M150AC

OPERATION AND SERVICE MANUAL

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CERTIFICATION

Rod-L Electronics, Inc. certifies that this instrument was thoroughly inspected and tested and found to meet its published specifications when it was shipped from the factory.

WARRANTY AND ASSISTANCE

This **Rod-L Electronics, Inc.** instrument is warranted against defects in materials and workmanship for 5 years following date of delivery. **Rod-L Electronics, Inc.** will repair or replace this instrument (at our discretion) if proven to be defective during the warranty period provided it is returned to **Rod-L Electronics, Inc.**

Rod-L Electronics, Inc. recommends that this instrument be calibrated on a 6 month cycle. Under no circumstance should a 12 month cycle be exceeded. This warranty remains valid providing calibration is performed at least once every 12 months by **Rod-L Electronics, Inc.** or a **Rod-L Electronics, Inc.** certified calibration service. This warranty is nontransferable and is offered solely to the original purchaser.

This warranty is void if the instrument has been changed, modified, or otherwise altered without the expressed permission of **Rod-L Electronics, Inc. Rod-L Electronics, Inc.** is not liable for consequential damages. No other warranty is expressed or implied.

Returned Material Authorization must be obtained from **Rod-L Electronics, Inc.** before returning this instrument for warranty repair. Transportation costs for return of defective instrument for warranty repair must be prepaid and borne by the customer. **Rod-L Electronics, Inc.** will assume the cost of transportation when returning Warranty Repaired Equipment to the customer. Such method of transportation shall be at the discretion of **Rod-L Electronics, Inc.**

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List of Figures and Tables

Section 1
INTRODUCTION

1-1. Scope of This Manual

This publication provides operation and service instructions for the **Rod-L Electronics Inc.** Model M150AC Hipot Test Instrument. It is divided into six sections.

Section 1 - Introduction
Section 2 - Theory of Operation
Section 3 - Installation and Operation
Section 4 - Calibration
Section 5 - Parts Lists, Schematics, Diagrams

1-2. M150AC General Description and Test Features

The **Rod-L** Model M150AC Hipot Test Instrument is a rugged, self-contained tester designed for both laboratory and production use. Its purpose is to provide a means for evaluating the dielectric withstand capabilities of electric and/or electronic devices when subjected to abnormally high input voltages. This is accomplished by monitoring for "breakdown" in the form of arcing/corona or exceeding of the maximum allowable current, (total and/or resistive) determined by the positioning of "Current Trip Potentiometers." The Model M150AC also conducts a low current Ground Continuity Test concurrent with the Hipot Test to ensure that the Device Under Test (DUT) is capable of effectively shunting the "leakage" current produced by the high voltage to earth ground.

While designed as an IEEE 488 Bus compatible Hipot Test System (when used with the M1088 Bus Interface), all operational controls are front panel mounted for ease of access when manual operation is required. The use of digital meters with "hold" feature allows for enhanced accuracy in monitoring the test results as well as the setup of the test parameters. Incandescent lamps are utilized to indicate Tester Status, Test Parameter Under Adjustment, and Fail Mode encountered. Both audible and visual alarms are activated whenever any "Fail Mode" is encountered.

Connection of the DUT to the Hipot Tester is made via the front panel High Voltage Receptacle (DUT's that terminate in a three prong cord) or the rear panel High Voltage Connector (all others). To ensure adequate grounding of the DUT prior to commencement of the hipot test, a safety ground circuit referred to as "CHASSIS GROUND SENSE" must be completed.

NOTE: *The* CHASSIS GROUND SENSE *circuit is intended to act as a safety ground and ground continuity test for devices employing a chassis ground plane. For testing of two-wire devices or three-wire devices that are exempted by the pertinent regulatory agency from performing a chassis ground continuity test, the* CHASSIS GROUND SENSE *connection can be made to either Pin 2 of the rear panel high voltage connector or to any appropriate hipot chassis point (e.g., handle, screw, etc.)*

A detailed description of the circuits and features mentioned above can be found in Section 3 - Theory of Operation. The input/output and operational specifications pertaining to the Model M150AC Hipot Tester are shown in Table 1-1.

1-3. Safety Features

A) "Chassis Ground Sense" - Safety ground required to begin a test

B) Loss of safety ground terminates test cycle

C) Front panel receptacle accepts 3-pronged power cord from DUT providing maximum safety and significantly reduces time required to perform the test

D) Recessed START button

E) Visual alarm at failure

F) Audible alarm at failure

G) Fast electronic shut down of AC High Voltage

H) Hard RESET after failure required to perform next test

I) Visually displayed programming of AC Current and High Voltage

J) Complete discharge of Device Under Test (DUT)

K) Adjustable, linear Ramp Up of AC High Voltage

1-4. **Supplied Equipment**

A) Hipot Test Instrument, **Rod-L** Model M150AC

B) Power Cord, 7 ft

C) Chassis Ground Sense cable, 2 ft

D) Operation/Service Manual

E) Extra fuse set for the alternate AC supply voltage

F) Adjustment Tool for Test Parameter Potentiometers

Table 1-1: Model M150AC Specifications

Test Voltage
User specified up to 5000 V

Total Test Current
1mA (milliamperes) to 50mA full scale

Resistive "Real" Test Current
100μA (microamperes) to 5mA full scale

Under Current
100μA (microamperes) to 5mA full scale

Voltage Rate of Rise
50 V/s (Volts / second) to 5000 V/s (adjustable)

High Voltage Test Time
1 second to 100 seconds (adjustable)

High Voltage Shutdown
Within 2 milliseconds after a fault or end of test is detected (electronic shut down circuits)

Safety Ground Continuity
Reject level: 0.3 to 0.5Ω, ±0.03Ω (adjustable)

Monitoring Accuracy
2% ± 10 Volts on Voltmeter (last digit always 0)
2% ± 100μA (microamperes) Total Ammeter Reading
2% ± 10μA (microamperes) Real Ammeter Reading

Resolution (Output Voltage Control)
Displayed 10VAC, Actual is 1.5% of setup Voltage

Resolution (Output Current)
Displayed is 100μA (microamperes,) Actual is 1μA

Initial Turn-On Period
None; Requires RESET to extinguish the FAIL light before starting Hipot test

Input Power
115/230 VAC, 44-66 Hz., 500 watts, max

Regulation
0.05% at full load

Environmental Operating Temperature
0° to 50° C, 32° to 122° F

Exterior Color
Mint grey / Olive grey

Weight
30 lbs. net, 35 lbs. shipping

Dimensions
16.75 x 18.5 x 7 inches (43 x 47 x 18 cm)

Section 2
INSTALLATION AND OPERATION

The exclamation point within a triangle is intended to tell the user that important operating and servicing instructions are in the papers that are provided with the equipment.

WARNING

Verify that the voltage selector switch is positioned and the correct power supply cord is selected to match the voltage source.

WARNING

This product is shipped with a high voltage mating plug and cap installed on the rear panel HV OUT/INTERFACE connector. To reduce the risk of shock, this plug and cap must be used whenever the high voltage interface cable is not installed.

In addition, the high voltage interface cable must only be used when both ends are terminated at their respective equipment connectors. To reduce the risk of electric shock, the equipment must not be operated with one end not terminated.

2-1. General Information

This section contains the recommended procedures for unpacking, inspection, installation, and operation.

2-2. **Unpacking and Inspection**

A shipping carton that appears damaged should be inspected and unpacked with the carrier's agent present. Inspect the instrument for damage (scratches, dents, broken knobs or meters, etc.)

If the instrument is found to be damaged upon receipt, notify the carrier and **Rod-L Electronics** immediately. Retain the shipping carton and the padding material for the carrier's inspection.

2-3. **Rack Mounting**

The **Rod-L** Model M150AC Hipot Test Instrument is suitable for either bench or rack mounting. To rack mount the instrument, use Option 15 B.

The procedure for installing the Rack Mounting Kit on the M150AC is as follows:

A) Remove Extrusion insert (2 each) from both sides of instrument

B) Place L-Bracket (2) and secure to chassis with four machine screws furnished with Mounting Kit

C) Check that the screws and brackets are firmly secure

2-4. **Power Requirements**

The Model M150AC requires a power source of either 115 or 230 volts AC, 44 to 66 Hz single-phase. Prior to applying power to the instrument, ensure the AC line voltage selector switch on the Rear Panel is in the appropriate position. Also, the AC power socket to which the M150AC connects must have a functioning safety ground.

To protect operating personnel, NEMA, the National Electrical Manufacturers Association, recommends that the instrument panel and cabinet be grounded. The M150AC is equipped with a 3-conductor power cord, which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the 3-prong connector is the ground pin.

2-5. **Storage**

It is strongly recommended that the M150AC be packed as if for reshipment. Environmental conditions during storage and reshipment should be as follows:

A) Maximum temperature: 167°F (75°C)

B) Minimum temperature: -40°F (-40°C)

2-6. **Repackaging for Shipment**

If possible, use the original shipping container and packing materials. Otherwise:

A) Wrap the M150AC in heavy paper or plastic before placing it in the shipping container.

B) Use plenty of packing material around the instrument, and protect the front panel with cardboard or plastic bubble packing. Protect the instrument with two inch rubberized foam pads placed along all surfaces of the instrument, or with a layer of excelsior about 6 inches thick packed firmly against all surfaces of the instrument.

C) Use a strong, well-sealed shipping container (350 lb/sq in. bursting test).

D) Mark the container "FRAGILE - DELICATE INSTRUMENT."

2-7. **Installation**

Place the instrument in a sturdy position, preferably on an insulated surface, with all surrounding metal/conductors grounded. Position the power cord so as to avoid being walked on or pinched by other equipment.

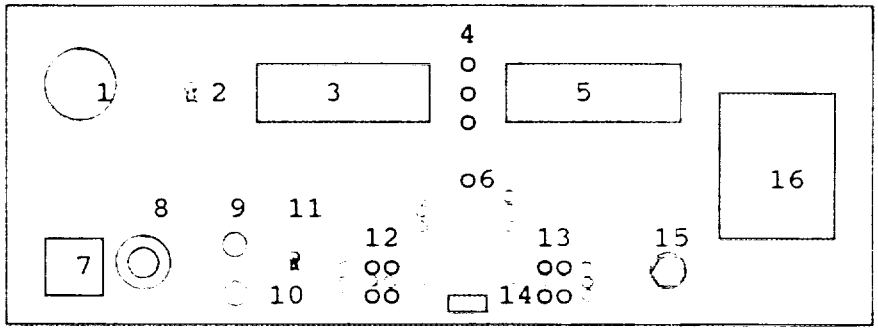
WARNING

This instrument to be used ONLY in **THREE WIRE GROUNDED OUTLETS**. It is recommended that periodic checks of the outlet and the ground wire be made to ensure operator safety.

2-8. **M150AC Rear Panel High Voltage Connector**

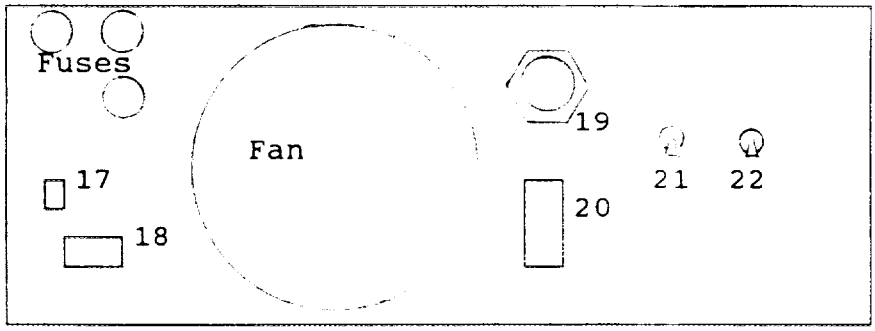
In order to make the M150AC Hipot Tester compatible with the **Rod-L** Ground Continuity testers, the *HIGH VOLTAGE RETURN* signal has been moved from Pin 3 to Pin 2 of the rear panel high voltage connector. In addition, a low active *START* signal was added to Pin 3 of the connector, and a low active *RESET* signal was added to Pin 4. (See Wiring Diagram 01198-02).

Figure 2-1: Front Panel Controls:



1: Alarm
2: Real or Total Current Switch chooses which current to be displayed
3: Output Current Meter
4: Tester Mode lamps indicate mode of M150AC
5: Output Voltage Meter
6: Fail lamp and Failure "type" or "Mode" indicators
7: Line Power Switch turns M150AC Hipot Tester on or off
8: Start Button for starting a test
9: Reset Button resets M150AC and clears fail lights
10: Stop Button to stop a test
11: Test Mode Switch chooses A or B test settings
12: Set-up pots to left with rotary switch on right for Total, Real, and Under Current Trip Points
13: Rotary switch to left with set-up pots on right for High Voltage set, Ramp and Dwell Times
14: Remote / Local (Manual Mode) Switch
15: Chassis Ground Sense banana jack for DUT Chassis Ground
16: High Voltage Receptacle block for DUT power cord

Figure 2-2: Rear Panel Controls:



17: Switch for 230 or 115V line input
18: Line input receptacle
19: HV Out / Interface Receptacle
20: Remote connector receptacle
21: Under Current enable/disable Switch
22: Test Tone enable/disable Switch

2-9. Factory Settings

The Model M150AC is shipped with the following factory-selected settings (unless otherwise requested in writing by the customer):

NOTE: *Appropriate extra fuses are provided for 230VAC operation.*

Table 2-1: Factory Settings

TEST MODE SWITCH	"A"	"B"
Voltage	1250 VAC	1500 VAC
Maximum Total Current	50 mA	50 mA
Maximum Real Current	5 mA	5 mA
Maximum Under Current	5 mA	5 mA
Test (Dwell) Time	60 sec	1 sec
Ramp Rate	200 V/sec	1000 V/sec
Input Line Voltage Select	115 VAC	
Remote/Local	Local	

2-10. Operational Check

This is an operator oriented procedure which allows operational check of the **Rod-L** Model M150AC Hipot Test Instrument without test equipment. Refer to Section 4 of this manual for a complete calibration procedure.

WARNING

AC high voltage is present at the front panel HV receptacle block and the rear panel cylindrical connector when the testing lamp is lit.

CAUTION

Changing Fuses: Turn off the M150AC and **DISCONNECT THE POWER CORD**. Then install the proper fuses. Otherwise, damage to the instrument and/or operator could result.

NOTE: *All the lights on the front panel should be extinguished and the meter should be at zero.*

A) Set LINE POWER switch to OFF.

B) Validate that fuses F1 and F2 are the proper values.

C) Verify Input Line Voltage Select Switch position.

D) Connect AC Power Cord to AC receptacle on the rear panel.

E) Connect the AC Power Cord to a 120 VAC ±10% power source.

F) Remove Setup Access Cover (Front Panel).

G) Ensure that the SETUP switches are positioned to the "RUN" position.

H) Verify Remote/Local Switch is in Local position.

I) Connect low current Ground Sense Cable to the CHASSIS GROUND SENSE terminal on the front panel. Then clip the other end of the cable to the Hipot Tester chassis.

J) Set LINE POWER switch to ON. The power ON lamp should illuminate.

K) Press the RESET button. After approximately 2 seconds the green READY lamp should also illuminate.

NOTE: *If the power ON lamp remains off, check for proper AC line voltage. If the power ON lamp is ON and the green READY lamp remains off, check the* CHASSIS GROUND SENSE *connections.*

L) With the READY lamp lit, push the START switch. The READY lamp will extinguish and the TESTING lamp will illuminate. With the TESTING lamp ON, quickly disconnect the CHASSIS GROUND SENSE cable. The FAIL and GRND lamps light and the alarm sounds, indicating a Safety Ground failure.

M) Push the RESET switch to extinguish the FAIL and GRND lamps and the alarm.

N) Reconnect the CHASSIS GROUND SENSE cable per step "I." The READY lamp should re-illuminate.

O) Push START. The TESTING lamp will light, the OUTPUT VOLTAGE meter will indicate the controlled rise to the preset voltage. The TESTING light will remain ON until test time has expired or a test failure is detected.

P) If the Test passes, the Pass light comes on.

2-11. **Testing Parameter Adjustments**

The LEFT side potentiometer group is used to adjust the A and B settings of:

A) Total Current Trip

B) Real Current Trip

C) Under Current Trip

The LEFT side selector switch is turned counter-clock-wise. Position it to the required parameter. An LED will turn on to indicate which parameter is being set. Adjust the selected trip pot until the desired setting is indicated on the current meter.

The RIGHT side potentiometer group is used to adjust the A and B settings of:

A) HV Output

B) HV Ramp Rate

C) Test Dwell Time

The RIGHT side selector switch is turned clock-wise. Position it to the required parameter. An LED turns on indicating which parameter is being set. Adjust the selected trip pot until the desired setting is indicated on the voltage meter.

2-12. **Remote / Local Operation**

Please note that M150ACs equipped with Revision A of the A34 Remote Control PCB will not be compatible with M988Cs that are equipped with the A93 Multiplexer (5 outputs) PCB. This also means that M150ACs that are equipped with the Revision B of the A34 will not be compatible with M988Cs that are set up to work with one unit only. The standard version that M150ACs are now equipped with is Revision B.

The Remote/Local miniature slide switch on the front panel puts the instrument in the remote or local (manual operation)

condition. When in the local position the instrument will ignore any signals at the interface port. In the remote position, the unit will only respond to the interface signals on the port and ignore all the front panel controls/settings except for the RESET and STOP buttons.

The A34 Remote PCB allows the M150AC to interface with any controller that is capable of outputting six 0 to 10 VDC analog signals and three TTL level digital signals. In addition, information on the High Voltage output, the Total Current being drawn, the Real Current being drawn, the Pass or Fail status, the Ready status, the Testing status, and the type of hipot Failure can be obtained if the controller is capable of inputting eleven TTL level signals and three 0 to 10 VDC analog signals. If fewer than eleven TTL inputs or three analog inputs are available on the controller, one can receive just the vital test information (i.e. pass/fail, total current drawn....)

On the A34 Remote Control PCB is JP1, a jumper that allows the user to select between digital control, or analog and digital control. When JP1 is not in place, the M150AC is in the Digital only Remote mode, and only digital signals like *START*, *RESET*, and the various *FAIL* signals are available via remote control.

When JP1 is in place on the A34 the M150AC can send and receive both digital and analog signals, and the test parameters — Test Voltage, Total Current Trip, Real Current Trip, Under Current Trip, Dwell Time and Voltage Ramp Rate — can be set via remote control. The M150AC can still be *STOP*ped and *RESET* manually. When digital and analog control is selected, the controller must supply all (it does not HAVE to supply Under Current Trip Point) of the analog control signals: those analog test parameters that are not supplied by the controller will be set at zero. In the case of the Total and Real Current Trip Points, for example, this will result in a Failure immediately after trying to initiate a hipot test.

When disabled by the rear panel switch, the Under Current Trip Point is the only parameter that can be left uncontrolled.

The *START* and *RESET* signals at J1 are high true TTL level inputs. On Revision A of the A34 PCB, *READY*, *TESTING*, *PASS*, *FAIL*, and failure type signals are high true TTL level outputs; on Revision B of the A34, they are low true TTL level outputs.

The Test Voltage (*RHVTEST*), Voltage Ramp Rate (*RRATE*) Dwell Time (*RDTIME*), Real Current Trip Point (*RIRTRIP*), Total Current Trip Point (*RITTRIP*), and Under Current Trip Point (*RIUTRIP*) signals are 0 to 10 VDC analog inputs (through J1, from the Remote connector). The High Voltage Output (*RHVRMS*), the Total Current drawn (*RITRMS*), and the Real Current drawn (*RIRRMS*) are are 0 to 10 VDC analog outputs.

In the case of both the analog inputs and analog outputs, the 0 to 10 VDC signals are linearly proportional to the parameters that they represent. For example, to set the output voltage at 2500 VAC (or half of full scale) *RHVRMS* would have to be 5 VDC. And if *RHVRMS* is 5 VDC, then the Hipot Tester is outputting 2500 VAC (see the specification sheet on page 7 for all of the maximum parameters).

In addition to the digital (and optional analog) signals, the controller must supply +5 VDC to Pin 20 of the remote interface connector and a reference (Digital Ground) to Pin 1 of the remote interface connector. If analog control is selected, the controller must also supply an analog reference (Analog Ground) to Pin 4 of the remote interface connector.

From the factory, the A34 PCB is configured for digital and analog control.

The pin configuration of the DB25 remote interface connector on the rear panel is shown on page 27.

2-13. **Device Under Test (DUT) Setup**

The DUT will be subjected to high voltage. The line and neutral of the DUT will be connected together from inside the M150AC. The HV will be applied across the line/neutral wire-set compared to the ground wire of the DUT.

The Current Output Meter on the M150AC will display the amount of "Leakage" current flowing with the HV. The Real Current can be displayed by switching the "REAL CURRENT/TOTAL CURRENT" switch on the front panel to the Real Current position.

Section 3
THEORY OF OPERATION

3-1. General Introduction

This section concerns the circuit theory for the M150AC Hipot Tester. Here are named the P. C. Boards:

3-2. Start Sequence Description

In brief, any of the *Start* signals goes to the A32 Hipot Controller PCB which then creates the signal *TESTING*. This signal goes to the A35 HV Generator PCB where it is passed through a delaying circuit and a relay. The relay causes the high voltage line to be connected to the primary of the high voltage transformer, T1, as well as sending the signal *RMPSTART* back to the A32 Hipot Controller.

RMPSTART combined with *TESTING* creates the signal *RAMPEN* which goes to the A33 Test Sequencer PCB. *RAMPEN* combines with the High Voltage and Ramp Rate settings from the A31 Front Panel Driver PCB and creates an AC Control signal called *ACCONT* which goes to the A35 HV Generator PCB.

At this time *ACCONT* causes the primary of the high voltage transformer, T1, to actually begin the high voltage ramp up.

More detailed descriptions of the circuits follow.

3-3. A10 Power Supply P. C. Board

3-3.1. Description

The A10 generates the regulated *+5VDC*, *+15VDC*, and *-15VDC* power supplies that are used throughout the unit.

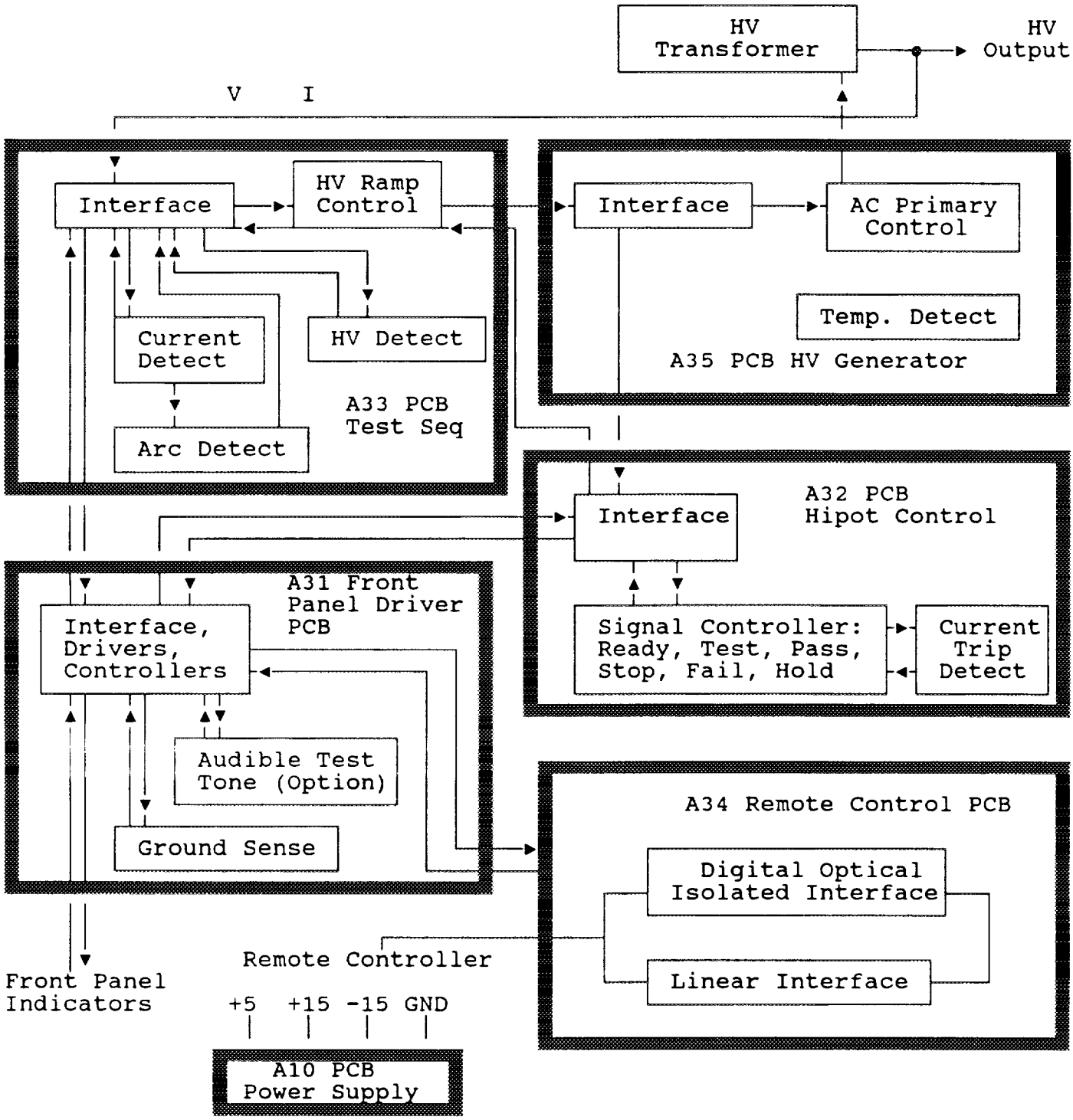


Figure 3-1: Instrument Block Diagram

3-3.2. **Theory**

Referring to schematic 00978-01, the different AC voltages are full wave rectified by U1, 2, and 3, and they are filtered and regulated by VR1, 2, and 3.

3-4. **A30 Front Panel P. C. Board**

3-4.1. **Description**

This board is mounted on the inside of the front panel and contains the switches for test parameter setup, RESET, STOP, A/B select, and Local/Remote select. It includes interface to the digital Meters on the Front Panel.

3-4.2. **Theory**

Referring to schematic # 01423-03, R12 through 16 are used for adjusting the *A TEST PARAMETERs*, and these signals are sent to the A31 Front Panel Driver through J2 on the A30. J2 Pin 10 carries the signal (*MAX LEV A30*) from the pot, R29, on the A31 Front Panel Driver PCB. This signal sets the maximum level that the parameters can be set at when these A30 pots are turned fully clock-wise. R38 through 43 adjust the *B TEST PARAMETERs*.

*LED*s CR2, 3, 4, 5, 8, and 9 are driven by the A31 through J1 on the A30. Some of these signals pass to the *LIGHT*s mounted on the Front Panel through J5. J1 also transmits the signals that go to the *SWITCHes* and the *ALARM* mounted on the front panel, using also J3. Further circuit description is in the A31 section.

The RESET and STOP signals are initiated on this board through switches, as are the A/B Test Parameter Select Switch, and the Local (manual operation) / Remote Switch. The *RESET* and *STOP* signals go through J4 of the A30 to J1 on the A36 Mother PCB (Pins 8 through 12 on the Mother PCB are not used). The *A/B SWITCH* and the *LOCAL/REMOTE SWITCH* go to the A31 through J2 and J1 respectively.

SW3 and SW5 are rotary switches that select test parameters to be displayed. They select the LED that will be lit, CR14 through 19, as well as the signal to be sent to the Digital Meters through U1 (and U5), and J6 or J7 respectively. When the switches are in the first position, which happens to be fully clock-wise for SW5 and fully counter-clock-wise for SW3, they are in the "Run" mode. The screwdriver slots will be vertical.

3-5. **A31 Front Panel Driver P. C. Board**

3-5.1. **Description**

The A31 powers the lights on the front panel and front panel switch board; drives the Voltage, Total Current, Real Current, and Audible Test Tone Pulse signals; and also supplies the Test Voltage and Current Trip points during test parameter setup. It correlates Ground Sense connections for failure.

3-5.2. **Theory**

Referring to schematic # 01403-03, the *FAIL*, *READY*, *TESTING* and *PASS LIGHTS* on the front panel are connected to the A30 Front Panel Switch PCB through J1. The signals come from the A32 Hipot Controller through the A36 Mother PCB and are driven through NAND gates. The *FAIL* signal comes in at edge-card connector P1 Pin 6 and is driven through U6 Pin 3 to J1 Pin 9, which goes to the A30 Front Panel Switch PCB to turn on the light. It also goes to U1 to produce *BUZZER DRV SIG*. The *READY* line inputs from P1 Pin M and is driven at U3 Pin 11 to J1 Pin 2. The *TESTING* signal comes in from P1 Pin 8, goes through U5 to Pin 5, and to J1 Pin 3. The *PASS* line enters from P1 Pin 16 to U5, and is brought out at Pin 3 to J1 Pin 4.

The Type-of-Failure lights on the A30 Front Panel are also powered at this point on the A31. The fail light signal for Under Current, called *FIUL*, is driven through U4 Pin 8, (having come in through P1 Pin T) to J1 Pin 11, and then to CR4 on the A30. The fail light signal for Total Current, *FITL*, enters through P1 Pin N, is powered at U4 Pin 3, exits through J1 Pin 5 to the A30, finally coming to CR2. Real Current, *FIRL*, comes in at P1 Pin 11, moves through U4 Pin 6, through J1 Pin 8, to the A30 and CR3. Arc failure, *FARCL*, inputs at P1 Pin 15, outputs at U4 Pin 11 to J1 Pin 7, then CR5 on the A30. The *TEMP* fail light comes in at P1 Pin 20, and U3 Pin 8 drives it to J1 Pin 10, and ends at CR8 on the A30. Ground failure, *FSGL*, enters from P1 Pin N at U3 and exits Pin 3, to J1 Pin 6, and finally to the A30, CR9.

The Audible Test Tone Pulse is generated at U10, an NE555 timer. Leaving Pin 3 it goes to U2 Pin 1 where it is combined with the *TESTING* to get the beeping during the test, going through U1 Pin 2 and J1 Pin 13 to J1 on the A30, then J3 on the A30, and finally to the alarm on the front panel. The signal also goes to P1 Pin L where it continues to the A32 Hipot Controller, and to U5 Pin 6, where the Testing signal is again added, creating the signal that turns the Testing light (on the front panel) on and off during a test, through J1 Pin 3 and J5 Pin 3 on the A30.

The Voltage signal is combined with *-HOLD198* at U8, and as *HVDPM* (High Voltage Digital Panel Meter) it goes through J2 Pin 16 to the A30.

The Current signals, *IRRMS* and *ITRMS*, coming from the A33 Current Sense and Sequencer PCB, pass through J1 Pin 15 and J1 Pin 14 respectively to the A30 Front Panel Switches PCB, then through the A30's J3 to the Total/Real Current select switch on the Front Panel. The resulting chosen signal, *TOTAL/REAL SW*, comes back to the A31 through J2 Pin 23 to U7 Pin 3. It comes out on Pin 5 as *ITRDPM* and is fed through J2 Pin 15 to the Digital Meter via the A30. On the A30, these signals go through switches SW3 and SW5 respectively, when switched to the "Run" position.

The *CURRENT TRIP POINTS* that were manually selected from the A30 Front Panel Switches PCB come in at J2. U17 chooses which set of parameters, A or B, and U12 chooses between the remote or manually selected signals, and holds the values at the outputs, (between 0 and 5 Volts DC) which are also forwarded to the A32 Hipot Control PCB. The *HIGH VOLTAGE SELECT*, *RAMP RATE* and *DWELL TIME* from the A30 come in at J2, then after A/B and remote/manual selections, the outputs are held on U11, and sent to the A33 Current Sense / Sequencer PCB.

P1 Pin 7 brings in the scanned Ground Sense connections, *SGSENSE*, and compares it at U14 with the setting made at R30. If the connections cause too high a resistance at *SGSENSE*, U14 activates the Ground Sense failure signal, *FSG*, and sends this signal through P1 Pin H to the A32.

3-6. **A32 Hipot Control P. C. Board**

3-6.1. **Description**

This board processes the START, RESET, and STOP signals, the Ready, Pass, and Testing signals, and related Fail signals.

It initiates the Fail signals related to the Total Current, Real Current, and Under Current.

Revision C changed capacitor spacings, added the cap onto U4 input, and polarity to C10.

3-6.2. **Theory**

With reference to schematic # 01408-03, the START, RESET, and STOP signals can come in at the edge-card connector from the front panel, through J1 on the A36 Mother PCB (called *STARTP*, *RESETP*, and *STOPP*); the remote interface, A34 Remote Control PCB (called *RSTART*, *RRESET*, and *RSTOP*); or they can come in from the M25 interface, J1 on the A32 PCB (*M25START* and *M25RESET*). *RL2* is from the Remote/Local switch on the A30 Front Panel Switch PCB.

When the M150AC is in the *READY* mode (output at U7 Pin 11 and going onto the A36 Mother PCB at edge-card connector P1 Pin Y) the *TESTING* signal is activated (at U15 Pin 1) after it receives a

START pulse (from U3 Pin 6). If the *RESET* signal (from U2 Pin 8) is received (at U3 Pin 1) while a test is in progress, the *TESTING* signal is de-activated. If a *RESET* signal (from U2 Pin 8) is received while there is no test in progress, all (if any) Fail signals are cleared (U12 and U13). As long as *RESET* is active, the M150AC is inhibited from returning to the *READY* mode.

The *READY* signal activates when 1) no Test is in progress, 2) no Fail signals are active, 3) the Pass signal is not active, and 4) the unit is not in the Stop mode.

The *PASS* signal originates at the end of the hipot Test cycle (U7 Pin 2, U13 Pin 10, then U15 Pin 13). Also, *DHOLD* is initiated from the *TESTING* signal at U15 Pin 2, going to U4 Pin 1, U9 Pin 4, U4 Pin 13, then off the edge-card connector at P1 Pin 21. *DHOLD* freezes the Digital Meters at their last reading at the end of a hipot test.

TESTING comes in at U3 Pin 12, and also turns on T1, the high voltage transformer (see also the A35 on page 27) through P1 Pin X. K1 on the A35 High Voltage Generator PCB causes the signal *RMPSTART* to go high, which comes into the A32 to U3 Pin 13, and then the signal *RAMPEN*, U3 Pin 8, is initiated and sent to the A33 Real Current / Test Sequencer through P1 Pin 19.

The *FAIL SIGNALS* are stored in set-reset flip-flops U12 and U13, and sent to the A31 Front Panel Driver board. The *L* suffix stands for light. These signals get cleared when the *RESET* signal is activated.

The Total Current output, *ITRMS*, is compared to the Total Current Trip Point, *ITTRIP*, at U11 Pins 4 and 5. If the Total Current Trip Point is exceeded, a Fail signal, *FIT*, is generated at Pin 2. The Real Current output, *IRRMS*, is compared to the Real Current Trip Point, *IRTRIP*, at U11 Pins 6 and 7. If the Real Current Trip Point is exceeded, a Fail signal is generated, coming out of U5 Pin 1 as *FIR*.

ITRMS is also compared to the Under Current Trip point, *IUTRIP*, at U10 Pins 2 and 3, and an Under Current Fail signal, *FIU*, is generated if the Under Current Trip point is greater than the Total Current output after the Dwell Voltage has been reached. A switch on the rear panel allows the Under Current function to be turned off.

3-7. A33 I/V Sense and Test Sequencer P. C. Board

3-7.1. Description

The A33 board measures the Total Current and Real Current during a test, and measures the high voltage output level. It

controls the output voltage Ramp Rate and magnitude. It also controls the Arc Failure signal.

Revision C changes trace spacing and adds RC network with shunting diodes to protect inputs on U1 and U9.

3-7.2. **Theory**

Referring to schematic # 01403-03, when *RAMPEN*, Ramp Enable at P1 Pin J, goes high, the ramp control circuit, U2 and U10, measures *RRATE*, the Ramp Rate Setting from the A31 Front Panel Driver at edge-card connector P1 Pin F. The DC signal at U10 Pin 1 is inversely proportional to the output voltage, from 0 to -10V if the output voltage is set at its highest. *HVTEST*, at P1 Pin H, is the high voltage setting from the A31. It is compared at U16 to the inverse ramping signal from U10 Pin 1, and a DC signal is put out; AC Control, *ACCONT*, at U10 Pin 7, that is fed to the A35 HV Generator PCB through P1 Pin 17. *ACCONT* ramps from 0 VDC to some value, between 0 and 10 VDC, which is proportional to the high voltage output. *HVTEST* also creates the signal at U4 Pin 3, *DWELL*, that indicates when the Dwell voltage has been reached. The length of the hipot Test cycle (Ramp Time plus Dwell Time) is determined from the signal *DTIME* at P1 Pin R, and then a signal, *EOT*, from U11 Pin 7 through P1 Pin 5, is put out to shut down the high voltage when the test time has elapsed.

The High Voltage Transformer, T1 on the chassis, puts out 2 signals at Pins 1 and 2; one is 5000 Volts AC, and it goes to the receptacle on the front panel, the HV connector on the rear panel, and to the A71 Resistor PCB. It is called *HVRED*. The other pin of T1, *CURTSEN* (was HVBLK), is the 0 volt lead, and it is used to measure the Current being drawn during a test.

HVRED from T1 (see above paragraph) goes to the A71 and is limited using two 3MΩ resistors in series. *CURTSEN* goes to the A71, is limited, then tied to the limited *HVRED*, now becoming *VOLTSEN* (was HVFDBK). *VOLTSEN* comes into the A33 via P1 Pin N via the A36 Mother PCB, J2. It is amplified, U21 Pin 1, being called *HVSENSE*, goes through a True RMS Analog-Digital Converter, U17, and is amplified again at U21 Pin 7. This signal, *HVRMS*, is a DC signal, indicative of the amplitude of the High Voltage output, and goes to the Voltage Output Meter via the A31 Front Panel Driver PCB, via P1 Pin Y.

CURTSEN (see above 2 paragraphs) comes into the A33 from T1 and the A71 through J1 Pin 2. It is amplified at U20 Pin 1 and becomes *ITSENSE*, which then goes through a True RMS Analog-Digital Converter, U15, and is amplified again at U20 Pin 7. It is now the DC signal, *ITRMS*, proportional to the amount of Total Current being drawn. It is fed to the Current Output Meter via the A31 Front Panel Driver PCB via P1 Pin P.

CURTSEN (from above paragraphs) is also used at U1 and U9 to sense for arcing in the DUT. If a current spike greater than 70mA is detected, the Arc Failure signal, *FARC*, is activated and sent through P1 Pin E to the A32 Hipot Control PCB.

The amount of Real Current being drawn during a test is calculated from the Total Current, *ITRMS* (see above paragraphs), and either *ITSENSE* or *HVSENSE* at U18. The output is amplified at U19, with R62 allowing for adjustment, and this becomes *IRRMS*, a DC signal proportional to the amount of Real Current being drawn. The signal goes to the A31 Front Panel Driver PCB through P1 Pin 20.

R71 is used to adjust a 5 volt power supply which is exclusive to the Real Current circuit. It is for using a capacitive load (use oil filled capacitors only).

3-8. A34 Remote Control P. C. Board

3-8.1. Description

This board provides digital and analog interfacing capabilities which allow the M150AC to be controlled remotely.

3-8.2. Theory

See Section 2-7 for Operation Instructions, page 10, and refer to schematic # 01428-02.

Note that M150ACs equipped with Revision A of the A34 Remote Control PCB will not be compatible with M988Cs that are equipped with the A93 Multiplexer (5 outputs) PCB. This also means that M150ACs that are equipped with the Revision B of the A34 will not be compatible with M988Cs that are set up to work with one unit only. M150ACs are now equipped with Revision B.

The *REMOTE/LOCAL* miniature slide switch on the front panel must be in the *REMOTE* position to respond to the interface signals on the port. It will ignore all the front panel controls and settings except for the RESET and STOP buttons.

JP1 on the A34 is a jumper that allows the user to select between digital control, or analog and digital control. When JP1 is not installed, the M150AC is in the *DIGITAL ONLY REMOTE MODE*, and only digital signals like START, RESET, and the various FAIL signals are available via remote control.

When JP1 is installed the M150AC can send and receive both digital and analog signals, and the test parameters — Test Voltage, Total Current Trip, Real Current Trip, Under Current Trip, Dwell Time and Voltage Ramp Rate — can be set via remote control. The M150AC can still be STOPped and RESET manually. When digital and analog control is selected, the controller must supply all (it

does not HAVE to supply Under Current Trip Point) of the analog control signals: those analog test parameters that are not supplied by the controller will be set at zero. In the case of the Total and Real Current Trip Points, for example, this will result in a Failure immediately after trying to initiate a hipot test. When disabled by the rear panel switch, the Under Current Trip Point is the only parameter that can be left uncontrolled.

The *START* and *RESET* signals at J1 are high true TTL level inputs. On Revision A of the A34 PCB, *READY*, *TESTING*, *PASS*, *FAIL*, and failure type signals are high true TTL level outputs; on Revision B of the A34, they are low true TTL level outputs.

The Test Voltage (*RHVTEST*), Voltage Ramp Rate (*RRATE*) Dwell Time (*RDTIME*), Real Current Trip Point (*RIRTRIP*), Total Current Trip Point (*RITTRIP*), and Under Current Trip Point (*RIUTRIP*) signals are 0 to 10 VDC analog inputs (through J1, from the Remote connector). The High Voltage Output (*RHVRMS*), the Total Current drawn (*RITRMS*), and the Real Current drawn (*RIRRMS*) are are 0 to 10 VDC analog outputs.

In the case of both the analog inputs and analog outputs, the 0 to 10 VDC signals are linearly proportional to the parameters that they represent. For example, to set the output voltage at 2500 VAC (or half of full scale) *RHVRMS* would have to be 5 VDC. And if *RHVRMS* is 5 VDC, then the Hipot Tester is outputting 2500 VAC (see the specification sheet on page 7 for all of the maximum parameters).

In addition to the digital (and optional analog) signals, the controller must supply +5 VDC to Pin 20 of the remote interface connector and a reference (Digital Ground) to Pin 1 of the remote interface connector. If analog control is selected, the controller must also supply an analog reference (Analog Ground) to Pin 4 of the remote interface connector.

The pin configuration of the DB25 remote interface connector on the rear panel is as follows:

DB 25 Pin #	Signal Name	Analog/Digital
1	Dig. Gnd.	
2	HVOut	A
3	ITOut	A
4	Ana. Gnd.	
5	VRef	A
6	ITTrip	A
7	DTime	A
8	RRate	A
9	IRTrip	A
10	IROut	A
11	-FSG (Gnd. Fail)	D
12	-FTemp (not used)	
13	-FIU (Under Curr. Fail)	D
14	-FIR (Real Curr. Fail)	D
15	-FIT (Total Curr. Fail)	D
16	-FARC (Arc Fail)	D
17	IUTrip	A
18	Reset	D
19	Start	D
20	Ext. +5	
21	-Ready	D
22	-Testing	D
23	-Fail	D
24	Stop	D
25	-Pass	D

3-9. **A35 HV Generator P. C. Board**

3-9.1. **Description**

The A35 controls the AC signals for the high voltage transformer.

3-9.2. **Theory**

Referring to schematic # 01415-03, the AC signals are developed from the inputs *+VDD* and *-VDD* which come from the diode-bridge on the Rear Panel, DB1, and capacitors C1 and 2. The *+VDD* is split into *LVDD* and *RVDD* and they need to be balanced (see calibration section on page 29). The developed signals, *PRI1* and *PRI2* are fed to the primary of the high voltage transformer, T1 on the chassis. *PRI2* goes first through a relay, K1 on the A35, that allows voltage to be fed to T1 only when a test is in progress.

K1 is controlled by the signal *TESTING*, coming from P1 Pin 9, which comes from the A32 Hipot Control PCB. *TESTING* goes through a delaying circuit, then K1 switches in *PRI2* and the *RMPSTART* signal which is sent to the A32 (see also the A32 section on page 22).

ACCONT comes in from the A33 Real Current / Test Sequencer PCB through P1 Pin 7. This signal goes through U4, an analog multiplier, and becomes *632OUT*, available at TP1. It controls the magnitude of the AC output.

10VAC comes into the A35 through P1 Pin 12 from the power supply transformer, T2. After going through U2, an analog multiplier, and U5A, an amplifier, *ACREF* is created which references on U4 for *632OUT*.

3-10. **A36 Mother P. C. Board**

This is the board in which the other boards are seated, except for the A35 HV Generator and A30 Front Panel Board. The schematic # is 01438-02.

Section 4
MAINTENANCE AND SERVICE

WARNING

These Service Instructions are for use by qualified personnel ONLY. To avoid electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so!

4-1. Introduction

This section provides maintenance and service information for the **Rod-L** M150AC. Included is a list recommended test equipment, calibration procedures and adjustment data.

4-2. Equipment Needed

The following equipment will be needed to complete the factory calibration procedures:

1) Oscilloscope

2) Digital Multi-Meter (DMM)

3) High Voltage Probe

4) Potentiometer adjusting screw driver

5) High Voltage Loads

4-3. Factory Calibration Procedures

It is recommended that the M150AC be calibrated at the same line input voltage as will be used for normal operation. If line frequency is different from 60Hz, remember that required capacitor values will change.

Disconnect the A35 High Voltage Generator PCB for testing the low voltage boards.

The HV Transformer must not be connected until the A35 has

been completely tested. Also, the +VDD and -VDD signals on the A35 must not be connected until the initial A35 set up has been completed.

4-3.1. **A10 Power Supply Board:**

DISCONNECT THE A35 High Voltage Generator PCB for testing the low voltage boards.

Ensure that the regulated +5VDC, +15VDC, and -15VDC power supplies on the A10 are good.

4-3.2. **A30 Front Panel Switch**

The A30 is not a calibrated PCB. The switches and pots are for setting Test Parameters for manual mode (Local) operation. The High Voltage setup should be from 0 volts to 5 kiloVolts. If it is less than 5kV, adjust *R29* on the A31, which affects *ALL* the *MAXIMUM* levels.

Make sure that the Local/Remote Operation Switch is in the Local (Manual Operation) Mode. Set the High Voltage output for 1500V.

4-3.3. **A31 Front Panel Driver Calibration Points: Chassis Ground Sense, Voltage and Current Meters, Test Fail Points**

R29 — Calibrates the Meters to display the *MAXIMUM* settable test parameter when the adjustment pots are turned fully clock-wise (i.e. Total Trip should display 50mA when set to the maximum).

R30 — Calibrates Ground Fail light to come on when .5Ω or more is between the chassis and the *GROUND SENSE* receptacle.

4-3.4. **A32 Hipot Control**

The A32 has no positions for calibration.

Make sure that the A35 High Voltage Generator PCB is disconnected for testing the A32.

Check especially that the following signals are working properly: TESTING at P1 Pin X, output from U15 Pin 1; and FAIL at P1 Pin U, output from U14 Pin 1.

4-3.5. **A35 HV Generator Calibration: High Voltage Balance**

A) Initial Set Up:

NOTE: *The HV Transformer at connector T1 must* NOT *be connected until the A35 HV Generator has been completely tested!*

1) Turn the power to the M150AC off.

2) Ensure that the Front Panel Remote/Local switch is in the Local mode.

3) Make sure that the +VDD and -VDD signals from DB1, C1, and C2, the diode-bridge and capacitors on the rear panel and chassis, are disconnected from the A35 PCB. These signals are marked on the PCB as +VDD and -VDD, and also called connector points *E1* and *E2*. The wires that go to this connector are brown and red.

4) Connect an oscilloscope to *ACREF* at TP2.

5) Turn the M150AC line power on.

6) With the oscilloscope, assure that a "clean" sine wave is being output at TP2. If the sine wave at TP2 is not clean, or if the signal is DC, check the signal coming into Pin 12 of connector P1. P1 Pin 12 should be connected to T3, the 10 VAC transformer, via the A36 Mother PCB.

7) After ensuring an AC wave form at TP2, connect a *DMM* to *ACREF* at TP2.

8) Adjust potentiometer R10 until TP2 is about 7 VAC RMS.

9) Connect the oscilloscope to *632OUT* at TP1.

10) Set the scope to display DC voltage at 50mV per division.

11) *632OUT*, TP1, should be a slightly "noisy" low amplitude sine wave.

12) Use potentiometer R28 to adjust the DC offset to zero (i.e. the zero crossing of the sine wave should be at the zero reading on the scope).

13) Now that the DC offset has been zeroed, use potentiometer R27 to adjust the amplitude of the signal to as close to zero as possible;

realistically, one should be able to adjust the signal down to about 10mV at the peaks of the wave form.

B) High Voltage Balance:

1) Turn the power to the M150AC *OFF!*

WARNING

Do NOT connect the +VDD and -VDD while power is on.

2) Ensure that the +VDD and -VDD signals from DB1, C1, and C2, the diode-bridge and capacitors on the rear panel and chassis, are reconnected to the A35 PCB. These signals are marked on the PCB as +VDD and -VDD, and also called connector points *E1* and *E2*. The wires that go to this connector are brown and red.

3) Put the positive DMM probe on *+VDD* at TP4, and the negative probe on *LVDD* at TP3.

4) Set the DMM to read DC voltage in the milliVolt range.

5) Turn on the line power.

6) Adjust R42 until the DMM reads about 65mVDC.

7) Move the negative DMM probe to *RVDD* at TP5 and adjust R43 until the DMM reads about 65mV.

8) Put an oscilloscope probe on *PRI2* at connector P3 Pin 3, and the other scope probe on connector *PRI1* at P2 Pin 3.

9) Set both scope channels to 20 Volts per division.

10) Set the M150AC Hipot Tester to output about 300 Volts.

11) Push the M150AC *START* button.

12) The two waveforms should be 90 degrees out of phase (i.e. inverted) perfect sine waves.

C) The High Voltage Transformer:

1) Turn the power to the M150AC *OFF!*

2) Connect the HV Transformer into place at T1.

3) Turn on the line power.

4) At the Front Panel Setup switches, set the Voltage to 1500V.

5) START the M150AC.

6) Hook a DMM with a High Voltage Probe to the output, either the front or the rear panel.

7) Push the START button on the front panel to initiate a test.

8) Use R10 to make the actual output voltage (as displayed on the DMM) correspond to what was set on the front panel. (Note that adjusting R10 DOES NOT effect the calibration of the high voltage display).

9) It is at this point that the Output Voltage Meter should be adjusted. This is done using R65 on the A33 I Sense / Test Sequencer PCB.

4-3.6. A33 I/V Sense Test Sequencer Calibration Points: High Voltage, Total and Real Current Sense (no arc)

Check that the -DWELL signal is working properly. The current and voltage readings can only be adjusted after the A35 High Voltage Generator PCB has been set up and connected into place.

R69 — Calibrates the Voltage Meter to 0000 in the *IDLE* state.
R61 — Calibrates the Current Meter to 00.0 in the *IDLE* state.
R65 — Calibrates *Output Voltage* Meter. (Mid Scale = 2500V)
R54 — Calibrates the Total Current reading. (E.g. 37mA)

R62 — Calibrates the Real Current reading. (For calibration, use a resistive load). (E.g. 3.7mA)

R71 — Calibrates the Real Current reading when using a capacitive load. Real Current should be 1/10 of the Total Current.

The following are suggested for testing loads:

Res Load = 600kΩ - 700kΩ, high wattage (100 - 200 watts)

Cap Load = .015μF, 8kV

4-3.7. A34 Remote Control

There are no points to calibrate on the A34.

Section 5
BILLS OF MATERIALS, SCHEMATICS, DIAGRAMS

Rod-L Electronics, Inc. -- Bill Of Materials
00790-01 Mdl M150AC 5.0kV 50mA Hipot Tester

Rod-L P/N	Description	qty	Reference
01500-01	Assy Unit M150AC Tested Hipot Tester	1.0	Unit
01163-03	Assy Kit Covers @ ButtonUp M150AC	1.0	ButtonUp
01170-12	Assy Kit Ship M150AC Box w/ Accessories	1.0	Shipping
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials

01163-03 Assy Kit Covers @ ButtonUp M150A

Rod-L P/N	Description	qty	Reference
01303-01	Asmy Plate Cover Bot Fabricated 16x16 M150	1.0	Bottom Cover
01302-01	Asmy Plate Cover Top Fabricated 16x16 M150	1.0	Top Cover
00455-01	Assy Handle Instrument	2.0	Handle
01304-01	Asmy Plate Cover Side Fabricated 7x16 M150	2.0	Side Covers
00340-02	Plate Retainr Handl Oliv VnylPaint Alum 4x5 M150	2.0	Handle Retainers
00619-01	Assy Foot Instrument w/Rivit, Spring, & Washer	5.0	Foot
00444-09	Stand Tilt Wire Form Instrument	1.0	Stand
00858-02	Plate Decor Side Strip .8125x6.3125alumGluM150	2.0	Side Strip
00620-01	Grip 2.3"L 'A' Plastic Black Molded SideFrame	2.0	Grip
00620-02	Grip 2.3"L 'B' Plastic Black Molded SideFrame	2.0	Grip
50656-05	Foam w/o Adhesive 3x3.75x6 Ethafoam	1.0	Foam on Top Cover
50573-01	Nut Push-On U-shape Clip # 6 black Tinnerman	4.0	HW Top & Bottom Cover
50532-02	Screw PanSem Phl 8-32 x .250	4.0	HW Handle Retainers
50779-02	Screw Fl Hd 100d Phl 6-32 x .250	16.0	HW Side Covers
50779-04	Screw Fl Hd 100d Phl 6-32 x .500	4.0	HW Top & Bottom Cover
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01170-12 Assy Kit Ship M150AC Box w/ Accessories

Rod-L P/N	Description	qty	Reference
50667-12	Box Shipping 10"x 19.5"x 21.5" Lettered for M150	1.0	Box
50663-08	Foam Shipping EndCap 10x19.5 M150 (add corner)	2.0	Box
77152-01	NIN Envelope 'Packing Slip' Clear Front,Stick Back	1.0	Box
50502-01	Bag poly clear 2mil x2x3 w/sealing	1.0	Bag
50502-05	Bag poly clear 2mil x4x6 w/sealing	1.0	Bag
50510-01	Asm Kit Con Plug HV cord mtg 4pin Amp 863022-2	1.0	HV Con Mate
50015-01	Asm Cable Power AC std 18AWG 1250W 7.5'L	1.0	Power Cord
50342-36	Asm Cable Jumper 18AWG StakngBana/StdAllig 36" blk	1.0	Ground Cable
50401-02	Asm Cable RS232 DB25P (2ea) 2' shielded (Remote)	1.0	Interface cable
77127-01	NIN Tool Adj Scrwdrvr Aligner (also PN 50989-01)	1.0	Adjustment Tool
50683-01	Label 'Calibration' green & white	1.0	Certification
60009-01	Manual M150AC 16 Jy 91	1.0	Manual
90074-01	NIN Form Certificate Technical	1.0	Certification
50062-10	Fuse Norm Blo 5.00A 250V 3AG .25x1.25"	3.0	Extra Fuses
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01500-01 Assy Unit M150AC Tested Hipot Tester

Rod-L P/N	Description	qty	Reference
01198-02	NIN Diag Wire Unit M150AC RevB	0.0	Reference
01503-02	Assy Unit M150AC Untested Hipot Tester (RevB)	1.0	Untested Unit
01436-02	Assy PCB A36 Mother (Rev2) M150AC	1.0	A36
01421-04	Assy PCB A30 Front Panel Switches RevD M150AC	1.0	A30
00459-02	Assy PCB A10 Power Supply	1.0	A10
01401-03	Assy PCB A31 Front Panel Driver (RevC) M150AC	1.0	A31
01406-04	Assy PCB A32 Hipot Control (RevD) M150AC	1.0	A32
01412-03	Assy PCB A33 I/V Sense,Real I, Sequencer M150 RevC	1.0	A33
01426-03	Assy PCB A34 Remote Analog & Digital (RevC) M150AC	1.0	A34
01416-03	Assy PCB A35 HV Generator (RevC) M150AC	1.0	A35
50463-01	Asm Cable&Cons: FRC 14p DIP (2ea) 6"	2.0	Meter Cables
00924-02	Assy Cable&Cons: FRC Mascn 16p 2ro (2ea) 14"L	1.0	A30 Cable
01008-01	Assy Cable&Cons: FRC Mascn 26p 2ro (2ea) 12"L	1.0	A30 Cable
01010-04	Assy Cable&Cons: FRC DB25S pemnut,Mascn 26p2ro 13"	1.0	Remote Cable
50676-01	Spacer # 4 x.437 x.25 OD FF round nylon	2.0	HW A30
50544-01	Nut Kep 4-40 x .250 (1/4) O.D.	4.0	HW A30
50530-02	Screw PanSem Phl 4-40 x .250	4.0	HW A36
REV-C	NIN Rev-C This Assy is at Rev-C	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01503-02 Assy Unit M150AC Untested Hipot Tester (RevB)

Rod-L P/N	Description	qty	Reference
01198-02	NIN Diag Wire Unit M150AC RevB	0.0	Reference
01216-01	Assy Plate Front M150AC	1.0	Front Panel Assy
01217-02	Assy Plate Rear M150AC RevB	1.0	Rear Panel Assy
01218-02	Assy Plate Chassis M150AC RevB	1.0	Chassis Assy
01493-02	Assy Heatsink 4 XS & Fan M150AC	1.0	HS
01305-01	Plate Frame Side 7x16 die cast alum M150	2.0	Frames
01507-01	Assy Harness Unit M150	1.0	Wiring
00647-01	Label Model No., Logo, U.L. Logo: 1x3 on Pin Feed	2.0	S/N
50544-04	Nut Kep 10-32 x .375 (3/8) O.D.	6.0	HW HS
50532-02	Screw PanSem Phl 8-32 x .250	4.0	HW Frames
50533-04	Screw PanSem Phl 10-32 x .500	6.0	HW HS
50778-03	Screw Fl Hd 100d Phl 8-32 x .375	18.0	HW Frames
90072-02	NIN Form Traveler Mfg Ordr,Prod Tst,QC Data ACs	1.0	Traveller
REV-C	NIN Rev-C This Assy is at Rev-C	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01416-03 Assy PCB A35 HV Generator (RevC) M150AC

Rod-L P/N	Description	qty	Reference
01415-01	NIN Schem PCB A35 HV Generator M150AC	0.0	Reference
01417-03	PCB Fab A35 HV Generator (RevC) M150AC	1.0	A35 PCB Fab
50388-01	IC V Reg Adjustable TO-92 LM317LZ	1.0	U3
50101-01	IC Op Amp JFET Input LoOffset LoDrift dual LF412CN	2.0	U5,6
50129-01	IC Comparator LoPwr Lo Offset V quad LM339	1.0	U7
50368-01	IC NAND 2-In Hi speed CMOS quad 74HC03	1.0	U9
50381-01	IC Multiplier Analog AD632H	2.0	U2,4
50390-01	IC Op Amp JFET Input Lo Power quad LF444CN	1.0	U1
50617-01	IC Driver Peripheral dual DS3632NS	1.0	U8
50264-08	IC-Socket 8p Lo Profile .3 DIP	3.0	X5,6,8
50264-14	IC-Socket 14p Lo Profile .3 DIP	3.0	X1,7,9
50707-02	Pot K 1 1 turn CERMET	2.0	R42,43
50702-04	Pot K 1 20 turns offset pins rectangle	2.0	R10,27
50702-11	Pot K 100 20 turns offset pins rectangle	1.0	R28
50125-24	Res Ohm 4.7 1/4W 5% CC	1.0	R51
50316-01	Res Ohm 1 3W 1% WW	2.0	R29,40
50316-05	Res Ohm 10 3W 1% WW	1.0	R46
50125-08	Res Ohm 100 1/4W 5% CC	1.0	R9
50125-21	Res Ohm 330 1/4W 5% CC	1.0	R8
50125-17	Res Ohm 680 1/4W 5% CC	4.0	R14,38,44,45
50125-31	Res K 1 1/4W 5% CC	1.0	R55
50350-13	Res K 1.1 1/4W 1% MF	2.0	R30,41
50125-40	Res K 4.7 1/4W 5% CC	2.0	R15,39
50350-42	Res K 5.11 1/4W 1% MF	2.0	R11,18
50125-85	Res K 8.2 1/4W 5% CC	4.0	R12,13,36,37
50125-44	Res K 10 1/4W 5% CC	4.0	R24,33,52,53
50350-45	Res K 10 1/4W 1% MF	2.0	R34,35
50350-33	Res K 20 1/4W 1% MF	1.0	R7
50350-46	Res K 51.1 1/4W 1% MF	3.0	R23,25,26
50350-87	Res K 56.2 1/4W 1% MF	2.0	R17,20
50350-36	Res K 100 1/4W 1% MF	3.0	R4,21,22
50360-61	Res K 140 1/4W 1% MF	2.0	R48,49
50125-93	Res K 160 1/4W 5% CC	1.0	R50
50125-64	Res K 200 1/4W 5% CC	4.0	R1-3,5
50125-66	Res K 240 1/4W 5% CC	1.0	R54
50150-51	Res K 240 1/2W 5% CC	1.0	R47
50350-56	Res Meg 1 1/4W 1% MF	2.0	R16,19
50126-04	Res Meg 2 1/4W 5% CC	1.0	R6
50043-01	Diode 1N747 Zen 3.6V	2.0	D5,7
50045-01	Diode 1N825 Zen 6.2V	2.0	D9,10
50046-01	Diode 1N4003 Rec	6.0	D1-4,6,8
50243-02	Trnstor 2N3440 NPN SS HV Amp 250V TO-39 SGS only!	2.0	Q2,4
50244-01	Trnstor 2N5415 PNP SS HV HiCur Amp 300VbrCEO TO-39	2.0	Q1,3
50209-21	Cap. 200 pF 50V 20% cerm disc lo V	2.0	C11,12
50209-19	Cap. 470 pF 100V 10% cerm disc lo V	2.0	C7,8
50318-10	Cap .068 uF 50VDC 10% MF poly axial	1.0	C10
50066-05	Cap .1 uF 50V 20% mono dip .25 leads	11.0	C1,17-25,27
50066-12	Cap .22 uF 50V 20% mono dip .20 leads	2.0	C2,3
50064-17	Cap 1 uF 35VDC 10% tant resin dip	1.0	C4
50066-04	Cap 1 uF 50V 20% mono dip .20 leads	2.0	C15,16
50321-10	Cap 1 uF 50V 20% elect radial	1.0	C26
50324-17	Cap 2 uF 50V elect axial	2.0	C13,14
50321-07	Cap 22 uF 250V elect radial	2.0	C6,9
151-01	Pin-Micro Test .070dia .3/.062 ID x.145 gold	8.0	TP1-8
50222-12	Con Header w/FricLock 12p M 1ro .100"C/C .025"sq	1.0	P1
50904-01	Con Header 90d 6p M 1ro .156"C/C.025"sq 18AWG 4A	2.0	P2,3

Pan-L Electronics, Inc. -- Bill Of Materials

01216-01 Assy Plate Front M150AC

Rod-L P/N	Description	qty	Reference
01212-02	Plate Front M150AC (Rev C) MintGrey screened	1.0	Front Plate
01220-01	Assy Harness Plate Front M150AC	1.0	Wiring
50463-01	Asm Cable&Cons: FRC 14p DIP (2ea) 6"	2.0	Cable
00671-01	Assy Con Recp Hi Voltage Block 3P FP All Units	1.0	HV Recp
00977-01	Assy Switch START Rev A ALL Instruments	1.0	Start Switch
01512-02	Label Desc and Test Status M150AC RevB	1.0	Label
50246-01	Meter Digital 4 1/2 digit Dummy 0 M3500DZ	2.0	Meters
50527-01	Con Post Binding/StdBanaJack blk .875"L .94"Base	1.0	BP1 (Ground Sense)
50565-02	Switch Toggle DPDT 125VDC O-N-O Alco MTA 206A	1.0	SW Push for Real I
50710-01	Switch Rocker SPDT w/ Lamp 125VAC Alco XRL210A004	1.0	SW1 Line Power
50007-01	Button Red .375 dia x.25 Tall C&K 7527-RED	1.0	SW Reset
50007-02	Button White .375 dia x.25 Tall C&K 7527-WHITE	1.0	SW Push for Real I
50193-01	Lamp Incand Amber pnl mnt 6" Leads Alco MC-680LT	1.0	Testing Lamp
50193-02	Lamp Incand Green pnl mnt 6" Leads Alco MC-680LT	2.0	Ready, Pass Lamps
50193-03	Lamp Incand Red pnl mnt 6" Leads Alco MC-680LT	1.0	Fail Lamp
50520-01	Alarm 3-30VDC Sonalert AI 380	1.0	Alarm
50827-01	Nut Push-On Flat 3/16" Clip	4.0	Lamps
01139-01	Bracket L-Shape 1hole ea side .5Wx.5x.35 mtg ALL	4.0	HW HV Recp
50676-01	Spacer # 4 x.437 x.25 OD FF round nylon	10.0	HW Meters, A30
50202-03	Lug Solder # 6 1 solder hole, 1 internal lock	2.0	
50584-01	Washer Fiber # 6 black HH Smith 2162	8.0	HW Meters
50544-01	Nut Kep 4-40 x .250 (1/4) O.D.	8.0	HW HV Recp
50530-02	Screw PanSem Phl 4-40 x .250	4.0	HW HV Recp
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01217-02 Assy Plate Rear M150AC RevB

Rod-L P/N	Description	qty	Reference
01221-01	Assy Harness Plate Rear M150AC	1.0	Wiring
01211-05	Plate Rear M150AC RevE	1.0	Rear Plate
50029-02	Diode-Bridge CSB-252	1.0	DB1
50509-01	Con Recp 4p HV Housing pnl mtg blk plastic Amp	1.0	HV Con
50451-01	Con Nut 1" for HV Con blk plastic	1.0	HV Con
50049-01	Con Recp Filter 3P 115/250VAC 60hz 8200pF 20%	1.0	AC IN
50075-01	Fuse-Holder Littlefuse 342014	3.0	F1-3
50062-10	Fuse Norm Blo 5.00A 250V 3AG .25x1.25"	3.0	F1-3
50565-02	Switch Toggle DPDT 125VDC O-N-O Alco MTA 206A	1.0	Under Curr disable
50560-01	Switch Slide 4PDT 115/230VAC Sel Sw.Crft47227LFE	1.0	A7
50258-07	Rivet .250" L .120" dia stem A7 Switch	2.0	A7AV
50202-02	Lug Solder # 4 1 solder hole, 1 internal lock	1.0	Filter
50585-04	Washer Star # 4	1.0	Grounds
50587-20	Washer Internal Lock .875 OD x.53125 ID	3.0	F1-3
50544-01	Nut Kep 4-40 x .250 (1/4) O.D.	2.0	Grounds
50544-03	Nut Kep 8-32 x .344 (11/32) O.D.	1.0	DB1
50530-04	Screw PanSem Phl 4-40 x .500	2.0	Filter
50532-06	Screw PanSem Phl 8-32 x .750	5.0	Heatsink, DB1
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01218-02 Assy Plate Chassis M150AC RevB

Rod-L P/N	Description	qty	Reference
01213-02	Plate Chassis M150AC RevB	1.0	Chassis Plate
00581-02	Assy PCB A71 HV & Curr Sense AV 5kV	1.0	A71
50993-02	Trnsfrmr 250W 100:10 5kV seeded Q 5741 M150	1.0	T1
50995-01	Trnsfrmr 10V 1A M150AC Mouser 41LF100	1.0	T3
50998-02	Trnsfrmr W 120(2): 127@4A,18,18,9,1.5 M150 PS	1.0	T2
50217-02	Cap 2000 uF 200VDC 10% elect thread lug	2.0	C1,2
50006-02	Cap-Bracket 2"x 2.06" Mouser 539-VR8	2.0	C1,2
50584-01	Washer Fiber # 6 black HH Smith 2162	4.0	HS
50074-10	Washer Flat #10 3/8 OD steel zinc pltg	4.0	T3
50544-03	Nut Kep 8-32 x .344 (11/32) O.D.	6.0	C1,2
50544-05	Nut Kep 6-32 x .250 (1/4) O.D.	6.0	T3, C1,2, HS
50544-04	Nut Kep 10-32 x .375 (3/8) O.D.	8.0	T1,2
50531-03	Screw PanSem Phl 6-32 x .375	2.0	T3
50531-04	Screw PanSem Phl 6-32 x .500	2.0	HS
50531-07	Screw PanSem Phl 6-32 x .875	2.0	C1,2
50532-03	Screw PanSem Phl 8-32 x .375	5.0	T3, Grounds
50532-04	Screw PanSem Phl 8-32 x .500	1.0	C1
50533-04	Screw PanSem Phl 10-32 x .500	8.0	T1,2
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01507-01 Assy Harness Unit M150

Rod-L P/N	Description	qty	Reference
01318-02	Assy Cable Jumper Res 5kohm w/ 2 #10 Ring Lugs 4"	0.0	Res on C1
50327-01	Res K 5 5W 1% WW	2.0	Res on C1
50670-03	Con Terminal Ring 14-16AWG #10 lug or stud blue	19.0	HW Res on C1
50231-01	Con Pin Contact M 18-24AWG .062 Crimp loose Molex	2.0	HV Con
50452-01	Con Pin F 16-18AWG Blue Stripe HV Amp 862797-2	4.0	HV Con
50310-03	Con 3p Block Plug (Mpins) w/Ears Molex 03-06-2031	1.0	
50460-03	Con 3p F lro .100" Mascon Panduit CE100F-22-03-D	3.0	BP1-A32,A71-A33,A36J2
50460-12	Con 12p F lro .100" Mascon Panduit CE100F-22-12-	2.0	A35,36
50458-04	Con 4p F lro .156" 18AWG 4A Mascon CE156F18-4-	1.0	T1 to A35
50458-06	Con 6p F lro .156" 18AWG 4A Mascon CE156F18-6-	1.0	A36 J4
50461-03	Con Cover End 3p .100" P Panduit EC-100F-03-D-	3.0	BP1-A32,A71-A33,A36J2
50461-12	Con Cover End 12p .100" P Panduit EC 100F-12-L	2.0	A35,36
50459-04	Con Cover End 4p .156" P Panduit EC156F-4-	1.0	T1 to A35
50459-06	Con Cover End 6p .156" P Panduit EC156F-6-	1.0	A36 J4
50399-01	TieWrap CableBundle dia .75 SST1M-M	35.0	Tie Wraps
50585-06	Washer Star # 8	4.0	HW Grounds
50544-03	Nut Kep 8-32 x .344 (11/32) O.D.	4.0	HW Grounds
50532-03	Screw PanSem Phl 8-32 x .375	4.0	HW Grounds
50533-03	Screw PanSem Phl 10-32 x .375	4.0	HW Grounds
50709-00	Wire 22AWG insul STC UL1061 PVC color undesignate	25.0	Wiring
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01493-02 Assy Heatsink 4 XS & Fan M150AC

Rod-L P/N	Description	qty	Reference
01414-01	Heatsink Fins 4 TO-3 & hole for Fan M150	1.0	Heatsink
50047-01	Fan 115V 50/60hz 14W 4.7sq x1.5" 105CFM	1.0	Fan
50070-02	Fan-Finger Guard 4.13 sq Mtg Holes Fan-S 08129	1.0	Fan Guard
50238-01	Trnstor 2SK176 Power MOSFET Amp Lo Freq N-Channel	2.0	Q6,8
50239-01	Trnstor 2SJ56 Power MOSFET Amp Lo Freq P-Channel	2.0	Q5,7
50176-01	Trnstor-Insulator Thermal TO-3 Silicon Rubber	4.0	Q5-8
50458-06	Con 6p F lro .156" 18AWG 4A Mascon CE156F18-6-	2.0	To A35 P2,3
50459-06	Con Cover End 6p .156" P Panduit EC156F-6-	2.0	To A35 P2,3
50531-07	Screw PanSem Phl 6-32 x .875	8.0	HW Q5-8
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
00247-02 Assy PCB A 7AV Line Select Switch

Rod-L P/N	Description	qty	Reference
00247-03	PCB Fab A 7AV AC Voltage Input Select Switch (RevB	1.0	A7 PCB Fab
50286-01	Varistor 10 Joules GE VA130LA10A	2.0	V1,2
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
00459-02 Assy PCB A10 Power Supply

Rod-L P/N	Description	qty	Reference
00978-01	NIN Schem PCB A10 Power Supply	0.0	Reference
00459-03	PCB Fab A10 Power Supply (RevB)	1.0	A10 PCB Fab
50130-01	IC V Reg +5 TO-220 UA7805 or LM340T5	1.0	VR1
50123-01	IC V Reg -15 TO-220 7915 or K1703-B or LM320T-15	1.0	VR2
50169-01	IC V Reg +15 TO-220 UA7815	1.0	VR3
50830-01	Fuse-Pico 4A 125V Littlefuse 275004 (251004?)	1.0	F1
50030-01	Diode-Bridge CSB05 70V 1A	3.0	U1-3
50032-01	Diode 1N4002 Rec 100V 1A	3.0	CR1-3
50324-04	Cap 3000 uF 16VDC 10% elect axial	1.0	C1
50060-01	Cap 1 uF 35V 10% tant axial	3.0	C2,3,6
50320-04	Cap 470 uF 25VDC 20% elect axial	2.0	C4,5
50151-01	Pin-Micro Test .070dia .3/.062 ID x.145 gold	4.0	TP1-4
50544-01	Nut Kep 4-40 x .250 (1/4) O.D.	3.0	VR1-3
50530-02	Screw PanSem Phl 4-40 x .250	3.0	VR1-3
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01416-03 Assy PCB A35 HV Generator (RevC) M150AC

Rod-L P/N	Description	qty	Reference
50905-01	Con Header w/FricLock 4p M 1ro .156"C/C.025"sq 4A	1.0	T1
50630-01	Relay 12VDC DPDT 1a 8pin Z440-ND or ORZ-SH-212D	1.0	K1
50291-03	Con 3p Block Recp (Fpins) w/oEars Molex03-06-1032	1.0	E1,2 (+,-VDD)
50341-01	Con Pin Contact F 18-24AWG .062 Crimp Loose Molex	2.0	E1,2 (+,-VDD)
50709-00	Wire 22AWG insul STC UL1061 PVC color undesignate	1.0	E1,2 (+,-VDD)
77710-01	NIN Dwg Loc not used See Ref	0.0	C5, R31,32
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01436-02 Assy PCB A36 Mother (Rev2) M150AC

Rod-L P/N	Description	qty	Reference
01438-02	NIN Schem PCB A36 Mother (Rev2) M150AC	0.0	Reference
01437-02	PCB Fab A36 Mother Board (Rev2) M150AC	1.0	A36 PCB Fab
50316-01	Res Ohm 1 3W 1% WW	1.0	R1
50409-01	Con 30p Cardedge 15pos PCB mtg pins no Ears	1.0	A10
50420-01	Con 44p Cardedge 22pos PCB mtg pins no Ears	4.0	A31-34
50905-07	Con Header w/FricLock 7p M 1ro .156"C/C.025"sq 4A	1.0	J4
50222-03	Con Header w/FricLock 3p M 1ro .100"C/C .025"sq	1.0	J2
50222-12	Con Header w/FricLock 12p M 1ro .100"C/C .025"sq	2.0	J1,3
50071-01	Con Guide PCB 3" L 4-40 mtg SAE 1250V	10.0	A10,31-34
50612-01	Standoff 4-40 x .375 x.25 OD FF hexBrassCad	6.0	HW mtg
50584-02	Washer Fiber # 4 black HH Smith 2161	3.0	HW mtg
50530-02	Screw PanSem Phl 4-40 x .250	16.0	HW mtg

Rod-L Electronics, Inc. -- Bill Of Materials
01421-04 Assy PCB A30 Front Panel Switches RevD M150AC

Rod-L P/N	Description	qty	Reference
01423-01	NIN Schem PCB A30 Front Panel Switches M150AC	0.0	Reference
01422-04	PCB Fab A30 Front Panel Switches (RevD) M150AC	1.0	A30 PCB Fab
50412-01	IC-Socket 6p Carrier or Solderable from Top	1.0	SW1
50264-14	IC-Socket 14p Lo Profile .3 DIP	4.0	X1,2,J6,7
50369-01	IC AND 2-In Hi speed CMOS quad 74HC08	1.0	U2
50374-01	IC NOR 2-In Hi speed CMOS quad 74HC02	1.0	U1
50125-22	Res Ohm 270 1/4W 5% CC	6.0	R8-11,18,19
50125-21	Res Ohm 330 1/4W 5% CC	2.0	R44,45
50125-54	Res K 51 1/4W 5% CC	3.0	R1-3
50701-03	Pot K 10 10 turns inline pins vert square	12.0	R12-17,38-43
50209-14	Cap .01 uF 100V 20% cerm disc lo V	4.0	C2-5
50324-05	Cap 10 uF 25VDC 10% elect axial	1.0	C1
50222-07	Con Header w/FricLock 7p M 1ro .100"C/C .025"sq	1.0	J4
50222-10	Con Header w/FricLock 10p M 1ro .100"C/C .025"sq	1.0	J5
50222-12	Con Header w/FricLock 12p M 1ro .100"C/C .025"sq	1.0	J3
50614-16	Con HeaderStrip 16p M 2ro .100"C/C .025"sq	1.0	J1
50614-26	Con HeaderStrip 26p M 2ro .100"C/C .025"sq	1.0	J2
50197-02	LED Green IDI 5310F5	6.0	CR14-19
50197-03	LED Red IDI 5310F1	6.0	CR2-9
50495-01	Switch Slide DIP DPDT Alco ASF-22	1.0	SW1
50498-01	Switch Rotary 4PDT Mini Switchcraft MRJB 3-4	2.0	SW3,5
50555-02	Switch PushButton Momntry SPDT PCBleads C&K 8121C	2.0	Reset,Stop
50563-01	Switch Toggle SPDT PCB Leads Alco MTN106D-PC	1.0	Test Mode
50173-04	Washer Shoulder # 4 .235 x.125 x.047 nylon	12.0	Lamps
REV-C	NIN Rev-C This Assy is at Rev-C	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01401-03 Assy PCB A31 Front Panel Driver (RevC) M150AC

Rod-L P/N	Description	qty	Reference
01403-01	NIN Schem PCB A31 Front Panel Driver (RevA) M150AC	0.0	Reference
01402-03	PCB Fab A31 Front Panel Driver (RevC) M150AC	1.0	A31 PCB Fab
50091-01	IC Timer NE555 or MOTOROLA MC1455P	1.0	U10
50096-01	IC Mux/Demux Analog 2-Channel CMOS triple CD4053	4.0	U11,12,16,17
50124-01	IC Sample & Hold Monolythic LF398	2.0	U7,8
50128-01	IC Op Amp Lo Power quad LM324	1.0	U13
50364-01	IC Mux 2 to 1 Hi speed CMOS quad 74HC157	1.0	U15
50368-01	IC NAND 2-In Hi speed CMOS quad 74HC03	2.0	U3,4
50369-01	IC AND 2-In Hi speed CMOS quad 74HC08	1.0	U2
50160-03	IC OR 2-In Lo Pwr Schotky quad 74LS32	1.0	U1
50371-01	IC Comparator Voltage LM211	1.0	U14
50617-01	IC Driver Peripheral dual DS3632NS	2.0	U5,6
50655-01	IC Inverter Schmitt Trig Hi speed CMOS hex 74HC14	1.0	U9
50264-08	IC-Socket 8p Lo Profile .3 DIP	6.0	X5-8,10,14
50264-14	IC-Socket 14p Lo Profile .3 DIP	6.0	X1-4,9,13
50264-16	IC-Socket 16p Lo Profile .3 DIP	5.0	X11,12,15-17
50702-05	Pot K 2 20 turns offset pins rectangle	1.0	R29
50702-06	Pot K 5 20 turns offset pins rectangle	1.0	R30
50350-58	Res K 1.02 1/4W 1% MF	2.0	R8,11
50125-35	Res K 2 1/4W 5% CC	2.0	R1,33
50125-38	Res K 3 1/4W 5% CC	2.0	R16,20
50350-63	Res K 3.4 1/4W 1% MF	1.0	R21
50125-44	Res K 10 1/4W 5% CC	6.0	R3,4,6,25,26,34
50350-45	Res K 10 1/4W 1% MF	2.0	R15,22
50350-83	Res K 19.1 1/4W 1% MF	3.0	R9,12,28
50125-79	Res K 20 1/4W 5% CC	1.0	R27
50350-62	Res K 22.6 1/4W 1% MF	1.0	R23
50125-48	Res K 24 1/4W 5% CC	1.0	R31
50350-84	Res K 40.2 1/4W 1% MF	2.0	R7,10
50350-90	Res K 49.9 1/4W 1% MF	2.0	R5,24
50125-59	Res K 100 1/4W 5% CC	2.0	R2,32
50350-37	Res K 187 1/4W 1% MF	2.0	R17,19
50350-23	Res K 200 1/4W 1% MF	1.0	R18
50125-65	Res K 220 1/4W 5% CC	1.0	R14
50350-40	Res K 464 1/4W 1% MF	1.0	R13
50008-01	Diode LM336Z-5.0 Zener w/ Adj V Ref	1.0	CR1
50044-01	Diode 1N750 Zen 4.7V	1.0	CR2
50272-01	Trnstor 2N3904 NPN SS Gen Purp RF 40VbrCEO TO-92	4.0	Q1-4
50066-03	Cap .01 uF 50V 20% mono dip .25 leads	13.0	C4-7,10-13,16-20
50066-05	Cap .1 uF 50V 20% mono dip .25 leads	2.0	C8,9
50066-04	Cap 1 uF 50V 20% mono dip .20 leads	2.0	C14,15
50324-09	Cap 10 uF 63VDC 20% mini elect axial	3.0	C1-3 sub 50324-13
50222-03	Con Header w/FricLock 3p M 1ro .100"C/C .025"sq	1.0	P2
50614-16	Con HeaderStrip 16p M 2ro .100"C/C .025"sq	1.0	J1
50614-26	Con HeaderStrip 26p M 2ro .100"C/C .025"sq	1.0	J2
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01406-04 Assy PCB A32 Hipot Control (RevD) M150AC

Rod-L P/N	Description	qty	Reference
01408-03	NIN Schem PCB A32 Hipot Control (RevC) M150AC	0.0	Reference
01407-03	PCB Fab A32 Hipot Control (RevC) M150AC	1.0	A32 PCB Fab
50264-08	IC-Socket 8p Lo Profile .3 DIP	1.0	X10
50264-14	IC-Socket 14p Lo Profile .3 DIP	12.0	X1-8,11,14-16
50264-16	IC-Socket 16p Lo Profile .3 DIP	3.0	X9,12,13
50107-01	IC FF D dual CMOS CD4013 Motorola MC14013	2.0	U4,15
50129-01	IC Comparator LoPwr Lo Offset V quad LM339	1.0	U11
50369-01	IC AND 2-In Hi speed CMOS quad 74HC08	2.0	U1,7
50370-01	IC OR 2-In Hi speed CMOS quad 74HC32	2.0	U2,6
50371-01	IC Comparator Voltage LM211	1.0	U10
50373-01	IC AND 4-In Hi speed CMOS dual 74HC21	1.0	U3
50374-01	IC NOR 2-In Hi speed CMOS quad 74HC02	2.0	U5,16
50375-01	IC Monostable Multivrtr Retrig dual H CMOS 74HC123	1.0	U9
50377-01	IC Latch R/S w/ Out-Enable N CMOS quad CD4043	2.0	U12,13
50378-01	IC OR/NOR 8-In Hi speed CMOS 74HC4078	2.0	U8,14
50350-74	Res K 3.01 1/4W 1% MF	2.0	R9,11
50350-63	Res K 3.4 1/4W 1% MF	1.0	R16
50125-40	Res K 4.7 1/4W 5% CC	2.0	R24,25
50350-60	Res K 4.99 1/4W 1% MF	3.0	R21-23
50125-44	Res K 10 1/4W 5% CC	6.0	R1,4,6,18-20
50350-45	Res K 10 1/4W 1% MF	2.0	R7,8
50350-59	Res K 11.3 1/4W 1% MF	2.0	R10,15
50125-54	Res K 51 1/4W 5% CC	3.0	R2,3,5
50350-37	Res K 187 1/4W 1% MF	2.0	R12,13
0350-23	Res K 200 1/4W 1% MF	1.0	R14
50350-92	Res K 499 1/4W 1% MF	1.0	R17
50209-14	Cap .01 uF 100V 20% cerm disc lo V	15.0	C4-9,11-18,21
50066-05	Cap .1 uF 50V 20% mono dip .25 leads	1.0	Add at U16 pin5 to p2
50064-17	Cap 1 uF 35VDC 10% tant resin dip	1.0	C10
50066-06	Cap 2.2 uF 50V 20% mono dip .25 leads	2.0	C19,20
50324-05	Cap 10 uF 25VDC 10% elect axial	3.0	C1-3
50222-05	Con Header w/FricLock 5p M lro .100"C/C .025"sq	1.0	J1
REV-C	NIN Rev-C This Assy is at Rev-C	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01411-04 Assy PCB A33 I/V Sense,Real I, Sequencer M150 RevB

Rod-L P/N	Description	qty	Reference
01413-01	NIN Schem PCB A33 I/V Sense Sequencr& CurReal M150	0.0	Reference
01411-02	PCB Fab A33 I/V Sense,Real I, Sequencer M150 RevB	1.0	A33 PCB Fab
50264-08	IC-Socket 8p Lo Profile .3 DIP	14.0	X1,3,5-7,9-13,16,19,
50264-08	IC-Socket 8p Lo Profile .3 DIP	0.0	20,21
50264-14	IC-Socket 14p Lo Profile .3 DIP	3.0	X4,8,14
50264-16	IC-Socket 16p Lo Profile .3 DIP	2.0	X2,18
50371-01	IC Comparator Voltage LM211	6.0	U1,5,6,9,11,12
50384-01	IC Switch Analog CMOS IH5143(JE)	1.0	U2
50101-01	IC Op Amp JFET Input LoOffset LoDrift dual LF412CN	7.0	U3,7,10,13,16,20,21
50382-01	IC FF J-K Dual Edge Trig w/Clock H CMOS 74HC107	1.0	U4
50385-01	IC OR Exclusive 2-In Hi speed CMOS quad 74HC86	1.0	U8
50655-01	IC Inverter Schmitt Trig Hi speed CMOS hex 74HC14	1.0	U14
50380-01	IC Converter A/D True RMS AD536A	2.0	U15,17
50383-01	IC Generator Trigometric AD639A	1.0	U18
50100-01	IC Op Amp JFET Input LoOffset LoDrift LF411CN	1.0	U19
50086-01	IC V Reg Adjustable TO-220 LM317T	1.0	U22
50846-01	IC V Ref Diode 5.0V w/ Adj V Ref LM336Z-5.0 (Z=pac	1.0	CR1
50702-11	Pot K 100 20 turns offset pins rectangle	1.0	R54
50702-10	Pot K 50 20 turns offset pins rectangle	4.0	R61,62,65,69
50702-04	Pot K 1 20 turns offset pins rectangle	1.0	R71
50036-01	Diode 1N914B Signal 100V	5.0	CR2-5,7
50046-01	Diode 1N4003 Rec	2.0	CR6,8
50125-79	Res K 20 1/4W 5% CC	2.0	R1,11
50350-26	Res K 4.22 1/4W 1% MF	2.0	R3,5
50125-31	Res K 1 1/4W 5% CC	4.0	R4,6,24,27
50126-01	Res Meg 1 1/4W 5% CC	4.0	R7,10,23,26
50350-60	Res K 4.99 1/4W 1% MF	6.0	R8,9,13,14,44,45
50126-13	Res Meg 5.1 1/4W 5% CC	2.0	R12,25
50125-44	Res K 10 1/4W 5% CC	5.0	R15,22,28,39,46
50350-90	Res K 49.9 1/4W 1% MF	1.0	R16
50350-36	Res K 100 1/4W 1% MF	4.0	R17,18,55,59
50350-33	Res K 20 1/4W 1% MF	4.0	R19,20,48,49
50125-35	Res K 2 1/4W 5% CC	1.0	R21
50125-54	Res K 51 1/4W 5% CC	2.0	R29,30
50350-45	Res K 10 1/4W 1% MF	2.0	R31,40
50363-01	Res Ohm 590 1/4W 5% CC	1.0	R32
50350-79	Res K 3.83 1/4W 1% MF	1.0	R33
50125-59	Res K 100 1/4W 5% CC	5.0	R34,36,47,51,76
50125-64	Res K 200 1/4W 5% CC	1.0	R35
50125-48	Res K 24 1/4W 5% CC	2.0	R37,38
50350-56	Res Meg 1 1/4W 1% MF	2.0	R41,50
50350-34	Res K 34.8 1/4W 1% MF	1.0	R42
50125-23	Res Ohm 240 1/4W 5% CC	1.0	R43
50125-61	Res K 150 1/4W 5% CC	2.0	R52,68
50350-39	Res K 309 1/4W 1% MF	1.0	R56
50125-57	Res K 75 1/4W 5% CC	1.0	R57
50350-68	Res K 41.2 1/4W 1% MF	1.0	R58
50125-50	Res K 30 1/4W 5% CC	2.0	R60,67
50126-04	Res Meg 2 1/4W 5% CC	2.0	R63,64
50350-87	Res K 56.2 1/4W 1% MF	1.0	R66
50325-69	Res Ohm 249 1/8W 1% MF	2.0	R72,73
50350-58	Res K 1.02 1/4W 1% MF	1.0	R77
50066-03	Cap .01 uF 50V 20% mono dip .25 leads	18.0	C1,2,5,6,9,10,12-14,
50066-03	Cap .01 uF 50V 20% mono dip .25 leads	0.0	19,27,29-32,34,35,
50066-03	Cap .01 uF 50V 20% mono dip .25 leads	0.0	38,39
50064-10	Cap 10 uF 35VDC 10% tant resin dip	1.0	C3

Rod-L Electronics, Inc. -- Bill Of Materials
01412-04 Assy PCB A33 I/V Sense,Real I, Sequencer M150 RevD

Rod-L P/N	Description	qty	Reference
50324-17	Cap 2 uF 50V elect axial	4.0	C4,7,8,28
50066-04	Cap 1 uF 50V 20% mono dip .20 leads	2.0	C11,33
50064-13	Cap 2.2 uF 35VDC 10% tant resin dip	4.0	C15,17,20,21
50060-01	Cap 1 uF 35V 10% tant axial	4.0	C16,18,22,23
50066-01	Cap .33 uF 50V 20% mono dip .20 leads	2.0	C25,26
50066-05	Cap .1 uF 50V 20% mono dip .25 leads	1.0	C36
50209-18	Cap. 100 pF 100V 10% cerm disc lo V	1.0	w/ R1
50151-01	Pin-Micro Test .070dia .3/.062 ID x.145 gold	2.0	TP1,2
50222-03	Con Header w/FricLock 3p M lro .100"C/C .025"sq	1.0	J1
50173-04	Washer Shoulder # 4 .235 x.125 x.047 nylon	1.0	U22
50530-03	Screw PanSem Phl 4-40 x .375	1.0	U22
50543-04	Nut Hex 4-40 x .250 (1/4) O.D.	1.0	U22
50835-02	NIN Res selected 5% 1/4W CC	1.0	R75
77710-01	NIN Dwg Loc not used See Ref	0.0	X9,11,12,15,17,18,
77710-01	NIN Dwg Loc not used See Ref	0.0	R2,41,53,70 CR7, C24
REV-C	NIN Rev-C This Assy is at Rev-C	0.0	

Rod-L Electronics, Inc. -- Bill Of Materials
01426-03 Assy PCB A34 Remote Analog & Digital (RevC) M150AC

Rod-L P/N	Description	qty	Reference
01428-01	NIN Schem PCB A34 Remote Analog & Digital M150AC	0.0	Reference
01427-03	PCB Fab A34 Remote Analog & Digital (RevC) M150AC	1.0	A34 PCB Fab
50264-06	IC-Socket 6p Lo Profile .3 DIP	14.0	X1-6,9-16
50264-08	IC-Socket 8p Lo Profile .3 DIP	1.0	X7
50264-14	IC-Socket 14p Lo Profile .3 DIP	4.0	X8,17-19
50091-01	IC Timer NE555 or MOTOROLA MC1455P	1.0	U7
50095-01	IC Inverter/Driver OC hex 7416N	1.0	U8
50079-01	IC Optical Coupler H11B1	13.0	U1-5,9-16
50098-01	IC Optical Coupler TIL117	1.0	U6
50128-01	IC Op Amp Lo Power quad LM324	3.0	U17-19
50125-08	Res Ohm 100 1/4W 5% CC	2.0	R7,10
50125-21	Res Ohm 330 1/4W 5% CC	4.0	9,12,15,17
50125-31	Res K 1 1/4W 5% CC	20.0	R2,3,5,6,21,22,24,25,
50125-31	Res K 1 1/4W 5% CC	0.0	27,28,30,31,33,34,
50125-31	Res K 1 1/4W 5% CC	0.0	36,37,39,40,42,43,
50125-36	Res K 2.2 1/4W 5% CC	14.0	R1,4,8,11,14,16,20,
50125-36	Res K 2.2 1/4W 5% CC	0.0	23,26,29,32,35,38,
50125-36	Res K 2.2 1/4W 5% CC	0.0	41
50125-44	Res K 10 1/4W 5% CC	30.0	R13,19,44-70,71
50125-79	Res K 20 1/4W 5% CC	1.0	R18
50066-03	Cap .01 uF 50V 20% mono dip .25 leads	32.0	C2-7,9-19,22-36
50324-05	Cap 10 uF 25VDC 10% elect axial	4.0	C1,8,20,21
50614-26	Con HeaderStrip 26p M 2ro .100"C/C .025"sq	1.0	J1
50614-02	Con HeaderStrip 2p M 1ro .100"C/C .025"sq	3.0	JP1-3
50340-01	Jumper Shorting for HeaderStrips 2p Shunt	2.0	JP1,2

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

F2 BRN DB1 RED
AC + CSB-252 RED C1+
P/N 50310-03 C2- BRN - AC BRN F3
-VDD BRN
+VDD

A35 E1,2

P1
W/BLU
WHT
A32-J1
W/BRN RESET
BRN START
UNDER I DISABLE SW
NO C NO
P/N 50460-05 TIE-WRAP (TYP)

BLK RED "HVRED" A71-2
W/BRN P1-1 (A32)
BRN P1-2 (A32)
J4
HV CONN.

BRN T2-1 F2 BRN DBI-AC
BRN T2-3 F3 BRN DBI-AC
WHT/BLK J2-L F1 WHT/BLK SW1-2

J2
LINE FILTER
FIU WHT/BLK GRN A7-10 WHT

FAN TERM.
BLK A7-15
BLK A7-14

A7
SW1-6 WHT
J2-N WHT
T2 BRN
T3 BLK
T2 BLK/YEL
T2 WHT
T3 BLK
SW1-4 W/GRY
T2 BLK
FAN-1 BLK
T2 BLK/GRN
FAN-2 BLK

5KΩ 5KΩ
DBI- BRN WHT 2000μF 200VDC (2ea) RED DBI+
C2+ C1+
WHT

T2
PS 1 BRN F2
A7-90 WHT RED 2 BLK/GRN 63.5V@4ARMS F3
3 BRN
4 BLK P4 1 5.5VDC
9V@1A RMS
5 ORN 2 5.5VDC
A7-30 BRN 6 YEL 3 -10.5VDC
A7-5 BLK/YEL 18V@100mARMS → A33-J4
A7-140 BLK/GRN 7 GRN 4 -10.5VDC
BLK/RED 8 RED 5 +10VDC
18V@100mARMS
9 BLU +10VDC
10 GRN
1.5V@3ARMS
A7-150 BLK 11 WHT

A35-P3 ←
J3 HEATSINK J2
GRN D BLU
BLU G GRN
BLK BLK
RED YEL
YEL RED
GRN ORN
Q6 Q8 2SK176
Q5 Q7 2SJ56
→ A35-P2

PT1 RED T1 HV 5KV "HVRED" WHT
A35-T1 → 1 2 3 4 BLU ØV CURTSEN WHT → A71-8

T3 10VAC 10VAC RED P2-3 → A36-J2-3
A7-3 BLK
A7-9 BLK RED
WHT

J3 HV RECP "HVRED" A71-4
N L RED
G BLK

A71 RED J4-1
"HVRED" WHT T1-1
3M (2ea) RED J3-L,N
+5V WHT T1-2
4.2K SHLD WHT
GND
A33-J1-2 P1 CURTSEN

1.5VAC
A36-J2 ← P2 1 2 3 W/RED VOLTSEN A71-6
RED 10VAC T3

BP
A31-J2 ← P2 SHLD WHT SGSENSE

P1 P4
12 RED +5 1
11 YEL GND 2
10 BRN AGND 3
9
8 BLU START P 5
7 GRN STOP P 6
6 ORN RESET P 4
5
A36-J1 ← → A30-J4

P3
W/RED 12
W/BRN 11
10
9
8 AI- GRY
7 AI+ VIO
6 +5 BLU
5 GND GRN
4 COM YEL
3 IR ORN
2 IT RED
1 IR BRN
→ A30-J3

A36-J2-2 VOLTSEN W/RED P2-2

P3
12 AGND BRN
11 AGND RED
10 +5V ORN
9 -15V YEL
8 +15V GRN
7 F TEMP BLU
6 ACCONT VIO
5 AGND GRY
4 TESTING WHT
3
2 RMPSTART W/BRN
1 Ø VAC W/RED
A36-J3 ←
J1
1 2 3 4 5 6 7 8 9 10 11 12
→ A35-P1

ALARM GRY
VIO
RED NO BLU
ORN C YEL
BRN NC GRN
REAL SELECT SW

START SW C W/RED NC W/BRN

(POWER) SW1
4 W/GRY A7-9
2 W/BLK F1
3 WHT A7-1

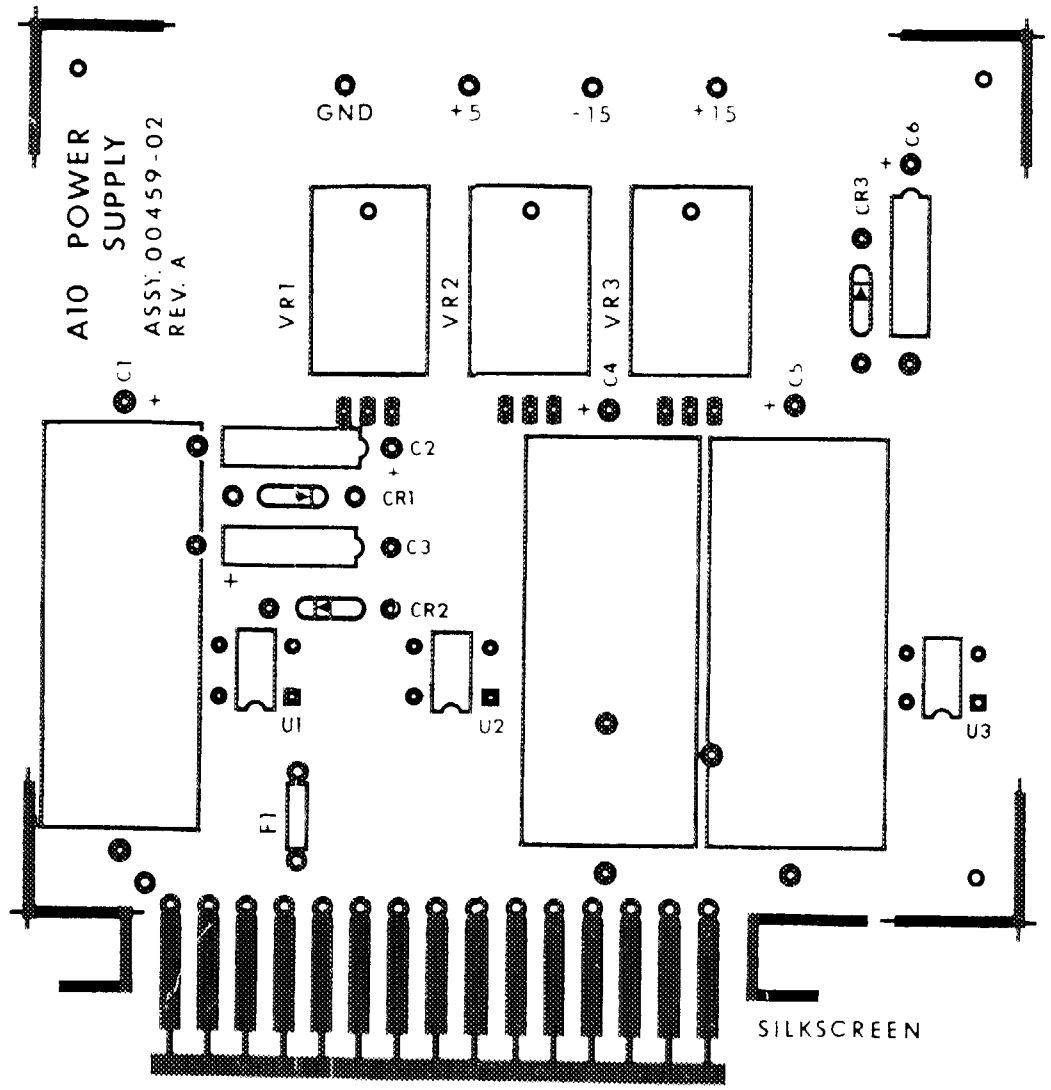
NOTES:
1. (18) INDICATES 18A.W.G. WIRE SIZE OTHERWISE 22A.W.G.
2. CONNECTORS GOING TO P.C.B.S ARE OFTEN NUMBERED BACKWARDS
3. A30=FRNT. PNL. PCB A31=FRNT. PNL. DRIVER PCB
   A32=CONTROL PCB A35=I/V SENSE PCB
   A36=HV GEN. PCB A36=MOTHER PCB

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES .XX ± .XXX ±	CONTRACT NO	ROD-L ELECTRONICS, INC.	
	APPROVALS DATE	WIRING DIAG., M150AC	
MATERIAL	DRAWN		
FINISH	DESIGNED		
NEXT ASSY USED ON	CHECKED ERS 3MAY90	SIZE C FSCM NO.	DWG. NO 01198-02 REV. B
APPLICATION	DO NOT SCALE DRAWING	ISSUED M.G. 12/2/	SCALE SHEET OF

DWG NO SH REV

REVISIONS

REV.	DESCRIPTION	DATE	APPR.
A	CHANGED PARTS CALL OUT	6-84	BILL



PADMASTER

NOTES:

1. REFERENCE SCHEMATIC DRAWING NO. 00978-01
2. SEE SEPARATE PARTS LIST.

PARTS LIST

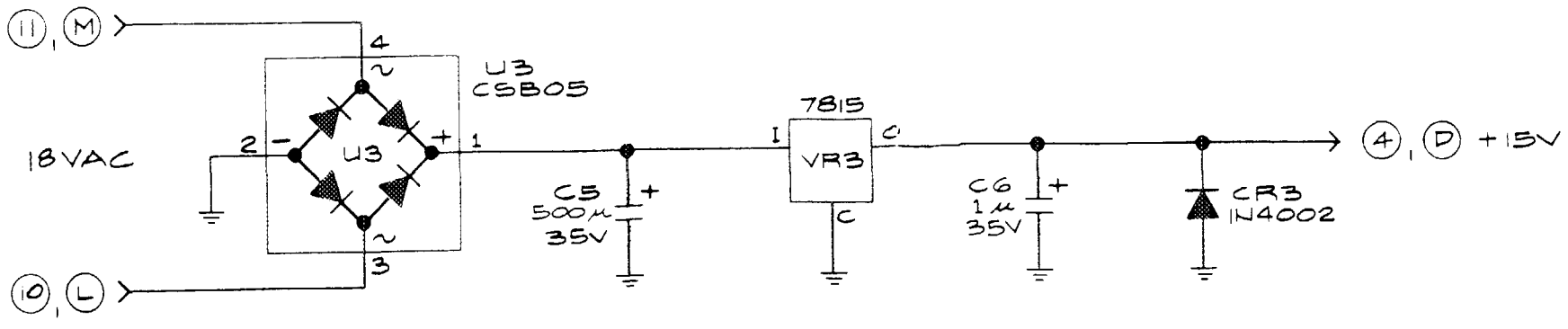
GROUND TESTER	JUN 6-84	PRO-LOG ELECTRONICS, INC.

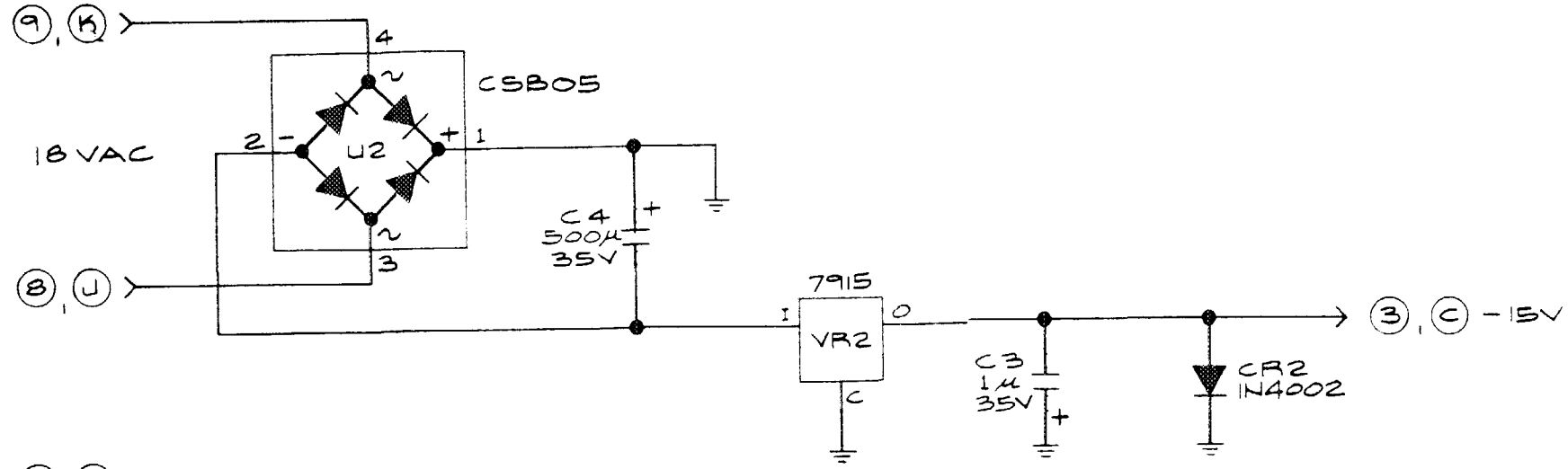
ASSEMBLY PCBA
A10
POWER SUPPLY BOARD

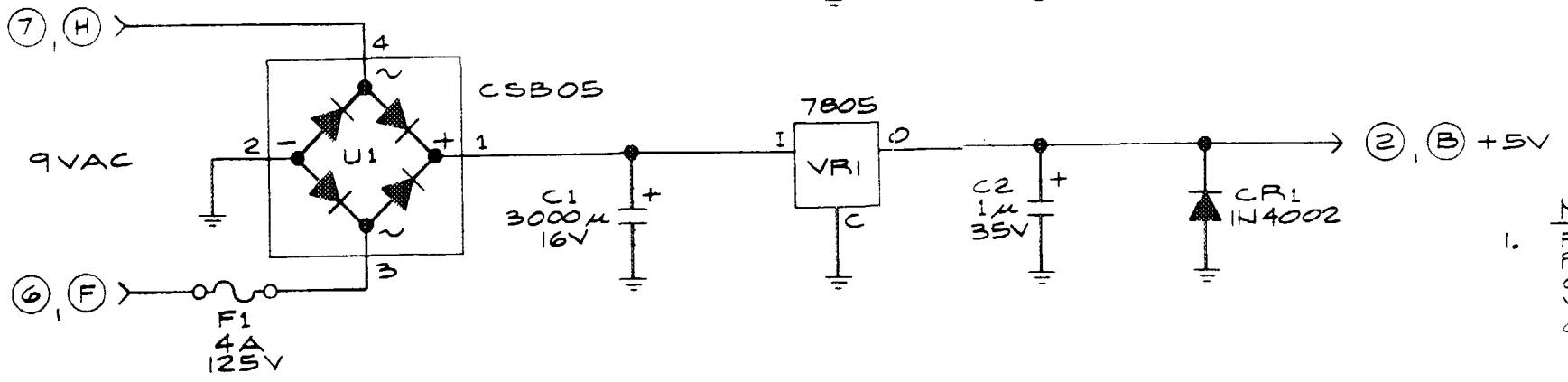
SIZE C | DWG NO. 00459-02 | REV. A

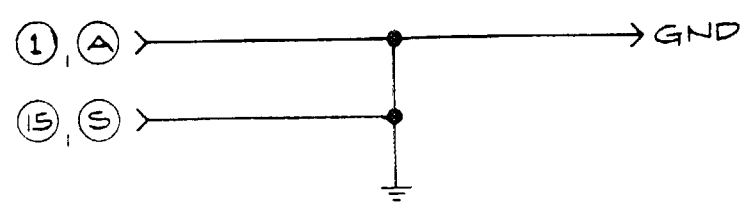
SCALE 2X | SHEET 1 OF 1

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	REPLACED DWG # 00459-01	5-21-86	HOLLEY
	B	CHANGED C4, 5 TO 500 µf	2-10-87	JWK









NOTE:

1. F1 PROVIDES SHORT CIRCUIT PROTECTION IF THE OUTPUT OF VR1 IS SHORTED AND VR1 FAILS TO LIMIT THE OUTPUT CURRENT

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
PARTS LIST				

	OHM SENSE TESTER GND TESTER
00459-02	
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES .XX ± .XXX ±

MATERIAL —

FINISH —

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN JWN	3-84
CHECKED	
ISSUED	

RIDL ELECTRONICS, INC. 1086 HAMILTON COURT · MENLO PARK, CALIFORNIA 94025 · (415) 322-0711

SCHEMATIC
A10
POWER SUPPLY

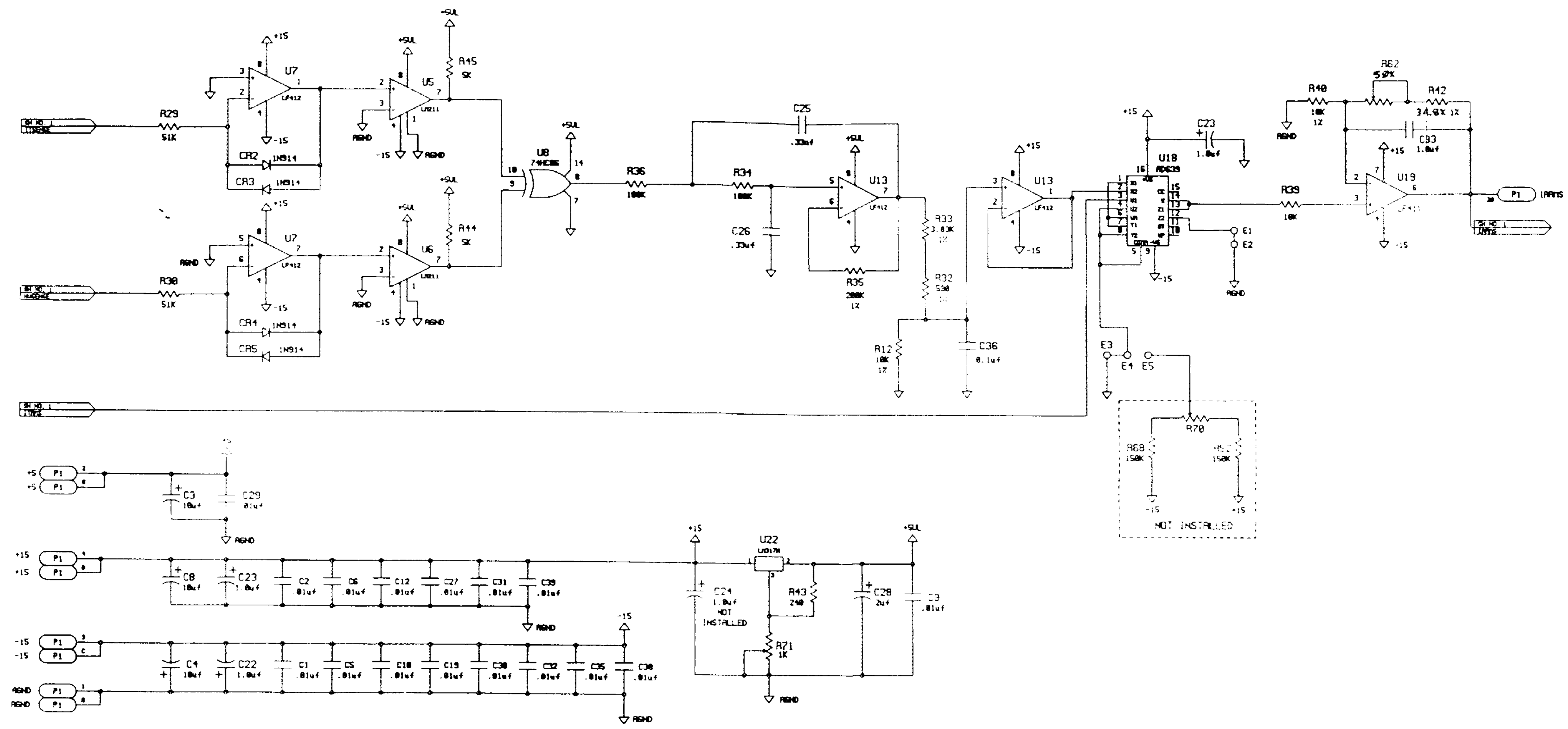
SIZE	FSCM NO.	DWG. NO.	REV.
C		00978-01	B

SCALE — SHEET 1 OF 1

DWG NO

SH

REV



ROD-L ELECTRONICS, INC.
923 HAMILTON AVE.
MENLO PARK, CALIFORNIA 94025
(415) 322-0711

SCHEMATIC DIAGRAM
A33 TEST SP. PAPER

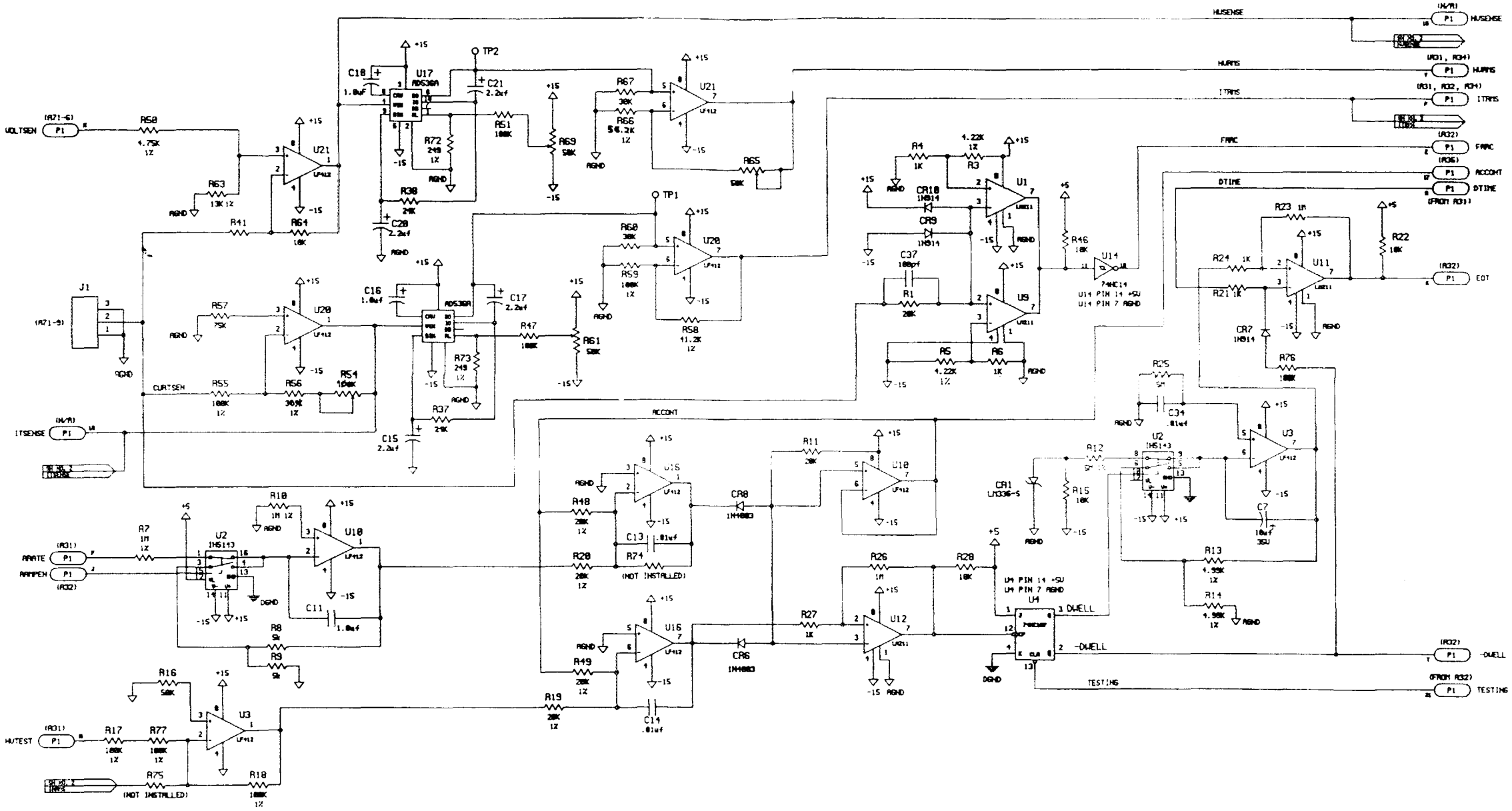
CONTRACT NO.

APPROVALS | DATE
DRAWN SMITH GRAPHICS

SCALE NTS

SHEET 2 OF 2

DO NOT SCALE DRAWING


VOLTSEN
ITSENSE
CURTSEN
AMATE
AMPEN
HUTEST
HUSENSE
HURTS
ITRTS
FRRC
ACCONT
DTIME
EOT
-DWELL
TESTING
U1
U2
U3
U4
U9
U10
U11
U12
U14
U15
U16
U17
U18
U20
U21
TP1
TP2
J1
CR1
CR6
CR7
CR8
CR9
CR10
C7
C11
C13
C14
C15
C16
C17
C18
C20
C21
C34
R1
R3
R4
R5
R6
R7
R8
R9
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R47
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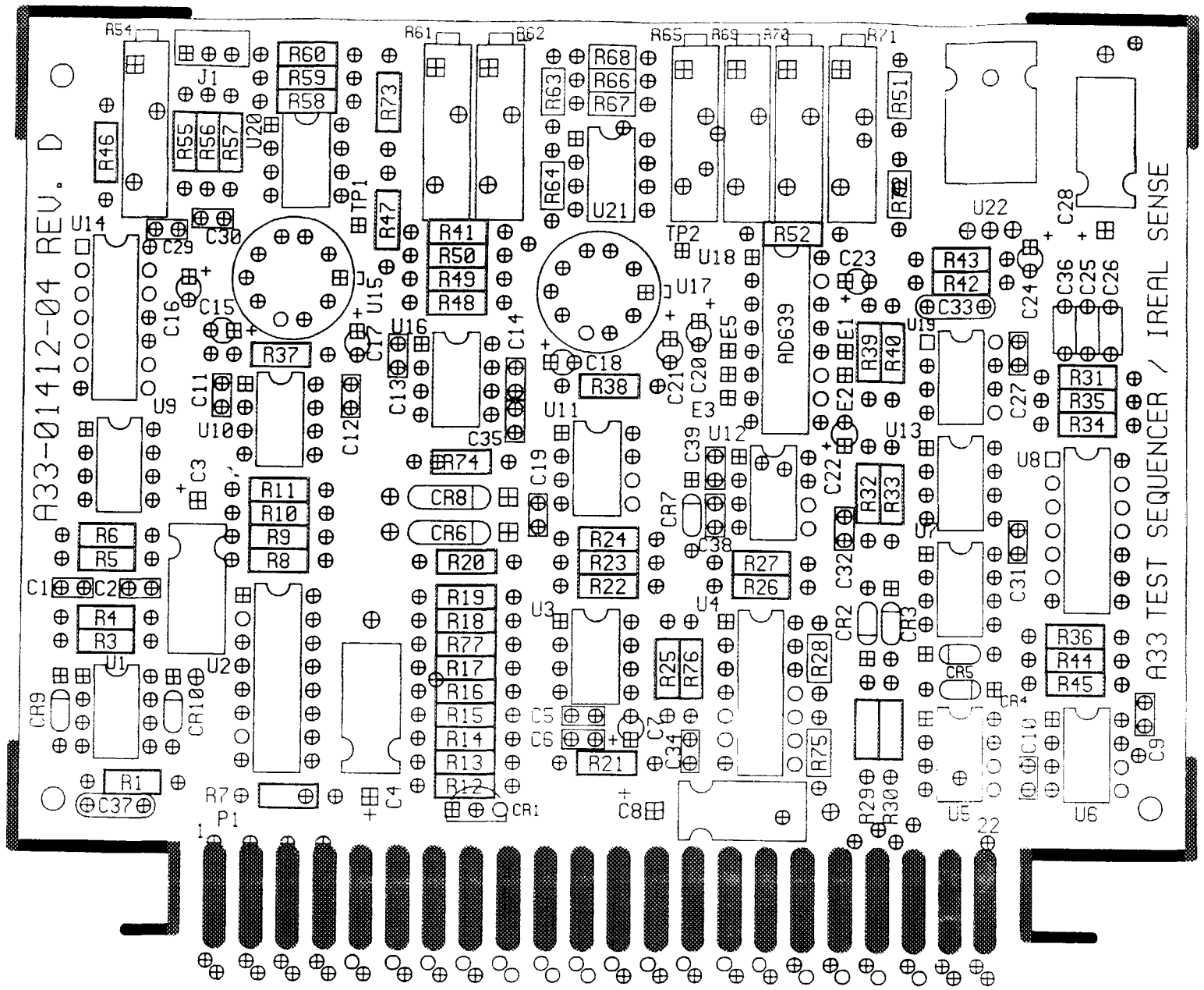
R59
R60
R61
R63
R64
R65
R66
R67
R68
R69
R72
R73
R74
R75
R76
R77
AGND
DGND
+15
-15
+5
(HV/R) P1 HUSENSE
(R31, R34) P1 HURTS
(R31, R32, R34) P1 ITRTS
(R32) P1 FRRC
(R36) P1 ACCONT
P1 DTIME (FROM R31)
(R32) P1 EOT
(R32) P1 -DWELL
(FROM R32) P1 TESTING
U14 PIN 14 +5V
U14 PIN 7 AGND
U4 PIN 14 +5V
U4 PIN 7 AGND
3 DWELL
(NOT INSTALLED)
ROD-L ELECTRONICS, INC.
923 HAMILTON AVE.
MENLO PARK, CALIFORNIA 94025
(415) 322-8711
SCHEMATIC DIAGRAM
HOT TEST INTERFACE
043-04
SHEET 1 OF 2

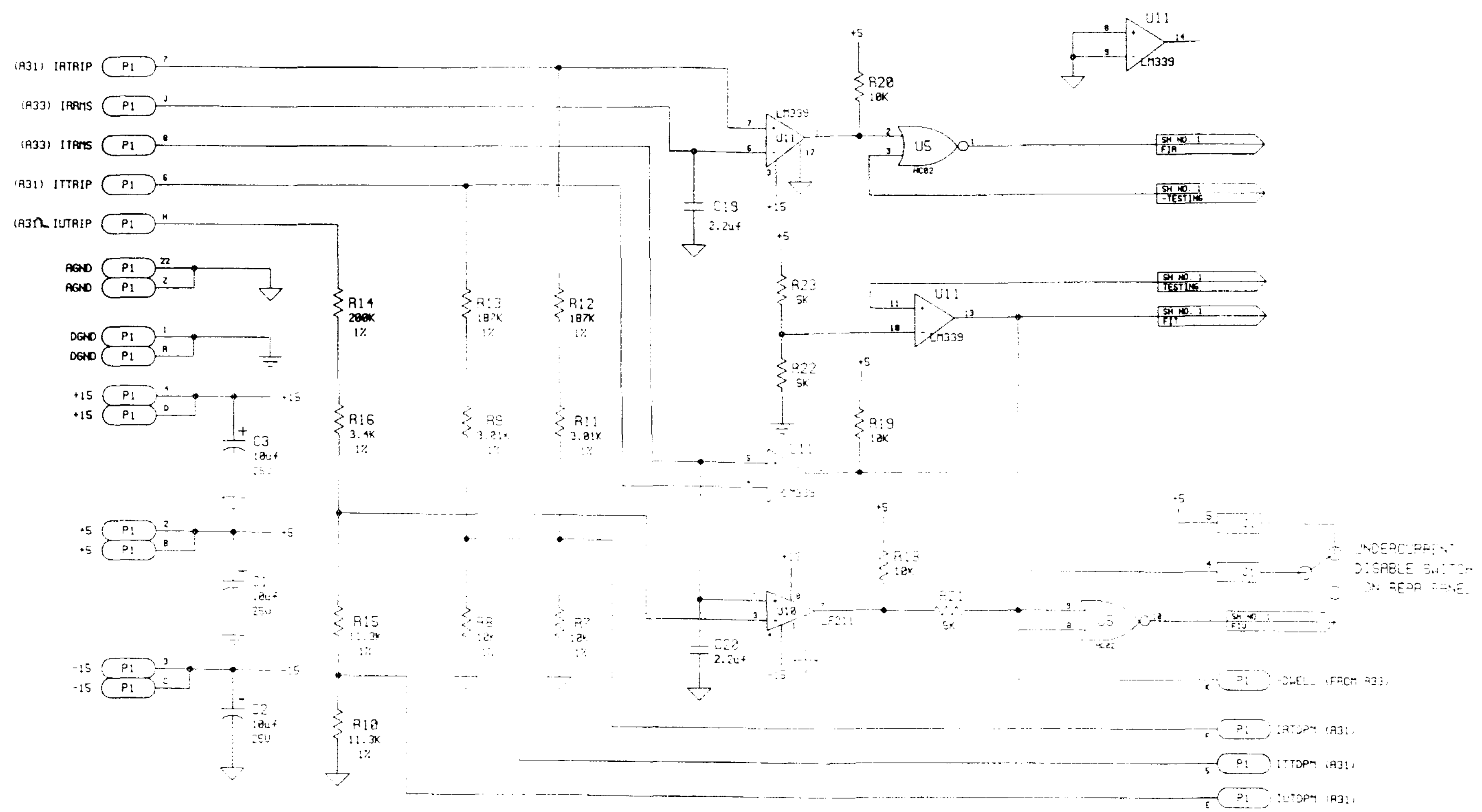


REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	C	ADDED DIODES TO BACK		
	D	ADDED DIODES, TRANSISTOR	14APR92	EDS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES XX = .010 1° XXX = .005	CONTRACT NO.	ROD-L ELECTRONICS, INC. 923 HAMILTON AVE. MENLO PARK, CALIFORNIA 94025 (415) 322-0711
MATERIAL	APPROVALS / DATE DRAWN SMITH GRAPHICS 4-9-92 CHECKED ISSUED	ASSEMBLY DRAWING A33 TEST SEQUENCER
DO NOT SCALE DRAWING		SIZE B FSCM NO. DWG. NO. 01412-04 REV. D SCALE NTS SHEET 1 OF 1

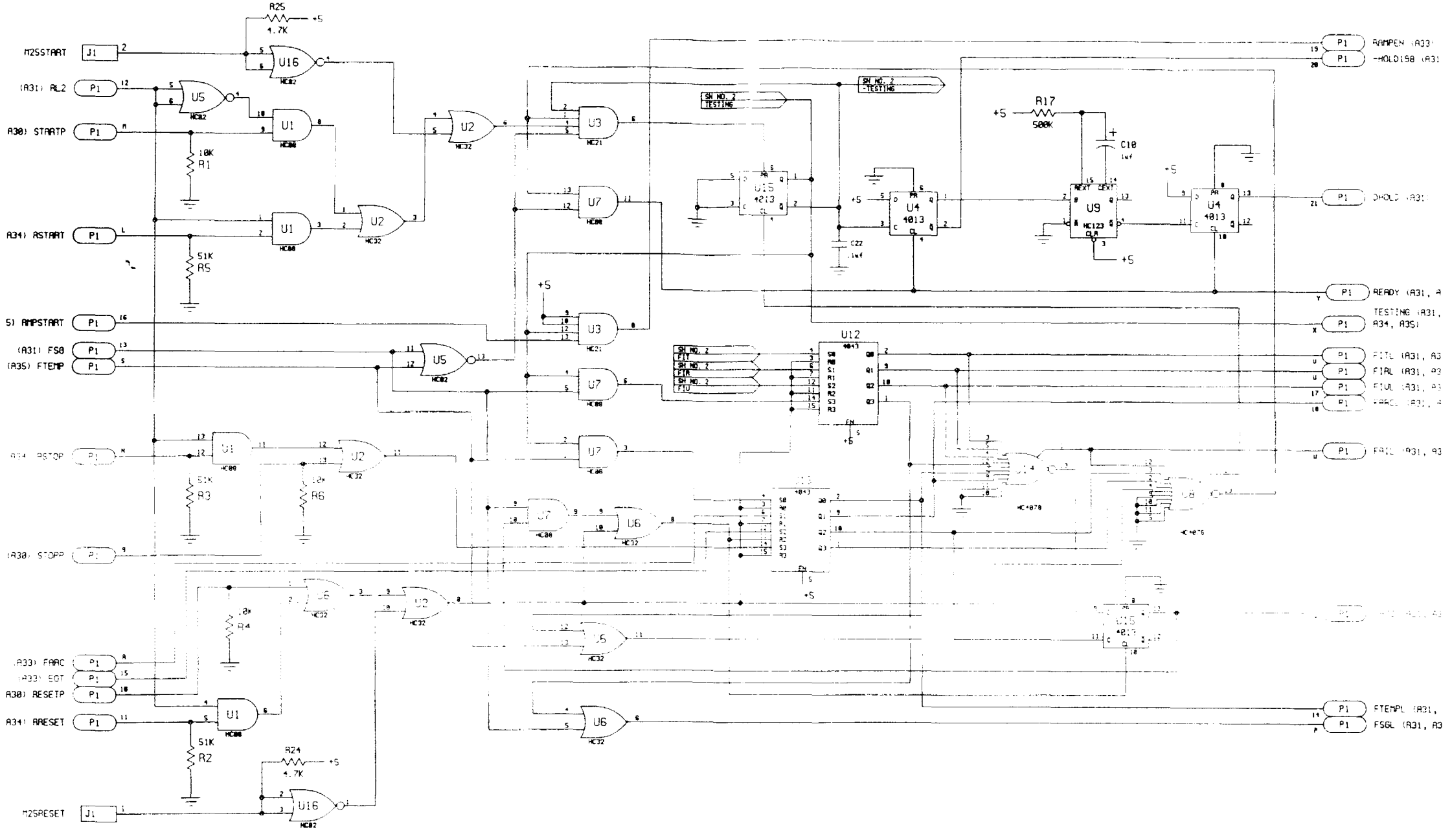
REVISIONS

SHE	REV	DESCRIPTION	DATE	APPROVED



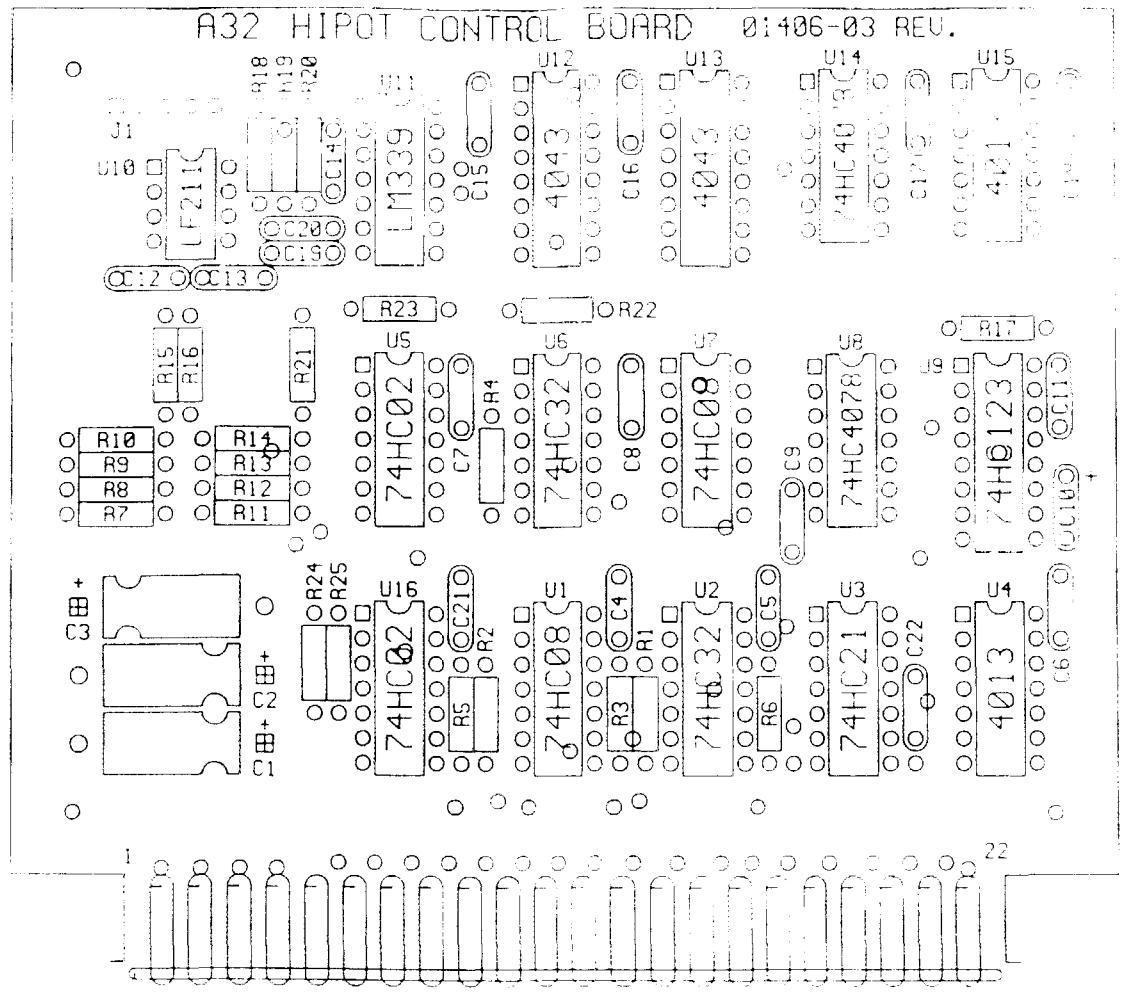
CONTRACT NO.

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



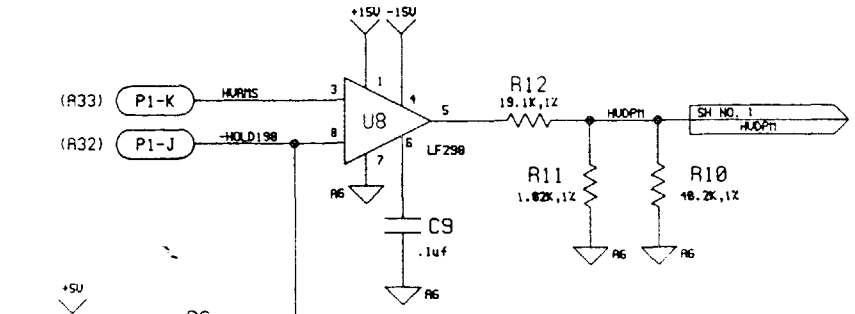
CONTRACT NO.		
APPROVED	DATE	

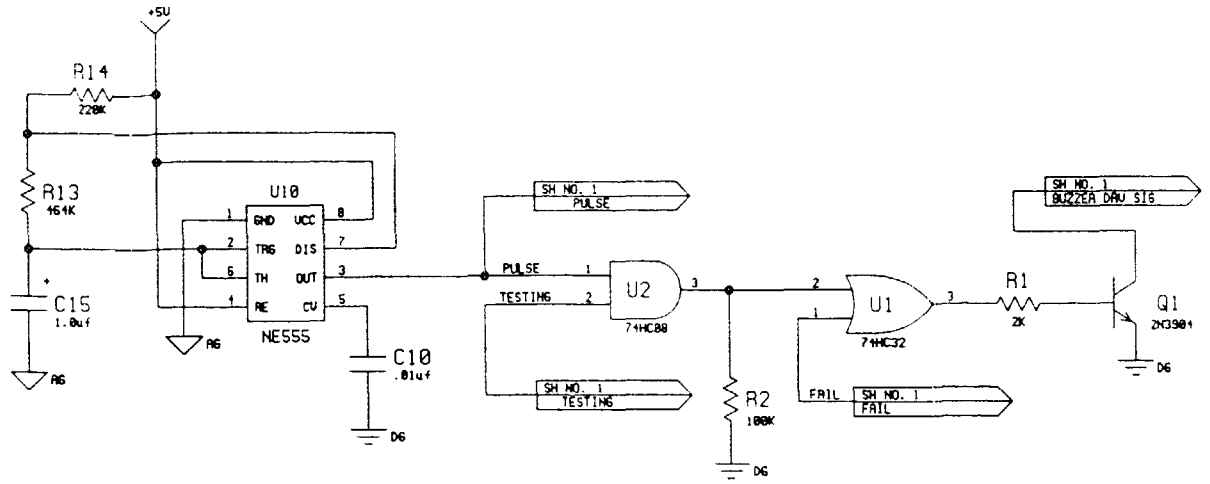
ROHL ELECTRONICS, INC.
603 HAMILTON AVE.
MENLO PARK, CALIFORNIA 94025
(415) 322-2711

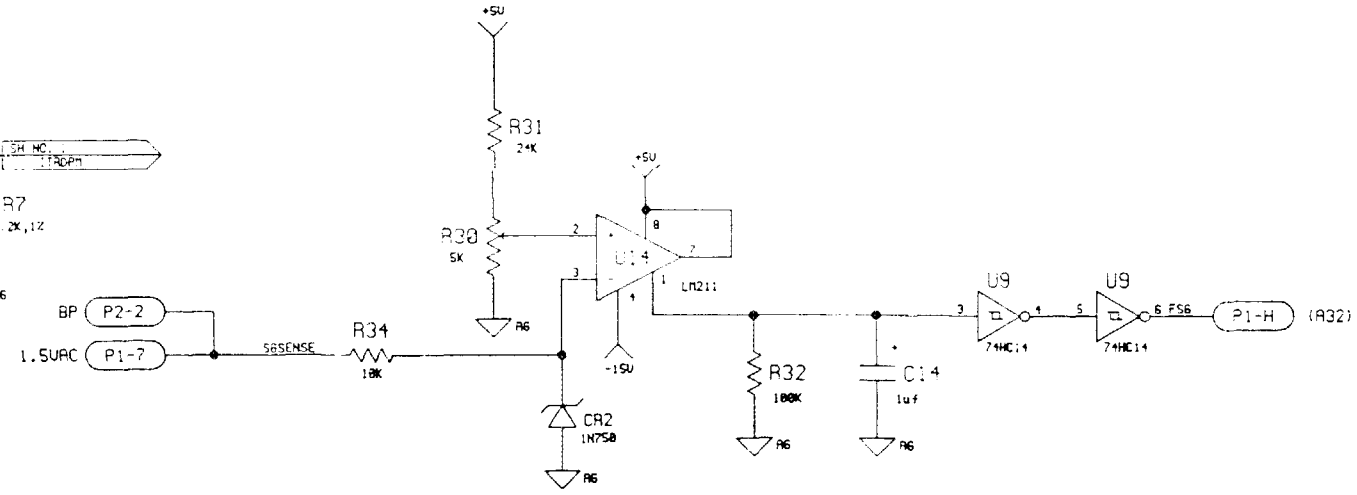


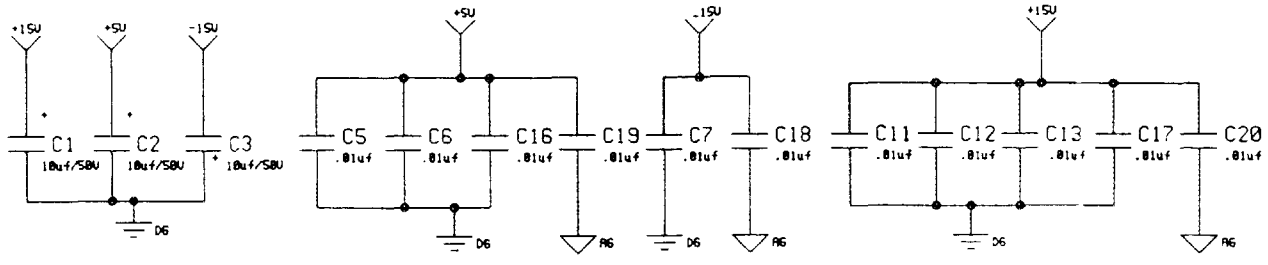
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES XX = ±.0 ° XXX = ±.005	CONTRACT NO.	ROD-L ELECTRONICS, INC. 923 HAMILTON AVE. MENLO PARK, CALIFORNIA 94025 415 323-9711
MATERIAL	APPROVALS DATE	ASSEMBLY DRAWING A32 HIPOT CONTROL BOARD
FINISH	DRAWN SMITH GRAPHICS 4-2-92	SIZE D FSCM NO. DWG. NO. 01406-03-01 REV. B
DO NOT SCALE THIS DRAWING	CHECKED ISSUED	SCALE 1:1 SHEET 1 OF 1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED





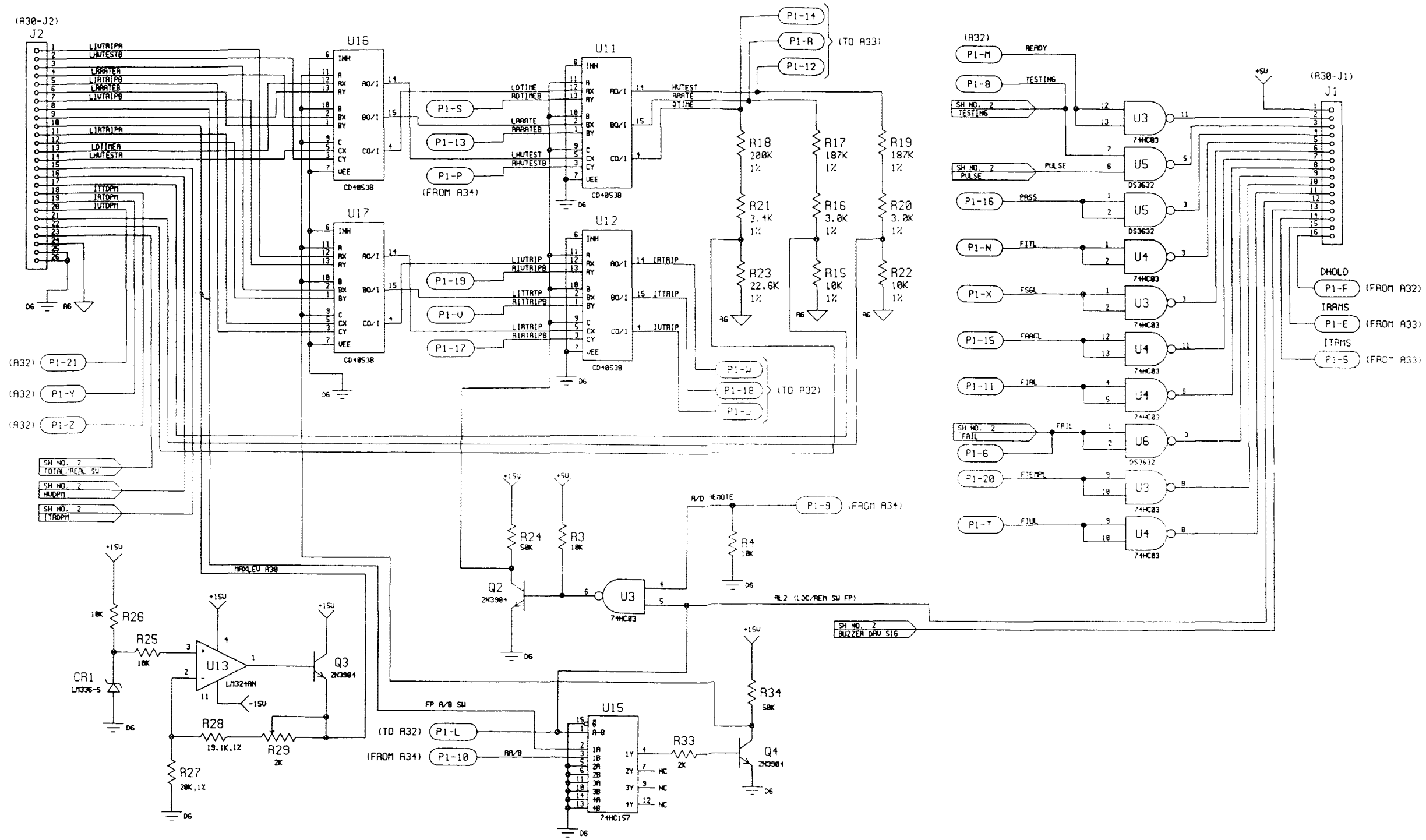




		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES . XX .XXX ±	CONTRACT NO	ESE ELECTRONICS, INC. 925 HAMILTON AVENUE · MENLO PARK, CALIFORNIA 94025 · (415) 327-8211	
		MATERIAL	APPROVALS / DRAWN SMITH 5-90 / DESIGNED / CHECKED	SCHEMATIC A31 FRONT PANEL DRIVER BOARD	
NEXT ASSY	USED ON	FINISH		SIZE FSCM NO D	DWG NO [illegible] REV C
APPLICATION		DO NOT SCALE DRAWING		WEIGHT	SHEET [illegible] OF [illegible]

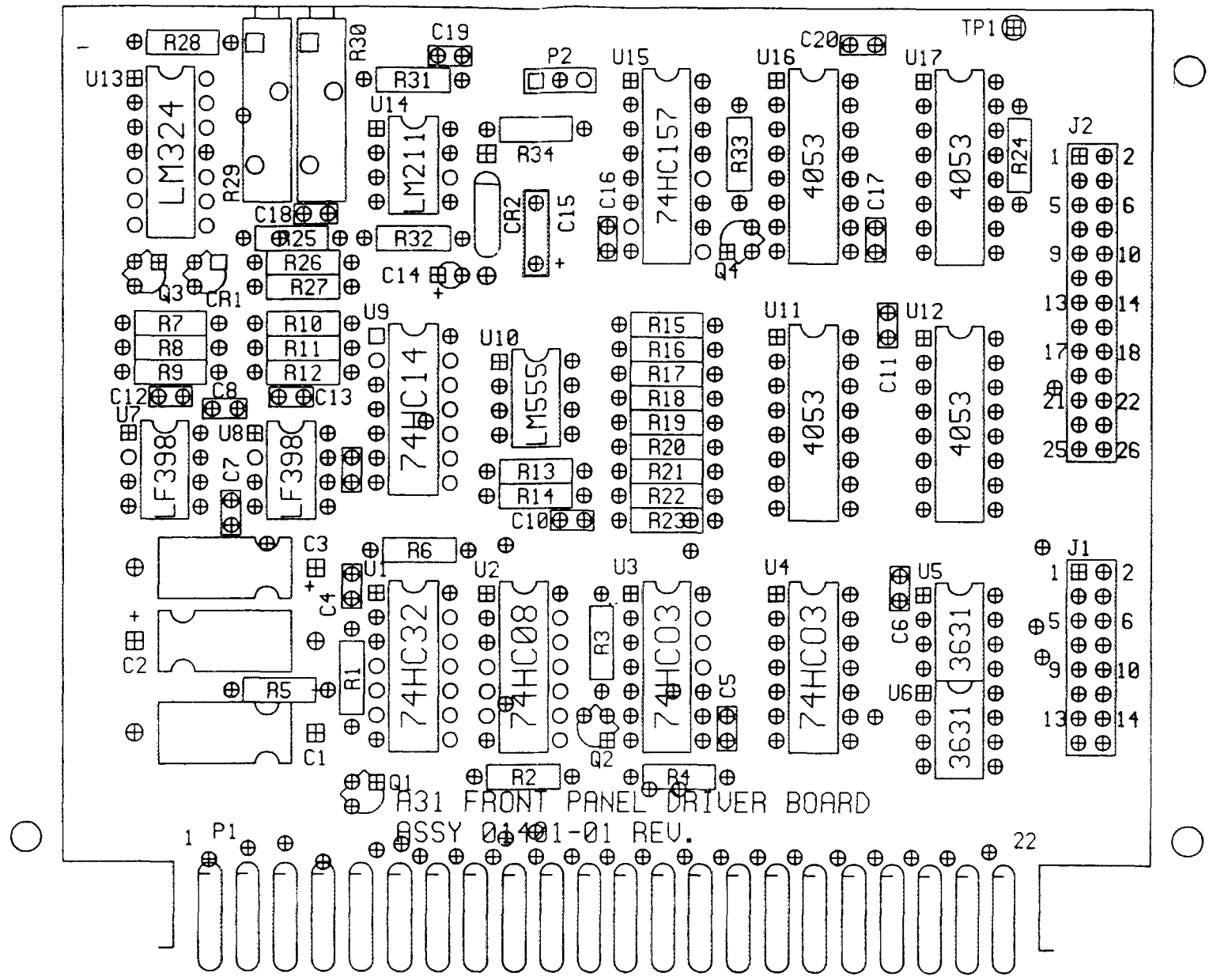
8 7 6 5 4 3 2 1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES .XX ± .XXX ±	CONTRACT NO	RSD-1 ELECTRONICS, INC.	
MATERIAL	APPROVALS	DATE	SCHEMATIC A31 FRONT PANEL DRIVER BOARD
FINISH	DRAWN S.MITH	5-92	
NEXT ASSY USED ON	DESIGNED		
APPLICATION	CHECKED	SIZE FSCM NO D	DWG NO A23-313 REV E
DO NOT SCALE DRAWING	RELEASED	SCALE NONE	SHEET 1 OF 2

B A



		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±	CONTRACT NO.	ESI ELECTRONICS, INC. 1098 HAMILTON COURT • MENLO PARK, CALIFORNIA 94025 • (415) 322-0711	A
		MATERIAL	APPROVALS / DATE	ASSEMBLY DRAWING A31 FRONT PANEL DRIVER	
		FINISH	DRAWN		
NEXT ASSY	USED ON		DESIGNED		
			CHECKED	SIZE D · FSCM NO. · DWG. NO. 01401-03 · REV. C	
APPLICATION		DO NOT SCALE DRAWING	ISSUED	SCALE · SHEET	

3 2 1

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED

(A31-J1) J1

(FP LIGHTS) J5

(FP SWITCHES, ALARM) J3

(A36-J1) J4

(A31-J2) J2

SW1 LOCAL/REMOTE SW

CR2 CR9 CR5 CR3 CR8 CR4 — R9 R19 R10 R11 R18 R8 270

BUZZER DRV SIG
ITRPS
IARPS
D-HOLD

A/B SW
STOP SW
RESET SW
C1
TOTAL/REAL SW

R39 R41 R13 R16 R38 R42 10K
R12 R14 R17 R15 R40 R43 10K

DPM J14

SET LIGHT SW SW5 SEC-3
CR14 CR15 CR16 — R44 R45 330
TOTAL 1 REAL 1 UNDER

SET LIGHT SW SW3 SEC-3
CR17 CR18 CR19
HU RAMP DWELL

SW5 SEC-2
R1 R2 R3 61K

74HC02 U1
74HC08 U5
I SCALE SEL

SW5 SEC-1
SW3 SEC-1
SW3 SEC-2

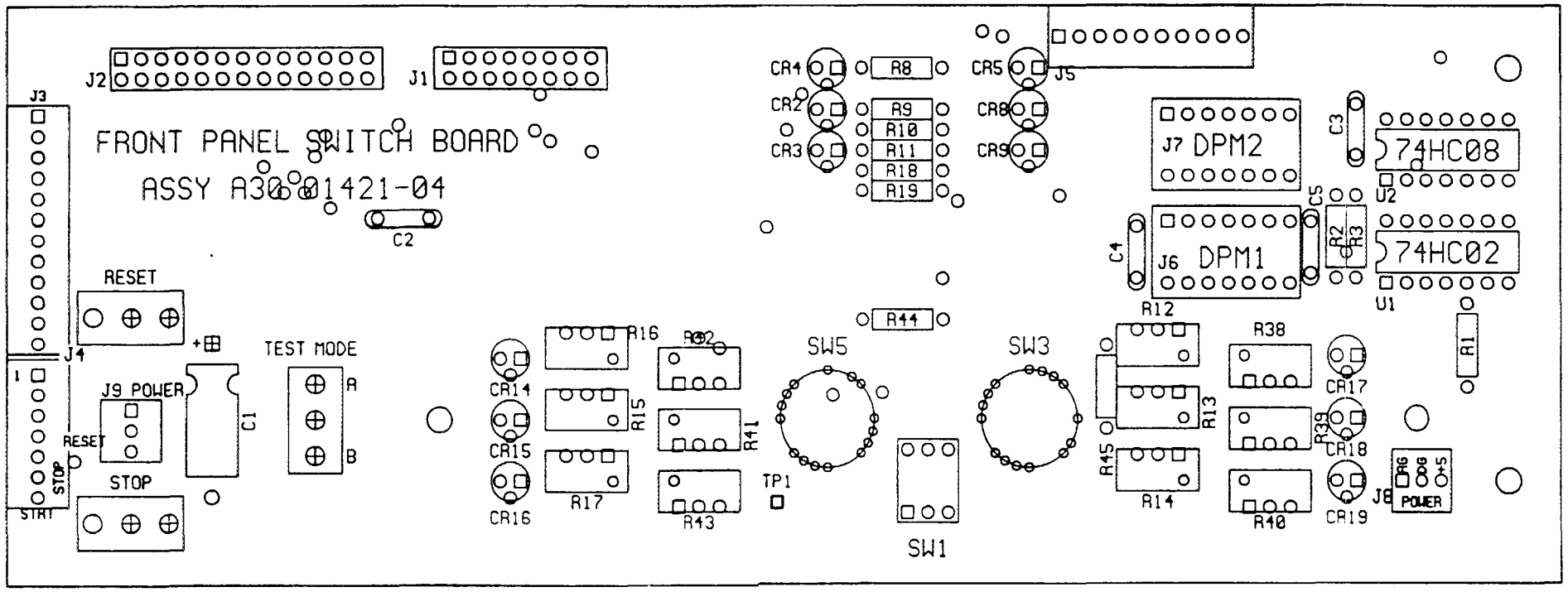
DPM2 J7
J6 DPM1

J8 J9

C2 C3 C4 C5 .01uf

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±	CONTRACT NO.	ROSE ELECTRONICS, INC. 1995 HAMILTON COURT MENLO PARK CALIFORNIA 94025 (415) 322-6711			
MATERIAL	APPROVALS	DATE	SCHEMATIC A30 FRONT PANEL SWITCH BOARD		
FINISH	DRAWN SMITH	5-90			
	DESIGNED		SIZE C	FSCM NO.	DWG. NO. 01423-03 REV C
	CHECKED		SCALE NTS		SHEET OF
NEXT ASSY USED ON	ISSUED				
APPLICATION	DO NOT SCALE DRAWING				

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	D	SWITCH HOLES SPACED	FE 90	EDS



NEXT ASSY	USED ON		
APPLICATION		DO NOT SCALE DRAWING	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
± XX ± ·
.XXX ±

MATERIAL

FINISH

CONTRACT NO

APPROVALS	DATE
DRAWN	
DESIGNED	
CHECKED	
ISSUED	

RSI ELECTRONICS, INC. 1088 HAMILTON COURT MENLO PARK, CALIFORNIA 94025

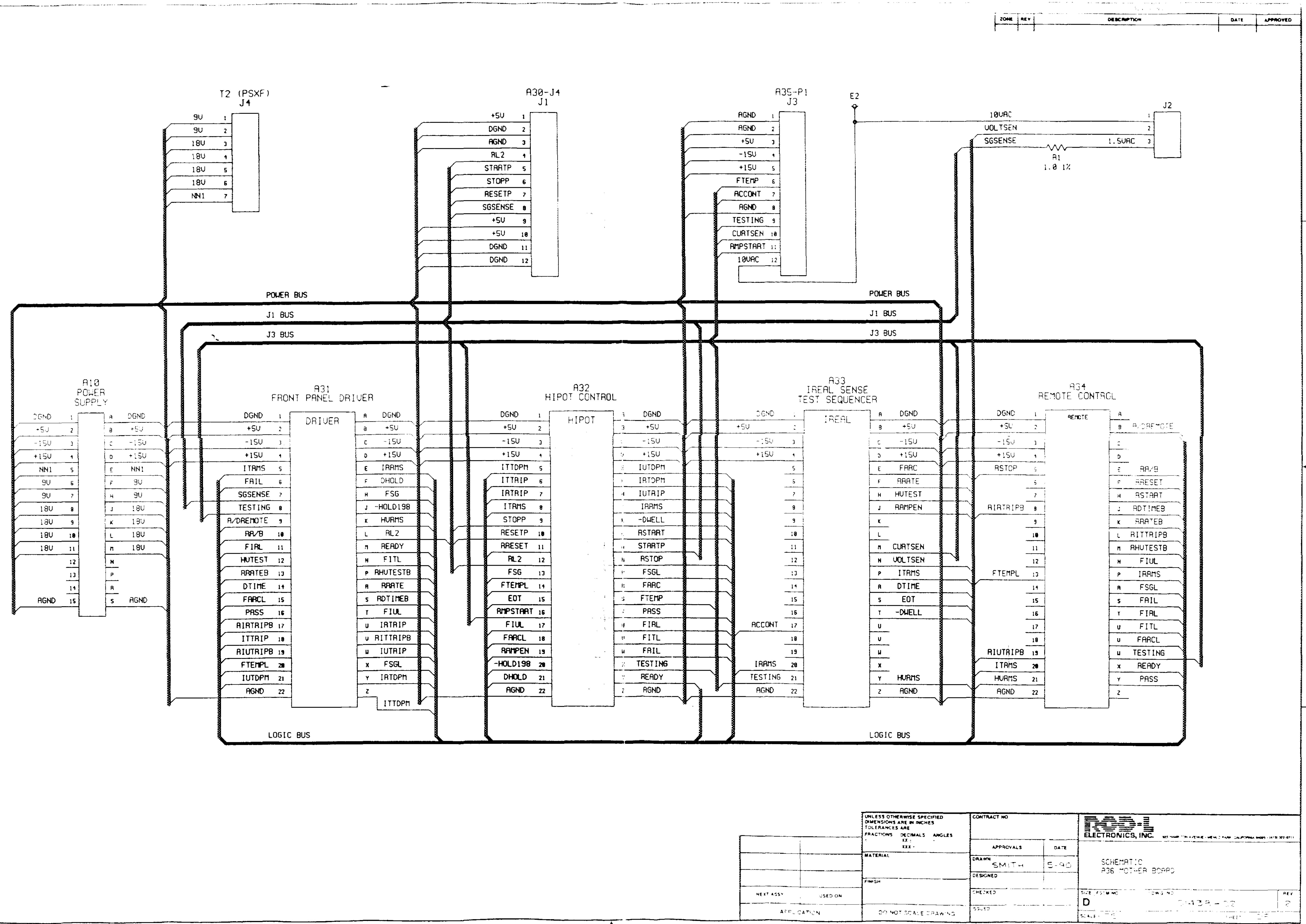
ASSEMBLY DRAWING
A30 FRONT PANEL PCB

SIZE	FSCM NO.	DWG. NO	REV.
C		01421-04	D
SCALE		SHEET OF	

DWG NO

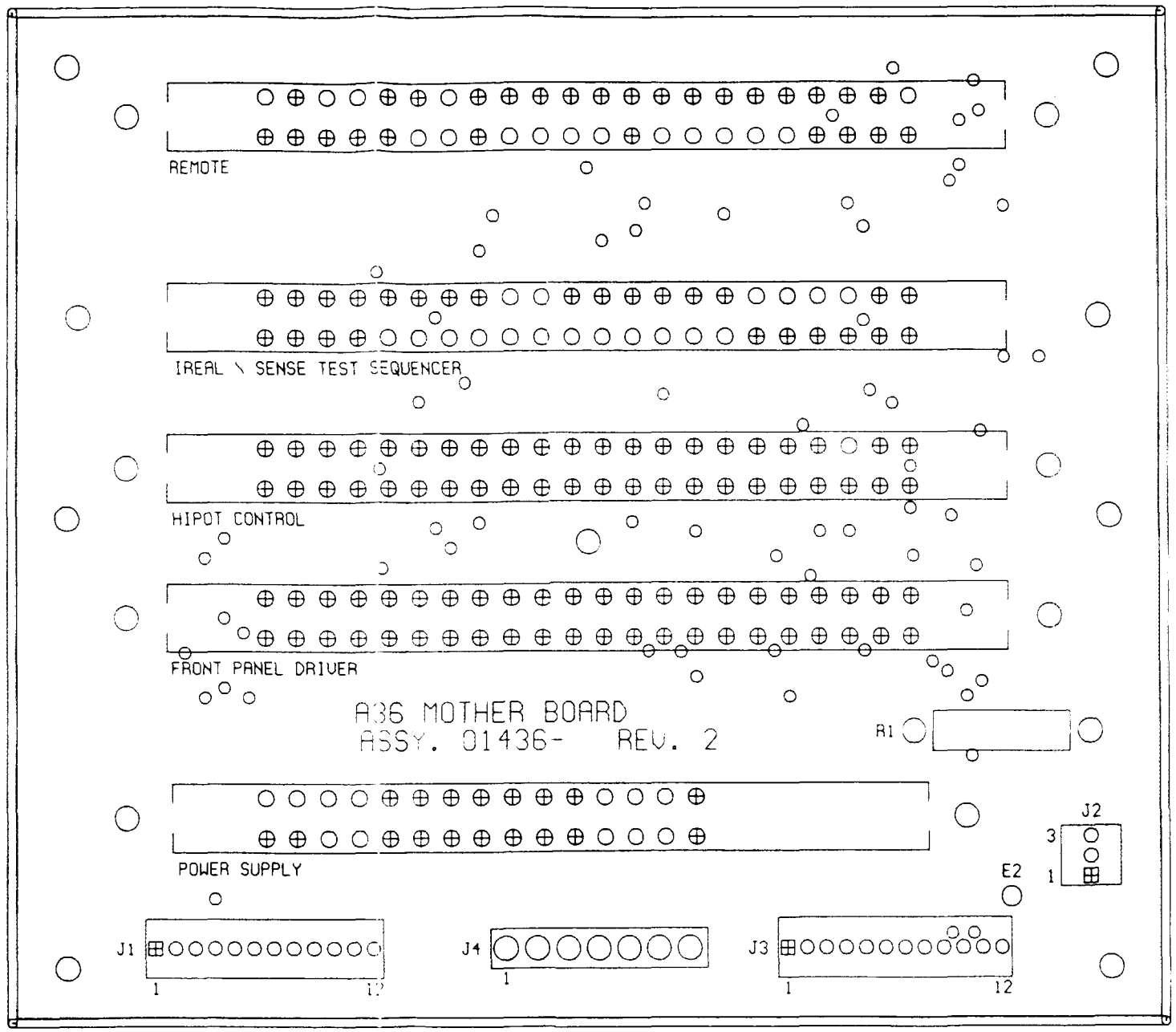
NEXT

REV



T2 (PSXF) J4
A30-J4 J1
A35-P1 J3
E2
J2
10VAC
VOLTSEN
SGSENSE
1.5VAC
R1 1.0 1%
POWER BUS
J1 BUS
J3 BUS
A10 POWER SUPPLY
A31 FRONT PANEL DRIVER
DRIVER
A32 HIPOT CONTROL
HIPOT
A33 IREAL SENSE TEST SEQUENCER
IREAL
A34 REMOTE CONTROL
LOGIC BUS
ROD-L ELECTRONICS, INC.
SCHEMATIC A36 MOTHER BOARD
DRAWN SMITH 5-90
DO NOT SCALE DRAWING

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	2	MOVED CARD GUIDE HOLES FOR REV C ASS	FEB 90	EDS



NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
.XX ±
.XXX ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN	
DESIGNED	
CHECKED	
ISSUED	

ROD-L ELECTRONICS, INC. 1086 HAMILTON COURT MENLO PARK, CALIFORNIA 94025 (415) 322-6111

ASSEMBLY DRAWING
A36 MOTHER BOARD

SIZE	FSCM NO.	DWG. NO.	REV
C		C 1436-02	2

SCALE | SHEET OF

DWG NO | SH | REV

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES .XX ± .XXX ±	DO NOT SCALE DRAWING	APPLICATION
MATERIAL		NEXT ASSY USED ON
FINISH		

CONTRACT NO	APPROVALS	DATE
CHECKED	DRAWN	5-93
DESIGNED	SCHEMATIC R3S HU GENERATOR	

ELECTRONICS, INC.

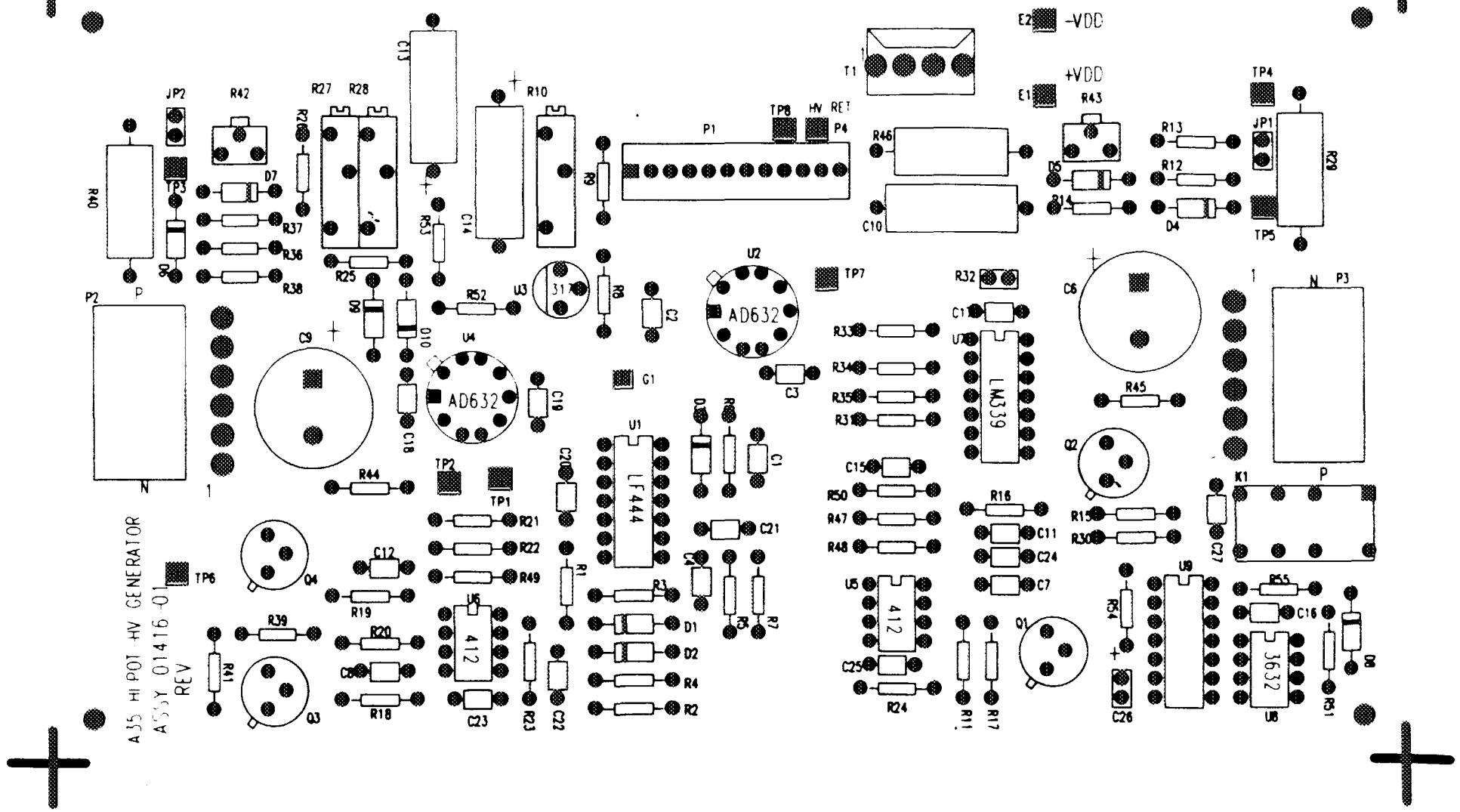
SIZE D | DWG NO | REV C

SCALE: 1:1 | SHEET 1 OF 3

HEATSINK (OFF BOARD)

TNOTE: THERMISTOR IS MOUNTED TO HEAT SINK

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED



QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	
CHECKED	
ISSUED	

POP-L ELECTRONICS, INC. 923 HAMILTON AVENUE • MENLO PARK, CALIFORNIA 94025 • (415) 322-0711

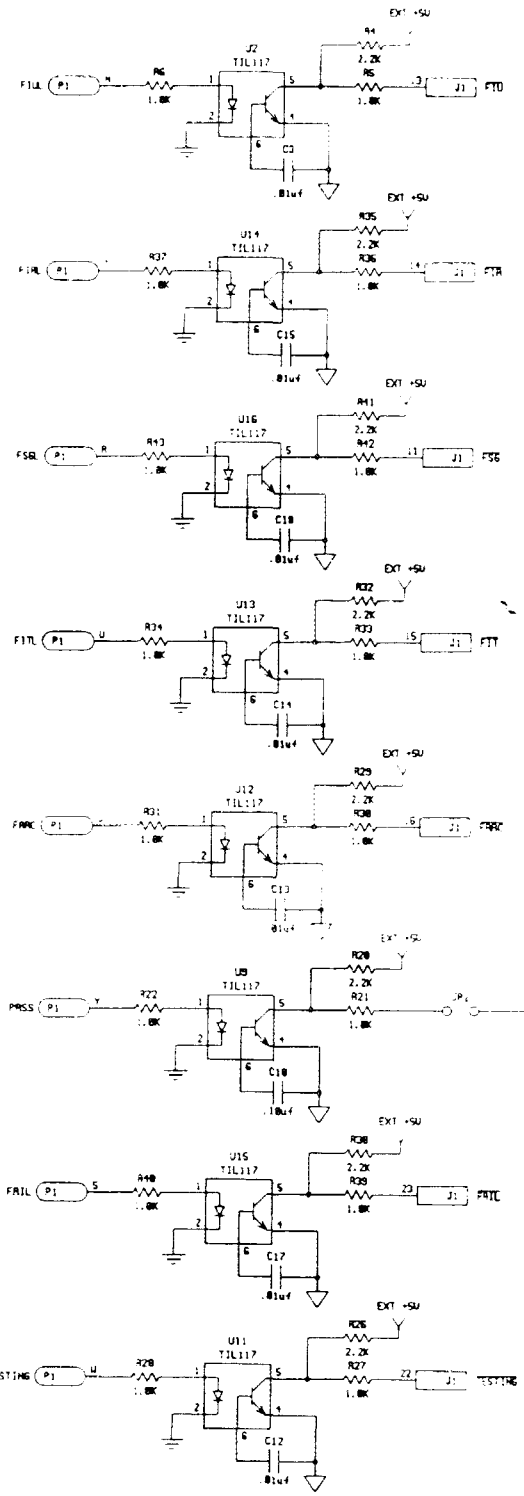
ASSY A35 PCB HV GENERATOR

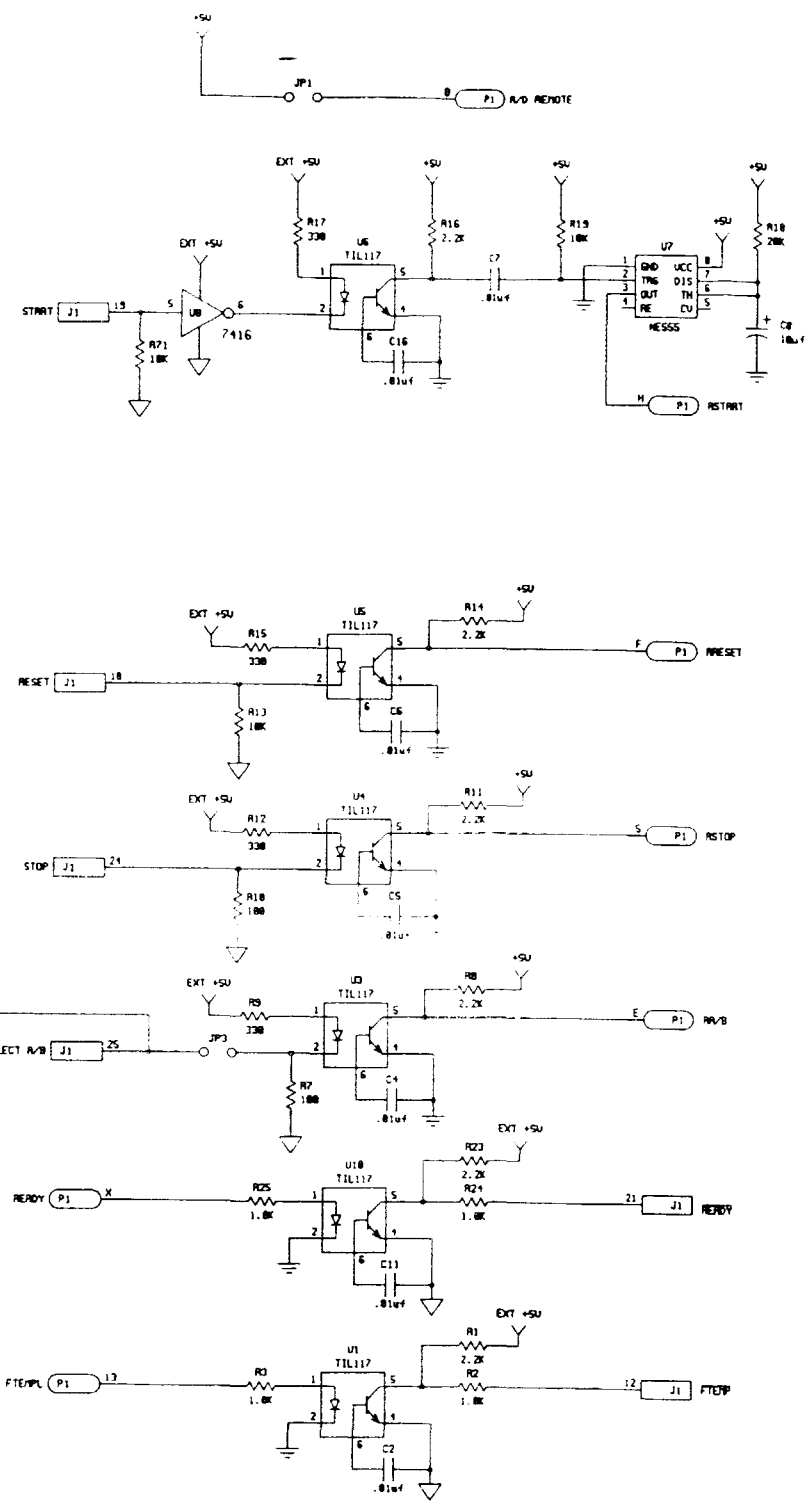
SIZE	FSCM NO.	DWG. NO.	REV.
B		01416-03	C

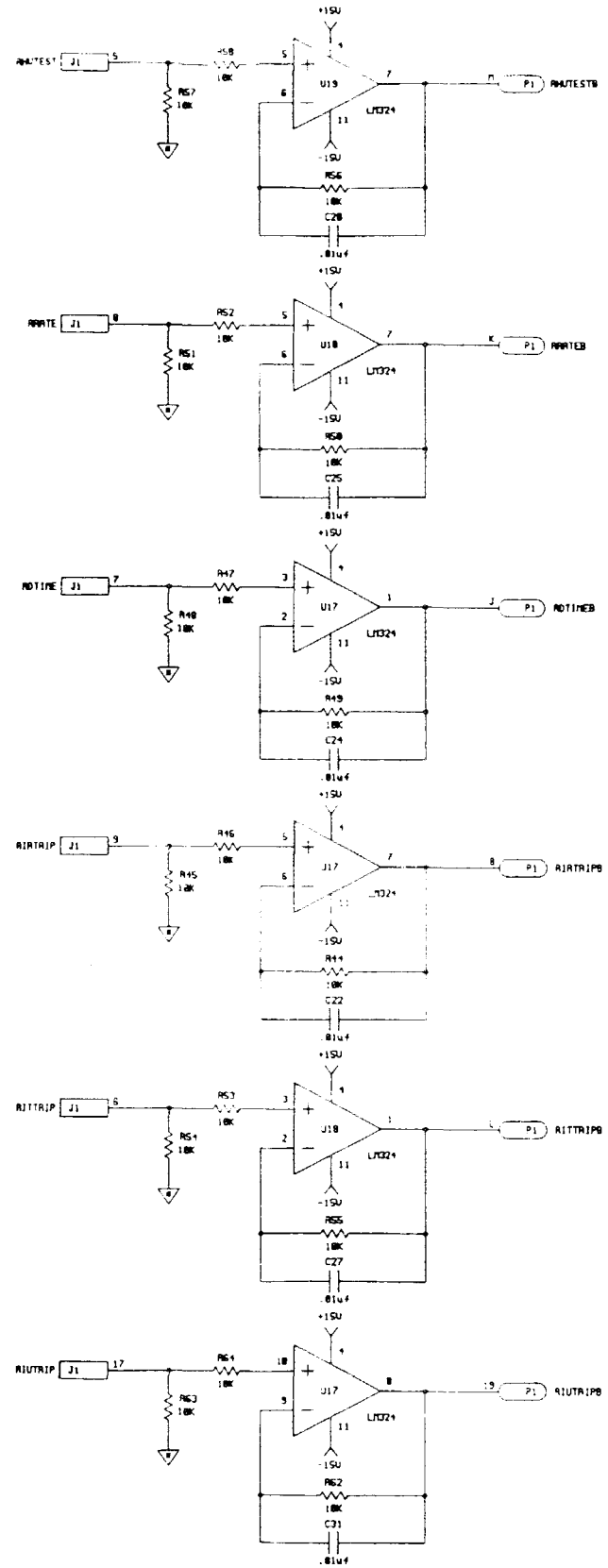
SCALE 2 x | SHEET 1 of 1

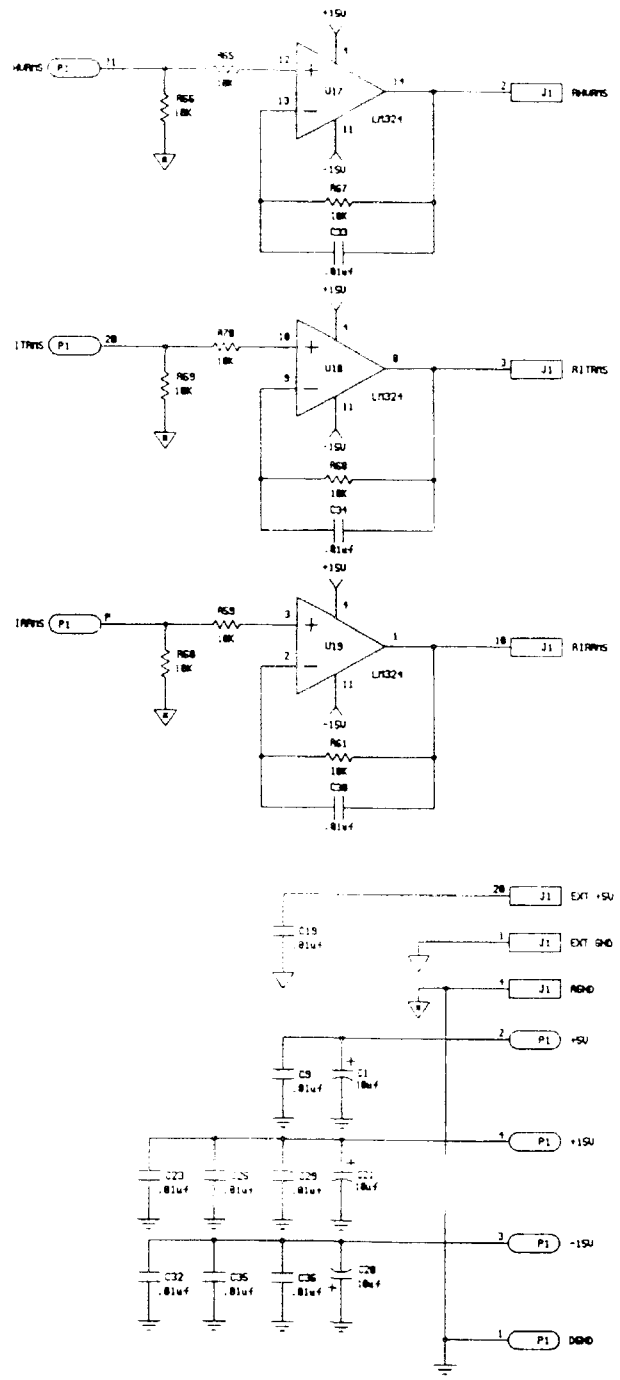
	M150
NEXT ASSY	USED ON
APPLICATION	

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED









		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES .X ± .XXX ±	CONTRACT NO
		MATERIAL	APPROVALS / DATE
		FINISH	DRAWN SMITH 5-90
NEXT ASSY	USED ON		DESIGNED
APPLICATION		DO NOT SCALE DRAWING	CHECKED
			ISSUED

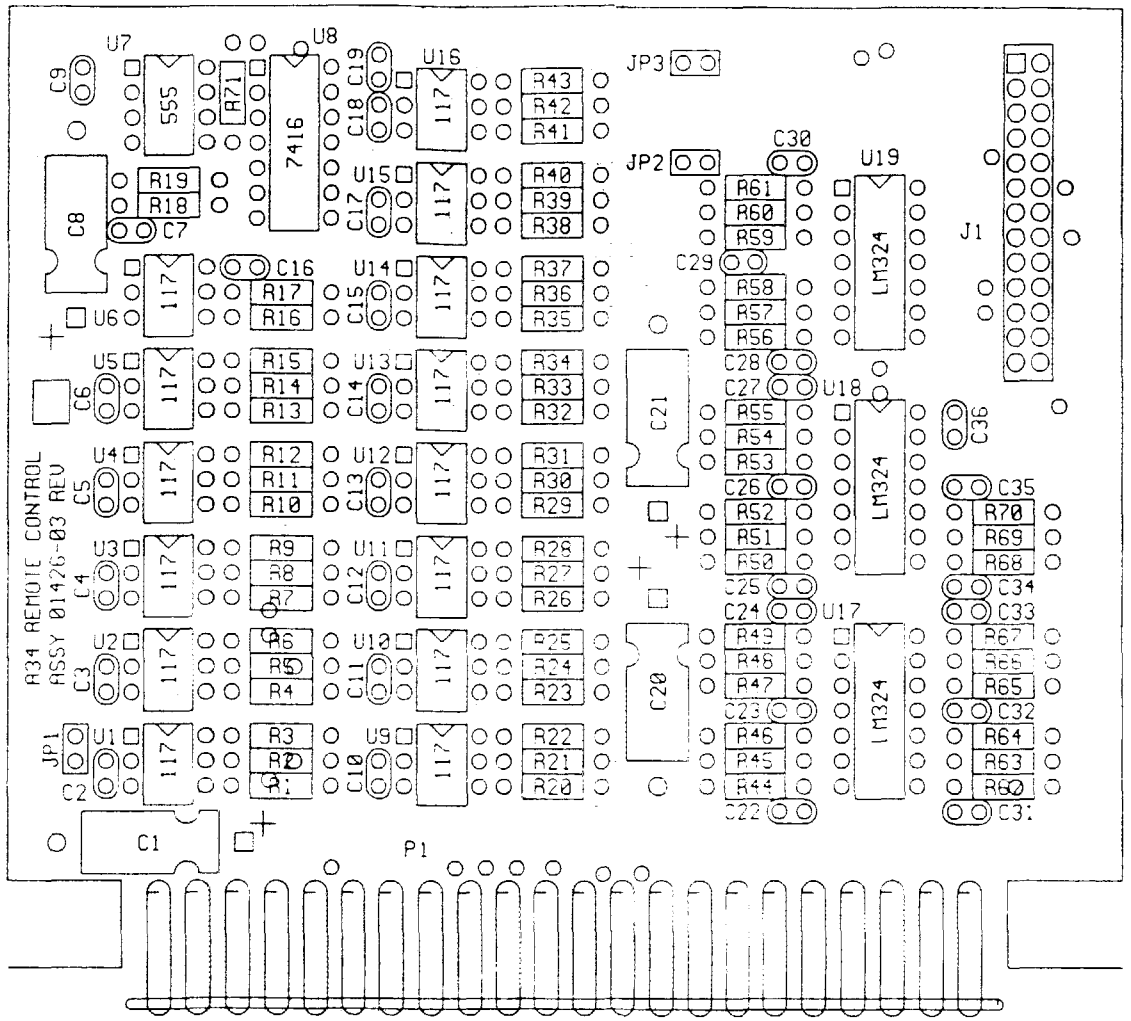
RSI ELECTRONICS, INC.

SCHEMATIC
A34 REMOTE CONTROL

SIZE	FSCM NO	DWG NO	REV
D		[illegible]	C

SCALE [illegible] SHEET [illegible]

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED



NEXT ASSY	USED ON		
APPLICATION			

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
.XX ±
.XXX ±

DO NOT SCALE DRAWING

CONTRACT NO

APPROVALS	DATE
DRAWN SMITH	5-90
DESIGNED	
CHECKED	
ISSUED	

MATERIAL

FINISH

RSD-L ELECTRONICS, INC.

ASSEMBLY DRAWING
A34 REMOTE CONTROL

SIZE	FSCM NO.	DWG NO.	REV.
C		01426-03	C

SCALE: FS SHEET OF

NEXT ASSY | USED ON

REV | SH | DWG NO