

**FC-30**  
**SCA GENERATOR**

**September, 1998**

**IM No. 597-0008-004**

# IMPORTANT INFORMATION

## EQUIPMENT LOST OR DAMAGED IN TRANSIT.

When delivering the equipment to you, the truck driver or carrier's agent will present a receipt for your signature. Do not sign it until you have: 1) inspected the containers for visible signs of damage and 2) counted the containers and compared with the amount shown on the shipping papers. If a shortage or evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. Claims for loss or damage will not be honored without proper notification of inspection by the carrier.

## RF PRODUCT TECHNICAL ASSISTANCE – REPAIR SERVICE – REPLACEMENT PARTS.

Technical assistance is available from Broadcast Electronics by letter, prepaid telephone, fax, or E-mail. Equipment requiring repair or overhaul should be sent by common carrier, prepaid, insured, and well protected. If proper shipping materials are not available, contact the Customer Service Department for a shipping container. Do not the mail equipment. We can assume no liability for inbound damage, and necessary repairs become the obligation of the shipper. Prior arrangement is necessary. Contact the Customer Service Department for a Return Authorization.

Emergency and warranty replacement parts may be ordered from the following address. Be sure to include the equipment model number, serial number, part description, and part number. Non-emergency replacement parts may be ordered directly from the Broadcast Electronics stock room by fax at the number shown below.

### FACILITY CONTACTS –

Broadcast Electronics, Inc. – Quincy Facility  
4100 N. 24th St. P.O. BOX 3606  
Quincy, Illinois 62305  
Telephone: (217) 224-9600  
Fax: (217) 224-9607  
E-Mail: General – [bdcast@bdcast.com](mailto:bdcast@bdcast.com)  
Web Site: [www.bdcast.com](http://www.bdcast.com)

### RF PRODUCT TECHNICAL ASSISTANCE – REPAIR – EMERGENCY/WARRANTY REPLACEMENT PARTS –

Telephone: (217) 224-9600  
E-Mail: [rfservice@bdcast.com](mailto:rfservice@bdcast.com)  
Fax: (217) 224-9607

### NON-EMERGENCY REPLACEMENT PARTS –

Fax: (217) 224-9609

## RETURN, REPAIR, AND EXCHANGES.

Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. All returned merchandise must be sent freight prepaid and properly insured by the customer.

## WARRANTY ADJUSTMENT.

Broadcast Electronics, Inc. warranty is included in the Terms and Conditions of Sale. In the event of a warranty claim, replacement or repair parts will be supplied F.O.B. factory. At the discretion of Broadcast Electronics, the customer may be required to return the defective part or equipment to Broadcast Electronics, Inc. F.O.B. Quincy, Illinois. Warranty replacements of defective merchandise will be billed to your account. This billing will be cleared by a credit issued upon return of the defective item.

## PROPRIETARY NOTICE.

This document contains proprietary data of Broadcast Electronics, Inc. No disclosure, reproduction, or use of any part thereof may be made except by prior written permission.

## MODIFICATIONS.

Broadcast Electronics, Inc. reserves the right to modify the design and specifications of the equipment in this manual without notice. Any modifications shall not adversely affect performance of the equipment so modified.

## TABLE OF CONTENTS

PARAGRAPH		PAGE NO.
<b>SECTION I</b>		
1-1	Equipment Description	1
1-5	Specifications	1
<b>SECTION II</b>		
2-1	Unpacking	3
2-4	Environmental Requirements	3
2-6	Installation	3
2-8	Preliminary Installation	4
2-17	Preliminary Installation RS-232 Data Communication	6
2-21	Placement	6
2-23	Wiring	6
2-26	Initial Checkout	6
2-37	RS-232 Data Communication Calibration	7
<b>SECTION III</b>		
3-1	Operation	8
3-8	Controls and Indicators	8
<b>SECTION IV</b>		
4-1	Theory of Operation	10
<b>SECTION V</b>		
5-1	First Level Maintenance	10
5-4	Second Level Maintenance	10
5-7	Adjustments	13
5-9	Modulation Display	13
5-19	Modulation	13
5-40	Troubleshooting	14
5-43	Component Replacement	15
5-51	Parts Lists and Drawings	16

## ILLUSTRATIONS

FIGURE		PAGE NO.
1	FC-30 SCA Generator	1
2	SCA Generator Wiring	5
3	SCA Generator Controls and Indicators	8
4	SCA Generator Block Diagram	11
5	Modulation Calibration Adjustment	15
6	Semiconductor Terminal Designation Diagrams	17

## TABLES

TABLE		PAGE NO.
1	Specifications	2
2	SCA Generator Controls and Indicators	9
3	SCA Generator Troubleshooting	16
4	FC-30 SCA Generator 110V/220V 50/60 Hz	20
5	FC-30 SCA Generator 110V/220V 92 kHz	20
6	Accessory Kit	21
7	Access Cable Assembly	21
8	SCA Generator Circuit Board Assembly	21
9	SCA Generator Cable Assembly	26

# SECTION I

## 1-1. EQUIPMENT DESCRIPTION.

1-2. The Broadcast Electronics Model FC-30 is a high-quality SCA generator designed for transmission of audio or dc coupled data on a multiplexed subcarrier (see Figure 1). Features of the FC-30 include an extremely stable oscillator providing very low FM noise and high modulation linearity. A controlled-decay subcarrier muting system eliminates receiver noise resulting from slow-to-act receiver squelch circuits; a fault common to many SCA generator designs.



COPYRIGHT © 1990 BROADCAST ELECTRONICS, INC

**FIGURE 1. FC-30 SCA GENERATOR**

**597-0008-1**

1-3. The FC-30 allows full remote control operation utilizing optically isolated inputs and outputs. All control inputs are configured to accept either positive or negative polarity control logic. A tapped dual-primary power transformer and a fused voltage selector/filter assembly allows operation from a wide range of ac input potentials.

1-4. The unit requires 1 3/4 inches (4.45 cm) of 19 inch (48.26 cm) vertical rack space for mounting. The FC-30 contains extensive RFI protection which allows mounting in the transmitter cabinet or in a separate enclosure. Input and output connections are made to a terminal strip and BNC connectors mounted to the SCA generator rear panel. A convenient subcarrier test connector along with all operating controls and indicators are located on the front panel. The SCA generator is available in one basic configuration as follows:

PART NO.	DESCRIPTION
909-0051-204	SCA Generator, 97 to 133V ac or 194 to 266V ac, Single Phase, 50 or 60 Hz, with Accessory Kit consisting of: accessory cable, 3-wire ac line cord with N. E. M. A. standard plug and rack mounting hardware.
909-0051-304	SCA Generator, same as 909-0051-204 with 3-wire ac line cord with European CEE 7/7 plug.

## 1-5. SPECIFICATIONS.

1-6. Refer to Table 1 for electrical and physical specifications relative to operation of the FC-30 SCA generator.

**TABLE 1. ELECTRICAL AND PHYSICAL SPECIFICATIONS  
(Sheet 1 of 2)**

PARAMETER		SPECIFICATIONS
SUBCARRIER FREQUENCY		67 kHz (39 kHz to 95 kHz available on special order).
SUBCARRIER FREQUENCY STABILITY		±0.5% (335 Hz at 67 kHz), +32°F to +122°F (0°C to +50°C).
SUBCARRIER HARMONIC CONTENT		Less than 0.3%.
SUBCARRIER OUTPUT		Adjustable, 0.5V p-p to 4.0V p-p at 600 Ohms, Resistive, Unbalanced.
SUBCARRIER TEST OUTPUT		5.0V p-p at 10 k Ohms, Resistive.
SUBCARRIER ENVELOPE DECAY		Greater than 100 Milliseconds from 90% to 10% subcarrier level.
MODULATION CAPABILITY		±20% of Subcarrier Frequency, Maximum.
FM NOISE		Less than 72 dB (referenced at ±6 kHz deviation modulated at 400 Hz with 150 microsecond deemphasis).
INPUTS:	AUDIO	Adjustable from +10 dBm to -10 dBm for ±6 kHz deviation at 400 Hz, ac coupled, 600 Ohms, Resistive.
	DATA	Adjustable from 1.0V p-p to 4.0V p-p for ±6 kHz deviation, dc coupled. 10 k Ohm, Supplied with 75 Ohm Resistor Termination.
PREEMPHASIS:	AUDIO	150 Microseconds (75 microseconds with internal jumper).
	DATA	No preemphasis.
FREQUENCY RESPONSE:	AUDIO	±0.5% dB, 10 Hz to 10 kHz, exclusive of low-pass filter.
	DATA	±0.5 dB, dc to 10 kHz.
LOW-PASS FILTER		Sixth Order, -3 dB at 4.3 kHz (other filters available on special order). May be bypassed.
TOTAL HARMONIC DISTORTION		Less than 0.5% throughout pass band.
INTERMODULATION		Less than 0.5% 60 Hz to 7 kHz, 1:1 Ratio (low-pass and pre-emphasis filter bypassed).
CROSSTALK SCA TO STEREO		-60 dB or better. Below 100% modulation of left or right using 75 Microsecond deemphasis and FX-30 Exciter.
CROSSTALK STEREO TO SCA		-50 dB or better below ±6 kHz deviation of SCA using 150 Microsecond deemphasis, FX-30 Exciter and FS-30 Stereo Generator.

**TABLE 1. ELECTRICAL AND PHYSICAL SPECIFICATIONS  
(Sheet 2 of 2)**

PARAMETER	SPECIFICATIONS
AUDIO MUTING LEVEL	Adjustable from 10 dB to 30 dB below program level.
AUDIO MUTING DELAY	Adjustable from 0.5 seconds to 10.0 seconds.
OPERATING TEMPERATURE RANGE	+32°F to +122°F (0°C to +50°C).
MAXIMUM ALTITUDE	0 to 15,000 Feet (4572 m) above sea level.
HUMIDITY	95%, Non-condensing.
DIMENSIONS:	
HEIGHT	1.75 inches (4.5 cm).
WIDTH	19.0 inches (48.3 cm).
DEPTH	9.0 inches (22.9 cm).
AC POWER REQUIREMENTS	97 to 133V ac or 194 to 266V ac, 50/60 Hz, 7 Watts.
WEIGHT: UNPACKED	4.5 pounds (2 kg).

## SECTION II

2-1. **UNPACKING.**

2-2. The equipment becomes the property of the customer when the equipment is delivered to the carrier. Carefully unpack the SCA generator. Perform a visual inspection to determine that no apparent damage has been incurred during shipment. All shipping materials should be retained until it is determined that the unit has not been damaged. Claims for damaged equipment must be promptly filed with the carrier or the carrier may not accept the claim.

2-3. The contents of the shipment should be as indicated on the packing lists. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify both the carrier and Broadcast Electronics, Inc.

2-4. **ENVIRONMENTAL REQUIREMENTS.**

2-5. Table 1 provides environmental conditions which must be considered prior to SCA generator installation.

2-6. **INSTALLATION.**

2-7. Each SCA generator is operated, tested, and inspected at the factory prior to shipment and is ready for installation when received. Installation is accomplished in four steps: 1) preliminary installation, 2) placement, 3) wiring, and 4) initial checkout.

2-8. **PRELIMINARY INSTALLATION.**

2-9. The FC-30 SCA generator is shipped from the factory in the following configuration:

<b>PARAMETER</b>	<b>CONDITION</b>
REMOTE MODE CONTROL	NEGATIVE POLARITY
REMOTE MODE INDICATOR	NEGATIVE POLARITY
PREEMPHASIS SELECTION	150 us
DATA INPUT FILTER	INSERTED

2-10. If an alternate configuration is desired, refer to drawing 597-0008-5 as required and the following information.



**WARNING**      ***DISCONNECT THE PRIMARY POWER TO THE SCA GENERATOR BEFORE PROCEEDING.***

**WARNING**

- A. Disconnect the primary power to the generator.
- B. Place the unit on a suitable work surface and remove the top cover.
- C. REMOTE MODE CONTROL POLARITY SELECT. Plug P3 onto J3 if negative polarity control logic is to be used or J4 if positive polarity control logic is to be used (see Figure 2).
- D. REMOTE MODE INDICATOR POLARITY SELECT. Plug P5 onto J5 if negative polarity output is desired or J6 if positive polarity output is desired (see Figure 2).
- E. PREEMPHASIS SELECTION. P8 must be inserted onto J8 if 150 microsecond preemphasis is desired. If 75 microsecond preemphasis is desired, P8 must be positioned over one pin only of J8 so that the connection across J8 is opened.
- F. DATA INPUT FILTER BYPASS SELECT. If the data input is to be used and no low-pass filter is desired, insert P9 onto J9, pins 2 and 3. If the low-pass filter in the data path is desired, insert P9 onto J9, pins 1 and 2.
- G. AUDIO LOW-PASS FILTER CUT-OFF FREQUENCY SELECT. Typically the low-pass filter in the SCA generator is configured for a cut-off frequency of 4.3 kHz but may be changed if desired. Refer to the SCA generator circuit board schematic diagram for further information.

2-11. Replace the top cover.

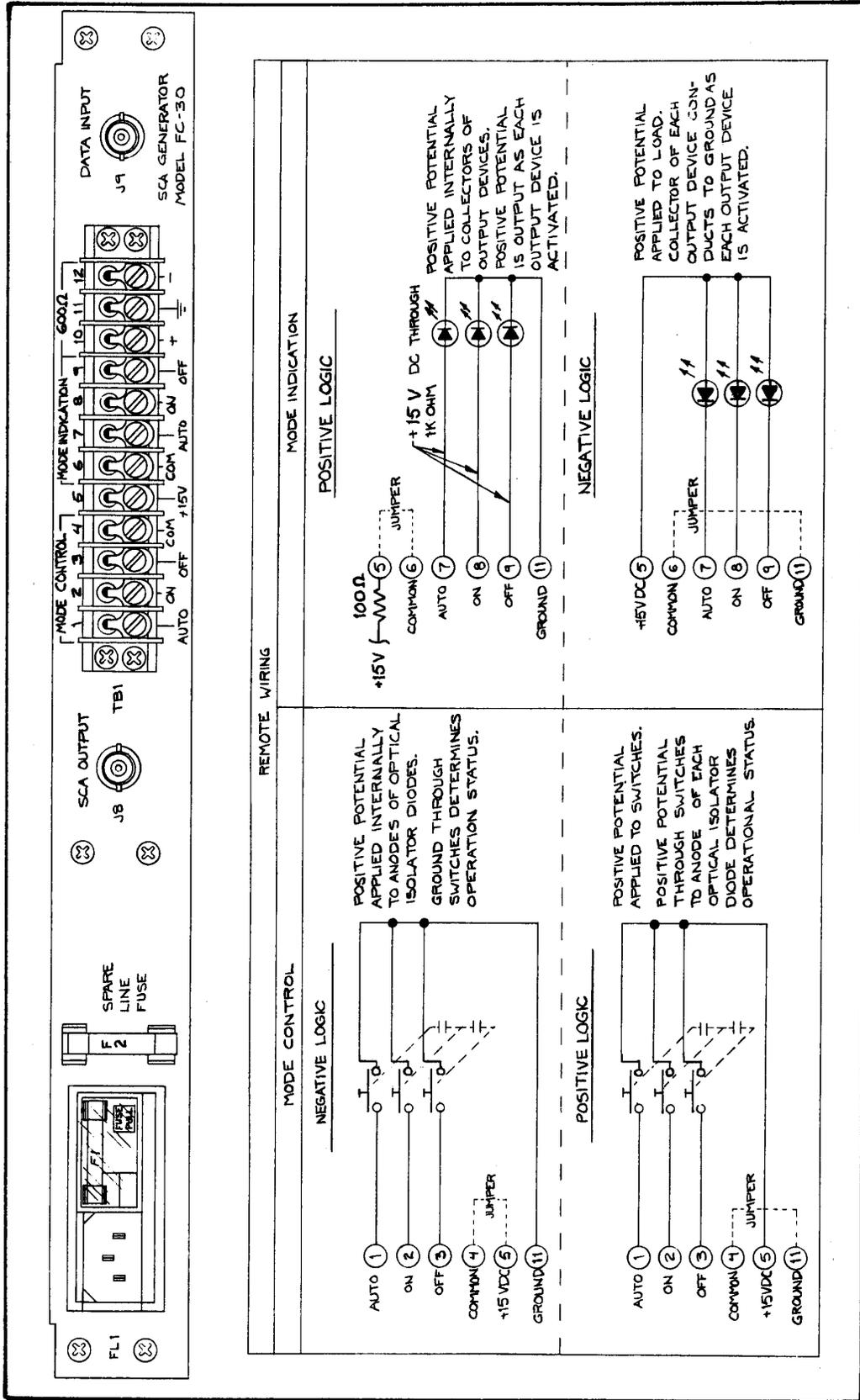
2-12. Remove the fuse from the ac line voltage selector on the SCA generator rear panel.

2-13. Ensure the primary ac line voltage with which the SCA generator will be used is visible on the ac line voltage selector circuit board (100V, 115/120V, 220V, or 230/240V).

2-14. If the ac line voltage must be changed, remove the ac line voltage selector circuit board with a small pair of needle-nose pliers. Reinsert the circuit board so that the correct ac line voltage is visible when the circuit board is inserted into the receptacle.

2-15. Two fuses are shipped with the SCA generator. A 1/8 Ampere fuse is required for the 100/115 volt range and a 1/16 Ampere fuse is required for the 220/240 volt range. Both fuses must be slow-blow types.

2-16. Install the correct fuse for operation at the desired ac line voltage.



597-0008-2

COPYRIGHT © 1990 BROADCAST ELECTRONICS, INC

FIGURE 2. SCA GENERATOR WIRING

- 2-17. **PRELIMINARY INSTALLATION, RS-232 DATA COMMUNICATION.**
- 2-18. The FC-30 is designed to process all types of data communication including RS-232. The unit will directly modulate the RS-232 information on a sub-carrier for broadcast transmission. To ensure accurate and stable operation, it is recommended the information be processed at 300 or 1200 baud. If the FC-30 is required to process RS-232 data, modify the unit as follows.
- 2-19. Refer to FC-30 assembly diagram 597-0008-5 in SECTION VII, DRAWINGS and replace inductor L8 on the **DATA INPUT** connector with a 1 k Ohm  $\pm 5\%$ , 1/4W resistor.
- 2-20. Refer to FC-30 assembly diagram 597-0008-5 in SECTION VII, DRAWINGS and replace resistor R2 on the SCA generator circuit board with two 1N4148 diodes.
- 2-21. **PLACEMENT.**
- 2-22. The SCA generator requires 1 3/4 inches (4.45 cm) of 19 inch (48.26 cm) rack space and may be mounted in any convenient location within reach of signal and power cables. The signal cables should be as short and direct as possible. The SCA generator should not be mounted directly above heat-generating equipment. It should also be noted that the more constant the ambient temperature in which the SCA generator operates, the greater the stability of the SCA generator oscillator. Otherwise no special requirements need be observed.
- 2-23. **WIRING.**
- 2-24. Wire the audio inputs with 600 Ohm two-conductor shielded wire or the data input with 50 or 75 Ohm coaxial cable. To change input impedance of the data or audio inputs, refer to SCA Generator Block Diagram.
- 2-25. Wire the remote mode control inputs and the remote mode indicator outputs (see Figure 2).
- 2-26. **INITIAL CHECKOUT.**
- 2-27. Depress the front panel **OFF** switch.
- 2-28. Connect an ac power source to the unit. The **OFF** indicator will illuminate.
- 2-29. Depress the **ON** switch. The **ON** indicator will illuminate.
- 2-30. Connect a frequency counter to the **SUBCARRIER TEST** connector. Adjust the **SUB-CARRIER FREQ** control to obtain the subcarrier frequency desired.
- 2-31. Adjust the **SUBCARRIER INJECT** control to obtain the level of SCA injection desired as indicated by the station modulation monitor (typically 8 to 10 percent).
- 2-32. Apply programming to the SCA generator as follows:
- (AUDIO) +10 dBm to -10 dBm @ 600 Ohms.  
(DATA) 1.0V to 4.0V p-p.
- 2-33. Adjust the **DATA** (for data communication other than RS-232) or **AUDIO MODULATION** control (as applicable) to obtain the modulation level desired as indicated by the station modulation monitor. Normally,  $\pm 6$  kHz deviation of the SCA is considered to be 100% modulation.
- 2-34. The **10%-100% MODULATION** indicator will flash intermittently as the modulation level changes to provide a convenient indication of modulation activity. The SCA generator will normally be modulated 100% with an audio input in which case the **100%+ MODULATION** indicator will flash intermittently as the modulation level peaks at 100% but will not remain illuminated unless the level exceeds 100%. The red 100% LED is factory calibrated to illuminate at a deviation of  $\pm 6$  kHz.

- 2-35. The **MUTE LEVEL** and **MUTE DELAY** controls have an effect only when the **AUTO** switch is depressed and should be adjusted as desired:
- A. The **MUTE DELAY** control adjusts the time delay between the end of the programming and when the carrier is muted. This delay is adjustable from one-half second to ten seconds (typically set for five seconds).
  - B. The **MUTE LEVEL** control adjusts circuitry which initiates a mute delay timing sequence whenever the audio input falls below a preset level. The **MUTE LEVEL** control is factory adjusted for 20 dB below 100% modulation with an audio input.
- 2-36. Depress the **AUTO** switch. The **AUTO** indicator will illuminate.
- 2-37. **RS-232 DATA COMMUNICATION CALIBRATION.** For FC-30 units modified for RS-232 data communication operation, adjust and calibrate the unit as follows:
- 2-38. Disconnect the FC-30 primary power.
- 2-39. Refer to the SCA receiver specifications and determine the **MARK** and **SPACE** frequencies.
- 2-40. Calculate and record the FC-30 center frequency using the following formula  

$$F_c = \frac{\text{MARK}_f + \text{SPACE}_f}{2}$$
- $F_c$  = Center Frequency  
 $\text{MARK}_f$  = Receiver Mark Frequency  
 $\text{SPACE}_f$  = Receiver Space Frequency
- 2-41. Disconnect the cable from the rear-panel **DATA INPUT** receptacle.
- 2-42. Connect a frequency counter to the rear-panel **SCA OUTPUT** receptacle.
- 2-43. Apply power to the unit.
- 2-44. Adjust the front-panel **SUBCARRIER FREQ** control until the frequency counter indicates the center frequency calculated in the preceding text.
- 2-45. Connect a -9V transistor battery supply to the rear-panel **DATA INPUT** receptacle.
- 2-46. Adjust the front-panel **DATA MODULATION** control until the frequency counter indicates the receiver **MARK** frequency.
- 2-47. Check the calibration by connecting a +9V transistor battery supply to the rear-panel **DATA INPUT** receptacle. The frequency counter must indicate the receiver **SPACE** frequency.
- 2-48. Disconnect the FC-30 primary power and remove the test equipment.

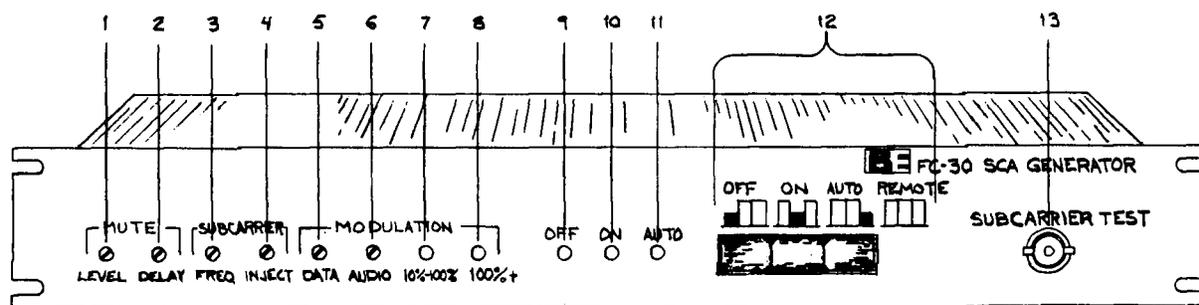
## SECTION III

### 3-1. OPERATION.

- 3-2. The following procedure assumes the SCA generator is completely installed and is free of any discrepancies.
- 3-3. Depress the **OFF** switch. The SCA generator will deenergize in a standby mode with no output. The **OFF** indicator will illuminate.
- 3-4. Apply programming to the SCA generator.
- 3-5. If continuous carrier output with no muting is desired, depress the **ON** switch. The **ON** indicator will illuminate and the SCA generator will be ready for service.
- 3-6. If it is desired that the carrier automatically mute with or without delay when programming is removed, depress the **AUTO** switch. The **AUTO** indicator will illuminate and the SCA generator will be ready for service.
- 3-7. The two mute adjustments have an effect only in the automatic mode of operation. The **MUTE LEVEL** control adjusts the level at which the carrier will mute and the **MUTE DELAY** control adjusts a variable delay associated with the muting circuit to compensate for slow-to-act receiver squelch circuits. These two controls should be adjusted for best operation by the user in each particular situation.

### 3-8. CONTROLS AND INDICATORS.

- 3-9. Refer to Figure 3 for the location of the controls and indicators associated with the SCA generator. The function of each control or indicator is described by Table 2.



COPYRIGHT © 1990 BROADCAST ELECTRONICS, INC  
597-0008-3

FIGURE 3. SCA GENERATOR CONTROLS AND INDICATORS

**TABLE 2. SCA GENERATOR CONTROLS AND INDICATORS**  
(Sheet 1 of 2)

<b>INDEX NO.</b>	<b>NOMENCLATURE</b>	<b>FUNCTION</b>
1	<b>MUTE LEVEL</b> Control (R67)	Presets an input signal threshold level below which the SCA generator output is muted. Operates only when the <b>AUTO</b> indicator is illuminated.
2	<b>MUTE DELAY</b> Control (R95)	Adjusts a timed delay of one-half to ten seconds initiated by the mute level circuitry which delays muting of the SCA carrier to allow the SCA receiver squelch circuitry time to react. Operates only when the <b>AUTO</b> indicator is illuminated.
3	<b>SUBCARRIER FREQ</b> Control (R89)	Adjusts the subcarrier output frequency.
4	<b>SUBCARRIER INJECT</b> Control (R91)	Adjusts the subcarrier output level.
5	<b>DATA MODULATION</b> Control (R13)	Adjusts the data signal input level.
6	<b>AUDIO MODULATION</b> Control (R35)	Adjusts the audio signal input level.
7	<b>10%-100% MODULATION</b> Indicator (DS5)	Illuminates to indicate the modulation level of the subcarrier is 10% or greater.
8	<b>100%+ MODULATION</b> Indicator (DS4)	Illuminates to indicate subcarrier modulation level is 100% or greater.
9	<b>OFF</b> Indicator (DS2)	Illuminates to indicate power is applied to the SCA generator and the unit is in standby with no output.
10	<b>ON</b> Indicator (DS3)	Illuminates to indicate the SCA generator carrier will not be muted when programming halts.
11	<b>AUTO</b> Indicator (DS1)	Illuminates to indicate the SCA generator carrier will be automatically muted when programming halts.
12	SCA Generator <b>ON/OFF/AUTO/REMOTE</b> Mode Switch (S1)	Provides local selection of the SCA generator operational modes.  When all three switch sections are out, remote control is enabled.  <b>OFF</b> switch (S1C): Configures equipment in standby mode with no output.

**TABLE 2. SCA GENERATOR CONTROLS AND INDICATORS  
(Sheet 2 of 2)**

INDEX NO.	NOMENCLATURE	FUNCTION
13	<b>SUBCARRIER TEST</b> Receptacle (J10)	<p><b>ON</b> switch (S1B): Configures equipment for operation in manual mode. Automatic muting inoperative.</p> <p><b>AUTO</b> switch (S1A): Configures equipment for operation in automatic mode. Automatic muting operational.</p> <p>Provides a convenient front-panel SCA carrier test point. (5V p-p into 10 k)</p>

## SECTION IV

### 4-1. THEORY OF OPERATION.

4-2. Theory of operation for the SCA generator is presented by Figure 4.

## SECTION V

### 5-1. FIRST LEVEL MAINTENANCE.



**WARNING**      *DISCONNECT POWER PRIOR TO SERVICING.*

**WARNING**

5-2. Maintenance of the SCA generator falls into the category of good housekeeping and is limited to whatever cleaning may be necessary and checking the performance level of the unit.

5-3. On a regular basis, clean the equipment of accumulated dust, check for overheated components, and tighten loose hardware as required. Ensure the input and output connections are secure.

### 5-4. SECOND LEVEL MAINTENANCE.

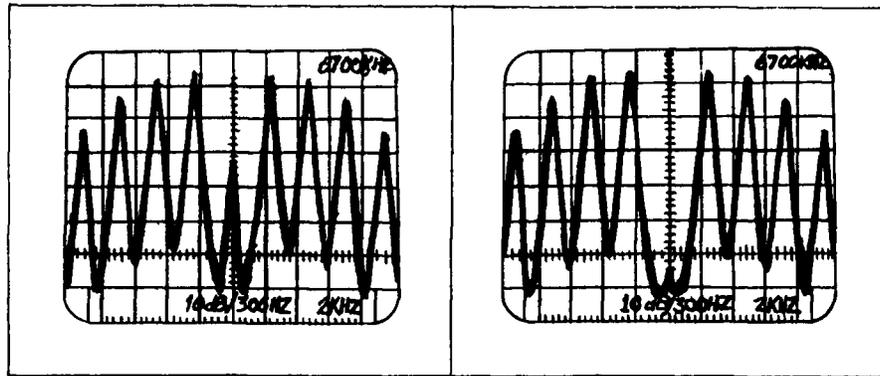
5-5. Second level maintenance consists of procedures required to restore the equipment to satisfactory operation after a fault has occurred.



- 5-6. The maintenance philosophy of the SCA generator consists of problem isolation to a specific assembly with subsequent troubleshooting as required to isolate specific defective components. If desired, an entire assembly may be returned to the factory for repair or exchange.
- 5-7. **ADJUSTMENTS.**
- 5-8. The following text provides adjustment procedures for all controls which are not described in Section II, Installation.
- 5-9. **MODULATION DISPLAY.** The modulation display calibration control (R70) will not normally require adjustment in the field unless the modulation or metering circuitry has been repaired. To adjust the modulation display calibration control (R70), proceed as follows:
- 5-10. **Required Equipment.** The following equipment is required for adjustment of the modulation display calibration control.
- A. No. 1 Phillips Screwdriver, 4 inches (10.16 cm) long.
  - B. Miniature Flat-Tip Screwdriver, 3/16 inch (0.5 cm) tip.
  - C. Calibrated Single Trace Oscilloscope or Calibrated High Input Impedance Voltmeter.
  - D. Calibrated Audio Generator, 600 Ohm Output.
- 5-11. **Procedure.** To adjust the modulation display calibration control (R70) proceed as follows:
- 5-12. Remove the SCA generator from service and remove the top cover.
- 5-13. Adjust the audio generator to 400 Hz at approximately 2 volts RMS.
- 5-14. Connect the audio generator to the rear panel terminal strip audio input.
- 5-15. Depress the **ON** switch and operate the SCA generator.
- 5-16. Measure the voltage on terminal E5 (refer to the SCA generator circuit board schematic diagram) and adjust the audio generator to obtain an indication of 6.0 volts p-p (2.12 volts RMS).
- 5-17. Adjust the modulation display calibration control (R70) so the **100%+ MODULATION** indicator just illuminates.
- 5-18. Remove the test equipment, replace the top cover, and return the SCA generator to service.
- 5-19. **MODULATION.** The modulation controls will not normally require adjustment in the field unless the modulation circuitry has been repaired. To adjust the modulation symmetry (R80), modulation balance (R141), and modulation calibration (R148) controls, proceed as follows:
- 5-20. **Required Equipment.** The following equipment is required for adjustment of the modulation symmetry (R80), modulation balance (R141), and modulation calibration (R148) controls:
- A. No. 1 Phillips Screwdriver, 4 inches (10.16 cm) long.
  - B. Miniature Flat-Tip Screwdriver, 3/16 inch (0.5 cm) tip.
  - C. Tektronix 7000 Series Oscilloscope Main Frame with Model 7L5 Plug-in Spectrum Analyzer or Equivalent.
  - D. Calibrated Audio Generator, 600 Ohm Output.
  - E. Calibrated Single-Trace Oscilloscope or Calibrated High Input Impedance Voltmeter.

F. Carbon Resistor, 620 Ohm  $\pm 5\%$ , 1/4W.

- 5-21. To adjust the modulation symmetry (R80), modulation balance (R141), and modulation calibration (R148) controls, proceed as follows:
- 5-22. Remove the SCA generator from service and remove the top cover.
- 5-23. Connect a 620 Ohm resistor across the **SCA OUTPUT** connector or adjust the input loading on the spectrum analyzer to 600 Ohms.
- 5-24. Depress the **ON** switch and operate the SCA generator with no signal input.
- 5-25. Measure the voltage across the resistor. The voltage must be less than 3.5 volts p-p (1.237 VRMS). If not, adjust the **SUBCARRIER INJECT** control (R91) as required.
- 5-26. Remove the resistor and test equipment from the SCA generator.
- 5-27. Adjust the spectrum analyzer input impedance selector to 600 Ohms.
- 5-28. Connect the spectrum analyzer input to the **SCA OUTPUT** connector.
- 5-29. Adjust the spectrum analyzer so that 67 kHz appears at the far left of the display. Adjust the horizontal sweep for 20 kHz per division with resolution of 300 Hz.
- 5-30. Adjust the spectrum analyzer to obtain full scale deflection of the 67 kHz subcarrier.
- 5-31. The following three carriers will be displayed: 67 kHz, 134 kHz, and 201 kHz. The levels of the 134 kHz and 201 kHz carriers will be below the level of the 67 kHz carrier.
- 5-32. Adjust the modulation balance control (R141) to minimize the second harmonic at 134 kHz. The control will null the second harmonic to approximately -60 dB.
- 5-33. Adjust the modulation symmetry control (R80) to minimize the third harmonic at 201 kHz. The control will null the third harmonic to approximately -65 dB.
- 5-34. Readjust the modulation balance control (R141) and the modulation symmetry control (R80) until no further improvement is noted.
- 5-35. Adjust the audio generator frequency to 2.495 kHz  $\pm 0.5$  Hz and connect the audio generator to SCA generator terminal strip terminals 10 (+) and 12 (-).
- 5-36. Adjust the audio generator output amplitude so that 2.120 VRMS  $\pm 0.01$  VRMS is noted on test point TP-1 within the SCA generator.
- 5-37. Adjust the spectrum analyzer so that the 67 kHz subcarrier appears in the center of the display using a horizontal sweep of 2 kHz per division (see Figure 5A).
- 5-38. Adjust the modulation calibration control (R148) to minimize the subcarrier at 67 kHz. The control will null the subcarrier to approximately -65 dB below the two adjacent carriers (see Figure 5B). A carrier null of 45 dB or better is satisfactory.
- 5-39. Remove the test equipment, replace the top cover, and return the SCA generator to service.
- 5-40. **TROUBLESHOOTING.**
- 5-41. Most troubleshooting consists of visual checks. To simplify troubleshooting, the various indicators should be used to isolate a malfunction to a specific area of the SCA generator. Table 5 is provided as a general guide to SCA generator malfunctions. Figure 5 provides pin-out-diagrams for all semiconductor devices except diodes.



A. CARRIER NOT NULLED

B. CARRIER NULLED

COPYRIGHT © 1990 BROADCAST ELECTRONICS, INC

597-0008-7

**FIGURE 5. MODULATION CALIBRATION ADJUSTMENT**

- 5-42. Once the trouble is isolated, refer to the section of this manual providing theory of operation to assist in problem resolution. All internal components are accessible through a removable top cover.
- 5-43. **COMPONENT REPLACEMENT.**
- 5-44. The circuit board used in the SCA generator is a double-sided board with plated through-holes. Because of the plated through-holes, solder fills the holes by capillary action. These conditions require that defective components be removed carefully to avoid damage to the board.
- 5-45. On all circuit boards, the adhesive securing the copper track to the board melts at almost the same temperature as solder. A circuit board track can be destroyed by excessive heat or lateral movement during soldering. Use of a small iron with steady pressure is required for circuit board repairs.
- 5-46. To remove a component from a double-sided circuit board, cut the leads from the body of the defective component while the device is still soldered to the board.
- 5-47. Grip each component lead, one at a time, with long nose pliers. Turn the board over and touch the soldering iron to the lead at the solder connection. When the solder begins to melt, push the lead through the back side of the board and cut off the bent outer end of the lead. Each lead may now be heated independently and pulled out of each hole. The holes may be cleared of solder by carefully re-heating with a low wattage iron and removing the residual solder with a soldering vacuum tool.
- 5-48. Install the new component and apply solder from the bottom side of the board. If no damage has been done to the plated through-holes, soldering of the top side is not required.



**WARNING**

**WARNING**

***MOST SOLVENTS WHICH WILL REMOVE ROSIN FLUX ARE VOLATILE AND TOXIC BY THEIR NATURE AND SHOULD BE USED ONLY IN SMALL AMOUNTS IN A WELL VENTILATED AREA, AWAY FROM FLAME, INCLUDING CIGARETTES AND A HOT SOLDERING IRON.***



**WARNING**

**WARNING**

***OBSERVE THE MANUFACTURER'S CAUTIONARY INSTRUCTIONS.***

**TABLE 3. SCA GENERATOR TROUBLESHOOTING**

SYMPTOM	DEFECT/REMEDY
10%-100% AND 100%+ MODULATION INDICATORS INOPERATIVE	Check Waveforms to Isolate Defective U14, D28, D29, Q3, D36, or Associated Component.
10%-100% OR 100%+ MODULATION INDICATOR FUNCTIONING INCORRECTLY	Defective U17A/DS4 or U17B/DS5, or Associated Component.
NO SCA OUTPUT	LDR1, Q4, Q5, U10, U13, U16, Power Supply, or Associated Component.
LOW SCA OUTPUT	DS3, LDR1, Q4, Q5, U16, or Associated Component.
SUBCARRIER OFF FREQUENCY	U13 or Associated Component.
NO MODULATION	U1, U7, U10, or Associated Component.
NO LOCAL CONTROL	U8, U9, or Associated Component.

5-49. After soldering, remove flux with a cotton swab moistened with a suitable solvent. Rubbing alcohol is highly diluted and is not effective. Solvents are available in electronic supply houses which are useful.

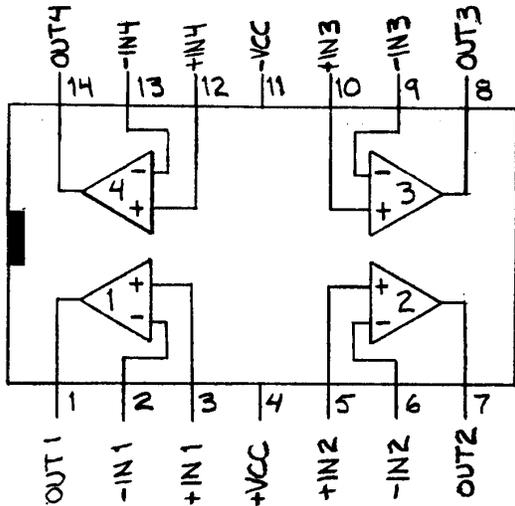
5-50. The board should be checked to ensure the flux has been removed and not just smeared about. Rosin flux is not normally corrosive, but rosin will absorb enough moisture in time to become conductive and cause problems.

5-51. **PARTS LISTS AND DRAWINGS.**

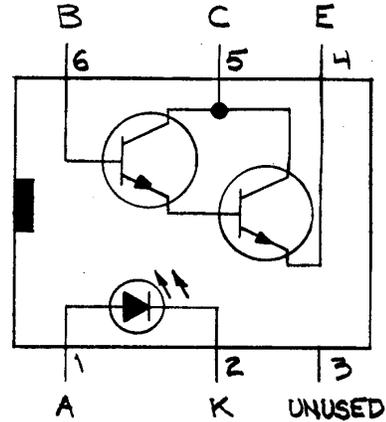
5-52. The following parts lists and drawings are presented as aids to maintenance:

**NOTE**

TOP VIEW SHOWN UNLESS OTHERWISE NOTED

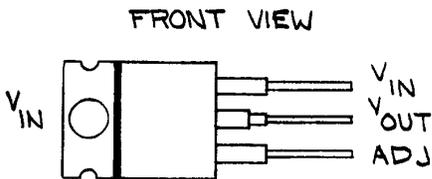


TLO74CN  
DUAL JFET INPUT  
QUAD OPERATIONAL AMPLIFIER

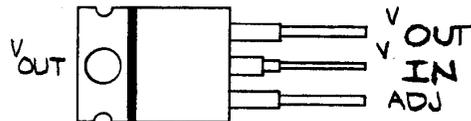


4N33  
OPTICAL ISOLATOR  
LED/PHOTO TRANSISTOR TYPE

FRONT VIEW

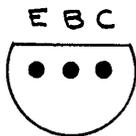


LM317T  
POSITIVE VOLTAGE  
REGULATOR

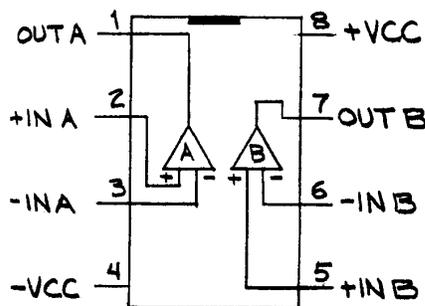


LM337T  
NEGATIVE VOLTAGE  
REGULATOR

BOTTOM VIEW



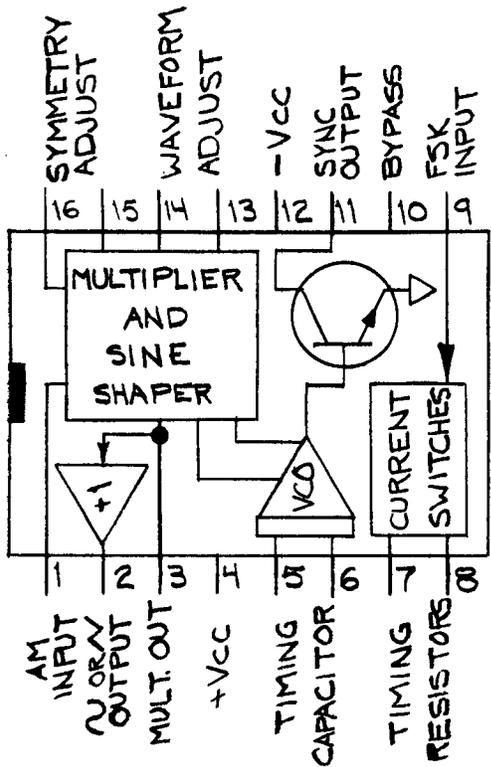
2N3904 NPN TRANSISTOR  
2N3906 PNP TRANSISTOR



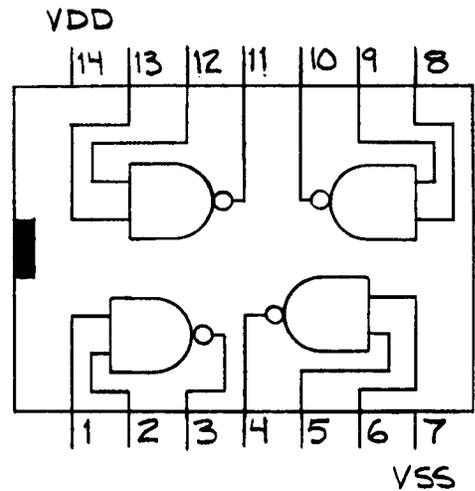
TLO72CP, TLO92CP  
JFET INPUT  
DUAL OPERATIONAL AMPLIFIER

COPYRIGHT © 1990 BROADCAST ELECTRONICS, INC  
597-0008-6A

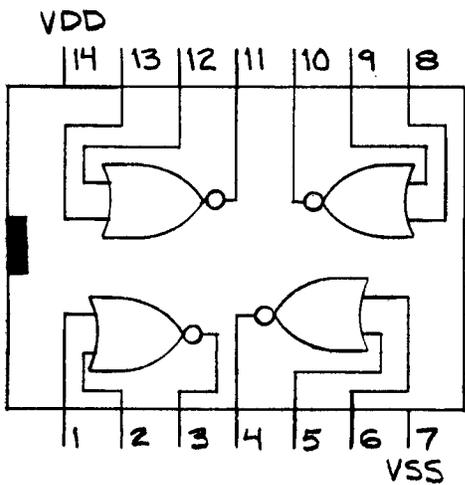
FIGURE 6. SEMICONDUCTOR TERMINAL DESIGNATION DIAGRAMS  
(Sheet 1 of 2)



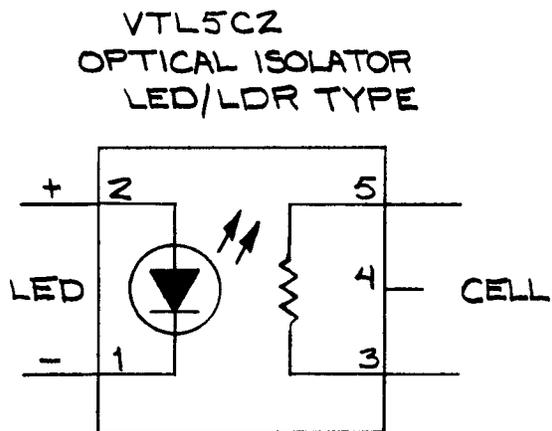
XR 2206 CP  
FUNCTION GENERATOR



MC14011 UB  
CMOS QUAD 2 INPUT NAND GATE



MC14001 UB  
CMOS QUAD 2 INPUT NOR GATE



VTL5C2  
OPTICAL ISOLATOR  
LED/LDR TYPE

COPYRIGHT © 1990 BROADCAST ELECTRONICS, INC  
597-0008-6B

FIGURE 6. SEMICONDUCTOR TERMINAL DESIGNATION DIAGRAMS  
(Sheet 2 of 2)

## PARTS LISTS

<b>TABLE</b>	<b>TITLE</b>	<b>NUMBER</b>
4	FC-30 SCA Generator 110V/220V 50/60 Hz	909-0051-204/-304
5	FC-30 SCA Generator 110V/220V 92 kHz	909-0051-292/392
6	Accessory Kit	959-0051/959-0183
7	Access Cable Assembly	947-0020
8	SCA Generator Circuit Board Assembly	917-0044
9	SCA GEnerator Cable Assembly	946-0030

## DRAWINGS

<b>TITLE</b>	<b>NUMBER</b>
SCA Generator Assembly Diagram	597-0008-5
SCA Generator Interconnect Schematic Diagram	C909-0053
SCA Generator Circuit Board Schematic Diagram	D909-0111

**TABLE 4. FC-30 SCA GENERATOR 110V/220V 50/60 HZ - 909-0051-204/-304**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C50	Capacitor Assembly, Feed-Thru, 100 pF: Kapton Dielectric Nylon Insulator	409-1817 423-6007	2 1
C51 THRU C62 C63	Capacitor, Ceramic, Feed-Thru, 100 pF ±20%, 500V	008-1033	12
C64	Capacitor Assembly, Feed-Thru, 100 pF: Kapton Dielectric Nylon Insulator	409-1817 423-6007	2 1
DS1	Capacitor, Ceramic, Feed-Thru, 100 pF ±20%, 500V	008-1033	1
DS2	Indicator, LED, Yellow, 521-9176, 2.3V @ 30 mA Maximum (AUTO Indicator)	323-9225	1
DS3	Indicator, LED, Red, 521-9212, 1.7V @ 50 mA Maximum (OFF Indicator)	323-9217	1
DS4	Indicator, LED, Green, 521-9175, 2.3V @ 40 mA Maximum (ON Indicator)	323-9224	1
DS5	Indicator, LED, Red, 521-9212, 1.7V @ 50 mA Maximum (100%+ MODULATION Indicator)	323-9217	1
FL1	Indicator, LED, Green, 521-9175, 2.3V @ 40 mA Maximum (10% - 100% MODULATION Indicator)	323-9224	1
J8 THRU J10	Filter, Modified, Fuse/Line 120/240V	360-6504	1
L1 THRU L9	Insulated BNC Connector	417-0048	3
TB1	Choke, Ferrite, 180 MHz, 2.5 Turns, Single Section	364-0002	9
----	Barrier Strip, 12 Terminal	412-0012	1
----	Switch Cap, Gray	343-6402	3
----	Fuse, MLD, 1/8 Ampere, 250V, Slow-Blow	334-0051	1
----	Accessory Kit (909-0051 Assembly Only)	959-0051	1
----	Accessory Kit (909-0051-300 Assembly Only)	959-0183	1
----	SCA Generator Circuit Board Assembly	917-0044	1
----	Cable Assembly, SCA Generator	946-0030	1

**TABLE 5. FC-30 SCA GENERATOR 110V/220V 92 KHZ - 909-0051-292/-392  
FOR 909-0051-292 ASSEMBLY**

----	FC-30, SCA Generator, 110V 50/60 Hz, B Series	909-0051-204	1
<b>DELETE PARTS FOR 909-0051-292 ASSEMBLY</b>			
----	Resistor, 13 k Ohm ±1%, 1/4W *(Remove R124, R129)	103-1305	2
----	Resistor, 1.33 k Ohm ±1%, 1/4W *(Remove R123)	103-1331	1
----	Resistor, 27.4 k Ohm ±1%, 1/4W *(Remove R88)	103-2751	1
<b>FOR 909-0051-392 ASSEMBLY</b>			
----	FC-30, SCA Generator 220V 50/60 Hz, B Series	909-0051-304	1
<b>DELETE PARTS FOR 909-0051-392 ASSEMBLY</b>			
----	Resistor, 13 k Ohm ±1%, 1/4W *(Remove R124, R129)	103-1305	2
----	Resistor, 1.33 k Ohm ±1%, 1/4W *(Remove R123)	103-1331	1
----	Resistor, 27.4 k Ohm ±1%, 1/4W *(Remove R88)	103-2751	1
R88	Resistor, 18.7 k Ohm ±1%, 1/4W	103-1875	1
R123	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R124	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R129	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1

**TABLE 6. ACCESSORY KIT - 959-0051/959-0183**

REF. DES.	DESCRIPTION	PART NO.	QTY.
F1,F2	Fuse, MDL, 1/8 Ampere, 250V, Slow-Blow (for 120 Volt Operation) (909-0051 Assembly Only)	334-0051	2
F1,F2	Fuse, MDL, 1/16 Ampere, 230V, Slow-Blow (for 230 Volt Operation) (909-0051-300 Assembly Only)	334-0052	2
----	Line Cord, N.E.M.A. Plug (909-0051 Assembly Only)	682-0001	1
----	Line Cord, European CEE 7/7 Plug (909-0051-300 Assembly Only)	682-0003	1
----	Access Cable Assembly	947-0020	1

**TABLE 7. ACCESS CABLE ASSEMBLY - 947-0020**

REF. DES.	DESCRIPTION	PART NO.	QTY.
P1,P2	BNC Connector for RG/58U	417-0205	2

**TABLE 8. SCA GENERATOR CIRCUIT BOARD ASSEMBLY - 917-0044  
(Sheet 1 of 5)**

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1,C2	Capacitor, Polystyrene, 0.47 uF, 100V	038-4753	2
C3,C4	Capacitor, Electrolytic, 1000 uF, 50V	014-1094	2
C5,C6	Capacitor, Polystyrene, 7500 pF, 50V	037-7540	2
C7 THRU C10	Capacitor, Electrolytic, 10 uF, 25V	023-1076	4
C11	Capacitor, Polystyrene, 7500 pF, 50V	037-7540	1
C12,C13	Capacitor, Electrolytic, 100 uF, 25V	023-1084	2
C14	Capacitor, Polystyrene, 7500 pF, 50V	037-7540	1
C15	Capacitor, Mylar Film, 0.1 uF, 100V	030-1053	1
C16	Capacitor, Polystyrene, 7500 pF, 50V	037-7540	1
C17	Capacitor, Electrolytic, 10 uF, 25V	023-1076	1
C18	Capacitor, Polystyrene, 7500 pF, 50V	037-7540	1
C19	Capacitor, Mylar Film, 0.1 uF, 100V	030-1053	1
C20	Capacitor, Electrolytic, 100 uF, 20V, Tantalum	063-1083	1
C21	Capacitor, Electrolytic, 10 uF, 25V	023-1076	1
C22,C23	Capacitor, Polystyrene, 7500 pF, 50V	037-7540	2
C24	Capacitor, Mylar Film, 0.1 uF, 100V	030-1053	1
C25	Capacitor, Electrolytic, 10 uF, 25V	023-1076	1
C26	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1
C27	Capacitor, Mylar Film, 0.1 uF, 100V	030-1053	1
C28	Capacitor, Electrolytic, 10 uF, 25V	023-1076	1
C29	Capacitor, Mylar Film, 0.1 uF, 100V	030-1053	1
C30	Capacitor, Electrolytic, 10 uF, 25V	023-1076	1
C31	Capacitor, Mica, 500 pF $\pm$ 1%, 500V	042-5021	1
C32	Capacitor, Ceramic Disc, 5 pF, 500V, NPO	001-5004	1
C33	Capacitor, Electrolytic, 10 uF, 25V	023-1076	1
C34	Capacitor, Mylar Film, 0.1 uF, 100V	030-1053	1
C35	Capacitor, Electrolytic, 10 uF, 25V	023-1076	1
C36	Capacitor, Mylar Film, 0.1 uF, 100V	030-1053	1
C37	Capacitor, Ceramic Disc, 5 pF, 500V, NPO	001-5004	1
C38 THRU C40	Capacitor, Electrolytic, 10 uF, 25V	023-1076	3
C41	Capacitor, Electrolytic, 100 uF, 25V	023-1084	1

**TABLE 8. SCA GENERATOR CIRCUIT BOARD ASSEMBLY - 917-0044**  
(Sheet 2 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C42	Capacitor, Mica, 0.001 uF, 500V	041-1032	1
C43	Capacitor, Mylar Film, 0.022 uF, 200V	031-2243	1
C44	Capacitor, Mylar Film, 0.047 uF, 100V	030-4743	1
C45	Capacitor, Mica, 100 pF, 500V	040-1022	1
C46	Capacitor, Electrolytic, 10 uF, 25V	023-1076	1
C47	Capacitor, Mica, 100 pF, 500V	040-1022	1
C48	Capacitor, Electrolytic, 10 uF, 25V	023-1076	1
C49	Capacitor, Mylar Film, 0.1 uF, 100V	030-1053	1
C65	Capacitor, Electrolytic, 10 uF, 16V, Non-Polarized	023-1075	1
D1 THRU D4	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	4
D5 THRU D8	Diode, 1N4148, Silicon, 75V @ 0.3A, Fast Switching	203-4148	4
D9 THRU D12	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	4
D13	Diode, 1N4148, Silicon, 75V @ 0.3A, Fast Switching	203-4148	1
D14,D15	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	2
D16,D17	Diode, 1N4148, Silicon, 75V @ 0.3A, Fast Switching	203-4148	2
D18	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	1
D19 THRU D21	Diode, 1N4148, Silicon, 75V @ 0.3A, Fast Switching	203-4148	3
D22	Diode, 1N4005, Silicon, 600V, 1 Ampere	203-4005	1
D23,D26	Diode, 1N4148, Silicon, 75V @ 0.3A, Fast Switching	203-4148	2
D28 THRU D30	Diode, HP5082-2800, High Voltage Schottky Barrier Type, 70V, 15 mA	201-2800	3
D31 THRU D35	Diode, 1N4148, Silicon, 75V @ 0.3A, Fast Switching	203-4148	5
D36	Diode, HP5082-2800, High Voltage Schottky Barrier Type, 70V, 15 mA	201-2800	1
D37 THRU D39	Diode, 1N4148, Silicon, 75V @ 0.3A, Fast Switching	203-4148	3
J1	Connector, Header, 6-Pin	417-0006-1	1
J2	Connector, Header, 2-Pin	417-4004	1
J3 THRU J6	Connector, Header, 6-Pin	417-0006-1	4
J7	Connector, Header, 8-Pin	417-0080	1
J8	Connector, Header, 2-Pin	417-4004	1
J9	Connector, Header, 3-Pin	417-0003	1
LDR1,LDR2	Optical Isolator, LDR/LED Type, VTL5C2 On Resistance: 500 Ohms Off Resistance: 1 Meg Ohm Cell Voltage: 200V Maximum Cell Current: 10 to 40 mA	323-7345	2
P8,P9	Programmable Jumper	340-0004	2
Q1 THRU Q4	Transistor, 2N3904, Silicon, NPN, TO-92 Case	211-3904	4
Q5	Transistor, 2N3906, Silicon, PNP, TO-92 Case	210-3906	1
R1	Resistor, 620 Ohm $\pm 5\%$ , 1/4W	100-6233	1
R2	Resistor, 75 Ohm $\pm 5\%$ , 1/4W	100-7523	1
R3	Resistor Network, 5 k Ohm $\pm 1\%$ , 1/4W, 16-Pin DIP (A THRU H)	226-0500	1
R5,R6	Resistor, 1 Meg Ohm $\pm 5\%$ , 1/4W	100-1073	2
R8,R9	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	2
R10	Resistor, 100 Ohm $\pm 5\%$ , 1/2W	110-1033	1
R12	Resistor, 680 Ohm $\pm 5\%$ , 1/4W	100-6833	1
R13	Potentiometer, 5 k Ohm $\pm 10\%$ , 1W, 10 Turn	179-5043	1
R14	Resistor, 330 Ohm $\pm 5\%$ , 1/4W	100-3333	1
R15	Resistor, 680 Ohm $\pm 5\%$ , 1/4W	100-6833	1
R16	Resistor, 1.33 k Ohm $\pm 1\%$ , 1/4W	103-1331	1
R17	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	1

**TABLE 8. SCA GENERATOR CIRCUIT BOARD ASSEMBLY - 917-0044**  
(Sheet 3 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R18,R19	Resistor, 4.99 k Ohm $\pm 1\%$ , 1/4W	100-5041	2
R20	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	1
R21 THRU R23	Resistor, 1 Meg Ohm $\pm 5\%$ , 1/4W	100-1073	3
R24	Resistor, 1.33 k Ohm $\pm 1\%$ , 1/4W	103-1331	1
R25	Resistor, 4.99 k Ohm $\pm 1\%$ , 1/4W	100-5041	1
R28	Resistor, 121 Ohm $\pm 1\%$ , 1/4W	100-1231	1
R29	Resistor, 4.99 k Ohm $\pm 1\%$ , 1/4W	100-5041	1
R31	Resistor, 100 k Ohm $\pm 5\%$ , 1/4W	100-1063	1
R33	Resistor, 121 Ohm $\pm 1\%$ , 1/4W	100-1231	1
R34	Resistor, 6.8 k Ohm $\pm 5\%$ , 1/4W	100-6843	1
R35	Potentiometer, 5 k Ohm $\pm 10\%$ , 1W, 10 Turn	179-5043	1
R36	Resistor, 330 Ohm $\pm 5\%$ , 1/4W	100-3333	1
R37	Resistor, 1 Meg Ohm $\pm 5\%$ , 1/4W	100-1073	1
R38	Resistor, 20 k Ohm $\pm 5\%$ , 1/4W	100-2053	1
R39	Resistor, 100 Ohm $\pm 5\%$ , 1/4W	100-1033	1
R40	Resistor, 20 k Ohm $\pm 5\%$ , 1/4W	100-2053	1
R41	Resistor, 4.99 k Ohm $\pm 1\%$ , 1/4W	100-5041	1
R42	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R43	Resistor, 39 k Ohm $\pm 5\%$ , 1/4W	100-8243	1
R44 THRU R46	Resistor, 1 Meg Ohm $\pm 5\%$ , 1/4W	100-1073	3
R47	Resistor, 4.99 k Ohm $\pm 1\%$ , 1/4W	100-5041	1
R48	Resistor, 56 k Ohm $\pm 5\%$ , 1/4W	100-5653	1
R49	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	1
R50	Resistor, 47 k Ohm $\pm 5\%$ , 1/4W	100-4753	1
R51	Resistor, 27 k Ohm $\pm 5\%$ , 1/4W	100-2753	1
R52	Resistor, 1 Meg Ohm $\pm 5\%$ , 1/4W	100-1073	1
R53	Resistor, 1 k Ohm $\pm 5\%$ , 1/4W	100-1043	1
R54	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	1
R55	Resistor, 4.99 k Ohm $\pm 1\%$ , 1/4W	100-5041	1
R56	Resistor, 1 k Ohm $\pm 5\%$ , 1/4W	100-1043	1
R57	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R58	Resistor, 4.99 k Ohm $\pm 1\%$ , 1/4W	100-5041	1
R59	Resistor, 15 k Ohm $\pm 5\%$ , 1/4W	100-1553	1
R60	Resistor, 47 k Ohm $\pm 5\%$ , 1/4W	100-4753	1
R61	Resistor, 22 k Ohm $\pm 5\%$ , 1/4W	100-2253	1
R62	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R63	Resistor, 1.2 k Ohm $\pm 5\%$ , 1/4W	100-1243	1
R64	Resistor, 100 Ohm $\pm 5\%$ , 1/4W	100-1033	1
R65	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R66	Resistor, 1 Meg Ohm $\pm 5\%$ , 1/4W	100-1073	1
R67	Potentiometer, 1 Meg Ohm $\pm 10\%$ , 1/2W	178-1074	1
R68,R69	Resistor, 5.1 k Ohm $\pm 5\%$ , 1/4W	100-5143	2
R70	Potentiometer, 2 k Ohm $\pm 10\%$ , 1/2W	177-2044	1
R71	Resistor, 4.7 k Ohm $\pm 5\%$ , 1/4W	100-4743	1
R72	Resistor, 1.2 k Ohm $\pm 5\%$ , 1/4W	100-1243	1
R73	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	1
R74	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1

**TABLE 8. SCA GENERATOR CIRCUIT BOARD ASSEMBLY - 917-0044**  
(Sheet 4 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R75	Resistor, 249 k Ohm $\pm 1\%$ , 1/4W	103-2496	1
R76	Resistor, 9.1 k Ohm $\pm 5\%$ , 1/4W	100-9143	1
R77	Resistor, 47 k Ohm $\pm 5\%$ , 1/4W	100-4753	1
R78	Resistor, 4.7 k Ohm $\pm 5\%$ , 1/4W	100-4743	1
R79	Resistor, 5.1 k Ohm $\pm 5\%$ , 1/4W	100-5143	1
R80	Potentiometer, 100 Ohm $\pm 10\%$ , 1/2W	177-1034	1
R81	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R82	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	1
R83	Resistor, 100 k Ohm $\pm 5\%$ , 1/4W	100-1063	1
R84	Resistor, 150 Ohm $\pm 5\%$ , 1/4W	100-1533	1
R85	Resistor Network, 10 k Ohm $\pm 1\%$ , 1/4W, 16-Pin DIP (A THRU H)	226-1055	1
R87	Resistor, 100 Ohm $\pm 5\%$ , 1/4W	100-1033	1
R88	Resistor, 27.4 k Ohm $\pm 1\%$ , 1/4W	103-2751	1
R89	Potentiometer, 5 k Ohm $\pm 10\%$ , 1W, 10 Turn	179-5043	1
R90	Resistor, 470 Ohm $\pm 5\%$ , 1/4W	100-4733	1
R91	Potentiometer, 5 k Ohm $\pm 10\%$ , 1W, 10 Turn	179-5043	1
R92	Resistor, 470 Ohm $\pm 5\%$ , 1/4W	100-4733	1
R94	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R95	Potentiometer, 1 Meg Ohm $\pm 10\%$ , 1/2W	178-1074	1
R96	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R97	Resistor, 820 Ohm $\pm 5\%$ , 1/4W	100-8233	1
R100	Resistor, 1 Meg Ohm $\pm 5\%$ , 1/4W	100-1073	1
R101	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R104	Resistor, 27 k Ohm $\pm 5\%$ , 1/4W	100-2753	1
R105	Resistor, 470 k Ohm $\pm 5\%$ , 1/4W	100-4763	1
R106	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	1
R107	Resistor, 1 k Ohm $\pm 5\%$ , 1/4W	100-1043	1
R108,R109	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R111 THRU R114	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	4
R115	Resistor, 5.1 k Ohm $\pm 5\%$ , 1/4W	100-5143	1
R116	Resistor, 220 k Ohm $\pm 5\%$ , 1/4W	100-2263	1
R117	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R118	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	1
R119	Resistor, 220 k Ohm $\pm 5\%$ , 1/4W	100-2263	1
R120	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R121	Resistor, 33 k Ohm $\pm 5\%$ , 1/4W	100-3353	1
R122	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R123	Resistor, 1.33 k Ohm $\pm 1\%$ , 1/4W	103-1331	1
R124	Resistor, 13 k Ohm $\pm 5\%$ , 1/4W	100-1353	1
R125	Resistor, 10 Meg Ohm $\pm 5\%$ , 1/4W	100-1083	1
R126	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	1
R127	Resistor, 27 k Ohm $\pm 5\%$ , 1/4W	100-2753	1
R128	Resistor, 47 k Ohm $\pm 5\%$ , 1/4W	100-4753	1
R129	Resistor, 13 k Ohm $\pm 5\%$ , 1/4W	100-1353	1
R130	Resistor, 20 k Ohm $\pm 1\%$ , 1/4W	103-2051	1
R131	Resistor, 9.09 k Ohm $\pm 1\%$ , 1/4W	103-9041	1
R132	Resistor, 1 k Ohm $\pm 1\%$ , 1/4W	103-1041	1
R133	Resistor, 10 Ohm $\pm 5\%$ , 1/4W	100-1023	1
R134	Resistor, 47 k Ohm $\pm 5\%$ , 1/4W	100-4753	1

**TABLE 8. SCA GENERATOR CIRCUIT BOARD ASSEMBLY - 917-0044**  
(Sheet 5 of 5)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R135,R136	Resistor, 1 k Ohm $\pm 5\%$ , 1/4W	100-1043	2
R137	Resistor, 620 Ohm $\pm 5\%$ , 1/4W	100-6233	1
R138	Resistor, 27 k Ohm $\pm 5\%$ , 1/4W	100-2753	1
R139	Resistor, 10 k Ohm $\pm 5\%$ , 1/4W	100-1053	1
R140	Resistor, 1 Meg Ohm $\pm 5\%$ , 1/4W	100-1073	1
R141	Potentiometer, 20 k Ohm $\pm 10\%$ , 1/2W	177-2054	1
R148	Potentiometer, 100 k Ohm $\pm 10\%$ , 1/2W	177-1064	1
S1	Ganged, 3 Station, Interlocked Push Switch, DPDT, 25W Maximum, 0.5 Ampere @ 50V ac or dc, Resistive Load or 0.125 Ampere at 110/120V ac, Resistive Load ( <b>OFF/ON/AUTO/REMOTE</b> Switch)	343-1202	1
U1	Integrated Circuit, TL074CN, Quad P-Channel JFET Input Operational Amplifier, 14-Pin DIP	221-0074	1
U2 THRU U4	Integrated Circuit, 4N33, Optical Isolator, Infared LED-Photo NPN Darlington Transistor Coupled Pair, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	3
U5	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0317	1
U6	Integrated Circuit, LM337T, Adjustable Negative Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0337	1
U7	Integrated Circuit, TL074CN, Quad P-Channel JFET Input Operational Amplifier, 14-Pin DIP	221-0074	1
U8	Integrated Circuit, MC14011, CMOS, Quad 2-Input NAND Gate, 14-Pin DIP	228-4011	1
U9	Integrated Circuit, MC14001, CMOS, Quad 2-Input NOR Gate, 14-Pin DIP	228-4001	1
U10	Integrated Circuit, TL074CN, Quad P-Channel JFET Input Operational Amplifier, 14-Pin DIP	221-0074	1
U11,U12	Integrated Circuit, 4N33, Optical Isolator, Infared LED-Photo NPN Darlington Transistor Coupled Pair, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	2
U13	Integrated Circuit, XR2206CP, Function Generator, 0.01 Hz to 1 MHz, 16-Pin DIP	229-2206	1
U14	Integrated Circuit, TL074CN, Quad P-Channel JFET Input Operational Amplifier, 14-Pin DIP	221-0074	1
U15	Integrated Circuit, 4N33, Optical Isolator, Infared LED-Photo NPN Darlington Transistor Coupled Pair, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	1
U16	Integrated Circuit, TL072CP, Dual P-Channel JFET Input Operational Amplifier, 8-Pin DIP	221-0072	1
U17	Integrated Circuit, TL092, Dual N-Channel JFET Input Operational Amplifier, 8-Pin DIP	221-0092	1
XR3,XR85	Socket, 16-Pin DIP	417-1604	2
XU1,XU7 THRU XU10	Socket, 14-Pin DIP	417-1404	5
XU13	Socket, 16-Pin DIP	417-1604	1
XU14	Socket, 14-Pin DIP	417-1404	1
XU16,XU17	Socket, 8-Pin DIP	417-0804	2
----	Heatsink, TO-220 Case, Low Profile	455-7805	2
----	Screw, 4-40 X 3/8, Nylon	420-4996	1
----	Transistor Mounting Insulator, TO-220 Case	409-7403	1
----	Nut, 4-40, Nylon	421-4901	1
----	Blank Circuit Board	517-0044	1

**TABLE 9. SCA GENERATOR CABLE ASSEMBLY - 946-0030**

<b>REF. DES.</b>	<b>DESCRIPTION</b>	<b>PART NO.</b>	<b>QTY.</b>
P1	Connector, 6-Pin	417-0601	1
P2	Connector, 2-Pin	417-0499	1
P3,P5	Connector, 6-Pin	417-0601	2
P7	Connector, 8-Pin	417-0046	1
----	Pins for P1, P2, P3, P5, and P7, Crimp Type	417-8766	25
T1	Transformer, Power, 50/60 Hz Primary: Dual 115V Primary, One Winding tapped at 100V Secondary: Dual 19V @ 0.09 Amperes	376-9852	1