

OWNER'S MANUAL

ACKNOWLEDGEMENT
COPY

MODEL TSK29C

SWR/WATTMETER KIT

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SWR/WATTMETER KIT
KPN 071-05221-000

This kit consists of the following parts:

<u>DESCRIPTION</u>	<u>QTY</u>
29C SWR/WATTMETER	1
HF233K POWER SENSOR	1
CABLE ASSEMBLY 4 ft.	1
CABLE ASSEMBLY 15 ft.	1
SPARE BATTERIES	2
OPERATING/SERVICE MANUAL	1

NOTE

The following additional cable assemblies used to connect the Power Sensor to the SWR/WATTMETER are available from Bendix/King:

<u>KING PART NO.</u>	<u>DESCRIPTION</u>
071-05065-0050	CABLE ASSEMBLY 4 ft.
071-05065-0051	CABLE ASSEMBLY 15 ft.
071-05065-0052	CABLE ASSEMBLY 25 ft.

**SIGNALCRAFTERS
MODEL TSK29C
TEST SET**

TABLE OF CONTENTS

1.0	GENERAL INFORMATION	1
1.1	INTRODUCTION	1
	1.1.1 Purpose of Manual.	1
	1.1.2 Purpose of Equipment.	1
1.2	EQUIPMENT DESCRIPTION	1
1.3	TECHNICAL SPECIFICATIONS	2
	1.3.1 Model 29C SWR/Wattmeter.	2
	1.3.2 Model HF233K Power Sensor.	4
	1.3.3 CA4 Cable Assembly.	4
	1.3.4 CA15 Cable Assembly.	5
2.0	INSTALLATION	6
2.1	GENERAL	6
2.2	UNPACKING AND INSPECTING EQUIPMENT	6
2.3	INSTALLATION PROCEDURES	6
	2.3.1 Installation of Model HF233K Power Sensor.	6
	2.3.2 Power Requirements.	6
	2.3.3 Mounting Considerations.	7
3.0	OPERATION	9
3.1	GENERAL	9
3.2	POWER ON.	9
3.3	RANGE SELECTION	9
3.4	RF POWER METER MODE SELECTION	9
3.5	OPERATIONAL FUNCTION OF SYSTEM	10
4.0	PREVENTIVE AND CORRECTIVE MAINTENANCE	11
4.1	PREVENTIVE MAINTENANCE	11
	4.1.1 Cleaning.	11
	4.1.2 Inspection.	12
4.2	CORRECTIVE MAINTENANCE	13
4.3	REPAIRS	13
4.4	CALIBRATION	14
	4.4.1 Test Equipment Requirements.	14
	4.4.2 Calibration Procedure.	15
5.0	TECHNICAL REFERENCE	17
5.1	GENERAL	17
5.2	PARTS LIST	17

**SIGNALCRAFTERS
MODEL TSK29C
TEST SET**

LIST OF ILLUSTRATIONS

FIGURE 1 - Typical Interconnect Diagram	7
FIGURE 2 - Model 29C Front Panel	8
FIGURE 3 - TSK29C Block Diagram	10
Table 4-1. Test Equipment Requirements	14
FIGURE 4 - Calibration test setup	14
FIGURE 5 - Model 29C PCB Component Layout	21
FIGURE 6 - Model 29C PCB Schematic Diagram	23
FIGURE 7 - Model 29C Schematic Diagram	25

**SIGNALCRAFTERS
MODEL TSK29C
TEST SET**

1.0 GENERAL INFORMATION

1.1 INTRODUCTION

1.1.1 Purpose of Manual.

This manual contains installation, operation and maintenance instructions plus a schematic and parts list for Signalcrafters Model TSK29C Test Set.

1.1.2 Purpose of Equipment.

The Signalcrafters Model TSK29C Test Set is used to accurately evaluate the performance of a 2 to 30 MHz, Single Sideband or Amplitude Modulated Transceiver, 2 to 30 MHz Automatic Antenna Tuner and the associated Antenna. The Model 29C SWR/Wattmeter provides direct readout of SWR regardless of the power level applied, and accurate power readings within the selected range.

1.2 EQUIPMENT DESCRIPTION

The Signalcrafters Model TSK29C Test Set consists of: Model 29C SWR/Wattmeter; Model HF233K Power Sensor; CA4 and CA15 Cable Assemblies; spare batteries; and Instruction manual.

The Model 29C SWR/Wattmeter is a compact, ruggedly constructed unit housed in an all metal cabinet, providing optimum protection and shielding of the solid-state computing circuitry.

The Signalcrafters Model HF233K Power Sensor is designed for remote connection through a 4-wire shielded cable. Input for the R.F. Signal to the Power Sensor is at the TX (IN) BNC connector, while output is at the ANT (OUT) BNC connector. The two BNC connectors are designed for direct connection to the King Radio Model 950 Transceiver at the KAC 952 PA/Coupler Unit.

The Model 29C SWR/Wattmeter provides automatically computed SWR readings. In either the 0-50 W or 0-250 W range no manual adjustments are necessary to provide accurate SWR readings.

**SIGNALCRAFTERS
MODEL TSK29C
TEST SET**

1.2 EQUIPMENT DESCRIPTION (cont'd)

Three toggle switches provide the following functions:

ON/OFF : Applies operating power from two internal
9 VDC batteries.

RANGE - 50/250 W : Manual RF POWER range selection.

MODE - PEAK/AVG : Selects RF POWER metering
characteristics.

A momentary push button switch provides the following feature:

BAT TEST : Displays battery condition on BATT. OK scale
of the RF POWER - WATTS meter.

The Model 29C SWR/Wattmeter operates on two (2) self-contained 9
volt batteries.

1.3 TECHNICAL SPECIFICATIONS

1.3.1 Model 29C SWR/Wattmeter.

MECHANICAL

Dimensions

Width : 9" (229 mm)
Height: 8.5" (216 mm)
Depth : 6" (152 mm)

Weight: 5 lbs (2.27 kg) less cables, Power Sensor, and spare
batteries.

Color: Blue, Polyurethane finish, with Lexan overlaid front
panel.

ELECTRICAL

Frequency Range: 2 to 30 MHz

Insertion SWR: Less than 1.05 to 1

**SIGNALCRAFTERS
MODEL TSK29C
TEST SET**

1.3.1 Model 29C SWR/Wattmeter (cont'd).

Impedance: 50 Ohms

Power Rating: 0.1-250 W in two ranges; 0-50 W and 0-250 W

Indicators:

Two taut-band meters

RF POWER - WATTS

Three scales: 0-50 watts
0-250 watts
BATT OK

Accuracy: $\pm 5\%$ at full scale; 1:1 SWR
Response: Selected by PEAK/AVG switch
(See Sec III, para. 3.4)
PEAK - Fast attack/slow release
AVG - Fast attack/fast release

SWR/REFLECTION COEFFICIENT

Two scales: SWR (1- ∞)
REFLECTION COEFFICIENT (0.1-1)

Controls:

Three toggle switches
ON/OFF
RANGE - 50/250 watts
MODE - PEAK/AVG

One momentary push button switch
BAT TEST

Connectors:

POWER SENSOR - Receptacle, bayonet, quick
disconnect, 4 pin, female

Power Requirements: ± 9 volts d.c. (internal batteries)

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MODEL TSK29C
TEST SET**

1.3.2 Model HF233K Power Sensor.

MECHANICAL

Dimensions:

Width : 3-1/16 in. (9.2 cm)
Height: 3-1/16 in. (9.2 cm)
Depth : 2-1.8 in. (5.4 cm)
(over coaxial connectors)

Weight: 7.2 oz. (205.3 grams)

Color: Blue, Polyurethane finish, bright nickel plate

ELECTRICAL

Frequency Range: 2-30 MHz

Insertion SWR: Less than 1.05 to 1

Impedance: 50 Ohms

Power Rating: 0.1-250 watts

Connectors: TX(IN); male BNC bulkhead mount
ANT(OUT); male BNC bulkhead mount
Output to SWR/Wattmeter; Quick disconnect
4 pin male bayonet receptacle

1.3.3 CA4 Cable Assembly.

MECHANICAL

Dimensions:

Length: 4 ft. (1.22 m)

Weight: 2 oz (57 grams)

ELECTRICAL

Four #26 AWG, stranded wires, teflon insulation,
shielded cable with teflon jacket

Connectors:

1 - Plug, bayonet, quick disconnect, 4 pin, female
1 - Plug, bayonet, quick disconnect, 4 pin, male

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MODEL TSK29C
TEST SET**

1.3.4 CA15 Cable Assembly.

MECHANICAL

Dimensions:

Length: 15 ft. (4.57 m)

Weight: 7 oz. (200 grams)

1.3.4 CA15 Cable Assembly (cont'd).

ELECTRICAL

Four #26 AWG, stranded wires, teflon insulation,
shielded cable with teflon jacket

Connectors:

- 1 - Plug, bayonet, quick disconnect, 4 pin, female
- 1 - Plug, bayonet, quick disconnect, 4 pin, male

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MODEL TSK29C
TEST SET**

2.0 INSTALLATION

2.1 GENERAL

The subsequent paragraphs cover the installation of the Model 29C SWR/Wattmeter and related accessories in the performance of tests on specific models of Transceivers in the King Radio line. The Model 29C SWR/Wattmeter and related accessories are removed after tests are completed.

2.2 UNPACKING AND INSPECTING EQUIPMENT

Exercise care when unpacking the equipment. Make a visual inspection of the equipment and accessories for any apparent damage incurred during shipment. If a claim for damage is to be made, save the shipping container to aid in substantiating the claim. All claims should be filed with the delivering transportation company.

2.3 INSTALLATION PROCEDURES

NOTE

Refer to applicable King Radio Installation Manual for equipment specifics and complete test procedures.

2.3.1 Installation of Model HF233K Power Sensor.

The Model HF233K Power Sensor is designed to mate with BNC connectors on specific models of King Radio equipments. TX(IN) and ANT(OUT) connectors are special BNC, bulkhead mounting male plugs.

The CA4 or CA15, Cable Assemblies supplied with the Model TSK29C Test Set connects the Power Sensor to the SWR/Wattmeter.

2.3.2 Power Requirements.

The Model 29C, SWR/Wattmeter is powered by two internal 9 volt batteries.

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MODEL TSK29C
TEST SET**

2.3.3 Mounting Considerations.

The Model 29C SWR/Wattmeter and associated accessories are designed for use only in sheltered environments. Under no circumstances should they be used or installed for use in areas which would expose the components to the elements of the weather.

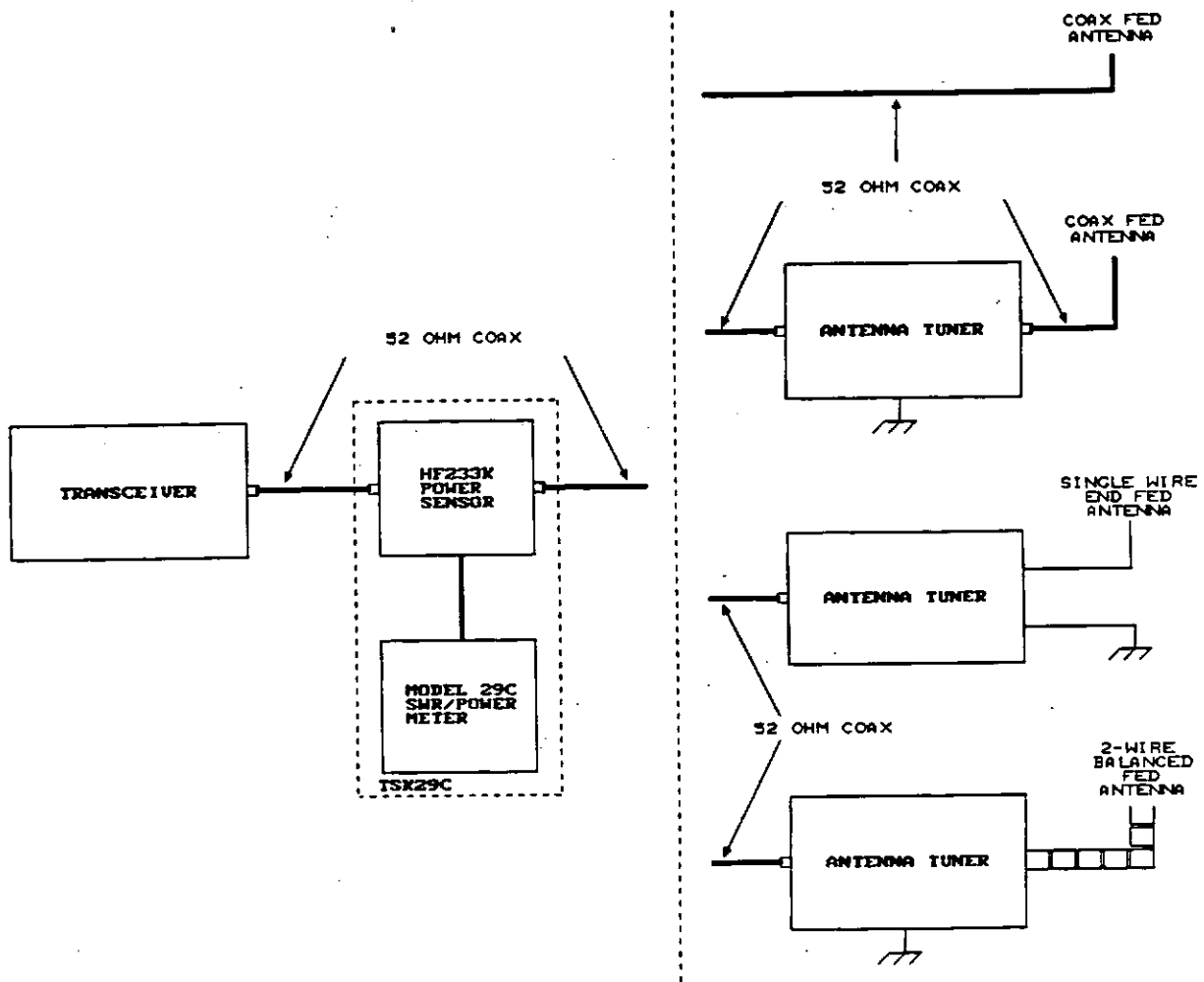


FIGURE 1 - Typical Interconnect Diagram

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TEST SET**

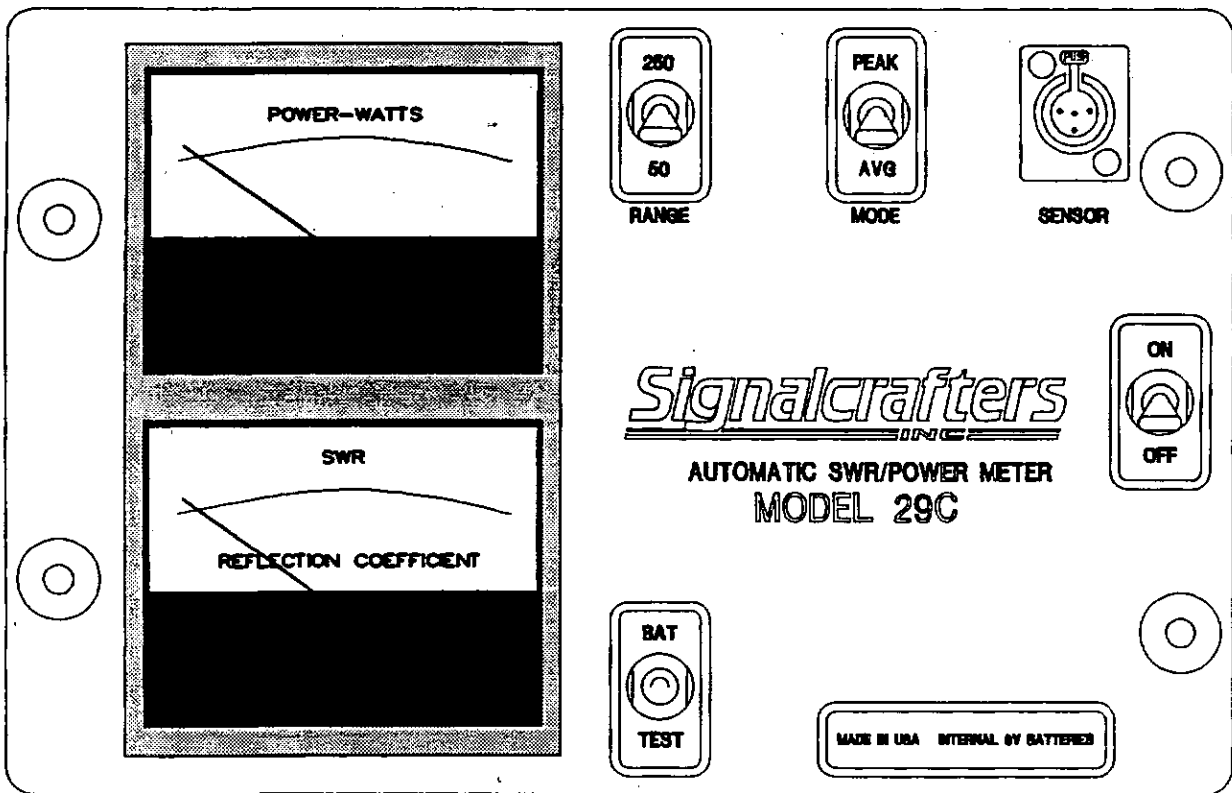


FIGURE 2 - Model 29C Front Panel

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TEST SET**

3.0 OPERATION

3.1 GENERAL

The operating controls for the Model 29C SWR/Wattmeter are shown in Figure 1, and their functions are described below.

ON/OFF	S1	Single throw toggle switch. Applies power to the unit from two internal 9 volt batteries.
BAT TEST	S2	Momentary push button. Connects battery to RF POWER-WATTS meter when momentarily pressed. ON/OFF switch must be in the ON position. Meter should indicate in BATT.OK portion of meter scale.
RANGE	S3	Single throw toggle switch. Selects power range; 50-250 watts.
MODE	S4	Single throw toggle switch. Selects metering characteristics; PEAK and AVG.

3.2 POWER ON.

Application of operating power to the SWR/Wattmeter is accomplished by throwing ON/OFF toggle switch, to ON position.

3.3 RANGE SELECTION

Select range by operating 250 W/50 W toggle switch, prior to performing tests with the equipment.

3.4 RF POWER METER MODE SELECTION

Select metering characteristics by throwing the PEAK/AVG toggle switch to correspond to signal measurement

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MODEL TSK29C
TEST SET**

3.4 RF POWER METER MODE SELECTION (cont'd)

characteristics desired. PEAK mode is fast attack/slow release for single sideband signals, while the AVG mode is fast attack/fast release and suitable for continuous carrier signals.

3.5 OPERATIONAL FUNCTION OF SYSTEM

The Block Diagram, Figure 3, shows the basic circuitry functions of the Model 29C SWR/Wattmeter.

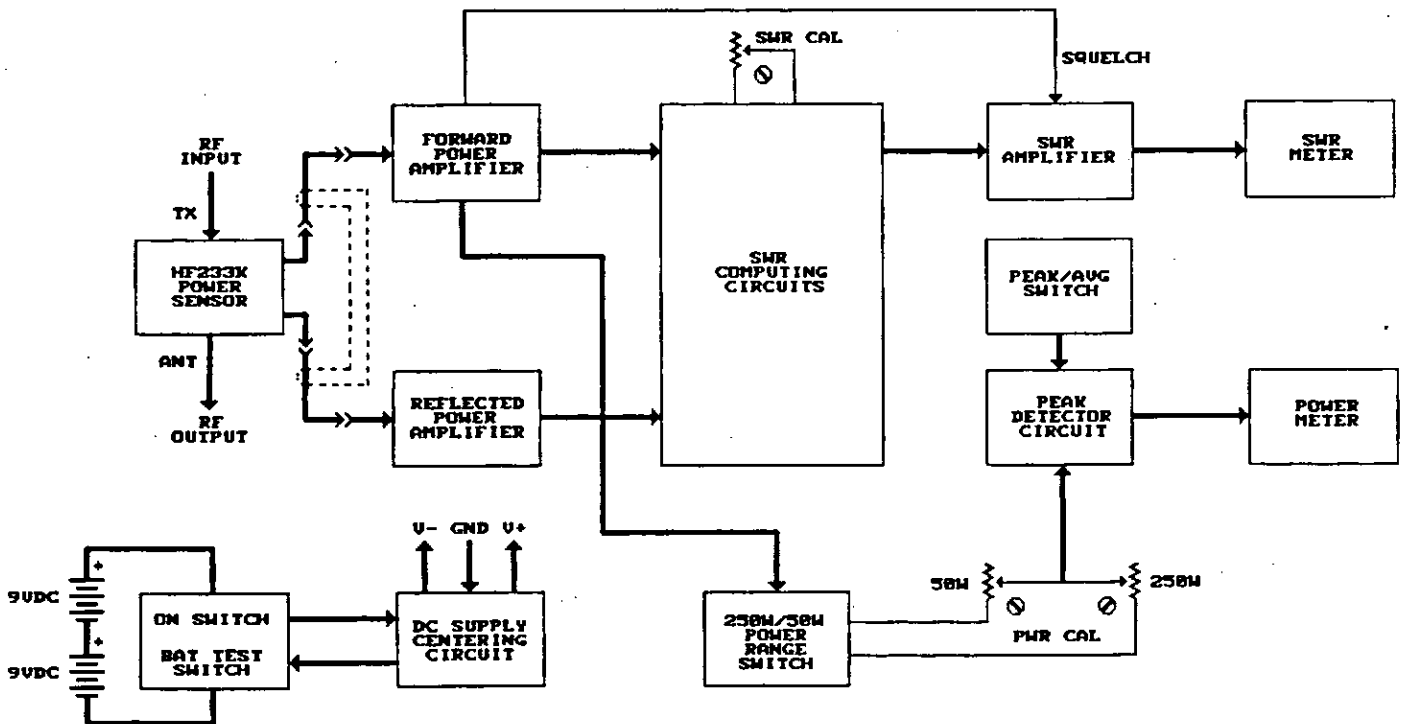


FIGURE 3 - TSK29C Block Diagram

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MODEL TSK29C
TEST SET**

4.0 PREVENTIVE AND CORRECTIVE MAINTENANCE

4.1 PREVENTIVE MAINTENANCE

Preventive Maintenance practices are those limited to care and cleaning of the equipment.

NOTE

The Power Sensor is not field repairable and should not be opened for cleaning, inspection or repair.

WARNING

Perform operations involving solvents only in a well ventilated area. Avoid breathing of solvent vapor and continuous contact with solvent.

4.1.1 Cleaning.

A. Printed Circuit Board - Interior of Chassis.

Remove dust and dirt from all surfaces with a soft-bristled brush in conjunction with an air jet.

NOTE

When the dress of wiring is disturbed, dressing should be noted, and when cleaning is finished, wiring should be restored to proper dress position.

WARNING

Goggles should be worn when using air jet (28 psi) to blow dust and dirt from equipment. Other persons should be warned away from hazardous area or working enclosure.

B. Metal Surfaces.

Clean with soft cloth moistened in trichlorethylene solvent, and dry with a clean dry cloth.

**SIGNALCRAFTERS
MODEL TSK29C
TEST SET**

4.1.1 Cleaning (cont'd).

C. Connectors.

Wipe dust and dirt from contacts using trichlorethylene solvent and a soft cloth. Wipe dry with a clean dry cloth. Remove dust from connectors using a small soft-bristled brush in conjunction with air jet.

D. Front Panel.

Clean the Lexan surface of the front panel using a mild liquid detergent and a soft lint-free cloth. Use water sparingly as the panel is not sealed and damage to the electronics may result.

4.1.2 Inspection.

A. Case.

Inspect case of SWR/Wattmeter and Power Sensor for deformations, dents, punctures or surfaces which might be wearing due to interference or mishandling.

B. Connectors.

Inspect for broken parts or other abnormal condition. Inspect for corrosion, signs of arcing, and for poorly soldered connections.

C. Resistors and Capacitors.

Inspect resistors and capacitors for signs of deterioration due to overheating, cracked, broken or charred insulation and solder joints.

D. Metal Surfaces and Mechanical.

Inspect metal surfaces for signs of corrosion, also check component mounting hardware for mechanical tightness.

E. Wiring.

Check wiring for damaged insulation and for proper dress.

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MODEL TSK29C
TEST SET**

4.2 CORRECTIVE MAINTENANCE

Corrective maintenance involves two basic procedures; 1) localization of trouble, 2) isolation of trouble. Localization means tracing the trouble to the unit or circuit responsible for abnormal operation. Isolation means tracing the trouble to the defective component. Quite frequently, the source of trouble can be isolated by inspection of components and wiring during the process of performing preventive maintenance.

4.3 REPAIRS

Component replacement in the Model 29C is basic and does not require any special tools or techniques to accomplish repairs. It is recommended that before you attempt repairs you refer to the Illustrated Parts Catalog Section of this manual (Figure 3) and determine the proper replacement part number, and verification of location of the part to be replaced using the information contained in the parts Catalog and illustrations.

NOTE

The SWR/Wattmeter must be recalibrated after cleaning or repairing of the electronics.

NOTE

The Technical Section of this manual contains the Parts List, PCB component layout information, as well as schematics for the Model 29C. The Power Sensor is not field repairable and, therefore, not supported in the Technical Section. If failure of the Power Sensor occurs, return it to Signalcrafters, Inc. for repair and recalibration.

**SIGNALCRAFTERS
MODEL TSK29C
TEST SET**

4.4 CALIBRATION

The Model 29C SWR/Wattmeter must be calibrated after repairs, cleaning, and as scheduled by Quality Assurance procedures of the using agency.

4.4.1 Test Equipment Requirements.

The required test equipment is listed in Table 4-1. Suitable equivalent equipments may be used if approved by the using agencies Quality Assurance Department.

EQUIPMENT	MANUFACTURER-MODEL NO.
Signal Generator	Hewlett-Packard Model HP-606B
Broadband Power Amplifier	ENI Model A-300
Attenuator, 500 W 30 db 50 Ohms	Bird Model 8325
Power Meter	Hewlett-Packard Model HP-435A
Power Sensor	Hewlett-Packard Model HP-8482

Table 4-1. Test Equipment Requirements

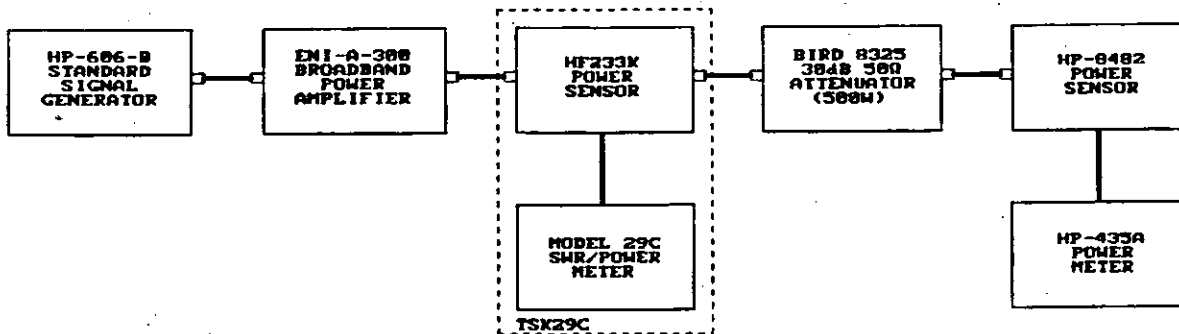


FIGURE 4 - Calibration test setup

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MODEL TSK29C
TEST SET**

4.4.2 Calibration Procedure.

The Model 29C power meter and SWR meter circuits can be independently calibrated following the procedure given below. Refer to Figure 4.

A. Power Calibration.

- (1) Remove the Model 29C from its case by removing the four attaching screws on the front panel.
- (2) Install fresh 9 volt batteries.
- (3) Connect the HF233K Power Sensor using the CA4 or CA15 Cable Assembly.
- (4) With no R.F. connections to the sensor, turn the instrument on and depress the BAT TEST button. The reading should be well within the BATT. OK arc, on the RF POWER-WATTS meter.
- (5) If there is a slight zero offset showing on the RF POWER-WATTS meter, this may be corrected by carefully adjusting the mechanical zero adjustment on the face of the meter. Do not make any adjustments to the SWR meter at this time. Place the MODE switch in the AVG position.
- (6) Connect the sensor as shown in Figure 4 and select the 50 W range on the Model 29C SWR/Wattmeter. Apply 50 watts of RF power at a frequency of 15 Mhz.
- (7) Adjust resistor R18 (PWR CAL - 50 W) to obtain a proper full scale reading on the RF POWER-WATTS meter. Place the MODE switch in the AVG position for all remaining adjustments.
- (8) Check the meter readings at 30 and 10 watts.
- (9) At this time, a sweep of the generator from 2 to 30 Mhz at a constant power of 40 watts will reveal any deficiencies in the HF233K Power Sensor.

**SIGNALCRAFTERS
MODEL TSK29C
TEST SET**

4.4.2 Calibration Procedure (cont'd).

- (10) Select the 250 W range on the Model 29C SWR/Wattmeter and apply 250 watts of RF power at a frequency of 15 MHz. Adjust resistor R19 (PWR CAL - 250 W) for proper full scale reading.

B. SWR Calibration.

NOTE

All SWR Calibration adjustments are made with a forward power indication of either 10 or 20 watts.

- (1) With 10 watts applied through the sensor into a good 50 ohm load, the SWR meter should read $SWR = 1$. No adjustment is necessary. Reduce power to zero and observe that the SWR reading maintains $SWR = 1$ when power is removed.
- (2) Remove the 50 Ohm load from the sensor and replace with a short, for $SWR = \infty$ (Infinity) setting.
- (3) Apply power until a forward reading of 10 watts is obtained. Adjust resistor R17 (SWR CAL) for proper full scale reading, $SWR = \infty$ (Infinity), on the SWR meter.
- (4) Disconnect equipment and return unit to service.

NOTE

If difficulty is observed, the instrument should be returned to the factory for repair and calibration. **DO NOT** attempt to adjust the HF233K Power Sensor in the field. The HF233K Power Sensor is **NOT** field repairable.

**SIGNALCRAFTERS
MODEL TSK29C
TEST SET**

5.0 TECHNICAL REFERENCE

5.1 GENERAL

This section of the Owner's Manual contains the Model 29C Parts List, PCB Component Layout Diagram, and the Schematic Diagram for use in the repair and servicing of the TSK29C.

5.2 PARTS LIST

88F0018 TSK29C SWR/POWER METER TEST KIT			
REF	PART#	QTY	DESCRIPTION
	87A0045	1	MODEL 29C SWR/POWER METER
	88F0035	1	HF233K 50 OHM POWER SENSOR
	78B0020	1	MODEL 29C OWNER'S MANUAL
	86K0113	1	5' POWER SENSOR CABLE
	87K0054	1	15' POWER SENSOR CABLE
	60D0103	2	ALKALINE 9V BATTERY
87A0045 MODEL 29C SWR/POWER METER			
REF	PART#	QTY	DESCRIPTION
	87G0046	1	MODEL 29C FRONT PANEL ASSEMBLY
	87E0047	1	MODEL 29C CASE BOTTOM ASSEMBLY
	87C0048	1	MODEL 29C CASE LID ASSEMBLY
87G0046 MODEL 29C FRONT PANEL ASSEMBLY			
REF	PART#	QTY	DESCRIPTION
	42A0058	1	METER, MODEL 29C SWR
	42G0059	1	METER, MODEL 29C POWER
	74A0160	1	ALUMINUM PANEL W/LEXAN OVERLAY
	74E0209	1	DOUBLE METER SHOCK ABSORBER PAD
	87F0051	1	MODEL 29C PCB ASSEMBLY
	87G0080	1	MODEL 29C CABLE; PCB TO METER
	87E0081	1	MODEL 29C CABLE; SENSOR JACK TO PCB

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MODEL TSK29C
TEST SET**

5.2 PARTS LIST (continued)

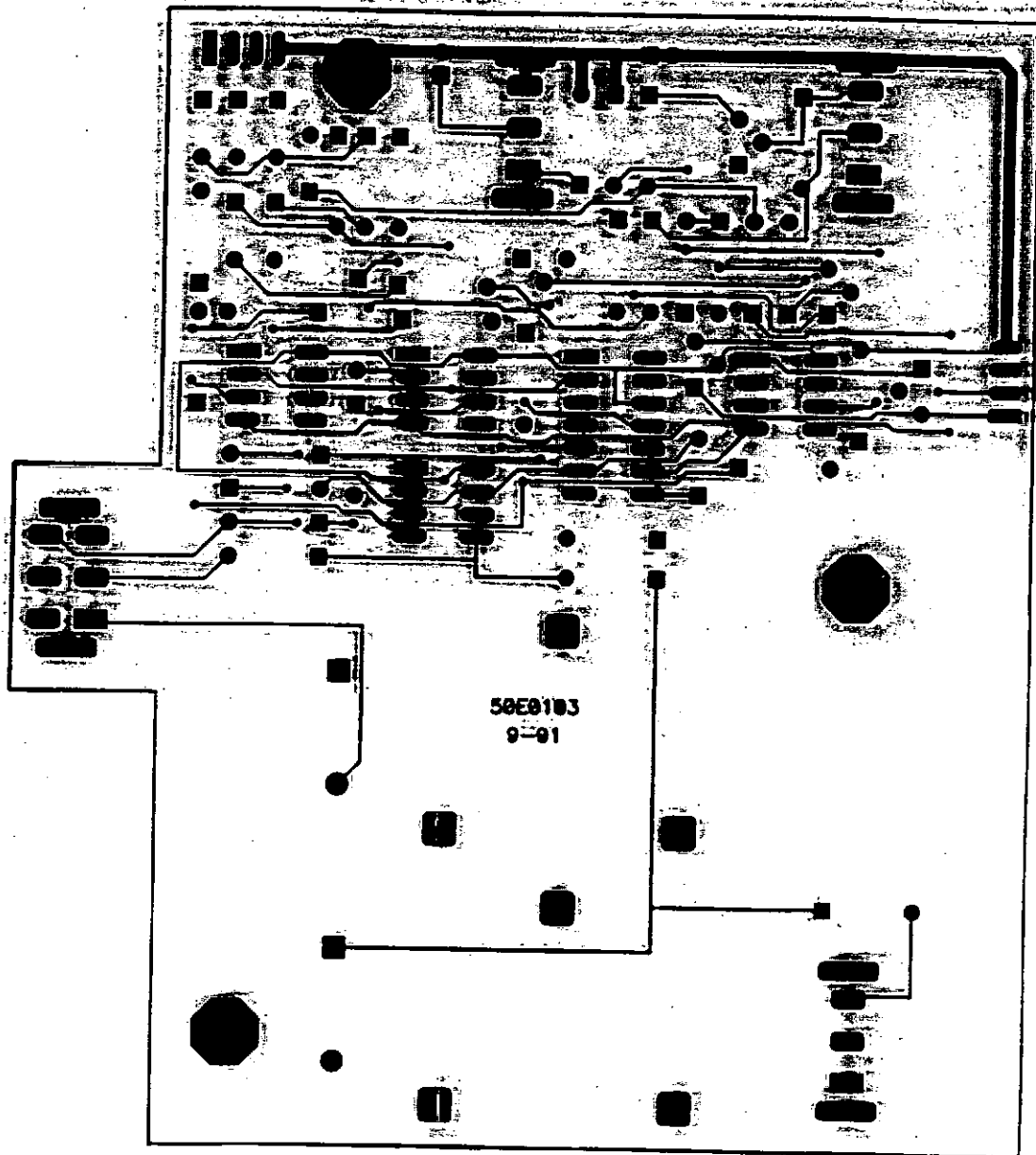
87F0051 MODEL 29C PCB ASSEMBLY			
REF	PART#	QTY	DESCRIPTION
BT1	60D0103	1	ALKALINE 9V BATTERY
BT2	60D0103	1	ALKALINE 9V BATTERY
C1	16E0038	1	0.001 uF CERAMIC DISC CAPACITOR 100 WVDC
C2	16E0038	1	0.001 uF CERAMIC DISC CAPACITOR 100 WVDC
C3	16B0040	1	0.005 uF CERAMIC DISC CAPACITOR 100 WVDC
C4	16E0038	1	0.001 uF CERAMIC DISC CAPACITOR 100 WVDC
C5	16A0011	1	51 pF ±10% CERAMIC DISC CAPACITOR 50 WVDC
C6	16E0276	1	22 uF ±10% TANTALUM CAPACITOR 10 WVDC
D1	30E0020	1	5082-2800 HOT CARRIER DIODE
D2	30E0020	1	5082-2800 HOT CARRIER DIODE
D3	30A0005	1	1N914 SILICON DIODE
J1	52G0366	1	4-PIN MALE HEADER
J2	52G0366	1	4-PIN MALE HEADER
JP1	60K0003	1	PCB MOUNT 9V BATTERY HOLDER
JP2	60K0003	1	PCB MOUNT 9V BATTERY HOLDER
PCB	50E0102	1	MODEL 29C PRINTED CIRCUIT BOARD
Q1	30F0351	1	2N5457 N-CHANNEL J-FET TRANSISTOR
Q2	30E0381	1	J176 P-CHANNEL J-FET TRANSISTOR
R1	10K1669	1	100 KΩ ±5% ¼ W CF RESISTOR
R2	10K1669	1	100 KΩ ±5% ¼ W CF RESISTOR
R3	10D1621	1	1 KΩ ±5% ¼ W CF RESISTOR
R4	10C1697	1	1.5 MΩ ±5% ¼ W CF RESISTOR
R5	10K1669	1	100 KΩ ±5% ¼ W CF RESISTOR
R6	10K1669	1	100 KΩ ±5% ¼ W CF RESISTOR
R7	10D1621	1	1 KΩ ±5% ¼ W CF RESISTOR
R8	10F1666	1	75 KΩ ±5% ¼ W CF RESISTOR
R9	10F1701	1	2.2 MΩ ±5% ¼ W CF RESISTOR
R11	10F1645	1	10 KΩ ±5% ¼ W CF RESISTOR
R12	10F1645	1	10 KΩ ±5% ¼ W CF RESISTOR
R13	10C1693	1	1 MΩ ±5% ¼ W CF RESISTOR
R14	10C1693	1	1 MΩ ±5% ¼ W CF RESISTOR
R15	10K1665	1	68 KΩ ±5% ¼ W CF RESISTOR
R16	10K1665	1	68 KΩ ±5% ¼ W CF RESISTOR
R17	12G0024	1	10 KΩ CERMET TRIM POTENTIOMETER
R18	10A1673	1	150 KΩ ±5% ¼ W CF RESISTOR
R19	12K0032	1	500 KΩ CERMET TRIM POTENTIOMETER
R20	10F1683	1	390 KΩ ±5% ¼ W CF RESISTOR
R21	12E0029	1	200 KΩ CERMET TRIM POTENTIOMETER
R22	10E1679	1	270 KΩ ±5% ¼ W CF RESISTOR
R23	10F1701	1	2.2 MΩ ±5% ¼ W CF RESISTOR

**SIGNALCRAFTERS
MODEL TSK29C
TEST SET**

5.2 PARTS LIST (continued)

87F0051 MODEL 29C PCB ASSEMBLY (continued)			
REF	PART#	QTY	DESCRIPTION
R24	10G1653	1	22 K Ω $\pm 5\%$ $\frac{1}{4}$ W CF RESISTOR
R25	10E1679	1	270 K Ω $\pm 5\%$ $\frac{1}{4}$ W CF RESISTOR
R26	10A1673	1	150 K Ω $\pm 5\%$ $\frac{1}{4}$ W CF RESISTOR
R27	10D1625	1	1.5 K Ω $\pm 5\%$ $\frac{1}{4}$ W CF RESISTOR
R28	10B2895	1	124 K Ω $\pm 5\%$ $\frac{1}{4}$ W MF RESISTOR
R29	10C1693	1	1 M Ω $\pm 5\%$ $\frac{1}{4}$ W CF RESISTOR
R30	10C1693	1	1 M Ω $\pm 5\%$ $\frac{1}{4}$ W CF RESISTOR
RFC1	22E0051	1	330 μ H 100 mA 7.5 Ω RF CHOKE
RFC2	22E0051	1	330 μ H 100 mA 7.5 Ω RF CHOKE
S1	44B0005	1	PCB MOUNT DPDT TOGGLE SWITCH
S2	44K0006	1	PCB MOUNT SPDT MOMENTARY PB SWITCH
S3	44F0007	1	PCB MOUNT SPDT TOGGLE SWITCH
S4	44F0007	1	PCB MOUNT SPDT TOGGLE SWITCH
U1	32F0051	1	TL022CP DUAL OP AMP
U2	34D0012	1	DF957A CUSTOM POWER METER IC
U3	32F0051	1	TL022CP DUAL OP AMP
U4	32F0051	1	TL022CP DUAL OP AMP
U5	32F0051	1	TL022CP DUAL OP AMP

TRANSPARENCY !!





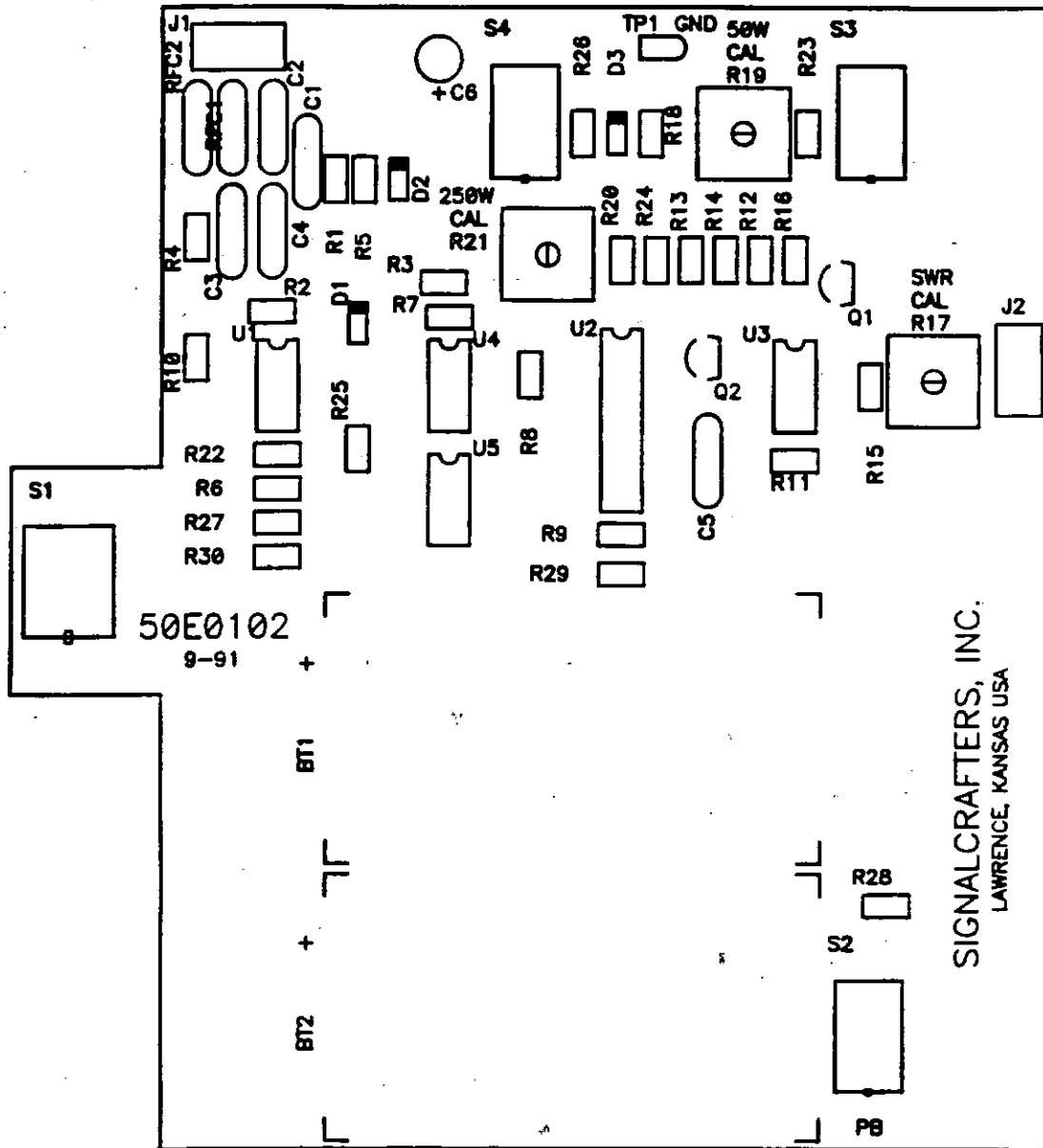
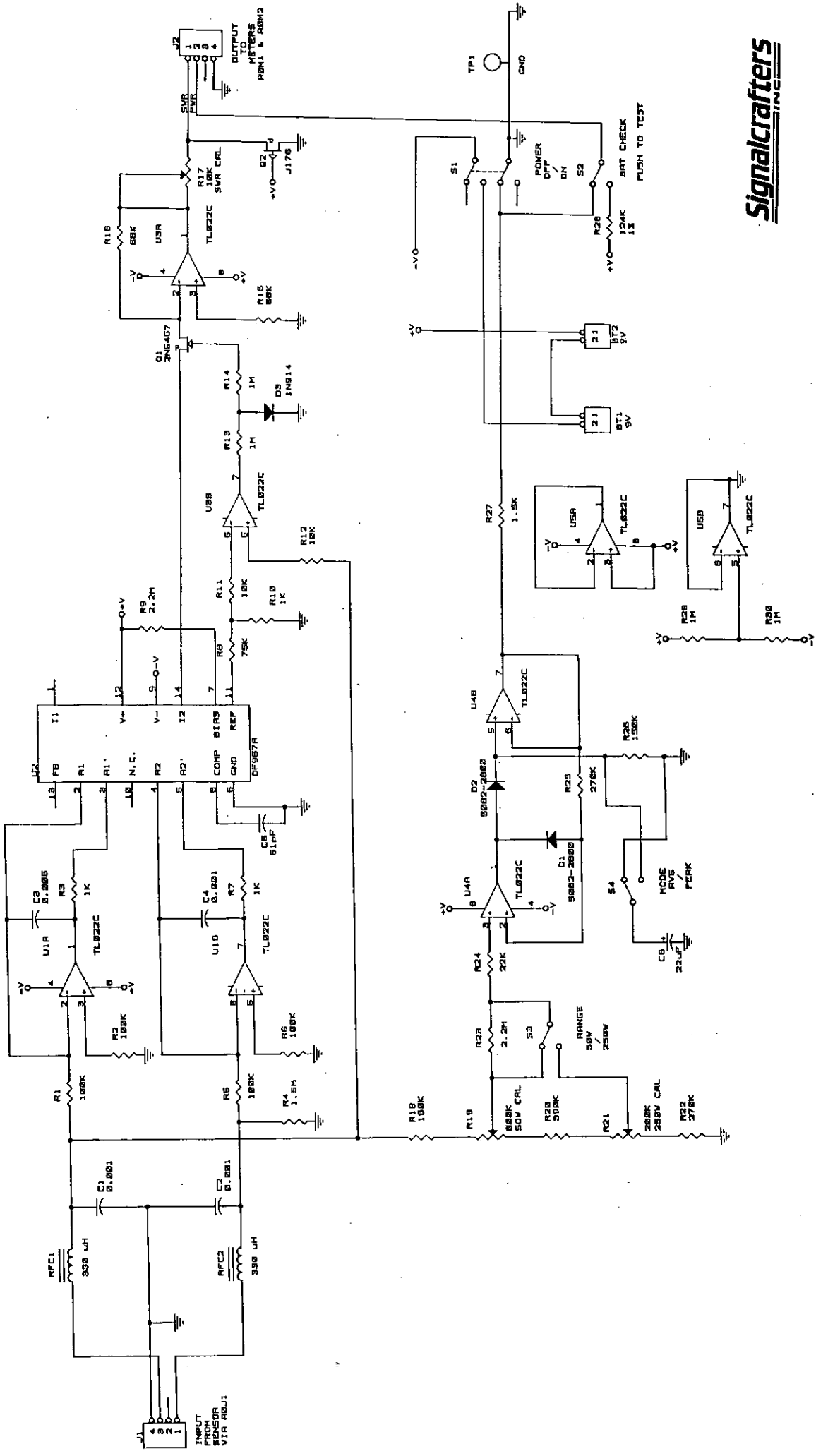


FIGURE 5 - Model 29C PCB Component Layout



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FIGURE 6 - Model 29C PCB Schematic



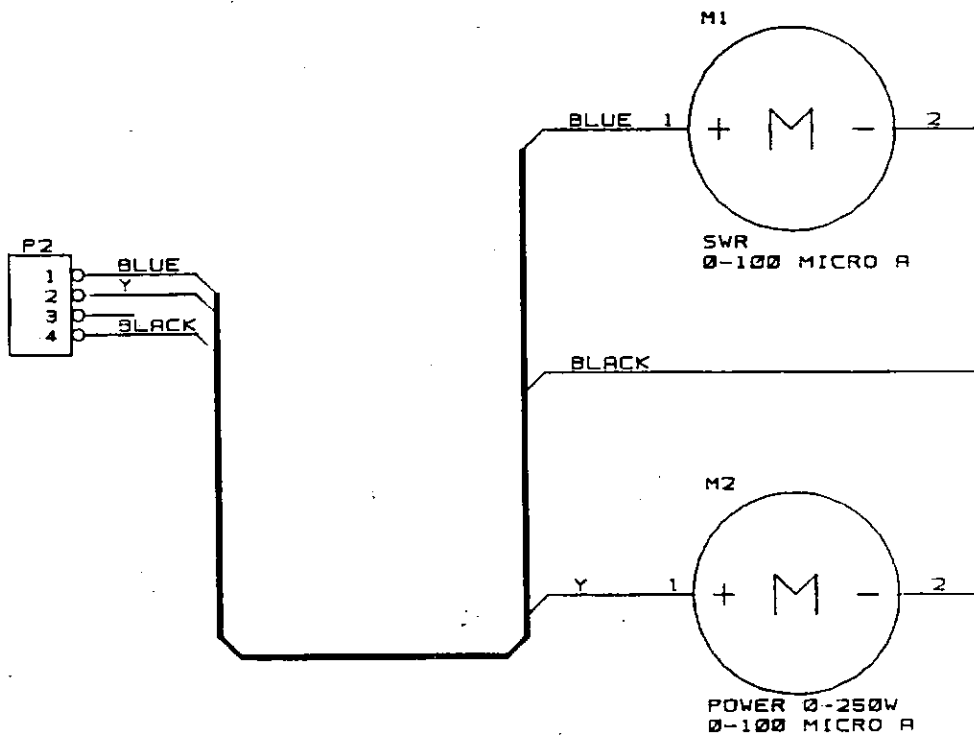
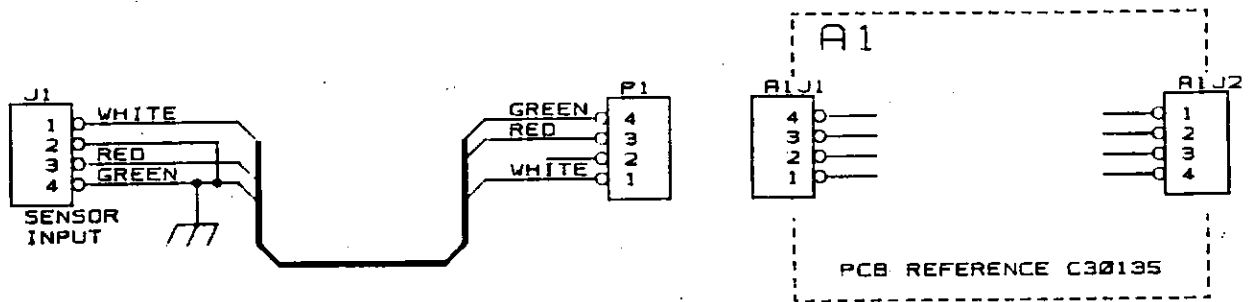


FIGURE 7 - Model 29C Schematic Diagram

