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**AXOPROBE-1A MICROELECTRODE AMPLIFIER
SERVICE**

Serial No. 243

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WARNING

THIS INSTRUMENT OPERATES FROM LINE VOLTAGES. DO NOT PERFORM ANY SERVICING UNLESS YOU ARE QUALIFIED TO DO SO. LINE VOLTAGES ARE PRESENT IN THE LEFT-MOST SECTION BETWEEN THE POWER ON/OFF SWITCH AND THE LINE INPUT FILTER.

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AXOPROBE-1A Multipurpose Microelectrode Amplifier

SPECIFICATIONS

Note: Numbered items are detailed in the Table.

HEADSTAGES

Types: HS-2 series headstages are standard.

Voltage Gain: All headstages record voltage at a unity gain.

Headstage Current Gain (H): Select on basis of cell input resistance (R_{in}) and maximum current capacity (I_{max}).

$H = x \cdot 0.0001$ for ion-sensitive electrodes with current passing.

$H = x \cdot 0.01$ for R_{in} greater than approx. 300 M Ω .

$H = x \cdot 0.1$ for R_{in} approx. 30–300 M Ω .

$H = x \cdot 1$ for R_{in} approx. 3–30 M Ω .

$H = x \cdot 10$ for R_{in} approx. 0.3–3 M Ω .

These ranges suggested for optimum performance. Considerable overlap is allowable.

Extracellular Electrodes: Operate with any H value (but check I_{max} and Input Leakage Current).

Ionophoresis: Typically uses $H = x \cdot 1$.

⁽¹⁾ **Current Setting and Measuring Resistance (R_o):** Located inside headstage. R_o determines H. R_o is *not* the input resistance.

⁽²⁾ **Input Resistance:** Inversely proportional to H.

⁽³⁾ **I_{max} :** Maximum current that can be passed with input grounded via indicated sum of cell resistance (R_{in}) and electrode resistance (R_e).

Compliance Voltage: ± 30 V. Max voltage that can be applied across high-resistance electrodes.

⁽⁴⁾ **Noise:** Values measured at V_e output with input grounded via R_e . Single-pole lowpass filter used to set measurement circuit -3 dB bandwidth. Capacitance Neutralization adjusted so step response of V_e is non-overshooting and so -3 dB bandwidth of v_e is equal to measurement circuit bandwidth.

Hum (Power Line Noise): Less than 20 μ V peak-to-peak, grounded input, input-referred.

⁽⁵⁾ **10–90% Settling Time (t_{10-90}):** Two values shown; $t_{10-90,V}$ for voltage step applied to input via R_e ; $t_{10-90,I}$ for current step into same R_e . Capacitance Neutralization adjusted for fastest non-overshooting response.

Input Capacitance: Largely eliminated from step response considerations by bootstrapped power supplies and Capacitance Neutralization. See Settling Time specifications.

⁽⁶⁾ **Capacitance Neutralization Range:** Ten-turn potentiometer. L version headstages have smallest range and lowest noise. M version headstages have larger range but more noise.

Capacitance Neutralization Leakage Current: Prevented by removal of DC potentials from neutralization capacitor and shield. Removal has 1 s or 10 s time constant.

⁽⁷⁾ **Case/Shield:** Case and shield connector connected to Capacitance Neutralization or to unity-gain buffered electrode potential (V_e).

⁽⁸⁾ **Input Leakage Current (I_{leak}) vs. Temperature.** Temperature dependence measured near 25°C. At fixed temperature input leakage current can be adjusted to zero.

PREAMPS (Two Channels)

Offset Range: ± 500 mV. Ten-turn potentiometers.

Electrode Resistance Compensation Range: $10 \div H$ M Ω /turn. Ten-turn potentiometers. Coupling resistance range, on ME1 control only, is $1 \div H_2$ M Ω /turn.

Test: For electrode resistance measurement. 100H mV/M Ω or H mV/M Ω . Res. Comp. must be off.

Clear: Forces ± 100 nA through electrode.

In Use/Standby: Microelectrode 2 amplifier only. In Standby position disables panel meter and Capacitance Neutralization circuit.

TABLE

PARAMETER	UNITS	HS-2 x 10M	HS-2 x 1M	HS-2 x 1L	HS-2 x 0.1L	HS-2 x 0.01M	HS-2M x 0.0001
⁽¹⁾ R_o	M Ω	10^6	10^7	10^7	10^8	10^8	10^{11}
⁽²⁾ Input Resistance	Ω	10^{10}	10^{11}	10^{11}	10^{12}	10^{13}	10^{15}
⁽³⁾ I_{max} ($R_{in} + R_e$)	nA	10,000 (2M Ω)	1,000 (20M Ω)	1,000 (20M Ω)	100 (200M Ω)	10 (2G Ω)	0.1 (200G Ω)
⁽⁴⁾ Noise (R_e , Bandwidth)	μ Vrms	24 (1M Ω) (10kHz)	70 (10M Ω) (10kHz)	54 (10M Ω) (10kHz)	53 (100M Ω) (1kHz)	40 (1G Ω) (100Hz)	30 (10G Ω) (10Hz)
⁽⁵⁾ $t_{10-90,V}(R_e)$	μ s	4	12	11	34	40	2,000
$t_{10-90,I}(R_e)$	μ s	4 (1M Ω)	13 (10M Ω)	12 (10M Ω)	36 (100M Ω)	300 (1G Ω)	3,000 (100G Ω)
⁽⁶⁾ Capacitance Neutralization Range	pF	0 to 22	0 to 22	0 to 8	0 to 8	0 to 22	0 to 22
⁽⁷⁾ Case/Shield Connected To	—	Cap Neut	Cap Neut	Cap Neut	Cap Neut	V_e	V_e
⁽⁸⁾ I_{leak} vs. Temp	pA/°C	30	3	3	0.3	0.1	0.005
⁽⁹⁾ I Output Sensitivity Maximum Meter Reading	mV/nA	1 1.999 μ A	10 199.9 nA	10 199.9 nA	100 19.99 nA	1,000 1.999 nA	0.1V 19.99 pA
⁽¹⁰⁾ C_x Enhancement/Neutralization Range	pF	40	40	15	15	15	40

BUZZ

Frequency: Approx 50 Hz–10 kHz. Logarithmic potentiometer.
Duration: Approx. 5–500 ms. Logarithmic potentiometer.
Amplitude: 0 to ± 30 V. Attenuated by input capacitance. Linear potentiometer.
Activation: Front-panel debounced switch, footswitches, or logic HIGH level on rear-panel connector.

OUTPUTS

⁽⁹⁾ **I₁ and I₂:** Actual electrode currents. 10 \div H mV/nA.
⁽⁹⁾ **Current Meter:** Recognizes H of headstage in use and sets decimal point accordingly. Maximum meter reading is less than headstage current limit (I_{max}). Currents exceeding current meter range can be measured on I₁ and I₂ outputs. Display selections are I₁ and I₂.
Voltage Meters: Range ± 1999 mV. Separate meters for V₁ and V₂. V₁ meter also displays V₁–V₂.
V_e: Raw headstage voltage. 0.1%
10V: x10 output with Resistance Compensation and Offset. 0.1%
10(V₁–V₂): Difference of 10V₁ and 10V₂. Matched to 0.01%
100V: x100 output. AC coupled (1 Hz). 2%.
V_{BATH}: x1 bath potential. 1%
Output Impedances: 500 Ω .
⁽¹⁰⁾ **C_x Compensation:** Used to compensate for the coupling capacitance between electrodes. ENHANCE position adds ME2 voltage via a capacitor into ME2 headstage input, thus matching electrode responses to common-mode signals. Used for ion-sensitive electrode recording. NEUTRALIZE position subtracts ME2 voltage from ME2 headstage input. Used for double-barrel current passing.

LOWPASS FILTERS

Two independent filters: F1, F2. Second-order.
–3 dB frequencies: Twelve. 2, 5, 10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K Hertz. Continuous rotation.
F1 Inputs: Switch selected. 10V₁, 10V₂, 10(V₁–V₂), V_{e1}, 100V₁, I₁.
F2 Inputs: Switch selected. 10V₁, 10V₂, V_{BATH}, V_{e2}, 100V₂, I₂.
Bypass Switch: In ACTIVE position signals are filtered. In BYPASS position signals are wideband.

INTERNAL COMMANDS

Note: Commands from all sources sum linearly.
DC Current Command: One for each preamp. ± 100 H nA max. Ten-turn potentiometers.
Pulse Current Command: One for each preamp. ± 1000 H nA max. Ten-turn potentiometers. Activated by HIGH control signal on PULSE GATE input or by front-panel switch.
Step Command: Shared by preamps. Destination switch determines which preamp command goes to. ± 199.9 H nA max. Set on thumb-wheel switch. Activated by HIGH control signal on STEP GATE input or by front-panel switch.

EXTERNAL COMMANDS

Sensitivities: 20H nA/V
Input Impedance: 100 k Ω
Max. Input Voltage: ± 30 V

CALIBRATION SIGNAL

Internal: Activated by HIGH control signal on CAL. GATE input or by front-panel switch. Input-referred values: 10 mV on x 10 outputs, 1 mV on x 100 outputs, 10H nA on I outputs.
External: Proportional to applied voltage. Input-referred values: 2 mV/V on x10 outputs, 0.2 mV/V on x100 outputs, 2H nA/V on I outputs. 100 k Ω input impedance.
Accuracy: 1% typical.
Audio Monitor: Pitch proportional to V₁ or V₂. Internal speaker bypassed when earphone plugged in.

BATH POTENTIAL SUBTRACTION

Signal recorded by bath headstage or by external amplifier is subtracted from x10 outputs. Subtraction band-limited to 10 kHz. If bath potential not measured system automatically reverts to using 0 V as reference potential. Standard headstages work as bath headstages if plugged into bath headstage connector.

GROUNDING

Signal ground is isolated from chassis and power ground.

CONTROL INPUTS

Above 3 V accepted as logic HIGH. Below 2 V accepted as logic LOW. Inputs protected to ± 15 V.

PAIRING BRACKET (BR–1)

BR–1 bracket (optional extra) for mounting two headstages as a pair.

HEADSTAGE DIMENSIONS

Case is 2.25 x 1.14 x 0.87" (57.2 x 29.0 x 22.1 mm). Mounting rod is 4 (102) long. Available mounting rod diameters (D) are 1/2, 3/16, or 3/8 (6.3, 7.9 or 9.5). Specify required mounting rod diameter with order. Cable length is 10 feet (3 m).

HEADSTAGE CONNECTORS

Sockets for microelectrode input, shield drive and ground output are 0.08" (2 mm) diameter. Input socket is Teflon insulated.

CABINET DIMENSIONS

7 (177) high, 19 (483) wide, 12.5 (317) deep. Mounts in standard 19" rack. Handles included.

SUPPLY REQUIREMENTS

Line Voltage: 100–125 VAC or 200–250 VAC. User selectable by an internal switch.
Line Frequency: 50–60 Hz.
Power: 20 W.
Fuse: 0.5 A slow. 5 x 20 mm.
Line Filter: RFI filter is included.
Line cord: Shielded line cord is provided.

ACCESSORIES PROVIDED

Operator's Manual
Service Manual
2 mm plugs for use with headstage
Low-capacitance test resistor for each headstage
Spare fuse
Footswitches to operate Buzz of both electrodes.

ORDERING INFORMATION

When ordering please specify:

1. Current gain (H) and type of two headstages provided.
2. Current gain (H) and type of any extra headstages.
3. Diameter (D) of headstage mounting rods.

Unless you specify otherwise, the AXOPROBE–1A will be supplied with one HS-2 H=x0.1L and one HS-2 H=x1L headstage, each with D=3/16 (7.9 mm). Domestic and international sales are direct from the factory.

10% discount applies to simultaneous purchase of two or more AXOPROBE–1As by a single group. For non-simultaneous purchases, 10% discount applies to second and subsequent AXOPROBE–1As purchased by a single group within 12 months. Discount must be requested when placing order.

WARRANTY

12 months parts and labor from date of receipt.

SERVICE

Service is available at the factory. A detailed service manual is supplied with each AXOPROBE–1A.

For further information call us. A factory expert will be pleased to answer your technical and ordering inquiries.

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THEORY OF OPERATION

GENERAL

The AXOPROBE-1A contains amplifiers for two separate microelectrodes (ME1 and ME2).

Each channel is fully independent. The microelectrode is plugged into a small high-input-impedance headstage which is connected by cable to the main unit. The microelectrode voltage is recorded at the same time that current is passed. Command voltages are generated internally but timing must come from external sources.

For a complete description of the operation of the AXOPROBE-1A see the Operator's Manual.

POWER SUPPLY - ASSEMBLY NO. A1007

Located in the left-hand section of the instrument.

WARNING: Line voltages are present in the power-supply section.

The line input connector contains an RFI filter, the fuse in use and a spare fuse. A slide switch on the circuit board puts the two primary windings into series or parallel connection for 230 V or 115 V operation respectively. Line voltages from 200-250 V and 100-125 V AC are acceptable.

Five regulated outputs are generated: +50 V, -50 V, +15 V, -15 V, +5 V. Standard 3-terminal regulators are used. Test points on the circuit board allow the regulator input and output voltages to be conveniently measured. 2 mV of line-frequency noise and 2 mV of wideband noise are acceptable. This noise is rejected by the rest of the circuitry.

MICROELECTRODE 1 - ASSEMBLY A1006

Headstages

HS-2 series headstages are unity-gain buffers to convert the high-impedance microelectrode signal into a low-impedance signal for transmission to the main unit. A $5\text{ K}\Omega$ resistor protects the input from static discharges. Resistor R_0 is used for current setting and measuring. A trim pot allows the offset voltage to be adjusted. This is important for removing the input leakage current. Capacitor C_n is used for neutralizing the input capacitance. A resistor from the unity-gain buffer output removes the DC voltage from across C_n which would otherwise cause a leakage current to flow through the insulation resistance of C_n .

Headstage Power Supply

Constant current sources CRD3, CRD4 and transistors Q3 and Q4 comprise a floating $\pm 10\text{ V}$ power supply for the headstages. The transistors are arranged as amplified diodes to simulate 10 V zener diodes. The common point of the floating supply is driven by the electrode voltage (V_{1A}) buffered through A22. To modify the headstage supply for greater speed but less stability reduce C33 to 150 pF or less.

Capacitance Neutralization

A15 and A16 provide positive feedback to the headstage input through C_n . If relay RL4 is energized an oscillating voltage called Buzz is applied to the microelectrode through C_n .

C_x Compensation

Amplifier A31 adds a variable amount of the voltage on microelectrode 2 to the microelectrode 1 input through C_n . The polarity is either positive or negative depending upon whether enhancement or neutralization is selected, respectively.

Current Source

A26 and R_o (inside headstage) comprise a constant current source (CCS). The command voltage at the output of A24 is forced across R_o thereby setting the electrode current. The common mode rejection ratio of A26 is adjusted by RVT18.

Commands

Command voltages from several sources are summed in A24. V_R is a stable 5 V reference voltage used to establish the internal commands. V_T comes from the thumbwheel switch. U1 is a CMOS switch used to pulse the output of A23 and simultaneously light an LED. The gain of A24 is 3 or 0.3 depending on the source. The gain of A26 is 0.67. Thus the overall gain is 2 or 0.2.

Current Measurement

Differential amplifier A17 measures the buffered voltage across R_o . This voltage is scaled in A18 and supplied to the I_1 output.

Voltage Measurement

The output of A17 is amplified in A19 before connecting to the Resistance Compensation potentiometer. The wiper voltage of this potentiometer is proportional to the IR voltage drop across the microelectrode and is subtracted from the electrode voltage in A21. Offset compensation is done in A21. A calibration signal is added and the bath potential subtracted in A25. A divide-by-10 network on the output of A25 scales the x10 output for display on the digital panel meter.

The x100 output comes from A14. This amplifier is AC coupled.

The initial x10 gain for both the x10 output and the x100 output is done in A37. A sample-and-hold amplifier (A38) is used, under control of the experimenter, to prevent artifacts recorded by the electrode from being fed through to the outputs.

MICROELECTRODE 2 - ASSEMBLY A1006

This amplifier is similar to the microelectrode-1 amplifier. An In Use/Standby switch replaces the Display switch. In the Standby position the capacitance neutralization circuit is disabled. This prevents any unexpected oscillations from occurring in an open-circuited headstage. There is no C_x compensation circuitry, nor is there a sample-and-hold amplifier for blanking.

COMMON CIRCUITRY - ASSEMBLY A1006

Buzz Generator

The Buzz oscillation is gated by monostable U6. U6 is triggered by front-panel switches debounced in U4, or externally by footswitches or logic-level pulses. U6 simultaneously turns on an oscillator and activates the relay in the ME1 or ME2 section. The appropriate relay is selected in U4. Drive current for the relay coil comes from the Darlington transistors in U2. The oscillator consists of A33 and A34. The output amplitude ranges from zero to ± 30 V.

Step Command

The output of the Thumbwheel-to-Voltage Converter (assembly A1004) is changed from a continuous to a step voltage by CMOS switch U3. The CMOS switch is activated by the external STEP ACTIVATE input or by the front-panel switch after inversion in U2. The step voltage is routed to ME1 or ME2 by the Destination switch. The output of U2 also drives an LED selected by this switch.

Calibration Signal

The second switch in U3 is activated by the external CAL ACTIVATE or by the front-panel switch. The 5 V reference voltage is then scaled to become a 1 V output on A27. External CAL. signals are also scaled 5:1 in A27.

Power Input

All power for the main circuit board comes from the power supply board to connector J4.

Panel Meters

The V_1 meter displays either V_1 from the ME1 section or V_1-V_2 from the output of A30.

The V_2 meter is switched off by the second pole of the In Use/Standby switch.

The current meter displays either I_1 or I_2 . The decimal point is set by a link in the headstage corresponding to the headstage current gain (H). Pin 2 of the panel meter is the decimal point common. Pins A, 1, and 3 select the various decimal points.

Differential Amplifier

The difference of $10V_1$ and $10V_2$ is found in amplifier A30.

Bath Amplifier

An HS-2 headstage can be plugged into connector J3. The voltage recorded by this headstage or by an external amplifier is buffered by A28.

Audio Monitor

The Audio Monitor puts out a tone whose pitch is proportional to V_1 or V_2 . When the selector switch is in the OFF position a negative input is applied to the voltage controlled oscillator U7 to switch it off. The pitch is tuned by RVT24. An earphone can be plugged into the Phone jack on the front panel. This disables the speaker drive.

Filters

Two second-order lowpass filters (assembly A1005) are located on the front panel. The input to each filter is selected by a rotary switch. The filter output can be bypassed.

Reference

A stable reference is generated in A35. This is inverted in A29 so that a bipolar reference is available.

STEP COMMAND GENERATOR - ASSEMBLY A1004

The setting of the thumbwheel switch establishes the current output of the multiplying digital-to-analog convertor A1. A2 converts the current output into a voltage output. The polarity and maximum output depends on the polarity and amplitude of the reference voltage connected to V_{in} of A1.

SECOND ORDER LOWPASS FILTER - ASSEMBLY A1005

This filter is a lowpass Sallen and Key filter. The filter is a multiple coincident pole type which has zero overshoot (damping ratio = 1). The twelve-position rotary switch rotates without stops.

ADJUSTMENT PROCEDURE

FOR SERIAL # 0126 AND ABOVE

Abbreviations

CMRR; common-mode rejection ratio

TP; test point

Vpp; volts peak-to-peak

gnd; ground

HCG; headstage current gain

scope; cathode ray oscilloscope

DVM; digital volt meter

DPM; digital panel meter

Equipment required

Differential-input scope with 50 uV/div resolution

DVM

Square-wave generator

Trim procedure

It is important to do the trims in the order presented because some of them rely on earlier trims. For brevity, only changes to the previous setup are listed for each trim.

Measurement techniques

Measuring 0 V. You will be asked to trim for 0 V differentially, e.g. across TP7 - TP8. First connect both probes from the scope to the ground point (the second mentioned test point, in this example TP8) to establish 0 V. Next connect the probes separately to the two test points and make the requested trim. See fig. 1 for details of how to ground the oscilloscope correctly.

Filtering. When measuring zero volts or establishing a null the input to the scope should be lowpass filtered at 10 kHz or less.

Measuring DC voltages. To eliminate offset errors from the measurement all of these measurements will be balanced. That is, the command potential will be switched alternately from +ve to -ve and the difference in the measured outputs will be measured. Connect DVM ground to yellow ground plug at rear of unit.

HCG. Some measurements require a x1 headstage and a 10 M 1% resistor. If you do not have a x1 headstage a x0.1 headstage can be used with a 100 M 1% resistor.

1. Reference Voltage accuracy

Using DVM monitor TP19(VT)

Thumbwheel on 100.0 continuous

Repetitively switch from +100.0 to -100.0

[] Trim RVT21 for 10.00V difference

2. Thumbwheel-to-Voltage Convertor offset

Thumbwheel on 000.0

On scope measure TP19(VT) - TP10(gnd) at 100 μ V/div

Repetitively switch from CONT. to EXT.

[] Adjust trim pot on back of thumbwheel for a null

3. CCS1 CMRR

Switch off all current commands

Plug x1 headstage into ME1 connector

Connect a 1 Vpp 100 Hz square wave directly to the headstage input

On scope measure TP8(Vo1) - source voltage at 100 μ V/div

[] Trim RVT18 for a null

4. I1 CMRR

On scope measure TP11(I1) - TP10(gnd) at 100 μ V/div

[] Trim RVT20 for a null

5. ME1 Command accuracy

Remove headstage

Link pins 8(gnd) and 11(V1A) with a 22 ohm resistor

Using DVM monitor TP8(Vo1)

Thumbwheel on 100.0 continuous

Destination ME1

Repetitively switch from +100.0 to -100.0

[] Trim RVT17 for 2.000 V difference

6. I DPM accuracy

Display current I1

Repetitively switch from +100.0 to -100.0

Adjust trim pot inside I1 DPM to read ± 100.0

7. ME1 Pulse offset

Thumbwheel off

On scope measure TP8(Vo1) - TP10(gnd) at $100\mu\text{V}/\text{div}$

Pulse potentiometer on zero

Establish level on scope for Pulse switch in OFF position

Set switch to CONT. position

Repetitively switch from + to -

Trim RVT16 for balanced shift about established level

8. CCS1 offset

Switch Pulse Command off

Trim RVT19 for OV

9. I1 offset

Set Resistance Compensation potentiometer to zero, Normal position

On scope measure TP12(10V1) at $2\text{mV}/\text{div}$

Use offset control to center trace on screen

Trim RVT13 so that trace does not shift as Resistance Compensation increased to maximum.

10. Headstage offset

Set Resistance Compensation potentiometer to zero

Plug headstage into ME1 slot

Ground via resistor of $10\text{ M} \div \text{H}$

Wait 5 min after plugging in headstage

Adjust trim pot inside headstage until there is no shift when the grounding resistor is shorted out

Repeat for other headstages

11. 10V1 accuracy

Plug in x1 headstage

Ground via 10 M Ω

Set Resistance Compensation to indicate 0 M Ω

Using DVM monitor TP16(F1)

On F1 select Ve1

Repetitively switch thumbwheel from +100.0 to -100.0

Make a note of the total voltage change

On F1 select 10V1

[] Trim RVT15 so change in 10V1 is ten times change in Ve1

12. V1 DPM accuracy

On F1 select Ve1

Continue repetitive switching

[] Adjust trim pot inside V1 DPM to read same total change as DVM

13. ME1 Resistance Compensation accuracy

On scope measure TP12(10V1) at 20mV/div

Ground via 10 M, 1% or better

Set Resistance Compensation to indicate 10 M

Thumbwheel on 100.0

Externally activate at 100 Hz

[] Trim RVT14 for a null

14. CCS2 CMRR

Switch off all current commands

Plug x1 headstage into ME2 connector

Connect a 1 Vpp 100 Hz square wave directly to the headstage input

On scope measure TP2(Vo2) - source voltage at 100 μ V/div

[] Trim RVT8 for a null

15. I2 CMRR

On scope measure TP5(I2) - TP4(gnd) at 100 μ V/div

[] Trim RVT10 for a null

16. ME2 Command accuracy

Remove headstage

Link pins 8(gnd) and 11(V1A) with a 22 ohm resistor

Using DVM monitor TP2(Vo2)

Thumbwheel on 100.0 continuous

Destination ME2

Repetitively switch from +100.0 to -100.0

[] Trim RVT7 for 2.000 V difference

17. ME2 Pulse offset

Thumbwheel off

On scope measure TP2(Vo2) - TP4(gnd) at 100 μ V/div

Pulse potentiometer on zero

Establish level on scope for Pulse switch in OFF position

Set switch to CONT. position

Repetitively switch from + to -

[] Trim RVT6 for balanced shift about established level

18. CCS2 offset

Switch Pulse Command off

[] Trim RVT9 for OV

19. I2 offset

Set Resistance Compensation potentiometer to zero, Normal position

On scope measure TP6(10V2) at 2mV/div

Use offset control to center trace on screen

[] Trim RVT3 so that trace does not shift as Resistance Compensation increased to maximum.

20. 10V2 accuracy

Plug in x1 headstage

Ground via 10 M Ω

Set Resistance Compensation to indicate 0 M Ω

Using DVM monitor TP17(F2)

On F2 select Ve2

Repetitively switch from +100.0 to -100.0

Make a note of the total voltage change

On F2 select 10V2

[] Trim RVT5 so change in 10V2 is ten times change in Ve2

21. V2 DPM accuracy

On F2 select Ve2

Continue repetitive switching

[] Adjust trim pot inside V2 DPM to read same total change as DVM

22. ME2 Resistance Compensation accuracy

On scope measure TP6(10V2) at 20mV/div

Ground via 10 M, 1% or better

Set Resistance Compensation to indicate 10 M Ω

Thumbwheel on 100.0

Externally activate at 100 Hz

[] Trim RVT4 for a null

23. 100V2 offset

Switch off external activation

Remove headstage

On scope measure TP3(100V2) - TP4(gnd) at 10mV/div

[] Trim RVT1 for OV

24. V1-V2 accuracy

Plug in two headstages

Connect a 1 Vpp 100 Hz square wave directly to both headstage inputs

On scope measure TP20(V1-V2) - TP4(gnd) at 10mV/div

[] Trim RVT23 for a null

25. CAL accuracy

Switch off external activation

Using DVM monitor TP18(CAL)

Repetitively activate CAL switch

[] Trim RVT22 for -1.000 V shift

26. Audio Monitor frequency

Connect scope or frequency meter to TP23(VCO)

Select V1 as Audio Monitor input

Set V1 Offset to 0 V

[] Trim RVT24 for 2.25 kHz (450 us period)



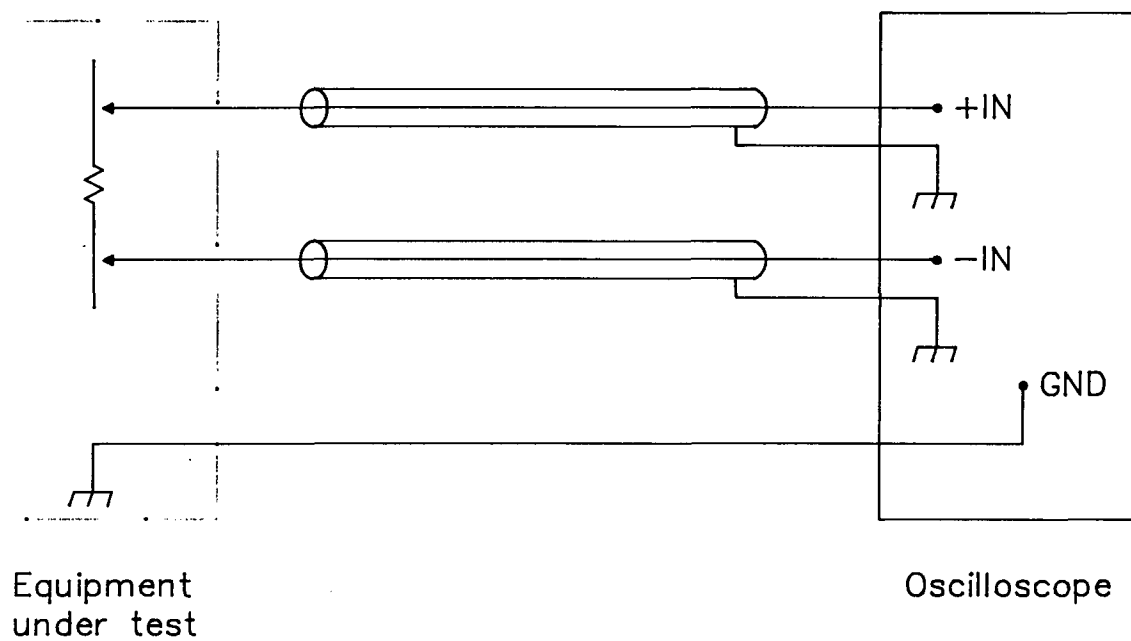


FIG. 1 - DIFFERENTIAL MEASUREMENTS ON OSCILLOSCOPE

Correct technique for connecting an oscilloscope to make differential measurements in low and medium frequencies.

MAINTENANCE

Adjustment and repair should only be attempted by skilled electronic technicians or engineers.

Caution

Line voltage is connected to some of the transformer leads and some parts of the power-supply board in the left hand side of the instrument. Always unplug the power cord before attempting to handle or repair these sections.

Access

All test points and trim potentiometers can be accessed by removing the top cover.

All components can be desoldered from the main circuit board without removing the board. Simply remove the bottom cover for access to the non-component side of the board. We anticipate no reason to remove the main circuit board.

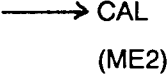
Routine Maintenance


Routine maintenance is not required. The adjustment procedure should be performed after repairs to the main circuit board but not otherwise.

As required, the operator of the instrument can perform the headstage leakage current adjustment described in the operator's manual.

DRAWING CONVENTIONS

Signal Identification


 refers to a signal called CAL going to the ME2 section of the circuit.

CAL 
 refers to a signal called CAL coming from the COMMON section of the circuit.

Signal Naming

The same name may be used for related devices, signals and time periods. Logic signals are named to correspond to positive logic. A bar over the name indicates the logic complement. Signal names in square boxes appear on the front and rear panels.


Component Values

Electrical components shown on the diagrams are in the following units unless noted otherwise.


Capacitors: Values one or greater are in picofarads (pF)
 Values less than one are in microfarads (uF)

Resistors: Ohms

Special Symbols


 Indicates SIGNAL leaves circuit board at connector number x, pin y.

Relays and semiconductor switches are normally shown unenergized.


 Trim potentiometer.


 Panel potentiometer.

Reserved Wire Colors

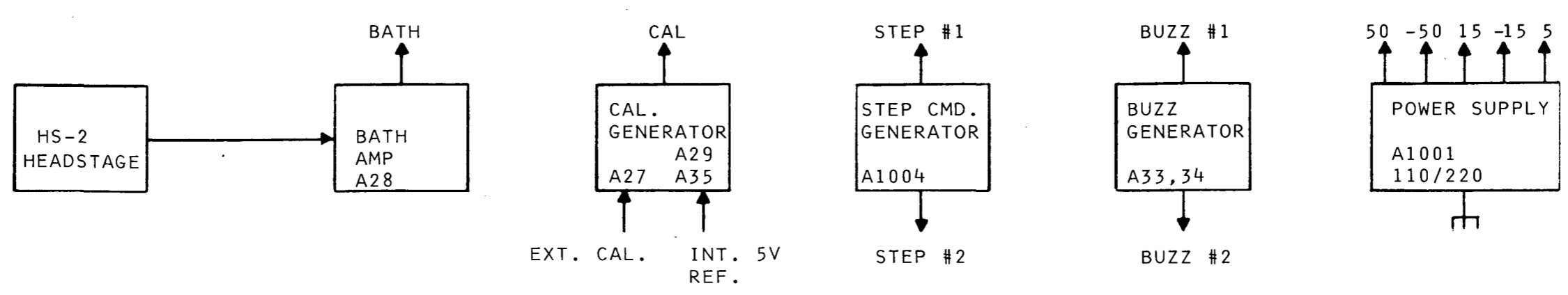
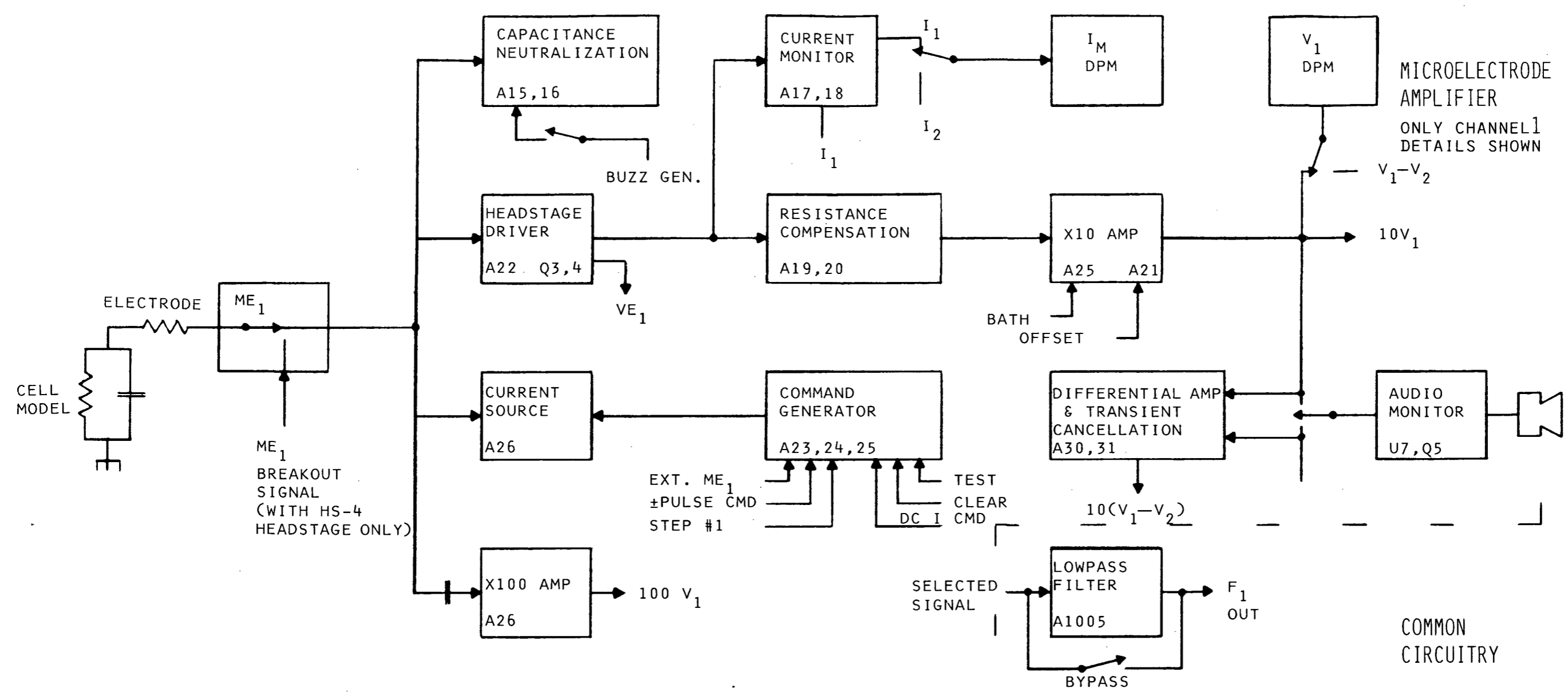
Orange: +5 V

Red: +15 V

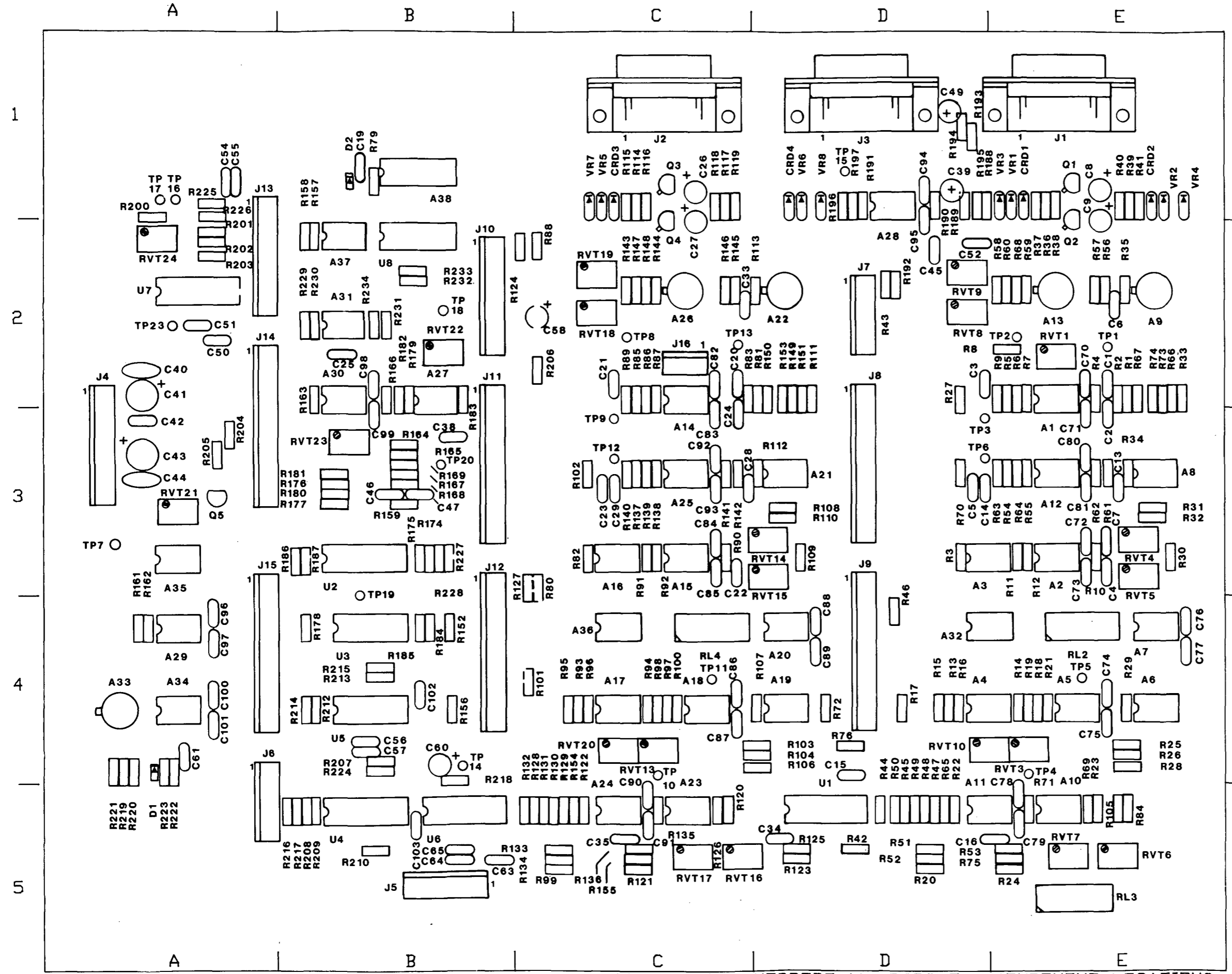
Yellow: Signal ground

Blue: -15 V

Green: Digital ground

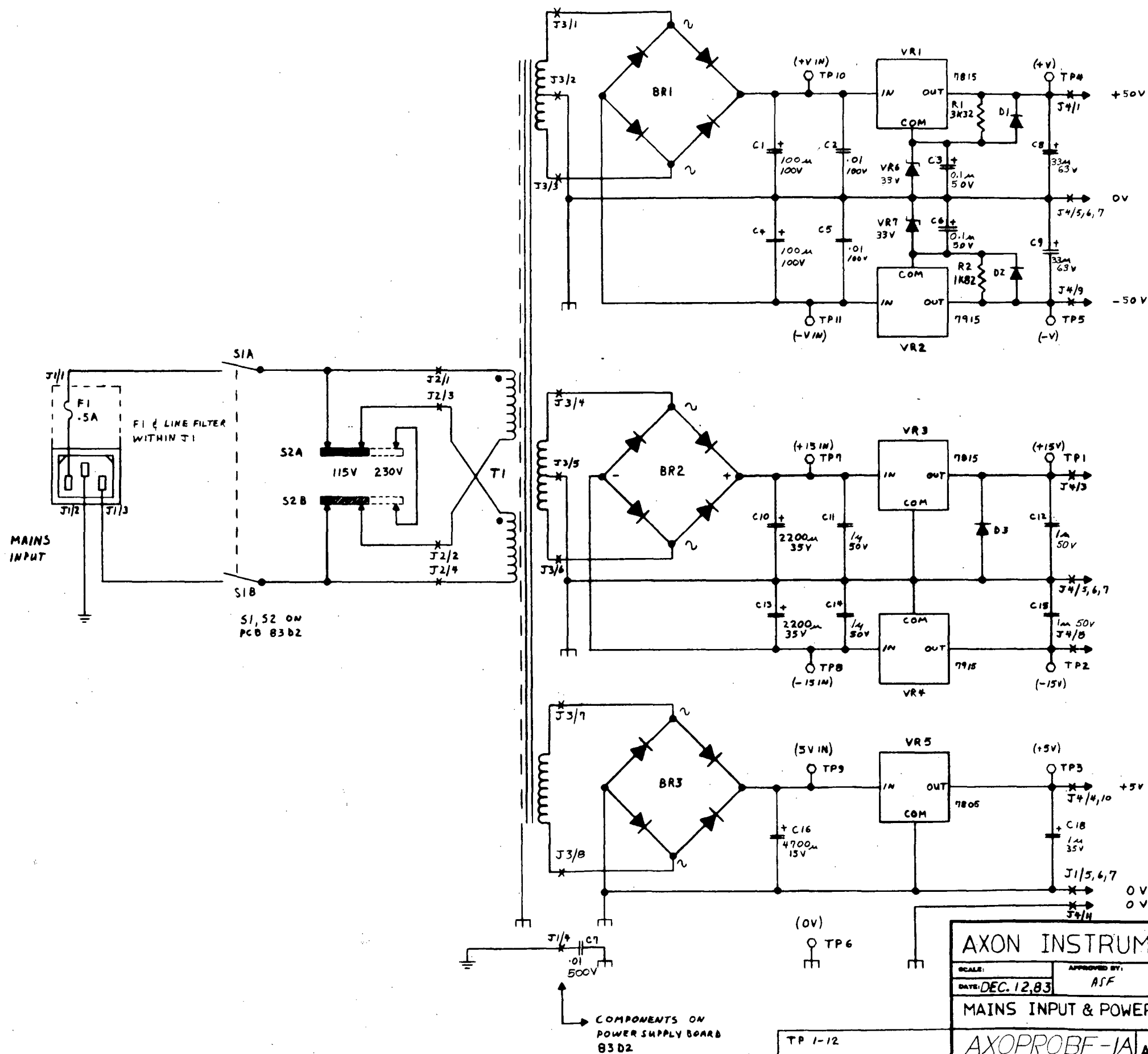


AXOPROBE BLOCK DIAGRAM



REF	LOCATION	REF	LOCATION
A1	2E	RVT1	2E
A2	3E	RVT2	NC
A3	3E	RVT3	4E
A4	4E	RVT4	3E
A5	4E	RVT5	3E
A6	4E	RVT6	5C
A7	4E	RVT7	5E
A8	3E	RVT8	2D
A9	2E	RVT9	2D
A10	5E	RVT10	4D
A11	5D	RVT11	NC
A12	3E	RVT12	NC
A13	2E	RVT13	4C
A14	2C	RVT14	3D
A15	3C	RVT15	3D
A16	3C	RVT16	5C
A17	4C	RVT17	5C
A18	4C	RVT18	2C
A19	4D	RVT19	2C
A20	4D	RVT20	4C
A21	3D	RVT21	3A
A22	2D	RVT22	2B
A23	5C	RVT23	3B
A24	5C	RVT24	2A
A25	3C		
A26	2C		
A27	2B	TP1	2E
A28	1D	TP2	2E
A29	4A	TP3	3E
A30	2B	TP4	4E
A31	2B	TP5	4E
A32	4E	TP6	3D
A33	4A	TP7	3A
A34	4A	TP8	2C
A35	3A	TP9	3C
A36	4C	TP10	4C
A37	2B	TP11	4C
A38	1B	TP12	3C
		TP13	2C
		TP14	4B
U1	5D	TP15	1D
U2	3B	TP16	1A
U3	4B	TP17	1A
U4	5B	TP18	2B
U5	4B	TP19	4B
U6	5B	TP20	3B
U7	2A	TP21	NC
U8	2B	TP22	NC
		TP23	2A

NOV-10-85 AXDPROBE-1A PCB8-5 COMPONENT LOCATIONS

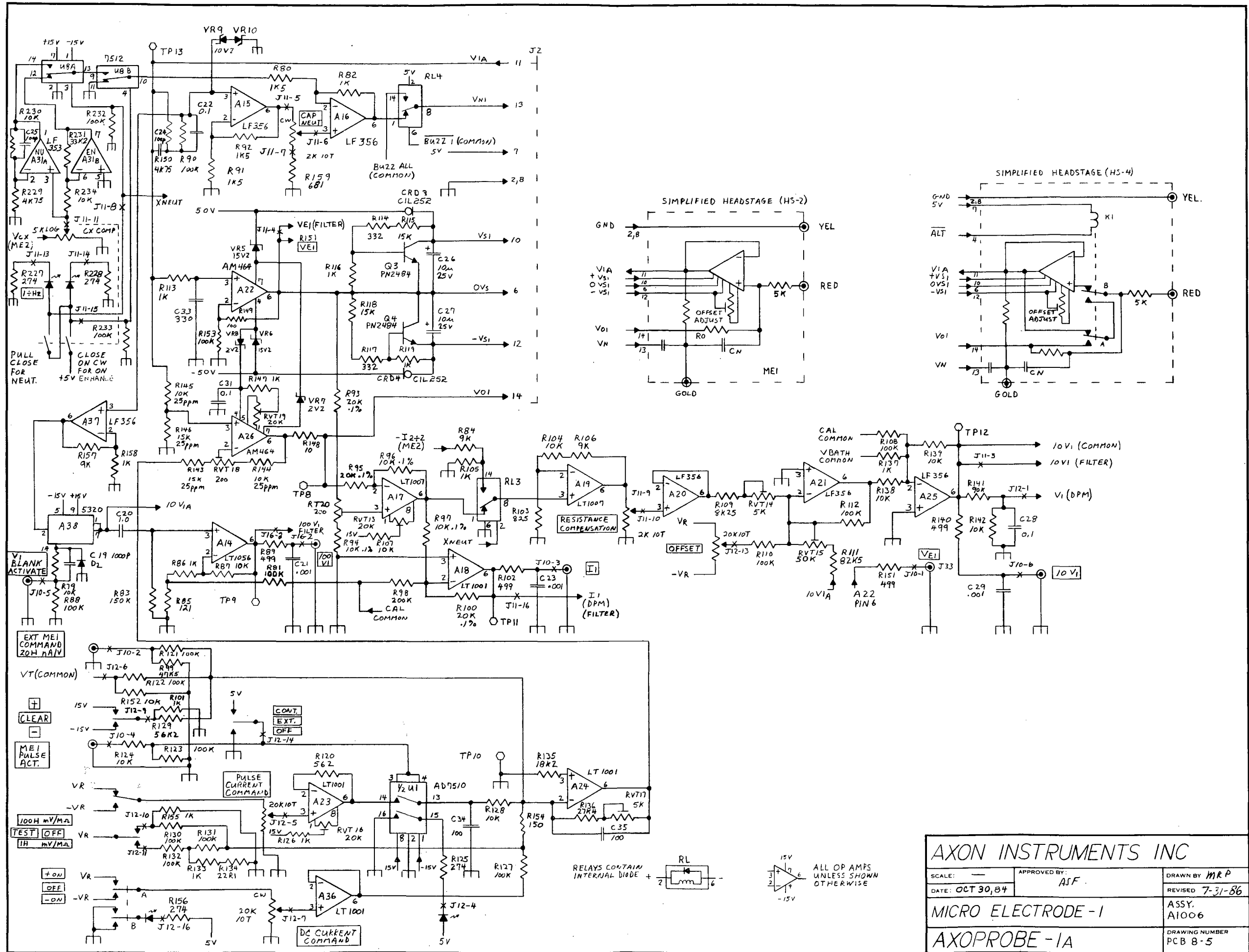


S1, S2 ON PCB 83B2

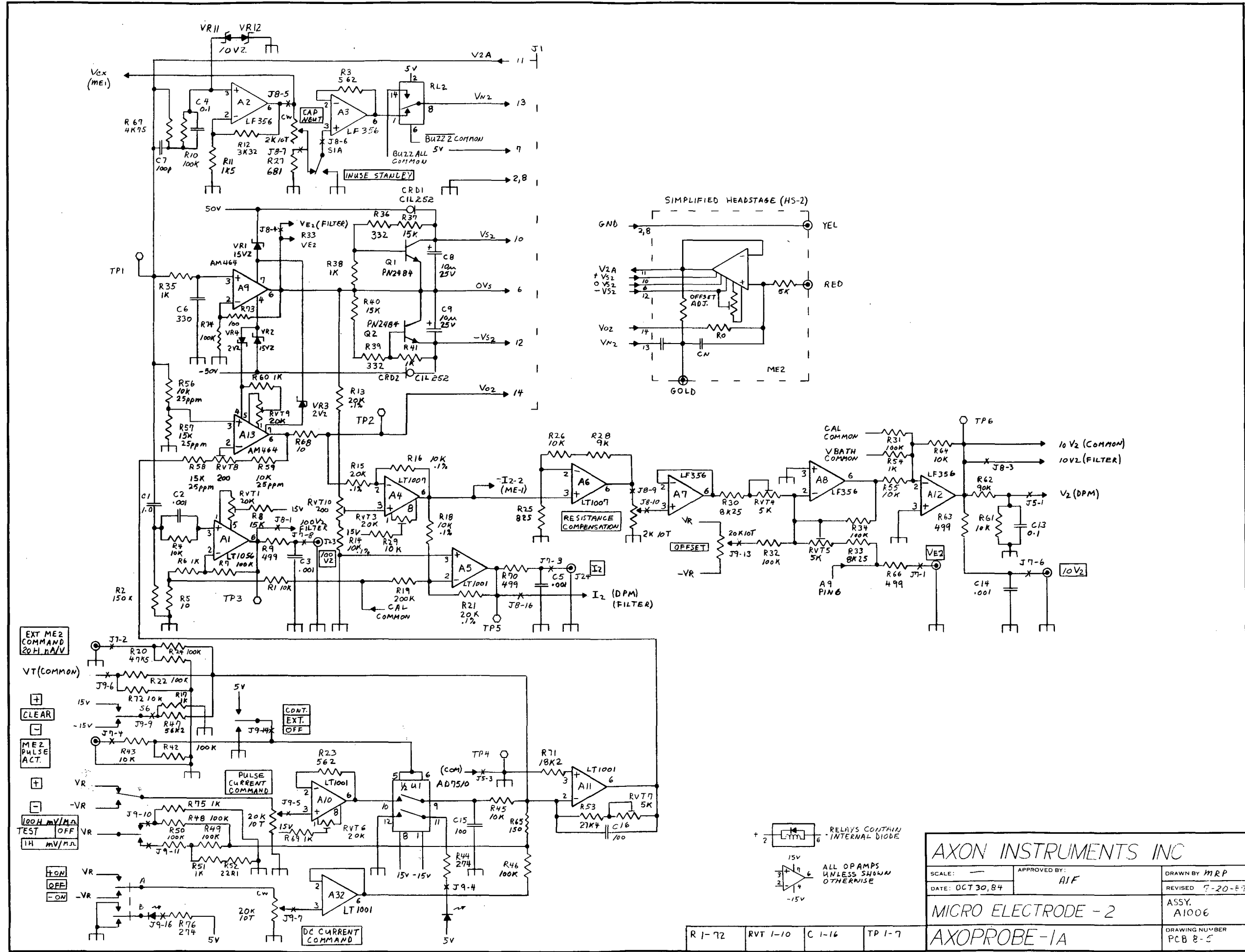
COMPONENTS ON POWER SUPPLY BOARD 83B2

TP 1-12

AXON INSTRUMENTS INC		
SCALE:	APPROVED BY:	DRAWN BY: MRP
DATE: DEC. 12, 83	ASF	REVISION: APR. 84
MAINS INPUT & POWER SUPPLY		
AXOPROBE-IA1007		PCB 83D2



AXON INSTRUMENTS INC		
SCALE: —	APPROVED BY: ASF	DRAWN BY: MRP
DATE: OCT 30, 84		REVISED: 7-31-86
MICRO ELECTRODE-1		ASSY. A1006
AXOPROBE-1A		DRAWING NUMBER PCB 8-5

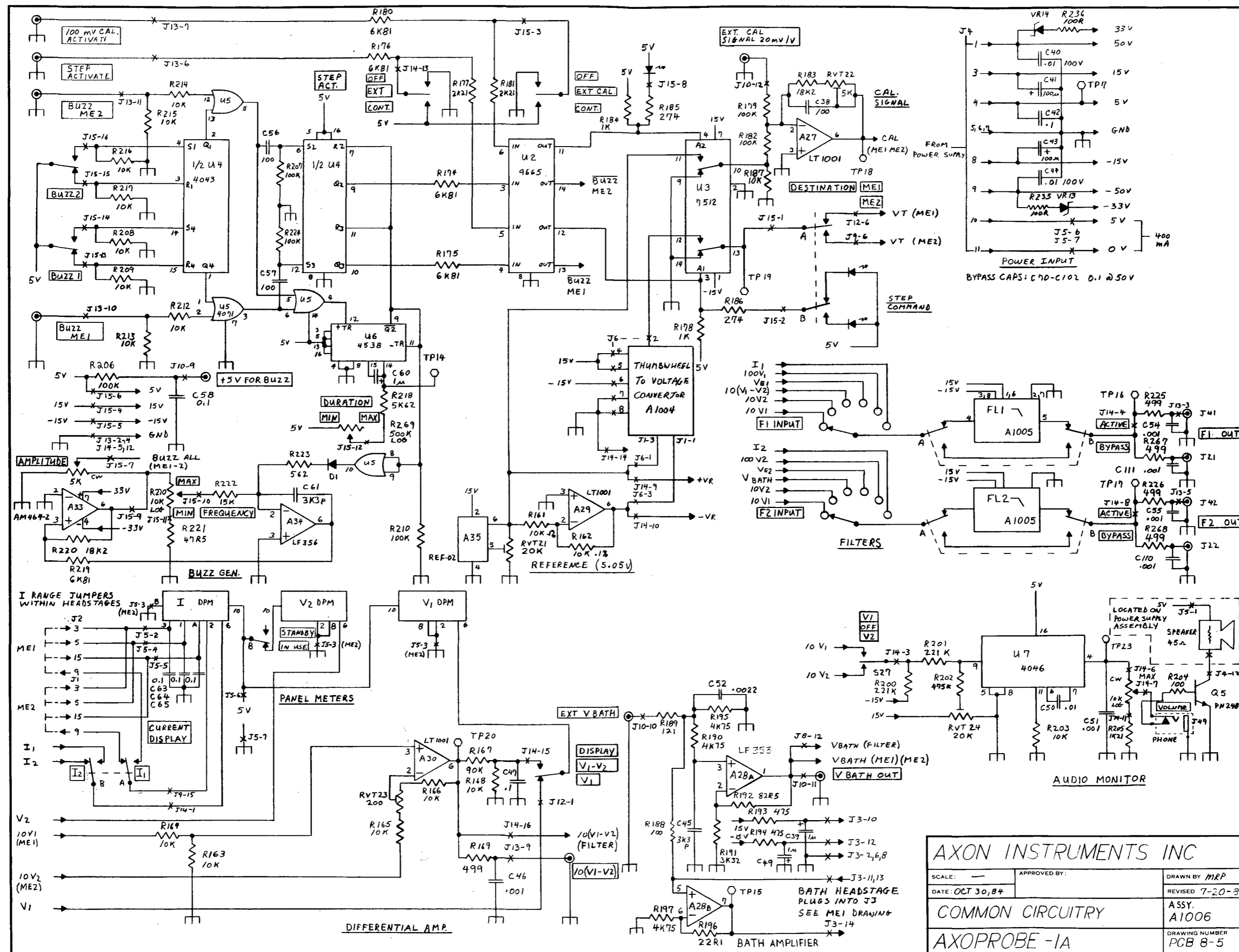


AXON INSTRUMENTS INC

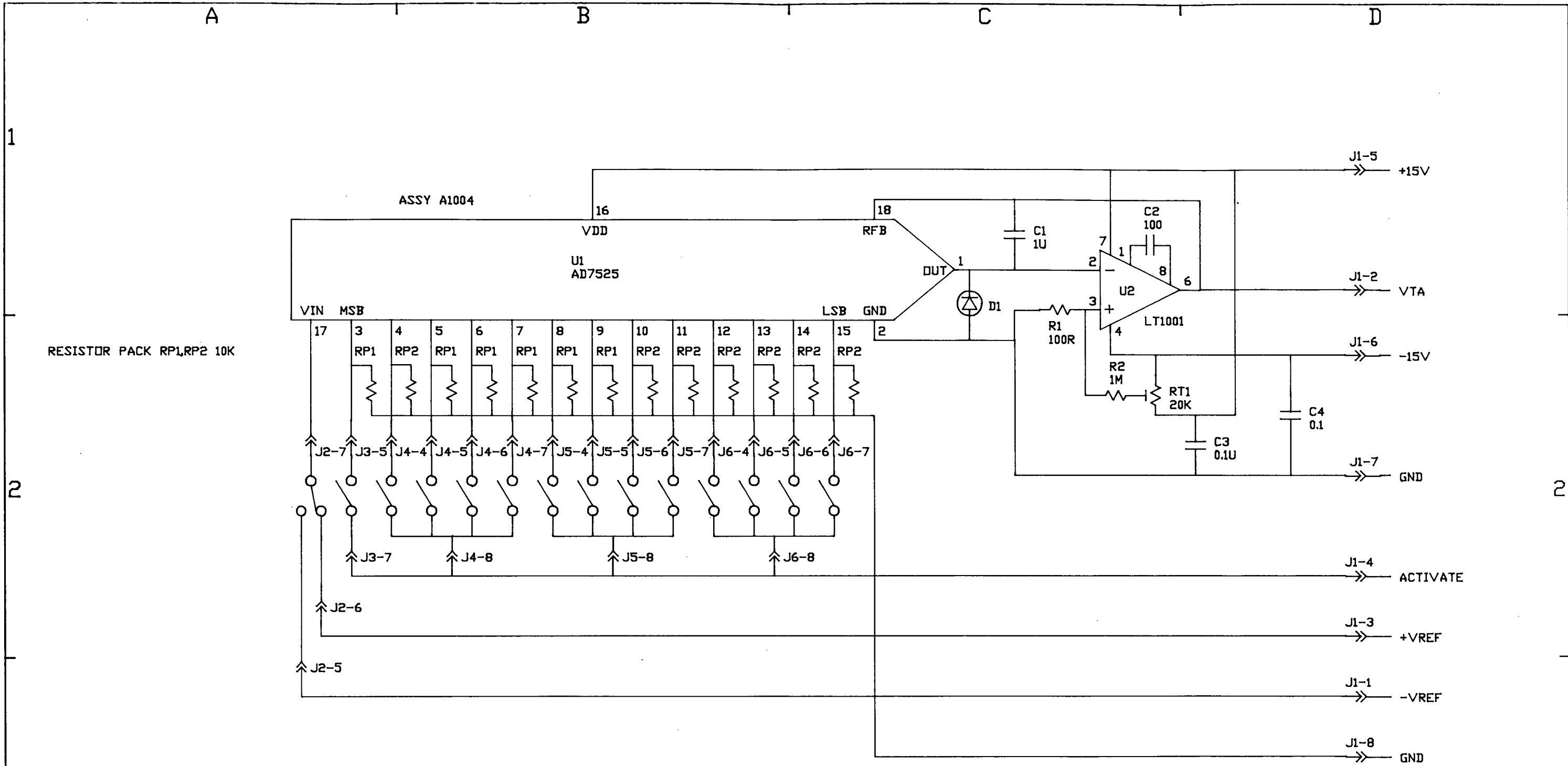
SCALE: — APPROVED BY: AIF
 DATE: OCT 30, 84 DRAWN BY: MRP
 REVISED: 7-20-87
 ASSY: A1006
 DRAWING NUMBER: PCB 8-5

MICRO ELECTRODE - 2
 AXOPROBE-1A

R 1-72 RVT 1-10 C 1-16 TP 1-7



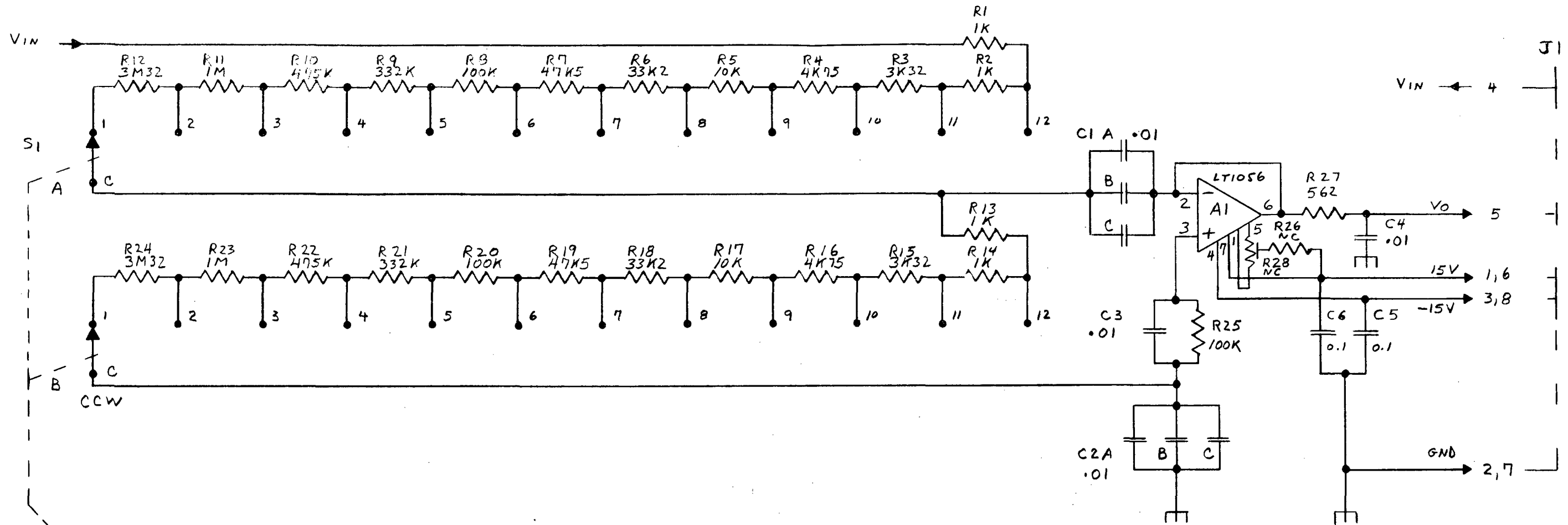
AXON INSTRUMENTS INC		
SCALE: —	APPROVED BY:	DRAWN BY <i>MRP</i>
DATE: OCT 30, 84		REVISED 7-20-87
COMMON CIRCUITRY		ASSY. A1006
AXOPROBE-1A		DRAWING NUMBER PCB 8-5



+	1	9	9	9
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COMPONENTS LOCATED BEHIND THUMBWHEEL SWITCH ON PCB0003

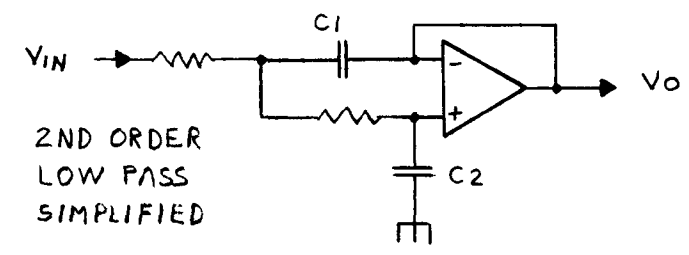
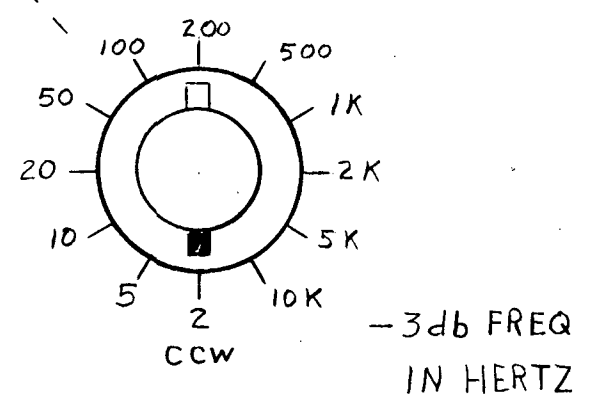
B	INITIAL PART	1 OF 1	JUN-11-87
REV	DESCRIPTION OF CHANGE	SHEETS AFFECTED	REV DATE
AXON INSTRUMENTS, INC.			MAY-12-87
PRODUCT	COMMON	TITLE THUMBWHEEL TO VOLTAGE CONVERTOR	
DWN BY	TOLERANCE: 0.XX ± 0.015*	FDR INTERNAL USE	DWG #
BB	XX* ±3* 0.XXX ± 0.005*	07264CC	PCB0003
		SHEET #	1 OF 1



NOTE: C1B,C
C2B,C
NOT USED

IF A1 = LT1056
DELETE R26, 28

ALL COMPONENTS
ON PCB 9-1



AXON INSTRUMENTS INC		
SCALE:	APPROVED BY:	DRAWN BY MRP
DATE: May 84		REVISED 4-21-86
2ND ORDER LOWPASS FILTER		ASSY NUMBER A1005
		DRAWING NUMBER PCB 9-1

R1-28 C1-6

BILL OF MATERIALS WITH BURDEN
AXON INSTRUMENTS, INC., 07/17/87

FOR ASSEMBLY A1006 CIRCUIT, AXOPROBE-1 MAIN BOARD

PAGE 1

ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
22048AA1056	*1	1	IC, OP AMP, FET, LT1056	1.000	A1
22048AA356	*1	2	IC, OP AMP, FET, LF356	1.000	A2
22048AA356	*1	3	IC, OP AMP, FET, LF356	1.000	A3
22048AA1007	*1	4	IC, OP AMP, LT1007	1.000	A4
22048AA1001	*1	5	IC, OP AMP, LT1001	1.000	A5
22048AA1007	*1	6	IC, OP AMP, LT1007	1.000	A6
22048AA356	*1	7	IC, OP AMP, FET, LF356	1.000	A7
22048AA356	*1	8	IC, OP AMP, FET, LF356	1.000	A8
22048AA4642	*1	9	IC, OP AMP, 45V, AM464-2/22645	1.000	A9
22048AA1001	*1	10	IC, OP AMP, LT1001	1.000	A10
22048AA1001	*1	11	IC, OP AMP, LT1001	1.000	A11
22048AA356	*1	12	IC, OP AMP, FET, LF356	1.000	A12
22048AA4642	*1	13	IC, OP AMP, 45V, AM464-2/22645	1.000	A13
22048AA1056	*1	14	IC, OP AMP, FET, LT1056	1.000	A14
22048AA356	*1	15	IC, OP AMP, FET, LF356	1.000	A15
22048AA356	*1	16	IC, OP AMP, FET, LF356	1.000	A16
22048AA1007	*1	17	IC, OP AMP, LT1007	1.000	A17
22048AA1001	*1	18	IC, OP AMP, LT1001	1.000	A18
22048AA1007	*1	19	IC, OP AMP, LT1007	1.000	A19
22048AA356	*1	20	IC, OP AMP, FET, LF356	1.000	A20
22048AA356	*1	21	IC, OP AMP, FET, LF356	1.000	A21
22048AA4642	*1	22	IC, OP AMP, 45V, AM464-2/22645	1.000	A22
22048AA1001	*1	23	IC, OP AMP, LT1001	1.000	A23
22048AA1001	*1	24	IC, OP AMP, LT1001	1.000	A24
22048AA356	*1	25	IC, OP AMP, FET, LF356	1.000	A25
22048AA4642	*1	26	IC, OP AMP, 45V, AM464-2/22645	1.000	A26
22048AA1001	*1	27	IC, OP AMP, LT1001	1.000	A27
22048AA353	*1	28	IC, OP AMP, DUAL, LF353	1.000	A28
22048AA1001	*1	29	IC, OP AMP, LT1001	1.000	A29
22048AA1001	*1	30	IC, OP AMP, LT1001	1.000	A30
22048AA353	*1	31	IC, OP AMP, DUAL, LF353	1.000	A31
22048AA1001	*1	32	IC, OP AMP, LT1001	1.000	A32
22048AA4642	*1	33	IC, OP AMP, 45V, AM464-2/22645	1.000	A33
22048AA356	*1	34	IC, OP AMP, FET, LF356	1.000	A34
22048AD02C	*1	35	IC, VOLTAGE REF, +5V, REF-02C	1.000	A35
22048AA1001	*1	36	IC, OP AMP, LT1001	1.000	A36
22048AA356	*1	37	IC, OP AMP, FET, LF356	1.000	A37
22032AA5320	*1	38	IC, S + H, 5320-5	1.000	A38
22048AB7510	*1	51	IC, QUAD CMOS SPST SWITCHES, 7510DIJ	1.000	U1
22032AC9665	*1	52	IC, HEPT DARLINGTON DRIVER, 9665	1.000	U2
22048AB7512	*1	53	IC, DUAL CMOS SPDT SWITCHES, 7512DIJ	1.000	U3
22016AA4043	*1	54	IC, CMOS, QUAD R-S LATCH, 4043	1.000	U4
22016AA4071	*1	55	IC, CMOS, QUAD 2-INP OR, 4071	1.000	U5
22016AA4538	*1	56	IC, CMOS, DUAL MONOSTABLE, 4538	1.000	U6
22016AA4046	*1	57	IC, CMOS, PHASE-LOCKED LOOP, NAT SEMI, 4046	1.000	U7
22048AB7512	*1	58	IC, DUAL CMOS SPDT SWITCHES, 7512DIJ	1.000	U8
46736AA2484	*1	101	TRANSISTOR, SI, NPN, TO-92, 2484/PN100A	1.000	Q1
46736AA2484	*1	102	TRANSISTOR, SI, NPN, TO-92, 2484/PN100A	1.000	Q2
46736AA2484	*1	103	TRANSISTOR, SI, NPN, TO-92, 2484/PN100A	1.000	Q3
46736AA2484	*1	104	TRANSISTOR, SI, NPN, TO-92, 2484/PN100A	1.000	Q4
46736AA2484	*1	105	TRANSISTOR, SI, NPN, TO-92, 2484/PN100A	1.000	Q5
14888AA1305	*1	201	DIODE, CUR RGLTR, 600MW, 75POV, 5MA, CIL1305	1.000	CRD1
14888AA1305	*1	202	DIODE, CUR RGLTR, 600MW, 75POV, 5MA, CIL1305	1.000	CRD2
14888AA1305	*1	203	DIODE, CUR RGLTR, 600MW, 75POV, 5MA, CIL1305	1.000	CRD3

BILL OF MATERIALS WITH BURDEN
 AXON INSTRUMENTS, INC., 07/17/87

FOR ASSEMBLY A1006

CIRCUIT, AXOPROBE-1 MAIN BOARD

PAGE 2

ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
1488AA1305	*1	204	DIODE, CUR RGLTR, 600MW, 75POV, 5MA, CIL1305	1.000	CRD4
15344AA965A	*1	301	DIODE, ZENER, 500MW, 15V, 1N965A	1.000	VR1
15344AA965A	*1	302	DIODE, ZENER, 500MW, 15V, 1N965A	1.000	VR2
15344AA4614	*1	303	DIODE, ZENER, 500MW, 1.8V, 1N4614	1.000	VR3
15344AA4614	*1	304	DIODE, ZENER, 500MW, 1.8V, 1N4614	1.000	VR4
15344AA965A	*1	305	DIODE, ZENER, 500MW, 15V, 1N965A	1.000	VR5
15344AA965A	*1	306	DIODE, ZENER, 500MW, 15V, 1N965A	1.000	VR6
15344AA4614	*1	307	DIODE, ZENER, 500MW, 1.8V, 1N4614	1.000	VR7
15344AA4614	*1	308	DIODE, ZENER, 500MW, 1.8V, 1N4614	1.000	VR8
15344AA758	*1	309	DIODE, ZENER, 500MW, 10V, 1N758	1.000	VR9
15344AA758	*1	310	DIODE, ZENER, 500MW, 10V, 1N758	1.000	VR10
15344AA758	*1	311	DIODE, ZENER, 500MW, 10V, 1N758	1.000	VR11
15344AA758	*1	312	DIODE, ZENER, 500MW, 10V, 1N758	1.000	VR12
15344AA965A	*1	313	DIODE, ZENER, 500MW, 15V, 1N965A	1.000	VR13
15344AA965A	*1	314	DIODE, ZENER, 500MW, 15V, 1N965A	1.000	VR14
05488AD1004	*1	401	CAP, CER, ML, 50V, 20%, 1U	1.000	C1
05520AA1001	*1	402	CAP, FILM, 10%, 100V, 0.001U	1.000	C2
05520AA1001	*1	403	CAP, FILM, 10%, 100V, 0.001U	1.000	C3
05488AC1003	*1	404	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C4
05520AA1001	*1	405	CAP, FILM, 10%, 100V, 0.001U	1.000	C5
05472AA3300	*1	406	CAP, CER, DISC, 50V, 10%, 330P	1.000	C6
05472AA1000	*1	407	CAP, CER, DISC, 50V, 10%, 100P	1.000	C7
05760AB1005	*1	408	CAP, TANT, 25V, 10U	1.000	C8
05760AB1005	*1	409	CAP, TANT, 25V, 10U	1.000	C9
00000AB	*1	410	NC	1.000	C10
00000AB	*1	411	NC	1.000	C11
00000AB	*1	412	NC	1.000	C12
05488AC1003	*1	413	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C13
05520AA1001	*1	414	CAP, FILM, 10%, 100V, 0.001U	1.000	C14
05472AA1000	*1	415	CAP, CER, DISC, 50V, 10%, 100P	1.000	C15
05472AA1000	*1	416	CAP, CER, DISC, 50V, 10%, 100P	1.000	C16
00000AB	*1	417	NC	1.000	C17
00000AB	*1	418	NC	1.000	C18
05520AA1001	*1	419	CAP, FILM, 10%, 100V, 0.001U	1.000	C19
05488AD1004	*1	420	CAP, CER, ML, 50V, 20%, 1U	1.000	C20
05520AA1001	*1	421	CAP, FILM, 10%, 100V, 0.001U	1.000	C21
05488AC1003	*1	422	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C22
05520AA1001	*1	423	CAP, FILM, 10%, 100V, 0.001U	1.000	C23
05472AA1000	*1	424	CAP, CER, DISC, 50V, 10%, 100P	1.000	C24
05472AA1000	*1	425	CAP, CER, DISC, 50V, 10%, 100P	1.000	C25
05760AB1005	*1	426	CAP, TANT, 25V, 10U	1.000	C26
05760AB1005	*1	427	CAP, TANT, 25V, 10U	1.000	C27
05488AC1003	*1	428	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C28
05520AA1001	*1	429	CAP, FILM, 10%, 100V, 0.001U	1.000	C29
00000AB	*1	430	NC	1.000	C30
00000AB	*1	431	NC	1.000	C31
00000AB	*1	432	NC	1.000	C32
05472AA3300	*1	433	CAP, CER, DISC, 50V, 10%, 330P	1.000	C33
05472AA1000	*1	434	CAP, CER, DISC, 50V, 10%, 100P	1.000	C34
05472AA1000	*1	435	CAP, CER, DISC, 50V, 10%, 100P	1.000	C35
00000AB	*1	436	NC	1.000	C36
00000AB	*1	437	NC	1.000	C37
05472AA1000	*1	438	CAP, CER, DISC, 50V, 10%, 100P	1.000	C38
05760AA1004	*1	439	CAP, TANT, 35V, 1U	1.000	C39

BILL OF MATERIALS WITH BURDEN
 AXON INSTRUMENTS, INC., 07/17/87

FOR ASSEMBLY A1006 CIRCUIT, AXOPROBE-1 MAIN BOARD

ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
05472AB1002	*1	440	CAP, CER, DISC, 500V, 0.01U	1.000	C40
05456AF1006	*1	441	CAP, ALUM, ELCTLT, RDL LEAD, 25V, 100U	1.000	C41
05488AC1003	*1	442	CAP, CER, ML, 50V, 0.2IN, 0.1U	1.000	C42
05456AF1006	*1	443	CAP, ALUM, ELCTLT, RDL LEAD, 25V, 100U	1.000	C43
05472AB1002	*1	444	CAP, CER, DISC, 500V, 0.01U	1.000	C44
05520AA3301	*1	445	CAP, FILM, 10%, 100V, 0.0033U	1.000	C45
05520AA1001	*1	446	CAP, FILM, 10%, 100V, 0.001U	1.000	C46
05488AC1003	*1	447	CAP, CER, ML, 50V, 0.2IN, 0.1U	1.000	C47
00000AB	*1	448	NC	1.000	C48
05760AA1004	*1	449	CAP, TANT, 35V, 1U	1.000	C49
05520AA1002	*1	450	CAP, FILM, 10% 100V, 0.01U	1.000	C50
05520AA1001	*1	451	CAP, FILM, 10%, 100V, 0.001U	1.000	C51
05520AA2201	*1	452	CAP, FILM, 10%, 100V, 0.0022U	1.000	C52
00000AB	*1	453	NC	1.000	C53
05520AA1001	*1	454	CAP, FILM, 10%, 100V, 0.001U	1.000	C54
05520AA1001	*1	455	CAP, FILM, 10%, 100V, 0.001U	1.000	C55
05472AA1000	*1	456	CAP, CER, DISC, 50V, 10%, 100P	1.000	C56
05472AA1000	*1	457	CAP, CER, DISC, 50V, 10%, 100P	1.000	C57
05488AC1003	*1	458	CAP, CER, ML, 50V, 0.2IN, 0.1U	1.000	C58
00000AB	*1	459	NC	1.000	C59
05760AA1004	*1	460	CAP, TANT, 35V, 1U	1.000	C60
05520AA3301	*1	461	CAP, FILM, 10%, 100V, 0.0033U	1.000	C61
05488AC1003	*1	462	CAP, CER, ML, 50V, 0.2IN, 0.1U	1.000	C62
05488AC1003	*1	463	CAP, CER, ML, 50V, 0.2IN, 0.1U	1.000	C63
05488AC1003	*1	464	CAP, CER, ML, 50V, 0.2IN, 0.1U	1.000	C64
05488AC1003	*1	465	CAP, CER, ML, 50V, 0.2IN, 0.1U	1.000	C65
00000AB	*1	466	NC	1.000	C66
00000AB	*1	467	NC	1.000	C67
00000AB	*1	468	NC	1.000	C68
00000AB	*1	469	NC	1.000	C69
05488AC1003	*1	470	CAP, CER, ML, 50V, 0.2IN, 0.1U	34.000	C70-103
35440BA	*1	502	RELAY, PCB MOUNT, DIP, FORM 1C, 5V	1.000	RL2
35440BA	*1	503	RELAY, PCB MOUNT, DIP, FORM 1C, 5V	1.000	RL3
35440BA	*1	504	RELAY, PCB MOUNT, DIP, FORM 1C, 5V	1.000	RL4
15216AA914	*1	551	DIODE, SI, 1N914	1.000	D1
15216AA914	*1	552	DIODE, SI, 1N914	1.000	D2
09456CE015	*1	601	CONN, D SUB, FEMALE, 90 DEG PCB W/BRKT, 15-PIN	1.000	J1
09456CE015	*1	602	CONN, D SUB, FEMALE, 90 DEG PCB W/BRKT, 15-PIN	1.000	J2
09456CE015	*1	603	CONN, D SUB, FEMALE, 90 DEG PCB W/BRKT, 15-PIN	1.000	J3
09696CA012	*1	604	CONN, PCB, 0.100, STRAIGHT, GOLD, 12-PIN	1.000	J4
09696CA008	*1	605	CONN, PCB, 0.100, STRAIGHT, GOLD, 8-PIN	1.000	J5
09696CA008	*1	606	CONN, PCB, 0.100, STRAIGHT, GOLD, 8-PIN	1.000	J6
09696CA008	*1	607	CONN, PCB, 0.100, STRAIGHT, GOLD, 8-PIN	1.000	J7
09696CA016	*1	608	CONN, PCB, 0.100, STRAIGHT, GOLD, 16-PIN	1.000	J8
09696CA016	*1	609	CONN, PCB, 0.100, STRAIGHT, GOLD, 16-PIN	1.000	J9
09696CA012	*1	610	CONN, PCB, 0.100, STRAIGHT, GOLD, 12-PIN	1.000	J10
09696CA016	*1	611	CONN, PCB, 0.100, STRAIGHT, GOLD, 16-PIN	1.000	J11
09696CA016	*1	612	CONN, PCB, 0.100, STRAIGHT, GOLD, 16-PIN	1.000	J12
09696CA012	*1	613	CONN, PCB, 0.100, STRAIGHT, GOLD, 12-PIN	1.000	J13
09696CA016	*1	614	CONN, PCB, 0.100, STRAIGHT, GOLD, 16-PIN	1.000	J14
09696CA016	*1	615	CONN, PCB, 0.100, STRAIGHT, GOLD, 16-PIN	1.000	J15
09696CA004	*1	616	CONN, PCB, 0.100, STRAIGHT, GOLD, 4-PIN	1.000	J16A,B
20688CB	*1	701	HEAT SINK, TO-5, PRESS ON	1.000	FOR A9
20688CB	*1	702	HEAT SINK, TO-5, PRESS ON	1.000	FOR A13

BILL OF MATERIALS WITH BURDEN
AXON INSTRUMENTS, INC., 07/17/87

ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
20688CB	*1	703	HEAT SINK, TO-5, PRESS ON	1.000	FOR A22
20688CB	*1	704	HEAT SINK, TO-5, PRESS ON	1.000	FOR A26
20688CB	*1	705	HEAT SINK, TO-5, PRESS ON	1.000	FOR A33
31856AA2002	*1	801	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 20K	1.000	RVT1
00000AB	*1	802	NC	1.000	RVT2
31856AA2002	*1	803	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 20K	1.000	RVT3
31856AA5001	*1	804	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 5K	1.000	RVT4
31856AA5001	*1	805	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 5K	1.000	RVT5
31856AA2002	*1	806	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 20K	1.000	RVT6
31856AA5001	*1	807	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 5K	1.000	RVT7
31856AA2000	*1	808	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 200R	1.000	RVT8
31856AA2002	*1	809	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 20K	1.000	RVT9
31856AA2000	*1	810	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 200R	1.000	RVT10
00000AB	*1	811	NC	1.000	RVT11
00000AB	*1	812	NC	1.000	RVT12
31856AA2002	*1	813	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 20K	1.000	RVT13
31856AA5001	*1	814	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 5K	1.000	RVT14
31856AA5002	*1	815	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 50K	1.000	RVT15
31856AA2002	*1	816	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 20K	1.000	RVT16
31856AA5001	*1	817	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 5K	1.000	RVT17
31856AA2000	*1	818	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 200R	1.000	RVT18
31856AA2002	*1	819	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 20K	1.000	RVT19
31856AA2000	*1	820	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 200R	1.000	RVT20
31856AA2002	*1	821	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 20K	1.000	RVT21
31856AA5001	*1	822	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 5K	1.000	RVT22
31856AA2000	*1	823	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 200R	1.000	RVT23
31856AA2002	*1	824	POT, TRIM, MULTITURN, CERMET, TOP ADJUST, 20K	1.000	RVT24
38976CA008	*1	901	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA1
38976CA008	*1	902	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA2
38976CA008	*1	903	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA3
38976CA008	*1	904	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA4
38976CA008	*1	905	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA5
38976CA008	*1	906	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA6
38976CA008	*1	907	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA7
38976CA008	*1	908	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA8
38976CB008	*1	909	SOCKET, IC, GOLD PLD, 8-PIN ROUND, 0.23 DIA	1.000	XA9
38976CA008	*1	910	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA10
38976CA008	*1	911	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA11
38976CA008	*1	912	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA12
38976CB008	*1	913	SOCKET, IC, GOLD PLD, 8-PIN ROUND, 0.23 DIA	1.000	XA13
38976CA008	*1	914	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA14
38976CA008	*1	915	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA15
38976CA008	*1	916	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA16
38976CA008	*1	917	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA17
38976CA008	*1	918	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA18
38976CA008	*1	919	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA19
38976CA008	*1	920	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA20
38976CA008	*1	921	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA21
38976CB008	*1	922	SOCKET, IC, GOLD PLD, 8-PIN ROUND, 0.23 DIA	1.000	XA22
38976CA008	*1	923	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA23
38976CA008	*1	924	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA24
38976CA008	*1	925	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA25
38976CB008	*1	926	SOCKET, IC, GOLD PLD, 8-PIN ROUND, 0.23 DIA	1.000	XA26
38976CA008	*1	927	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA27

BILL OF MATERIALS WITH BURDEN
 AXON INSTRUMENTS, INC., 07/17/87

FOR ASSEMBLY A1006 CIRCUIT, AXOPROBE-1 MAIN BOARD

ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
38976CA008	*1	928	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA28
38976CA008	*1	929	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA29
38976CA008	*1	930	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA30
38976CA008	*1	931	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA31
38976CA008	*1	932	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA32
38976CB008	*1	933	SOCKET, IC, GOLD PLD, 8-PIN ROUND, 0.23 DIA	1.000	XA33
38976CA008	*1	934	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA34
38976CA008	*1	935	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA35
38976CA008	*1	936	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA36
38976CA008	*1	937	SOCKET, IC, GOLD PLD, DUAL LEAF, 8-PIN	1.000	XA37
38976CA014	*1	938	SOCKET, IC, GOLD PLD, DUAL LEAF, 14-PIN	1.000	XA38
38976CA016	*1	951	SOCKET, IC, GOLD PLD, DUAL LEAF, 16-PIN	1.000	XU1
38976CA016	*1	952	SOCKET, IC, GOLD PLD, DUAL LEAF, 16-PIN	1.000	XU2
38976CA014	*1	953	SOCKET, IC, GOLD PLD, DUAL LEAF, 14-PIN	1.000	XU3
38976CA016	*1	954	SOCKET, IC, GOLD PLD, DUAL LEAF, 16-PIN	1.000	XU4
38976CA014	*1	955	SOCKET, IC, GOLD PLD, DUAL LEAF, 14-PIN	1.000	XU5
38976CA016	*1	956	SOCKET, IC, GOLD PLD, DUAL LEAF, 16-PIN	1.000	XU6
38976CA016	*1	957	SOCKET, IC, GOLD PLD, DUAL LEAF, 16-PIN	1.000	XU7
38976CA014	*1	958	SOCKET, IC, GOLD PLD, DUAL LEAF, 14-PIN	1.000	XU8
38976CA014	*1	972	SOCKET, IC, GOLD PLD, DUAL LEAF, 14-PIN	1.000	XRL2
38976CA014	*1	973	SOCKET, IC, GOLD PLD, DUAL LEAF, 14-PIN	1.000	XRL3
38976CA014	*1	974	SOCKET, IC, GOLD PLD, DUAL LEAF, 14-PIN	1.000	XRL4
35952AA1002	*1	1001	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R1
35952AA1503	*1	1002	RES, FILM, MET, 0.25W, 1%, 100PPM, 150K	1.000	R2
35952AA5620	*1	1003	RES, FILM, MET, 0.25W, 1%, 100PPM, 562R	1.000	R3
35952AA1002	*1	1004	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R4
35952AA100*	*1	1005	RES, FILM, MET, 0.25W, 1%, 100PPM, 10R	1.000	R5
35952AA1001	*1	1006	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R6
35952AA1003	*1	1007	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R7
35952AA1502	*1	1008	RES, FILM, MET, 0.25W, 1%, 100PPM, 15.0K	1.000	R8
35952AA4990	*1	1009	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	R9
35952AA1003	*1	1010	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R10
35952AA1501	*1	1011	RES, FILM, MET, 0.25W, 1%, 100PPM, 1.5K	1.000	R11
35952AA3321	*1	1012	RES, FILM, MET, 0.25W, 1%, 100PPM, 3.32K	1.000	R12
35952AC2002	*1	1013	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 20.00K	1.000	R13
35952AC1002	*1	1014	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K	1.000	R14
35952AC2002	*1	1015	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 20.00K	1.000	R15
35952AC1002	*1	1016	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K	1.000	R16
35952AA1001	*1	1017	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R17
35952AC1002	*1	1018	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K	1.000	R18
35952AA2003	*1	1019	RES, FILM, MET, 0.25W, 1%, 100PPM, 200K	1.000	R19
35952AA4752	*1	1020	RES, FILM, MET, 0.25W, 1%, 100PPM, 47.5K	1.000	R20
35952AC2002	*1	1021	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 20.00K	1.000	R21
35952AA1003	*1	1022	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R22
35952AA5620	*1	1023	RES, FILM, MET, 0.25W, 1%, 100PPM, 562R	1.000	R23
35952AA1003	*1	1024	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R24
35952AA8250	*1	1025	RES, FILM, MET, 0.25W, 1%, 100PPM, 825R	1.000	R25
35952AA1002	*1	1026	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R26
35952AA6810	*1	1027	RES, FILM, MET, 0.25W, 1%, 100PPM, 681R	1.000	R27
35952AA9001	*1	1028	RES, FILM, MET, 0.25W, 1%, 100PPM, 9K	1.000	R28
35952AA1002	*1	1029	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R29
35952AA8251	*1	1030	RES, FILM, MET, 0.25W, 1%, 100PPM, 8.25K	1.000	R30
35952AA1003	*1	1031	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R31
35952AA1003	*1	1032	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R32

BILL OF MATERIALS WITH BURDEN
AXON INSTRUMENTS, INC., 07/17/87

FOR ASSEMBLY A1006

CIRCUIT, AXOPROBE-1 MAIN BOARD

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ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
35952AA8251	*1	1033	RES, FILM, MET, 0.25W, 1%, 100PPM, 8.25K	1.000	R33
35952AA1003	*1	1034	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R34
35952AA1001	*1	1035	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R35
35952AA3320	*1	1036	RES, FILM, MET, 0.25W, 1%, 100PPM, 332R	1.000	R36
35952AA1502	*1	1037	RES, FILM, MET, 0.25W, 1%, 100PPM, 15.0K	1.000	R37
35952AA1001	*1	1038	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R38
35952AA3320	*1	1039	RES, FILM, MET, 0.25W, 1%, 100PPM, 332R	1.000	R39
35952AA1502	*1	1040	RES, FILM, MET, 0.25W, 1%, 100PPM, 15.0K	1.000	R40
35952AA1001	*1	1041	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R41
35952AA1003	*1	1042	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R42
35952AA1002	*1	1043	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R43
35952AA2740	*1	1044	RES, FILM, MET, 0.25W, 1%, 100PPM, 274R	1.000	R44
35952AA1002	*1	1045	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R45
35952AA1003	*1	1046	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R46
35952AA5622	*1	1047	RES, FILM, MET, 0.25W, 1%, 100PPM, 56.2K	1.000	R47
35952AA1003	*1	1048	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R48
35952AA1003	*1	1049	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R49
35952AA1003	*1	1050	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R50
35952AA1001	*1	1051	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R51
35952AA221*	*1	1052	RES, FILM, MET, 0.25W, 1%, 100PPM, 22.1R	1.000	R52
35952AA2742	*1	1053	RES, FILM, MET, 0.25W, 1%, 100PPM, 27.4K	1.000	R53
35952AA1001	*1	1054	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R54
35952AA1002	*1	1055	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R55
35952AC1002	*1	1056	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K	1.000	R56
35952AD1502	*1	1057	RES, FILM, MET, 0.25W, 1%, 25PPM, 15K	1.000	R57
35952AD1502	*1	1058	RES, FILM, MET, 0.25W, 1%, 25PPM, 15K	1.000	R58
35952AC1002	*1	1059	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K	1.000	R59
35952AA1001	*1	1060	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R60
35952AA1002	*1	1061	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R61
35952AA9002	*1	1062	RES, FILM, MET, 0.25W, 1%, 100PPM, 90K	1.000	R62
35952AA4990	*1	1063	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	R63
35952AA1002	*1	1064	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R64
35952AA1500	*1	1065	RES, FILM, MET, 0.25W, 1%, 100PPM, 150R	1.000	R65
35952AA4990	*1	1066	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	R66
35952AA4751	*1	1067	RES, FILM, MET, 0.25W, 1%, 100PPM, 4.75K	1.000	R67
35952AA100*	*1	1068	RES, FILM, MET, 0.25W, 1%, 100PPM, 10R	1.000	R68
35952AA1001	*1	1069	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R69
35952AA4990	*1	1070	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	R70
35952AA1822	*1	1071	RES, FILM, MET, 0.25W, 1%, 100PPM, 18.2K	1.000	R71
35952AA1002	*1	1072	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R72
35952AA1000	*1	1073	RES, FILM, MET, 0.25W, 1%, 100PPM, 100R	1.000	R73
35952AA1003	*1	1074	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R74
35952AA1001	*1	1075	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R75
35952AA2740	*1	1076	RES, FILM, MET, 0.25W, 1%, 100PPM, 274R	1.000	R76
00000AB	*1	1077	NC	1.000	R77
00000AB	*1	1078	NC	1.000	R78
35952AA1002	*1	1079	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R79
35952AA1501	*1	1080	RES, FILM, MET, 0.25W, 1%, 100PPM, 1.5K	1.000	R80
35952AA1003	*1	1081	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R81
35952AA1001	*1	1082	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R82
35952AA1503	*1	1083	RES, FILM, MET, 0.25W, 1%, 100PPM, 150K	1.000	R83
35952AA9001	*1	1084	RES, FILM, MET, 0.25W, 1%, 100PPM, 9K	1.000	R84
35952AA1210	*1	1085	RES, FILM, MET, 0.25W, 1%, 100PPM, 121R	1.000	R85
35952AA1001	*1	1086	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R86

BILL OF MATERIALS WITH BURDEN
 AXON INSTRUMENTS, INC., 07/17/87

FOR ASSEMBLY A1006 CIRCUIT, AXOPROBE-1 MAIN BOARD

ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
35952AA1002	*1	1087	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R87
35952AA1003	*1	1088	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R88
35952AA4990	*1	1089	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	R89
35952AA1003	*1	1090	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R90
35952AA1501	*1	1091	RES, FILM, MET, 0.25W, 1%, 100PPM, 1.5K	1.000	R91
35952AA1501	*1	1092	RES, FILM, MET, 0.25W, 1%, 100PPM, 1.5K	1.000	R92
35952AC2002	*1	1093	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 20.00K	1.000	R93
35952AC1002	*1	1094	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K	1.000	R94
35952AC2002	*1	1095	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 20.00K	1.000	R95
35952AC1002	*1	1096	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K	1.000	R96
35952AC1002	*1	1097	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K	1.000	R97
35952AA2003	*1	1098	RES, FILM, MET, 0.25W, 1%, 100PPM, 200K	1.000	R98
35952AA4752	*1	1099	RES, FILM, MET, 0.25W, 1%, 100PPM, 47.5K	1.000	R99
35952AC2002	*1	1100	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 20.00K	1.000	R100
35952AA1001	*1	1101	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R101
35952AA4990	*1	1102	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	R102
35952AA8250	*1	1103	RES, FILM, MET, 0.25W, 1%, 100PPM, 825R	1.000	R103
35952AA1002	*1	1104	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R104
35952AA1001	*1	1105	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R105
35952AA9001	*1	1106	RES, FILM, MET, 0.25W, 1%, 100PPM, 9K	1.000	R106
35952AA1002	*1	1107	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R107
35952AA1003	*1	1108	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R108
35952AA8251	*1	1109	RES, FILM, MET, 0.25W, 1%, 100PPM, 8.25K	1.000	R109
35952AA1003	*1	1110	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R110
35952AA8252	*1	1111	RES, FILM, MET, 0.25W, 1%, 100PPM, 82.5K	1.000	R111
35952AA1003	*1	1112	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R112
35952AA1001	*1	1113	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R113
35952AA3320	*1	1114	RES, FILM, MET, 0.25W, 1%, 100PPM, 332R	1.000	R114
35952AA1502	*1	1115	RES, FILM, MET, 0.25W, 1%, 100PPM, 15.0K	1.000	R115
35952AA1001	*1	1116	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R116
35952AA3320	*1	1117	RES, FILM, MET, 0.25W, 1%, 100PPM, 332R	1.000	R117
35952AA1502	*1	1118	RES, FILM, MET, 0.25W, 1%, 100PPM, 15.0K	1.000	R118
35952AA1001	*1	1119	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R119
35952AA5620	*1	1120	RES, FILM, MET, 0.25W, 1%, 100PPM, 562R	1.000	R120
35952AA1003	*1	1121	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R121
35952AA1003	*1	1122	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R122
35952AA1003	*1	1123	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R123
35952AA1002	*1	1124	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R124
35952AA2740	*1	1125	RES, FILM, MET, 0.25W, 1%, 100PPM, 274R	1.000	R125
35952AA1001	*1	1126	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R126
35952AA1003	*1	1127	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R127
35952AA1002	*1	1128	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R128
35952AA5622	*1	1129	RES, FILM, MET, 0.25W, 1%, 100PPM, 56.2K	1.000	R129
35952AA1003	*1	1130	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R130
35952AA1003	*1	1131	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R131
35952AA1003	*1	1132	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R132
35952AA1001	*1	1133	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R133
35952AA221*	*1	1134	RES, FILM, MET, 0.25W, 1%, 100PPM, 22.1R	1.000	R134
35952AA1822	*1	1135	RES, FILM, MET, 0.25W, 1%, 100PPM, 18.2K	1.000	R135
35952AA2742	*1	1136	RES, FILM, MET, 0.25W, 1%, 100PPM, 27.4K	1.000	R136
35952AA1001	*1	1137	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K	1.000	R137
35952AA1002	*1	1138	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R138
35952AA1002	*1	1139	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R139
35952AA4990	*1	1140	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	R140

BILL OF MATERIALS WITH BURDEN
AXON INSTRUMENTS, INC., 07/17/87

ITEM	LEVEL	SEQ.	DESCRIPTION	CIRCUIT, AXOPROBE-1 MAIN BOARD	QUANTITY	REFERENCE
35952AA9002	*1	1141	RES, FILM, MET, 0.25W, 1%, 100PPM, 90K		1.000	R141
35952AA1002	*1	1142	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K		1.000	R142
35952AD1502	*1	1143	RES, FILM, MET, 0.25W, 1%, 25PPM, 15K		1.000	R143
35952AC1002	*1	1144	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K		1.000	R144
35952AC1002	*1	1145	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K		1.000	R145
35952AD1502	*1	1146	RES, FILM, MET, 0.25W, 1%, 25PPM, 15K		1.000	R146
35952AA1001	*1	1147	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K		1.000	R147
35952AA100*	*1	1148	RES, FILM, MET, 0.25W, 1%, 100PPM, 10R		1.000	R148
35952AA1000	*1	1149	RES, FILM, MET, 0.25W, 1%, 100PPM, 100R		1.000	R149
35952AA4751	*1	1150	RES, FILM, MET, 0.25W, 1%, 100PPM, 4.75K		1.000	R150
35952AA4990	*1	1151	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R		1.000	R151
35952AA1002	*1	1152	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K		1.000	R152
35952AA1003	*1	1153	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K		1.000	R153
35952AA1500	*1	1154	RES, FILM, MET, 0.25W, 1%, 100PPM, 150R		1.000	R154
35952AA1001	*1	1155	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K		1.000	R155
35952AA2740	*1	1156	RES, FILM, MET, 0.25W, 1%, 100PPM, 274R		1.000	R156
35952AA9001	*1	1157	RES, FILM, MET, 0.25W, 1%, 100PPM, 9K		1.000	R157
35952AA1001	*1	1158	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K		1.000	R158
35952AA6810	*1	1159	RES, FILM, MET, 0.25W, 1%, 100PPM, 681R		1.000	R159
35952AC1002	*1	1161	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K		1.000	R161
35952AC1002	*1	1162	RES, FILM, MET, 0.25W, 0.1%, 25PPM, 10.00K		1.000	R162
35952AA1002	*1	1163	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K		1.000	R163
35952AA1002	*1	1164	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K		1.000	R164
35952AA1002	*1	1165	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K		1.000	R165
35952AA1002	*1	1166	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K		1.000	R166
35952AA9002	*1	1167	RES, FILM, MET, 0.25W, 1%, 100PPM, 90K		1.000	R167
35952AA1002	*1	1168	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K		1.000	R168
35952AA4990	*1	1169	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R		1.000	R169
35952AA1000	*1	1170	RES, FILM, MET, 0.25W, 1%, 100PPM, 100R		1.000	R170
35952AA1000	*1	1171	RES, FILM, MET, 0.25W, 1%, 100PPM, 100R		1.000	R171
00000AB	*1	1173	NC		1.000	R173
35952AA6811	*1	1174	RES, FILM, MET, 0.25W, 1%, 100PPM, 6.81K		1.000	R174
35952AA6811	*1	1175	RES, FILM, MET, 0.25W, 1%, 100PPM, 6.81K		1.000	R175
35952AA6811	*1	1176	RES, FILM, MET, 0.25W, 1%, 100PPM, 6.81K		1.000	R176
35952AA2211	*1	1177	RES, FILM, MET, 0.25W, 1%, 100PPM, 2.21K		1.000	R177
35952AA1001	*1	1178	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K		1.000	R178
35952AA1003	*1	1179	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K		1.000	R179
35952AA6811	*1	1180	RES, FILM, MET, 0.25W, 1%, 100PPM, 6.81K		1.000	R180
35952AA2211	*1	1181	RES, FILM, MET, 0.25W, 1%, 100PPM, 2.21K		1.000	R181
35952AA1003	*1	1182	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K		1.000	R182
35952AA1822	*1	1183	RES, FILM, MET, 0.25W, 1%, 100PPM, 18.2K		1.000	R183
35952AA1001	*1	1184	RES, FILM, MET, 0.25W, 1%, 100PPM, 1K		1.000	R184
35952AA2740	*1	1185	RES, FILM, MET, 0.25W, 1%, 100PPM, 274R		1.000	R185
35952AA2740	*1	1186	RES, FILM, MET, 0.25W, 1%, 100PPM, 274R		1.000	R186
35952AA1002	*1	1187	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K		1.000	R187
35952AA1000	*1	1188	RES, FILM, MET, 0.25W, 1%, 100PPM, 100R		1.000	R188
35952AA1210	*1	1189	RES, FILM, MET, 0.25W, 1%, 100PPM, 121R		1.000	R189
35952AA4751	*1	1190	RES, FILM, MET, 0.25W, 1%, 100PPM, 4.75K		1.000	R190
35952AA3321	*1	1191	RES, FILM, MET, 0.25W, 1%, 100PPM, 3.32K		1.000	R191
35952AA825*	*1	1192	RES, FILM, MET, 0.25W, 1%, 100PPM, 82.5R		1.000	R192
35952AA4750	*1	1193	RES, FILM, MET, 0.25W, 1%, 100PPM, 475R		1.000	R193
35952AA4750	*1	1194	RES, FILM, MET, 0.25W, 1%, 100PPM, 475R		1.000	R194
35952AA4751	*1	1195	RES, FILM, MET, 0.25W, 1%, 100PPM, 4.75K		1.000	R195
35952AA221*	*1	1196	RES, FILM, MET, 0.25W, 1%, 100PPM, 22.1R		1.000	R196

BILL OF MATERIALS WITH BURDEN
 AXON INSTRUMENTS, INC., 07/17/87

FOR ASSEMBLY A1006

CIRCUIT, AXOPROBE-1 MAIN BOARD

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ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
35952AA4751	*1	1197	RES, FILM, MET, 0.25W, 1%, 100PPM, 4.75K	1.000	R197
00000AB	*1	1198	NC	1.000	R198
00000AB	*1	1199	NC	1.000	R199
35952AA2213	*1	1200	RES, FILM, MET, 0.25W, 1%, 100PPM, 221K	1.000	R200
35952AA2213	*1	1201	RES, FILM, MET, 0.25W, 1%, 100PPM, 221K	1.000	R201
35952AA4753	*1	1202	RES, FILM, MET, 0.25W, 1%, 100PPM, 475K	1.000	R202
35952AA1002	*1	1203	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R203
35952AA1000	*1	1204	RES, FILM, MET, 0.25W, 1%, 100PPM, 100R	1.000	R204
35952AA1211	*1	1205	RES, FILM, MET, 0.25W, 1%, 100PPM, 1.21K	1.000	R205
35952AA1003	*1	1206	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R206
35952AA1003	*1	1207	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R207
35952AA1002	*1	1208	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R208
35952AA1002	*1	1209	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R209
35952AA1003	*1	1210	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R210
00000AB	*1	1211	NC	1.000	R211
35952AA1002	*1	1212	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R212
35952AA1002	*1	1213	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R213
35952AA1002	*1	1214	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R214
35952AA1002	*1	1215	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R215
35952AA1002	*1	1216	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R216
35952AA1002	*1	1217	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R217
35952AA5621	*1	1218	RES, FILM, MET, 0.25W, 1%, 100PPM, 5.62K	1.000	R218
35952AA6811	*1	1219	RES, FILM, MET, 0.25W, 1%, 100PPM, 6.81K	1.000	R219
35952AA1822	*1	1220	RES, FILM, MET, 0.25W, 1%, 100PPM, 18.2K	1.000	R220
35952AA475*	*1	1221	RES, FILM, MET, 0.25W, 1%, 100PPM, 47.5R	1.000	R221
35952AA1502	*1	1222	RES, FILM, MET, 0.25W, 1%, 100PPM, 15.0K	1.000	R222
35952AA5620	*1	1223	RES, FILM, MET, 0.25W, 1%, 100PPM, 562R	1.000	R223
35952AA1003	*1	1224	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R224
35952AA4990	*1	1225	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	R225
35952AA4990	*1	1226	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	R226
35952AA2740	*1	1227	RES, FILM, MET, 0.25W, 1%, 100PPM, 274R	1.000	R227
35952AA2740	*1	1228	RES, FILM, MET, 0.25W, 1%, 100PPM, 274R	1.000	R228
35952AA4751	*1	1229	RES, FILM, MET, 0.25W, 1%, 100PPM, 4.75K	1.000	R229
35952AA1002	*1	1230	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R230
35952AA3322	*1	1231	RES, FILM, MET, 0.25W, 1%, 100PPM, 33.2K	1.000	R231
35952AA1003	*1	1232	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R232
35952AA1003	*1	1233	RES, FILM, MET, 0.25W, 1%, 100PPM, 100K	1.000	R233
35952AA1002	*1	1234	RES, FILM, MET, 0.25W, 1%, 100PPM, 10K	1.000	R234
42816CA	*1	1401	TERMINAL, PCB, TEST EYELET	1.000	TP1
42816CA	*1	1402	TERMINAL, PCB, TEST EYELET	1.000	TP2
42816CA	*1	1403	TERMINAL, PCB, TEST EYELET	1.000	TP3
42816CA	*1	1404	TERMINAL, PCB, TEST EYELET	1.000	TP4
42816CA	*1	1405	TERMINAL, PCB, TEST EYELET	1.000	TP5
42816CA	*1	1406	TERMINAL, PCB, TEST EYELET	1.000	TP6
42816CA	*1	1407	TERMINAL, PCB, TEST EYELET	1.000	TP7
42816CA	*1	1408	TERMINAL, PCB, TEST EYELET	1.000	TP8
42816CA	*1	1409	TERMINAL, PCB, TEST EYELET	1.000	TP9
42816CA	*1	1410	TERMINAL, PCB, TEST EYELET	1.000	TP10
42816CA	*1	1411	TERMINAL, PCB, TEST EYELET	1.000	TP12
42816CA	*1	1412	TERMINAL, PCB, TEST EYELET	1.000	TP12
42816CA	*1	1413	TERMINAL, PCB, TEST EYELET	1.000	TP13
42816CA	*1	1414	TERMINAL, PCB, TEST EYELET	1.000	TP14
42816CA	*1	1415	TERMINAL, PCB, TEST EYELET	1.000	TP15
42816CA	*1	1416	TERMINAL, PCB, TEST EYELET	1.000	TP16

BILL OF MATERIALS WITH BURDEN
AXON INSTRUMENTS, INC., 07/17/87

FOR ASSEMBLY A1006

CIRCUIT, AXOPROBE-1 MAIN BOARD

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ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
42816CA	*1	1417	TERMINAL, PCB, TEST EYELET	1.000	TP17
42816CA	*1	1418	TERMINAL, PCB, TEST EYELET	1.000	TP18
42816CA	*1	1419	TERMINAL, PCB, TEST EYELET	1.000	TP19
42816CA	*1	1420	TERMINAL, PCB, TEST EYELET	1.000	TP20
00000AB	*1	1421	NC	1.000	TP21
00000AB	*1	1422	NC	1.000	TP22
42816CA	*1	1423	TERMINAL, PCB, TEST EYELET	1.000	TP23
07264CH	*1	1501	CIRCUIT, PRINTED, AXOPROBE-1, MAIN, PCB8	1.000	NONE

BILL OF MATERIALS WITH BURDEN
 AXON INSTRUMENTS, INC., 07/17/87
 FOR ASSEMBLY A1007 POWER SUPPLY, AXOPROBE-1

ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
05456AE1006	*1	1	CAP, ALUM, ELCTLT, RDL LEAD, 100V, 100U	1.000	C1
05472AB1002	*1	2	CAP, CER, DISC, 500V, 0.01U	1.000	C2
05488AC1003	*1	3	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C3
05456AE1006	*1	4	CAP, ALUM, ELCTLT, RDL LEAD, 100V, 100U	1.000	C4
05472AB1002	*1	5	CAP, CER, DISC, 500V, 0.01U	1.000	C5
05488AC1003	*1	6	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C6
00000AB	*1	7	NC	1.000	C7
05456AB3305	*1	8	CAP, ALUM, ELCTLT, RDL LEAD, 63V, 33U	1.000	C8
05456AB3305	*1	9	CAP, ALUM, ELCTLT, RDL LEAD, 63V, 33U	1.000	C9
05456AC2207	*1	10	CAP, ALUM, ELCTLT, RDL LEAD, 35V, 2200U	1.000	C10
05488AC1003	*1	11	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C11
05488AC1003	*1	12	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C12
05456AC2207	*1	13	CAP, ALUM, ELCTLT, RDL LEAD, 35V, 2200U	1.000	C13
05488AC1003	*1	14	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C14
05488AC1003	*1	15	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C15
05456AD4707	*1	16	CAP, ALUM, ELCTLT, RDL LEAD, 16V, 4700U	1.000	C16
00000AB	*1	17	NC	1.000	C17
05488AC1003	*1	18	CAP, CER, ML, 50V, 0.21N, 0.1U	1.000	C18
35952AA3321	*1	101	RES, FILM, MET, 0.25W, 1%, 100PPM, 3.32K	1.000	R1
35952AA1821	*1	102	RES, FILM, MET, 0.25W, 1%, 100PPM, 1.82K	1.000	R2
09696CB004	*1	201	CONN, PCB, 0.156, STRAIGHT W/LOCK, 4-PIN	1.000	J1
09696CB004	*1	202	CONN, PCB, 0.156, STRAIGHT W/LOCK, 4-PIN	1.000	J2
09744CC004	*1	203	CONN, INS DISPL, 0.156, 4-PIN	1.000	P2
09744CD004	*1	204	CONN, COVER, FOR 0.156 INS DISPL, 4-PIN	1.000	FOR P2
09696CA008	*1	205	CONN, PCB, 0.100, STRAIGHT, GOLD, 8-PIN	1.000	J3
09744CA008	*1	206	CONN, INS DISPL SOCKET, 0.100, GOLD, 8-PIN	1.000	P3
09744CB008	*1	207	CONN, COVER, FOR 0.100 INS DISPL, 8-PIN	1.000	FOR P3
09744CA012	*1	208	CONN, INS DISPL SOCKET, 0.100, GOLD, 12-PIN	1.000	P4
09744CB012	*1	209	CONN, COVER, FOR 0.100 INS DISPL, 12-PIN	1.000	FOR P4
09696CA004	*1	210	CONN, PCB, 0.100, STRAIGHT, GOLD, 4-PIN	1.000	J5
09744CA004	*1	211	CONN, INS DISPL SOCKET, 0.100, GOLD, 4-PIN	1.000	FOR J5
09744CB004	*1	212	CONN, COVER, FOR 0.100 INS DISPL, 4-PIN	1.000	FOR J5
15216AA4004	*1	301	DIODE, SI, 1A, 400PIV, 1N4004	1.000	D1
15216AA4004	*1	302	DIODE, SI, 1A, 400PIV, 1N4004	1.000	D2
15216AA4004	*1	303	DIODE, SI, 1A, 400PIV, 1N4004	1.000	D3
34784AA04	*1	401	RECT, BRIDGE, 1.5A, 400PIV, W04M	1.000	BR1
34784AA04	*1	402	RECT, BRIDGE, 1.5A, 400PIV, W04M	1.000	BR2
34784AA04	*1	403	RECT, BRIDGE, 1.5A, 400PIV, W04M	1.000	BR3
20688CA	*1	501	HEAT SINK, PCB MOUNT, FOR TO-220, 2 IN	1.000	H1
20688CA	*1	502	HEAT SINK, PCB MOUNT, FOR TO-220, 2 IN	1.000	H2
20688CA	*1	503	HEAT SINK, PCB MOUNT, FOR TO-220, 2 IN	1.000	H3
20688CA	*1	504	HEAT SINK, PCB MOUNT, FOR TO-220, 2 IN	1.000	H4
20688CA	*1	505	HEAT SINK, PCB MOUNT, FOR TO-220, 2 IN	1.000	H5
37136CB1880	*1	506	SCREW, PHH, PNH, SST, #4-40 X 0.188	10.000	FOR HEATSINKS
22048AC7815	*1	601	IC, VOLTAGE REG, +15V, 7815CT	1.000	VR1
22048AC7915	*1	602	IC, VOLTAGE REG, -15V, 7915CT	1.000	VR2
22048AC7815	*1	603	IC, VOLTAGE REG, +15V, 7815CT	1.000	VR3
22048AC7915	*1	604	IC, VOLTAGE REG, -15V, 7915CT	1.000	VR4
22048AC7805	*1	605	IC, VOLTAGE REG, +5V, 7805CT	1.000	VR5
15344AA973A	*1	606	DIODE, ZENER, 500MW, 33V, 1N973A	1.000	VR6
15344AA973A	*1	607	DIODE, ZENER, 500MW, 33V, 1N973A	1.000	VR7
42816CA	*1	701	TERMINAL, PCB, TEST EYELET	11.000	TP1-11
41488BA	*1	801	SWITCH, POWER, PB, PCB MOUNT, 2P2T	1.000	S1
41488B00	*1	802	SWITCH, CAP FOR POWER PB, BLACK	1.000	S1

BILL OF MATERIALS WITH BURDEN
 AXON INSTRUMENTS, INC., 07/17/87

FOR ASSEMBLY A1007 POWER SUPPLY, AXOPROBE-1

ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
41488BC	*1	803	SWITCH, PLUNGER EXTENDER FOR PUSHBUTTON	6.000	S1
41648BA	*1	804	SWITCH, SLIDE, PCB MOUNT, 2P, ON-NONE-ON	1.000	S2
07264CD	*1	901	CIRCUIT, PRINTED, POWER SUPPLY, 5 OUTPUT, PCB4	1.000	NONE
17360CM	*1	903	ENCL, PANEL, BASE FOR POWER SUPPLY, PAN5	1.000	NONE
17360CN	*1	904	ENCL, PANEL, VERTICAL SHIELD, PAN6	1.000	NONE
04288CA	*1	905	BUSHING, NYLON, 0.875 OD X 0.063, B-875-750	1.000	NONE
17360CF	*1	906	ENCL, TOP/BOTTOM COVER, 420 X 305 MM	2.000	NONE
17360CC	*1	907	ENCL, SIDE WALLS WITH FEET, PAIR, 4E	1.000	NONE
17360CB	*1	908	ENCL, LONG SECT, 420 MM	4.000	NONE
17360CE	*1	909	ENCL, DEPTH REDUCING SECT, 420 MM	1.000	NONE
39776CB7500	*1	912	SPACER, ALUM, 0.75 X 0.25, #4-40	6.000	NONE
39776CB6250	*1	913	SPACER, ALUM, 0.625 X 0.25, #4-40	4.000	NONE
11888CA	*1	916	CORD, LINE, SHIELDED, U.S. TO IEC, 2M	0.600	NONE
11888CB	*1	917	CORD, LINE, SHIELDED, SOLDER ENDS TO IEC, 2M	0.400	NONE
45952AB	*1	1001	TRANSFORMER, LOW HUM, 5 OUTPUT, TRF2	1.000	T1
39872DA	*1	1051	SPEAKER, INTERCOM, 45 OHM, 1W, 2.5IN	1.000	LS1

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ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
41776BA	*1	1	SWITCH, TGL, MINI, 2P, ON-NONE-ON	1.000	USE/STANDBY
41776BE	*1	3	SWITCH, TGL, MINI, 1P, ON-OFF-ON	1.000	PULSE CONT/EXT/OFF
41776BF	*1	4	SWITCH, TGL, MINI, 2P, ON-OFF-ON	1.000	DC CURRENT +/-OFF/-
41776BB	*1	5	SWITCH, TGL, MINI, 1P, ON-NONE-ON	1.000	PULSE +/-
41776BD002	*1	6	SWITCH, TGL, 1P, (ON)-OFF-(ON), MIL-S-83731	1.000	CLEAR
41776BD	*1	7	SWITCH, TGL, MINI, FLATTED, 1P, (ON)-OFF-(ON)	1.000	TEST CURRENT
41776BE	*1	9	SWITCH, TGL, MINI, 1P, ON-OFF-ON	1.000	PULSE CONT/EXT/OFF
41776BB	*1	10	SWITCH, TGL, MINI, 1P, ON-NONE-ON	1.000	PULSE +/-
41776BF	*1	11	SWITCH, TGL, MINI, 2P, ON-OFF-ON	1.000	DC CURRENT +/-OFF/-
41776BD002	*1	12	SWITCH, TGL, 1P, (ON)-OFF-(ON), MIL-S-83731	1.000	CLEAR
41776BD	*1	13	SWITCH, TGL, MINI, FLATTED, 1P, (ON)-OFF-(ON)	1.000	TEST CURRENT
41776BE	*1	16	SWITCH, TGL, MINI, 1P, ON-OFF-ON	1.000	STEP OFF/EXT/CONT
41776BH	*1	17	SWITCH, TGL, SHORT, 2P, ON-NONE-ON	1.000	DESTINATION
41776BE	*1	18	SWITCH, TGL, MINI, 1P, ON-OFF-ON	1.000	CAL OFF/EXT/CONT
41776BB	*1	19	SWITCH, TGL, MINI, 1P, ON-NONE-ON	1.000	V1/(V1-V2)
41776BA	*1	20	SWITCH, TGL, MINI, 2P, ON-NONE-ON	1.000	BYPASS/ACTIVE
41776BA	*1	21	SWITCH, TGL, MINI, 2P, ON-NONE-ON	1.000	BYPASS/ACTIVE
41552BA	*1	22	SWITCH, PB, MINI, MOM, 1P2T	1.000	BUZZ
41552BA	*1	23	SWITCH, PB, MINI, MOM, 1P2T	1.000	BUZZ
41776BA	*1	24	SWITCH, TGL, MINI, 2P, ON-NONE-ON	1.000	I1/I2
41616BA	*1	25	SWITCH, ROT, 1IN, 2P/2-6T	1.000	F1 INPUT
41616BA	*1	26	SWITCH, ROT, 1IN, 2P/2-6T	1.000	F2 INPUT
41776BE	*1	27	SWITCH, TGL, MINI, 1P, ON-OFF-ON	1.000	AUDIO V1/OFF/V2
41552BC00	*1	41	SWITCH, CAP FOR MINI PB, 0.375, BLACK	1.000	FOR BUZZ
41552BC00	*1	42	SWITCH, CAP FOR MINI PB, 0.375, BLACK	1.000	FOR BUZZ
A1005	*1	51	FILTER, 2ORDER LOWPASS	1.000	F1
A1005	*1	52	FILTER, 2ORDER LOWPASS	1.000	F2
09728CA	*1	101	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	F1 OUT
09728CA	*1	102	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	F2 OUT
22352CE	*1	103	JACK, PHONE, 2-COND, 0.141 ID, SHUNTED	1.000	PHONE
48176CF	*1	104	WASHER, PLAIN, FIBER, 0.25 ID	1.000	FOR PHONE
29456CK001	*1	105	NUT, HEX, NICKEL PLD, 0.25-32 X 0.313 X 0.094	1.000	FOR PHONE
09744CA008	*1	111	CONN, INS DISPL SOCKET, 0.100, GOLD, 8-PIN	1.000	P5
09744CB008	*1	112	CONN, COVER, FOR 0.100 INS DISPL, 8-PIN	1.000	FOR P5
09744CA016	*1	113	CONN, INS DISPL SOCKET, 0.100, GOLD, 16-PIN	1.000	P8
09744CB016	*1	114	CONN, COVER, FOR 0.100 INS DISPL, 16-PIN	1.000	FOR P8
09744CA016	*1	115	CONN, INS DISPL SOCKET, 0.100, GOLD, 16-PIN	1.000	P9
09744CB016	*1	116	CONN, COVER, FOR 0.100 INS DISPL, 16-PIN	1.000	FOR P9
09744CA016	*1	117	CONN, INS DISPL SOCKET, 0.100, GOLD, 16-PIN	1.000	P11
09744CB016	*1	118	CONN, COVER, FOR 0.100 INS DISPL, 16-PIN	1.000	FOR P11
09744CA016	*1	119	CONN, INS DISPL SOCKET, 0.100, GOLD, 16-PIN	1.000	P12
09744CB016	*1	120	CONN, COVER, FOR 0.100 INS DISPL, 16-PIN	1.000	FOR P12
09744CA016	*1	121	CONN, INS DISPL SOCKET, 0.100, GOLD, 16-PIN	1.000	P14
09744CB016	*1	122	CONN, COVER, FOR 0.100 INS DISPL, 16-PIN	1.000	FOR P14
09744CA016	*1	123	CONN, INS DISPL SOCKET, 0.100, GOLD, 16-PIN	1.000	P15
09744CB016	*1	124	CONN, COVER, FOR 0.100 INS DISPL, 16-PIN	1.000	FOR P15
09680CB	*1	125	CONN, EDGE, 2X10-PIN, 0.156, EYELETS, W/MOUNTS	1.000	P48
09680CB	*1	126	CONN, EDGE, 2X10-PIN, 0.156, EYELETS, W/MOUNTS	1.000	P49
09680CB	*1	127	CONN, EDGE, 2X10-PIN, 0.156, EYELETS, W/MOUNTS	1.000	P50
09744CA002	*1	128	CONN, INS DISPL SOCKET, 0.100, GOLD, 2-PIN	1.000	P16A
09744CB002	*1	129	CONN, COVER, FOR 0.100 INS DISPL, 2-PIN	1.000	FOR P16A
31792AA2001	*1	201	POT, TEN TURN, WIREWOUND, 2K	1.000	CAP NEUT
31792AA2001	*1	203	POT, TEN TURN, WIREWOUND, 2K	1.000	RES COMP
31792AA2002	*1	204	POT, TEN TURN, WIREWOUND, 20K	1.000	OFFSET

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ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
31792AA2002	*1	207	POT, TEN TURN, WIREWOUND, 20K	1.000	DC CURRENT
31792AA2001	*1	208	POT, TEN TURN, WIREWOUND, 2K	1.000	CAP NEUT
31792AA2001	*1	210	POT, TEN TURN, WIREWOUND, 2K	1.000	RES COMP
31792AA2002	*1	211	POT, TEN TURN, WIREWOUND, 20K	1.000	ME1 OFFSET
31792AA2002	*1	212	POT, TEN TURN, WIREWOUND, 20K	1.000	PULSE
31792AA2002	*1	215	POT, TEN TURN, WIREWOUND, 20K	1.000	DC CURRENT
31664AG5001	*1	216	POT, SGL TURN, PLSTC, LOG, 5K, W/SWITCHES, POT4	1.000	CX COMP
35952AA4990	*1	217	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	F1 OUT
35952AA4990	*1	218	RES, FILM, MET, 0.25W, 1%, 100PPM, 499R	1.000	F2 OUT
31664AA5003	*1	219	POT, SGL TURN, PLSTC, LOG, 500K	1.000	BUZZ DURATION
31664AA1002	*1	220	POT, SGL TURN, PLSTC, LOG, 10K	1.000	BUZZ FREQUENCY
31664AB5001	*1	221	POT, SGL TURN, PLSTC, LIN, 5K	1.000	BUZZ AMPLITUDE
31664AA1002	*1	222	POT, SGL TURN, PLSTC, LOG, 10K	1.000	AUDIO MONITOR
31792AA2002	*1	223	POT, TEN TURN, WIREWOUND, 20K	1.000	PULSE
29456CK001	*1	231	NUT, HEX, NICKEL PLD, 0.25-32 X 0.313 X 0.094	1.000	FOR CX COMP
A1004	*1	301	CONVERTOR, THUMBWHEEL-TO-VOLTAGE	1.000	A1004
05520AA1001	*1	350	CAP, FILM, 10%, 100V, 0.001U	1.000	F1 OUT
05520AA1001	*1	351	CAP, FILM, 10%, 100V, 0.001U	1.000	F2 OUT
23296CL00	*1	401	KNOB, WING, 14.5 MM, 0.25, BLK W/LINE	1.000	F1 INPUT
23296CJ05	*1	402	KNOB, CAP FOR 14.5MM, GREEN	1.000	F1 INPUT
23296CL00	*1	403	KNOB, WING, 14.5 MM, 0.25, BLK W/LINE	1.000	F2 INPUT
23296CJ04	*1	404	KNOB, CAP FOR 14.5MM, YELLOW	1.000	F2 INPUT
23296CL00	*1	405	KNOB, WING, 14.5 MM, 0.25, BLK W/LINE	1.000	F1 FREQ
23296CJ05	*1	406	KNOB, CAP FOR 14.5MM, GREEN	1.000	F1 FREQ
23296CL00	*1	407	KNOB, WING, 14.5 MM, 0.25, BLK W/LINE	1.000	F2 FREQ
23296CJ04	*1	408	KNOB, CAP FOR 14.5MM, YELLOW	1.000	F2 FREQ
23296CK00	*1	409	KNOB, 14.5MM, 0.25, BLK	1.000	ME2 CAP NEUT
23296CJ04	*1	410	KNOB, CAP FOR 14.5MM, YELLOW	1.000	ME2 CAP NEUT
23296CK00	*1	411	KNOB, 14.5MM, 0.25, BLK	1.000	ME1 CAP NEUT
23296CJ05	*1	412	KNOB, CAP FOR 14.5MM, GREEN	1.000	ME1 CAP NEUT
23296CJ00	*1	413	KNOB, CAP FOR 14.5MM, BLK	1.000	CX COMP
23296CD00	*1	414	KNOB, 14.5MM, 0.125, BLK W/LINE	1.000	CX COMP
23296CC00	*1	415	KNOB, 14.5MM, 0.25, BLK W/LINE	1.000	BUZZ DURATION
23296CJ06	*1	416	KNOB, CAP FOR 14.5MM, BLUE	1.000	BUZZ DURATION
23296CC00	*1	417	KNOB, 14.5MM, 0.25, BLK W/LINE	1.000	BUZZ FREQUENCY
23296CJ06	*1	418	KNOB, CAP FOR 14.5MM, BLUE	1.000	BUZZ FREQUENCY
23296CC00	*1	419	KNOB, 14.5MM, 0.25, BLK W/LINE	1.000	BUZZ AMPLITUDE
23296CJ06	*1	420	KNOB, CAP FOR 14.5MM, BLUE	1.000	BUZZ AMPLITUDE
23296CC00	*1	421	KNOB, 14.5MM, 0.25, BLK W/LINE	1.000	AUDIO MONITOR
23296CJ00	*1	422	KNOB, CAP FOR 14.5MM, BLK	1.000	AUDIO MONITOR
15024BB02	*1	501	DIODE, LIGHT EMITTING, T1, RED DIFFUS	1.000	ME1 DESTINATION
15024BB02	*1	502	DIODE, LIGHT EMITTING, T1, RED DIFFUS	1.000	ME2 DESTINATION
15024BB02	*1	503	DIODE, LIGHT EMITTING, T1, RED DIFFUS	1.000	DC CURRENT
15024BB02	*1	504	DIODE, LIGHT EMITTING, T1, RED DIFFUS	1.000	DC CURRENT
15024BB02	*1	505	DIODE, LIGHT EMITTING, T1, RED DIFFUS	1.000	ME1 RES COMP
15024BB02	*1	506	DIODE, LIGHT EMITTING, T1, RED DIFFUS	1.000	PULSE CURRENT
15024BB02	*1	507	DIODE, LIGHT EMITTING, T1, RED DIFFUS	1.000	PULSE CURRENT
15024BB02	*1	508	DIODE, LIGHT EMITTING, T1, RED DIFFUS	1.000	CX COMP
15024BB02	*1	509	DIODE, LIGHT EMITTING, T1, RED DIFFUS	1.000	OUTPUT CAL
14640CB	*1	601	DIAL, TURNS COUNTING, 1IN DIAM, W/BRAKE	1.000	RES COMP
14640CB	*1	602	DIAL, TURNS COUNTING, 1IN DIAM, W/BRAKE	1.000	OFFSET
14640CB	*1	603	DIAL, TURNS COUNTING, 1IN DIAM, W/BRAKE	1.000	DC CURRENT
14640CB	*1	604	DIAL, TURNS COUNTING, 1IN DIAM, W/BRAKE	1.000	PULSE CURRENT
14640CB	*1	605	DIAL, TURNS COUNTING, 1IN DIAM, W/BRAKE	1.000	RES COMP

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ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
14640CB	*1	606	DIAL, TURNS COUNTING, 1IN DIAM, W/BRAKE	1.000	OFFSET
14640CB	*1	607	DIAL, TURNS COUNTING, 1IN DIAM, W/BRAKE	1.000	DC CURRENT
14640CB	*1	608	DIAL, TURNS COUNTING, 1IN DIAM, W/BRAKE	1.000	PULSE CURRENT
26544DA	*1	651	METER, PANEL, 1.999V, C INTENSITY	1.000	CURRENT METER
26544DA	*1	652	METER, PANEL, 1.999V, C INTENSITY	1.000	ME1 METER
26544DA	*1	653	METER, PANEL, 1.999V, C INTENSITY	1.000	ME2 METER
17360CQ	*1	701	ENCL, PANEL, FRONT, COMPLETE, FOR AXOPROBE-1,PAN10	1.000	NONE

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PANEL, REAR, AXOPROBE-1

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ITEM	LEVEL	SEQ.	DESCRIPTION	QUANTITY	REFERENCE
09728CA	*1	2	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	STEP GATE
09728CA	*1	3	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	100MV CAL GATE
09728CA	*1	4	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	ME1 PULSE GATE
09728CA	*1	5	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	ME2 PULSE GATE
09728CA	*1	6	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	EXT VBATH
09728CA	*1	7	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	EXT CAL SIGNAL
09728CA	*1	8	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	V1 BLANK GATE
09728CA	*1	9	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	EXT ME1 COMMAND
09728CA	*1	10	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	EXT ME2 COMMAND
09728CA	*1	11	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	VE1
09728CA	*1	12	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	VE2
09728CA	*1	13	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	100(V1-V2)
09728CA	*1	14	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	VBATH
09728CA	*1	15	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	10V1
09728CA	*1	16	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	10V2
09728CA	*1	17	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	I1
09728CA	*1	18	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	I2
09728CA	*1	19	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	100V1
09728CA	*1	20	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	100V2
22352CA02	*1	21	JACK, BANANA (4.44MM), PANEL, RED	1.000	+5V FOR BUZZ
22352CA07	*1	22	JACK, BANANA (4.44MM), PANEL, VIOLET	1.000	BUZZ ME1
22352CA07	*1	23	JACK, BANANA (4.44MM), PANEL, VIOLET	1.000	BUZZ ME2
09728CA	*1	24	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	F1
09728CA	*1	25	CONN, BNC, ISOLATED, PANEL MOUNT, RECEPTACLE	1.000	F2
22352CA04	*1	26	JACK, BANANA (4.44MM), PANEL, YELLOW	1.000	SIGNAL GROUND
09744CA008	*1	51	CONN, INS DISPL SOCKET, 0.100, GOLD, 8-PIN	1.000	P7
09744CB008	*1	52	CONN, COVER, FOR 0.100 INS DISPL, 8-PIN	1.000	FOR P7
09744CA012	*1	53	CONN, INS DISPL SOCKET, 0.100, GOLD, 12-PIN	1.000	P10
09744CB012	*1	54	CONN, COVER, FOR 0.100 INS DISPL, 12-PIN	1.000	FOR P10
09744CA012	*1	55	CONN, INS DISPL SOCKET, 0.100, GOLD, 12-PIN	1.000	P13
09744CB012	*1	56	CONN, COVER, FOR 0.100 INS DISPL, 12-PIN	1.000	FOR P13
09744CC004	*1	57	CONN, INS DISPL, 0.156, 4-PIN	1.000	P1
09744CD004	*1	58	CONN, COVER, FOR 0.156 INS DISPL, 4-PIN	1.000	FOR P1
09744CA002	*1	59	CONN, INS DISPL SOCKET, 0.100, GOLD, 2-PIN	1.000	P16B
09744CB002	*1	60	CONN, COVER, FOR 0.100 INS DISPL, 2-PIN	1.000	FOR P16B
17360CR	*1	101	ENCL, PANEL, REAR, FOR AXOPROBE-1, PAN9	1.000	NONE
19248BA5000	*1	103	FUSE, 5 X 20MM, SLOW, 500MA	2.000	NONE
09712CA	*1	105	CONN, LINE, W/1A FILTER, W/5X20MM FUSE HLDR	1.000	NONE

CHANGES TO THE SERVICE MANUAL

To Keep abreast of newly developed electronic components, technologies and user comments, Axon Instruments continually tries to improve its products.

Because shipping and manual printing schedules sometimes conflict, your manual may not contain the most up-to-date information. The following pages contain change information, unless your manual is correct as printed.

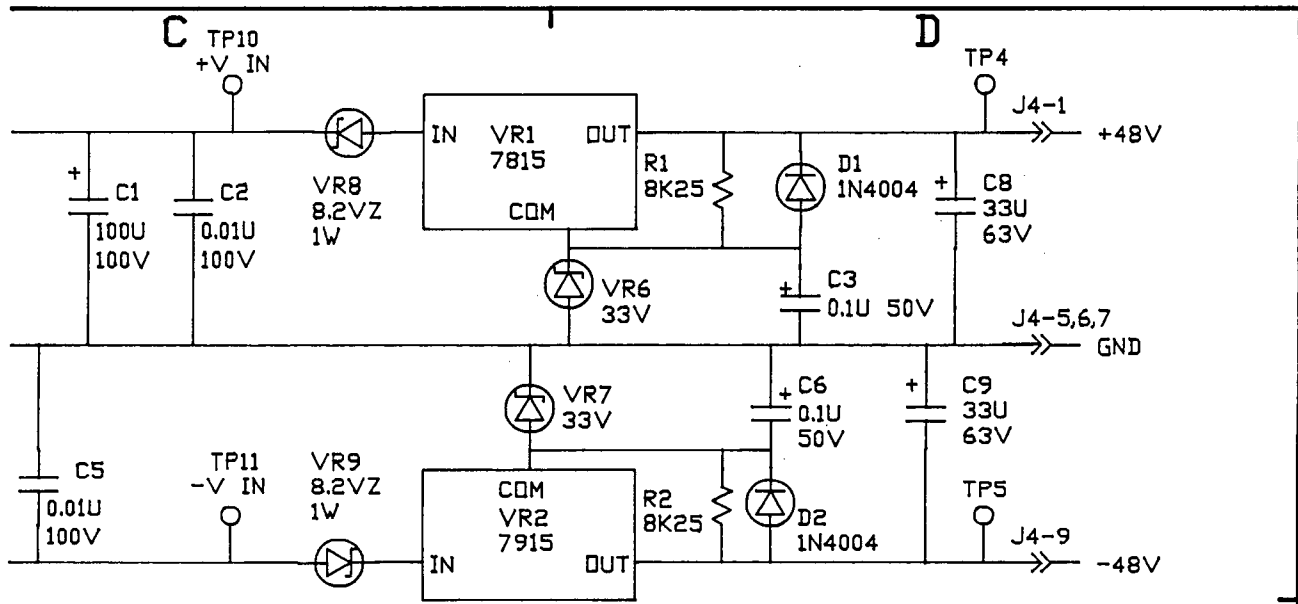
ERRATA AXOPROBE-1A

Please note the following changes to the powersupply.

Schematic 3430-005.SCH:

Add 8.2V Zeners VR8, VR9
Changed R1, R2 to 8K25

APN 4030-005
APN 3500-219



AXON INSTRUMENTS, INC.

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Phone (415) 340-9988, Telex 677-1237

Fax 344-4282, MCI Mail 275-2095

November 1987

Dear AXOPROBE Owner:

The AXOPROBE now has a new accessory: the CLAMP-1 model cell.

This model cell plugs directly into the input sockets of the headstages. A switch allows the CLAMP-1 model cell to be configured as (a) BATH mode -- two 50 M Ω electrodes to ground, or (b) CELL mode -- two electrodes connected to a 50 M Ω // 500 pF cell.

The CLAMP-1 model cell can be used to test and practice using the AXOPROBE. Techniques such as bridge balancing and capacitance compensation can be easily rehearsed. The CLAMP-1 model cell is a useful tool to use while learning the operation of the AXOPROBE and subsequently to verify the correct operation of the AXOPROBE and the recording pathway.

This model cell is being supplied as a standard accessory with new AXOPROBE-1As. It is also being supplied at no charge to owners of AXOPROBE-1As that shipped after July 1st, 1987. If you fall into this category, this letter will be accompanied by a CLAMP-1 model cell.

For earlier users, we are making the CLAMP-1 model cell available for a minimal cost of \$130.

You may order the model cell by phone or in writing. In either case, we will need an official purchase order number. The CLAMP-1 model cell is available for delivery 2 weeks after receipt of an order.

We hope you will find that this model cell is a useful tool to assist you in using your AXOPROBE.

Yours sincerely,



Alan Finkel, Ph.D.
President

INSTRUCTIONS / INFORMATION

CLAMP-1 MODEL CELL

If you do not need to model your cell exactly, the CLAMP-1 Model Cell is a convenient model to work with. The cell and electrode components simulate a small-to-medium sized cell having an input resistance of $50\text{ M}\Omega$, a membrane time constant of 25 ms and electrode resistances of $50\text{ M}\Omega$. See the figure below. The case of the model cell is connected to ground. Shielding between the two electrode resistors is effected by the body of the switch.

Install the model cell by plugging it into one or both of your headstages. Connect the gold-plated ground jack to the **yellow** jack on the back of the ME1 headstage using the cable provided. Do not make any connection to the gold-plated jack on the front of the HS-2 headstage – this is connected to the headstage case which is driven to the electrode potential.

When the switch is in the BATH position, both electrode resistors are connected to ground. This is a convenient position for practicing bridge balancing techniques and offset adjustment.

When the switch is in the CELL position, both electrode resistors are effectively intracellular. In Bridge or DCC mode you should see exponential voltage responses to steps of current. In dSEVC mode you should be able to clamp the cell at gains of up to 0.8 nA/mV using an HS-2 x0.1 headstage, at sampling rates up to 8 kHz . In TEVC mode, use one of the following electrode combinations: 1) two x0.1 headstages, two x1 headstages, or a x1 headstage for ME2 and a x0.1 headstage for ME1. The electrode resistances in this model cell are too large for you to practice cSEVC.

