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M300RT

OPERATION

AND

SERVICE MANUAL

ROD-L
ELECTRONICS, INC.
923 Hamilton Avenue
Menlo Park, CA 94025
(650) 322-0711

60005-05
Revised
2 September 1997

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ROD-L
ELECTRONICS, INC.
923 HAMILTON AVENUE • MENLO PARK • CALIFORNIA • 94025
650-322-0711 • 800-548-6305 OUTSIDE CALIFORNIA FAX 650-326-1993

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 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.

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Table of Contents

Section			Page
1	**Introduction**		
	1-1	Scope of This Manual	6
	1-2	General Description and Test Features	6
	1-3	Product Specifications (Table 1-1)	7
	1-4	Safety Features	8
	1-5	Supplied Equipment	8
2	**Installation and Operation**		
		Safety Warnings	9
	2-1	General Information	9
	2-2	Unpacking and Inspection	9
	2-3	Installation	10
	2-4	Power Requirements	10
	2-5	Operating Controls	10
	2-6	Storage	10
	2-7	Repackaging for Shipment	11
	2-8	Initial Installation and Power-Up	12
	2-9	Factory Settings (Table 3-1)	13
	2-10	Operational Check	13
	2-11	Fail Indications	13
	2-12	Set Resistance Fail Point	14
	2-13	Preset Test Time/Rise Time	14
	2-14	Automatic Test Procedure	15
3	**Theory of Operation**		
	3-1	General Introduction	16
	3-2	High Voltage Module	17
	3-2.1	Description	18
	3-2.2	A53 Doubler/Rectifier PCB Theory	19
	3-2.3	A52 HV Relay PCB Theory	19
	3-2.4	Driver Assembly Theory	19
	3-3	A51 Hipot Control PCB, Rev D and above	20
	3-3.1	Description	20
	3-3.2	Theory	20
	3-4	A50 Mother PCB, Rev E and above	23
	3-4.1	Description	23
	3-4.2	Low Voltage Low Power Supply Theory	23
	3-4.3	HV Control Theory	23
	3-4.4	Interface Theory	24
	3-5	A60 Resistance Sensing PCB	24
	3-5.1	Description	24
	3-5.2	Theory	25

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Section **Page**

4 Maintenance and Service

4-1 Introduction 26
4-2 Equipment Needed 26
4-3 Factory Calibration Procedures 27
4-4 Set Up 27
4-5 Meter Mechanical Zero 27
4-6 Circuitry Set Up: A50 and A51 Rev D & above 27
4-6.1 Reference Voltage Initial Condition 27
4-6.2 Arc Sense 28
4-6.3 V-Set and R-Set Adjust 28
4-6.4 Switching Power Supply Oscillator Duty Cycle Adj 28
4-7 Final Voltage Meter Accuracy 28
4-8 CalibrationááΩ Measurement and Failure Threshold 29
4-9 Fail Pots Calibration 30
4-10 HV ON Lamp 30
4-11 Test Time Calibration 30
4-12 Ramp Rate Calibration 31
4-13 List of Adjustment Potentiometers 32
4-14 Trouble Shooting 32

5 Options

5-1 Options 01 and 19, Remote Control 33
5-2 Option 05, Hands Off Operation 37
5-3 Option 06, Rear Panel Lockout Cover 37
5-4 Option 07, Extra HV receptacle on Rear Panel ... 37
5-5 Option 10, Audible Test Tone 37
5-6 Option 14A Special Pin Assignment 37
5-7 Option 15 Rack Mounting 38
5-8 Option 24B Blank Front Panel Start 38
5-9 Option 25 Two-Voltage Switch (250V/500V std) ... 38

6 Bills of Materials, Schematics, Diagrams

BOMs for Assy's 39
Wiring Diagrams, Assembly Prints, and Schematics
for all PCBs (in same order as BOMs) 119

www.valuetronics.com

List of Figures and Tables

Table 1-1	Model M300RT Specifications	7
Figure 2-1	M300RT Front Panel Controls	11
Figure 2-2	M300RT Rear Panel Controls	12
Table 2-1	Factory Settings	13
Figure 3-1	Instrument Functional Block Diagram	16
Figure 3-2	HV Generator Functions	17
Figure 3-3	HV Control Functions	17
Figure 3-4	M300RT Test Times	21
Figure 3-5	General Control Functions	22
Table 4-1	Fault Location Chart	32
Table 5-1	DB25 Pin #, Signal Name, Analog/Digital .	36
Table 5-2	Resistance/Voltage Correspondence	36

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Section 1

INTRODUCTION

1-1. Scope of This Manual

This publication provides operating and servicing instructions for the **Rod-L Electronics, Inc.** Model M300RT Resistance Test Instrument. It is divided into six sections.

Section 1 - Introduction (capabilities and specifications)
Section 2 - Installation and Operation
Section 3 - Theory of Operation
Section 4 - Calibration
Section 5 - Options
Section 6 - Parts Lists, Schematics, Diagrams

1-2. M300RT General Description and Test Features

The **Rod-L** Model M300RT Resistance Tester is a rugged, self-contained tester designed for both laboratory and production use. Its purpose is to provide a simple and safe DC High Voltage (HV) insulation resistance test for evaluating the insulation of electric and/or electronic devices. This is accomplished by monitoring for minimum value of resistance.

The M300RT Resistance Tester tests in full compliance with UL, VDE, IEC, and MIL STD 202 test standards.

The M300RT tests and displays DC voltage and resistance, measuring resistance up to 4000MΩ using a voltage of 500 VDC. It also incorporates a rapid, automatic electronic shutdown circuit to turn off the high voltage within 2ms (two milliseconds) of a fault or other End Of Test, and it completely discharges the Device Under Test (DUT). To prevent turn-on surges, the high voltage has an electronically controlled rate-of-rise (adjustable from 50V/sec to 500V/sec). It also includes an arc detection circuit.

The voltage ramp, test time, test voltage, and insulation resistance failure threshold points are easily preset through rear panel adjustments. Two ramp rates and test time intervals are selectable through a front panel A/B switch. The control circuits and High Voltage generation are solid state for reliability. Specifications are given in Table 1-1.

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1-3. Product Specifications (Table 1-1)

Table 1-1: Model M300RT Specifications

Resistance Scale
Three: 40MΩ, 400MΩ, 4000MΩ
Trip Point user adjustable over range

Test Voltage
50 - 500 VDC, user specified, factory set

Voltage Rate of Rise
5 V/second to 500 V/second (user adjustable)

High Voltage Test Time
1 second to 180 seconds (user adjustable)

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

Accuracy (Resistance and Voltage Monitoring)
Better than 1%

Resolution (Output Voltage Control)
2.5V

Ripple
1% at full load, 0.05% at zero current

Input Power
115/230 VAC, 44-66 Hz., 300 watts, max

Regulation
0.05% at full load

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

Exterior Color
Mint grey and Olive Grey or Black

Weight
24 lbs (10.9 kg) net, 29 lbs (13.15 kg) shipping

Dimensions
16.75 x 13.25 x 5.5 inches (43 x 34 x 14 cm)

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1-4. **Safety Features**

A) Recessed START button

B) Visual alarm at failure

C) Audible alarm at failure (continuous tone)

D) Fast electronic shut down of DC High Voltage

E) Complete discharge of Device Under Test (DUT)

F) Hard RESET after failure required to perform next test

G) Visually displayed Programming of Resistance Trip Point

H) High Voltage Output closed to Ground when not in test

1-5. **Supplied Equipment**

A) Resistance Test Instrument, **Rod-L** Model M300RT

B) Power Cord, three pronged, 6 ft

C) Kit for HV connector mate

D) Operation/Service Manual

E) Extra fuse set for the alternate AC supply voltage

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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.

CAUTION

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 hole cover installed on the rear panel HV OUT/INTERFACE connector. To reduce the risk of shock, this plug and cover 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

Retain the shipping carton and the padding material. **Rod-L Electronics** may assess a charge for a new shipping container if an instrument is not received in the original container.

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.)

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If the instrument is found to be damaged upon receipt, notify the carrier and **Rod-L Electronics** immediately.

2-3. Installation

The **Rod-L** Model M300RT Resistance Test Instrument is suitable for either bench or rack mounting. To rack mount the instrument, use Option 15A. The instructions for rack mounting are on page 38.

2-4. Power Requirements

The **Rod-L** Model M300RT Resistance Tester 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. When using the **Rod-L** M300RT with other **Rod-L** Testers, the Ground Sense Circuit often works better when the **Rod-L** Testers are connected to a line input with the same ground circuit.

2-5. Operating Controls

The front panel and rear panel controls and indicators are shown and briefly described in Figures 2-1 and 2-2.

2-6. Storage

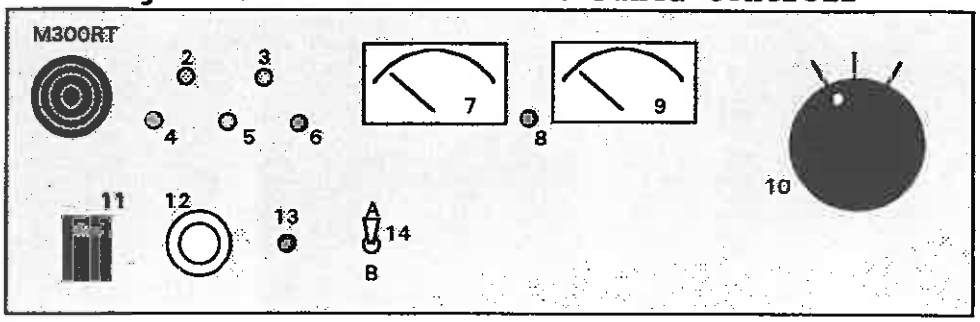
It is strongly recommended that the M300RT be packed as if for reshipment. Environmental conditions during storage and reshipment should be as follows:

A) Maximum temperature: 167°F (75°C)

B) Minimum temperature: -40°F (-40°C)

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Figure 2-1: M300RT Front Panel Controls



1.	Alarm	emits audible signal on failure
2.	R-SET lamp	on when R-SET switch is in set position off when R-SET switch is in run position
3.	V-SET lamp	on when V-SET switch is in set position off when V-SET switch is in run position
4.	READY lamp	on when ready to begin Test
5.	TESTING lamp	on during Test Cycle
6.	FAIL lamp	on if Test fails
7.	Resistance meter	indicates insulation resistance of DUT indicates fail point when in R-SET mode
8.	HV ON lamp	flashes when 40VDC or more is present
9.	Voltage meter	indicates DC volts applied to DUT indicates max DC volts when in V-SET mode
10.	Range Select	selects sensitivity for resistance meter. × = a full scale of 40 MΩ × = a full scale of 400 MΩ × = a full scale of 4,000 MΩ
11.	AC ON switch	turns on and indicates line power input
12.	START switch	initiates Resistance Test if READY
13.	RESET button	resets Tester
14.	A/B switch	chooses A or B Ramp Rate and Test Time

2-7. Repackaging for Shipment

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

A) Wrap the M300RT in heavy paper or plastic before placing it in the shipping container.

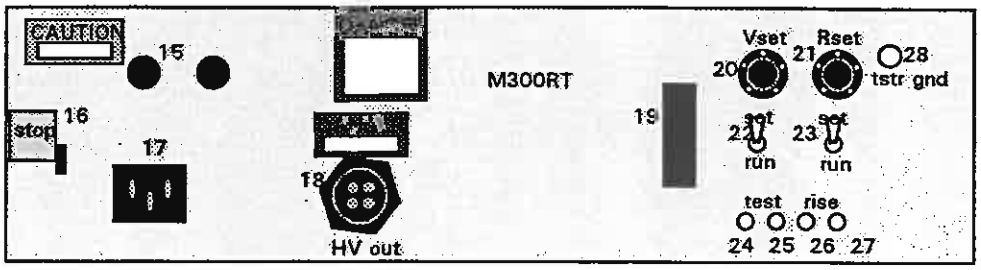
B) Use plenty of packing material around the instrument, and protect the front panel with cardboard or plastic bubble packing. Protect the instrument with two inch rubberized foam pads placed along all surfaces of the instrument, or with a layer of excelsior about 6 inches thick packed firmly against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

C) Use a strong, well-sealed shipping container (350 lb/in² bursting test.)

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

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Figure 2-2: M300RT Rear Panel Controls



15.	AC Fuses	F1/F2 3A @ 115VAC, 1.5A @ 230VAC
16.	Voltage Selector Switch	chooses 115VAC or 230VAC input; be sure to install correct fuses
17.	AC line power in	receptacle
18.	HV Out	for connection to DUT
19.*	Remote connector	(*Optional) for Remote Interface
20.	V-SET pot	for voltage programming
21.	R-SET pot	for resistance trip programming
22.	V-SET switch	in "set" position allows voltage programming pot to be adjusted and viewed on the voltage meter
23.	R-SET switch	in "set" position allows resistance "trip" fail point programming pot to be adjusted and viewed on the current meter
24.	"A" Test Time Adjustment potentiometer	
25.	"B" Test Time Adjustment potentiometer	
26.	"A" Voltage Rise (Ramp Rate) Adjustment potentiometer	
27.	"B" Voltage Rise (Ramp Rate) Adjustment potentiometer	
28.	Ground jack	for connecting tester's chassis' together

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. Initial Installation and Power-Up

The **Rod-L** M300RT is shipped configured for 115 VAC operation. Appropriate fuses (1.5 ampere) are also provided for 230 VAC operation. Before applying 230 VAC power to the instrument, perform the following:

CAUTION

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

Then change the AC line voltage selector switch on the Rear Panel.

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2-9. Factory Settings

The **Rod-L** M300RT Tester is shipped with the following factory-selected settings (unless otherwise requested in writing by the customer):

Table 2-1: Factory Settings

TEST MODE SWITCH	"A"	"B"
Voltage	500 VDC	500 VDC
Resistance Trip Point	0 Ω	0 Ω
Test (Dwell) Time	15 sec	3 sec
Ramp Rate	100 V/sec	250 V/sec
Input Line Voltage Select	115 VAC	

2-10. Operational Check

This is an operator oriented procedure which allows operational check of the **Rod-L** M300RT Resistance Test Instrument without test equipment. Refer to Section 4 of this manual for a complete calibration procedure.

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.

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 115 VAC ±10% power source.

F) Ensure that the V-SET and R-SET switches are in the "RUN" position. Place the AC/DC switch in the DC position.

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

H) After about one second, the green READY lamp should illuminate.

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I) With the READY lamp lit, push the START switch. The HV O" lamp will begin flashing.

> **WARNING**
>
> **DC high voltage is present** at the front panel HV receptacle block and the rear panel cylindrical connector when the HV ON lamp flashes.

J) The OUTPUT VOLTAGE meter will indicate the controlled rise to the preset voltage. The HV ON light will remain flashing until the test time has expired or a test failure is detected.

K) The RESISTANCE meter should register a value while the test is in progress. Once the test has ceased, the RESISTANCE meter should register ∞ (infinity).

L) Check the RESET function by pressing the RESET button during a test. The voltage indicators should either go off or return to zero.

2-11. Fail Indications

Under-Resistance failures are represented with the FAIL lamp and audible alarm coming on continuously until the RESET button is pressed.

Option 05 Hands-Off FAIL signal is about two seconds long, and then the Hipot Tester resets itself automatically.

When Option 10 Audible Test Tone is installed the alarm will sound pulses at 3 to 6 beeps per second whenever a TEST is in progress.

2-12. Set Resistance Fail Point

To set the resistance trip point, decide on a value that will fail anything less than that point. When the R-SET switch is in the "set" position, adjust the R dial on the rear panel until the desired setting is indicated on the resistance meter (CCW to increase).

Be sure to return the SET switches to the RUN position.

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2-13. **Preset Test Time/Rise Time**

With the A/B switch in the A position, the A Test Time Pot can be adjusted (CW to increase). A TEST must be in progress to adjust for desired Ramp Rate (rate of rise to full voltage). Remember, **increasing the time will decrease the Ramp Rate.**

The "A" test time pot is used to adjust for desired dwell time at full voltage. These adjustments may reqire starting the TEST several times.

The "B" times are adjusted with the A/B switch in the B position.

2-14. **Automatic Test Procedure**

Connect the Device Under Test (DUT) to the Resistance Tester output voltage receptacle on the rear panel. The READY light should be on, so the DUT is ready to be tested with the START signal coming from the REMOTE or the START Switch.

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Section 3

THEORY OF OPERATION

3-1. General Introduction

This section concerns the circuit theory for the M300RT Resistance Tester. This system was designed to ensure high quality, accuracy, flexibility, and safety of operation.

Briefly, the hot and neutral lines on the power cord of the Device Under Test (DUT) should be connected together and to one clip lead of the M300RT Resistance Tester, and the ground of the power cord must be connected to the other clip lead. The RESET button must be pressed at this time, which turns on the READY light (if A51 Control PCB Rev D or above is installed). Only then will the Test cycle be allowed to start.

The *PARAMETERS SET UP* feature allows the user, before a test is run, to preset all the parameters needed to run a Resistance Test: Test Time, Rate of high voltage Rise, final testing High Voltage, and resistance failure "Trip Point." The user can observe the programming of the High Voltage and the Resistance Trip Point on the voltage and resistance meters. V-SET and R-SET lights on the Front Panel are turned on during the setting of these two parameters.

After the parameters are set up, the test can be started manually with the recessed *START* button, or automatically "remotely" through the Remote Interface Option, or with the "Hands-Off" Option connected. Then, HV Control signals HV Generation to begin. This opens the relay that is normally closed between the High Voltage Output and the Ground. HV Control continuously monitors the output voltage, and sends/receives the preset High Voltage information. A *TEST* light turns on to indicate a test in progress. A *HV ON* light will flash when there is greater than 40 volts at the output receptacle on the rear panel.

Finishing a test —— either manually with the Reset switch, automatically through the Remote Interface, because the test time has expired, or a failure was detected —— makes General Control stop HV Control. A relay immediately shorts the High Voltage to Ground so that any charge accumulated on the DUT during the test will be removed.

The Resistance Tester can be digitally controlled through the different statuses via the optically isolated *REMOTE*.

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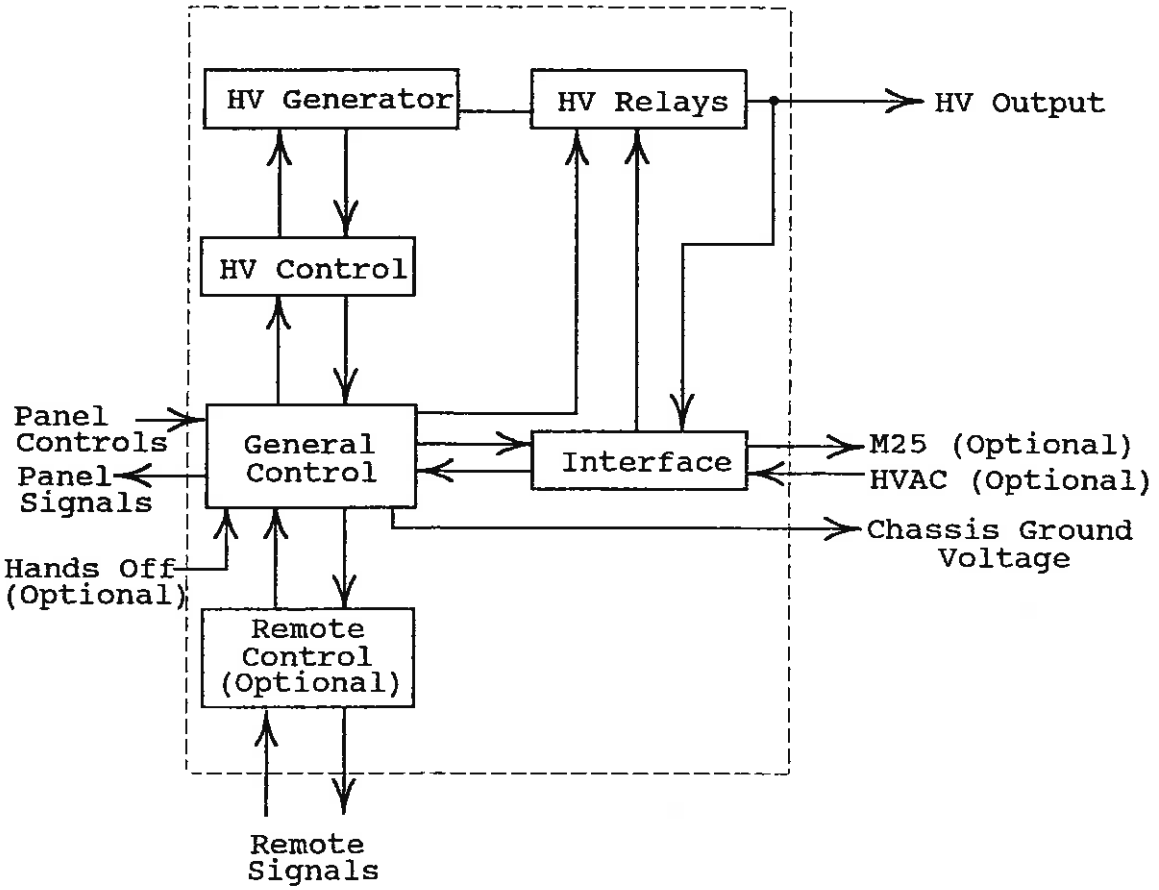


Figure 3-1: Instrument Functional Block Diagram

Electrically, the M300RT system is divided into three parts:

A) Low Voltage and low power circuits
B) Low Voltage and high power circuits
C) High Voltage and high power circuits

These are physically located in different places. The first is on the printed circuit boards (PCBs) on the left side of the instrument, looking from the front. The second is on the right and mid-rear of the instrument. The third is enclosed in a metallic box.

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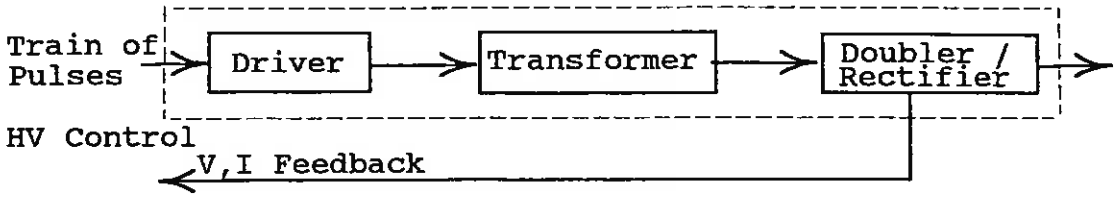


Figure 3-2: HV Generator Functions

3-2. High Voltage Module

3-2.1. Description

High Voltage Generation (see Figure 3-2) consists of the Driver heatsink assembly and the High Voltage Module. Within the High Voltage Module are the HV transformer, the A52 HV Relay PCB, and the A53 Doubler/Rectifier PCB.

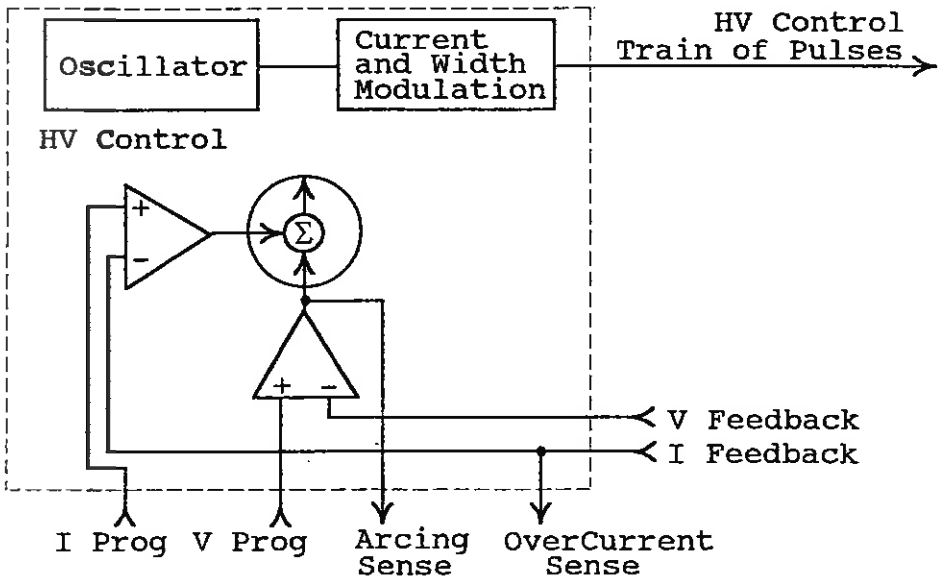


Figure 3-3: HV Control Functions

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3-2.2. **A53 Doubler/Rectifier P. C. Board Theory**

On the A53 Doubler/Rectifier PCB (refer to schematic 00392-01), when the HV produced in the secondary of the HV transformer, T2, is negative, current goes into the circuit through the *RVB-1* input (Pin 9). This current goes through R2 and CR1, closing the loop through R1 and C1, charging this capacitor. C3 and C4 provide filtering, and TZ1 is a voltage suppressor to R2.

When the HV in the secondary of T2 is positive, current goes into the circuit through *HV AC IN* (Pin 1). This current goes through C1. R1 closes the loop through CR2, R2, R16 and C2, charging this capacitor to a value equal to about twice the peak of the HV produced at the secondary of T2. C1 had already been charged to a value about one times the peak value when the positive peak arrived to be added to it.

From the set of limiting resistors, R3 through R8, a signal proportional to the HV DC output is taken with the dividing network composed of R13, R14, R15, and the resistors R21, R22, and R33 on the A50 Mother PCB.

R7, C7, C8, C6 provide filtering and TZ2 is a voltage suppressor to ensure low voltage in the *VFB* line.

3-2.3. **A52 HV Relay P. C. Board Theory**

On the A52 HV Relay PCB, (refer to schematic 00395-01) the HV output comes from the HVDC generated in the M300RT (relay K1.) The relay K3 is always on because the AC/DC input is disconnected. The relay K2 closes to ground the HV any time there is not a Resistance test going on. This safety feature ensures that the DUT is discharged.

3-2.4. **Driver Assembly Theory**

The Driver assembly (schematic 00389-04), located inside the middle part of the M300RT Rear Panel, receives the train of pulses coming from the HV Control (refer to Figures 3-2 and 3-3) and produces high current switching of the transformer primary, to produce high voltage in the secondary. This voltage is half-wave rectified to reference it to ground and double it.

On the *Driver* are transistors Q1 through Q4 which drive the HV transformer T2. R1, R2, and R3 ensure a balanced distribution of the current among Q1, Q2, and Q3. Q4 drives them in a Darlington configuration.

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3-3. A51 Hipot Control P. C. Board, Revision D and above

3-3.1. Description

The A51 Hipot Control PCB, physically located in a vertical position on the A50 Mother PCB, contains the main circuitry of the general control block.

In concept the High Voltage Control (refer to Figure 3-3) receives feedback signals from the A53 Doubler/Rectifier PCB and the A60 Resistance Sensing PCB, monitoring the High Voltage Output and Resistance. It consists of an oscillator of approximately 33kHz and the comparator circuits. High voltage and resistance signals from the high voltage generator are compared with the preset voltage and resistance trip point, and are current- and width- modulated by the output of the comparators. The proper signal is held at the comparator's output to ensure that the output voltage matches what was preset, and the resistance is not insufficient to the preset value

There are many General Control functions on the A51 Hipot Control PCB also (see Figure 3-5). *V-SET* and *R-SET* switches permit setting up the desired DC High Voltage and Resistance Trip Points.

SELECT A/B gives the A or B Test/Rate of Rise combination which can be adjusted.

3-3.2. Theory

With reference to schematic #00379-06, the latch U11, Pin 4 on schematic #00379-06 determines the TEST status. Its output, U11, Pin 1, will be high, producing *TEST* status only if the *START* button is pressed when the *RESET* input at U11, Pin 14 is low.

The *RESET* input becomes low if: 1) the RESET button is pressed giving a high at the edge-card connector Pin P; 2) the Test Time is over, causing U1, Pin 14, the output, to go low.

The *FAILURE* latch, U11, Pin 10 is triggered by any of the inputs of U15; pin 9 the HANDS OFF failure (option) while a test is in progress, pin 10 ARC failure, or pin 12 insufficient resistance (OVERCURRENT) failure. After a failure is produced, the FAILURE latch has to be RESET before the START signal can trigger the TEST latch again.

The ground failure circuit is held inoperative in the M300RT Resistance Tester Ground by tying the input at the edge-card connector 5, E to ground.

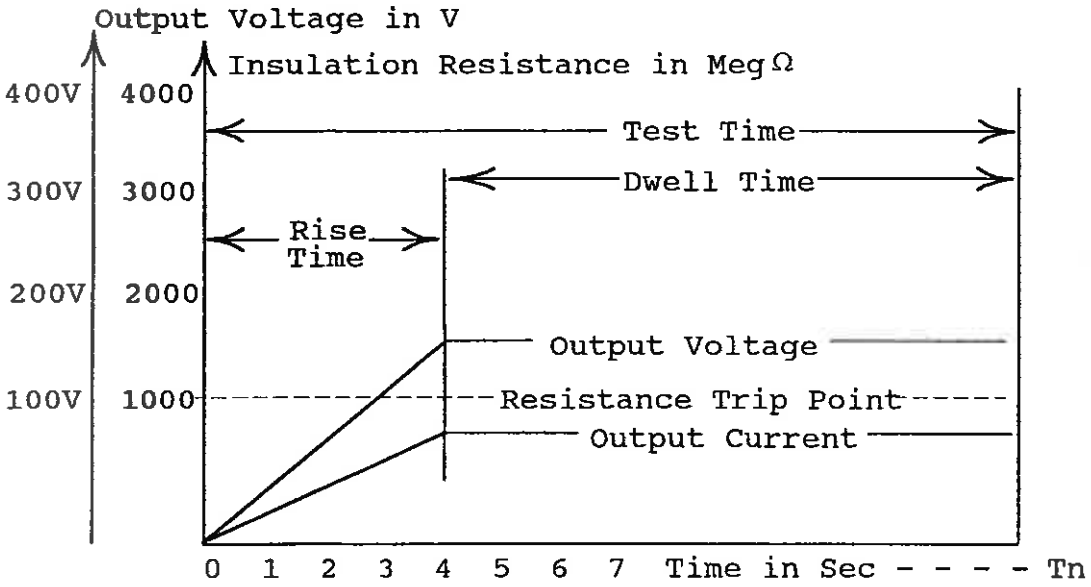
U13 pin 14 produces a ramp up signal, and its slope depends on the *VRISE* voltage, which can be external (*EXT VRISE*) or one of the two (*VRISE A*, *VRISE B*) given by adjusting the two potentiometers,

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R70 and R71, on the A50 Mother PCB, accessible from the Rear Panel. The output *VPROG* to the HV Control located on the A50 Mother PCB is going to be this ramp up signal until it reaches the *VREF* given externally by *EXTVREF* or the internal *VREF* adjusted by the pot R11 on the Rear Panel. After *VPROG* reaches the *VREF* value, this is going to be its value until the test finishes. (Refer to Figure 3-4).

U13, pin 8 produces another ramp up signal with its slope proportional to the *VTEST* voltage given externally by *EXT VTEST*) or internally by *VRISE A* or *VRISE B* which are adjustable by pots R66 and R69 on the A50 Mother PCB, accessible from the Rear Panel. When U13-8 becomes equal to 12V, a *RESET* signal is produced at U1-14 resetting the *TEST* latch.

The analog switches in U7 make the *VPROG* be the ramp up signal proportional to *VRISE* through the A contacts, until *VRISE* is equal to *VREF*. *VPROG* will be equal to *VREF* from that time on through the B contact. C and D contacts will discharge and hold shorted the capacitors C10 and C11 of U13 while not in TEST.



Rise (Ramp) Time = Time to rise from 0 to 100% Test Voltage
Dwell Time = Time at 100% Test Voltage
Test Time = Rise Time + Dwell Time
Rate of Rise = Final Voltage / Rise Time

Figure 3-4: M300RT Test Times

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The adjustment of the Rate of Rise is very important due to the fact that the charging current during the application of the High Voltage can be several times higher than the DC leakage current. A tripping failure can be produced when the resistance presented during this charging transient is lower than the resistance tripping point even when the resistance during the stable period is higher. See page 14 for setting the Rate of Rise.

The analog switch, U9, chooses between external or internal *VRISE* and *VTEST*.

The analog switch, U3, chooses between A or B *VRISE* and *VTEST*.

The analog switch, U10, chooses between external or internal *VREF* and *RTRIP*.

The analog switch, U8, chooses which voltage and resistance, (*VREF* and *RTRIP* and the actual *VMON* and *RMON* from the HV Module and A60 Resistance Sensing PCB), will be shown on the voltmeter and resistance meter during V-SET and R-SET modes.

U1, pin 13 indicates when an *OVERCURRENT* (insufficient resistance) is produced, giving a RESET signal.

U13, Pin 1 is the result of filtering and comparing the *ARC* signal. A *RESET* is sent when an *ARC* is detected.

U13, Pin 7 indicates when the HV in the output is in excess of a certain value and the A-Stable U5 gives the flashing signal for the corresponding HV ON lamp.

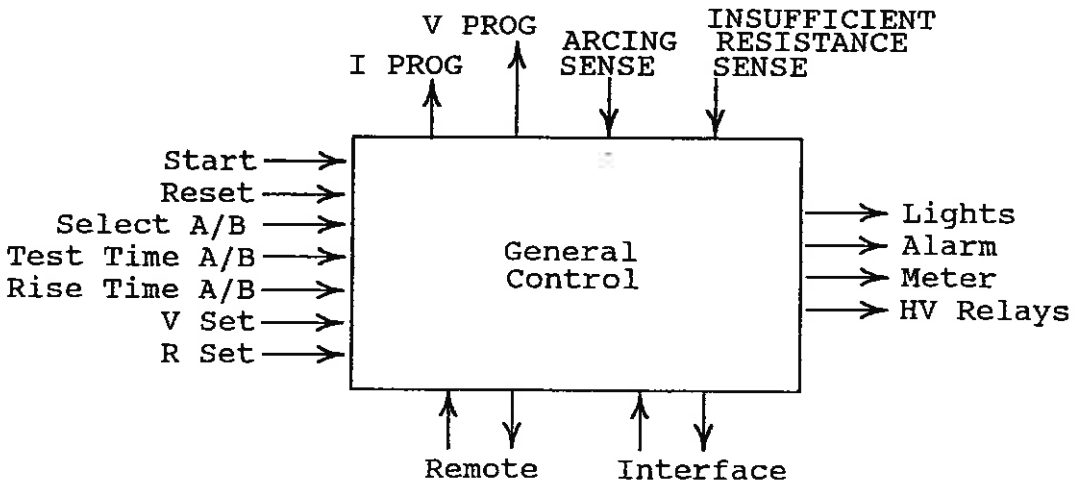


Figure 3-5: General Control Functions

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3-4. A50 Mother P. C. Board, Revision E and above

3-4.1. Description

The A50 Mother PCB, physically located in a horizontal position on the left side of the M300RT, contains the LOW VOLTAGE LOW POWER SUPPLY, the HV CONTROL, and the INTERFACE circuitry for the switches, lights, and for other **Rod-L** instruments.

3-4.2. Low Voltage Low Power Supply Theory

With reference to the two page schematic # 00382-XX, VR3, VR2, and VR1 provide regulated *+15V*, *-15V* and *+5V* with adequate filtering and anti-latch-up diode.

The 1.8V *GROUND SENSE* voltage is also supplied through PS connector Pin 10.

3-4.3. HV Control Theory

VPROG is the amount of High Voltage output required to be generated during the test. *IPROG* is the trip point or amount of resistance required during a test.

VPROG, coming from Pin 16 of the A51 Hipot Control PCB, is calibrated to be initially -0.15V. When the *START* button is pressed and the test begins, *VPROG* ramps up slowly and linearly and U5 compares this voltage with the *VFB* from U5, Pin 8.

If *VFB* is less than the *VPROG*, U5 Pin 1 becomes negative forcing Q1 into a conductive state which allows the oscillation pulses to propagate from U4, Pin 3. These pulses go through *DRIVE 1* and *DRIVE 2* (header pins HV, Pin 3 and HV, Pin 2) to the Driver transistors. As the control current gets negative, the current pulses increase, and the current through R25 decreases making the pulses wider. An equilibrium state is produced when *VPROG* and *VFB* are equal.

RTRIP, coming from the A51 Pin H, is compared with the *RVB1* from the A60 Resistance Sensing PCB delivered at U5 Pin 12 through the *HV RTN* input. When *RTRIP* is smaller than *RVB-1* the output U5, Pin 14 increases from -15V. This condition is seen as an *OVERCURRENT* through the A51 Hipot Control PCB Pin F.

The HV Relay signals, which actually go to the A52 HV Relay PCB, permit only DC or AC voltage at the high voltage output, and keep the output to GROUND while not in TEST.

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3-4.4. Interface Theory

Refering to 00382-XX, a two-page schematic drawing of the A50 Mother PCB, U8 is a buffer for *AC/DC*, *RESET*, and *START* switches. The AC/DC input is left disconnected, which leaves the relay K3 on the A52 HV Relay PCB operating permanently.

U11 is a buffer for the *REMOTE START*. *GND TESTER RESET* and *RESET* are unused as the M300RT Resistance Tester doesn't interface with the Ground Continuity Tester.

U13 is an inverter buffer for *V-SET* and *R-SET* switches, and *the REMOTE* detection signal. The *BURN* switch input of U13 is tied to ground to disable this option.

U12 is an inverter driver for the *Test*, *Ready*, and *Failure* signals to the Remote Option PCB. The outputs of *AC RESET* and *START* are disconnected since there is no *AC Hipot Tester* interface.

The *BUZZER* provides audible alarm when *ARCING*, *OVERCURRENT* (insufficient resistance), failure is detected during a test.

U9 unifies all the *RESET* and *START* inputs and *A/B* selector signals.

U7 and U6 are buffer and driver for the front panel lights except for *READY*.

U1, U2, and U3 are drivers for the HV relay signals and the *READY* light on the front panel.

U10 allows *START* to activate only in the *READY* condition. The input *FP1* is tied to ground to ensure a constant *READY* condition. Since the *DC* mode is always selected and no 1.5 VAC is connected to PS10, the *START* signal then goes to the A51 Hipot Control PCB.

3-5. A60 Resistance Sensing P. C. Board

3-5.1. Description

The objective is to measure the resistance of a device connected to the HV OUTPUT during the application of HV DC.

The method used for monitoring the output resistance is to evaluate the output current. When the output leads are shorted, a maximum amount of output current is obtained producing a maximum deflection on the resistance meter, corresponding to a zero resistance value, i.e., 0Ω. As resistance is connected to the output leads, the current produced by the preset amount of output

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voltage decreases with a corresponding smaller deflection on the resistance meter. Of course, when the output leads are open, the output current is zero and the deflection on the resistance meter corresponds to the ∞ (infinite) resistance load value, i.e., no deflection.

3-5.2. **Theory**

As shown on schematic 00454-01 the resistance network is calculated using standard HV precision resistors to produce 9.8V whenever the output leads are shorted and the maximum output current is produced. These internal current limiting resistor values, which correspond to the three middle scale values, are set with the front panel switch to 1MΩ, 10MΩ, and 100MΩ. This switch selects one of three internal resistors, 20kΩ, 200kΩ, or 2MΩ, to produce 9.8V when the output leads are shorted.

The common contact of S1-A sends the monitoring voltage to the high input impedance buffer, which is input protected from transients. Then the voltage is slightly amplified to give 12V with an input of 9.8V. This buffered voltage is applied to the HV return input on the A50 Mother PCB to drive the resistance meter. The 12V signal is adjusted on the A50 Mother PCB by potentiometer R74 to produce exactly 10V, providing full deflection on the resistance meter when the HV output leads are shorted. This meter is designed to give a resistance value for the different output current values produced by the 500VDC output voltage.

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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** M300RT Resistance Tester. Included is a list of recommended test equipment, calibration procedures and adjustment data.

Rod-L recommends that the hipot testers be calibrated on a or 12 month cycle at the discretion of the customer based on volume of usage. Under no circumstance should a 12 month cycle be exceeded.

4-2. Equipment Needed

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

A) Oscilloscope

B) Digital Multi-Meter (DMM) (Voltage floating input)

C) High Voltage Probe

D) 115 - 230 VAC Line Step Up Transformer

E) AC Variac

F) High Voltage Loads

G) Standard Resistors 2W 1%: 1MΩ, 10MΩ, 100MΩ

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4-3. Factory Calibration Procedures

There are eight major calibration points on the M300RT Resistance Tester. They are:

A) Meter Mechanical Zero

B) Circuitry Set Up

C) Resistance Meter Calibration

D) Voltmeter Calibration

E) Fail Pots Calibration

F) HV ON Lamp

G) Test Time Calibration

H) Ramp Rate Calibration

4-4. Set Up

It is recommended that the M300RT 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.

4-5. Meter Mechanical Zero

With the M300RT turned OFF, note the position of the meter pointers on the front panel. The voltmeter should read 0 ± 1 minor division, and the resistance meter should read ∞ ± 1 minor division. If they do not, adjust the null screw.

4-6. Circuitry Set Up: A50 and A51 Revision D and above

4-6.1. Reference Voltage Initial Condition

A) Connect a DMM to test point *VPROG* (TP1, or cathode side of CR16) on the A50 Mother PCB.

B) Adjust potentiometer R9 on the A51 Hipot Control PCB for a -0.15 VDC reading.

C) Disconnect the DMM.

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4-6.2. **Arc Sense**

A) Connect a DMM to the adjusting lead of R5 (TP2) on the A51 Hipot Control PCB.

B) Adjust R5 for a -0.8 VDC reading.

C) Disconnect the DMM.

4-6.3. **V-Set and I-Set Adjust**

A) Adjust V-SET and R-SET pots to middle position.

B) Put V-SET and R-SET switches in the "set" position.

C) Adjust V-SET pot to read 10V with the DMM at Pin 1 of the A51 edge card connector.

D) Adjust RV-1 on the A50 Mother PCB for full scale voltage meter reading.

E) Adjust R-SET pot to read 10V with the DMM at Pin A of the A51 PCB edge connector, or Pin 14 of U6 on the A51 PCB.

F) Adjust RI-1 on the A50 Mother PCB for full scale reading on the front panel resistance meter.

G) Disconnect the DMM.

4-6.4. **Switching Power Supply Oscillator Duty Cycle Adjustment**

A) Connect an oscilloscope between U4 Pin 3 (TP3) on the A50 Mother PCB and Ground.

B) Adjust the time base for viewing an approximate 38kHz wave train.

C) Push the *START* switch and adjust potentiometer R29 on the A50 Mother PCB for an approximate 10μS pulse with a period of 26 - 30μS.

D) RESET the instrument and disconnect the oscilloscope. Note that U4, Pin 3 is fully reset, i.e., at -15V.

4-7. **Final Voltage Meter Accuracy**

A) Turn the power on.

B) Set the voltage to 500 volts (via the rear panel V-SET dial). Remember to return the switch to the "run" position.

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C) Connect a HV connector cable with alligator-clip ends to the HV connector on the Rear Panel.

D) Connect a HV Probe to Pin 1 of the Rear Panel HV connector.

E) Push the START switch.

F) Adjust the pot R52 counterclockwise on the A50 Mother PCB so that the voltage indicated on the Front Panel Meter is the same as that indicated on the DMM. The reference is to Chassis Ground.

G) RESET the instrument.

H) Check the accuracy of the volt meter throughout the volt meter range.

4-8. **Calibration - Resistance Measurement and Failure Threshold**

A) Set the front panel RANGE SELECT switch to ×1.

CAUTION
Do not change the setting of the RANGE SELECT during a test cycle.

B) Put V-SET and R-SET switches in the "set" position.

C) Adjust R-SET potentiometer until the RESISTANCE meter is one division beyond 0Ω.

D) Adjust R-SET potentiometer until the VOLTAGE meter reads 500 VDC.

E) Remember to return the SET switches to the "run" position.

F) Short HV OUT, J1 pins 1 and 3 together.

G) Push the START switch.

H) Adjust A50 Mother PCB potentionmeter, R74, until the front panel RESISTANCE meter reads 0Ω. If R74 is adjusted past 0Ω the resistance failure threshold will trip. Back off R74 one turn and repeat steps F and G.

I) Push the RESET button.

J) Repeat steps A through G for RANGE SELECT positions ×10 and ×100. Do not adjust R74.

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K) Set the front panel RANGE SELECT switch to ×1.

L) Remove the short from the HV OUT, J1, and replace it wit. a 1MΩ 2W 1% load resistor.

M) Put R-SET switch in the "set" position.

N) Adjust the R-SET potentiometer until the RESISTANCE meter reads 3MΩ.

O) Return the SET switch to the "run" position.

P) Press the START button.

Q) When the SET resistance is reached, the test should end with a FAIL and audible alarm.

R) Press the RESET button.

S) Disconnect the test equipment.

4-9. **Fail Pots Calibration**

A) With the Load Resistor in place from the above step, an increase or decrease in the voltage will change the resistance reading, also.

B) Insure that, by adjusting the Resistance Trip Point pot c the Rear Panel (using R-SET), this trip point will set several different Resistance Trip Points accurately.

4-10. **HV ON Lamp**

A) Rotate the potentiometer R6 on the A51 Hipot Control PCB fully clockwise (CW).

B) Using the V-SET switch and potentiometer, set the *voltage* to 10 VDC and push the *START* button. (Remember to return the V-SET switch to the "run" position).

C) Slowly turn the R6 CCW until the HV ON lamp flashes.

D) *RESET* the M300RT.

4-11. **Test Time Calibration**

A) Place the *A/B* switch in the "A" position.

B) Press the *START* button and observe the Test Time.

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C) The "A" Test Time can be lengthened by rotating R66 on the A50 Mother PCB clockwise. It can be shortened turning CCW. Adjust R66 for desired Test Time.

NOTE: RISE TIME *is measured from the time that the voltage starts to rise, to the time the voltage reaches 95% of full voltage value, (500V).* TEST TIME *is measured from the time that the START button is pushed, to the time the voltage turns off. It includes* DELAY TIME, RAMP TIME, DWELL TIME, *and* RECOVERY. DWELL TIME *is measured from the time that the voltage reaches 95% of full voltage value, to the time the voltage turns off.*

D) Place the *A/B* switch in the "B" position.

E) Press the *START* button and observe the Test Time.

F) Test Time "B" can be lengthened by rotating R69 on the A50 Mother PCB clockwise. It can be shortened turning CCW. Adjust R69 for desired Test Time.

4-12. **Ramp Rate Calibration**

A) Place the *A/B* switch in the "A" position.

B) Press the *START* button and observe the Rise Time (Ramp Rate).

C) Rise Time "A" can be lengthened by turning R70 on the A50 Mother PCB CW, which, when fully CW, the rise time should take 100s, corresponding to 5 V/s. It can be shortened turning CCW, which, when fully CCW, the rise time should take 1s, corresponding to 500 V/s. Adjust R70 for desired Ramp Rate.

D) Place the *A/B* switch in the "B" position.

E) Press the *START* button and observe the Rise Time.

F) Rise Time can be lengthened by turning R71 on the A50 Mother PCB CW. It can be shortened turning CCW. Adjust R71 for desired Ramp Rate.

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4-13. List of Adjustment Potentiometers

R9 on the A51 PCB	Reference Voltage Initial Condition
R5 on the A51 PCB	Arc Sense
RV-1 on the A50 Mother	F.S. (Full Scale) Voltage (when V-SET on RP is 10V at A51 Edge-card connector Pin 1)
RI-1 on the A50 Mother	F.S. Resistance (when R-SET on RP is 10V at A51 Edge-card connector Pin A)
R29 on the A50 Mother	Oscillator Duty Cycle Adjustment
R52 on the A50 Mother	Voltage Meter Adjustment
R74 on the Mother	Resistance Meter Adjustment
R6 on the A51	High Voltage On Lamp
R66 on the A50 Mother	A Test Time
R69 on the A50 Mother	B Test Time
R70 on the A50 Mother	A Rise Time
R71 on the A50 Mother	B Rise Time

4-14. Trouble Shooting

Table 4-1 is a list of problems, probable causes, and remedies for fault location. It should assist the technician in isolating a fault location. This table does not tabulate all the possible symptoms; only those Customer Service has determined most likely to occur.

Table 4-1: Fault Location Chart

No AC power	Check fuse	Replace as needed
No READY indication	Check power supply Check/verify Driver	Replace defective component
FAIL indication	Verify trip setting Check control circuit	Calibrate V-SET, R-SET trip points
R-SET/V-SET lamp always on	Check mother board, U13	Replace defective component

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Section 5

OPTIONS

5-1. Remote Control; Options 01 and 19

The M300RT has remote control and data logging capability when one of the Remote Options is used. It would include another PCB, and the signals would come through a DB-25 connector on the rear panel.

Two versions of the Remote Option are available (see schematic 01306-02): either Option 01 Digital or Option 19 Analog and Digital. The A19 Remote Control/Low Current PCB is configured differently for the various combinations available.

The Remote Functions are categorized into two main types for purposes of this manual: Digital and Analog.

5-1.1. Digital Functions

These functions concern the status of the instrument and are available with Option 01. There are three inputs: *START*, *RESET*, and *SELECT A*. There are four outputs: *READY*, *TEST*, *PASS*, and *FAILURE*. These signals are TTL compatible and optically isolated.

START starts a test cycle during the low to high transition if a *READY* status already exists. The *START* input has to remain high for about 15ms minimum.

RESET resets all the operations of the M300RT when a high level is held.

READY puts out a low level when the instrument is initialized.

TEST is a low level output when a test is in progress.

PASS is a low level output when a test passes.

FAILURE is output at low level whenever there is an abortive condition during a test. Conditions that could cause this are *Overcurrent and/or insufficient resistance condition and / or breakdown failure*. When Option 05 Hands Off is used, a failure would be produced if the *START* input was released during a test. So if a remote option is used with the Hands Off Option, the *START* input must go to low a level and stay there during the test.

AC/DC should not be active on the M300RT Resistance Tester.

SELECT A, when held low, selects the A set of parameters, and when high, selects the B set of parameters to be set.

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REMOTE (or *REM* on older units) selects the remote analog programming capability when a high level input is held. This allows the High Voltage, Resistance Trip Point, Ramp Rate, and Test Time (Duration) to be programmed.

5-1.2. **Analog Functions**

These functions are for the programming of the main parameters of a test, and the data logging of the High Voltage and Resistance (current) as are on the M300RT front panel meters. These functions are available only with Option 19. The signals are analog, scaled to 10V maximum, and interface a remote controller to special circuitry in the M300RT. The digital *REMOTE* input has to be at a high level in order to activate that special circuitry.

EXT VREF is the input that selects——with any voltage from 0 to 10V——the *dwell time High Voltage* value at the end of the Ramp up. The F.S. (full scale) High Voltage value corresponds to 10V, and the relationship between *EXT VREF* and High Voltage is completely linear. This input should be held at 10V in the M300RT Resistance Tester to get the 500 VDC at the output for which the meters are calibrated.

EXT ITRIP chooses——with any voltage from 0 to 10V——the *Insufficient Resistance Trip Point* value. The F.S. resistance value corresponds to 10V, and the relationship between *EXT RTRIP* and the *Insufficient Resistance Trip Point* is explained on page 35, Table 5-2.

EXT VTEST is the input that selects——with any voltage from 0 to 10V——the *Test Time Duration*. A 10V input corresponds to about 1sec, and the relationship between *EXT VTEST* and *Test Time Duration* is inversely proportional. This means that as the *EXT VTEST* voltage decreases, the Test Time duration increases.

EXT VRISE is the input that chooses——with any voltage from 0 to 10V——the Ramp Rate. The F.S. High Voltage value per second corresponds to 10V, and the relationship between *EXT VRISE* and Ramp up Rate is completely linear.

OUTPUT RESISTANCE monitors the actual resistance output, where 10V represents the F.S. Resistance value. The relationship between the monitoring magnitude and the output resistance is described on page 35, Table 5-2.

OUTPUT VOLTAGE monitors the actual High Voltage output, where 10V represents the F.S. High Voltage value. The relationship between the monitoring and the actual value is completely linear with 10V corresponding to 500V.

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5-1.3. **Remote Theory**

The digital inputs on the A19 Remote Control PCB; *START*, *RESET*, *SELECT A*, *REMOTE*, and *AC/DC*, are connected to U7, the TTL buffer inverter 7416, which drives the optical isolators U4, U5, U6, U3, and U14 respectively to provide the proper signals to the M300RT. These inputs are high level active.

The digital outputs *READY*, *TEST*, *PASS*, and *FAILURE* on the A19 are provided by the outputs of the optical isolators U10, U11, and U9 respectively. These outputs are low level active.

The remote controller must provide an external 5V supply and the respective external ground return. The +5V supply would have to provide about 100mA. The fan out of the outputs is about 3 TTL gates.

The analog inputs, *EXT VREF*, *EXT RTRIP*, *EXT VTEST*, and *EXT VRISE* come in to a voltage follower, LM324, at either U1 or U2. The signals are then delivered to the standard circuitry which is activated by the *REMOTE* signal.

The LM324 U2 also provides buffering for the analog outputs *OUTPUT CURRENT* and *OUTPUT VOLTAGE*.

The input impedance for the input signals is 10kΩ, and the output impedance for the output signals is about 75Ω. The analog signals are not optically isolated, and a separate ground reference lead is provided which is ultimately tied to the chassis of the M300RT Resistance Tester. No external voltage supply has to be provided for the analog interface.

The DB-25 pin assignment needed for using the Remote Options is shown in Table 5-1, page 35.

5-1.4. **Resistance Tester Remote Programming**

When used Option 19 is used, the Resistance Trip Point can be set remotely using the analog input *EXT ITRIP* on pin 6 of the DB-25 connector. Also, analog monitoring of the actual resistance value is obtained through the *IOUT* output at pin 10 of the DB-25. These analog signals are scaled to make 10V correspond to 0Ω, and then 0V equal ∞Ω or open output. This correspondence is non-linear and is detailed on page 39 in Table 5-2 for a ×1 scale. For ×10, ×100 scales, the value would have to be multiplied by 10 or 100 respectively.

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Table 5-1:

DB25 Pin #	Signal Name	Analog / Digital
1	EXTGND (Digital Supply)	
2	ROUT	A
3	VOUT	A
4	GND (Analog Reference)	
5	EXTVREF	A
6	EXTRTRIP	A
7	EXT VTEST	A
8	EXT VRISE	A
9		
10		
11		
12		
13		
14		
15		
16	EXTGND (Digital Supply)	
17	REMOTE	D
18	RESET	D
19	START	D
20	EXT +5V (Digital Supply)	
21	READY	D
22	TEST	D
23	FAILURE	D
24		
25	SELECTA	D

Table 5-2:
Correspondence

Resistance (MegΩ)	Voltage (Volts)
0.000	10.000
0.010	9.903
0.025	9.761
0.050	9.533
0.075	9.315
0.100	9.107
0.150	9.718
0.200	8.361
0.250	8.031
0.300	7.727
0.350	7.445
0.400	7.183
0.450	6.939
0.500	6.711
0.600	6.296
0.700	5.930
0.800	5.604
0.900	5.313
1.000	5.050
1.250	4.493
1.500	4.048
1.750	3.682
2.000	3.377
2.500	2.898
3.000	2.537
3.500	2.257
4.000	2.032
5.000	1.694
7.500	1.197
10.000	0.926
20.000	0.485
30.000	0.329
40.000	0.249

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5-2. Option 05, Hands Off Operation

5-2.1. Option 05, Hands Off Operation Description

Option 05 Hands Off Operation is used to force the operator to maintain closure of two palm switches in order to start AND keep the test going. With both hands occupied, the operator cannot touch the DUT (Device Under Test) during a test, hence, their HANDS are OFF the DUT.

The **Rod-L** M300RT Resistance Tester uses two five-pin DIN connectors on the rear panel to connect to the palm switches whenever Option 05 is installed. It also means, though, that **even if you wan't to use the regular START button, you must hold the button down for the duration of the test.** Otherwise, the M300RT will fail.

This option must be installed at the factory because it uses a special rear panel.

5-2.2. Option 05, Hands Off Operation Theory

The Hands Off signal is from U15 pin 9, a CMOS NAND gate, on the A51 Hipot Control PCB.

5-3. Option 06, Rear Panel Lockout Cover

Option 06 is a lexan cover for the rear panel controls. It is installed by removing the top cover to add the standoff hardware to the rear panel.

5-4. Option 07, Extra HV receptacle on Rear Panel

This option provides the rear panel with another 4-pin High Voltage receptacle. It is usually only needed for extra Start and Reset signals, wherein the pinout is sometimes changed and called Option 14. It is installed at the factory.

5-5. Option 10, Audible Test Tone

When Option 10 Audible Test Tone is installed in a M300RT, there will be a beeping sound whenever a test is in progress. This feature is produced by a small PCB attached to the inside of the unit near the alarm. The board is called the A27 Audible Test Tone PCB. It must be installed at the factory.

5-6. Option 14, Special Pin Assignment - Rear Output Connector/Mate

This option incorporates special wiring to assign HV output to pin #1 and HV Return to pin #2 of Rear Panel HV Output Connector and add Start and Reset. (The M300RT is normally wired with HV Return on pin 3.) It must be installed at the factory.

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5-7. Option 15, Rack Mounting

To rack mount the instrument, use Option 15 A. The procedu for installing the Rack Mounting Kit 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

5-8. Option 24B, Blank Front Panel Start Switch

This option provides a blank panel in place of the start switch.

5-9. Option 25 Two-Voltage Switch (250V/500V standard)

Normally, the M300RT tests at 500V. This option allows the choice of testing at either 500V or 250V. A switch and associated wiring is installed at the factory. Other voltages can be arranged for.

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Section 6

BILLS OF MATERIALS, SCHEMATICS, DIAGRAMS

Following are M300RT Bills Of Materials for help in identifying typical **Rod-L** part numbers.

00750-01 for M300RT 40
01170-06 Ship Kit 42
01163-01 ButtonUp Kit 41
01160-01 Assy Bottom Cover 43
00619-01 Foot
01161-01 Assy Top Cover
00455-01 Handle 44
00886-01 Tested M300RT 45
00383-01 PCB A50 Mother 50
00381-06 PCB A51 Control Logic DC,RT 52
00415-04 HV Module DC,RT 53
00397-02 PCB A52 HV Relay DC,RT 54
00452-11 Assy Relay Tested
00394-02 PCB A53 Voltage Doubler DC,RT 55
00885-01 Untested Unit RT 46
00852-01 Front Panel M300RT 47
00699-01 Harness Front Panel DC,RT 59
00454-02 PCB A60 Res.s, Switch 56
00977-02 Start Switch 57
00853-01 Rear Panel M300RT 48
00389-04 Heatsink/Driver DC,RT 58
00856-01 Harness Rear Panel DC,RT 60
00247-02 PCB A 7AV LineSel Swtch 62
00854-01 Chassis M300RT 49
00855-01 Harness Chassis DC,RT 61

00801-03 Option 01B DC, RT 63
00819-01 Option 19A DC, RT 64
01010-03 Cable & Conctrs DB25S-26p (remote) 72
01170-13 Ship Kit Option 01 65
01170-14 Ship Kit Option 19 66
01174-18 PCB A19 Op01 P/S RevB (stuffd Midl,uppr R) 67
01174-10 PCB A19 Op19 P/S RevB (stufd Midl,uprR,Lsid) 68
01174-19 PCB A19 Pass Signal Only 69
00387-02 PCB A54 Op19 Rem Cntrl 70
01014-01 PCB A55 Op01 Rem Cntrl 71
00805-02 Option 05 DC 73
01170-16 Ship Kit DC Option 05 74
00849-07 Assy Cable Opt05 DC 5' shld 75
00806-05 Option 06D RT 76
00807-01 Option 07 xtra HV con 77
00810-02 Option 10 Aud Tst Ton AC, DC 78
00432-02 PCB A27 Opt10 Audible Test Tone 79
00814-01 Option 14 Spcl Pin Assignment 80
00815-01 Option 15 5" 81
00824-03 Option 24B blank Start 82
00825-01 Option 25 2V sw RT 83
00750-02 for M300RT-MP21 84
00751-01 for M300RT-LOR 85

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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 7"H units M150AC	1.0	ButtonUp
01170-12	Assy Kit Ship M150AC Box w/ Accessories	1.0	Shipping

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Rod-L Electronics, Inc. -- Bill Of Materials
01163-01 Assy Kit Covers @ ButtonUp 5"H units <ND>

Rod-L P/N	Description	qty	Reference
01160-01	Assy Plate Cover Bottom w/ Feet & Stand Instru <ND	1.0	Bottom Cover
01161-01	Assy Plate Cover Top w/ Foam Instrument <ND>	1.0	Top Cover
00455-01	Assy Handle Instrument	2.0	Handle
00339-06	Asmy Plate Cover SideRear Fab vinylBlk2.5x4.5 M100	2.0	SideRear Covers
00338-06	Asmy Plate Cover SideFrnt Fab vnyl black2x4.5 M100	2.0	SideFront Covers
00340-06	Asmy Plate Retainr Handl Fab vinyl Blk 4.5x5 M100	2.0	Handle Covers
50301-01	Asm Kit Con-Cover Cutout DB25 black plastic	1.0	Remote Cover
00858-01	Plate Decor Side Strip .833x4.5" alum no glue ALL	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
50573-01	Nut Push-On U-shape Clip # 6 black Tinnerman	4.0	HW Top & Bottom Cover
50544-01	Nut Kep 4-40 x .250 (1/4) O.D.	2.0	HW Remote Cover
50530-02	Screw PanSem Phl 4-40 x .250	2.0	HW Remote Cover
50532-02	Screw PanSem Phl 8-32 x .250	4.0	HW Handle Covers
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	

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Rod-L Electronics, Inc. -- Bill Of Materials
01170-06 Assy Kit Ship M300RT Box w/ Accessories

Rod-L P/N	Description	qty	Reference
50667-14	Box Shipping 13"x 18"x 21"Letrd M100sA,G,D,R,I,J	1.0	Box
50663-11	Foam Shipping EndCap M100 5.5"	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
50305-01	Cover Hole Plug .5" dia blk plastic HH Smith 3092	1.0	Chassis Grnd cover
50298-01	Cover Hole Plug 1" Hole metal 12 prong HH S 612	1.0	HV con cover
00909-01	Label 'Alert I!' instruction in manual (for UL)	1.0	Label
01347-01	Label 'Stop! Use correct voltage/fuse' blk on yelo	1.0	Label
50683-01	Label 'Calibration' green & white	1.0	Certification label
01372-01	Label 'This product is U.L....' 2x5.5 box outside	1.0	Box label
60005-04	Manual M300RT Resistance Tester 2 Jy 96	1.0	Manual
90074-01	NIN Form Certificate Technical	1.0	Certification
ONE-EACH	NIN Of the Following Parts, Only what is Ordered:	0.0	SEE BELOW!!!
50063-04	Fuse slo blo 1.50A 250V 3AG .25x1.25"	2.0	For 230V Op
50063-08	Fuse slo blo 3.00A 250V 3AG .25x1.25"	0.0	Should be for 115V Op

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Rod-L Electronics, Inc. -- Bill Of Materials
01160-01 Assy Plate Cover Bottom w/ Feet & Stand Instru <ND

Rod-L P/N	Description	qty	Reference
00342-06	Asmy Plate Cover Bot Fab'd 11x16 vinyl black M100	1.0	Cover
00619-01	Assy Foot Instrument w/Rivit, Spring, & Washer	5.0	Foot
00444-09	Stand Tilt Wire Form Instrument	1.0	Stand
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00455-01 Assy Handle Instrument

Rod-L P/N	Description	qty	Reference
00669-02	Asmy Handle Instrumnt Finsh (Buffed w/LaborOutside	1.0	Buffed Handle
00668-01	Spring Wire Torsion 3.2" Crooked Ends Handle	1.0	Spring
00857-01	Grip Handle 4.4" L plastic Instrument	1.0	Grip
		1.0	Add Label 00667-01
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00886-01 Assy Unit M300RT Tested Resistance Tester

Rod-L P/N	Description	qty	Reference
00547-08	NIN Diag Wire Unit M300RT Resistance Tester	0.0	Reference
00885-01	Assy Unit M300RT Untested Resistance Tester	1.0	Untested Unit
00415-04	Assy HV Module Box DC	1.0	HV Module Assy
00383-01	Assy PCB A50 Mother M300RT	1.0	A50 PCB Assy
00381-06	Assy PCB A51 Control Logic (RevF) M100DC	1.0	A51 PCB Assy
50531-03	Screw PanSem Phl 6-32 x .375	10.0	HW A50
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00885-01 Assy Unit M300RT Untested Resistance Tester

Rod-L P/N	Description	qty	Reference
00547-08	NIN Diag Wire Unit M300RT Resistance Tester	0.0	Reference
00852-01	Assy Plate Front M300RT	1.0	Front Panel Assy
00853-01	Assy Plate Rear M300RT	1.0	Rear Panel Assy
00854-01	Assy Plate Chassis M300RT	1.0	Chassis Assy
00343-05	Asmy Plate Frame Side 5x13 fin & polshd M100s	2.0	Frames
00647-01	Label Model No., Logo, U.L. Logo: 1x3 on Pin Feed	2.0	S/N
50217-01	Cap 31000 uF 50V elect thread lug	1.0	C1
50006-01	Cap-Bracket 2.5"dia Sprague 34775-2.5	1.0	C1
50531-07	Screw PanSem Phl 6-32 x .875	2.0	C1
50532-02	Screw PanSem Phl 8-32 x .250	4.0	HW Frames
50779-04	Screw Fl Hd 100d Phl 6-32 x .500	3.0	C1 mounting
50778-03	Screw Fl Hd 100d Phl 8-32 x .375	18.0	HW Frames
90072-03	NIN Form Traveler Mfg Ordr,Prod Tst,QC Data DC	1.0	Traveller
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00852-01 Assy Plate Front M300RT

Rod-L P/N	Description	qty	Reference
00547-08	NIN Diag Wire Unit M300RT Resistance Tester	0.0	Reference
00699-01	Assy Harness Plate Front M100DC	1.0	Wiring
00522-07	Plate Front M300RT MintGrey screened	1.0	Front Panel
00454-02	Assy PCB A60 Resistance Sensing M300RT	1.0	A60
00977-02	Assy Switch START Rev B ALL Instruments	1.0	S4 (Start)
01139-01	Bracket L-Shape 1hole ea side .5Wx.5x.35 mtg ALL	4.0	Meters
00643-02	Label Desc and Test Status M300RT	1.0	FP Label
50449-05	Con Terminal Strip 5lug, 1gnd mtg, solder type	3.0	FP TS1-3
50460-08	Con Mascon HousingRecp 1ro F .100"22gauge 8p Pand	1.0	Range Sel
50461-08	Con Cover End .100" Mascon Housing 8p P Panduit	1.0	Range Sel
50565-02	Switch Toggle DPDT 125VDC O-N-O Alco MTA 206A	1.0	S7 (A/B)
50710-01	Switch Rocker SPDT w/ Lamp 125VAC sqPnlMnt WireLug	1.0	S1 (AC ON)
50555-01	Switch PushButton Momntry SPDT wiringLug C&K 8121Z	1.0	S5 (Reset)
50007-01	Button Red .375 dia x.25 Tall C&K 7527-RED	1.0	S5 (Reset)
50727-01	Knob 2.125 OD x 1.25 hi shaft Pointer blk/insert	1.0	Range Sel
50193-01	Lamp Incand Amber flat cylind lens pnl mnt 6"Leads	3.0	I4,5,6 (Test,R,V Set)
50193-02	Lamp Incand Green flat cylind lens pnl mnt 6"Leads	1.0	I3 (Ready)
50193-03	Lamp Incand Red flat cylind lens pnl mnt 6" Leads	2.0	I2,7 (F,HV)
50520-01	Alarm 3-30VDC Sonalert AI 380	1.0	AL1
50204-31	Meter Analog w/scale 0-500 V DC	1.0	M1 (V)
50204-04	Meter Analog w/scale 0-Inf Megohm	1.0	M2 (R)
50204-00	Meter Analog 0-1mA misc scale KYCO 7521	0.0	M1,2
50202-03	Lug Solder # 6 1 solder hole, 1 internal lock	6.0	AL1,M1,2
50173-05	Washer Shoulder # 6 .375 x.031 x.093 nylon	4.0	M1,2
50827-01	Nut Push-On Flat 3/16" Clip	6.0	I2-7
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	Sq Sw, Brackets

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Rod-L Electronics, Inc. -- Bill Of Materials
00853-01 Assy Plate Rear M300RT

Rod-L P/N	Description	qty	Reference
00856-01	Assy Harness Plate Rear M100DC	1.0	Wiring
00524-06	Plate Rear M300RT screened	1.0	Rear Panel
00389-04	Assy Heatsink Driver M100DC	1.0	HS Driver
50706-02	Pot K 5 10 turns pnl mnt 3 lug 2W .875 x.75	2.0	R10,11
50227-01	Knob Dual Counting Dial w/ Brake 020H 1413-66123	2.0	R10,11
50449-05	Con Terminal Strip 5lug, 1gnd mtg, solder type	1.0	RP TS
50509-01	Con Recp 4p Cylind HV Housing PnlMtg blk plst Amp	1.0	J1
50451-01	Con Nut 1" for HV Con blk plastic	1.0	J1
50049-01	Con PowerEntryInt'l Filter IEC320 250vac60hz8200pF	1.0	AC IN
50075-01	Fuse-Holder Littlefuse 342014	2.0	F1,2
50063-08	Fuse slo blo 3.00A 250V 3AG .25x1.25"	2.0	F1,2 (for 115V)
50063-04	Fuse slo blo 1.50A 250V 3AG .25x1.25"	0.0	F1,2 (for 230V)
50560-01	Switch Slide 4PDT 115/230VAC Sel Sw.Crft47227LFE	1.0	A7AV
50565-02	Switch Toggle DPDT 125VDC O-N-O Alco MTA 206A	2.0	S5,6 (V,R set)
50670-06	Con Terminal Ring 10-12AWG(yl) #10 lug orStud thin	2.0	BP2,3
50258-07	Rivet .250" L .120" dia stem A7 Switch	2.0	A7AV
50585-05	Washer Star # 6	1.0	TS1
50587-20	Washer Internal Lock .875 OD x.53125 ID	2.0	F1,2
50544-01	Nut Kep 4-40 x .250 (1/4) O.D.	2.0	Filter
50544-05	Nut Kep 6-32 x .250 (1/4) O.D.	1.0	TS1
50530-04	Screw PanSem Phl 4-40 x .500	2.0	Filter
50531-03	Screw PanSem Phl 6-32 x .375	1.0	TS1
50532-03	Screw PanSem Phl 8-32 x .375	3.0	HS Driver
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00854-01 Assy Plate Chassis M300RT

Rod-L P/N	Description	qty	Reference
00855-01	Assy Harness Plate Chassis M100DC	1.0	Wiring
00414-05	Plate Chassis M100DC	1.0	Chassis Plate
00390-07	Trnsfrmr 96W 24V 4A Power Supply DC Quality4516	1.0	PS XF
50449-07	Con Terminal Strip 7lug, 2gnd mtg, solder type	2.0	TS1,2
50669-02	Standoff 6-32 x .5 x.25 OD FF rnd alum	5.0	HW A50
50611-02	Standoff 6-32 x .5 x.25 OD FF rnd nylon	1.0	HW A50
50585-05	Washer Star # 6	4.0	TS1,2
50074-10	Washer Flat #10 3/8 OD steel zinc pltg	4.0	TS1,2
50544-05	Nut Kep 6-32 x .250 (1/4) O.D.	4.0	TS1,2
50544-03	Nut Kep 8-32 x .344 (11/32) O.D.	8.0	HW PS XF
50531-03	Screw PanSem Phl 6-32 x .375	10.0	HW TS1,2, A50
50532-04	Screw PanSem Phl 8-32 x .500	4.0	HW PS XF
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00383-01 Assy PCB A50 Mother M300RT

Rod-L P/N	Description	qty	Reference
00382-01	NIN Schem PCB A50 Mother M100DC	0.0	Reference
00384-03	PCB Fab A50 Mother M100DC,M300RT (RevG)	1.0	A50 PCB Fab
00421-06	Heatsink L-Shape 3holes 1.7x1.8 blk anodized A50	1.0	HS1
50264-08	IC-Socket 8p Lo Profile .3 DIP	3.0	X1,2,4
50264-16	IC-Socket 16p Lo Profile .3 DIP	5.0	X3,6,7,12,13
50264-14	IC-Socket 14p Lo Profile .3 DIP	5.0	X5,8-11
50264-06	IC-Socket 6p Lo Profile .3 DIP	4.0	X14-17
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
50167-01	IC Driver Peripheral dual 75452	2.0	U1,2
50117-01	IC Buffer CMOS hex CD4050	2.0	U3,7
50091-01	IC Timer NE555 or MOTOROLA MC1455P	1.0	U4
50128-01	IC Op Amp Lo Power quad LM324	1.0	U5
50121-01	IC Driver LED 6-Segment DM75494	1.0	U6
50141-01	IC Buffer/Driver hex 7417	2.0	U8,11
50114-01	IC NAND 3-In CMOS triple CD4023	1.0	U9
50108-01	IC AND 2-In CMOS quad CD4081	1.0	U10
50116-01	IC Inverter CMOS hex CD4049	2.0	U12,13
50080-01	IC Optical Coupler H11B3	2.0	U14,15
50098-01	IC Optical Coupler TIL117	2.0	U16,17
50032-01	Diode 1N4002 Rec 100V 1A	1.0	CR1
50020-01	Diode MR811 Fast Recov 100V 1amp	2.0	CR2,3
50036-01	Diode 1N914B Signal 100V	13.0	CR4-16
50040-01	Diode 1N4742 Zen 12V 1A	1.0	CR17
50030-01	Diode-Bridge CSB05 70V 1A	2.0	BR1,2
50267-01	Trnstor 2N2222 NPN SS Gen Purp Amp 30VbrCEO TO-18	1.0	Q1
50274-01	Trnstor 2N4314 PNP Power TO-39	1.0	Q2
50283-01	Trnstor LH0070 PNP BCD V Ref TO-38	1.0	Q3
50659-01	Trnstor-Insulator Thermal for TO-220	3.0	VR1-3
50336-01	ResPak SIP K 100 8p 4r 1%	3.0	RP1,2,5
50338-01	ResPak SIP K 22 8p 4r 1%	1.0	RP4
50701-01	Pot K 1 10 turns inline pins vert square	3.0	R29,RV1,RI1
50701-03	Pot K 10 10 turns inline pins vert square	1.0	R48
50701-04	Pot K 50 10 turns inline pins vert square	1.0	R74
50701-06	Pot Meg 1 10 turns inline pins vert square	1.0	R52
50702-11	Pot K 100 20 turns offset pins rectangle	4.0	R66,69-71
50817-04	Jumper Wire #22 AWG .4" long	1.0	R27
50316-01	Res Ohm 1 3W 1% WW	1.0	R1
50125-40	Res K 4.7 1/4W 5% CC	6.0	R2,3,8,30,31,35
50125-59	Res K 100 1/4W 5% CC	4.0	R4,9,10,59
50125-11	Res Ohm 180 1/4W 5% CC	5.0	R12,13,19,67,68
50125-31	Res K 1 1/4W 5% CC	6.0	R18,22,54,55,72,73
50125-12	Res Ohm 200 1/4W 5% CC	1.0	R20
50125-36	Res K 2.2 1/4W 5% CC	1.0	R21
50125-21	Res Ohm 330 1/4W 5% CC	3.0	R23,75,76
50125-08	Res Ohm 100 1/4W 5% CC	5.0	R24,34,37,38,58
50125-34	Res K 1.6 1/4W 5% CC	1.0	R25
50125-89	Res K 1.8 1/4W 5% CC	1.0	R26
50125-15	Res Ohm 470 1/4W 5% CC	2.0	R32,57
50125-04	Res Ohm 47 1/4W 5% CC	1.0	R33
50125-44	Res K 10 1/4W 5% CC	5.0	R36,39,49,60,60A
50125-61	Res K 150 1/4W 5% CC	1.0	R50
50126-02	Res Meg 1.2 1/4W 5% CC	1.0	R51
50125-21	Res Ohm 330 1/4W 5% CC	1.0	R53
50125-39	Res K 3.3 1/4W 5% CC	1.0	R56

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Rod-L Electronics, Inc. -- Bill Of Materials
00383-01 Assy PCB A50 Mother M300RT

Rod-L P/N	Description	qty	Reference
50125-86	Res K 22 1/4W 5% CC	1.0	R62
50350-16	Res K 9.09 1/4W 1% MF	2.0	RI,V
50324-08	Cap 500 uF 50VDC 10% elect axial	2.0	C1,2
50324-04	Cap 3000 uF 16VDC 10% elect axial	1.0	C3
50209-14	Cap .01 uF 100V 20% cerm disc lo V	24.0	C4,5,7,8,11,12,14,15,
50209-14	Cap .01 uF 100V 20% cerm disc lo V	0.0	18-24,28,31,34,37-42
50066-07	Cap .47 uF 50V 20% mono dip .25 leads	6.0	C6,13,25,33,35,36
50060-01	Cap 1 uF 35V 10% tant axial	2.0	C9,10
50209-15	Cap .001 uF 100V 20% cerm disc lo V	1.0	C16
50324-05	Cap 10 uF 25VDC 10% elect axial	1.0	C17
50064-12	Cap 4.7 uF 35VDC 10% tant resin dip	1.0	C26
50066-10	Cap .033 uF 50V 20% mono dip .25 leads	1.0	C30
50066-02	Cap .047 uF 50V 20% mono dip .20 leads	1.0	C32
50571-01	Relay 5VDC DPDT 1a 8pin 1495SDC	1.0	K1
50420-01	Con Cardedge 44p 22pos PCB mtg pins no Ears	2.0	Control, Remote
50071-01	Con Guide PCB 3" L 4-40 mtg SAE 1250V	1.0	Control PCB
50222-03	Con Header w/FricLock 1ro .100"C/C .025"sq 3p M	1.0	HV
50222-07	Con Header w/FricLock 1ro .100"C/C .025"sq 7p M	1.0	HV
50222-08	Con Header w/FricLock 1ro .100"C/C .025"sq 8p M	2.0	RP
50222-10	Con Header w/FricLock 1ro .100"C/C .025"sq 10p M	3.0	FP, PS (2)
50611-02	Standoff 6-32 x .5 x.25 OD FF rnd nylon	1.0	Standoff
50669-02	Standoff 6-32 x .5 x.25 OD FF rnd alum	5.0	Standoff
50584-01	Washer Fiber # 6 black HH Smith 2162	1.0	Standoff
50173-04	Washer Shoulder # 4 .235 x.125 x.047 nylon	3.0	VR1-3
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	1.0	Card Guide
50530-03	Screw PanSem Phl 4-40 x .375	3.0	VR1-3
50531-03	Screw PanSem Phl 6-32 x .375	6.0	Standoff
77710-01	NIN Dwg Loc not used See Ref	0.0	R5-7,11,14-17,40-47
77710-01	NIN Dwg Loc not used See Ref	0.0	61-65
REV-F	NIN Rev-F This Assy is at Rev-F	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00381-06 Assy PCB A51 Control Logic (RevF) M100DC

Rod-L P/N	Description	qty	Reference
00379-01	NIN Schem PCB A51 Control Logic M100DC	0.0	Reference
00380-06	PCB Fab A51 Control Logic (Rev F) DC	1.0	A51 PCB Fab
50264-14	IC-Socket 14p Lo Profile .3 DIP	13.0	X1-4,6-10,12-15
50264-08	IC-Socket 8p Lo Profile .3 DIP	1.0	X5
50264-16	IC-Socket 16p Lo Profile .3 DIP	1.0	X11
50084-01	IC Comparator LoPwr LoOfstV quad LM139(SK3569/834)	1.0	U1
50078-01	IC Inverter CMOS hex CD4069UB	1.0	U2
50077-01	IC Switch Bilateral CMOS quad CD4066B	5.0	U3,7-10
50110-01	IC NAND 2-In CMOS quad CD4011	2.0	U4,12
50091-01	IC Timer NE555 or MOTOROLA MC1455P	1.0	U5
50128-01	IC Op Amp Lo Power quad LM324	3.0	U6,13,14
50115-01	IC Latch R/S 3state CMOS quad CD4044	1.0	U11
50111-01	IC NAND 4-In CMOS dual CD4012	1.0	U15
50702-11	Pot K 100 20 turns offset pins rectangle	3.0	R4,5,9
50702-04	Pot K 1 20 turns offset pins rectangle	1.0	R6
50036-01	Diode 1N914B Signal 100V	8.0	CR1-3,5,8-11
50040-01	Diode 1N4742 Zen 12V 1A	3.0	CR4,6,7
50269-01	Trnstor 2N2907 PNP SS Gen Purp Amp 40VbrCEO TO-18	1.0	Q1
50267-01	Trnstor 2N2222 NPN SS Gen Purp Amp 30VbrCEO TO-18	1.0	Q2
50125-56	Res K 68 1/4W 5% CC	1.0	R0
50125-48	Res K 24 1/4W 5% CC	1.0	R1
50125-44	Res K 10 1/4W 5% CC	22.0	R2,3,11,13-16,22,23,
50125-44	Res K 10 1/4W 5% CC	0.0	29,32-35,37,38,41,
50125-44	Res K 10 1/4W 5% CC	0.0	46-48,51,53
50125-51	Res K 33 1/4W 5% CC	1.0	R7
50125-59	Res K 100 1/4W 5% CC	8.0	R8,21,24,25,40,42,43,
50125-59	Res K 100 1/4W 5% CC	0.0	49
50125-39	Res K 3.3 1/4W 5% CC	1.0	R10
50125-53	Res K 47 1/4W 5% CC	2.0	R12,45
50125-86	Res K 22 1/4W 5% CC	10.0	R17,18,20,26,27,30,
50125-86	Res K 22 1/4W 5% CC	0.0	31,39,44,50
50125-31	Res K 1 1/4W 5% CC	1.0	R19
50125-60	Res K 120 1/4W 5% CC	1.0	R28
50125-69	Res K 330 1/4W 5% CC	1.0	R36
50125-08	Res Ohm 100 1/4W 5% CC	2.0	R53,54
50066-07	Cap .47 uF 50V 20% mono dip .25 leads	12.0	C1,4,7-9,12-14,17,18,
50066-07	Cap .47 uF 50V 20% mono dip .25 leads	0.0	24,25
50324-05	Cap 10 uF 25VDC 10% elect axial	5.0	C2,3,6,10,11
50209-14	Cap .01 uF 100V 20% cerm disc lo V	7.0	C5,15,16,20,22,23,26
50060-01	Cap 1 uF 35V 10% tant axial	1.0	C19
50060-10	Cap 4.7 uF 35V 10% tant axial	1.0	C21
77710-01	NIN Dwg Loc not used See Ref	0.0	C27, CR12
REV-E	NIN Rev-E This Assy is at Rev-E	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00415-04 Assy HV Module Box DC

Rod-L P/N	Description	qty	Reference
00397-02	Assy PCB A52 HV Relay M100DC	1.0	A52 PCB Assy
00394-02	Assy PCB A53 Voltage Doubler / Rectifier M100DC	1.0	A53 PCB Assy
00404-01	Plate Sides & Top HV Module alum fab M100DC	1.0	Cover
00404-02	Plate Sides & Base HV Module alum fab M100DC	1.0	Base
00655-01	Trnsfrmr 50W 50: 3750VAC 20mA DC HV Q 4305	1.0	XF
00109-52	Label 'Danger High Voltage' 2x3 in Wht w/Red & Blk	1.0	Danger Label
50460-07	Con Mascon HousingRecp 1ro F .100"22gauge 7p Pand	1.0	Con
50461-07	Con Cover End .100" Mascon Housing 7p P Panduit	1.0	Con
50452-01	Con Pin Contact HV F 16-18AWG Blue Stripe Amp	2.0	HV Con
50069-01	Grommet rubber for1/2" hole 3/8"x 5/8"x 1/16"	3.0	In Cover
50399-01	TieWrap CableBundle dia .75 SST1M-M	7.0	Tie Wraps
50581-01	Tie-Mount Cable Tie .75x.75 w/ Adhesive	4.0	Mounts
50584-01	Washer Fiber # 6 black HH Smith 2162	8.0	HW
50669-02	Standoff 6-32 x .5 x.25 OD FF rnd alum	8.0	HW Base
50677-03	Spacer # 6 x 1 x.25 OD FF round nylon	4.0	PCBs
50670-05	Con Terminal Ring 18-22AWG(red) # 6 lug or stud	1.0	HW Wiring
50543-06	Nut Hex 6-32 x .312 (5/16) O.D.	6.0	HW
50544-02	Nut Kep 6-32 x .312 (5/16) O.D.	4.0	HW
50531-03	Screw PanSem Phl 6-32 x .375	6.0	HW
50589-11	Screw Rnd Hd Slt 6-32 x 1.5	4.0	HW
50715-02	Tube Sleeving .375(3/8)ID clear	2.0	Tubing
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00397-02 Assy PCB A52 HV Relay M100DC

Rod-L P/N	Description	qty	Reference
00395-01	NIN Schem PCB A52 HV Relay M100DC	0.0	Reference
00396-02	PCB Fab A52 HV Relay M100DC	1.0	A52 PCB Fab
50300-31	Res K 1 3W 5% Metal Ox F	3.0	R1-3
50032-01	Diode 1N4002 Rec 100V 1A	3.0	CR1-3
50222-12	Con Header w/FricLock 1ro .100"C/C .025"sq 12p M	0.5	Header
50460-07	Con Mascon HousingRecp 1ro F .100"22gauge 7p Pand	1.0	Header
50461-07	Con Cover End .100" Mascon Housing 7p P Panduit	1.0	Header
00452-11	Assy Relay 50VA Reed Offset Pin Tested (378992)	3.0	K1-3
50709-00	Wire 22AWG insul STC UL1061 PVC color undesignate	6.0	A52
50773-02	Wire 22AWG 20kV insul STC UL3239 red	3.0	A52
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00394-02 Assy PCB A53 Voltage Doubler / Rectifier M100DC

Rod-L P/N	Description	qty	Reference
00392-01	NIN Schem PCB A53 Voltage Doubler/Rectifier M100DC	0.0	Reference
00393-03	PCB Fab A53 Voltage Doubler / Rectifier M100DC	1.0	A53 PCB Fab
50300-10	Res Ohm 10 2W 5% CC	3.0	R9-11
50150-07	Res Ohm 100 1/2W 5% CC	1.0	R12
50300-11	Res Ohm 100 2W 5% CC	9.0	R1-8,16
50150-30	Res K 1 1/2W 5% CC	1.0	R17
50200-47	Res K 1 1W 5% CC	1.0	R15
50201-02	Res Meg 100 3W 1% HV OX	1.0	R13
50032-01	Diode 1N4002 Rec 100V 1A	2.0	CR3,4
50021-01	Diode P6KE30C Transient Suppresor	2.0	TZ1,2
50017-01	Diode 20kV 25mA HVCA 100G15F, or LRX15F, JKV-15F	2.0	CR1,2
50209-12	Cap .0022uF 7500V 20% cerm disc	2.0	C7,8
50233-01	Cap .015 uF 8000VDC film axial	2.0	C1,2
50061-05	Cap .033 uF 80V 10% Pacer Film poly axial	1.0	C6
50061-03	Cap .1 uF 80V 10% Pacer Film poly axial	2.0	C3,5
50324-07	Cap 50 uF 50VDC 10% elect axial	1.0	C4
50709-00	Wire 22AWG insul STC UL1061 PVC color undesignate	6.0	A53
50773-02	Wire 22AWG 20kV insul STC UL3239 red	3.0	A53
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00454-02 Assy PCB A60 Resistance Sensing M300RT

Rod-L P/N	Description	qty	Reference
00454-01	NIN Schem PCB A60 Resistance Sensing Circuit M300	0.0	Reference
00454-03	PCB Fab A60 Resistance Sensing Circuit M300RT	1.0	A60 PCB Fab
50264-08	IC-Socket 8p Lo Profile .3 DIP	1.0	X1
50083-01	IC Op Amp LF355	1.0	U1
50702-09	Pot K 25 20 turns offset pins rectangle	1.0	R11
50040-01	Diode 1N4742 Zen 12V 1A	2.0	CR2,3
50021-01	Diode P6KE30C Transient Suppresor	1.0	CR1
50314-01	Res Meg 1 2W 1% 10kV film	1.0	R1
50314-03	Res Meg 9 2W 1% 10kV film	1.0	R2
50314-05	Res Meg 90 2W 1% 10kV film	1.0	R3
50314-02	Res Meg 2 2W 1% 10kV film	1.0	R4
50314-11	Res K 200 2W 1% 10kV film	1.0	R5
50314-10	Res K 20 2W 1% 10kV film	1.0	R6
50126-01	Res Meg 1 1/4W 5% CC	2.0	R7,9
50125-36	Res K 2.2 1/4W 5% CC	1.0	R8
50125-65	Res K 220 1/4W 5% CC	1.0	R10
50125-33	Res K 1.5 1/4W 5% CC	1.0	R12
50209-14	Cap .01 uF 100V 20% cerm disc lo V	1.0	C1
50222-07	Con Header w/FricLock 1ro .100"C/C .025"sq 7p M	1.0	PS
50551-01	Switch Rotary 2pole 3pos 2.5" sq mtg bd .25 shaft	1.0	SW1
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00977-02 Assy Switch START Rev B ALL Instruments

Rod-L P/N	Description	qty	Reference
00232-01	Bezel Round alum .990dia (Start Switch)	1.0	
00232-02	Button White Plastic .74dia x.6tall (Start Switch)	1.0	
50555-01	Switch PushButton Momntry SPDT wiringLug C&K 8121Z	1.0	
00232-03	Bezel-Nut Knurled alum 1 15/16 I.D. (Start Switch	1.0	
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00389-04 Assy Heatsink Driver M100DC

Rod-L P/N	Description	qty	Reference
00389-01	NIN Diag Wire Heatsink Driver M100DC	0.0	Reference
00388-04	Heatsink L-Shape 4 TO-3 1x2.3x6 blk anadz DC	1.0	Heatsink
50316-17	Res Ohm .33 3W 1% WW	3.0	R1-3
50029-01	Diode-Bridge CSB 251	1.0	CR1
50282-03	Trnstor 2N6678 NPN Power TO-3 RCA only !	4.0	Q1-4
50398-01	Trnstor-Socket TO-3 TO-340-G	4.0	Q1-4
50176-01	Trnstor-Insulator Thermal TO-3 Silicon Rubber	4.0	Q1-4
50460-03	Con Mascon HousingRecp 1ro F .100"22gauge 3p Pand	1.0	Conn
50461-03	Con Cover End .100" Mascon Housing 3p P Panduit	1.0	Conn
50449-07	Con Terminal Strip 7lug, 2gnd mtg, solder type	1.0	TS1
50669-02	Standoff 6-32 x .5 x.25 OD FF rnd alum	1.0	HW
50531-03	Screw PanSem Phl 6-32 x .375	2.0	HW
50531-04	Screw PanSem Phl 6-32 x .500	8.0	HW Q1-4
50531-05	Screw PanSem Phl 6-32 x .625	1.0	HW CR1
50532-06	Screw PanSem Phl 8-32 x .750	1.0	HW CR1
50399-01	TieWrap CableBundle dia .75 SST1M-M	7.0	Wiring
50517-22	Wire 22AWG Bus TC	1.0	Wiring
50709-00	Wire 22AWG insul STC UL1061 PVC color undesignate	10.0	Wiring
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00699-01 Assy Harness Plate Front M100DC

Rod-L P/N	Description	qty	Reference
50670-08	Con Terminal Ring 18-22AWG(red) #10 lug or stud	1.0	BP1
50460-10	Con Mascon HousingRecp 1ro F .100"22gauge 10p Pand	2.0	Con
50461-10	Con Cover End .100" Mascon Housing 10p P Panduit	2.0	Con
50581-01	Tie-Mount Cable Tie .75x.75 w/ Adhesive	4.0	Mounts
50399-01	TieWrap CableBundle dia .75 SST1M-M	30.0	Ties
50709-00	Wire 22AWG insul STC UL1061 PVC color undesignate	25.0	Wiring
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00856-01 Assy Harness Plate Rear M100DC

Rod-L P/N	Description	qty	Reference
00247-02	Assy PCB A 7AV Line Select Switch	1.0	A7 AV
50452-01	Con Pin Contact HV F 16-18AWG Blue Stripe Amp	6.0	HV Cons
50670-04	Con Terminal Ring 18-22AWG(red) # 8 lug or stud	2.0	Grounds
50670-08	Con Terminal Ring 18-22AWG(red) #10 lug or stud	2.0	BP
50460-08	Con Mascon HousingRecp 1ro F .100"22gauge 8p Pand	2.0	Cons
50461-08	Con Cover End .100" Mascon Housing 8p P Panduit	2.0	Cons
50532-03	Screw PanSem Phl 8-32 x .375	1.0	Heatsink
50581-01	Tie-Mount Cable Tie .75x.75 w/ Adhesive	2.0	Mounts
50399-01	TieWrap CableBundle dia .75 SST1M-M	20.0	Ties
50508-00	Wire 22AWG insul STC UL1015 color undesignated	2.0	Wiring
50709-00	Wire 22AWG insul STC UL1061 PVC color undesignate	4.0	Wiring
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00855-01 Assy Harness Plate Chassis M100DC

Rod-L P/N	Description	qty	Reference
01318-01	Assy Cable Jumper Res 500ohm w/ 2 #10 Ring Lugs 4"	0.0	Res Jumper
01319-01	Assy Cable Jumper Wire 22AWG blu w/1 #10 RngLug12"	0.0	Jumper to Cap
01319-02	Assy Cable Jumper Wire 22AWG orn w/1 #10 RngLug12"	0.0	Jumper to Cap
50356-01	Res Ohm 500 5W 5% WW	1.0	Res on Cap
50460-10	Con Mascon HousingRecp 1ro F .100"22gauge 10p Pand	1.0	Con
50461-10	Con Cover End .100" Mascon Housing 10p P Panduit	1.0	Con
50670-03	Con Terminal Ring 14-16AWG(blue) #10 lug or stud	2.0	HW Cap
50670-06	Con Terminal Ring 10-12AWG(yl) #10 lug orStud thin	2.0	HW Res on Cap
50532-03	Screw PanSem Phl 8-32 x .375	1.0	Cap
50533-03	Screw PanSem Phl 10-32 x .375	2.0	Cap
50581-01	Tie-Mount Cable Tie .75x.75 w/ Adhesive	4.0	Mounts
50399-01	TieWrap CableBundle dia .75 SST1M-M	25.0	Ties
50820-05	Tube Shrink 0.25 (1/4) dia	3.0	Wiring
50508-00	Wire 22AWG insul STC UL1015 color undesignated	3.0	Wiring
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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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	

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Rod-L Electronics, Inc. -- Bill Of Materials
00801-03 Opt 01B Remote Control Digital DC, RT

Rod-L P/N	Description	qty	Reference
01170-13	Assy Kit Ship Option 01 Remote Accessories	1.0	Ship Kit
01174-18	Assy PCB A19 Opt 01, Pass Signal DC,RT RevB std	1.0	A19 PCB Assy
01010-03	Assy Cable&Cons: FRC DB25S 2roPmnut,Mascn26p2ro12"	1.0	Cable Assy PCB to RP
50185-01	Asm Kit Con HW JackSocket Screw hex4-40 5/16L& HW	1.0	HW
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00819-01 Opt 19A Remote Control Digital & Analog DC, RT

Rod-L P/N	Description	qty	Reference
01170-14	Assy Kit Ship Option 19 Remote Accessories	1.0	Ship Kit
01174-10	Assy PCB A19 Opt 19, Pass Signal DC,RT RevB std	1.0	A19 PCB Assy
01010-03	Assy Cable&Cons: FRC DB25S 2roPmnut,Mascn26p2ro12"	1.0	Cable Assy PCB to RP
50185-01	Asm Kit Con HW JackSocket Screw hex4-40 5/16L& HW	1.0	HW
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
01170-13 Assy Kit Ship Option 01 Remote Accessories

Rod-L P/N	Description	qty	Reference
50301-01	Asm Kit Con-Cover Cutout DB25 black plastic	1.0	Remote cover
50305-03	Cover Hole Plug .25" dia blk plastic HH Smith3089	1.0	Remote swtch covr ACs
50403-01	Con D Sub Min M 25p 2ro Solder Cups pnl mtg DB25P	1.0	25P Con
50263-01	Asm Kit Con HW & Shell for DB25 DB51226-1A	1.0	Shell & HW

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Rod-L Electronics, Inc. -- Bill Of Materials
01170-14 Assy Kit Ship Option 19 Remote Accessories

Rod-L P/N	Description	qty	Reference	
50301-01	Asm Kit Con-Cover Cutout DB25 black plastic	1.0	-Remote cover	

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Rod-L Electronics, Inc. -- Bill Of Materials
01174-18 Assy PCB A19 Opt 01, Pass Signal DC,RT RevB std

Rod-L P/N	Description	qty	Reference
01306-02	NIN Schem PCB A19 Rem Cntrl Ana/Dig /LoCur (RvB)DC	0.0	Reference
01173-02	PCB Fab A19 Opt 01 / Opt 19 / Opt 09 Ps RevB DC,GT	1.0	A19 PCB Fab
50264-06	IC-Socket 6p Lo Profile .3 DIP	9.0	X4-6,9-14
50264-14	IC-Socket 14p Lo Profile .3 DIP	2.0	X7,8
50264-16	IC-Socket 16p Lo Profile .3 DIP	1.0	X17
50098-01	IC Optical Coupler TIL117	9.0	U4-6,9-14
50149-03	IC AND 2-in Lo pwr Schotky quad 74LS08	1.0	U8
50095-01	IC Inverter/Driver OC hex 7416N	1.0	U7
50155-03	IC FF Lo Pwr Schotky quad 74LS175	1.0	U17
50125-21	Res Ohm 330 1/4W 5% CC	6.0	R1,5,6,8,10,16
50125-17	Res Ohm 680 1/4W 5% CC	4.0	R3,4,12,14
50125-31	Res K 1 1/4W 5% CC	1.0	R17
50125-36	Res K 2.2 1/4W 5% CC	5.0	R7,9,11,13,15
50209-14	Cap .01 uF 100V 20% cerm disc lo V	12.0	C13-17,19-24,30
50060-21	Cap 10 uF 35V 10% tant axial	3.0	C11,18,31
50320-01	Cap 47 uF 25VDC 20% elect axial	1.0	C25
50614-26	Con HeaderStrip 2ro .100"C/C .025"sq 26p M PCBmnt	1.0	J1
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
01174-10 Assy PCB A19 Opt 19, Pass Signal DC,RT RevB std

Rod-L P/N	Description	qty	Reference
01306-02	NIN Schem PCB A19 Rem Cntrl Ana/Dig /LoCur (RvB)DC	0.0	Reference
01173-02	PCB Fab A19 Opt 01 / Opt 19 / Opt 09 Ps RevB DC,GT	1.0	A19 PCB Fab
50264-06	IC-Socket 6p Lo Profile .3 DIP	9.0	X3-6,9-13
50264-14	IC-Socket 14p Lo Profile .3 DIP	4.0	X1,2,7,8
50264-16	IC-Socket 16p Lo Profile .3 DIP	1.0	X17
50098-01	IC Optical Coupler TIL117	9.0	U3-6,9-13
50149-03	IC AND 2-in Lo pwr Schotky quad 74LS08	1.0	U8
50095-01	IC Inverter/Driver OC hex 7416N	1.0	U7
50155-03	IC FF Lo Pwr Schotky quad 74LS175	1.0	U17
50128-01	IC Op Amp Lo Power quad LM324	2.0	U1,2
50349-07	ResPak SIP K 10 8p 7r 1%	1.0	RP4
50335-01	ResPak SIP K 10 8p 4r 1%	3.0	RP1-3
50125-21	Res Ohm 330 1/4W 5% CC	5.0	R2,5,6,8,10
50125-17	Res Ohm 680 1/4W 5% CC	4.0	R3,4,12,14
50125-31	Res K 1 1/4W 5% CC	1.0	R17
50125-36	Res K 2.2 1/4W 5% CC	5.0	R7,9,11,13,15
50209-14	Cap .01 uF 100V 20% cerm disc lo V	28.0	C1-10,12-17,19-23,
50209-14	Cap .01 uF 100V 20% cerm disc lo V	0.0	26-30,35,36
50060-21	Cap 10 uF 35V 10% tant axial	3.0	C11,18,31
50320-01	Cap 47 uF 25VDC 20% elect axial	1.0	C25
50614-26	Con HeaderStrip 2ro .100"C/C .025"sq 26p M PCBmnt	1.0	J1
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
01174-19 Assy PCB A19 Pass Signal Only DC,RT RevB

Rod-L P/N	Description	qty	Reference
01306-02	NIN Schem PCB A19 Rem Cntrl Ana/Dig /LoCur (RvB)DC	0.0	Reference
01173-02	PCB Fab A19 Opt 01 / Opt 19 / Opt 09 Ps RevB DC,GT	1.0	A19 PCB Fab
50264-06	IC-Socket 6p Lo Profile .3 DIP	2.0	X12,13
50264-14	IC-Socket 14p Lo Profile .3 DIP	1.0	X8
50264-16	IC-Socket 16p Lo Profile .3 DIP	1.0	X17
50098-01	IC Optical Coupler TIL117	9.0	U12,13
50149-03	IC AND 2-in Lo pwr Schotky quad 74LS08	1.0	U8
50155-03	IC FF Lo Pwr Schotky quad 74LS175	1.0	U17
50125-17	Res Ohm 680 1/4W 5% CC	2.0	R12,14
50125-31	Res K 1 1/4W 5% CC	1.0	R17
50125-36	Res K 2.2 1/4W 5% CC	5.0	R13,15
50209-14	Cap .01 uF 100V 20% cerm disc lo V	2.0	C22,23
50060-21	Cap 10 uF 35V 10% tant axial	3.0	C11,18,31
50320-01	Cap 47 uF 25VDC 20% elect axial	1.0	C25
50614-26	Con HeaderStrip 2ro .100"C/C .025"sq 26p M PCBmnt	1.0	J1
REV-B	NIN Rev-B This Assy is at Rev-B	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00387-02 Assy PCB A54 Rem Cntrl Ana/Dig DC (see 01174-02)

Rod-L P/N	Description	qty	Reference
00385-01	NIN Schem PCB A54 Rem Cntrl Analog&Dig DC/RT (A19)	0.0	REF
00386-03	PCB Fab A54 Rem Cntrl Analog&Dig M100DC (see A19)	1.0	A54
50209-14	Cap .01 uF 100V 20% cerm disc lo V	13.0	C2-14
50060-01	Cap 1 uF 35V 10% tant axial	1.0	C1
50125-21	Res Ohm 330 1/4W 5% CC	7.0	R1,3,6,8,10-12
50125-36	Res K 2.2 1/4W 5% CC	3.0	R5,7,9
50125-44	Res K 10 1/4W 5% CC	18.0	R2,4,13-21,23-6,28-30
50128-01	IC Op Amp Lo Power quad LM324	2.0	U9,10
50095-01	IC Inverter/Driver OC hex 7416N	1.0	U8
50079-01	IC Optical Coupler H11B1	7.0	U1-7
50264-06	IC-Socket 6p Lo Profile .3 DIP	7.0	X1-7
50264-14	IC-Socket 14p Lo Profile .3 DIP	3.0	X8-10
50614-26	Con HeaderStrip 2ro .100"C/C .025"sq 26p M PCBmnt	1.0	J1
77710-01	NIN Dwg Loc not used See Ref	0.0	R22,27
REV-F	NIN Rev-F This Assy is at Rev-F	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
01014-01 Assy PCB A55 Rem Cntrl Dig M100DC (see 01174-05)

Rod-L P/N	Description	qty	Reference
01015-01	NIN Schem PCB A55 Rem Dig M100DC (see A19)	0.0	Reference
00450-03	PCB Fab A55 Rem Dig & LoCurr M100DC (see A19)	1.0	A55 PCB Fab
50264-06	IC-Socket 6p Lo Profile .3 DIP	7.0	X1,2,4-8
50264-14	IC-Socket 14p Lo Profile .3 DIP	1.0	X9
50079-01	IC Optical Coupler H11B1	7.0	U1,2,4-8
50095-01	IC Inverter/Driver OC hex 7416N	1.0	U9
50125-21	Res Ohm 330 1/4W 5% CC	7.0	R1,2,4-8
50125-36	Res K 2.2 1/4W 5% CC	4.0	R9-11,17
50209-14	Cap .01 uF 100V 20% cerm disc lo V	8.0	C1,2,4-9
50614-26	Con HeaderStrip 2ro .100"C/C .025"sq 26p M PCBmnt	1.0	J1
77710-01	NIN Dwg Loc not used See Ref	0.0	C3,R3,U3
REV-C	NIN Rev-C This Assy is at Rev-C	0.0	

www.valuetronics.com

Rod-L Electronics, Inc. -- Bill Of Materials
01010-03 Assy Cable&Cons: FRC DB25S 2roPmnut,Mascn26p2ro12"

Rod-L P/N	Description	qty	Reference
50418-01	Con Mascon 2ro F 26p FRC Term 3M 3399-6026(6326)	1.0	26p con
50430-02	Con D Sub Min F 25p 2ro FRC Term Threaded pnl mtg	1.0	DB25S con
50185-04	Asm Kit Con HW JackSocket Screw hex4-40 3/8L & HW	2.0	HW DB25S con
50253-26	Cable Ribbon 26 condctr 28 AWG	1.0	Ribbon Cable
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

www.valuetronics.com

Rod-L Electronics, Inc. -- Bill Of Materials
00805-02 Opt 05 Hands Off Operation (not w/M25) DC,RT

Rod-L P/N	Description	qty	Reference
01170-16	Assy Kit Ship Option 05 DC HandsOff Accessories	1.0	Ship Kit
00688-01	Assy Plate Rear M100DC	1.0	-RP Assy OUT
00688-05	Assy Plate Rear M100DC w/ Opt 05	1.0	RP Assy IN
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

www.valuetronics.com

Rod-L Electronics, Inc. -- Bill Of Materials
01170-16 Assy Kit Ship Option 05 DC HandsOff Accessories

Rod-L P/N	Description	qty	Reference
00849-07	Assy Cables Pair/Switches/5P DIN/shld Opt05 5' DC	1.0	PB Cable Set

www.valuetronics.com

Rod-L Electronics, Inc. -- Bill Of Materials
00849-07 Assy Cables Pair/Switches/5P DIN/shld Opt05 5' DC

Rod-L P/N	Description	qty	Reference
0016-03	Asm Cable w/ Switch Push Button 72"L shielded	2.0	Switches
50580-01	Con Cylind DIN 'Audio' 5p M w/Boot Cord Mtg	2.0	Cons
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

www.valuetronics.com

Rod-L Electronics, Inc. -- Bill Of Materials
00806-05 Opt 06D Cover Lock-Out Rear Panel RT

Rod-L P/N	Description	qty	Reference
00420-01	Cover Protective Rear Panel Clear DC	1.0	Cover
50669-03	Standoff 6-32 x1.50 x.25 OD FF rnd alum	4.0	HW
50531-03	Screw PanSem Phl 6-32 x .375	8.0	HW
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

www.valuetronics.com

Rod-L Electronics, Inc. -- Bill Of Materials
00807-01 Opt 07A extra HV con for Interface of Hipot & GT

Rod-L P/N	Description	qty	Reference
50509-01	Con Recp 4p Cylind HV Housing PnlMtg blk plst Amp	1.0	HV con
50451-01	Con Nut 1" for HV Con blk plastic	1.0	HV con
50452-01	Con Pin Contact HV F 16-18AWG Blue Stripe Amp	4.0	HV con

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Rod-L Electronics, Inc. -- Bill Of Materials
00810-02 Opt 10 Audible Testing Tone Beep M100/500,DC,RT

Rod-L P/N	Description	qty	Reference
00432-02	Assy PCB A27 Opt 10 Audible Test Tone	1.0	A27 PCB Assy
50460-07	Con Mascon HousingRecp 1ro F .100"22gauge 7p Pand	1.0	Conn
50461-07	Con Cover End .100" Mascon Housing 7p P Panduit	1.0	Conn
50709-00	Wire 22AWG insul STC UL1061 PVC color undesignate	5.0	Wiring
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00432-02 Assy PCB A27 Opt 10 Audible Test Tone

Rod-L P/N	Description	qty	Reference
00432-01	NIN Schem PCB A27 Opt 10 Audible Test Tone	0.0	Reference
00432-03	PCB Fab A27 Opt 10 Audible Test Tone	1.0	T27 PCB Fab
50264-08	IC-Socket 8p Lo Profile .3 DIP	1.0	X1
50091-01	IC Timer NE555 or MOTOROLA MC1455P	1.0	U1
50125-40	Res K 4.7 1/4W 5% CC	1.0	R1
50125-53	Res K 47 1/4W 5% CC	2.0	R3,4
50125-60	Res K 120 1/4W 5% CC	1.0	R2
50032-01	Diode 1N4002 Rec 100V 1A	1.0	CR1
50267-01	Trnstor 2N2222 NPN SS Gen Purp Amp 30VbrCEO TO-18	2.0	Q1,2
50209-14	Cap .01 uF 100V 20% cerm disc lo V	2.0	C1,3
50060-01	Cap 1 uF 35V 10% tant axial	1.0	C2
50584-01	Washer Fiber # 6 black HH Smith 2162	1.0	HW
50584-02	Washer Fiber # 4 black HH Smith 2161	1.0	HW
50612-01	Standoff 4-40 x .375 x.25 OD FF hexBrassCad	1.0	HW
50222-05	Con Header w/FricLock 1ro .100"C/C .025"sq 5p M	1.0	J1
50530-03	Screw PanSem Phl 4-40 x .375	1.0	HW
50709-00	Wire 22AWG insul STC UL1061 PVC color undesignate	2.0	
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

www.valuetronics.com

Rod-L Electronics, Inc. -- Bill Of Materials
00814-01 Opt 14 Pin Assignment RPHV Spcl M100/500,150,DC,RT

Rod-L P/N	Description	qty	Reference
01125-01	NIN Diag Wire Op14 Spcl Pin Assignment	0.0	Reference

www.valuetronics.com

Rod-L Electronics, Inc. -- Bill Of Materials
00815-01 Opt 15 Kit 19" Rack Mount 5.2"tall A,B,G,D,R,I,J

Rod-L P/N	Description	qty	Reference
00511-05	Bracket Rack Mtg Right 1.32x5.2 Tall MintGrey	1.0	Right Bracket
00512-05	Bracket Rack Mtg Left 1.32x5.2 Tall MintGrey	1.0	Left Bracket
50532-04	Screw PanSem Phl 8-32 x .500	4.0	HW

www.valuetronics.com

Rod-L Electronics, Inc. -- Bill Of Materials
00824-03 Opt 24B Blank Front Panel Start Switch Only

Rod-L P/N	Description	qty	Reference
00977-01	Assy Switch START Rev A ALL Instruments	1.0	-Start Switch Ob.
50298-01	Cover Hole Plug 1" Hole metal 12 prong HH S 612	1.0	Start Switch replac
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

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Rod-L Electronics, Inc. -- Bill Of Materials
00825-01 Opt 25 Two-Voltage Switch (250/500V Norm) M300RT

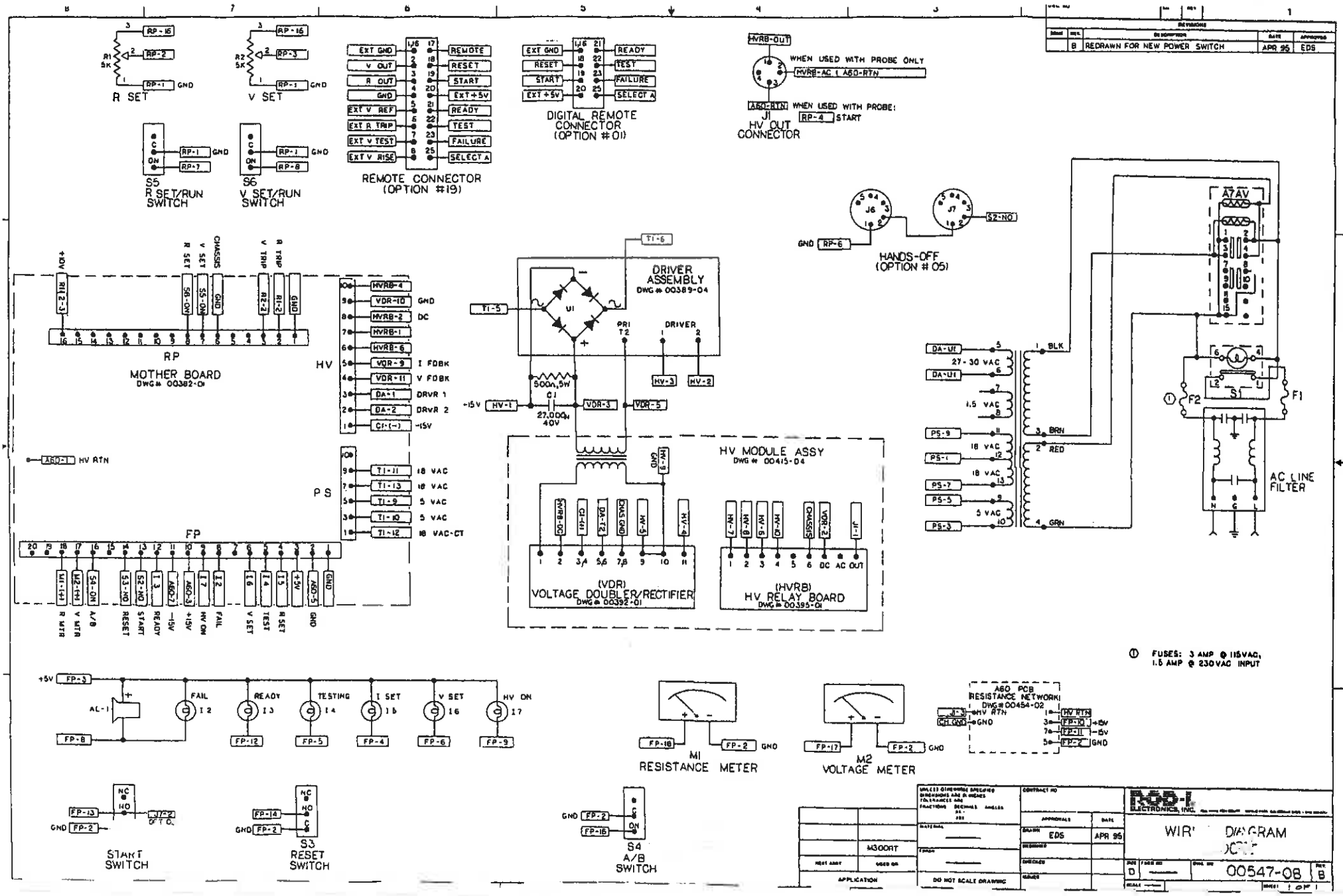
Rod-L P/N	Description	qty	Reference
50836-02	NIN Res selected 1% 1/4W MF	10.0	Resistors
50838-01	NIN Pot selected 10 turns inline pins V sq	4.0	Pots
REV-A	NIN Rev-A This Assy is at Rev-A	0.0	

www.valuetronics.com

Rod-L Electronics, Inc. -- Bill Of Materials
00750-02 Mdl M300RT-MP21 500V 0-40 Megohms

Rod-L P/N	Description	qty	Reference
00750-01	Mdl M300RT 500V 0-40 Megohms	1.0	M300RT
		0.0	Different Wiring

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Rod-L Electronics, Inc. -- Bill Of Materials
00751-01 Mdl M300RTLOR 500V 0-40 Megohms special interfac

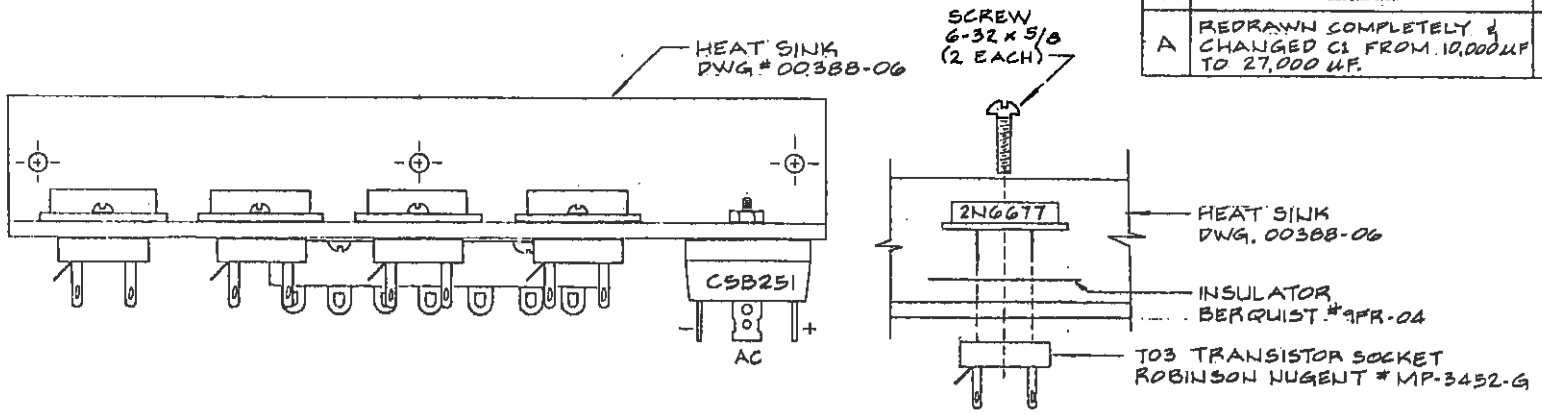
Rod-L P/N	Description	qty	Reference
00750-01	Mdl M300RT 500V 0-40 Megohms	1.0	Unit M300RT
		1.0	Modify intrface DC,GT

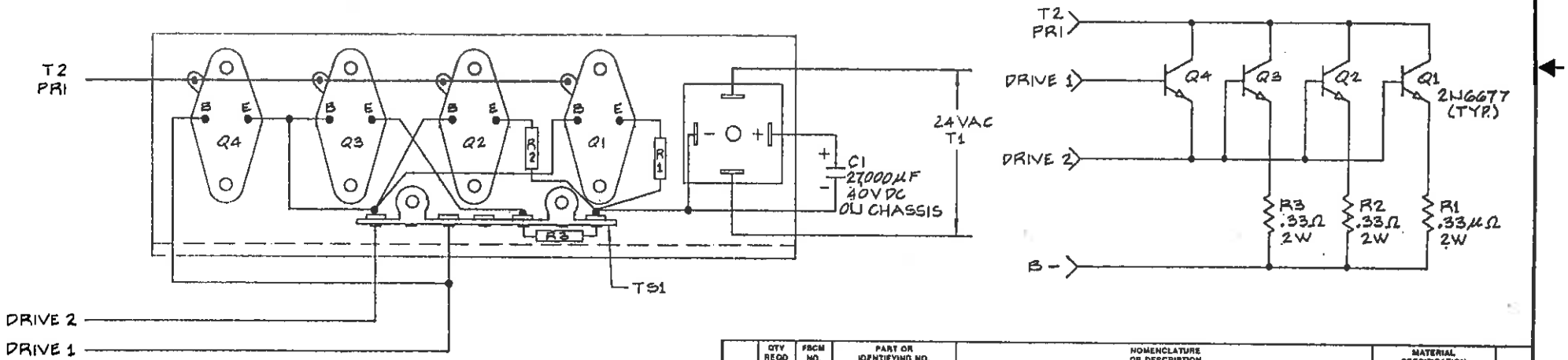
www.valuetronics.com

DWG. NO.	SH	REV.

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	REDRAWN COMPLETELY & CHANGED C1 FROM 10,000 µF TO 27,000 µF.	4-30-84	BILL





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 JUN	4-30-84
CHECKED WR Morel	6/1/84
DESIGNED Ramon Alvarez	6/1/84
ISSUED	

ELECTRONICS, INC. 1098 HAMILTON COURT • MENLO PARK, CALIFORNIA 94025 • (415) 322-0711

ASSEMBLY HIGH VOLTAGE DRIVER

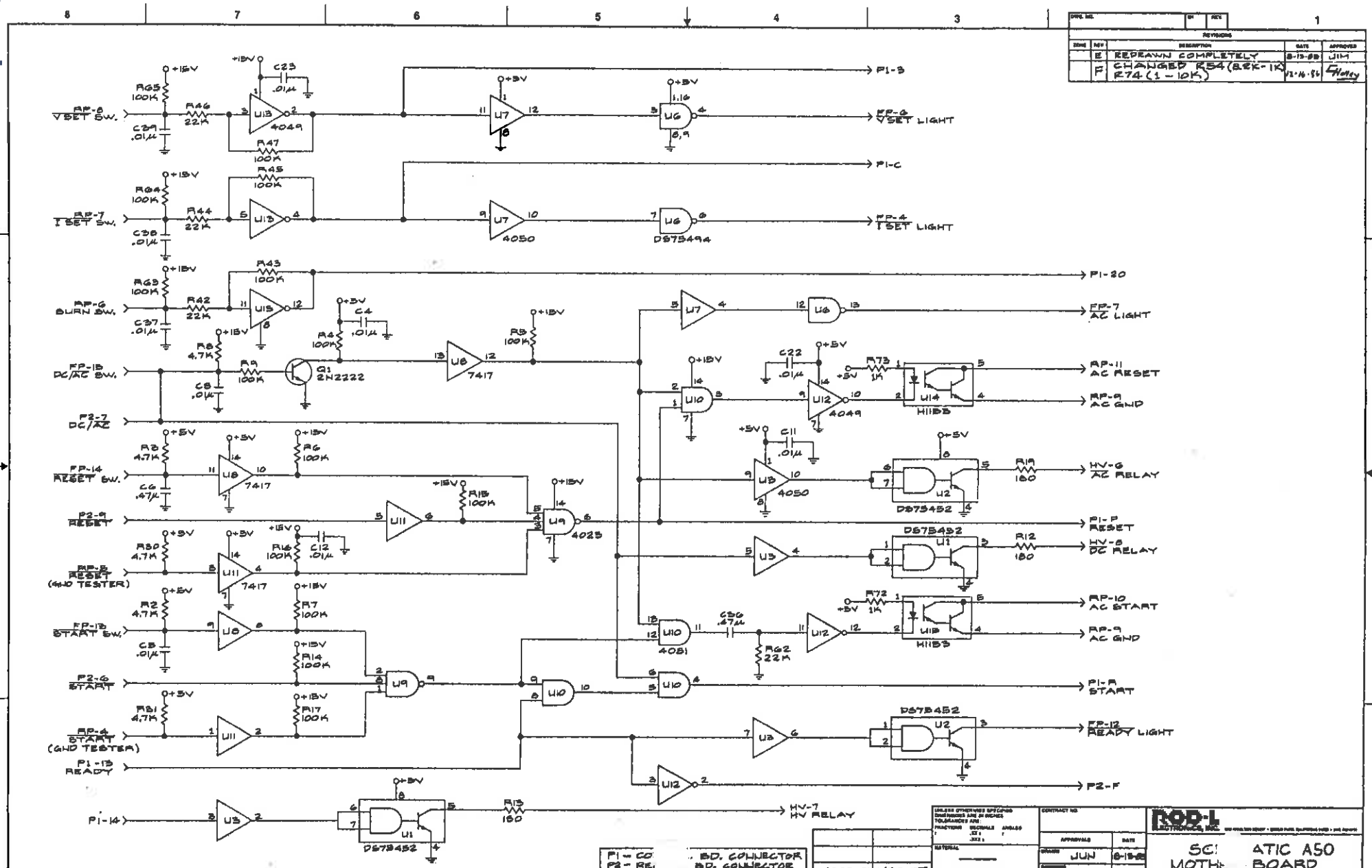
	M300RT
00681-01	M100.DC
NEXT ASSY	USED ON

APPLICATION

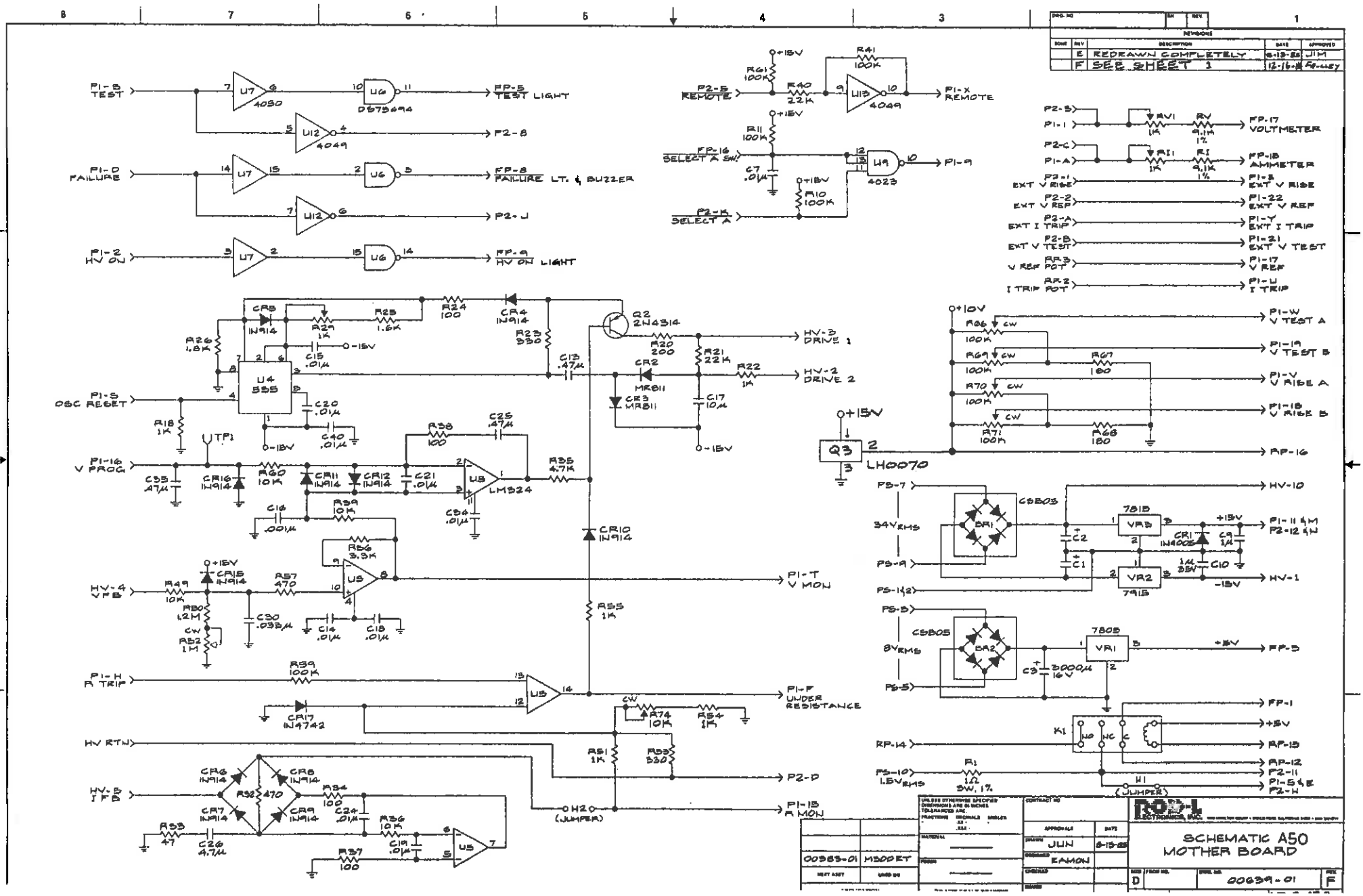
SIZE	FSCM NO.	DWG. NO.	REV.
B		00389-04	A

SCALE ——— SHEET 1 OF 1

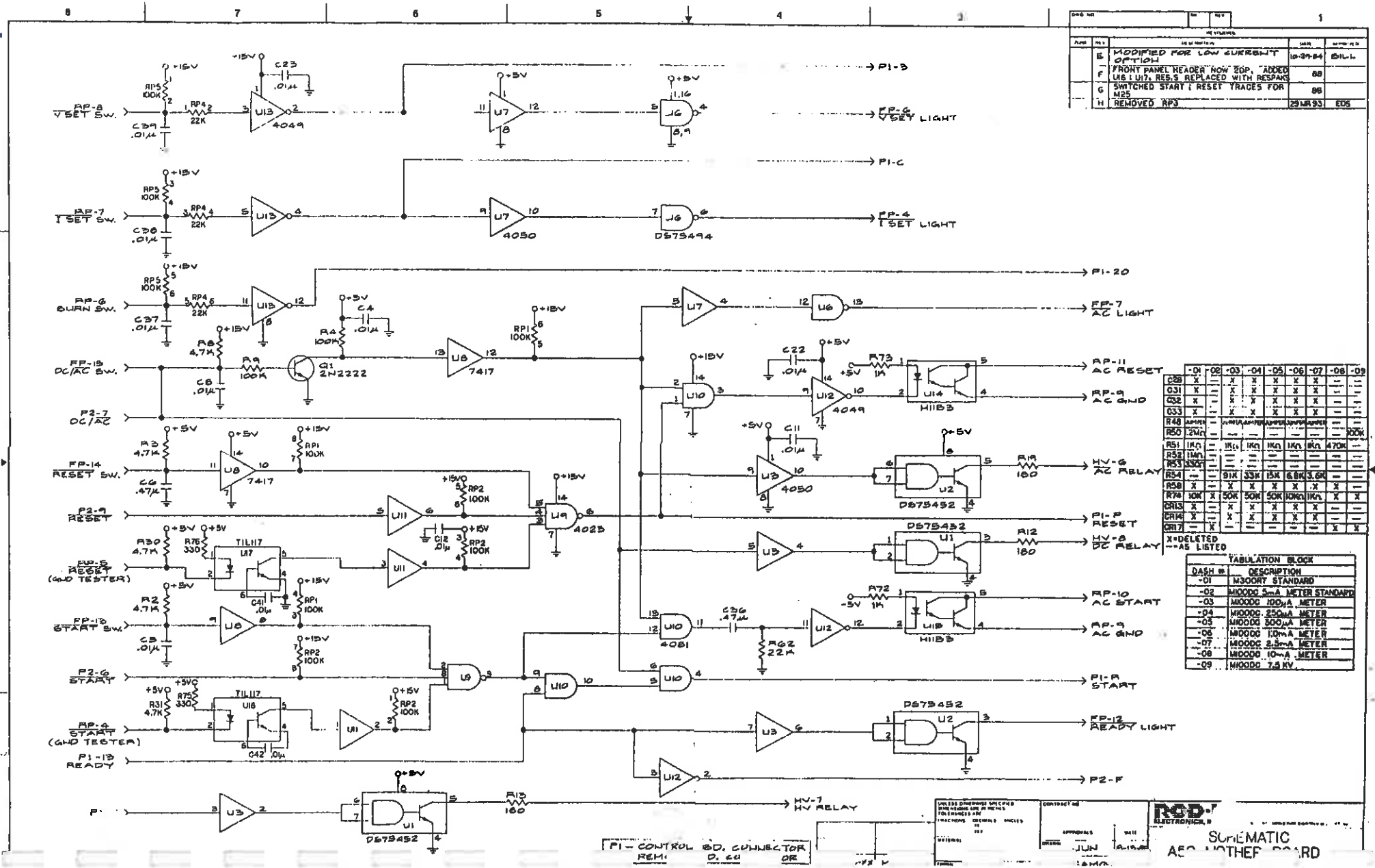
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	E	MODIFIED FOR LOW CURRENT OPTION	10-27-84	BILL
	F	FRONT PANEL HEADER NOW 20P, ADDED U16 & U17, RES.S REPLACED WITH RESPAKS	88	
	G	SWITCHED START & RESET TRACES FOR M25	88	
	H	REMOVED RP3	29MAR93	EDS

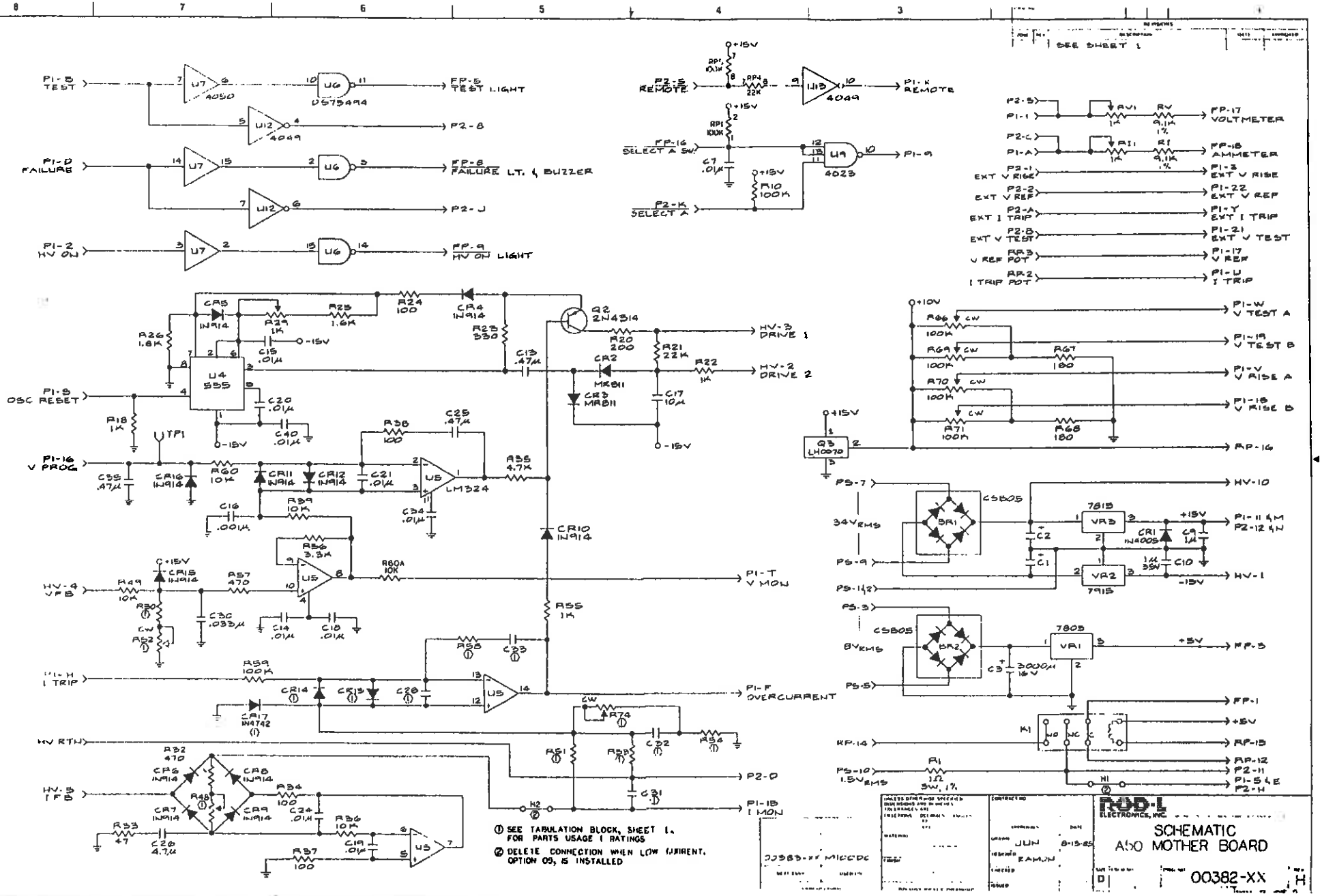
	-01	-02	-03	-04	-05	-06	-07	-08	-09
C28	X	—	X	X	X	X	—	—	—
C31	X	—	X	X	X	X	—	—	—
C32	X	—	X	X	X	X	—	—	—
C33	X	—	X	X	X	X	—	—	—
R48	APPER	—	APPER	APPER	APPER	APPER	—	—	—
R50	.2MΩ	—	—	—	—	—	—	—	100K
R51	1KΩ	—	1KΩ	1KΩ	1KΩ	1KΩ	1KΩ	470K	—
R52	1MΩ	—	—	—	—	—	—	—	—
R53	330Ω	—	—	—	—	—	—	—	—
R54	—	—	91K	33K	15K	6.8K	3.6K	—	—
R58	X	—	X	X	X	X	X	X	—
R74	10K	X	50K	50K	50K	10KΩ	1KΩ	X	X
CR13	X	—	X	X	X	X	X	—	—
CR14	X	—	X	X	X	X	X	—	—
CR17	—	X	—	—	—	—	—	X	X

X=DELETED
—=AS LISTED

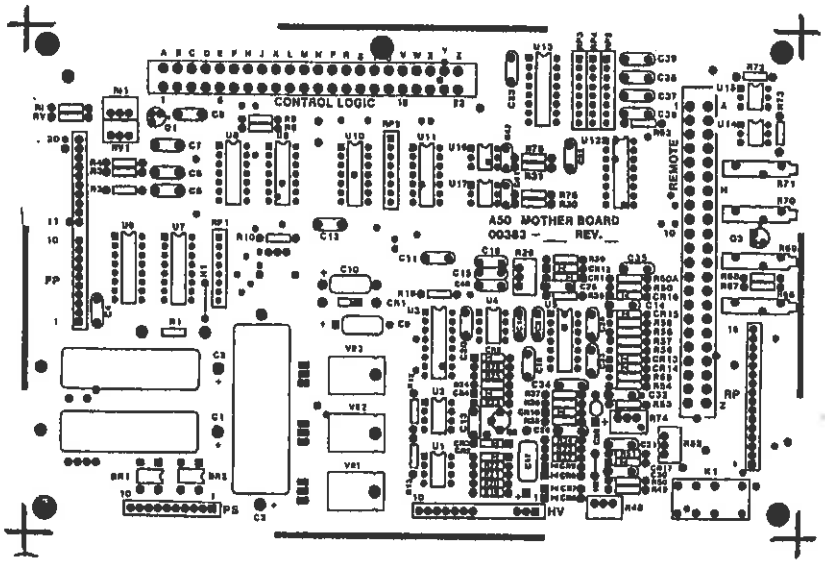
TABULATION BLOCK	
DASH #	DESCRIPTION
-01	M3OORT STANDARD
-02	M1000D 5mA METER STANDARD
-03	M1000D 100μA METER
-04	M1000D 250μA METER
-05	M1000D 500μA METER
-06	M1000D 1.0mA METER
-07	M1000D 2.5mA METER
-08	M1000D 10mA METER
-09	M1000D 7.5 KV

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	M300RT -01	M100DC -02	M100DC 100μA -03	M100DC 250μA -04	M100DC 1mA -05	M100DC 2.5mA -06	M100DC 7.5KV -07
C28	X	—	X	X	X	X	X
C31	X	—	X	X	X	X	X
C32	X	—	X	X	X	X	X
C33	X	—	X	X	X	X	X
R48	X	—	JUMPER	JUMPER	JUMPER	JUMPER	JUMPER
R50	1.2M	—	—	—	—	—	100K
R51	1K	—	1K	1K	1K	1K	1K
R52	1M	—	—	—	—	—	—
R53	330Ω	—	—	—	—	—	—
R54	8.2K	—	90K	33K	6.8K	3.6K	6.8K
R58	X	—	X	X	X	X	X
R74	1K	X	25K	25K	10K	1K	X
CR13	X	—	X	X	X	X	X
CR14	X	—	X	X	X	X	X
CR17	IN4742	X	IN4742	IN4742	IN4742	IN4742	X

X - DELETED
— - AS IS IN PARTS LIST

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED

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

MATERIAL

FINISH

APPLICATION — DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN	
DESIGNED	
CHECKED	
ISSUED	

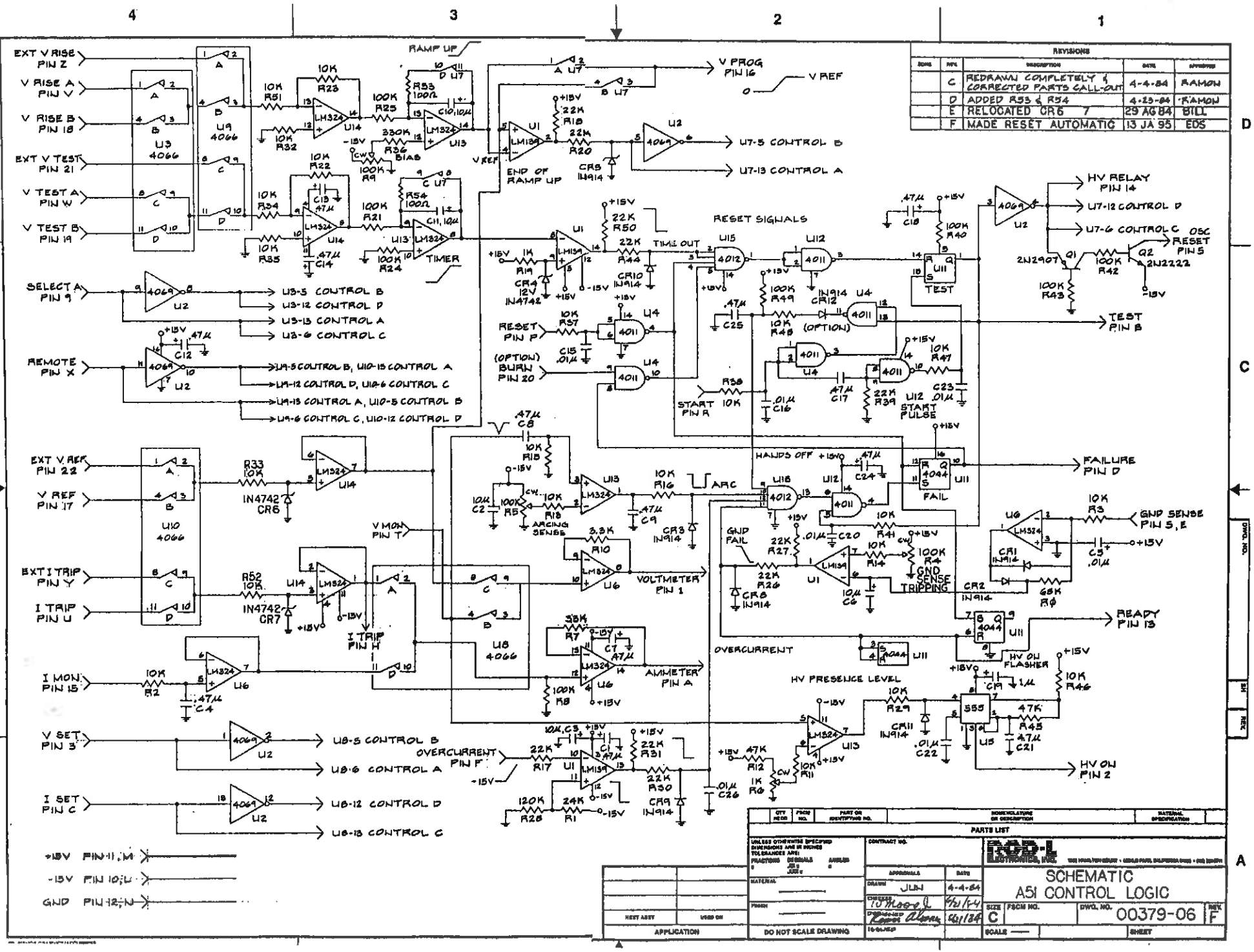
ROD-L ELECTRONICS, INC.

A50 MOTHER PCB MIOODC ASSY DRAWING

SIZE C | FSCM NO. | DWG. NO. 00_ XX | REV. G

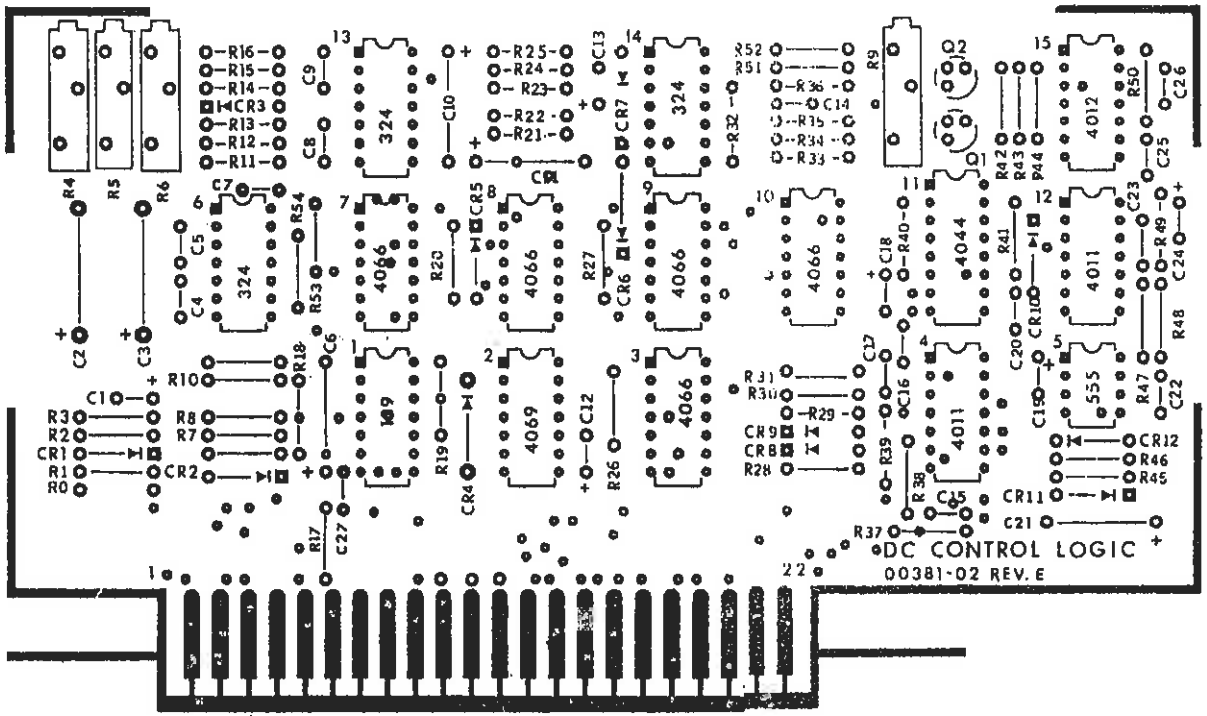
SCALE | SHEET OF

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REVISIONS			
E	RELOCATED CR617	8-29-84	BILL
F	MADE RESET AUTOMATIC	13 JA 95	EDS



SILKSCREEN
830815-1B

PADMASTER / SOLDERMASK 830815-1B

NOTE:

1. REFERENCE SCHEMATIC DRAWING #00379-01

* SEE SEPARATE PARTS LIST

M300RT M100DC	JWH	4-85	RCD-L ELECTRONICS, INC.

ASSEMBLY PCBA A51
LOGIC CONTROL

SIZE C | FSCM NO | DWG NO 003 | REV F

SCALE 2X | SHEET 1 OF 1

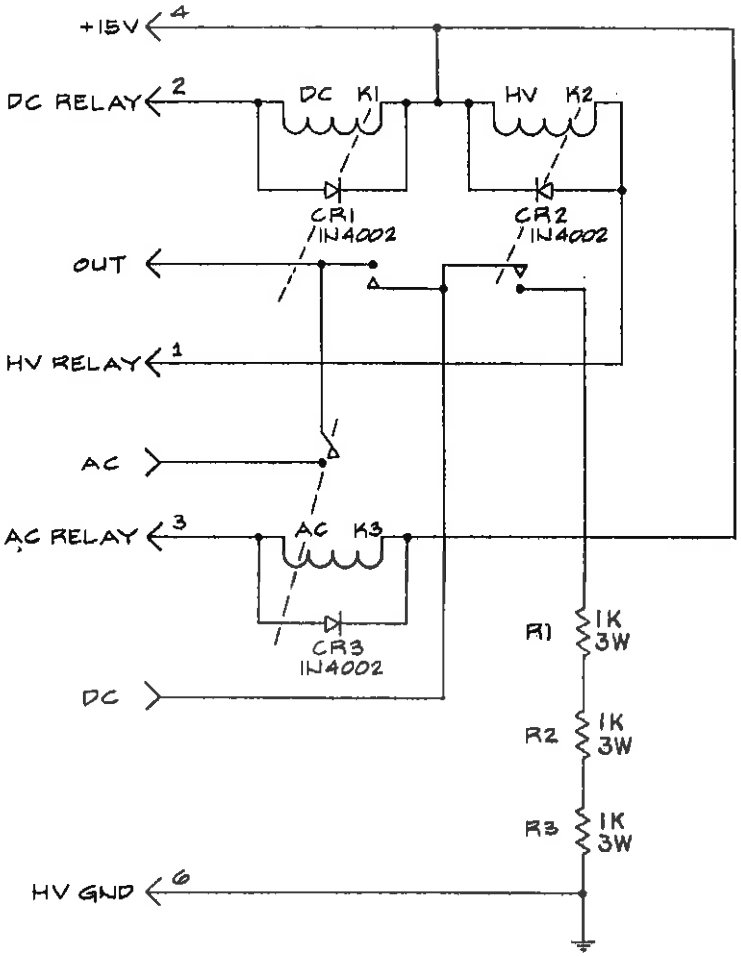
DO NOT SCALE DRAWING

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DWG. NO.	SH	REV.

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	REDRAWN COMPLETELY	4-25-84	BILL
B	CHANGED REVISION LEVEL TO AGREE WITH FAB. & ASSEMBLY DRWGS	6-6-84	BILL
C	RESISTORS WERE 2W	MAY 89	EDS



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 JUN	4-25-84
CHECKED W Moore Jr	6/21/84
DESIGNED Ramon Alvarez	6/21/84
ISSUED	

	M500RT
00397-02	M1000C
NEXT ASSY	USED ON

APPLICATION

RDL ELECTRONICS, INC. 1081 HAMILTON COURT • MENLO PARK, CALIFORNIA 94025 • (415) 323-0711

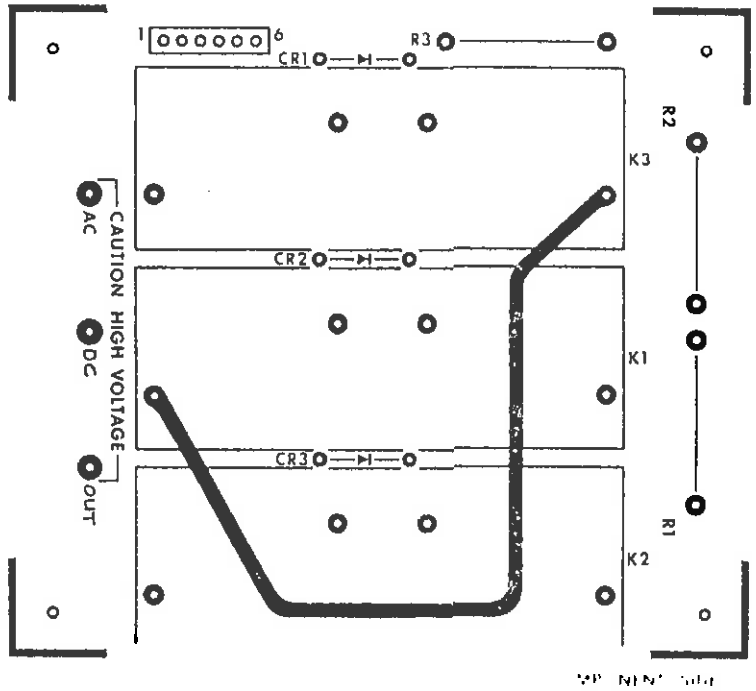
SCHEMATIC A52 HIGH VOLTAGE RELAY PCB

SIZE	FSCM NO.	DWG. NO.	REV.
B		00395-01	B

SCALE —— SHEET 1 OF 1

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REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	DC hot out were switched Relay out to correct	6/10/83	WM &
	B	CHANGED REV. TO AGREE WITH SCHEMATIC.	6-22-84	BILL



NOTE:
1- REFERENCE SCHEMATIC DRWG # 00395-01

* SEE SEPARATE PARTS LIST

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

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 EA INC.	6-83
CHECKED	

NEXT ASSY | USED ON

APPLICATION

RODL ELECTRONICS, INC.

ASSEMBLY PCB
A52 HIGH VOLTAGE RELAY

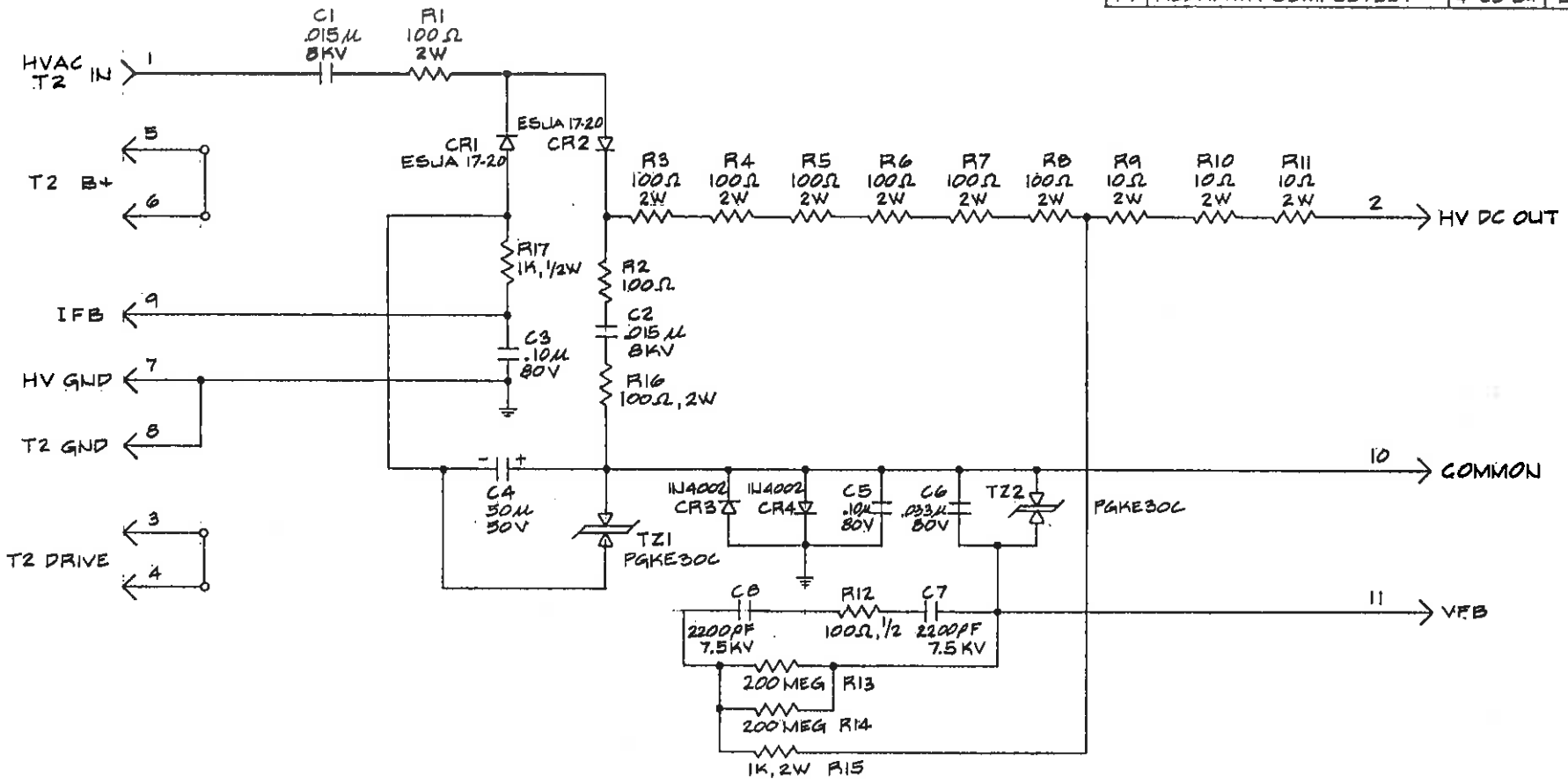
SIZE	CODE IDENT NO.	DRAWING NO.	REV
C		00397-	B

SCALE 2x SHEET 1 OF 1

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DWG. NO.	SH	REV.

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	REDRAWN COMPLETELY	4-25-84	BILL



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

PARTS LIST

	M300RT
00394-02	M100 DC
NEXT ASSY	USED ON
APPLICATION	

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 JUN	4:25-84
CHECKED W Morrell	6/1/84
DESIGNED Lemuel Illanes	6/11/84
APPLIED	

ELECTRONICS, INC. 1000 HAMILTON COURT • MENLO PARK, CALIFORNIA 94025 • (415) 323-9711

SCHEMATIC A53 HIGH VOLTAGE DOUBLER/RECTIFIER PCB

SIZE	FSCM NO.	DWG. NO.	REV.
B		00392-01	A

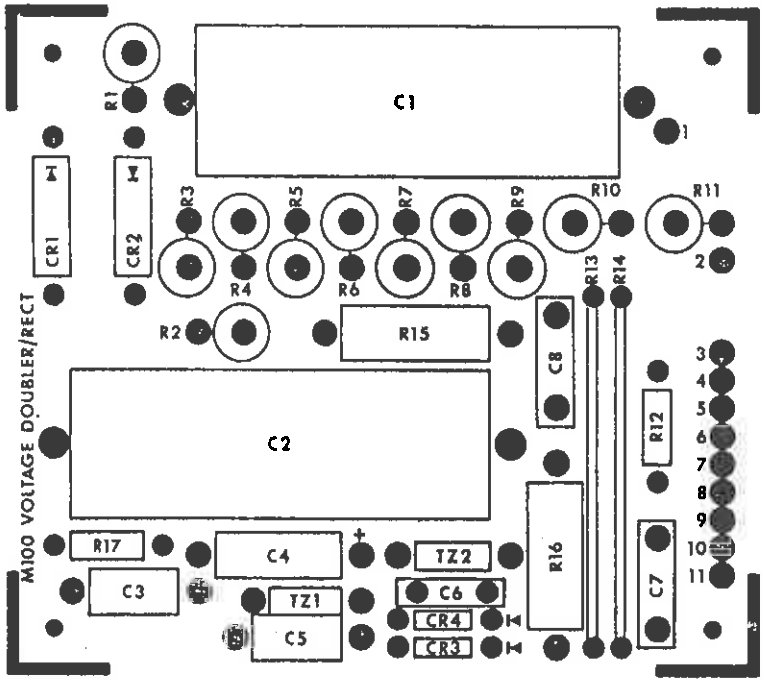
SCALE —— SHEET 1 OF 1

www.valuetronics.com

DWG. NO.	SH	REV.

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	11-85	



NOTE

1. REFERENCE SCHEMATIC DWG # 00392-01
2. SEE SEPARATE PARTS LIST.

	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 JUN	11-85
CHECKED	
ISSUED	

NEXT ASSY	USED ON
	M300RT
	M100DC
APPLICATION	

VALUE ELECTRONICS, INC. [illegible] HAMILTON [illegible] • MENLO PARK, CALIFORNIA 94025 • (415) 322-0711

ASSEMBLY PCB
A53 HIGH VOLTAGE DOUBLER/RECTIFIER

SIZE	FSCM NO.	DWG. NO.	REV.
A		00394-0[illegible]	A

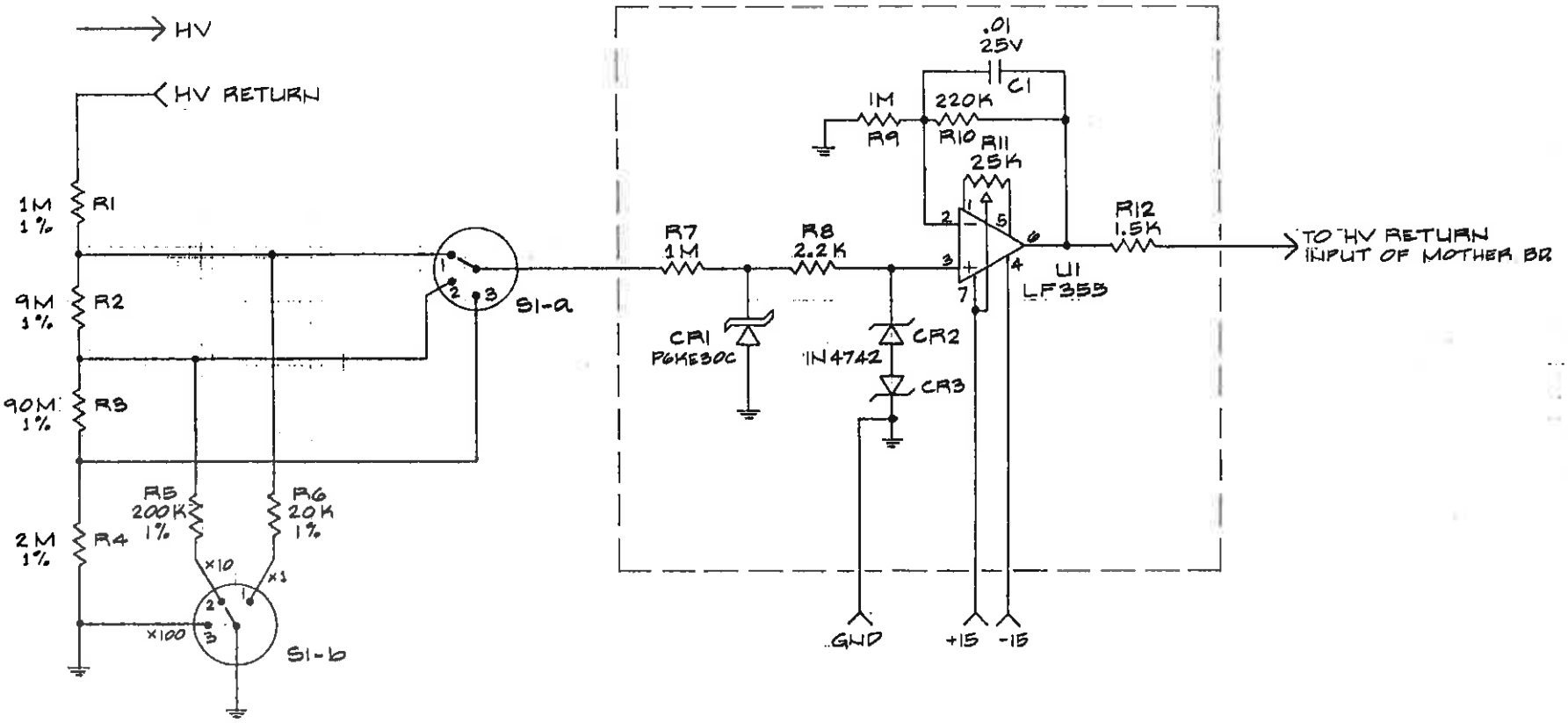
SCALE 1X SHEET 1 OF 1

www.valuetronics.com

DWG. NO.	SH	REV.

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	5-17-84	BILL



PARTS LIST

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

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 JUN	5-17-84
CHECKED	
ISSUED	

NEXT ASSY	USED ON
00454-02	M300RT

APPLICATION

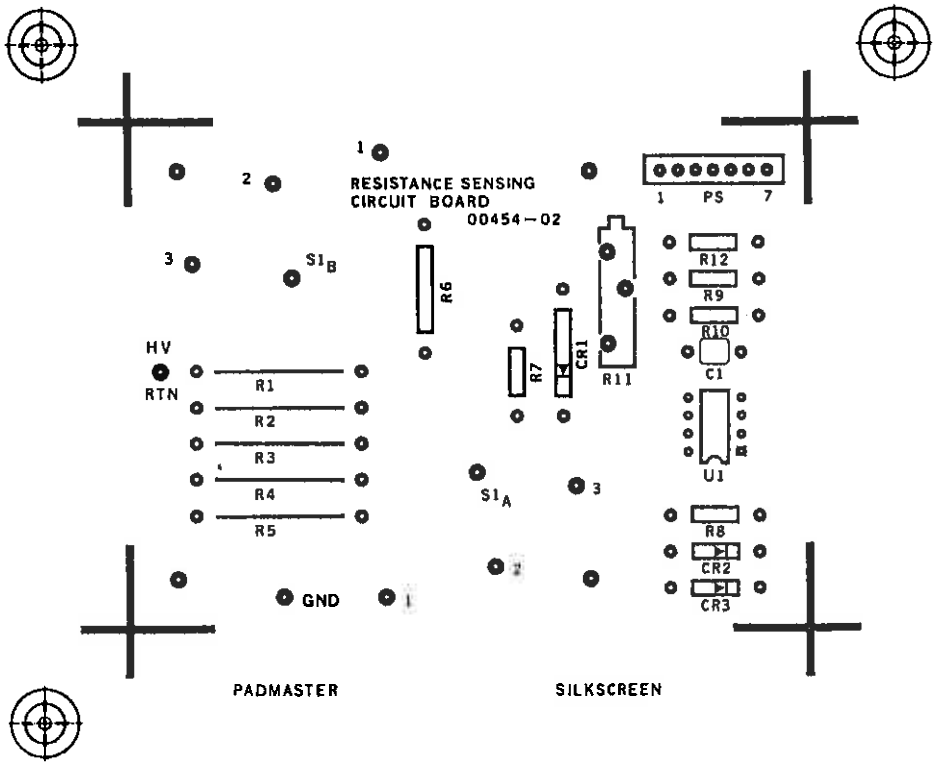
RDI ELECTRONICS, INC. 1080 HAMILTON COURT • MENLO PARK, CALIFORNIA 94025 • (415) 323-0711

SCHEMATIC A60
RESISTANCE SENSING
CIRCUIT BOARD

SIZE	FSCM NO.	DWG. NO.	REV.
B		00454-01	A

SCALE —— SHEET 1 OF 1

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NOTES:

1. REFERENCE SCHEMATIC DRAWING # 00454-01
2. SEE PARTS LIST # 00454-02.

M300RT

ROD-L ELECTRONICS, INC.

ASSEMBLY A60
RESISTANCE SENSING
CIRCUIT BOARD

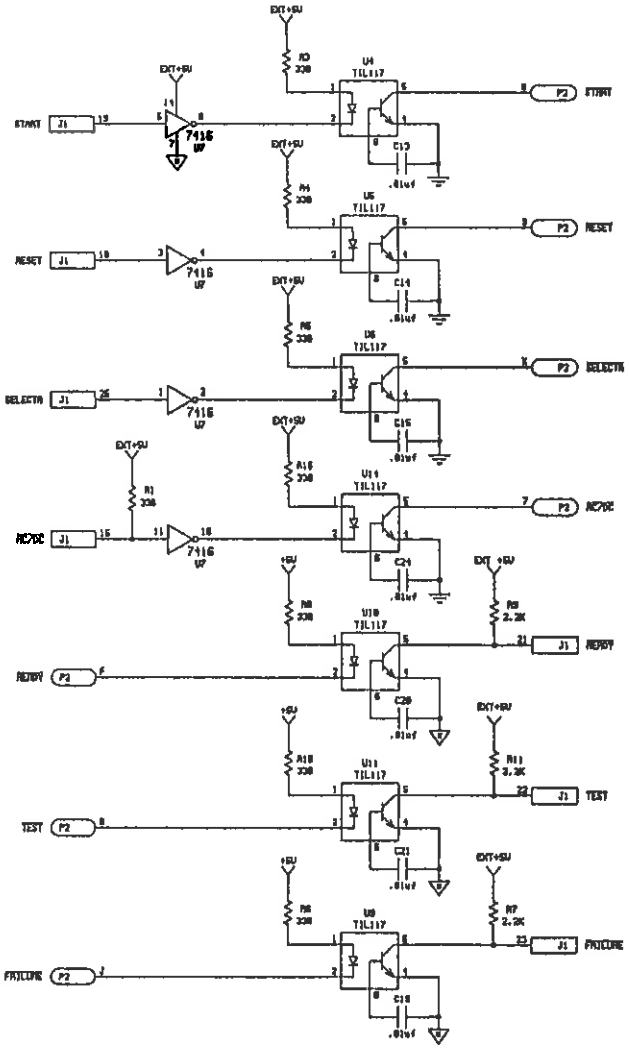
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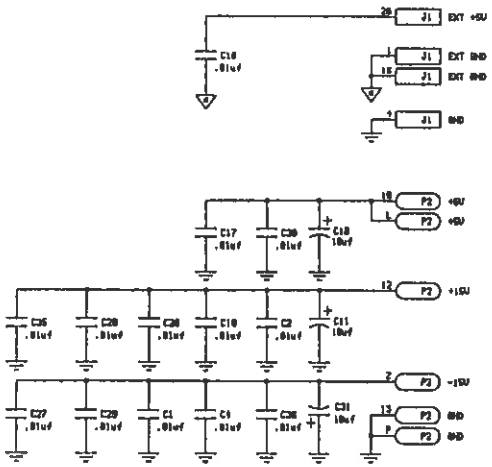
SCALE 2X | SHEET 1 OF 1

DRAWN JUN 3-85

DO NOT SCALE DRAWING

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REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED

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

VALUE ELECTRONICS, INC.

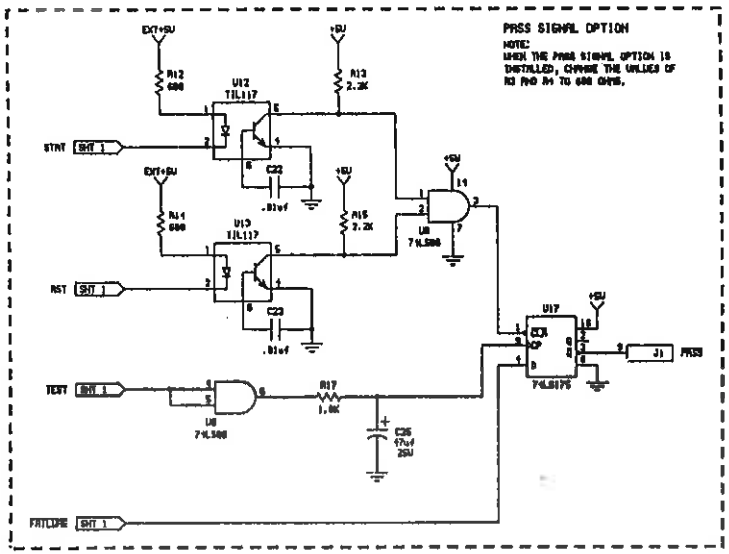
SCHEMATIC
A19 OPTION 01 DIGITAL REMOTE CONTROL

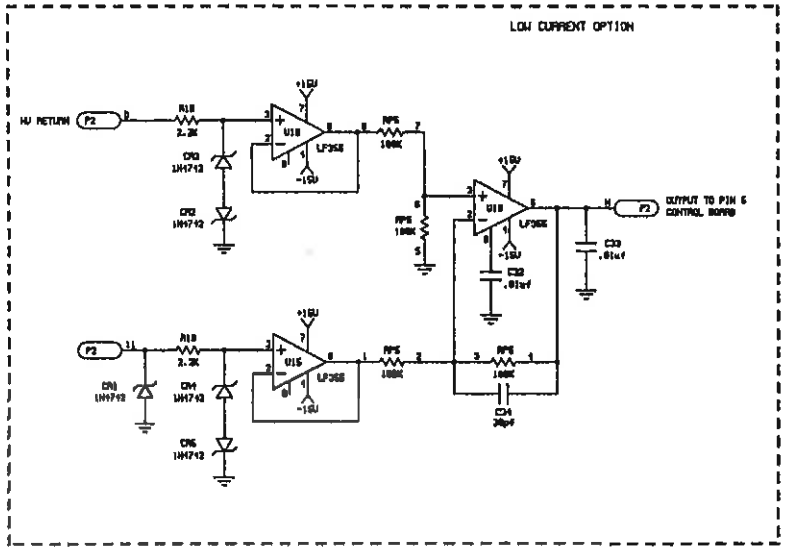
SIZE	FSCM NO.	DWG. NO.	REV.
C		01306-02	B

SCALE NTS | SHEET 1 OF 3

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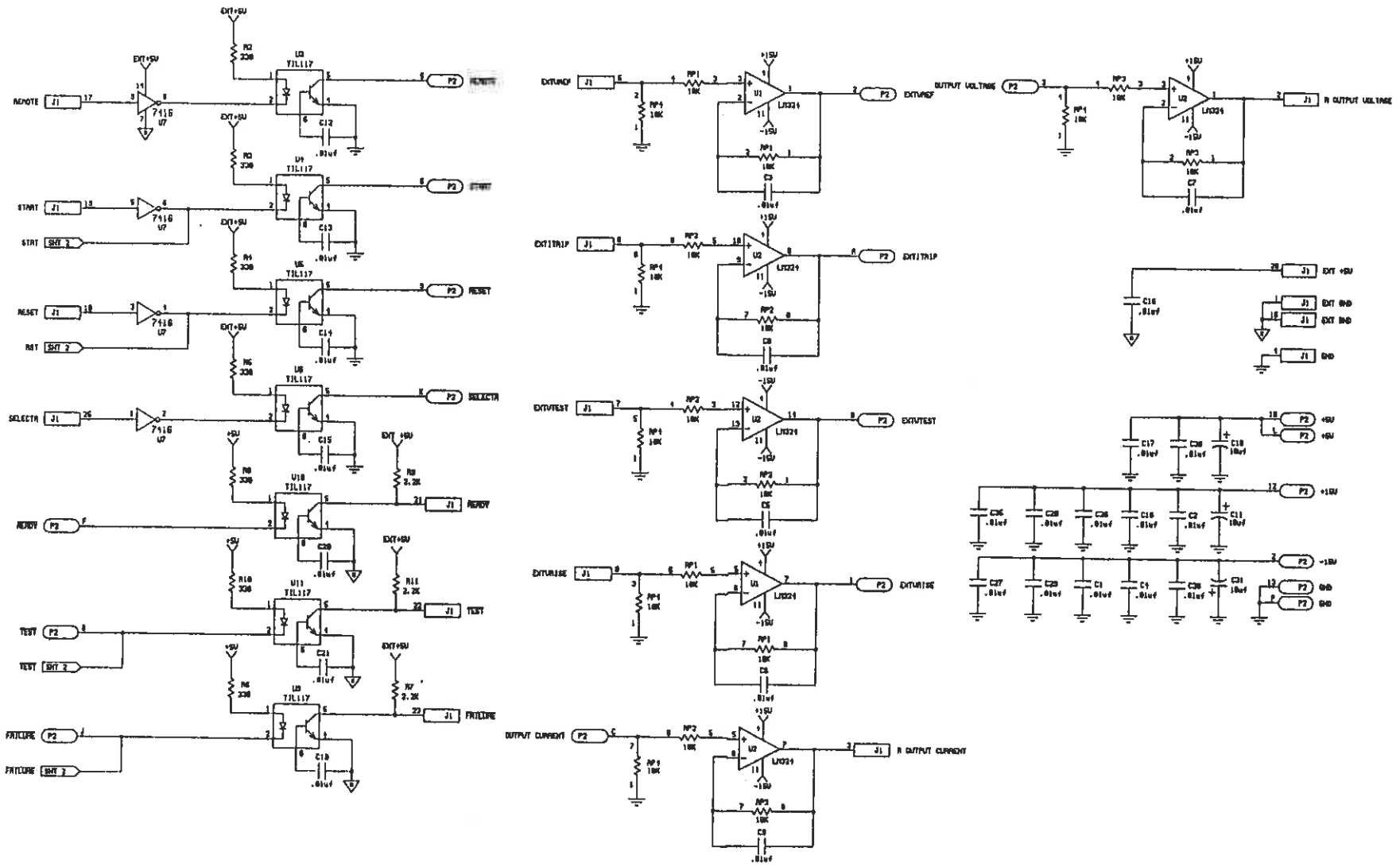
REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED





UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±	CONTRACT NO.	ROD-L ELECTRONICS, INC. 1800 HAMILTON BLVD. • MENLO PARK, CALIFORNIA 94025 • (415) 329-8711	
MATERIAL	APPROVALS / DRAWN SMITH	DATE 5-90	SCHEMATIC R19 OPTION PASS SIGNAL AND 89 LOW CURRENT
FINISH	DESIGNED		SIZE C / FSCM NO. / DWG. NO. 01306 / REV. B
NEXT ASSY USED ON / APPLICATION	CHECKED		SCALE / SHEET 2 OF 3
DO NOT SCALE DRAWING	ISSUED		

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NEXT ASSY	USED ON				
APPLICATION		DO NOT SCALE DRAWING			

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

MATERIAL

FINISH

CONTRACT NO.

APPROVALS	DATE
DRAWN SMITH	5-90
DESIGNED	
CHECKED	
ENGR	

R-D-L ELECTRONICS, INC.

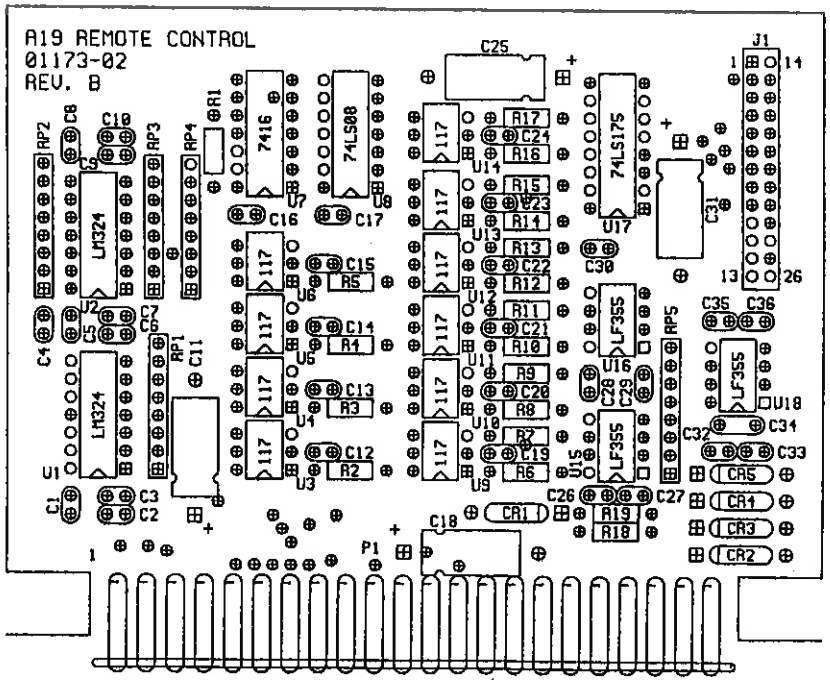
SCHEMATIC
A19 OPTION 19 DIGITAL AND ANALOG
REMOTE CONTROL

SIZE	FSCM NO.	DWG. NO.	REV.
C		01306-02	B

SCALE NTS SHEET 3 OF 3

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REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED



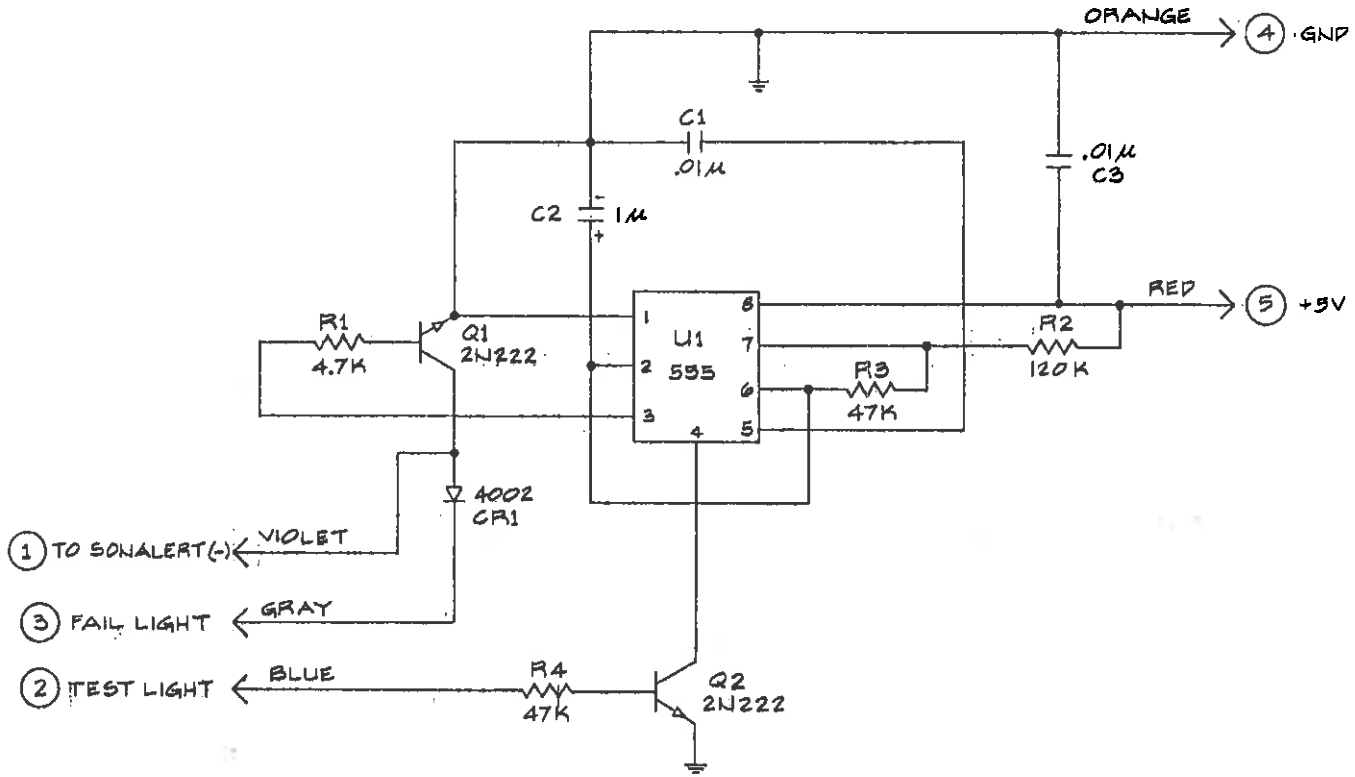
UNLESS OTHERWISE SPECIFIED DIMENSIONING ARE IN INCHES TOLERANCES ARE: FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±	CONTRACT NO.	R-D-L ELECTRONICS, INC.	
MATERIAL	APPROVALS	DATE	ASSEMBLY DRAWING A19 REMOTE CONTROL
FINISH	DRAWN SMITH	4-90	
NEXT ASSY	USED ON	DESIGNED	
APPLICATION	DO NOT SCALE DRAWING	CHECKED	SIZE C / FSCM NO. / DWG. NO. 01 02 / REV. B
		ISSUED	SCALE 2x / SHEET 1 OF 1

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DWG. NO.	SH	REV.

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

NEXT ASSY | USED ON

APPLICATION

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN JJH	4-23-84
CHECKED WMoore	6/25/84
DESIGNED Ramon Alvarez	6/25/84
ISSUED	

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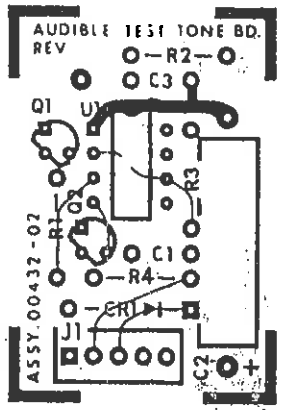
SCHEMATIC A27 PCBA
OPTION 10, AUDIBLE TEST TONE

SIZE	FSCM NO.	DWG. NO.	REV.
B		00432-01	

SCALE —— SHEET

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REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



PADMASTER COMPONENT SIDE

SILKSCREEN

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

CONTRACT NO.

APPROVALS	DATE
DRAWN LE	6/84
CHECKED	
ISSUED	

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ASSEMBLY A27 PCBA
OPTION 10 AUDIBLE TEST TONE

SIZE B | FSCM NO. | DWG. NO. OC 2-02 | REV.

SCALE 2 X | SHEET

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APPLICATION	DO NOT SCALE DRAWING

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