

32-5012

MANUAL
of Operating & Maintenance
Procedures
for

DC SECONDARY VOLTAGE STANDARD
Model 8100

1. Introduction

MODEL 8100 VOLTAGE STANDARD (VS8100)

The DC Secondary Standard is delivered fully calibrated and ready to serve within its certified accuracy for a duration of six months before requiring recalibration against primary standards. After unpacking, the line voltage selector switch on the rear panel should be set to 115 or 230 volts as appropriate. The VS8100 is ready for use; however, material in this manual will be informative and valuable for proper instrument application.

1.1 General Description

1.1.1 Review of VS8100 Features:

- Dual five decade output ranges
 ± 11.1110 with $100\ \mu\text{V}$ resolution
 ± 111.110 with $1\ \mu\text{V}$ resolution
- Accuracy 0.005% of reading $\pm 50\ \mu\text{V}$ @ $20^\circ\text{C} \pm 0.0002\%/^\circ\text{C}$
- Warm up to rated accuracy in less than 10 minutes
- High output current of 50 mA; short circuit proof
- 10 milliohm output impedance (100 ohms on low output range)
- No maximum external load capacity
- Isolated circuitry is unaffected by common mode voltages up to $\pm 500\ \text{V}$
- Front panel $\pm 1\ \text{mV}$ vernier

1.1.2 Review of Your New In-House Capability:

Because of the portability and fast warm up of the VS8100 you can use it on site to:

- Calibrate absolutely to 50 PPM
- Normalize to 25 PPM
- Standardize to 15 PPM
- Verify linearity to 25 PPM
- Monitor drift to 5 PPM
- Establish regulation to $\pm 1\ \mu\text{V}$

1.2 Certificate of Conformance

A certificate of conformance containing factory inspection test results is packed with each VS8100 DC Voltage Standard. This document should be retained in a log or file record for this instrument. It will serve to assure the NBS traceability of absolute accuracy, to provide a table of output voltages for recalibration comparisons, and to outline the factory test procedures used in determining these values.

1.3 Specifications

OUTPUT CHARACTERISTICS

VOLTAGE RANGE

Main Output: 0 to ± 11.1110 volts at front terminals

Auxiliary Output: 0 to ± 111.110 millivolts at rear panel terminals

CURRENT CAPABILITY – MAIN OUTPUT

0 to 50 milliamperes. Short-circuit proof. No restrictions on load capacitance.

ABSOLUTE ACCURACY (at 23°C)

50 PPM of reading, $\pm 50 \mu\text{V}$ (Includes 6-month stability and linearity.)

LONG-TERM STABILITY:

± 15 PPM, 60 days

LINEARITY:

within ± 25 PPM

TEMPERATURE COEFFICIENT:

2 PPM/°C

RESOLUTION:

Main Output: 100 microvolts (5 dialable, in line digital decades, and ± 1 mV vernier)

Auxiliary: 1 microvolt

OUTPUT IMPEDANCE

Main Output:

DC: 10 milliohms (max)

Dynamic: $L \leq 10 \mu\text{H}$; $R = 2\Omega$

Auxiliary Output:

DC: 100 ohms

NOISE

(0.001% of reading + $50 \mu\text{V}$) p-p

SETTLING TIME

$V < 300$ milliseconds

ISOLATION

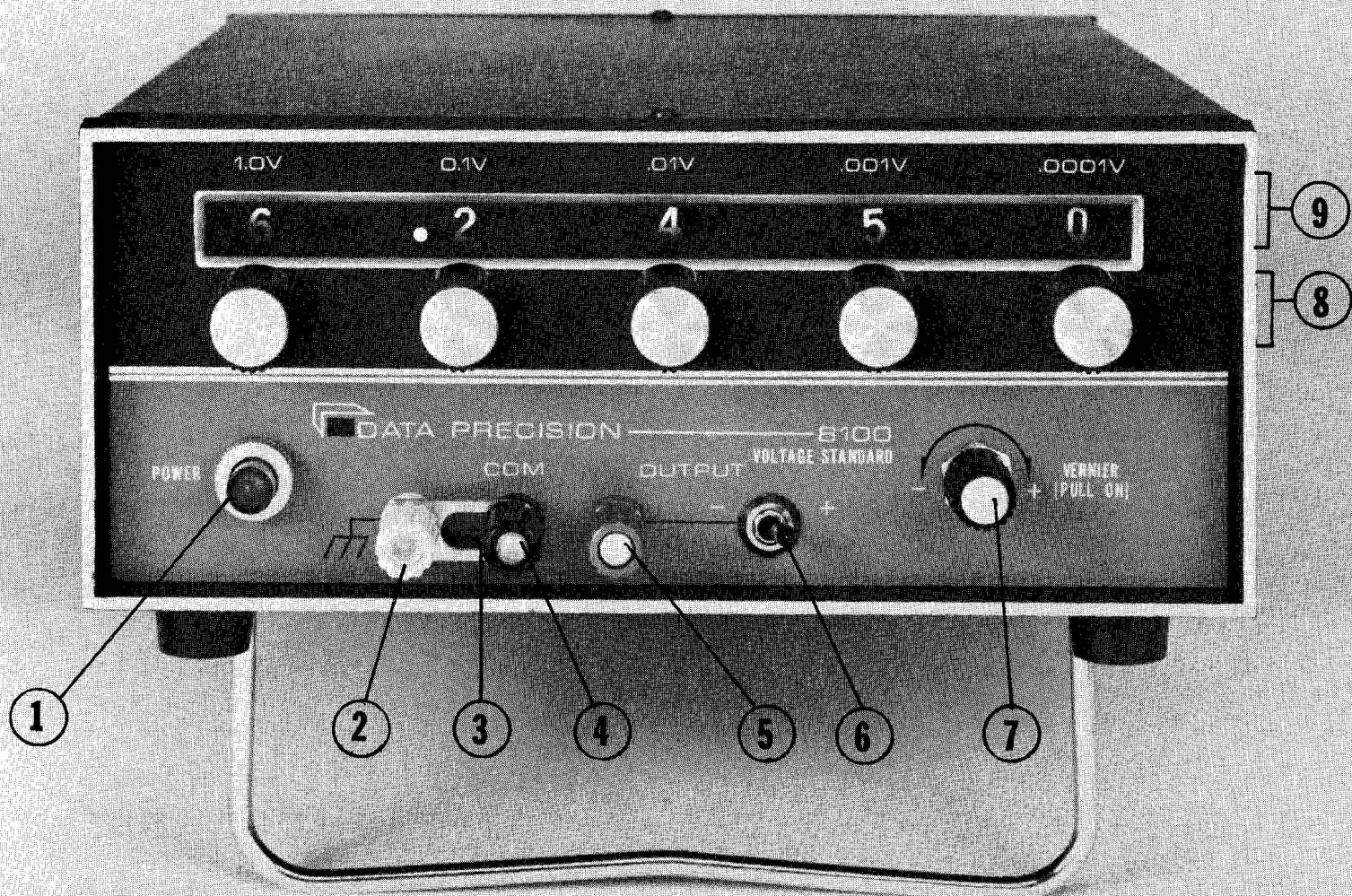
Output may be floated up to 500 VDC (maximum) above or below chassis ground.

WARM-UP TIME

Less than 10 minutes, to rated accuracy. For reduced accuracy of $\pm 0.02\%$, no warm-up time is required.

RECALIBRATION INTERVAL

6 months, for rated performance



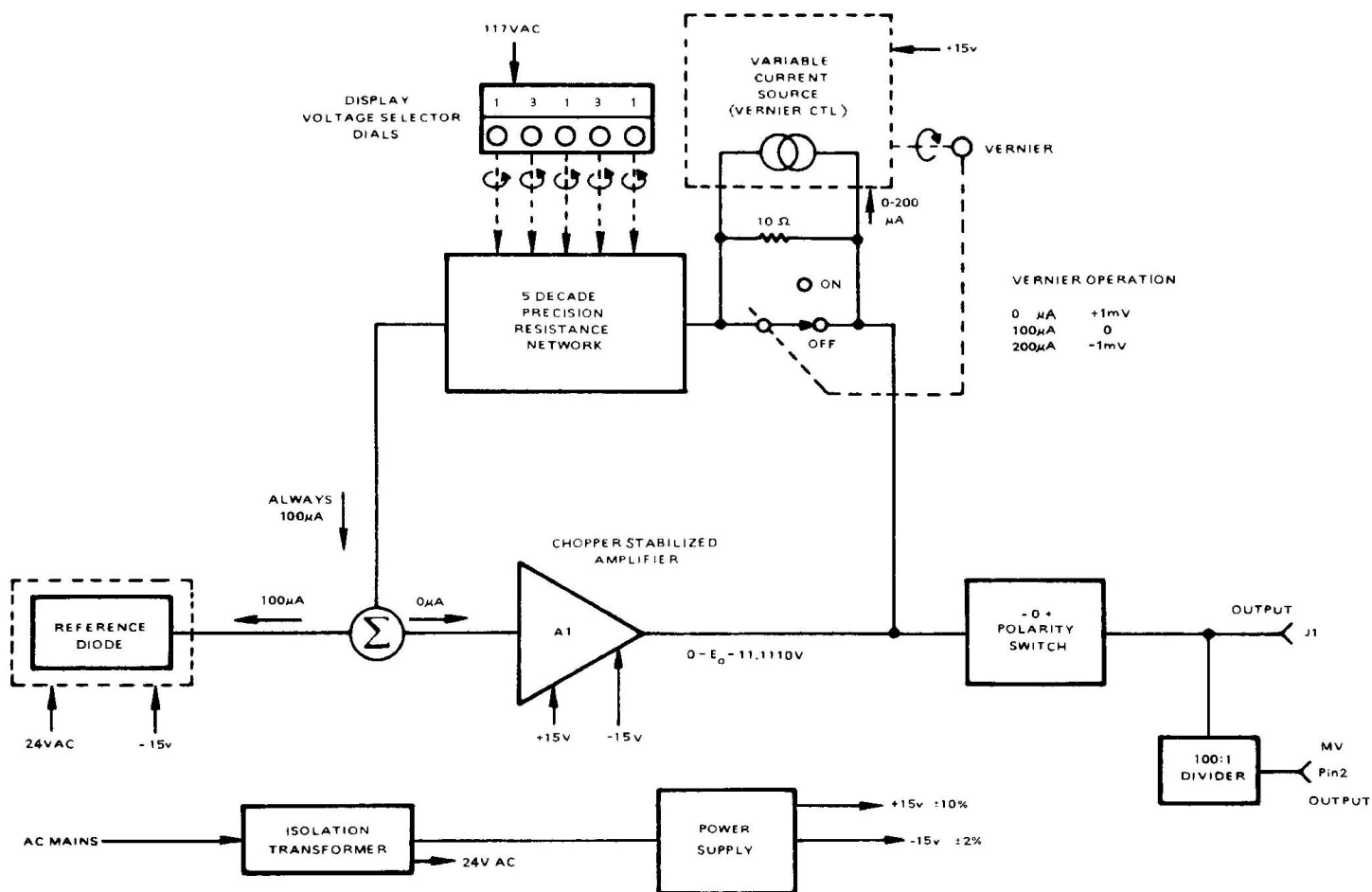


Figure 3.2.4.2 Simplified Block Diagram

VS8100

FIELD MAINTENANCE GUIDE

The following are footnotes relating to the maintenance guide flow chart

NOTE 1. START AND SET UP CHECKS

- Check to assure that
- A The 115 230V Switch is properly set
 - B The unit is plugged in
 - C The fuse is intact
 - D The POWER Switch is operated.
 - E The POWER Switch button glows red.
 - F The Display Lamps are glowing
 - G Some non zero output is dialed

NOTE 2. INTERNAL CHECKS ARE REQUIRED
Set the (-0+) Switch to (-). Use the BLACK binding post as the reference whenever voltages are to be measured to "ground". Dial an output of 10.0000V. Turn instrument upside down. Remove bottom case cover. CAUTION- EXPOSED AC LINE VOLTAGES. CASE IS GROUNDED.

NOTE 3. 30V ± 10% CHECKS OK
Measure 30 V DC ± 10% from the cathode of diode 6 (+) to the anode of diode 9 (-). These are adjacent lands near the power transformer.

NOTE 4. TROUBLESHOOT TRANSFORMER SECONDARY AND POWER SUPPLY ELEMENTS
Measure transformer secondary AC voltages as shown on the schematic. Measure rectifier output voltages and verify the integrity of +15V and -15V bus lines. Check the filter capacitors - heat may indicate excessive capacitor leakage. Peak-to-peak ripple voltage should not exceed 10 millivolts on the +15V DC supply or 1 millivolt on the -15V DC supply

NOTE 5. TROUBLESHOOT OUTPUT WIRING.
Troubleshoot non-printed circuit wiring from both sides of R26 to the output binding posts via Switch S6.

NOTE 6. TROUBLESHOOT MATRIX RESISTANCES AND WIRING
Check for damaged or broken wiring in the five switch decade matrix. Dial in all zeros and measure zero volts drop across the matrix, or measure the continuity of the feedback path with an ohmmeter (all zeros yields zero ohms, i.e. less than 20 milliohms).

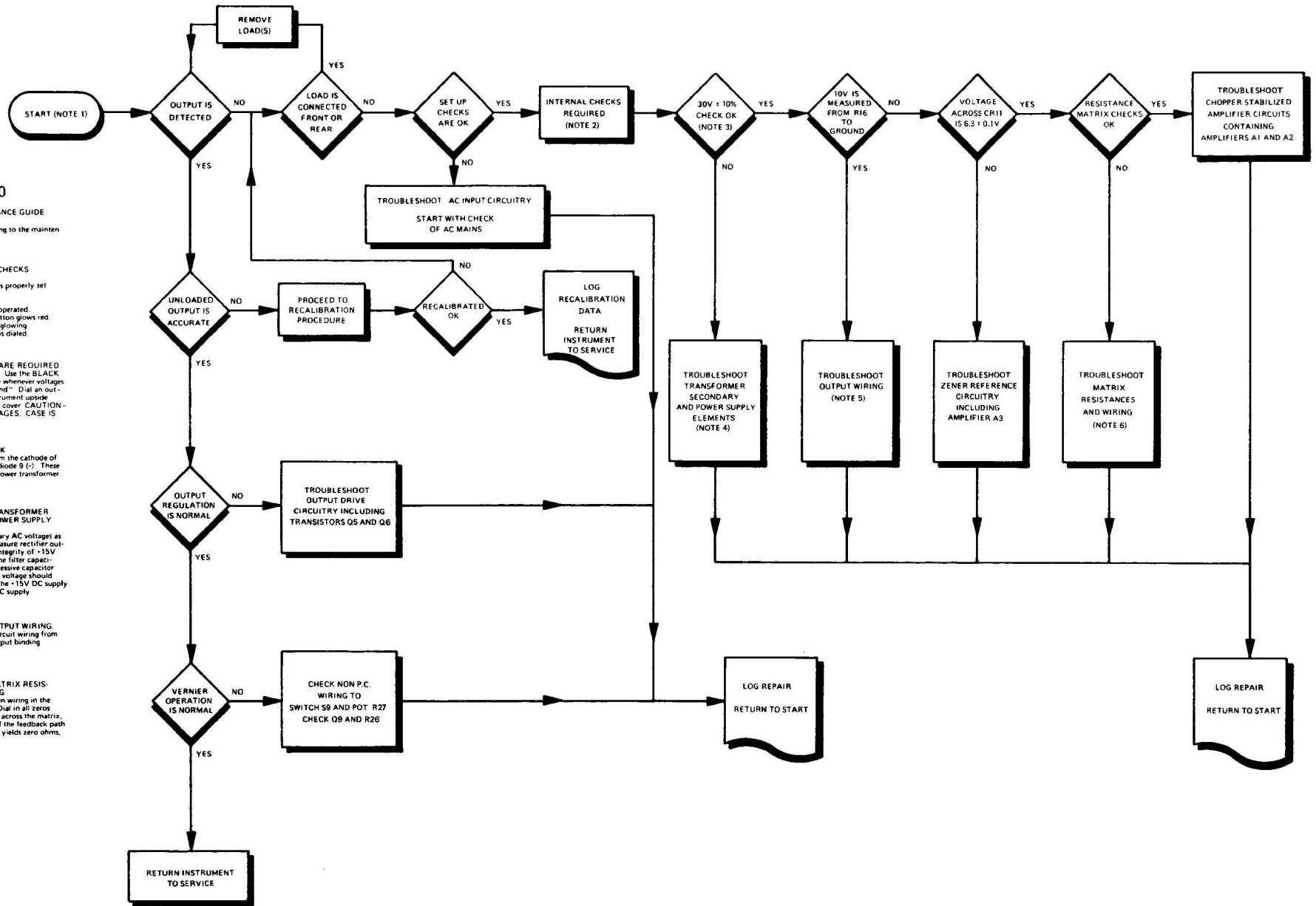


Figure 4.2.1 AN3100 Field Maintenance Procedure

5.2 Parts List

Schematic Designation

Description

Amplifiers

A1,A3

Operational Amplifier LM307

A2

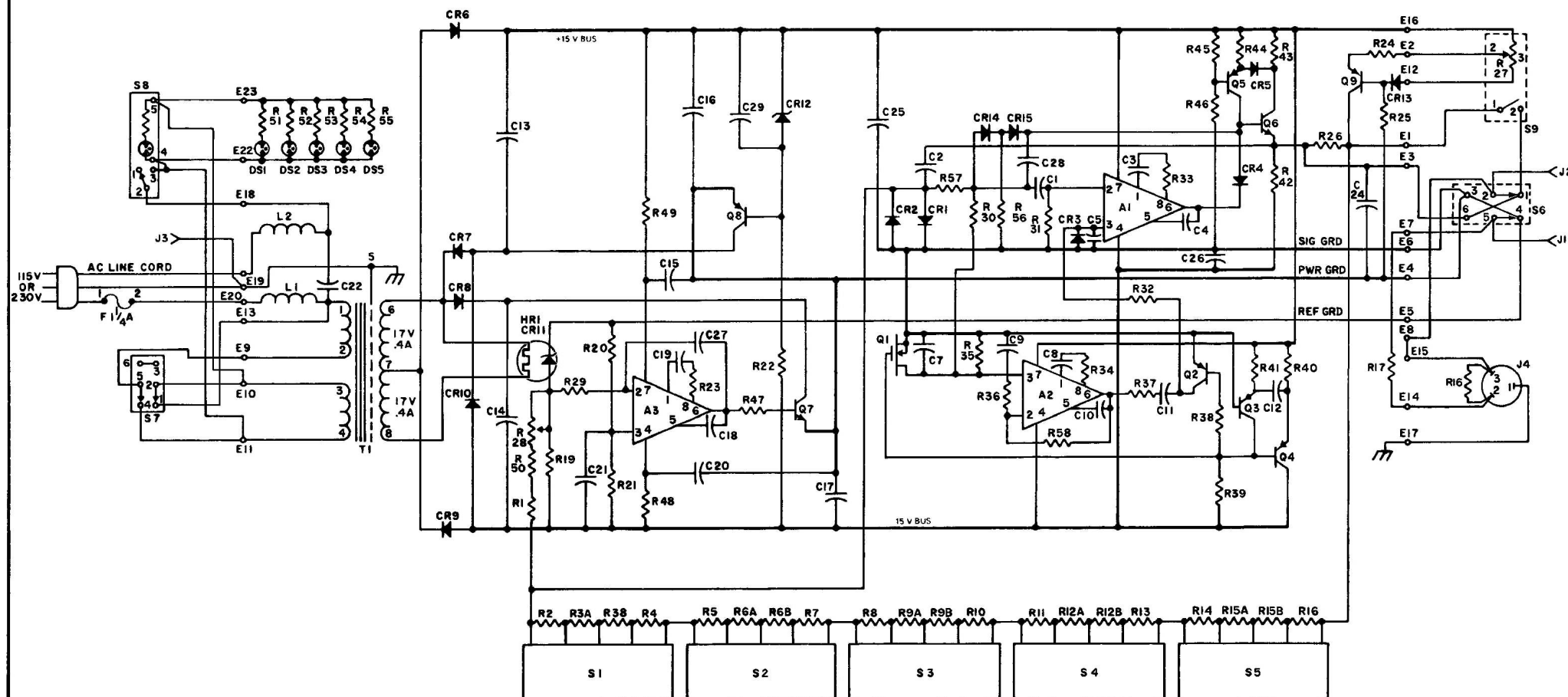
Operational Amplifier LM301A

Capacitors

Schematic Desig.	Description			Schematic Desig.	Description		
C1	0.1 μ f	10%	Polycarb	C15	0.01 μ f	Disc Ceramic	
C2	0.33 μ f	10%	Polycarb	C16,C17	6.8 μ f	20V	Tantalum
C5	15 μ f	10V	Tantalum	C20,C21	0.01 μ f	Disc Ceramic	
C6	0.1 μ f	10%	Polycarb	C22	0.005 μ f	1KV	Disc Ceramic
C7	150pf	5%	Dipped Mica	C24	6.8 μ f	20V	Tantalum
C8	3pf	5%	Dipped Mica	C25	0.01 μ f	Disc Ceramic	
C9	6.8 μ f	20V	Tantalum	C26	6.8 μ f	20V	Tantalum
C11,C12	0.1 μ f	10%	Mylar	C27	330pf	5%	Dipped Mica
C13,C14	500 μ f	50V	Electrolytic	C28	0.01 μ f	Disc Ceramic	
				C29	6.8 μ f	20V	Tantalum

Resistors

R1	62K	Resistors R1 through R21 must be installed as a matched set. Order by Part A8-1047 See Note for R1				R27	Potentiometer 1 K (see Switch S9 listing)
R2	50K					R28	200 Ω Trim Resistor Electra Midland RJ 24 CW 201
R3A,3B	20K					R29	5.49K 1% 1/2 W 100 PPM T.C.
R4	10K	See Note for R1				R30	100K 10% 1/4 W C.C.
R5	5K					R31,R32	499K 1% 1/2 W 100 PPM T.C.
R6A,6B	2K					R34	Jumper
R7	1K					R35	1M 20% 1/4 W C.C.
R8	500 Ω					R36	1.8K 5% 1/4 W C.C.
R9A,9B	200 Ω					R37	6.8K 10% 1/4 W C.C.
R10	100 Ω					R38	18K 5% 1/4 W C.C.
R11	50 Ω					R39	47K 5% 1/4 W C.C.
R12A,12B	20 Ω					R40,R41	68K 5% 1/4 W C.C.
R13	10 Ω					R42	4.7K 5% 1/4 W C.C.
R14	5 Ω					R43	33.2 Ω 1% 1/2 W 100 PPM T.C.
R15A,15B	2 Ω					R44	1K 20% 1/4 W C.C.
R16	1 Ω					R45	2.05K 1% 1/2 W 100 PPM T.C.
R17	10K					R46	13.3K 1% 1/2 W 100 PPM T.C.
R18	101.01 Ω					R47	390 Ω 20% 1/4 W C.C.
R19	1.15K					R48,R49	330 Ω 20% 1/4 W C.C.
R20	6.3K					R50	Factory Selected
R21	8.7K	See Note for R1				R51,52,53,54,55	4.7K 5% 1/4 W C.C.
R22	5.6K					R56	100K 10% 1/4 W C.C.
R24	10K	1%	1/2	W	100 PPM T.C.	R57	1K 20% 1/4 W C.C.
R25	6.19K	1%	1/2	W	100 PPM T.C.	R58	4.7M 5% 1/4 W C.C.
R26	10 Ω	1%	1/2	W	100 PPM T.C.		



SCHEMATIC DIAGRAM
MODEL 8100
VARIABLE DC SECONDARY
VOLTAGE STANDARD