

and zero out the meter if needed.

- 6) Connect one lead to the RF302 ACTIVE ELECTRODE jack and the other lead to the PATIENT PLATE jack located above the ACTIVE ELECTRODE jack.
- 7) Measure and record the DMM reading on the RF302 CALIBRATION DATA SHEET under LOAD MEASURED. Repeat for each RANGE/LOAD selection.
- 8) Compare each reading with the limits shown in the following table:

<u>RANGE/LOAD</u>	<u>LIMITS</u>
50W/50 ohms	49.0 - 51.0 ohms
100W/100 ohms	98.5 - 101.5 ohms
300W/100 ohms	98.5 - 101.5 ohms
300W/200 ohms	198.0 - 202.0 ohms
300W/300 ohms	297.0 - 303.0 ohms
500W/400 ohms	396.0 - 404.0 ohms
500W/500 ohms	495.0 - 505.0 ohms
- 9) Slide the OPEN CIRCUIT/RF LEAKAGE Switch to TEST. The DMM should read overrange or infinite resistance.
- 10) Set RF302 Function Switch to ACTIVE ELECTRODE and move the lead in the PATIENT PLATE jack to the GROUND jack. The DMM should read overrange.
- 11) Slide the ACTIVE ELECTRODE/RETURN FAULT Switch to TEST. The DMM should read 200 +/- 10 ohms. Record on the data sheet.
- 12) Set the RF302 Function Switch to PATIENT PLATE. Move the lead in the ACTIVE ELECTRODE jack to the PATIENT PLATE jack. The DMM should read 200 +/- 10 ohms. Record on the data sheet.
- 13) Set the RF302 Function Switch to CHASSIS. Move the lead in the

- 13) Set the RF302 Function Switch to CHASSIS. Move the lead in the PATIENT PLATE jack to the CHASSIS jack. The DMM should read 200 +/- 10 ohms. Record on the data sheet.
- 14) Connect the DMM leads between the two black PATIENT PLATE jacks. The DMM should read 24.6 +/- 1.2 ohms. Record on the data sheet.
- 15) Press the PUSH FOR REM TEST Switch. The DMM should read 137.0 +/- 6.8 ohms. Record on the data sheet.
- 16) Disconnect the DMM from the RF302.
- 17) Connect the Capacitor Analyzer between the ACTIVE ELECTRODE and GROUND jacks.
- 18) Set the RF302 Function Switch to RETURN FAULT. Slide the ACTIVE ELECTRODE/RETURN FAULT and the OPEN CIRCUIT/RF LEAKAGE switches to their TEST positions.
- 19) The Capacitor Analyzer should read 150 +/- 30 pF. Record the capacitance value on the data sheet.
- 20) Disconnect the Capacitor Analyzer from the RF302.
- 21) The following tests are performed using the Electrosurgery Machine, the True RMS Voltmeter, the Current Transformer and the Explosion Proof Foot Switch. Set up above test equipment as shown in Figure 7 on Page 33.
- 22) Set the RF302 Function Switch to OUTPUT POWER. Set the RF302 Range Switch to 50 WATTS/50 OHMS.
- 23) Calculate the amount of current that is required to give a 40-WATT reading on the 50 WATT scale on the RF302 meter. Use the following formula:

$$I = \sqrt{40/R}$$

Where:

I = The current needed for a 40 Watt Meter Reading

R = The measured resistance of the 50 OHM Load

- 24) Power up all the instruments in the test set up. The current transformer has a 0.1 volt/amp output. Therefore, the meter readings will need to be multiplied by 0.1 to get the current readings.
- 25) Set the CUT and COAG Controls to the minimum levels. Depress the CUT Foot Pedal and slowly turn the CUT level control until the RF302 reads 40 WATTS on the 50 WATT scale. Observe the reading on the True RMS Voltmeter. Return the CUT level control to the minimum level.
- 26) If the measured current is within 1% of the calculated current, no adjustment should be necessary. Skip steps 27 and 28 and proceed to step 29.
- 27) If the measured current is too low, then the RF302 meter is reading too high. Locate RT1 on the PCB on the back of the meter and turn the potentiometer counter-clockwise to decrease the RF302 meter reading. Repeat steps 25, 26 and 27 until the measured current is within 1% of the calculated current.
- 28) If the measured current is too high, then the RF302 meter is reading too low. Turn the potentiometer clockwise to increase the RF302 meter reading. Repeat steps 25, 26 and 28 until the measured current is within 1% of the calculated current.
- 29) Refer to the RF302 CALIBRATION DATA SHEET. Notice that each RANGE/LOAD SETTING has three meter readings (LO CUT, HI CUT and COAG). These are

Required Equipment

- 1) Digital Multimeter (DMM): 5 1/2 digits, .1% ohms accuracy (Keithly 191, Fluke 8842A, or equivalent)
- 2) True RMS Voltmeter (Fluke 8920A or equivalent)
- 3) Current Transformer (Pearson Model 411 or equivalent)
- 4) Electrosurgery Machine (Valleylab SSE2K or equivalent)
- 5) RF302 Test Leads
- 6) Capacitor Analyzer (Sencore CA55 or equivalent)
- 7) Oscilloscope
- 8) BNC to BNC Cables (2)
- 9) Explosion Proof footswitch for Electrosurgery Machine
- 10) Calculator
- 11) Small Standard Screwdriver

Procedure:

- 1) Remove the four screws from the top panel and lift the RF302 Assembly from the case.
- 2) Mechanically zero the RF302 meter with the small screwdriver.
- 3) Verify the fuse in the RF302 fuseholder is rated for .375 amperes.
- 4) Set the RF302 Function Switch to OUTPUT POWER. Set the Range Switch to the 50 ohm load.

NOTE: An RF302 PERFORMANCE CHART on page 57 is provided to assist the RF302 user in recording performance specifications. Copy this form for your convenience.

- 20) Record the voltage reading under **VOLTAGE APPLIED** of the RF302 PERFORMANCE CHART for the 300/100 SETTING. Record the RF302 reading under **METER READING** of the RF302 PERFORMANCE CHART. The first number (300) indicates the meter scale that the **METER READING** is taken. Repeat this step for the rest of the **RANGE/LOAD** settings.
- 21) Calculate the Correct Meter Reading (CMR) for each **RANGE/LOAD** setting by using the following formula:

$$CMR = V^2 / R.$$

Where:

CMR = the Correct Meter Reading.

V^2 = the square of the AC voltage of the power source.

R = the resistance at which the **RANGE/LOAD** Switch is set.

- 22) Compare the CMR with the **METER READING**. If all **METER READINGS** are within tolerance, the RF302 is performing within its published specifications. If any readings are out of tolerance, the RF302 should be recalibrated.

CALIBRATION PROCEDURE

This section describes the procedure for a full calibration of the Model RF302 (see Calibration Data Sheet on page 56 - and copy it for your convenience).

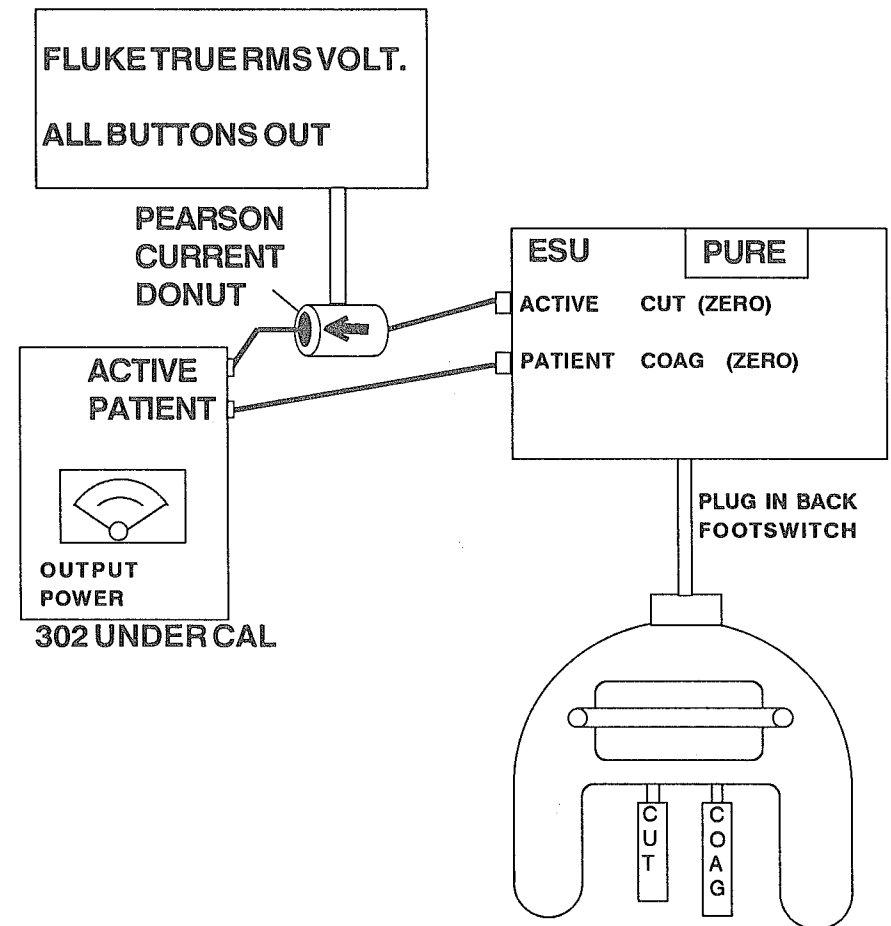


Figure 7. RF 302 / ESU wiring configuration

the RF302 meter readings that you will set the meter to when taking readings on the True RMS Voltmeter.

- 30) Start with the 50 WATT/50 OHM SETTING and adjust the Electrosurgery Unit's CUT control for a 10 WATT reading on the RF302 50 WATT scale. Record the current reading on the True RMS Voltmeter (remember to multiply by 0.1). Return the CUT level control to the minimum level.

- 31) Repeat the above step for each RANGE/LOAD SETTING and ESU SETTING outlined on the RF302 CALIBRATION DATA SHEET.
- 32) Calculate the APPLIED POWER for each set of data by using the following formula:

$$P = I^2 R$$
 Where:

 P = the applied power.
 I^2 = the square of the measured current.
 R = the resistance at which the RANGE/LOAD Switch is set.
- 33) Compare the APPLIED POWER with each METER READING. All readings should be within the LIMITS shown on the data sheet.
- 34) Connect the oscilloscope to the SCOPE BNC jack on the RF302 with a BNC to BNC cable.
- 35) Select the 100 WATT/100 OHM SETTING on the RF302.
- 36) Adjust the CUT Level Control on the Electrosurgery Unit until the meter reads 40 WATTS.
- 37) Adjust the oscilloscope to view a waveform of 50 mVpp +/- 10 mVpp.
- 38) Press the PUSH FOR 0-50 KHZ RESPONSE Switch. The meter should read zero.
- 39) Switch the RF302 Function Switch to ACTIVE ELECTRODE.

- 8) Slide the ACTIVE ELECTRODE/RETURN FAULT Switch to TEST. The DMM should read 200 +/- 10 ohms.
- 9) Set the RF302 Function Switch to PATIENT PLATE. Move the lead in the ACTIVE ELECTRODE jack to the PATIENT PLATE jack. The DMM should read 200 +/- 10 ohms.
- 10) Set the RF302 Function Switch to CHASSIS. Move the lead in the PATIENT PLATE jack to the CHASSIS jack. The DMM should read 200 +/- 10 ohms.
- 11) Connect the DMM leads between two black PATIENT PLATE jacks. The DMM should read 24.6 +/- 1.2 ohms.
- 12) Press the PUSH FOR REM TEST Switch. The DMM should read 137.0 +/- 6.8 ohms.
- 13) Disconnect the DMM from the RF302.
- 14) Verify the fuse in the RF302 fuseholder is rated for .375 amperes.
- 15) Mechanically zero the RF302 meter with the small screwdriver.
- 16) Set the RF302 Function Switch to OUTPUT POWER. Set the RF302 Range Switch to 300 WATTS/100 OHMS.
- 17) Connect the red and black RF302 Test Leads to the red (ACTIVE ELECTRODE) and black (PATIENT PLATE) banana jacks on the RF302 front panel.
- 18) Set the DMM for measuring 120 volts AC. Attach the DMM leads to a 120 AC volt power supply.
- 19) Connect the red and black leads to the 120 AC volt power source.

WARNING: This connection should be fused with a 2-AMP fast-blow fuse.

- 4) Calculator
- 5) 120 Volt AC Power Supply (Fused for 2 amperes)

Procedure:

- 1) Set the RF302 Function Switch to OUTPUT POWER and the RF302 Range Switch to the 50 WATT / 50 OHM Setting.
- 2) Set the DMM to the 2K OHMS range. Short out the test leads and zero out the meter if needed.
- 3) Connect one lead to the RF302 ACTIVE ELECTRODE jack and the other lead to the PATIENT PLATE jack located above the ACTIVE ELECTRODE jack.
- 4) Measure and record the DMM reading on the RF302 PERFORMANCE CHART under LOAD MEASURED. Repeat for each RANGE/LOAD selection.
- 5) Compare each reading with the limits shown in the following table:

<u>RANGE/LOAD</u>	<u>LIMITS</u>
50W/50 ohms	49.0 - 51.0 ohms
100W/100 ohms	98.5 - 101.5 ohms
300W/100 ohms	98.5 - 101.5 ohms
300W/200 ohms	198.0 - 202.0 ohms
300W/300 ohms	297.0 - 303.0 ohms
500W/400 ohms	396.0 - 404.0 ohms
500W/500 ohms	495.0 - 505.0 ohms

- 6) Slide the OPEN CIRCUIT/RF LEAKAGE Switch to TEST. The DMM should read overrange or infinite resistance.
- 7) Set the Function Switch to ACTIVE ELECTRODE and move the lead in the PATIENT PLATE jack to the GROUND jack. The DMM should read overrange.

- 40) Connect the Patient Plate from the Electrosurgery Unit to the RF302 GROUND jack and the Active Electrode from the Electrosurgery Unit to the RF302 ACTIVE ELECTRODE jack. Slide the ACTIVE ELECTRODE Switch to TEST.
- 41) Depress the CUT foot switch and adjust the CUT Level Control until the meter reads 300 mA on the 500 mA scale. Measure and compare to the RMS Voltmeter reading. The meter should read within +/- 25 mA.
- 42) Move the lead in the RF302 ACTIVE ELECTRODE jack to the RF302 PATIENT PLATE jack. Repeat step 41 for Patient Plate.
- 43) Move the lead in the RF302 PATIENT PLATE jack to the RF302 CHASSIS jack. Repeat step 41 for Chassis.

Calibration of the RF302 is now complete.

TROUBLESHOOTING GUIDE

The following guide is included to aid in troubleshooting the RF302.

- 1) No Meter Readings - This problem is usually caused by either a blown fuse or a faulty thermocouple ammeter. First, check the .375 Amp fuse. The fuse should be checked with an ohmmeter if possible. The resistance of the fuse should be less than 1.5 ohms. If the fuse is bad, replace with a 8AG .375 Amp ultra fast fuse (BIO-TEK part No. 46047).

WARNING: Do not replace with a higher value fuse. Using a higher value fuse may damage the RF302.

Next, check the thermocouple ammeter. The meter should be checked with an ohmmeter. The resistance between the terminals of the meter should be less than 1.5 ohms. If the meter is bad,

replace with a new meter (BIO-TEK part no. 3020505).

2) **Open Circuit RF Leakage Switch Does Not Work** - This problem is usually caused by the reed switch contacts being welded closed. To check this switch, set the Function Switch to OUTPUT POWER and connect an ohmmeter between the ACTIVE ELECTRODE and PATIENT PLATE jacks. The ohmmeter should read the resistance of the RANGE/LOAD SETTING. Next, slide the switch to TEST. The ohmmeter should read overload. A visual inspection can be used to verify that the switch is bad. Replace with a new reed switch (BIO-TEK part no. 56001).

3) **Return Fault/Active Electrode Switch Does Not Work** - This problem is usually caused by the reed switch contacts being welded closed. To check this switch, set the Function Switch to ACTIVE ELECTRODE and connect an ohmmeter between the ACTIVE ELECTRODE and GROUND jacks. The ohmmeter should read overrange. Slide the switch to TEST. The meter should now read about 200 ohms. A visual inspection can be used to verify that the switch is bad. Replace with a new reed switch (BIO-TEK part no. 56001).

4) **Resistances Read Too High at All Range/Load Settings** - Check the fuse and the ammeter. Refer to the above section on NO METER READINGS. If the fuse and meter are good, refer to page 2 of the schematic. This page shows a schematic for each RANGE/LOAD SETTING. Parts common to all RANGE/LOAD settings include S3, R11 and contacts 21 to 26 and 31 to 36 of S2. Refer to the Bill of Materials for the correct BIO-TEK part number.

5) **Range/Load Setting Resistances Out of Tolerance** - Refer to page 2 of the schematic for the RANGE/LOAD SETTING that is tolerance. The resistors and switch contacts are shown for each RANGE/LOAD SETTING. Check all components for the defective load. Refer to the Bill of Materials for the BIO-TEK part number.

REM CIRCUIT*

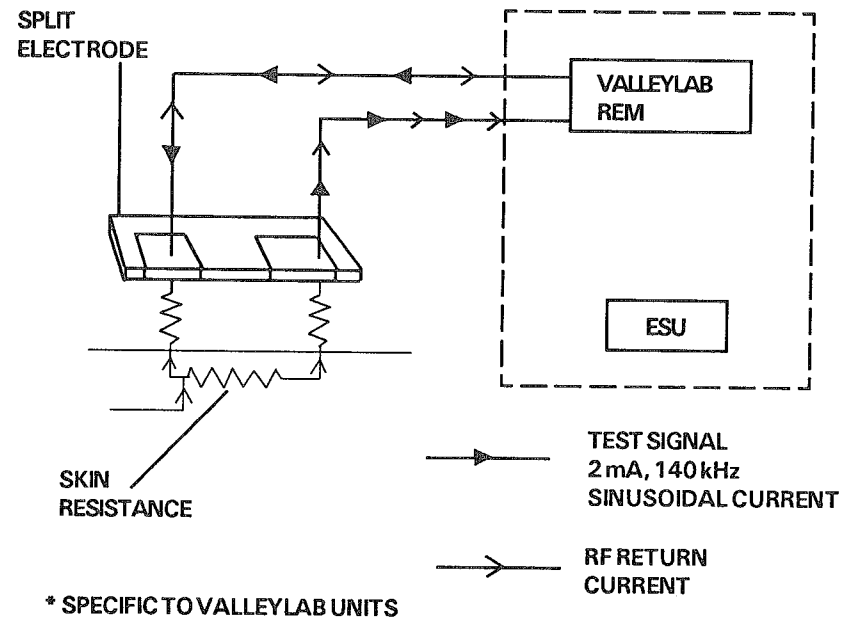


Figure 6. REM Circuit (Specific to Valleylab)

PERFORMANCE CHECK

This section describes the procedure for a performance check of the Model RF302.

Required Equipment :

- 1) Digital Multimeter (DMM): 5 1/2 digits, 0.1% ohms accuracy (Keithly 191, Fluke 8842A, or equivalent)
- 2) RF302 Test Leads
- 3) Small Standard Screwdriver

The Model RF302 is able to verify proper operation of Return Electrode Monitor (REM) systems. Typically, there are two patient plate electrode inputs on ESUs instead of one. This circuit should alarm only if the patient electrode loses sufficient patient contact (see Figure 6 on the following page). To test this system, the Model RF302 increases the resistance between the two return plates thereby simulating a loose patient plate.

- 1) Set up the ESU and the Model RF302 as instructed in the Section titled SETUP
- 2) Use an actual REM patient plate connected to the ESU. Cut off the plate and expose the two wires.
- 3) Connect the first black lead to either exposed wire with an alligator clip.
- 4) Connect the second black lead to the black banana jack marked PATIENT PLATE on the upper right hand corner of the Model RF302 front panel.
- 5) Attach a small alligator clip to the end of the black lead.
- 6) Connect this alligator clip (black lead) to the other exposed wire.
- 7) Switch the ESU power ON and apply 100 watts of power.
- 6) To test, press the REM TEST button.

TECHNICAL CIRCUIT DESCRIPTION

(Refer to Block Diagram on pg. 39)

Inputs - The electrical input signal to the RF302 measurement circuits consist of the ACTIVE Electrode input and one of three return paths; Ground, Chassis, or Patient Plate. The Patient Plate return path is the only return used when measuring output power. The others are used for leakage measurements.

When measuring RF Leakage, switch S6 is used to open the ACTIVE input path. Any power reading shown on the meter during RF leakage measurements is leakage current to earth ground. The second Patient Plate jack is used for testing REM circuits. The REM test is enabled by switch S4 which places parallel resistors R13 (30 Ohm 5W) and R14 (137 Ohm 25W) between the two patient plates. Capacitor C3 (150pF 3kV) and switch S5 in conjunction with S6 is used for Return Fault Verification. In this test, the ESU should sense this high capacitance between the active electrode, ground and alarm.

Loads & Ranges - Switch S1 (A&B) is used to select the appropriate test loads for output power. The loads consist of R1 thru R11. The loads for measuring RF leakage consist of R12 (105.5 Ohm) and R11 (95 Ohm). Switch S2 (A,B,C) is used to select the appropriate leakage paths. For chassis and patient plate leakages, switch S2 (A,B,C) in conjunction with switch S5 and S6 is used for the Active Electrode and Return Fault leakages. All leakage measurements are referenced to ground.

Low Pass Filter - The low pass filter consists of L1, L2 and L3, C1 and C2 and is actuated by switch S3. This filter sets a cutoff of 50 kHz.

Meter Circuit - The voltmeter in the RF302 is a 0-10 mV fullscale voltmeter with an input impedance of approximately 4 ohms. Potentiometer RT1 is used to adjust the fullscale voltage presented to the meter.

Fuse Circuit - The fuse F1 in the RF302 is a ultra fast .375 Amp fuse. Any replacement must be made with a .375 Amp AGX type fuse to assure protection of the meter.

SERVICE INFORMATION

The BIO-TEK Model RF302 Electrosurgery Analyzer should be returned to the factory if repairs are required. Contact the BIO-TEK Service Department to receive a RETURN AUTHORIZATION NUMBER. Carefully pack the unit (in its original carton, if possible), insure it for full retail value, and return it to:

BIO-TEK Instruments, Inc.
Highland Park, Box 998
Winooski, VT 05404-0998
Attn: Service Department

1 (802) 655-4044, or
1(800) 242-4685
TELEX 94-0136 BIO TEK SHVT
FAX 1(802) 655-3399

SCHEMATICS

The following schematics and drawings should enable users familiar with electronic design to service and repair the Model RF302. All questions pertaining to the Model RF302 should be directed to the BIO-TEK Service Department.

NOTE: BIO-TEK continually upgrades its products when they are returned for service or repair. Be sure to request updated Schematics if you intend to perform any diagnostics or repairs following service/repair work performed by the BIO-TEK Service Department.

NOTE: Maximum amplitude can be obtained with the maximum output power from the ESU.

- 4) Record the peak voltage obtained on the oscilloscope as V_{peak}
- 5) Connect the DVM to the BNC output of the Model RF302 to measure the VAC with the DVM. Record the readings displayed on the DVM as V_{rms}

NOTE: Maintain the same output power level as in the preceding steps.

- 6) Substitute the test values into the Crest Factor equation given at the beginning of this section and calculate the Crest Factor.
- 7) For additional information on determining Crest Factors for the Model RF302, please call BIO-TEK toll free at: 1 (800) 451-5172.

RETURN FAULT TEST

The Model RF302 tests ESUs equipped with return fault interrupters. It does this by simulating a capacitance from active-to-ground and when activated, the ESU should alarm and disable. The Return Fault System is tested as follows:

- 1) Set up the ESU and Model RF302 as instructed in the Section titled SETUP
- 2) Turn the Model RF302 left selector knob (RF LEAKAGE) to RETURN FAULT.
- 3) Switch the ESU to ON and apply 100 watts of power.
- 4) Slide the RETURN FAULT and OPEN FAULT slide switches to the TEST position; the ESU should alarm and disable.

- 4) Adjust the signal to maximum amplitude and time for an effective analysis while using the maximum output power of the ESU.
- 5) Set the Model RF302 left selector knob (RF LEAKAGE) to OUTPUT POWER and the right selector knob (OUTPUT POWER) to the 500 ohm load for best resolution.

MEASURING CREST FACTORS

The oscilloscope output on the Model RF302 can be used to calculate Crest Factors. The following equipment should be assembled before beginning the procedure:

- 1) Oscilloscope: 1 MHz, VDC, and
- 2) Digital voltmeter (DVM): 1 MHz, VDC (true rms). (The DVM can be a unit such as the Fluke 8920A.)

The following equation is used to calculate the Crest Factor:

$$\text{Crest Factor} = \frac{V_{\text{peak}}}{V_{\text{rms}}}$$

where:

V_{peak} = peak voltage obtained on the oscilloscope
 V_{rms} = voltage root mean square measured as VAC.

- 1) Connect the oscilloscope to the BNC output connector (SCOPE) on the Model RF302 and then set the oscilloscope amplitude of 1 V/cm and the sweep speed of 1 microsecond/cm.
- 2) Connect the ESU to the Model RF302 as instructed in the section titled OUTPUT POWER MEASUREMENTS.
- 3) Adjust the signal on the oscilloscope to the maximum amplitude and time to effectively analyze the output power.

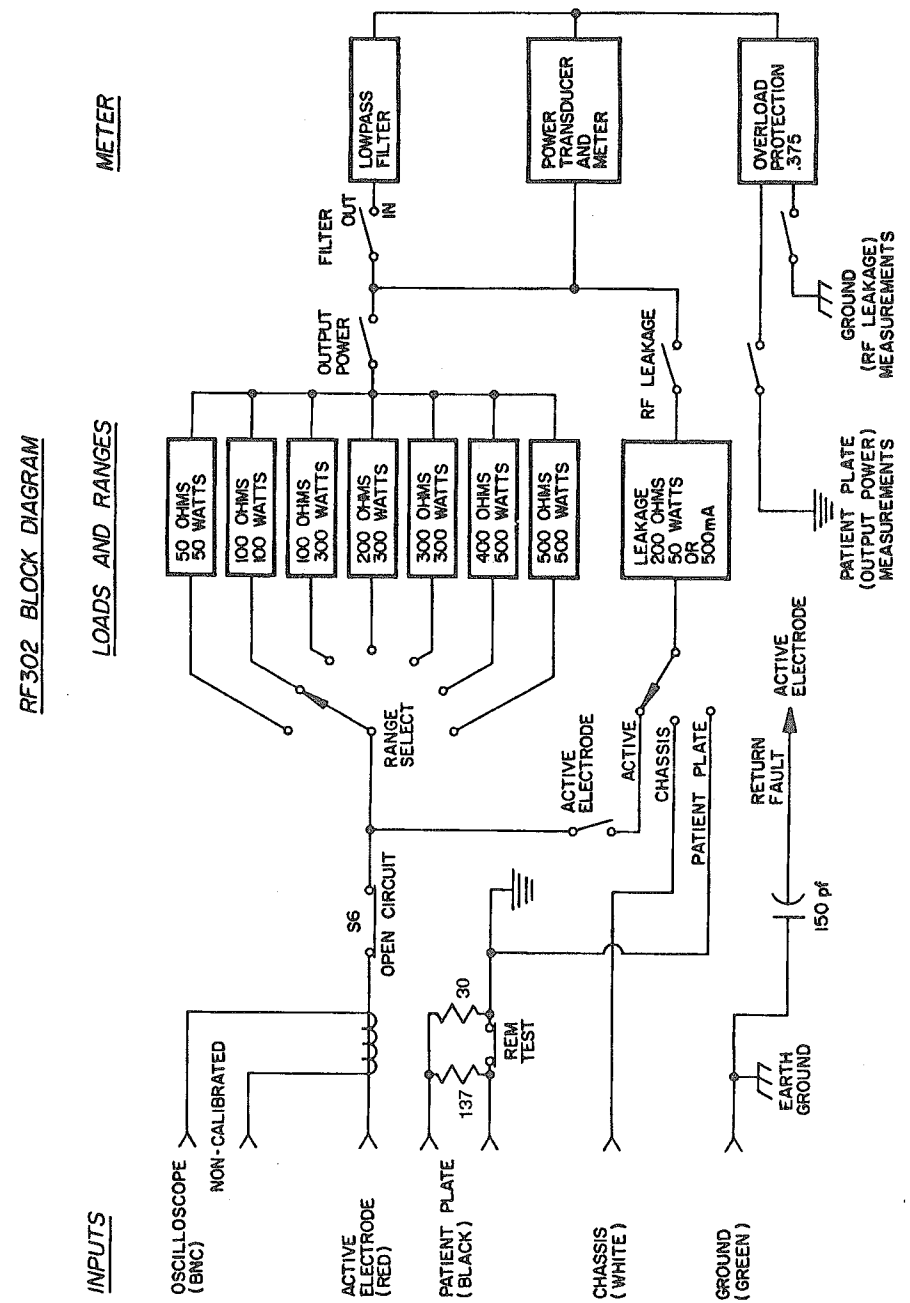


Figure 8. RF302 Block Diagram

MEASURING RF LEAKAGE-TO-GROUND CURRENT

The AC_{rms} current flow to ground during RF isolation testing can be approximated in the Model RF302 meter red mA scale. To achieve more accurate numbers, calculate current using Ohm's law with current equal to the square root of the power "P" divided by the resistance load "Z" such that:

$$I = \sqrt{P/Z}$$

Given a power reading of 4 watts, for example, the current is:

$$I = \sqrt{4/200}$$

$$I = \sqrt{0.02}$$

$$I = 141 \text{ mA.}$$

Table 3 on page 55 is a quick reference for any currents in milliamperes.

OSCILLOSCOPE OUTPUT

The Model RF302 is equipped with the BNC connection that is inductively coupled to a conductor inside the unit. This permits viewing of the waveform to verify proper operation of the ESU. The oscilloscope output is not calibrated for amplitude; however, precise frequency measurements can be made. To use the oscilloscope output:

- 1) Connect an oscilloscope to the output connector.
- 2) Set the amplitude selector of the oscilloscope on 1 V/cm.
- 3) Set the time sweep selector on the oscilloscope on 1 microsecond/cm.
- 4) Adjust the signal to maximum amplitude and time for an effective

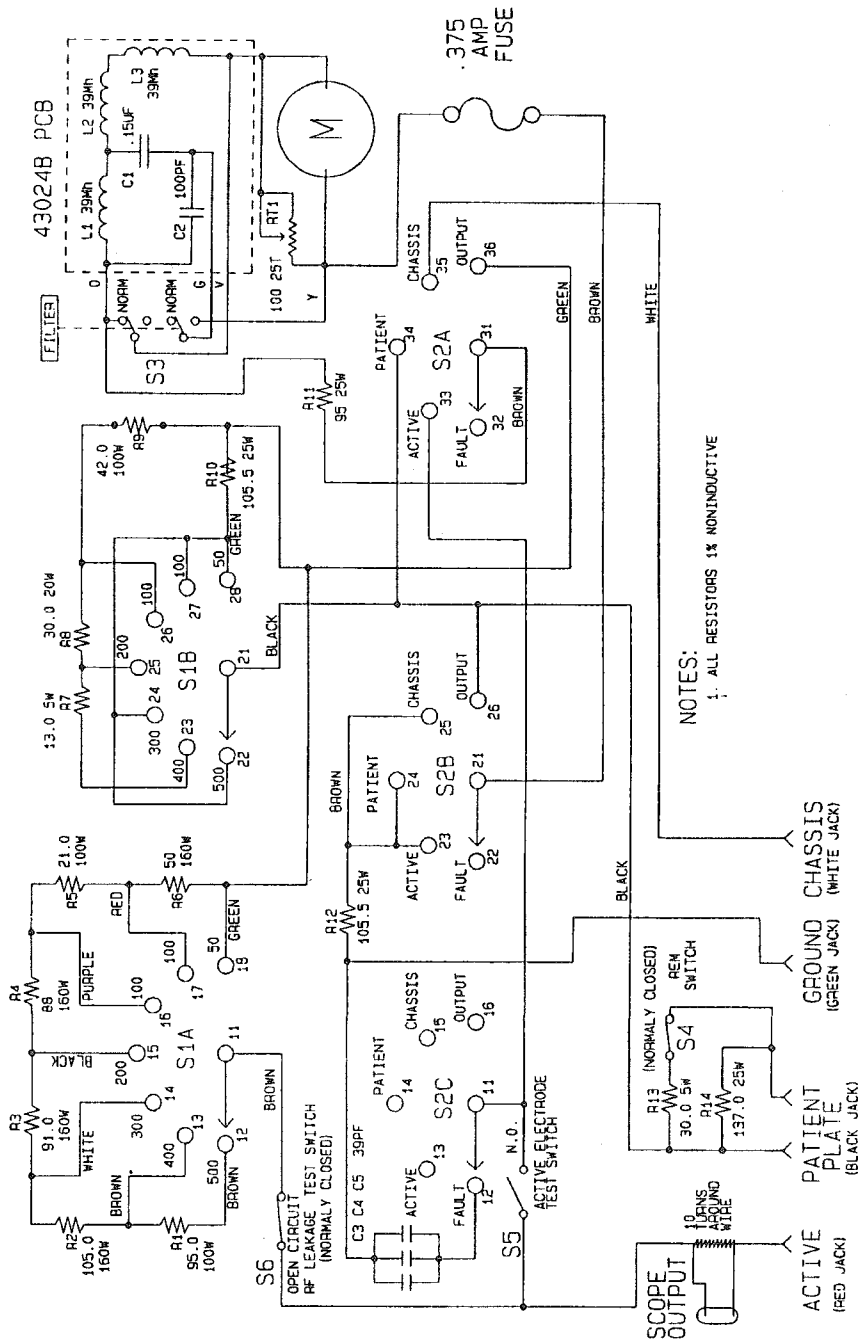


Figure 9A. RF302 Product Schematic

$$I = \sqrt{P/Z}$$

For example, given a power reading of 410 watts on the 500 ohm range, the current in Amperes is:

$$I = \sqrt{410/500}$$

$$I = \sqrt{0.82}$$

$$I = 0.906 A_{rms}$$

Table 1 on page 53 is a quick reference of many current levels.

MEASURING OUTPUT VOLTAGE

The AC_{rms} voltage of ESU's can be calculated. Table 2 on page 54 is a quick reference of many voltages. The output voltage is equal to the square root of the product of the power "P" and the load impedance "Z" such that:

$$V = \sqrt{P \times Z}$$

For example, for a given power reading of 410 W on the 500 ohm range, the voltage is:

$$V = \sqrt{410 \times 500}$$

$$V = \sqrt{205,000}$$

$$V = 452.8 V_{rms}$$

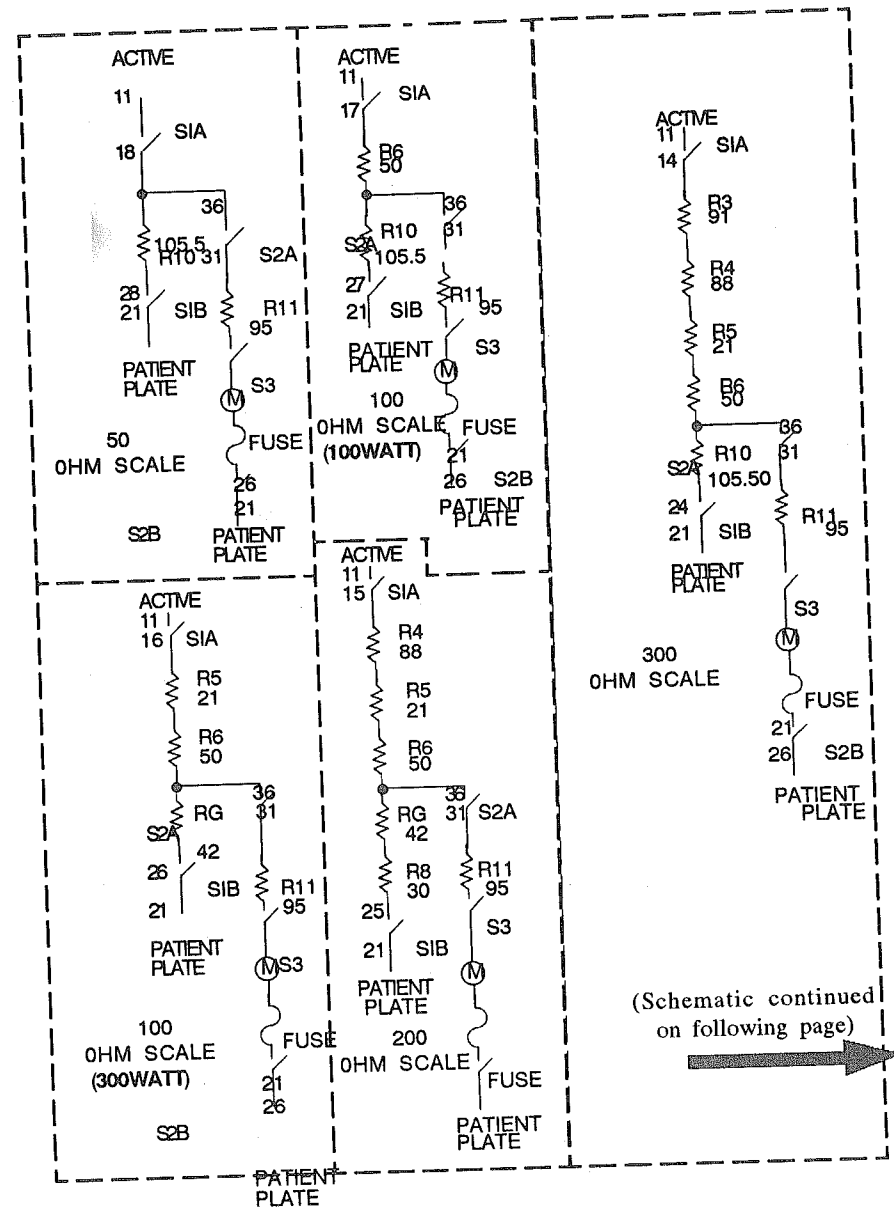


Figure 9B. RF302 Product Schematic (part 1 of 2)

(Schematic continued from previous page)

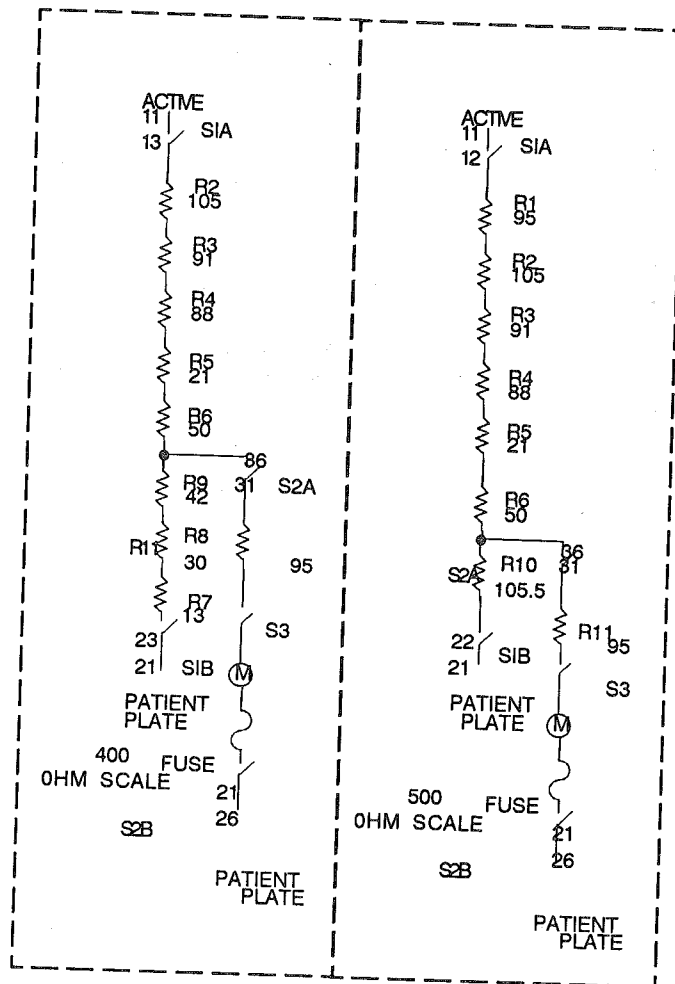


Figure 9B. RF302 Product Schematic (part 2 of 2)

DRAWING # 3020400-SC - REV E

10) Repeat the preceding Steps 4 through 8.

CAUTION: Do not perform the following Steps 11 through 15 unless the ESU has an isolated output. Proceed to Step 16 for non-isolated ESU's.

11) Set the Model RF302 left selector knob (RF LEAKAGE) to ACTIVE ELECTRODE.

Remove the patient plate lead and connect the active electrode lead.

12) Activate the CUT switch on the ESU.

13) Slide the OPEN CIRCUIT and ACTIVE ELECTRODE switches on the Model RF302 simultaneously. Read the leakage on the red mA scale or the 50 W scale.

14) Activate the COAG switch on the ESU and again perform Step 14, preceding.

15) If the maximum RF leakage is less than the manufacturer's specifications (or less than a preestablished limit), check OK on the RF3R tag. If not, the ESU needs to be serviced.

MEASURING OUTPUT CURRENT

The Model RF302 reads power output in watts of ESU's. If the root mean square (rms) current is desired, it can be calculated as described in the following paragraphs.

The current I is equal to the square root of the power P divided by the load impedance Z such that:

- 1) Remove all test leads except for the test being performed (i.e. chassis lead and ground lead for chassis test).

Set the Model RF302 right selector knob (OUTPUT POWER) to the load recommended by the manufacturer.

- 2) Set the power setting of the ESU to the maximum setting.
- 3) Set the Model RF302 left selector knob (RF LEAKAGE) to CHASSIS.

Remove all test leads except the chassis lead and the ground lead.

- 4) Turn the ESU ON.
- 5) Activate the CUT switch on the ESU. Read the leakage on the red mA Scale or the 50 W scale of the Model RF302.
- 6) With the CUT switch on the ESU activated, slide the OPEN CIRCUIT switch on the Model RF302 to test RF leakage under open circuit conditions.
- 7) Activate the COAG switch on the ESU. Read the leakage on the red mA scale or the 50 W scale of the Model RF302.
- 8) With the COAG switch on the ESU activated, slide the OPEN CIRCUIT switch on the Model RF302 to test RF leakage under open circuit conditions.
- 9) Set the Model RF302 left selector knob (RF LEAKAGE) to PATIENT PLATE.

Remove the chassis lead and connect the patient plate lead.

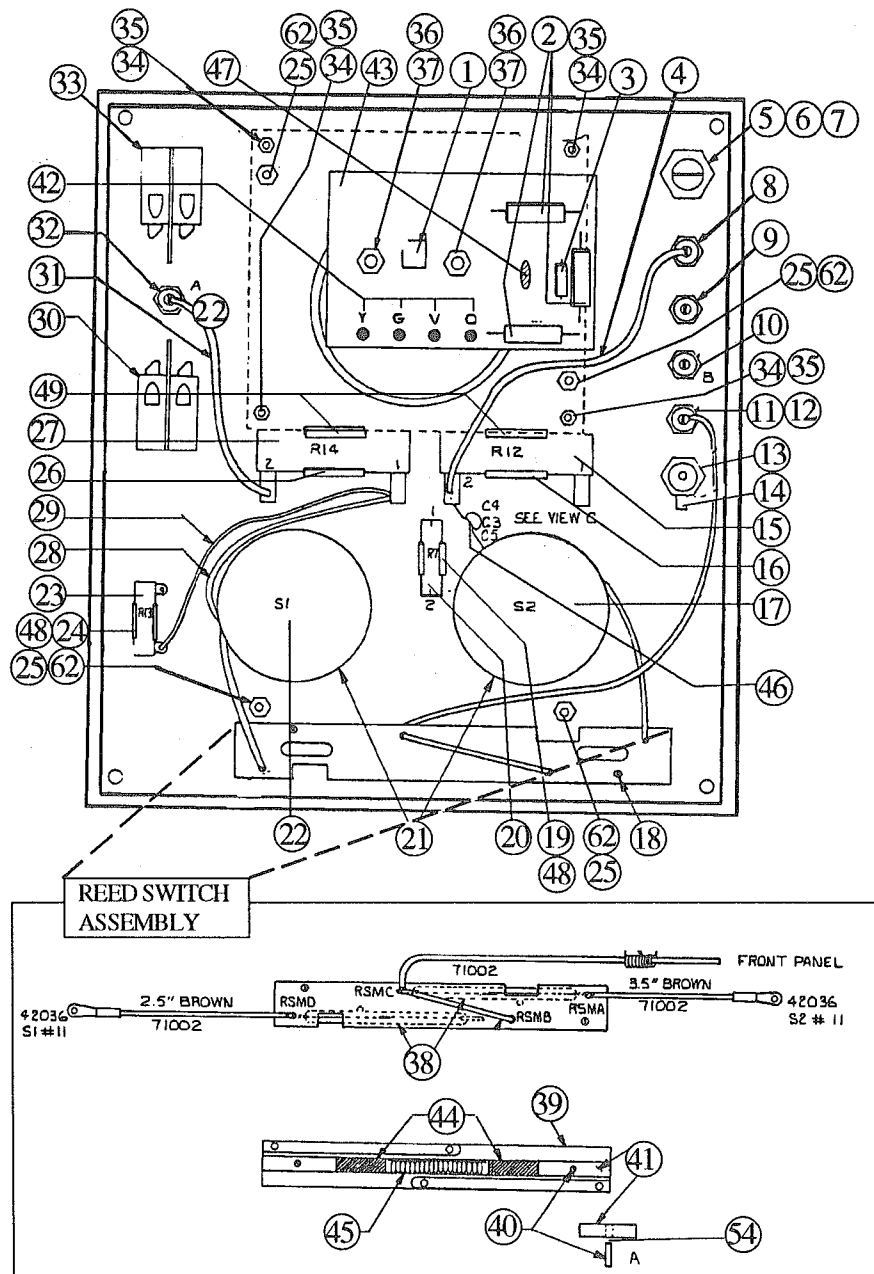
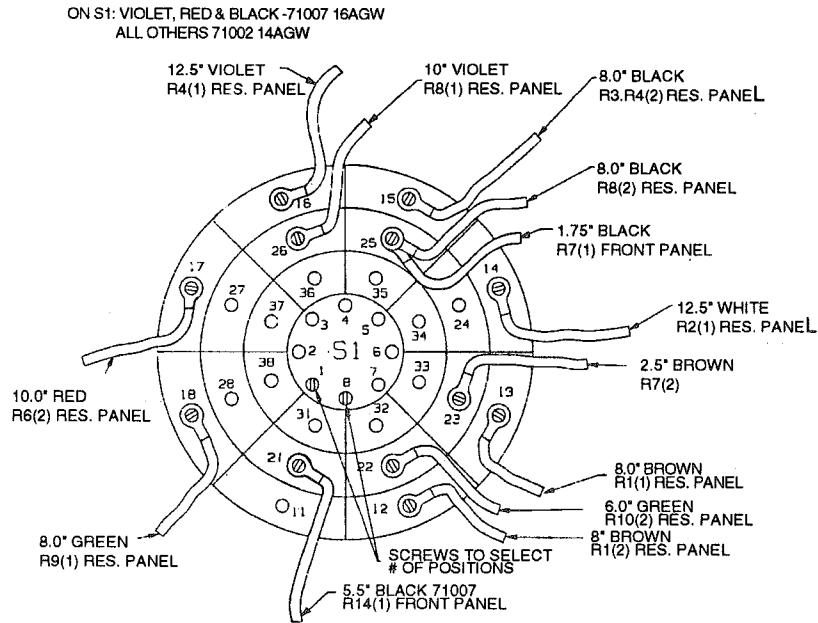


Figure 10A. Front Panel Assembly (1 of 3)

Selector Switch S1



Selector Switch S2

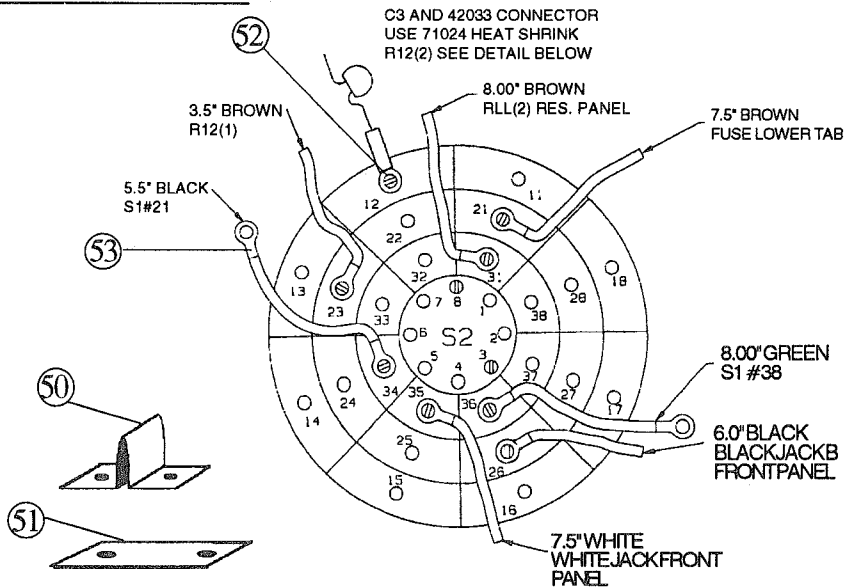


Figure 10B. RF302 Front Panel Assembly (2 of 3)

6) Push the switch on the RF302 labeled: PUSH FOR 0 -50 kHz RESPONSE.

7) The Model RF302 should read zero or less than 10 watts.

8) Activate the coag switch on the ESU.

9) The Model RF302 should read zero or less than 10 watts.

10) If the Model RF302 reads below 10 on both tests, record "NEGLIGIBLE" on the inspection tag. If there is a substantial reading when the filter button is activated; i.e., more than 10 watts, record "NOT SATISFACTORY" on the RF3R tag. The ESU must than be checked further by the user's service department before use.

ISOLATION TEST

The Model RF302 can measure RF leakage to ground from:

1. the chassis,
2. the active electrode,
3. the patient electrode.

CAUTION: Do not measure leakage from ACTIVE ELECTRODE to GROUND on non-isolated electrosurgery units. This may damage the Model RF302. PATIENT ELECTRODE to GROUND and CHASSIS to GROUND leakage may be measured without risk of damage.

High frequency leakage to ground from the Model RF302 electrosurgery analyzer is measured as follows:

- 4) Turn the ESU on and activate the CUT switch.
- 5) Compare the output on the Model RF302 with the output obtained with the manufacturer's recommended test load.
- 6) Activate the COAG switch on the ESU and compare the reading to the corresponding output using the manufacturer's recommended test load.
- 7) Test the other power settings in the same manner, including full power.
- 8) If the output power for this test is less than half of the output obtained with the manufacturer-specified load, the ESU should be checked by the user's service department.
- 9) Record the output power at maximum setting on the RF3R performance tag (see Figure 2 on page 3).

LOW FREQUENCY OUTPUT TEST

- 1) Set the OUTPUT POWER switch of the Model RF302 to the ESU manufacturer's recommended test load.
- 2) Set the Model RF302 left selector knob to OUTPUT POWER.
- 3) Set the power setting of the ESU to the maximum setting.
- 4) Turn the ESU ON.
- 5) Activate the CUT switch on the ESU.

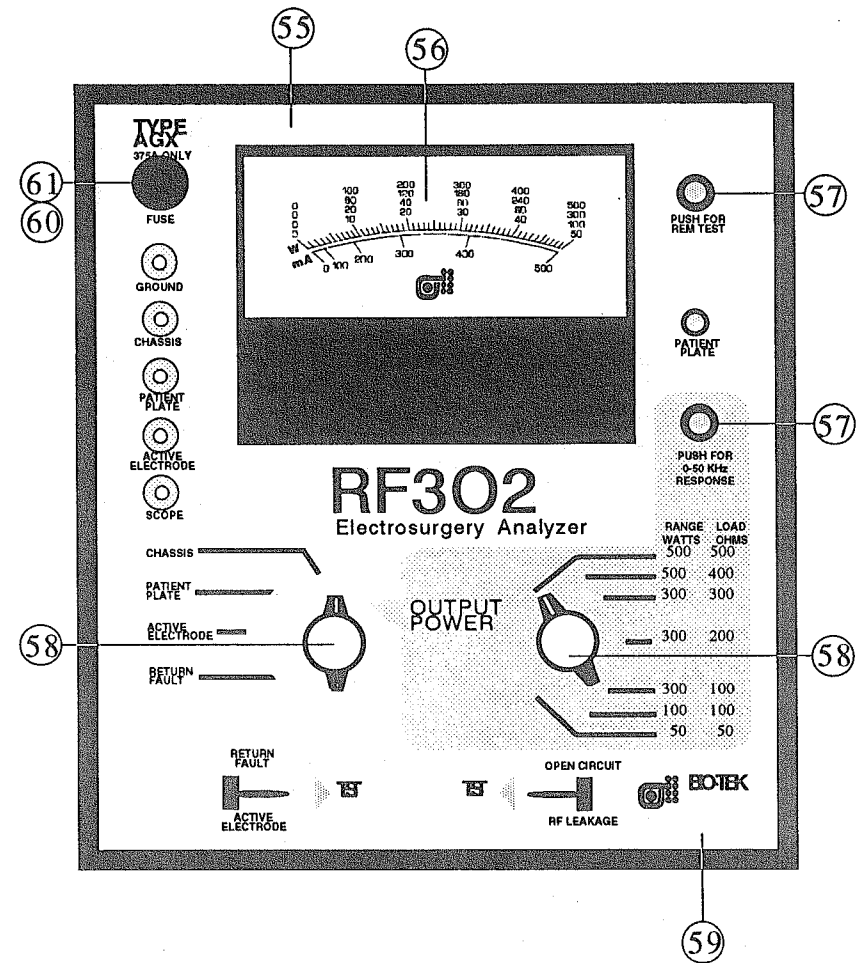


Figure 10C. RF302 Front Panel Assembly (3 of 3)

PART NO. 3020503
FRONT PANEL ASSEMBLY PARTS LIST

ITEM#	PART#	NO. PER ASSY	DESCRIPTION	REF
1)	35024	1.00	TRIMPOT 500 OHM, 25T	RT1
2)	63001	3.00	INDUCTOR 39uH	L1-3
3)	84004	1.00	CAP .15 uF 250V FOIL	C
4)	71007	10.70	WIRE HOOK-UP 16 AWG, 128.5"	
5)	46010	1.00	FUSEHOLDER 8AG	
6)	46047	1.00	FUSE, 3/8AMP 8AG	
7)	14013	1.00	NUT FLAT, FOR FUSEHLDR 46010	
8)	42004	1.00	BANANA JACK GREEN	
9)	42003	1.00	BANANA JACK WHITE	
10)	42002	2.00	BANANA JACK BLACK	
11)	42001	1.00	BANANA JACK RED	
12)	71024	0.20	SHRINK TUBE 1/8", 2.25"	
13)	42006	1.00	BNC CHASSIS SINGLE	
14)	42031	1.00	TERM RING 3/8 22-16 GA	
15)	33063	1.00	RES 105.5 OHM 1% 25W NI WW	R12
16)	49049	2.00	CLIP,SPRING .560ID .025TK	
17)	51006	2.00	SW ROT 8-POS 3-POLE POWER	S2
18)	12021	2.00	SCR PAN 4-40X5/8 SS SLOT	
19)	49362	2.00	CLIP,SPRING .312ID .012TK	
20)	33059	1.00	RES 13.0 OHM 1% 5W NI WW	R7
21)	17025	2.00	WSHR FLAT .477X.625 STEEL	
22)	51006	2.00	SW ROT 8-POS 3-POLE POWER	S1
23)	33090	1.00	RES 30.0 OHM 1% 5W NI WW	R13
24)	49362	2.00	CLIP,SPRING .312ID .012TK	
25)	45057	4.00	SPCR FF 4-40X2.00 AL HX	
26)	49049	2.00	CLIP,SPRING .560ID .025TK	
27)	33089	1.00	RES 137.0 OHM 1% 25W NI WW	R14
28)	71007	10.70	WIRE HOOK-UP 16 AWG, 128.5"	
29)	71002	1.00	WIRE HOOK-UP 14 AWG, 12"	
30)	52007	2.00	SW PB DPDT HIGH VOLTAGE	S3
31)	71007	10.70	WIRE HOOK-UP 16 AWG, 128.5"	
32)	42002	2.00	BANANA JACK BLACK	
33)	52007	2.00	SW PB DPDT HIGH VOLTAGE	S4
34)	16003	4.00	LKWSHR #6 HELICAL SPR SS	
35)	14004	4.00	NUT HEX 6-32 STEEL	
36)	14006	2.00	NUT HEX 10-32 SS	
37)	15006	2.00	LOCKNUT 10-32 SST	
38)	56001	2.00	SW REED HIGH VOLT	S5,6
39)	301B009	1.00	MOUNT REED RELAY	
40)	301B020	2.00	REED SWITCH SLIDER BAR	
41)	301B021	2.00	REED SWITCH SLIDER PEG	

- 2) Set the Model RF302 left selector knob to OUTPUT POWER.
- 3) Set the Model RF302 right selector knob (OUTPUT POWER) to the load specified in the ESU operator's manual.
- 4) Fill in the data on the top of the ESU performance record tag (see Figure 2 for RF3R tag) and indicate the load setting used.
- 5) Turn the ESU ON.
- 6) Set the power setting on the ESU on the first setting or partial power.
- 7) Activate the CUT and then the COAG switch on the ESU. Record the power setting, CUT power, and COAG power on the Model RF302 performance record tag.
- 8) Repeat Step 7, preceding, for 4 more power settings up to and including full power.

HEAVY LOAD TEST

- 1) Set the Model RF302 left selector knob to OUTPUT POWER.
- 2) Set the range switch to a 100 ohm load (either 100 or 300 watt range can be chosen).

NOTE: For bipolar units, the 50 ohm load 50 watt range may be chosen.

- 3) Set ESU to a power setting already used for output power.

Black & Red Leads:

- 1) If needed, attach a small alligator clip to one end of each black and red lead.
- 2) Connect the red lead (using alligator clip if needed) to the ACTIVE electrode of the ESU.
- 3) Connect the black lead (using alligator clip if needed) to the PATIENT PLATE electrode (the return electrode on bipolar units) of the ESU.

White lead:

- 1) Attach the large clamp to the end of the white lead.
- 2) Connect the white lead (clamp) to the chassis of the ESU.

NOTE: Be sure to attach the clamp to a bare screw connected to the chassis.

Green lead:

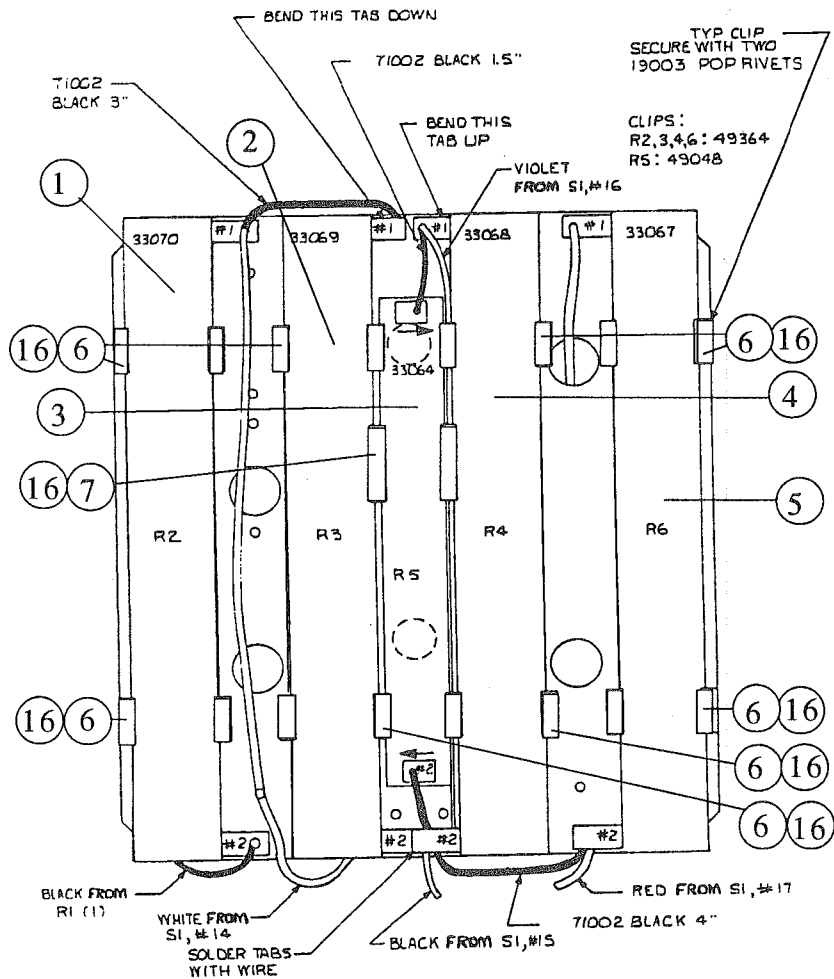
- 1) Attach the ground adapter to the green lead.
- 2) Plug the ground adapter into a ground pin of a grounded receptacle.
- 3) Plug the ESU into an appropriate power receptacle.

OUTPUT MEASUREMENTS

- 1) Consult the ESU manufacturer's manual for load impedance for power specifications.

— Cont'd from previous page

ITEM#	PART#	NO. PER ASSY	DESCRIPTION	REF
42)	49014	4.00	TERM PCB	
43)	43024	1.00	PCB 301B	
44)	49038	2.00	MAGNET	
45)	49037	1.00	SPRING .180 OD 1.25 FREE L	
46)	83016	3.00	CAP 39 pF 6000V DISC	C3,4,5
47)	83002	1.00	CAP 100 pF 1000V DISC	C2
48)	11018	2.00	SCR FH 2-56X1/4 SS SLOT	
49)	12019	4.00	SCR PAN 4-40X3/16 SS SLOT	
50)	51011	3.00	JUMPER DEC-DEC FOR 51006	
51)	51010	9.00	JUMPER POS-POS FOR 51006	
52)	42033	1.00	TERM RING #6 22-16 GA	
53)	42036	30.00	TERM RING #6 16-14 GA INS	
54)	66008	—	SUPERGLUE, A/R1)	
55)	3022501	1.00	PANEL, FRONT, RF302	
56)	3020504	1.00	RF302G AMMETER ASBY	
57)	301B013	2.00	NUT DRESS BLACK ACETAL	
58)	45002	2.00	KNOB BLACK DIAL POINT	
59)	3021001	1.00	RF302 FRNT PL OVERLAY	
60)	46010	1.00	FUSEHOLDER 8AG	
61)	46047	1.00	FUSE, 3/8AMP 8AG	
62)	11002	4.00	SCR FH 4-40X3/8 SS SLOT	



NOTES:
 CHECK LARGE HOLE PATTERNS TO DECIDE WHICH SIDE TO INSTALL CLIPS.
 INSTALL RS FIRST BEND TABS ACCORDING TO ARROW.
 ** WHEN INSTALLING CLIP FOR R1, PULL CLIP IN THE DIRECTION OF THE ARROW AND TIGHTEN NUTS.
 CLIPS: R1, R9: 49048
 R10, R11: 49049
 R8: 49363
 USE POP RIVET 19003 ON ALL CLIPS.
 INSERT RIVET THROUGH RESISTOR PANEL FIRST THEN, THROUGH THE CLIP.

Figure 11A. RF302 Resistor Panel Assembly (front)

DRAWING # 3020502-AS - REV B

NOTE: The extra black lead on the right of the meter is used to test REM features only. The connection is explained under "REM TESTING".

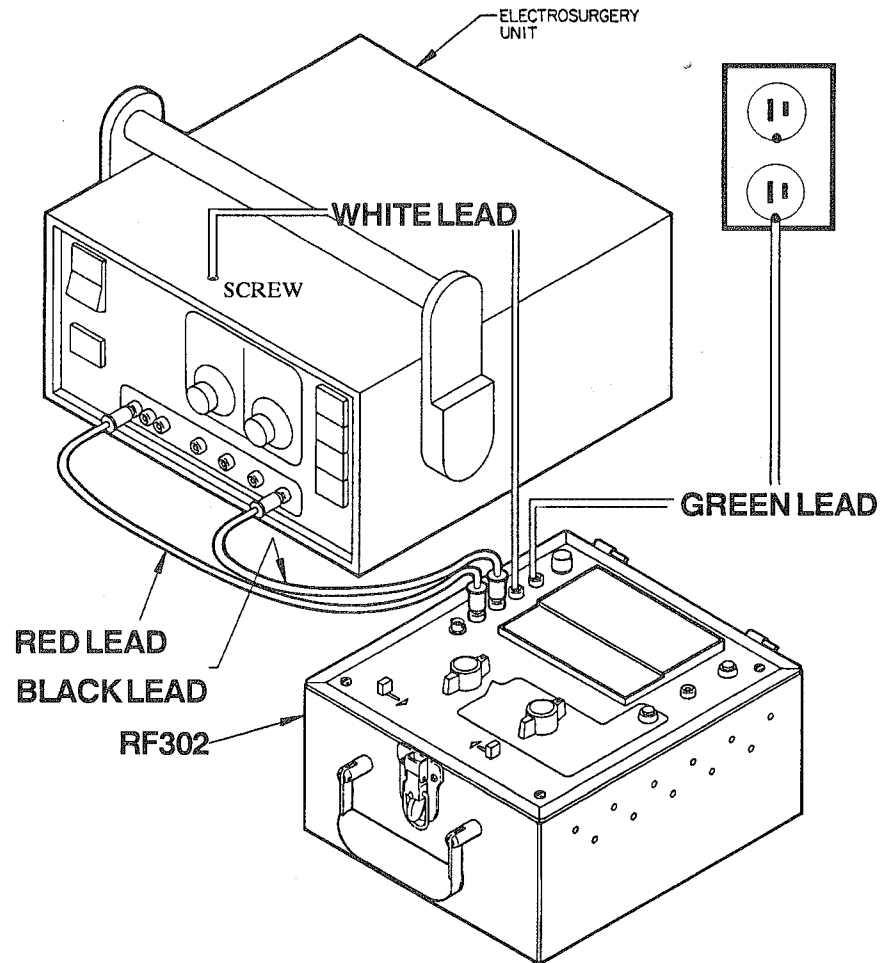


Figure 5. Test Setup

quency component of incoming power when the filter switch is activated.

OPERATION

WARNING: ESUs emit high frequency currents at voltages from 100 to 500 volts. The operator must be certain that the electrosurgery unit is OFF or non-active when making the necessary connections to the Model RF302.

Load/range Selection - For each load in Ohms (selected by the right selector switch) there is a corresponding meter range for accurate measurements.

RANGE (Watts)	LOAD (Ohms)	EACH DIVISION (Watts)
0 - 500	500	10
0 - 500	400	10
0 - 300	300	6
0 - 300	200	6
0 - 300	100	6
0 - 100	100	2
0 - 50	50	1

RF leakage tests are indicated on the red "mA" range on the meter face or the "50 W" range for readings in watts.

SETUP

Attach the 4 color-coded leads (provided as accessories) to the corresponding colored jacks on the Model RF302 front panel.

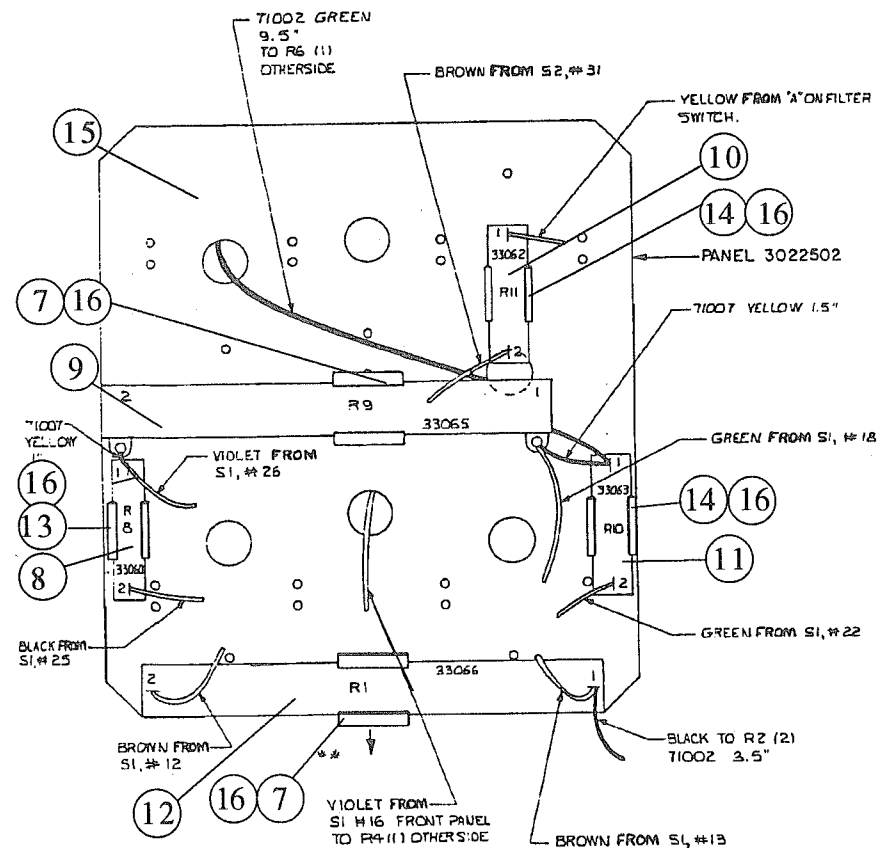


Figure 11B. RF302 Resistor Panel Assembly (rear)

DRAWING # 3020502-AS - REV B

PART NO. 3020502
RF302 RESISTOR PANEL ASSEMBLY PARTS LIST

ITEM#	PART#	NO. PER		DESCRIPTION	REF
		ASSY			
1)	33070	1.00		RES 105.0 OHM 1% 160W NI WW	R2
2)	33069	1.00		RES 91.0 OHM 1% 160W NI WW	R3
3)	33064	1.00		RES 21.0 OHM 1% 100W NI WW	R5
4)	33068	1.00		RES 88.0 OHM 1% 160W NI WW	R4
5)	33067	1.00		RES 50.0 OHM 1% 160W NI WW	R6
6)	49364	8.00		CLIP,SPRING 1.120ID .032TK	
7)	49048	3.00		CLIP,SPRING .770ID .025TK	
8)	33060	1.00		RES 30.0 OHM 1% 20W NI WW	R8
9)	33065	1.00		RES 42.0 OHM 1% 100W NI WW	R9
10)	33062	1.00		RES 95.0 OHM 1% 25W NI WW	R11
11)	33063	1.00		RES 105.5 OHM 1% 25W NI WW	R10
12)	33066	1.00		RES 95.0 OHM 1% 100W NI WW	R1
13)	49363	1.00		CLIP,SPRING .440ID .020TK	
14)	49049	2.00		CLIP,SPRING .560ID .025TK	
15)	3022502	1.00		PANEL, RESISTOR, RF302	
16)	19003	28.00		RIVET POP 1/8D .060-.125G	

- ⑨ **Banana Jack #5** - The fifth banana jack (black) provides the user with an additional PATIENT PLATE input during RETURN ELECTRODE MONITOR testing.
- ⑩ **REM Test Button** - The blue button in the upper right-hand corner of the Model RF302 front panel enables the user to perform a REM test.
- ⑪ **Meter** - Ranges and loads are selected by the OUTPUT POWER knob. For each ohm load selected, there is a corresponding meter range to ensure accurate readings (refer to the chart on the following page).
- ⑫ **Front Panel Screws** - There are 4 screws that hold the front panel in place. When these screws are removed from the 4 corners of the front panel, the internal components of the Model RF302 are exposed.

WARNING: Never open the unit when the ESU is connected to the RF302.

THEORY OF OPERATION

The Model RF302 is a precise instrument for measuring the output power of ESU's. The Model RF302 simulates the load seen by the electrosurgery machine during operation. The resistive loads inside the Model RF302 are non-inductive, accurate, and are not affected by prolonged use at the maximum electrosurgery machine output. The measuring system is a precise thermocouple that measures the electrical power for any frequency from DC to 3 MHz. The thermocouples are connected to a precision analog meter that directly reads ESU power. The meter is protected by a fast-blow instrument fuse. The filter switch is connected to precision inductive/capacitive components that act as a low pass filter. The meter will read the low fre-

GROUND (green)
 CHASSIS (white)
 PATIENT PLATE (black)
 ACTIVE ELECTRODE (red)

- ③ **BNC Connector** - The BNC connector is labeled "SCOPE" and enables the user to output a signal to an oscilloscope to verify the waveform shape.

NOTE: This output is isolated and is not calibrated.

Selector Knobs - The Model RF302 has 2 selector knobs that enable the user to:

- test output power for 7 different load/range options;
- test the RF leakage between the chassis and ground, the patient plate and ground, or the active electrode and ground with or without load;
- perform the return fault test.

- ④ **RF Leakage** - The RF LEAKAGE selector knob can be set to one of the five following test options:

- CHASSIS
- PATIENT PLATE
- ACTIVE ELECTRODE
- RETURN FAULT
- OUTPUT POWER

- ⑤ **Output Power** - The OUTPUT POWER selector knob enables the user to test the ESU in a given range (50 - 500 watts) with a given load (50 - 500 ohms).

Sliding Switches - There are 2 sliding switches found underneath the selector knobs:

- ⑥ - RETURN FAULT/ACTIVE ELECTRODE Test
- ⑦ - OPEN CIRCUIT/RF LEAKAGE Test

- ⑧ **50 kHz Response** - The blue button above the OUTPUT POWER ranges and loads enables the user to test for the frequency response in the 0-50 kHz range.

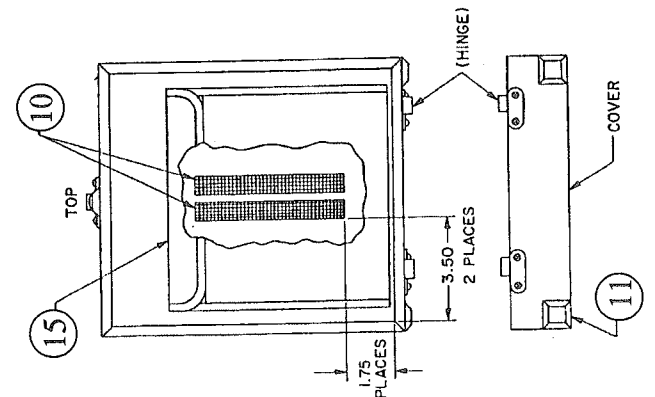
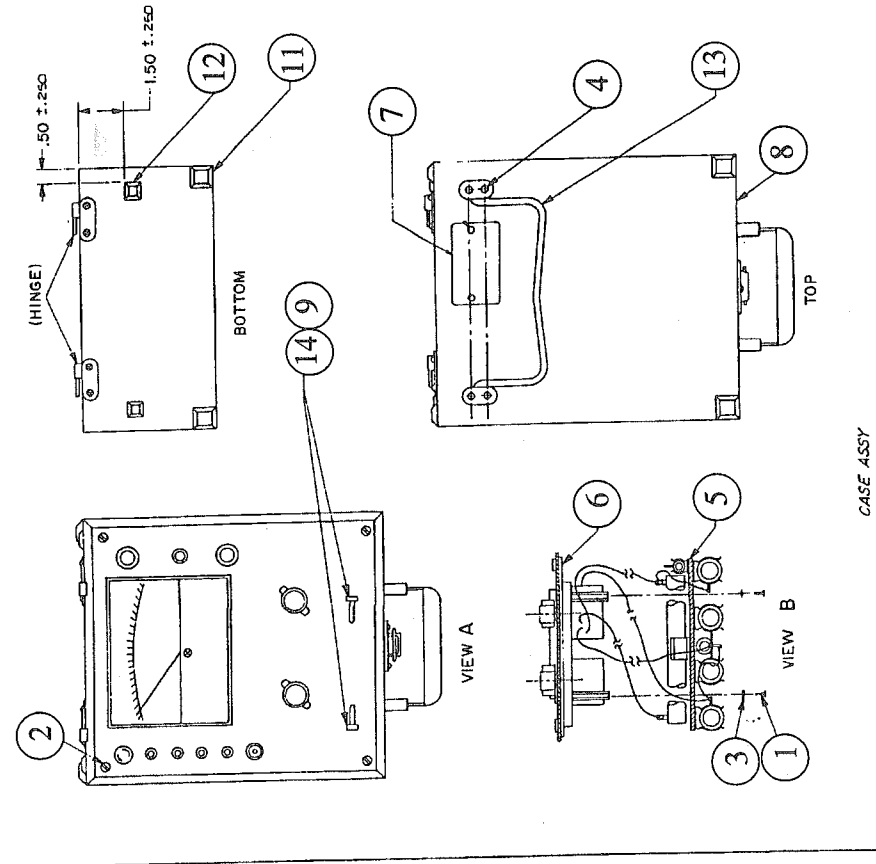


Figure 12. RF302 Final Assembly

ITEM#	PART#	NO. PER ASSY	DESCRIPTION	REF
1)	12005	4.00	SCR PAN 4-40X3/8 SS SLOT	---
2)	12013	4.00	SCR PAN 8-32X1/2 SS SLOT	---
3)	16002	4.00	LKWSHR #4 HELICAL SPR SS	---
4)	19006	6.00	RIVET POP AL HEAD/ST SHNK	---
5)	3020502	1.00	RF302 RESISTOR PANEL ASBY	---
6)	3020503	1.00	RF302G FRONT PANEL ASBY	---
7)	3021003	1.00	SERIAL NO. QC TAG GOV	---
8)	3022100	1.00	CASE 302 DRILLED	---
9)	45007	2.00	BUTTON RECT BLACK	---
10)	47013	0.84	VLCRO, HOOK .625W BLK W/AHSV, 10"	---
11)	49064	6.00	FOOT RUBBER 3/16" SQ BLK	---
12)	49065	2.00	FOOT RUBBER 9/16" SQ BLK	---
13)	49222	1.00	TILT BAR	---
14)	66008	0.00	SUPERGLUE, A/R	---
15)	3020105	1.00	RF302 POUCH	---

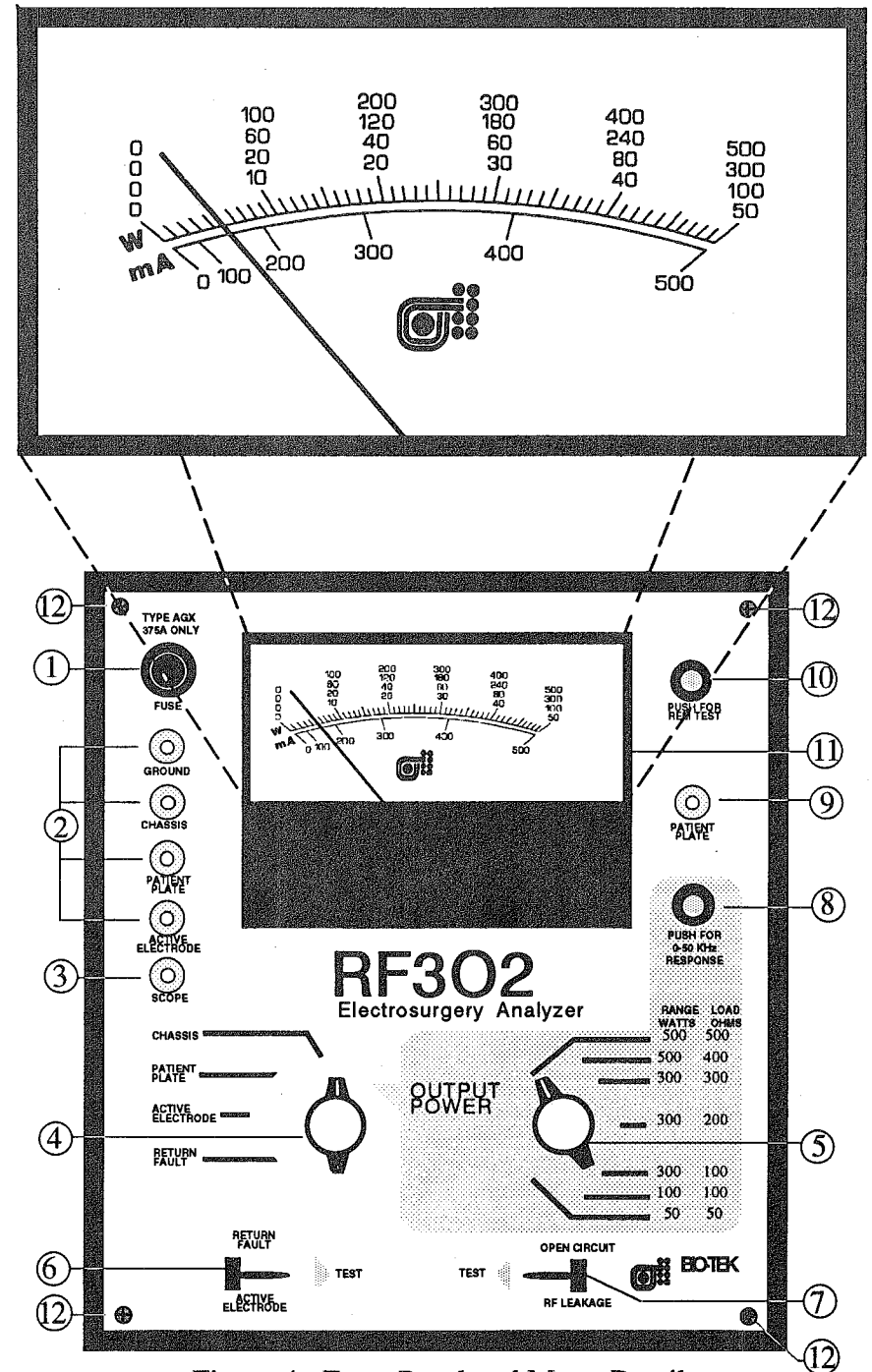


Figure 4. Front Panel and Meter Detail

EQUIPMENT CARE

The RF302 must be kept clean and moisture-free at all times. The unit can be cleaned effectively as follows:

Circuit Board - After soldering, use an acid brush dipped in isopropyl alcohol to remove flux and dirt residue. Wipe dry with a paper towel. Repeat if necessary.

CAUTION: Use the isopropyl alcohol in a well ventilated area. Do not smoke or use near heat or flame.

Panel - Use compressed air, 30 psi maximum, to blow dust off the panel. Use all-purpose spray cleaner (409 or equivalent) on the meter and overlay.

CAUTION: Avoid using solvents that damage plastic.

Case - Clean the outside formica surface with the all-purpose spray cleaner. Wipe dry with a paper towel. Use compressed air to blow dust out of the inside of the case.

CAUTION: The inside of the case must be moisture-free to prevent corrosion of the electrical components.

DESCRIPTION

An illustration of the Model RF302 front panel is shown in Figure 4 on the following page. The components of the front panel are described starting in the upper lefthand corner of the panel and proceeding counterclockwise.

- ① **Fuse Holder** - The RF302 utilizes an AGX .375A ultrafast blow fuse to provide circuit protection for the thermocouple and meter.
- ② **Banana Jacks** - The Model RF302 can accommodate 5 electro-surgical leads (banana jacks). The 4 jacks on the left hand side of the front panel include:

CURRENT Current "I" Amperes (rms)	POWER					
	500 Ohm Load (Watts)	400 Ohm Load (Watts)	300 Ohm Load (Watts)	200 Ohm Load (Watts)	100 Ohm Load (Watts)	50 Ohm Load (Watts)
0.10	5	4	3	2	1	0.5
0.20	20	16	12	8	4	2
0.30	45	36	27	18	9	4
0.40	80	64	48	32	16	8
0.45	10*1	81	61	41	20	10
0.50	125	100	75	50	25	12
0.55	151	121	91	61	30	15
0.60	180	144	108	72	36	18
0.65	211	169	127	85	42	21
0.70	245	196	147	98	49	24
0.75	281	225	169	113	56	28
0.80	320	256	192	128	64	32
0.85	361	289	217	145	72	3.6
0.90	405	324	243	162	81	4.0
0.95	451	361	271	181	90	4.5
1.00	500	400	300	200	100	5.0
1.05	---	441	--	221	110	---
1.10	--	484	--	242	121	---
1.15	--	--	--	265	132	---
1.20	--	--	--	288	144	---
1.25	--	--	--	313	156	---
1.30	--	--	--	338	169	---
1.35	--	--	--	--	182	---
1.40	--	--	--	--	196	---
1.45	---	---	---	--	210	---
1.50	---	---	---	--	225	---
1.55	--	--	--	--	240	---
1.60	--	--	--	--	256	---
1.65	--	--	--	--	272	---
1.70	--	--	--	--	289	---
1.75	--	--	--	--	306	---

Table 1. Power-to-Current Conversion for the Model RF302

STORAGE AND SHIPPING

The RF302 should be stored at 77° F (25° C) with a relative humidity of 50%. The cover on the RF302 should always be closed and the latches snapped during storage and shipping. The storage environment should be free from vibration.

VOLTAGE	POWER					
	500 Ohm Load (Watts)	400 Ohm Load (Watts)	300 Ohm Load (Watts)	200 Ohm Load (Watts)	100 Ohm Load (Watts)	50 *Ohm Load (Watts)
50	5	6	8	13	25	50
60	7	9	12	18	36	72
75	11	14	19	28	56	112
85	15	18	24	36	72	---
100	20	25	33	50	100	---
110	24	30	40	61	121	---
125	31	39	52	78	156	---
135	37	46	60	91	182	---
150	45	56	75	113	225	---
160	51	64	85	128	256	---
175	61	77	102	153	306	---
185	68	86	114	171	---	---
200	80	100	133	200	---	---
210	88	110	147	221	---	---
225	101	127	169	253	---	---
235	110	138	184	276	---	---
250	125	151	208	312	---	---
260	135	169	225	---	---	---
275	151	189	252	---	---	---
300	180	225	300	---	---	---
325	211	264	---	---	---	---
350	245	306	---	---	---	---
375	281	352	---	---	---	---
400	320	400	---	---	---	---
425	361	452	---	---	---	---
450	405	506	---	---	---	---
475	451	---	---	---	---	---
500	500	---	---	---	---	---

Table 2. Power-to-Voltage Conversion for the Model RF302

WARRANTY

BIO-TEK warrants the RF302 to the original purchaser for a period of one year from the original purchase date. The warranty is for normal use and service, against defective materials or workmanship. If the customer ships the Model RF302 Electrosurgery Analyzer to **BIO-TEK**, postage prepaid, and **BIO-TEK** determines the defect to be in materials or manufacturing, **BIO-TEK** shall either repair or replace the unit at **BIO-TEK's** option, without cost to the customer.

This warranty is void if the RF302 has been visibly damaged by accident, misuse, or has been repaired or altered by persons or stations not authorized by **BIO-TEK**, or which has had the serial number altered, defaced, or removed.

BIO-TEK reserves the right to discontinue the RF302 at any time and to change specifications, price, or design without notice and without incurring any obligation. **BIO-TEK** will continue to stock service parts for up to 5 years after the manufacture of the unit has been discontinued. Parts shall include all materials, charts, instructions, diagrams, and accessories that are furnished with the unit.

The purchaser agrees to assume all liability for any damages or bodily injury which may result from the use or misuse of the unit by the purchaser, his employees, agents, or customers.

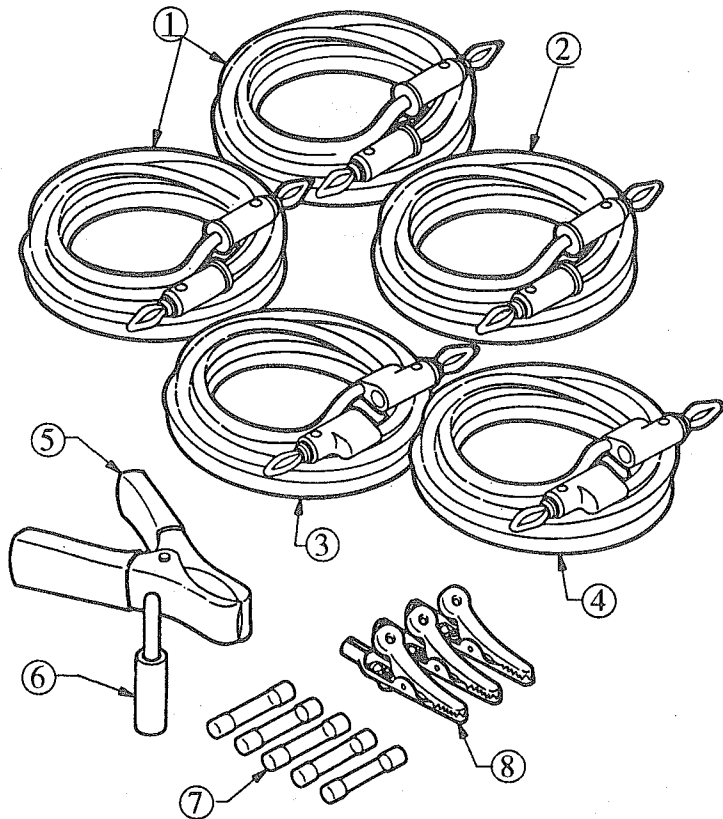


Figure 3. Accessories

ITEM#	PART#	NO. PER ASSY	DESCRIPTION	REF
1)	48017	2.00	LEAD SET (BLACK)	---
2)	48016	1.00	LEAD SET (RED)	---
3)	48158	1.00	LEAD SET (GREEN)	---
4)	48157	1.00	LEAD SET (WHITE)	---
5)	7770014	1.00	LARGE CLAMP	---
6)	48005	1.00	GROUND ADAPTER	---
7)	46047	5.00	FUSE 3/8A	---
8)	48009	3.00	ALLIGATOR CLIP	---

POWER (Watts)	CURRENT (Milliamperes)
2	100
4	141
6	173
8	200
10	224
12	245
14	265
16	283
18	300
20	316
22	332
24	346
26	360
28	374
30	387
32	400
34	412
36	424
38	436
40	447
42	458
44	469
46	480
48	490
50	500

Preparations for use - Find a relatively level surface on which to place the RF302. Unlatch the locks on the unit and place it facing the operator so that the meter scale can be easily read.

Table 3. Power-to-mA Conversion for the Model RF302

CALIBRATION DATA SHEET

Date: ___/___/___ Serial Number: _____ Calibrated By: _____

1. Meter zeros: _____ .375 A Fuse used: _____
2. Resistance ACTIVE ELECTRODE to GROUND: _____.
3. Resistance PATIENT PLATE to GROUND: _____.
4. Resistance CHASSIS to GROUND: _____.
5. Resistance Between the two PATIENT PLATE jacks.
Without Switch pressed: _____ With REM Switch pressed: _____.
6. RETURN FAULT Capacitance: _____.

7. OUTPUT POWER CALIBRATION

Range/Load Setting	ESU Setting	Load Measured (Ohms)	Current Measured (Amperes)	Applied Power (Watts)	Meter Reading (Watts)	Limits (Watts)
50/50	LO CUT	_____	_____	_____	10	+/- 2.5
50/50	HI CUT	_____	_____	_____	40	+/- 2.5
50/50	COAG	_____	_____	_____	5	+/- 2.5
100/100	LO CUT	_____	_____	_____	20	+/- 5.0
100/100	HI CUT	_____	_____	_____	60	+/- 5.0
100/100	COAG	_____	_____	_____	20	+/- 5.0
300/100	LO CUT	_____	_____	_____	30	+/- 15.0
300/100	HI CUT	_____	_____	_____	90	+/- 15.0
300/100	COAG	_____	_____	_____	60	+/- 15.0
300/200	LO CUT	_____	_____	_____	60	+/- 15.0
300/200	HI CUT	_____	_____	_____	180	+/- 15.0
300/200	COAG	_____	_____	_____	60	+/- 15.0
300/300	LO CUT	_____	_____	_____	90	+/- 15.0
300/300	HI CUT	_____	_____	_____	180	+/- 15.0
300/300	COAG	_____	_____	_____	60	+/- 15.0
500/400	LO CUT	_____	_____	_____	70	+/- 25.0
500/400	HI CUT	_____	_____	_____	250	+/- 25.0
500/400	COAG	_____	_____	_____	100	+/- 25.0
500/500	LO CUT	_____	_____	_____	100	+/- 25.0
500/500	HI CUT	_____	_____	_____	300	+/- 25.0
500/500	COAG	_____	_____	_____	100	+/- 25.0

ACCESSORIES

<u>Description</u>	<u>Quantity Supplied</u>	<u>Bio-Tek Part Number</u>
Complete Set of Leads	—	3020600
Red Lead	1	—
Black Lead	2	—
White Lead	1	—
Green Lead	1	—
Large Clamp	1	7770014
Alligator	3	48009
RF3R Tags	100	93008
User's Guide	1	3021005
Ground Adapter	1	48005
Fuse	5	46047
Warranty Card	1	—

NOTE: Figure 3 on the following page shows the various accessories provided with the Model RF302.

INSTALLATION

Operating Precautions - Refer to the manual's inside front cover for precautions that must be followed to ensure the safety of the RF302 operator.

Unpacking Instructions - Inspect the RF302 for cracks or scratches on either the panel or the case. Check the meter needle to ensure that it is intact. Carefully inspect the handle to assure that it is firmly attached to the case. If any damage is found, call BIO-TEK Instruments immediately at: 1 (800) 451-5172.

200	300
300	300
400	500
500	500

RF302 PERFORMANCE CHART

Isolation Test Range: 0 - 50 Watts with 200-Ohm Load from Patient Plate, Active Electrode, and Chassis

Current Range: 0 - 500 mA

Return Fault: 150 picofarads

Frequency Response: 0 - 5 MHz

Frequency Response: (Filter Pushed) 0 - 50 kHz

Load Accuracy: ± 2% at 50 ohms
± 1.5% at 100 ohms
± 1% 200 to 500 ohms

Meter Accuracy: ± 2%

Power Output Accuracy: ± 5% (Calibrated in Watts)

REM Test: Normal 24.6 Ohm Resistance, 137.0 Ohms with REM Switch Activated

Oscilloscope: Isolated (Uncalibrated)

Power Requirements: None

Measuring Technique: RF Thermocouples

Weight: 5.4 kg (12 lbs)

Dimensions: 28 cm X 23 cm X 18 cm
(11" X 9.1" X 7")

Range/Load Setting	Load Measured (Ohms)	Voltage Applied	CMR (Watts)	Meter Reading (Watts)	Ttl. (Watts)
50/50	_____	0*	0	0	N/A
100/100	_____	0*	0	0	N/A
300/100	_____	_____	_____	_____	+/- 15
300/200	_____	_____	_____	_____	+/- 15
300/300	_____	_____	_____	_____	+/- 15
500/400	_____	_____	_____	_____	+/- 25
500/500	_____	_____	_____	_____	+/- 25

* Do not apply 120 Volts to these settings. Readings will be greater than full scale.

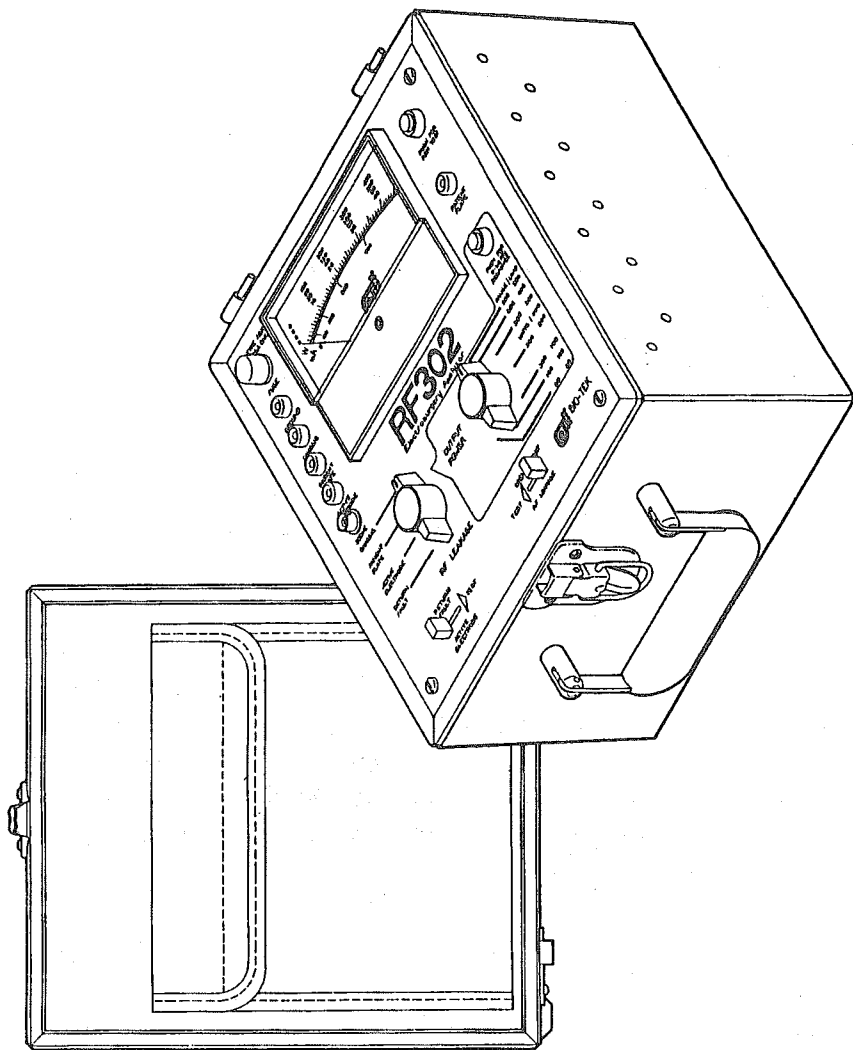


Figure 1. Model RF302 - Isometric View

INTRODUCTION

The Model RF302 is a passive, power-analyzing system designed to test electrosurgery units (ESU's) by:

1. measuring output power at the manufacturer's specified load and heavy load conditions,
2. measuring isolation-to-ground of the electrosurgical output,
3. testing for dangerous low-frequency currents,
4. enabling verification of output waveforms,
5. testing return electrode monitor (REM) systems, and
6. testing return fault systems.

The Model RF302 may be used by technical and non-technical personnel to test all ESUs for proper operation and calibration. Outputs can be recorded on the RF3R tag (see Figure 2 on page 3) and attached to the front panel of the ESU to ensure the operator that the unit outputs the proper power. An isometric view of the unit is provided in Figure 1 on the following page.

The Model RF302 simulates the load experienced by the ESU during an operation. The resistive loads inside the Model RF302 are non-inductive, accurate, and are not damaged by prolonged use at maximum output settings. The measuring system of the Model RF302 uses precise thermocouples that measure the electrical power for any frequencies from DC to 2 MHz. These thermocouples are connected to a precision analog meter that reads directly in power units of measure. The meter is protected by an ultrafast blow fuse. The filter switch is connected to

WARNING!

Electrosurgery units (ESU's) emit high frequency currents at voltages from 100-to-500 Volts.

The operator must be certain that the ESU is OFF when making the necessary connections to the Model RF302.

Never open the Model RF302 when an ESU is connected to the Model RF302.

NOTICES

© Copyright 1991

BIO-TEK® INSTRUMENTS, INC.
Highland Park, Box 998
Winooski, Vermont
05404-0998 USA
802-655-4040
800-451-5172
800-24-BIOTK (Service)
FAX: 802-655-7941 (Sales)
802-655-3399 (Service)
TELEX: 94-0136 BIO TEK SHVT

ALL RIGHTS RESERVED

This publication is protected by copyright and all rights are reserved. No part of this manual may be reproduced or transmitted in any form, or by any means electronic or mechanical, including photocopying and recording, for any purpose other than the purchaser's personal use without the written permission of BIO-TEK INSTRUMENTS, INC.

RESTRICTIONS AND LIABILITIES

Information in this document is subject to change, and does not represent a commitment by BIO-TEK. Changes made to the information in this document will be incorporated in new editions of the publication.

No responsibility is assumed by BIO-TEK for the use or reliability of software or equipment that is not supplied by BIO-TEK, or its affiliated dealers.

**BIO-TEK® is a registered trademark of
BIO-TEK INSTRUMENTS, INC.**



Figures

Figure 1.	Model RF302 - Isometric View.	2
Figure 2.	RF3R Tag.	3
Figure 3.	Accessories.	6
Figure 4.	Front Panel and Meter Detail.	9
Figure 5.	Test Setup.	13
Figure 6.	REM Circuit.	25
Figure 7.	RF302/ESU Wiring Configuration.	33
Figure 8.	RF302 Block Diagram.	39
Figure 9A.	RF302 Product Schematic (1 of 2).	40
Figure 9B.	RF302 Product Schematic (2 of 2).	41
Figure 10A.	RF302 Front Panel Wiring (1 of 3).	43
Figure 10B.	RF302 Front Panel Switch Wiring (2 of 3). ...	44
Figure 10C.	RF302 Front Panel Switch Wiring (3 of 3). ..	45
Figure 11A.	RF302 Resistor Panel Assembly (front).	48
Figure 11B.	RF302 Resistor Panel Assembly (rear).	49
Figure 12.	RF302 Final Assembly.	51

Tables

Table 1.	Power-to-Current Conversion.	53
Table 2.	Power-to-Voltage Conversion.	54
Table 3.	Power-to-mA Conversion.	55

BIO-TEK INSTRUMENTS, INC.
 Highland Park, Box 998
 Winooski, VT 05404-0998
 802-655-4040
 800-451-5172
 800-242-4685 (Service)
 TELEX 94-0136 BIO-TEK SHVT
 FAX 802-655-7941



BIO-TEK

USER'S GUIDE

RF302

ELECTROSURGERY ANALYZER

TABLE OF CONTENTS

Warnings.	inside front cover
Introduction.	1
Specifications.	3
Accessories.	5
Installation.	5
Storage and Shipping.	7
Warranty.	7
Equipment Care.	8
Description.	8
Theory of Operation.	11
Operation.	12
Setup.	12
Output Measurements.	14
Heavy Load Test.	15
Low Frequency Output Test.	16
Isolation Test.	17
Measuring Output Current.	19
Measuring Output Voltage.	20
Measuring RF Leakage-to-Ground Current.	21
Oscilloscope Output.	21
Measuring Crest Factors.	22
Return Fault Test.	23
REM Test.	25
Performance Check.	24
Calibration Procedure.	28
Troubleshooting Guide.	35
Technical Circuit Description.	37
Service Information.	38
Schematics.	40
Tables.	53
Data Forms.	56