Lamp, incandescent, 5V	272476	1		
J1,J10	Connector, female, 12 contact	291898	2		
J2,J5,J7, J8,J11, J12,J13	Connector, female, 24 contact	295352	7		
J3,J4,J9	Connector, female, 24 contact with 6 removed	284240	3		
J14	Connector, female, 18 contact	291906	1		
Q2,Q5	Tstr, silicon, PNP	195974	2		
Q3,Q6, Q7,Q19, Q20,Q34 Q35	Tstr, silicon, NPN	218396	7		
Q4,Q8	Tstr, silicon, unijunction	268110	2		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
Q9 thru Q18	Tstr, silicon, NPN	245480	10		
Q22 thru Q26	Tstr, silicon, NPN	218511	5		
Q27 thru Q31	Tstr, silicon, PNP	266619	5		
Q33,Q33	Tstr, FET, N-channel	288324	2		
Q36,Q37	Tstr, silicon, NPN	168708	2		
R1,R3,R60	Not Used				
R2,R4	Res, comp, 82k ± 5%, ¼ w	188458	2		
R5	Res, comp, 6.8k ± 5%, ¼ w	148098	1		
R6,R11, R20,R25	Res, comp, 3.9k ± 5%, ¼ w	148064	4		
R7,R58	Res, comp, 470Ω ± 5%, ¼ w	147983	2		
R8,R18	Res, comp, 2.7k ± 5%, ¼ w	170720	3		
R9	Res, comp, 1.2k ± 5%, ¼ w	190371	4		
RI0	Res, comp, 510S2 ± 5%, ¼ w	218032	1		
R12	Res, comp, 75k ± 5%, ¼ w	220525	1		
R13,R30	Res, comp, 2.2k ± 5%, ¼ w	148049	2		
R14,R57	Res, comp, 33k ± 5%, ¼ w	148155	2		
R15	Res, comp, 27Ω ± 5%, ¼ w	160812	1		
R16	Res, var, comp, 150k ± 20%, ½ w	267930	1		
R17	Res, comp, 1.8k ± 5%, ¼ w	175042	1		
R19,R48 thru R54 R64,R65	Res, comp, 10k ± 5%, ¼w (R64 on bottom side of PCB)	148106	10		
R21,R22, R59	Res, comp, 390Ω ± 5%, ¼ w	147975	3		
R23,R24	Res, comp, 16k ± 5%, ¼ w	221606	2		
R26,R27, R28	Res, comp, 1.2k ± 5%, ¼ w	190371	REF		
R29,R34 thru R38, R61	Res, comp, 8.2k ± 5%, ¼ w	160796	7		
R31,R39	Res, comp, 430Ω ± 5%, ¼ w	203869	2		

A14A1, DISPLAY PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
R32	Res, comp, 330Ω + 5%, 1/4w	147967	1		
R33	Res, comp, 470k ± 5%, 1/4w	188441	1		
R40	Res, comp, 4.7k ± 5%, 1/4w	148072	1		
R41	Res, comp, 5.1k ± 5%, 1/4w	193342	1		
R42	Res, var, cer met, 100k ± 10%, 1w	288308	1		
R43 thru R46,R55, R56,R62	Res, comp, 39Ω ± 5%, 1/4w	193391	7		
R47	Res, comp, 3.3k ± 5%, 1/4w	148056	1		
R63	Res, comp, 12k ± 5%, 1/4w	159731	1		
S1 thru S7	Range Switch Assembly	298232	1		
	Switch section, S1 thru S7, RANGE	355404	1		
	Buttons, switch, plastic S14, FUNCTION	355263	REF		
	Flex circuit	307504	1		
U1	IC, TTL, Hex Inverter Buffer Driver	288605	1		
U2,U3	IC, TTL, dual J-K flip flop	268441	2		
U4	IC, Decoder Driver,	267211	1		
V1	Tub, polarity indicator	272922	1		
V2 thru V7	Tube, neon readout	271494	6		
	Display function assembly (lamp, P/N 272476 may be purchased separately)	298562	1		
	Socket, IC, 14 contact	291542	1		
	Socket, IC, 16 contact	291534	3		

A14A1, DISPLAY PCB ASSEMBLY

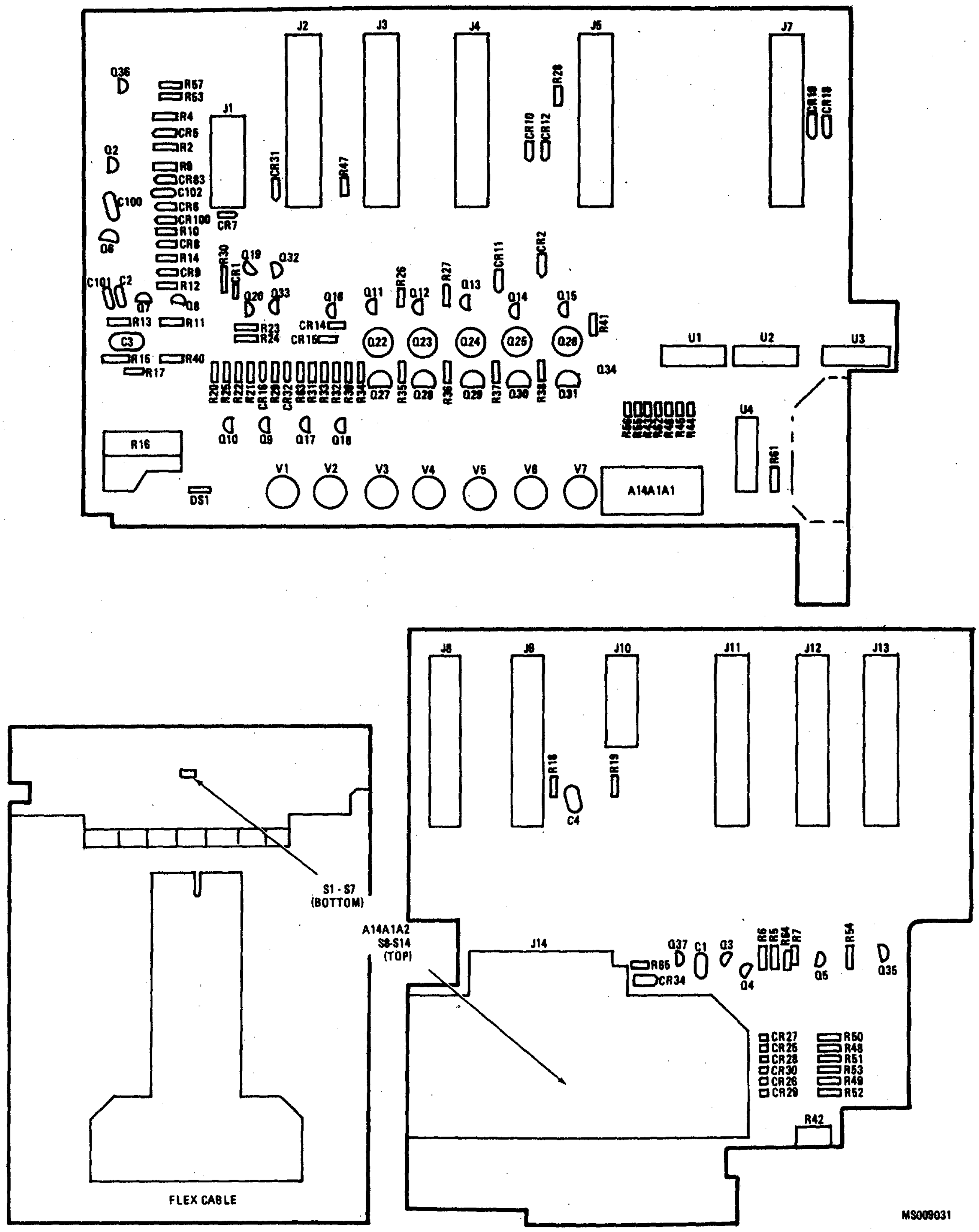


Figure 5-10. DISPLAY PCB ASSEMBLY

A15, REAR PANEL ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A15	**REAR PANEL ASSEMBLY (8400A-4452)**	301374			
	See Figure 5-1				
XF1	Fuse Holder	295741	1		
T1	Power Transformer Assembly	365171	1		
J16	Connector, PCB	291567	1		
J1	Power Receptacle, ac	284166	1		
Fl	Fuse, fast-blo, type AGC	153858	1		
S3	Switch, slide	226274	1		
	Rear Panel with S3 mounted	297648	1		

MANUFACTURERS' CROSS REFERENCE LIST					
FLUKE STOCK NO.	MFR.	MFR. PART NO.	FLUKE STOCK NO.	MFR.	MFR. PART NO.
105668	56289	C023B501J103M	148114	01121	CB1535
105692	71590	2DDH60N501K	148122	01121	CB1835
105734	71590	BB60301KW7W	148130	01121	CB2235
105890	71590	BB60181KS3N	148148	01121	CB2735
106732	71590	CF122	148155	01121	CB3335
108308	01121	EB4751	148163	01121	CB4735
108951	01121	EB5115	148171	01121	CB6835
110171	01121	HB9145	148189	01121	CB1045
110726	07910	1N964B	148346	14655	CD19F222J
112383	05277	1N4822	148361	14655	CD19F152J
113316	07910	1N748	148387	14655	CD19F102J
116111	05277	1N4817	148429	14655	CD19F471J
144717	01121	EB5105	148437	14655	CD15F391J
147892	01121	CB4705	148452	14655	CD15F271J
147926	01121	CB1015	148478	14655	CD15FI51J
147934	01121	CB1515	148494	14655	CD15F101J
147959	01121	CB2215	148528	14655	CDISF560J
			148536	14655	CD15SE470J
147967	01121	CB3315	148551	14655	CD15E220J
			148569	14655	CD15C150J
147975	01121	CB3915	148619	01295	2N1303
147983	01121	CB4715	148643	01295	2N1307
147991	01121	CB5615	149153	56289	C023B101F103M
148007	01121	CB6815	149161	56289	55C23A1
148015	01121	CB8215	149187	93332	1N270
148023	01121	CB1025	149484	01121	CB8205
148031	01121	CB1525	150359	95303	2N3053
148049	01121	CB2225	152470	53021	D20F103F
			153056	56289	150D156X9020B2
148056	01121	CB3325	155192	91627	TYPE MFF 1/2
148064	01121	CB3925	159731	01121	CB1235
148072	01121	CB4725	159947	00656	TYPE C1-1
			160226	05397	K2R2C20K
148080	01121	CB5625	160317	14655	CDIS5E330J
148098	01121	CB6825	160796	01121	CB8225
148106	01121	CB1035	160804	01121	CB2715

MANUFACTURERS' CROSS REFERENCE LIST					
FLUKE STOCK NO.	MFR.	MFR. PART NO.	FLUKE STOCK NO.	MFR.	MFR. PART NO.
160812	01121	CB2705	182790	56289	150D684X9035A2
160937	01121	CB2245	182873	14655	CD19F562G
161810	03877	SG5658	182956	91637	TYPE MFF 1/8
161919	56289	196D105X0035	184366	73445	C280AE/A470K
161943	56289	196D475X0020	186296	73445	C426ARE125
161992	73445	C280AEA100K	187195	07910	CD36554
162008	73445	C280AEA47K	188375	91637	TYPE MFF 1/8
166199	07910	1N754	188441	01121	CB4745
167460	84411	TYPE 863UW	188458	01121	CB8235
168195	91637	TYPE MFF 1/8	188466	01121	CB3935
168229	91637	TYPE MFF 1/8	190249	89536	190249
168252	91637	TYPE MFF 1/2	190272	93332	1N456A
168260	91637	TYPE MFF 1/8	190371	01121	CB1225
168278	91637	TYPE MFF 1/2	190520	01121	EB1071
168435	56289	C128B10H253M	190553	84411	TYPE 863UW
168708	03508	2N3391	190728	89536	190728
168716	07263	S19254	193318	01121	CB9125
168823	73445	C426ARF50	193334	01121	CB5135
170423	14655	CD15F221J	193342	01121	CB5125
170720	01121	CB2725	193391	01121	CB3905
170738	01121	CB5635			
175042	01121	CB1825	193441	01121	CB1845
175208	84141.	DM 15020K			
175224	14655	CD15E120J	193458	01121	CB1245
175232	56289	C023BIOIE502M	194803	73445	C280AEA220K
176644	14655	CD19F362G			
177998	14655	CD15E270J	194944	O1121	CB1065
178616	73445	C437ARG250	195974	04713	2N3906
180406	07910	1N758	198390	01121	CB2255
			200030	91637	RN55D1820F
180463	07910	1N968B	203323	03508	DHD1105
180505	18927	IN276	203869	01121	CB4315
180554	07910	CD12599	208975	14655	CD19F472J
			216986	14655	CD15C080K
182204	01121	CB1055	218081	04713	MPS6520
			218206	72982	530-000
182212	01121	CB1545	218396	04713	2N3904

MANUFACTURERS' CROSS REFERENCE LIST

FLUKE STOCK NO.	MFR.	MFR. PART NO.
218511	95303	60994
218693	01121	EB1065
219097	15898	765972
220061	01121	CB2735
220525	01121	CB7535
220541	01121	CB8245
221580	01121	CB1135
221606	01121	CB1635
221614	01121	CB2035
221903	01121	CB6215
221911	01121	CB6225
221937	01121	CB7545
221952	01121	CB3055
221960	01121	CB6255
225599	07263	S22650
226134	14655	CD15F15F500
226209	91637	TYPE MFF 1/8
226274	82389	46256LFE
226316	00656	TYPE MFF C1-1
229146	91637	TYPE MFF 1/8
229484	91637	TYPE MFF 1/8
229492	91637	TYPE MFF 1/8
229898	04713	MPS6522
229930	91293	JMC2951
234484	73445	C280AEA22K
234492	73445	C280AEA33K
234682	01121	CB3045
234708	91637	TYPE MFF 1/8
234971	91637	TYPE MFF 1/8
235266	91637	TYPE MFF1/8
235234	91637	TYPE MFF 1/8
235309	91637	TYPE MFF 1/8
235333	91637	TYPE MFF 1/8
236752	91637	TYPE MFF 1/8
236802	91637	TYPE MFF 1/8
236901	91637	C437ARF160
236935	73445	C426ARD200
237206	91637	TYPE MFF 1/8
237297	91637	TYPE MFF 1/8
240937	89536	240937
241091	91637	TYPE MFF 1/8
241356	73445	C426ARE20
241471	91637	TYPE MFF 1/8
241497	91637	TYPE MFF 1/8
245480	07263	S24496
246066	04713	EL131
246223	91637	TYPE MFF 1/8
246611	07910	1N961B
248807	91637	TYPE MFF 1/8
248906	95303	CA3046
249052	07910	1N963B
249284	89536	249284
256479	71450	TYPE 45
257501	17856	DN423
260356	91637	TYPE MFF 1/8
260364	91637	TYPE MFF 1/8
260547	91637	TYPE MFF 1/8
260554	07910	CD55105
260562	84411	863UW47391
260695	07910	IN754A
261180	71450	190PC200B
261370	22767	S1330
261388	04713	SPF179
261602	91637	TYPE MFF 1/8
261651	91637	TYPE MFF1/8
261842	01121	CB6205
261883	91637	TYPE MFF 1/8
266312	04713	MC862P
266619	07263	2N4888
267120	73445	C280AE/A27K
267153	04713	MC839P
267211	89536	267211

MANUFACTURERS' CROSS REFERENCE LIST

FLUKE STOCK NO.	MFR.	MFR. PART NO.	FLUKE STOCK NO.	MFR.	MFR. PART NO.
267385	91637	TYPE MMF 1/8			
267823	71450	190PC200B	272138	12040	DM8570
267856	71450	190PC102B	272252	07263	FD333
267872	71450	190PC502B	272476	71744	TYPE T1
267880	71450	190PC103B	272716	77342	TYPE R40
			272732	73445	C437ARD1600
267963	17856	DN503	272922	83594	B585-6ST
268011	AMI	T-1483	273151	74970	273-1-2
268110	03508	2N6027	274795	89536	274795
268367	04713	MC836P	275321	89536	275321
268375	04713	MC846P	275362	89536	275362
268383	01295	SN15832N	275552	32767	820-65
268441	18324	C4312A	275560	32767	820-45
268540	18324	C4319A	275578	32767	820-55
268557	18324	C4321A	275792	56289	39D805G350GE4
268581	71450	190PC104B	276527	23880	TSA-2900-14W
268789	91637	TYPE MFF 1/8	276535	23880	TSA-2900-16W
268797	91637	TYPE MMF 1/8	276691	11236	360T105A
268813	91637	TYPE MFF 1/8	277657	89536	277657
268821	91637	TYPE MFF 1/8	277665	89536	277665
268904	84411	TYPE X663F	277905	89536	277905
269019	71707	U-6-P	277913	89536	277913
269076	95303	2N4037	278309	89536	278309
269092	89536	269092	280198	89536	280198
271320	56289	150D335X5020B2	281790	91637	TYPE MFF 1/8
271361	91637	TYPE MFF 1/8	281865	12615	SL-841-777
271403	54294	TYPE SP22	282145	56289	HVD3-47
			283697	91637	TYPE MFF 1/8
271411	54294	TYPE VA32	284075	11726	QD200-78
271478	81741	TYPE 23-021			
271494	83594	B5853ST	284091	12617	TYPE MRR5
271502	12040	LM301A	284174	70903	KHS-7041
271908	91637	TYPE MFF 1/8	284240	00779	TYPE 583650
271924	07910	CFE13041	284505	89536	284505
272070	71707	UD-6-P	284711	71450	190PC201B
272096	91637	TYPE MFF 1/8	284760	12040	LM308H

MANUFACTURERS' CROSS REFERENCE LIST					
FLUKE STOCK NO.	MFR.	MFR. PART NO.	FLUKE STOCK NO.	MFR.	MFR. PART NO.
284885	84411	863UW33351	288563	91637	TYPE MFF 1/8
284968	75042	TYPE MEH	288597	04713	MC858P
284976	91637	TYPE MFF 1/4	288605	01295	SN7416P
285031	75915	279.015	288639	91637	TYPE MFF 1/8
285106	07910	CRE3021			
285114	71450	360S-200B	288647	89536	288647
285122	71450	360S-500A	288654	89536	288654
285130	71450	360S-IOIA	288670	89536	288670
285148	71450	360S201A	288688	89536	288688
285155	71450	360S-102A	288761	49956	RS2048
285163	71450	360S-202A	288803	01295	SN158097N
			288811	01537	MC856P
285171	71450	360S-103A	288837	01295	SN74100N
285189	91637	TYPE MFF 1/8	288845	01295	SN7402N
285213	71450	190PC253B	288852	04713	MC8312P
285239	89536	285239	288928	12040	LM308AH
285361	89536	285361	289066	91637	TYPE MFF 1/8
288043	89536	288043	289439	91637	TYPE MFF 1/8
288159	89536	288159	289470	91637	TYPE MFF 1/8
288167	89536	288167	289637	72982	538-006D-9-35
288175	89536	288175	289660	00327	TYPE M 12
288183	89536	288183	289686	89536	289686
288191	89536	288191	289850	12617	TYPE MRR2
288209	89536	288209	289975	91637	TYPE MFF 1/8
288217	89536	288217	289983	91637	TYPE MFF 1/8
288225	89536	288225	290130	89536	290130
288233	89536	288233	290148	89536	290148
288308	71450	360S-104A	290155	89536	290155
288324	15818	U2412	290163	89536	290163
288365	12040	LM310H	290247	89536	290247
288381	95303	40372	290262	89536	290262
288480	91637	TYPE MFF 1/8			
288498	91637	TYPE MFF 1/8	290270	89536	290270
288555	91637	TYPE MFF 1/2	290296	89536	290296

MANUFACTURERS' CROSS REFERENCE LIST					
FLUKE STOCK NO.	MFR.	MFR. PART NO.	FLUKE STOCK NO.	MFR.	MFR. PART NO.
290304	89536	290304	298893	89536	298893
290312	89536	290312	298992	89536	298992
290320	89536	290320	299610	89536	299610
290346	89536	290346	301382	89536	301382
290650	89536	290650	301390	89536	301390
291120	71450	360S501A	303412	89536	303412
291294	91637	TYPE MFF 1/8			
291526	89536	291526	303461	89536	303461
291534	00779	583529	306118	01295	GA3938A
291542	00779	583527	306126	01295	GA3937A
291690	89536	291690	307298	89536	307298
291898	00779	583650-2	307504	89536	307504
291906	00779	583650-3	309633	77342	TYPE R40
292193	89536	292193	309849	72982	8131-050-651-224M
292201	89536	292201	311746	89536	311746
292888	89536	292888	321398	89536	321398
292896	89536	292896	321661	89536	321661
292904	89536	292904	321679	89536	321679
292946	71785	133-59-02-011			
292953	01537	MC7400P	321687	89536	321687
292979	01295	SN7404N	339309	89536	339309
295121	89536	295121	340133	91637	TYPE MFF ¼
295196	56289	39D718G010JP4	340158	91637	TYPE MFF ¼
295337	28213	SF3402	340166	91637	TYPE MFF 1/8
295352	00779	583650-9	340208	91637	TYPE MFF 1/8
295535	89536	295535	340216	91637	TYPE MFF 1/8
295717	11726	QD101-78E	340224	91637	TYPE MFF 1/8
296582	75915	281005	340232	91637	TYPE MFF 1/8
297713	89536	297713	340240	91637	TYPE MFF 1/8
297762	89536	297762	340257	91637	TYPE MFF 1/8
297903	89536	297903	340265	03888	TYPE PME 75
298232	89536	298232	340273	95275	VY10CA2R2CA
298554	89536	298554			

MANUFACTURERS' CROSS REFERENCE LIST

FLUKE STOCK NO.	MFR.	MFR. PART NO.	FLUKE STOCK NO.	MFR.	MFR. PART NO.
340315	91637	TYPE MFF 1/8			
340323	91637	TYPE MFF l/4			
340745	95275	VYIOCA2R7CA			
342873	73445	C280AEA10K			
342881	73445	C280AEA6K8			
344283	95275	VYIOCA270JA			
347963	80294	3329H-J81-3RO			
375477	09214	MPD200			
428771	89536	428771			
394296	89536	394296			
267930	89536	267930			
268995	77342	R40-E0025-4			

Section 6

Option -07

Rear Input

6-1. INTRODUCTION

6-2. The Rear Input Option provides INPUT HI INPUT LO, Ω SENSE, Ω SOURCE and GUARD terminals at the rear of the instrument, in parallel with the front panel terminals.

6-3. INSTALLATION

6-4. The following procedure should be used to install the Rear Input Option:

a. Remove the instrument top dust and chassis guard covers.

b. Remove A13 TRUE RMS CONVERTER from instrument.

c. Remove connector bracket on inner chassis, right rear portion.

d. Mount Rear Input Connector onto the connector bracket top slot. Ensure that the lug which is attached to connector pin 2 is affixed to the inner guard chassis with one of the connector mounting screws.

e. Remount connector bracket -to inner chassis.

f. Lay the Rear Input harness along side the Right side of the inner chassis and between the A14 Display PCB and TB1. Clamp harness to inner chassis.

g. Connect Rear Input harness to terminals on rear of the front panel binding posts as follows:

RED - INPUT HI
BLACK - INPUT LO
YELLOW - HI Ω SOURCE
BROWN - LO Ω SOURCE

h. Install the A13 True RMS Converter.

i. Attach guard and instrument dust cover.

j. See Rear Input Mating Connector in this section for input connection instruction.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A16	**REAR INPUT ASSEMBLY (-07 Option) Figure 5-1**	8375A-07			
C2, C8	Cap, cer, 0.01 uF ± %, 100V	149153	2		
J17	Connector, 5-pin, Ext Ref Input	321679	▷1		
	▷1 (2 connectors are supplied. However, only 1 is used with the 8375A)				
J29	Connector, 9-pin, Rear Input	321661	1		
L1, L2	Inductor, toroid	333179	2		
T2	Xfmr, toroid	349670	1		

6-5. LIST OF REPLACEABLE PARTS

6-6. For column entry explanations, part ordering information and basic instrument configuration Use Codes and Serial Number Effectivity List, see Section 5, paragraphs 5-1 through 5-10. See paragraph 6-7, this option subsection for additional Use Codes and Serial Number Effectivity List assigned to this option.

6-7. SERIAL NUMBER EFFECTIVITY

6-8. A Use Code column is provided to identify certain parts that have been added, deleted, or modified during production of the Model 8375A. Each part in this option for which a use code has been assigned may be identified with a particular printed circuit board serial number by consulting the Use Code Effectivity List below. All parts with no code are used on all Rear Input Options with serial numbers 123 and on. NOTE: These Use Codes and Serial Number Effectivity apply to this option assembly only. For the standard instrument configuration, see Section 5, paragraph 5-9, and for additional options, see the appropriate option subsection.

USE CODE	SERIAL NUMBER EFFECTIVITY

Section 7

General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable Parts contained in Section 5. The following information is presented in this section:

List of Abbreviations

Federal Supply Codes for Manufacturers

Fluke Technical Service Centers - U.S. and Canada

Fluke Technical Service Centers - International

Sales Representatives - U.S. and Canada

Sales Representatives - International

List of Abbreviations and Symbols

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
°C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
cm	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
°F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^9)
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
h	high frequency
HZ	hertz
IC	integrated circuit
I	Intermediate frequency
In	Inch(es)
Intl	internal
I/O	input/output
k	kilo (10^3)
kHz	kilohertz
kW	kilohm(s)
kV	kilovolt(s)
N	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^6)
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MW	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(-) or neg	negative
NO	normally open
ns	nanosecond
opnl ampi	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmable read-only memory
psi	pound-force per square inch
RAM	random-access memory
rt	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
SI	silicon
semo	serial number
ar	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or µ	micro (10^{-6})
uhf	ultra high frequency
us or µs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtbl	crystal
xtlo	crystal oscillator
Q	ohm(s)
p	micro (10^{-6})

Federal Supply Codes for Manufacturers

00213
Nytronlcs Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisburg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884
Use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div,
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Translstron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona
Cleveland, Ohio

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571
Use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic'Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743
Rochester, New York
06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.

06751
Components, Inc. Semcor Dlv,
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div,
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
The Ross Milton Co.
South Hampton, Pennsylvania

07115
Replaced by 14674

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

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, Massachusetts

07261
Aumet Corp.
Culver City, California

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

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.

07792
Lerma Engineering Corp.
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933
Use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

Federal Supply Codes for Manufacturers (cont)

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

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

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988
Use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Elngineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, Minnesota

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

11711
General Instrument Corp.
Rectifier Division
Hicksville, New York

11726
Qualidyne Corp.
Santa Clara, California

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

12300
Potter-Brumfield Div.
AMF Canada LTD.
Guelph, Ontario, Canada

12323
Presin Co.. Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
The Budd Co. Polychem Products
Plastic Products Div,
Bridgeport, Pennsylvania

12615
U.S. Terminals Inc.
Cincinnati, Ohio

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

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California
Indianapolis, Indiana

13606
Use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors,
formerly Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

20584
Enochs Mfg. Inc.

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics
Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure Eng. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18812
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
GTE Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

Federal Supply Codes for Manufactures (cont)

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Bucheye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Rlveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox-Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co.
Corporate HQ
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
AB Enterprise inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical
Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

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

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross: A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp. formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, California

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey

70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnback Radio Co., Inc.
Freeport, New York

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

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

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

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

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

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village
Chicago, Illinois

72005
Wilber B. Driver Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303

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

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

Federal Supply Codes for Manufacturers (cont)

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Bechman Instrument Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrance, California

73445
Amperex Electronic Corp.
Hicksville, New York

73559
Carting Electric Inc.
West 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.
Components Corp.
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
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
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

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

78189
Shakeproof
Div. of Illinois Tool Works In c.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc.
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp.
Mepco Div.
A North American Phillips Co.
Norristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183
Use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
Arnold Stevens, Inc.
South Boston, Massachusetts

81073
Grayhill, inc.
La Grange, illinois

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81483
Therm-O-Disc Inc.
Mansfield, Ohio

81483
International Rectifier Corp.
Los Angeles, California

81590
Korry Mfg. Co.
Seattle, Washington

81741
Chicago Lock Co.
Chicago, Illinois

82305
Palmer Electronics Corp,
South Gate, California

82389
Switchcraft Inc.
Chicago, Illinois

82415
North American Phillips
Controls Corp.
Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
The Carr Co., United Can Div.
of TRW
Cambridge, Massachusetts

83298
Bendix Corp.
Electric Power Div.
Eatontown, New Jersey

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

83478
Rubbercraft Corp.
of America, Inc.
West Haven, Connecticut

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

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

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products
of Maiden Inc.
Stoneham, Massachusetts

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

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anaheim, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

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

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

Federal Supply Codes for Manufacturers (cont)

90201
Mallory Capacitor Co.
Div. of P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211
Use 56365
Square D Co.
Chicago, Illinois

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

90303
Mallory Battery Co.
Div. of Mallory Co., inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/lWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara. California

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737
Use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91838
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div. of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154
Use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

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

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, illinois

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

96853
Gulton Industries Inc.
Measurement and Controls Div.
formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts, Div. of
Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic
Hardware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena., California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena. California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect.
Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779
Use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

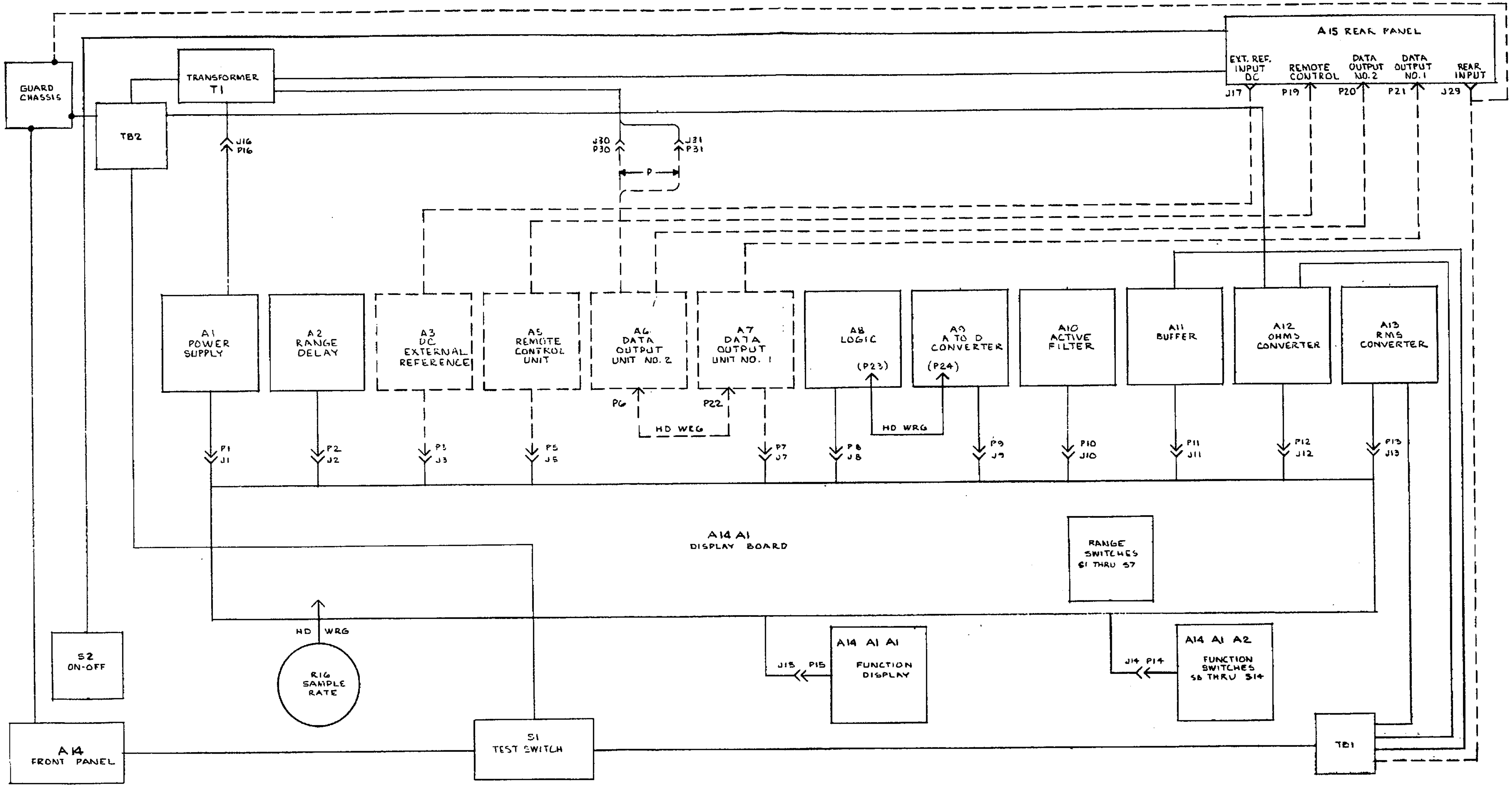
99942
Centrelab Semiconductor
Centrelab EleCtronics Div. of
Globe-Union Inc.
El Monte, California

Toyo Electronics
(R-Ohm Corp.)
Irvine, California

National Connector
Minneapolis, Minnesota

Section 8

Schematic Diagrams



NOTES:
1. HD WR6 HARD WIRING
NOT TO BE DISCONNECTED
2. .... CONNECTIONS FOR OPTIONS

FIGURE 8-1. INTERCONNECT DIAGRAM.
(8375A-1100)

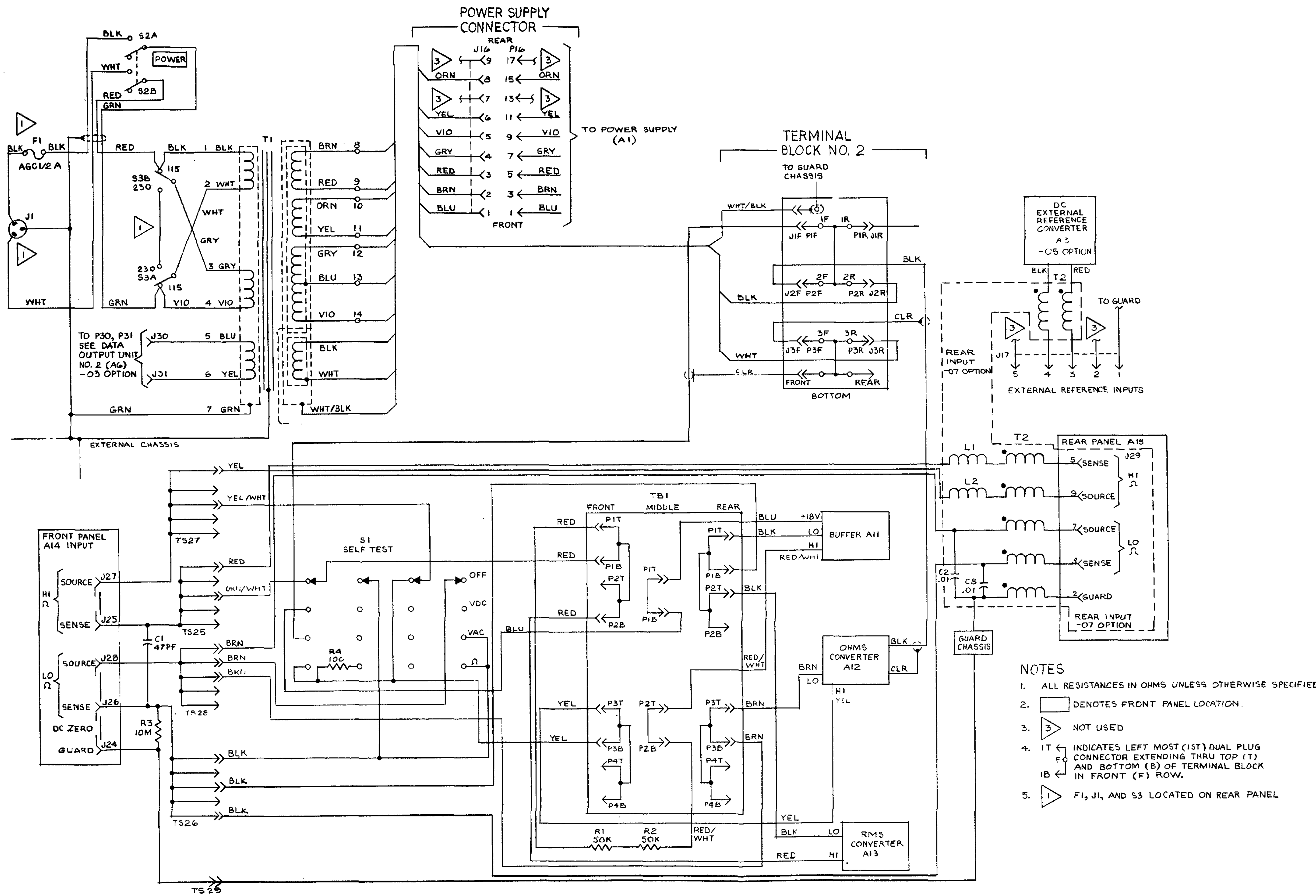


FIGURE 8-2. WIRING DIAGRAM.
(8375A-1000)

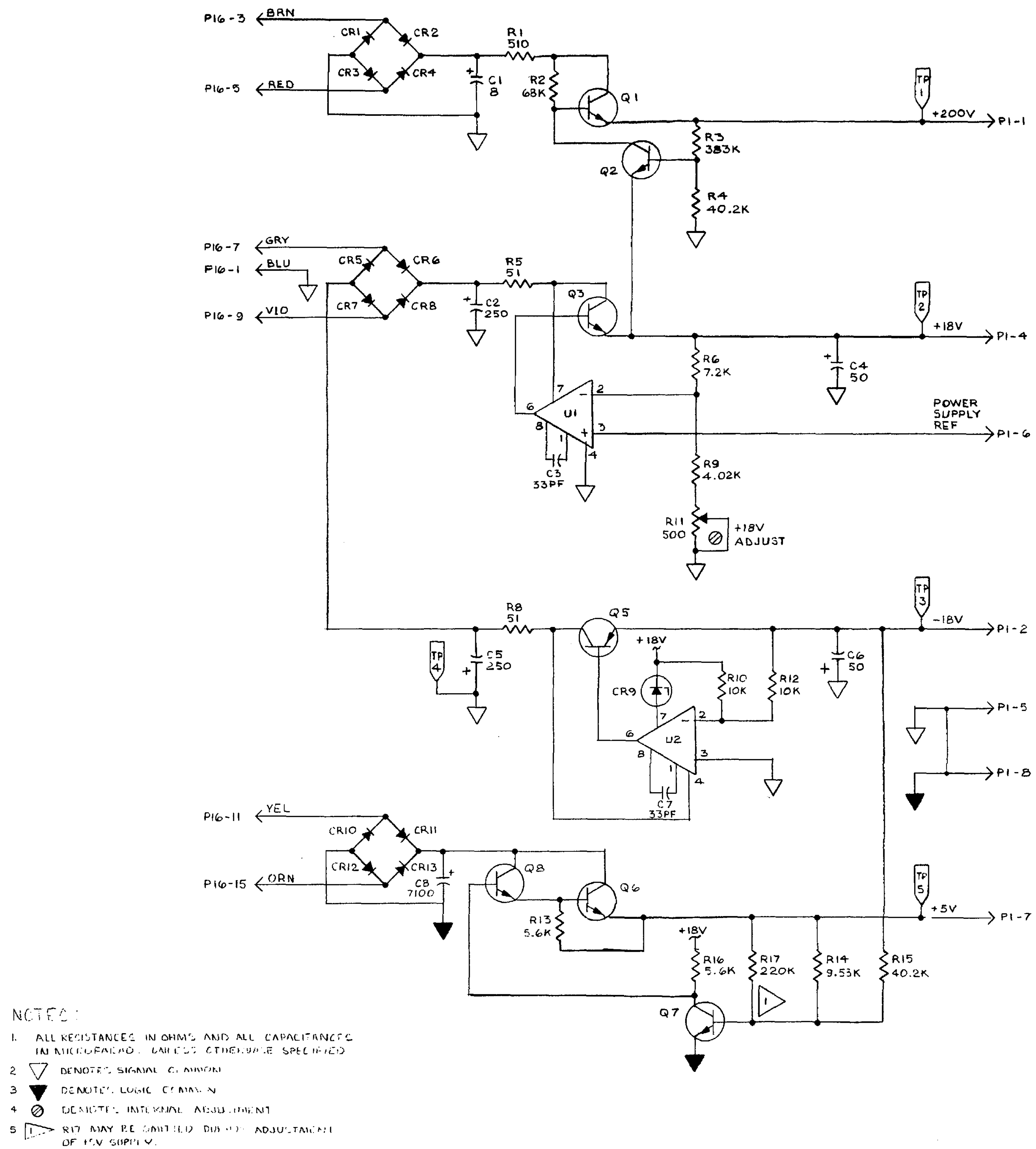
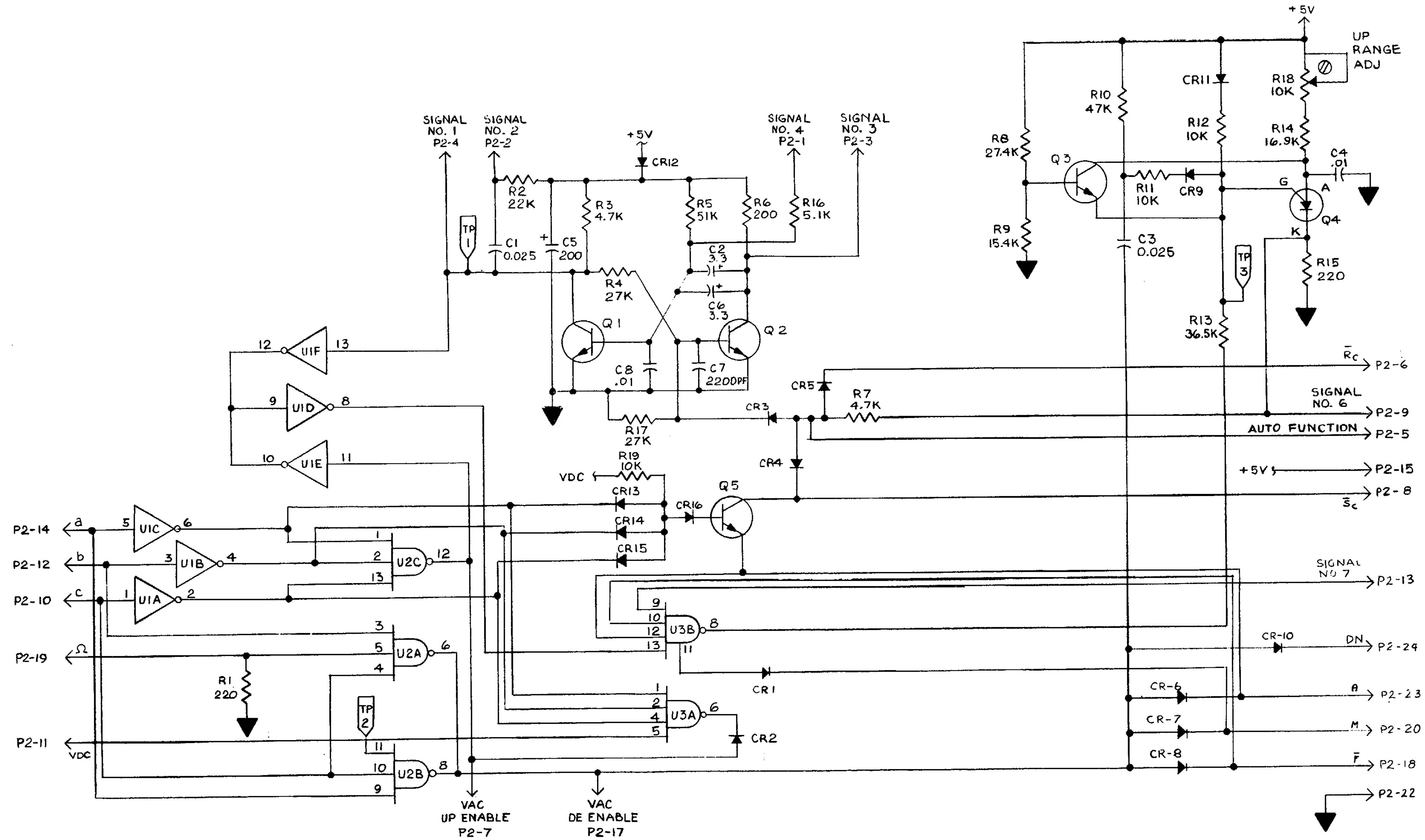


FIGURE 8-3. A1 POWER SUPPLY.
(8375A-1001)

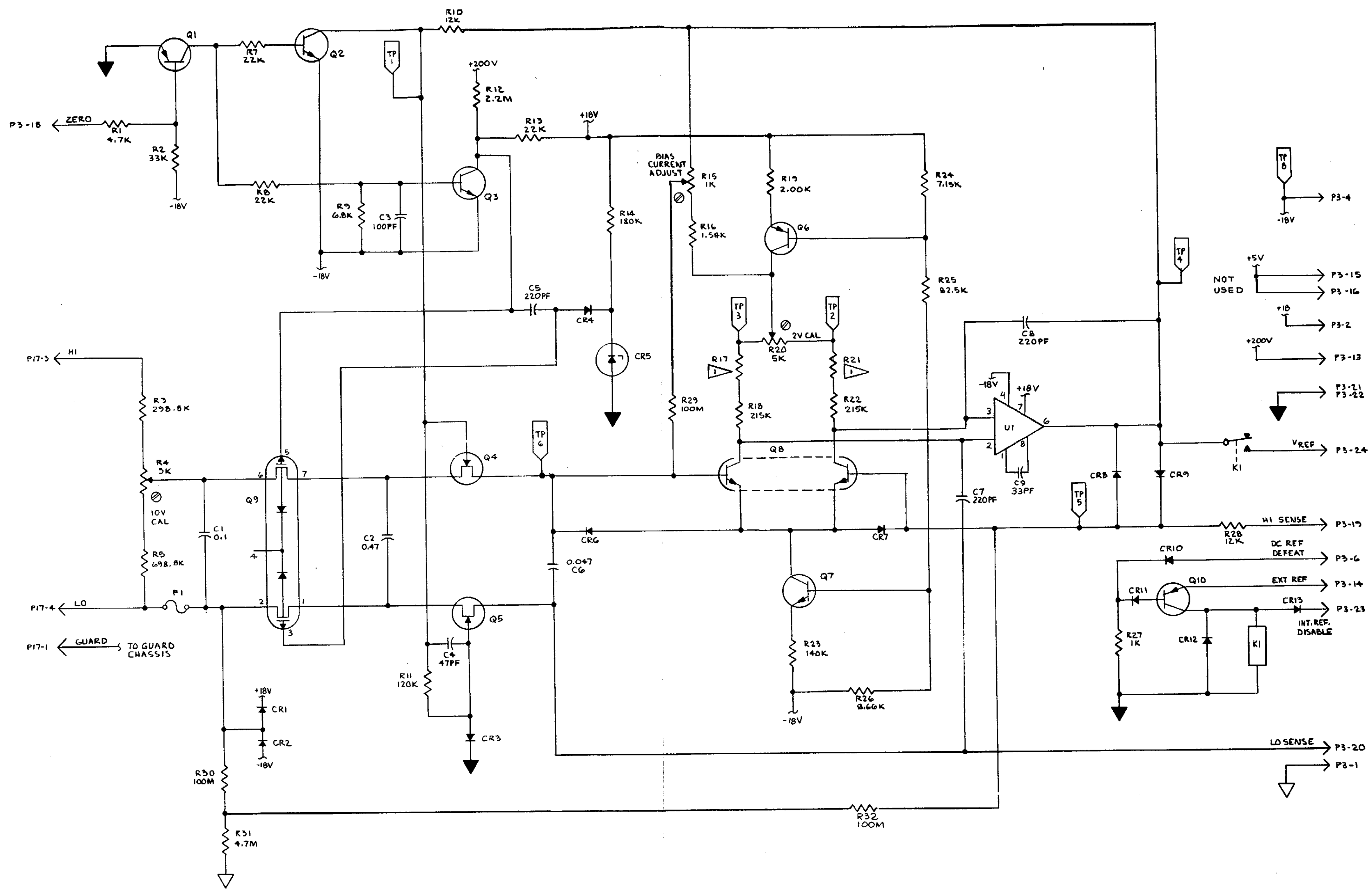


NOTES:

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. ▼ DENOTES LOGIC COMMON
3. ⊘ DENOTES INTERNAL ADJUSTMENT

IC	PIN CONNECTIONS	
	+5V	COMMON
U1	14	7
U2	14	7
U3	14	7

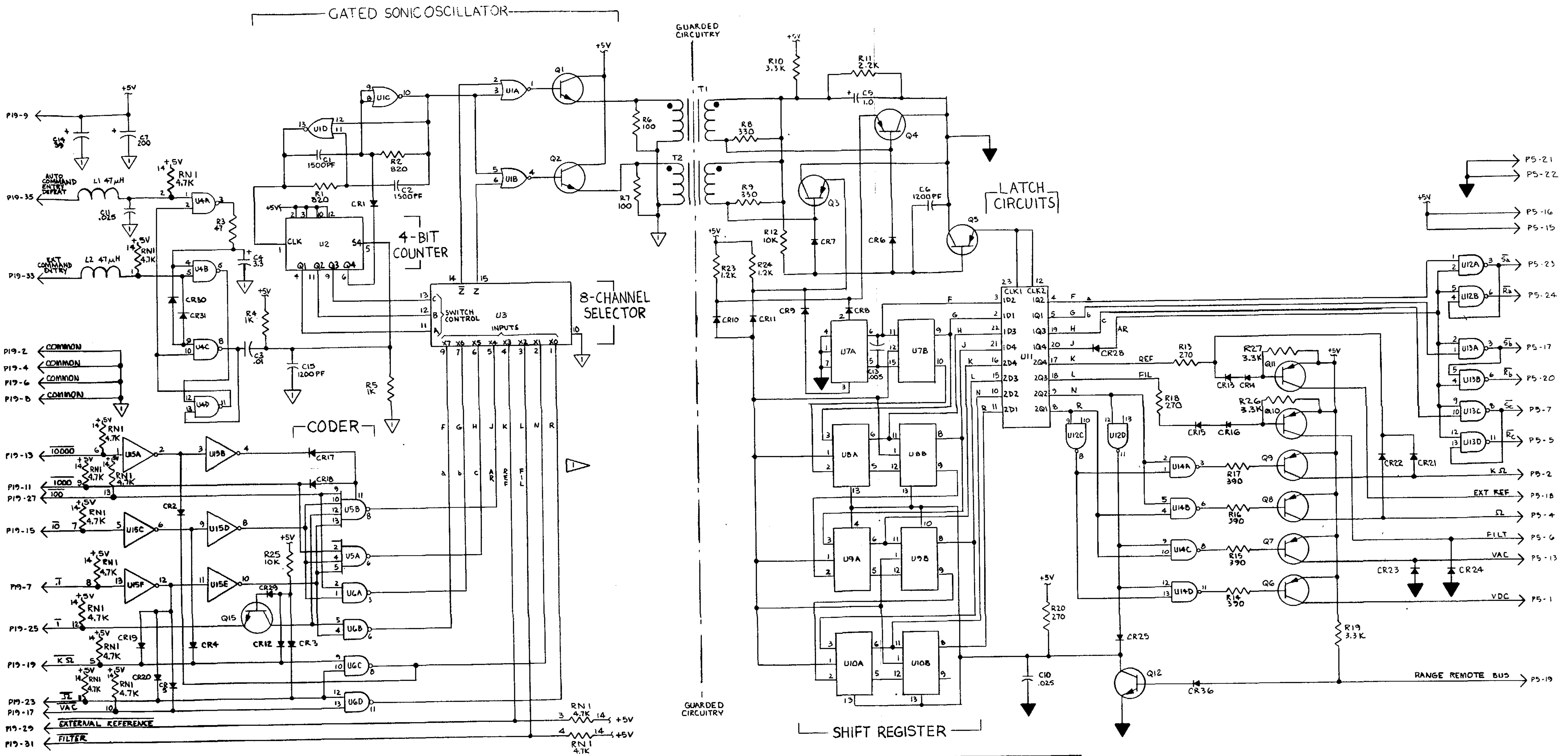
FIGURE 8-4. A2 RANGE DELAY.
(8375A-1006)

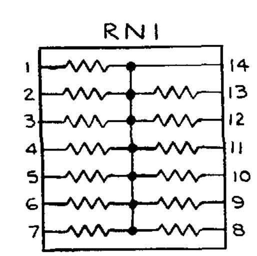


NOTES:

1 ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
2 ▽ DENOTES SIGNAL COMMON
3 ▼ DENOTES LOGIC COMMON
4 ⊘ DENOTES INTERNAL ADJUSTMENT
5 ▷ DENOTES FACTORY SELECTED PART

FIGURE 8-5. A3 DC EXTERNAL REFERENCE..
(8375A-1009)





NOTES:

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

2 ▼ DENOTES LOGIC COMMON

3 ▽ DENOTES COMMON OUTSIDE GUARD

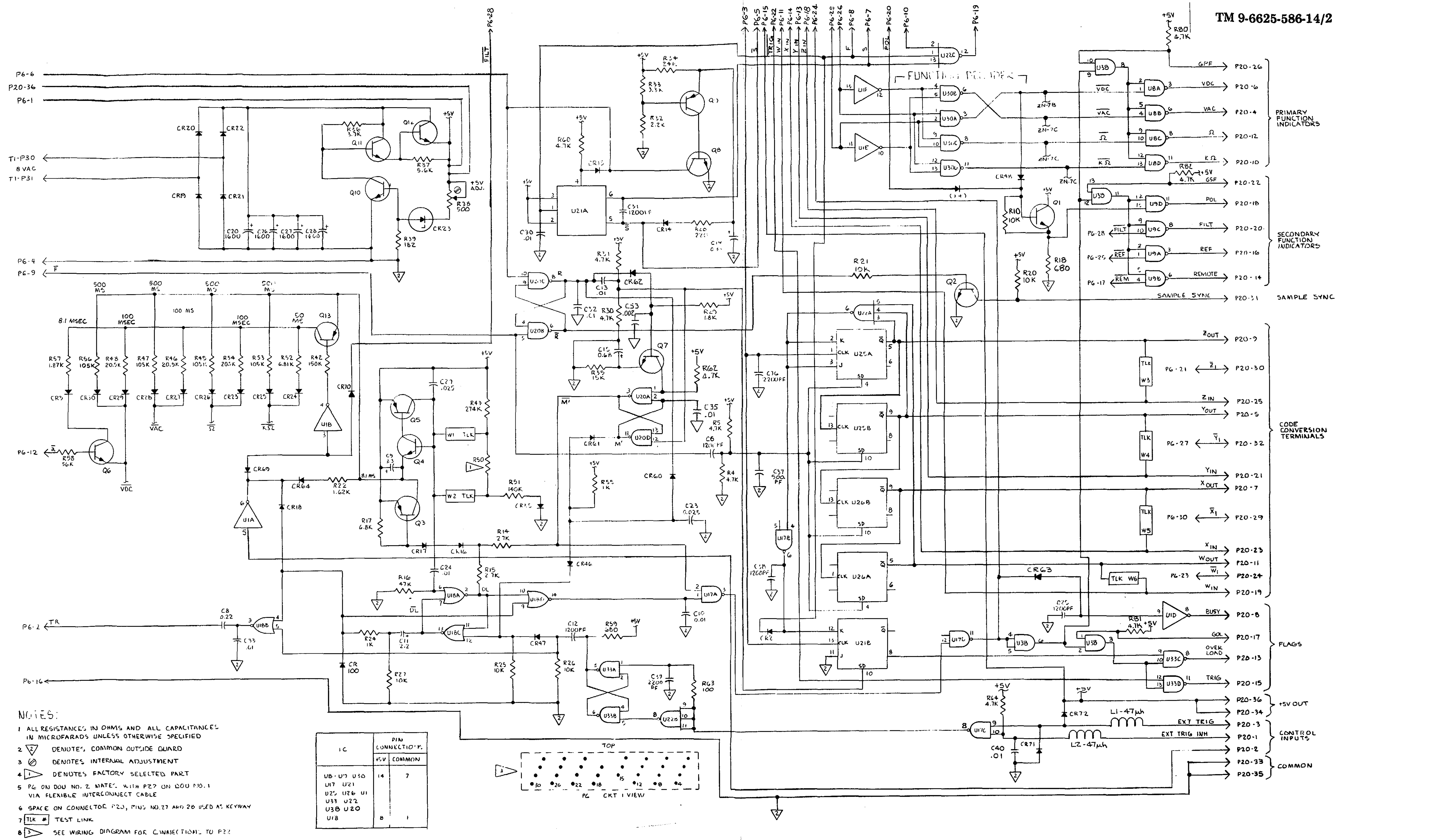
4 ▷ SIGNALS a. b. c. AR. REF. AND FIL CORRESPOND IN FUNCTION TO THOSE IN BASIC DVM. BUT ARE NOT IDENTICAL SIGNALS.

IC	PIN CONNECTIONS +5V	PIN CONNECTIONS COMMON
U1 - U6	14	7
U8 - U10		
U12 - U15		
U7	16	8
U11	24	7

HIGHEST REF DES	REF DES NOT USED
C15	C8, 9, 10 & 12
Q15	Q13, 14
U15	U11
R25	R21, 22
CR36	CR26, 27, 32 33, 34 & 35
RN1	
L2	
T2	

FIGURE 8-6. A5 REMOTE CONTROL UNIT.
(8375A-1011)

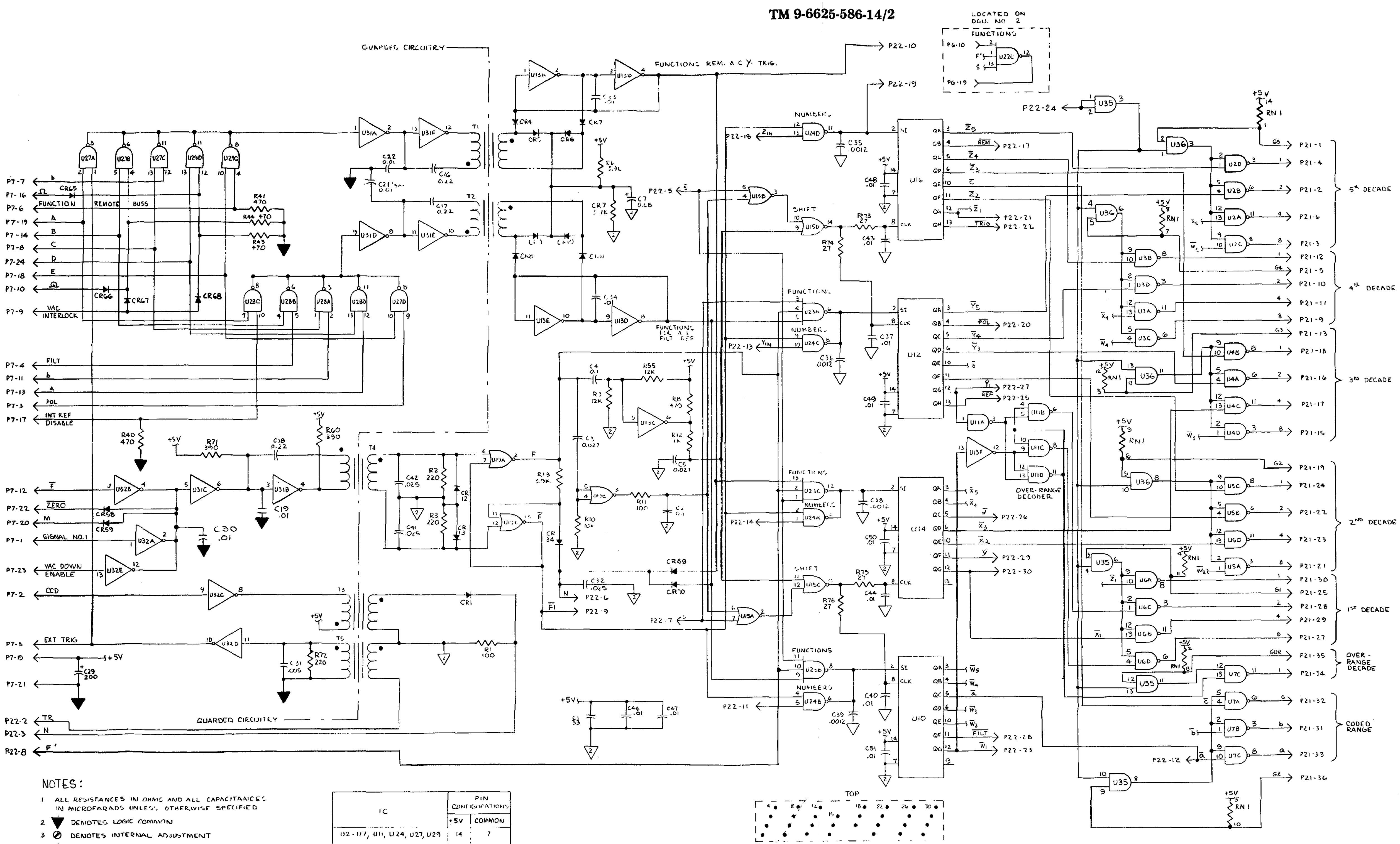
TM 9-6625-586-14/2



IC	PIN CONNECTIONS +5V	PIN CONNECTIONS COMMON
U8 - U9 U30 U17 U21 U25 U26 U1 U33 U22 U38 U20	14	7
U18	8	1

FIGURE 8-7. A6 DATA OUTPUT UNIT NO. 2.
(8375A-1013)

TM 9-6625-586-14/2

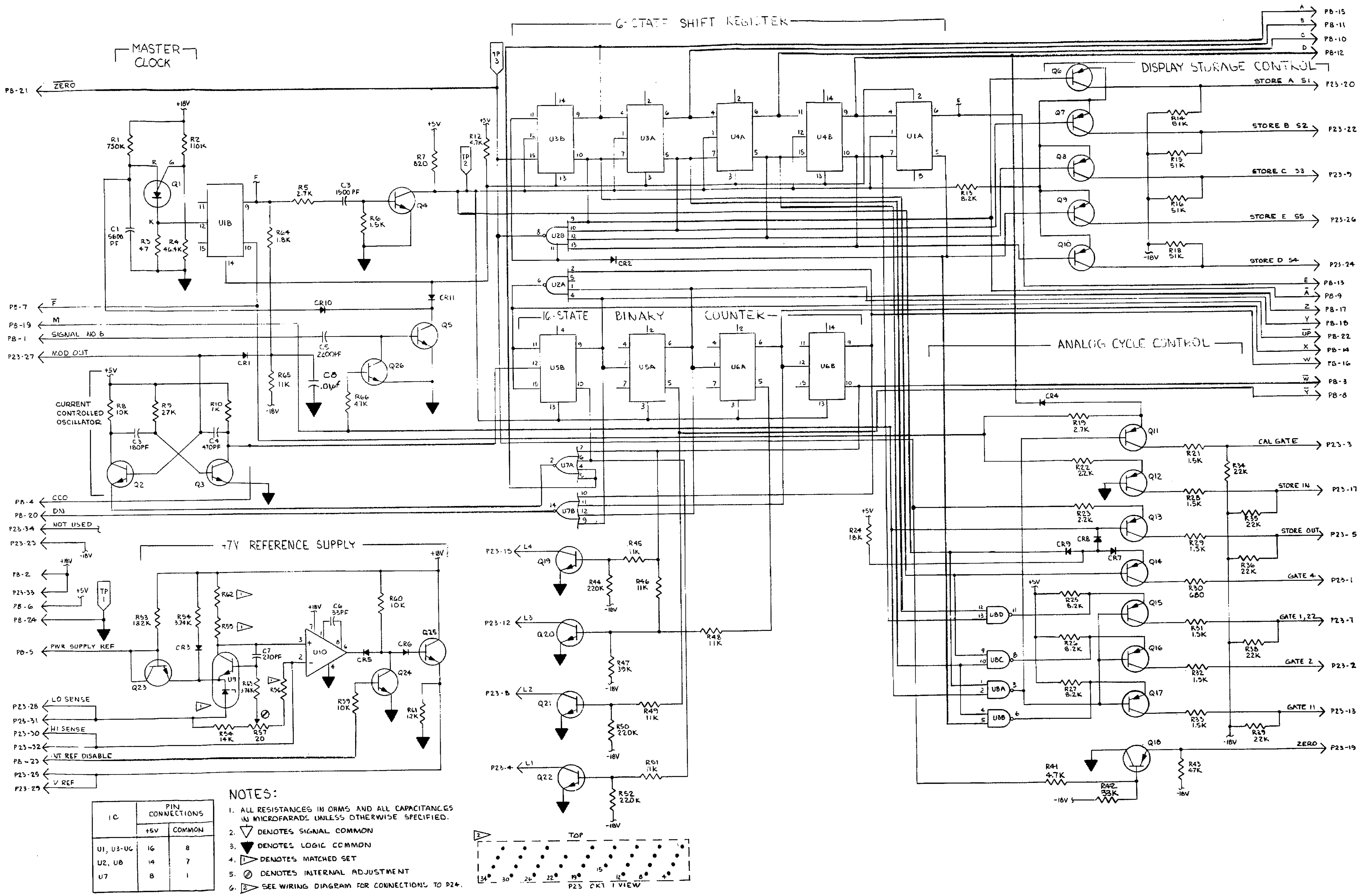


NOTES:

1 ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED
2 ▼ DENOTES LOGIC COMMON
3 ⊘ DENOTES INTERNAL ADJUSTMENT
4 ▽ DENOTES COMMON OUTSIDE GUARD
5 P22 ON DOU NO. 1 MATES WITH P6 ON DOU NO. 2 VIA FLEXIBLE INTERCONNECT CABLE
6 ▷ SEE WIRING DIAGRAM FOR CONNECTIONS TO P6

IC	PIN CONFIGURATIONS	
	+5V	COMMON
U2-U7, U11, U24, U27, U29	14	7
U10 U12 U14 U16	14	7
U23	14	7
U15 U19	8	1

FIGURE 8-8. A7 DATA OUTPUT UNIT NO. 1.
(8375A-1012)



IC	PIN CONNECTIONS	
	+5V	COMMON
U1, U3-U6	16	8
U2, U8	14	7
U7	8	1

NOTES:

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. ▽ DENOTES SIGNAL COMMON
3. ▼ DENOTES LOGIC COMMON
4. ▷ DENOTES MATCHED SET
5. ⊘ DENOTES INTERNAL ADJUSTMENT
6. ▷ SEE WIRING DIAGRAM FOR CONNECTIONS TO P24.

FIGURE 8-9. A8 LOGIC. (8375A-1004)

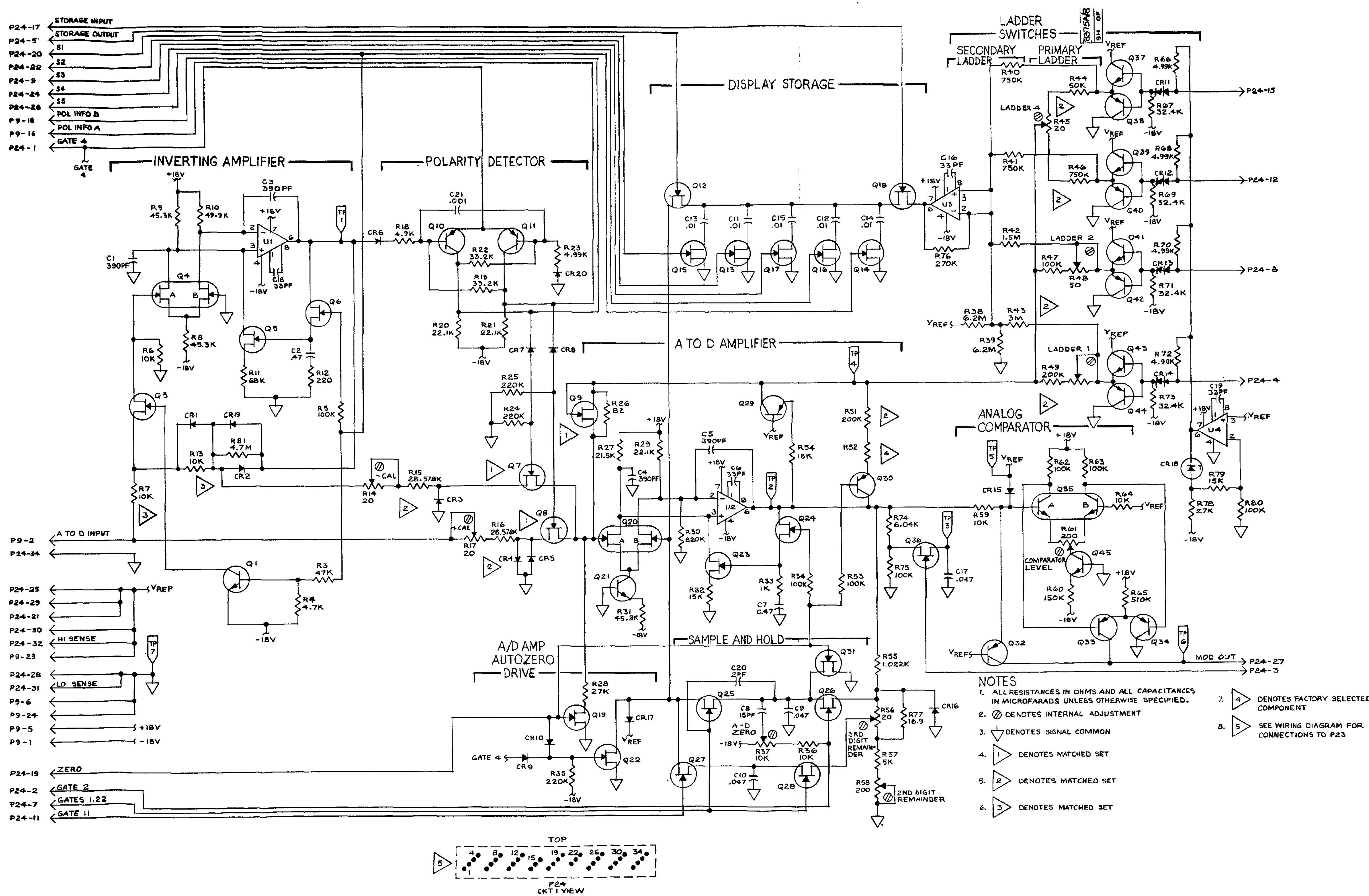
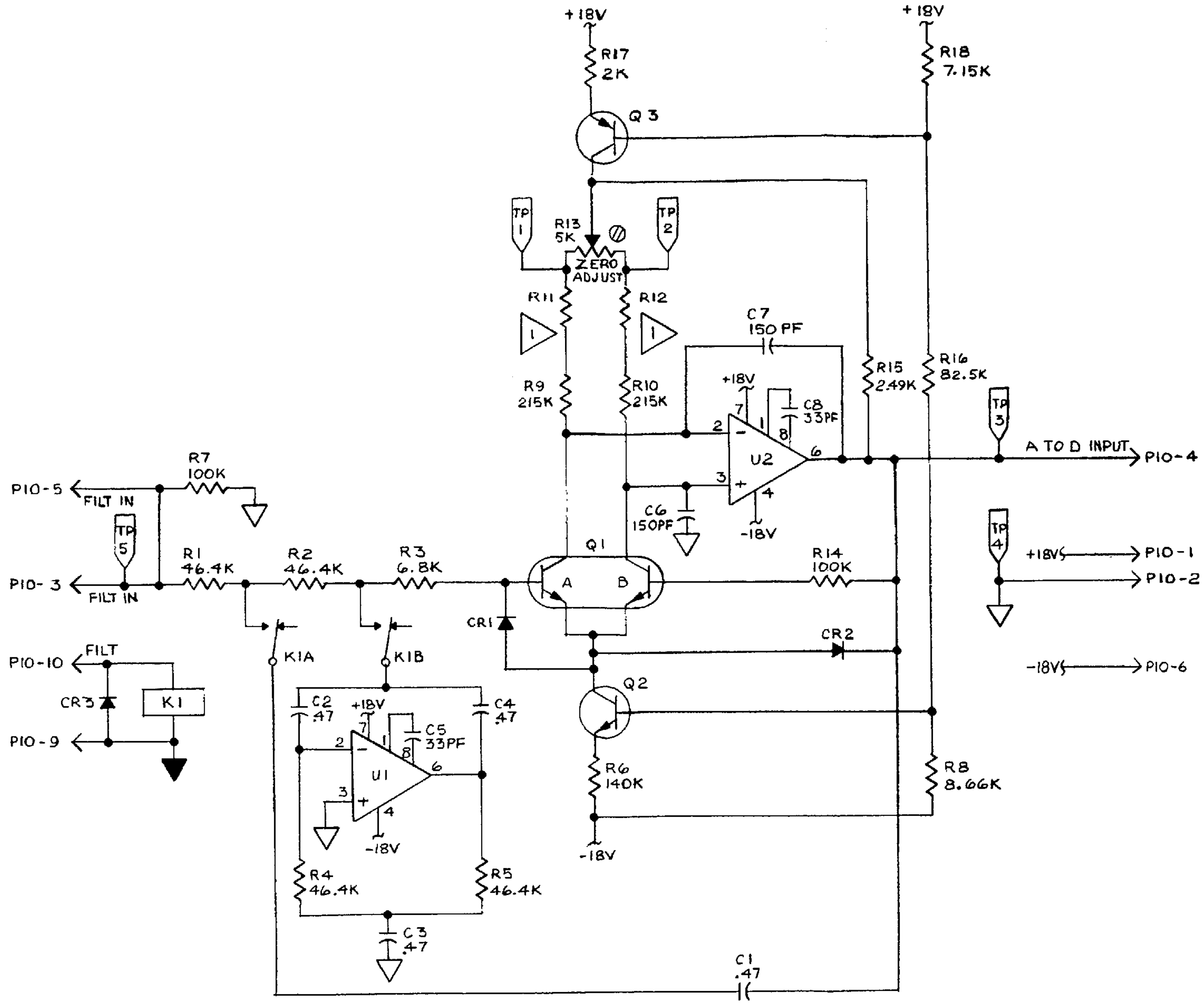


FIGURE 8-10. A9 A-TO-D CONVERTER.
(8375A-1003)



NOTES

1. ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. ▽ DENOTES COMMON.
3. ▼ DENOTES LOGIC COMMON.
4. ▷1 FACTORY SELECTED
5. ⊘ DENOTES INTERNAL ADJUSTMENT

FIGURE 8-11. A10 ACTIVE FILTER
(8375A-1015)

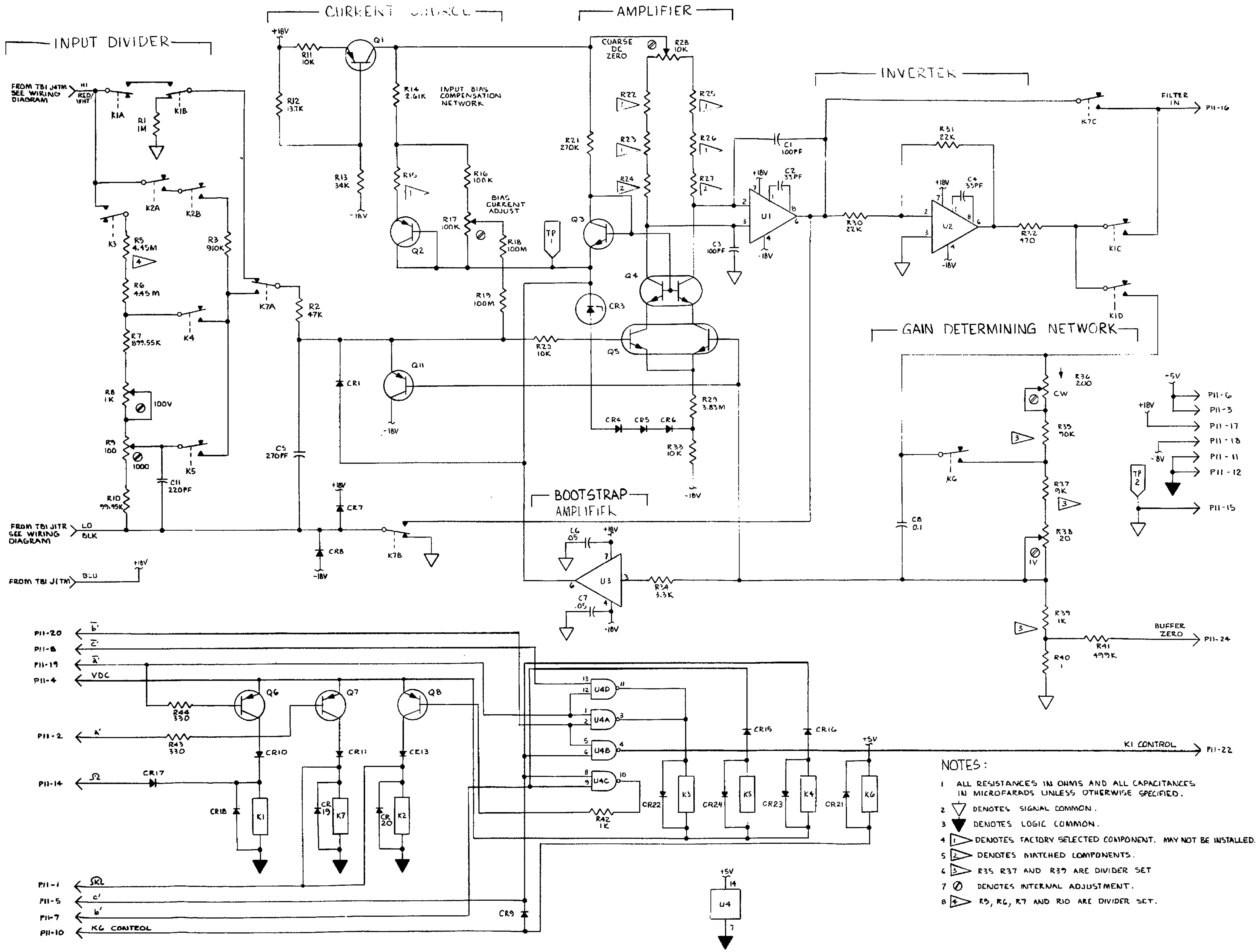


FIGURE 8-12. A11 BUFFER (8375A-1005)

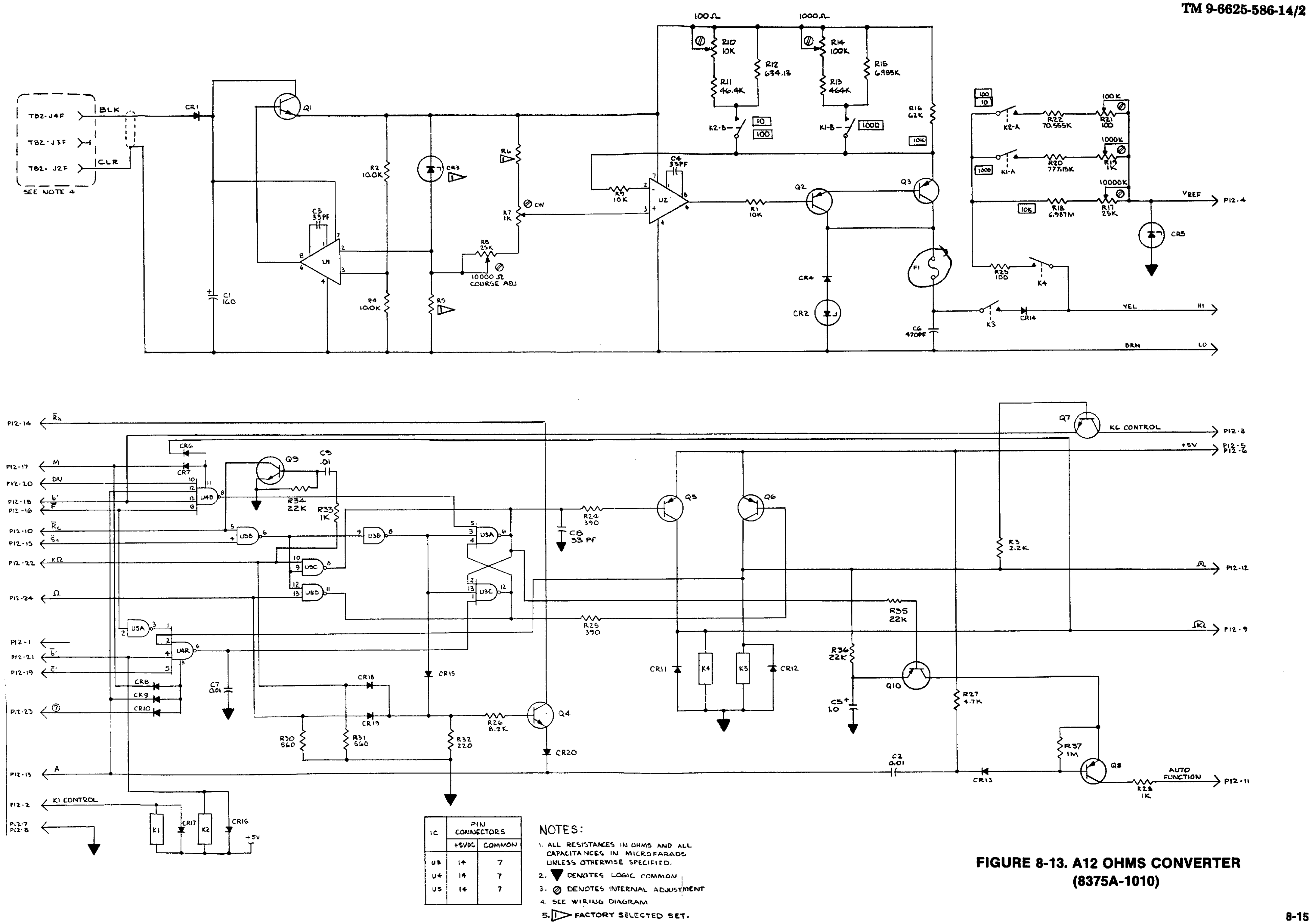


FIGURE 8-13. A12 OHMS CONVERTER
(8375A-1010)

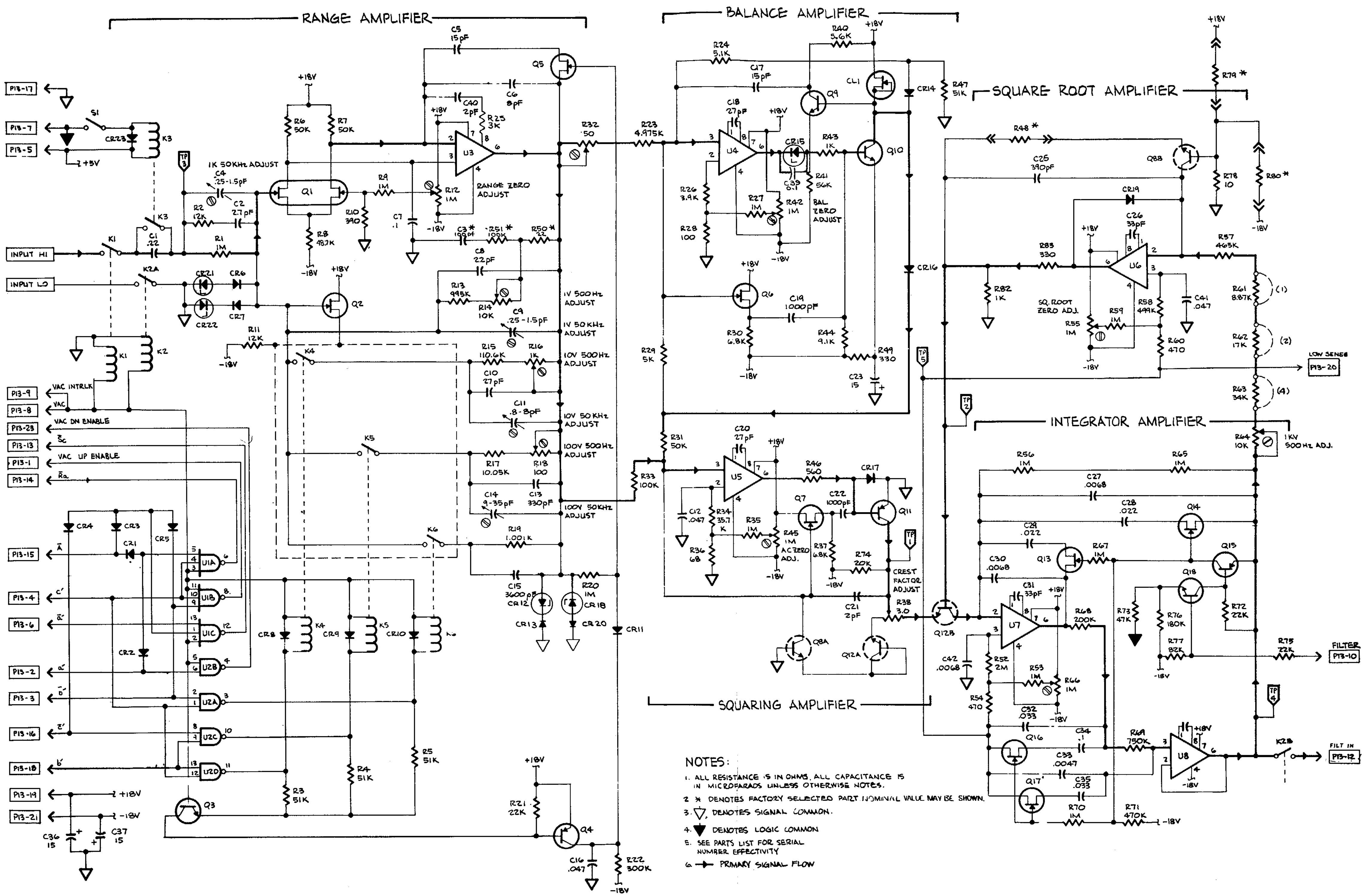


FIGURE 8-14. A13 TRUE RMS CONVERTER
(8375A-1022)

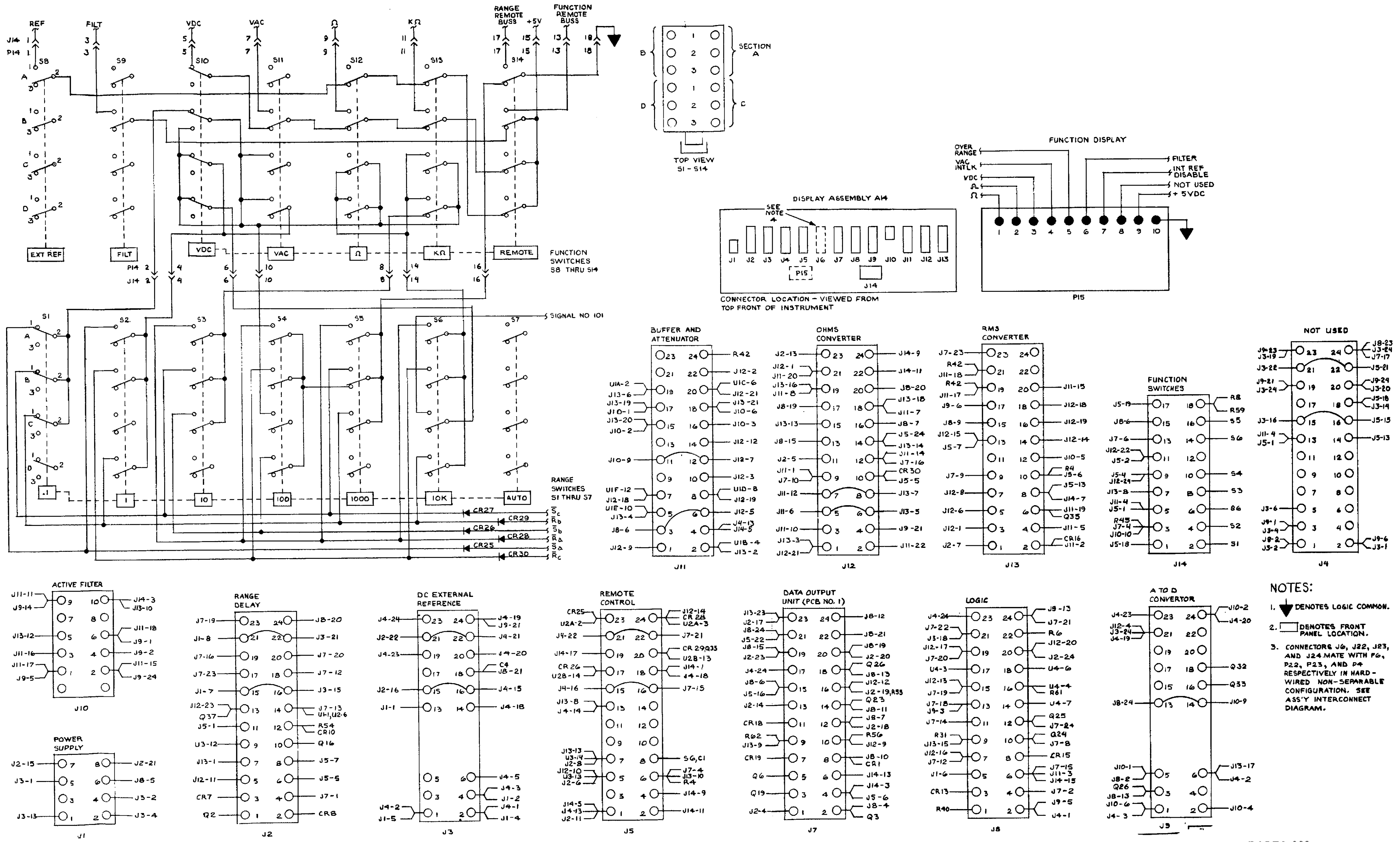


FIGURE 8-15. (1 of 2) A14 DISPLAY
(8375A-1002)

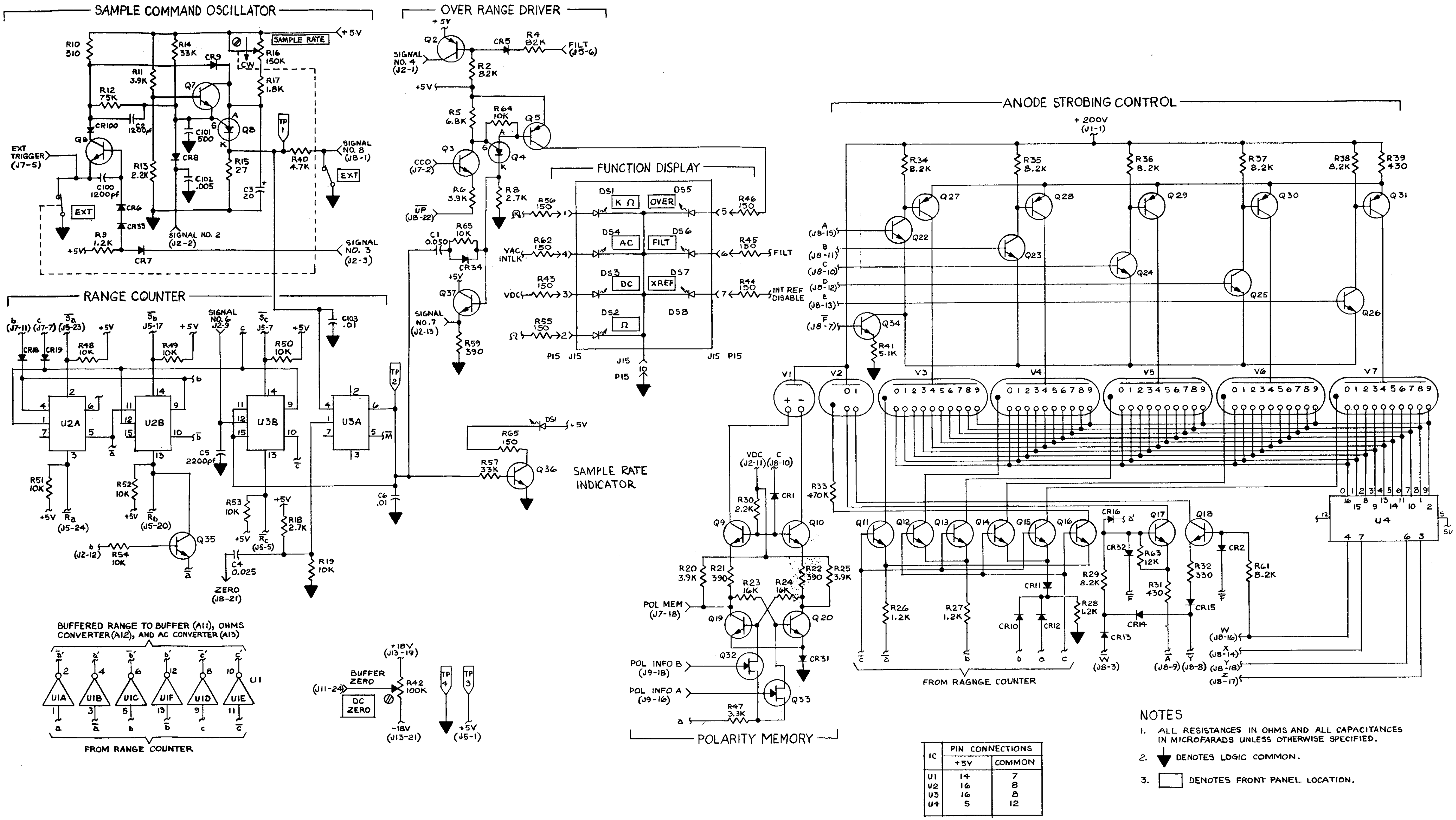


FIGURE 8-15. (2 of 2) A14 DISPLAY
(8375A-1002)

APPENDIX A
REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 9-1425-585-14	General Maintenance, Service Upon Receipt, Shipping and Storage, and Demolition to Prevent Enemy Use

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