

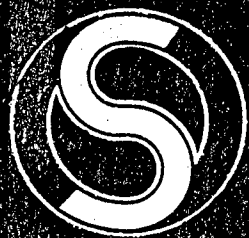
SIGNALCRAFTERS
I N C O R P O R A T E D

MODEL 30



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- AUTOMATIC COMPUTING
SWR POWER METER
- ADVANCED ENGINEERING
PERFORMANCE
- FEATURES THAT NO ONE
CAN TOUCH!



SIGNALCRAFTERS
I N C O R P O R A T E D

SIGNALCRAFTERS MODEL 30

INTRODUCTION

Congratulations! You have just purchased the finest, most advanced SWR/PWR meter available anywhere!

If this is your first experience with a computing SWR meter, you will have some pleasant surprises. You may also be puzzled at times by what you see, so please read this manual before you install the instrument. It is written for easy understanding and is well worth your time.

The purpose of the Model 30 is to monitor and display the forward power that your transmitter delivers to the transmission line and to simultaneously display the standing wave ratio on your transmission line. Forward power indicates to you how well your transmitter is working, and the SWR tells you how well your antenna system is accepting power. Thus, the whole picture is displayed on the two front panel meters.

Two features set the Model 30 apart from other instruments. First, the proper power range is selected automatically (manual override and reset also are provided) and secondly, the SWR is computed automatically with no operator adjustments required for complete hands-off operation from less than one watt to 2000 watts!

All of this is accomplished by a Signalcrafters designed integrated circuit. This state-of-the-art design is an exclusive with Signalcrafters.

INSTALLATION

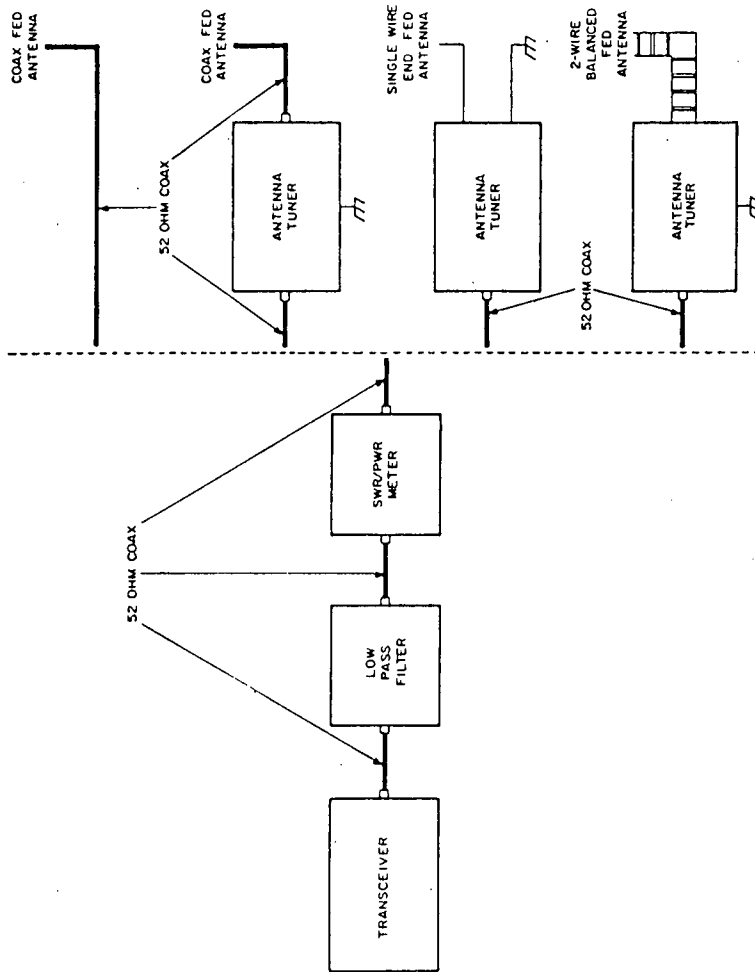


FIGURE 1

Figure 1 illustrates the various ways in which the Model 30 can be connected into your coaxial transmission line. The line impedance can be 50-52 ohms or 75 ohms, depending upon the plug-in directional coupler selected. The frequency range and the power handling capability also are dependent upon the coupler selected. For example: The Model 30 equipped with the Model HF-231 Directional Coupler measures RF power up to 2000 watts on 52 ohm coax lines and covers the frequency range of 1.8 to 30 MHz. For 75 ohm lines, you would need the Model HF-231A Directional Coupler. If you have need for VHF as well as HF capability, or more sensitivity in the HF range for QRP operation, please refer to the Signalcrafters catalog brochure covering the full line of Directional Couplers available for use with the Model 30. The Directional Coupler is not supplied with the Model 30 SWR/Power Meter because of the wide range of impedances, power ratings, and frequency of operation available for your selection. Appropriate Directional Coupler should be selected at time of ordering from the Signalcrafters catalog of accessories.

One RF Directional Coupler may be plugged directly into the rear of the Model 30, or remote mounted if that is more convenient. Hi-Fi extension cables (not supplied) are widely available and are recommended for the remote mounting interconnections. The extension cables, of course, carry no RF power. With this arrangement it is a simple matter to set up an outboard switching system to obtain power readings using two or more Directional Couplers permanently installed in your various antenna coaxial lines, even if they are not all of the same impedance.

Always make certain that the transmitter and antenna coaxial lines are connected to the proper ends of the Directional Coupler and that any inter-connecting cables are

SIGNALCRAFTERS MODEL 30

properly oriented. Otherwise the Model 30 meter readings will be meaningless.

Signalcrafters recommends that you place the Directional Coupler after any low pass filter since it is important that the filter be mounted as close to the transmitter as physically possible. The coupler is not a generator of measurable harmonics and will not cause radio frequency interference.

The Model 30 contains solid state devices and should be case grounded to the common station ground to protect it from stray RF fields and static discharges coming from the antenna.

Do not subject the Model 30 or the Directional Coupler to outdoor environments or to other extremes of temperature and humidity. Nominal precautions are all that is required for good performance, however, since the Model 30 circuits have exceptional temperature stability.

Front panel switching is provided for up to three antennas and a dummy load using outboard coaxial relays of your choice. The optional accessory, Model 51 Relay Box (indoor only) is fully compatible with the Model 30 which furnishes 12 volts a.c., 250 mA through switch controlled rear panel connections. A simple wiring change will convert these control outputs to a grounding contact circuit, which is sometimes more convenient for switching relays of your choice. When using other than the Model 51, Relay Box the Model 30 switch contacts must be arc protected and the accessory relay coil must be limited to 0.5 Amps at 30 volts d.c., If relay switching is not used in your installation, the Model 30 panel switches designated A1, A2, A3, and DUMMY LOAD and their rear panel connections may be disregarded.

SIGNALCRAFTERS MODEL 30

Two rear panel mounted RCA Type phono connectors provide d.c. outputs which track the SWR and RF POWER - WATTS meter readings. Full scale readings correspond to 1 volt at either output, with an internal circuit resistance of 10K ohms. The optional accessory Signalcrafters Model 40, Audio - Tuner, plugs into these two connectors. If not used they may be disregarded.

You will need a nominal 120 volt, 60 Hz, power source with grounded receptacle. Line voltage changes will have negligible effect on the accuracy of the Model 30 power measurements due to the inherent voltage regulation of the computer circuits.

NOTICE

Export Model 30E SWR/Power Meter is equipped with a multi-tap, 120/240 Volt, 50/60 Hz, transformer. Refer to the DIFFERENCE DATA SHEET, for instructions on changing taps to the specific voltages.

OPERATION

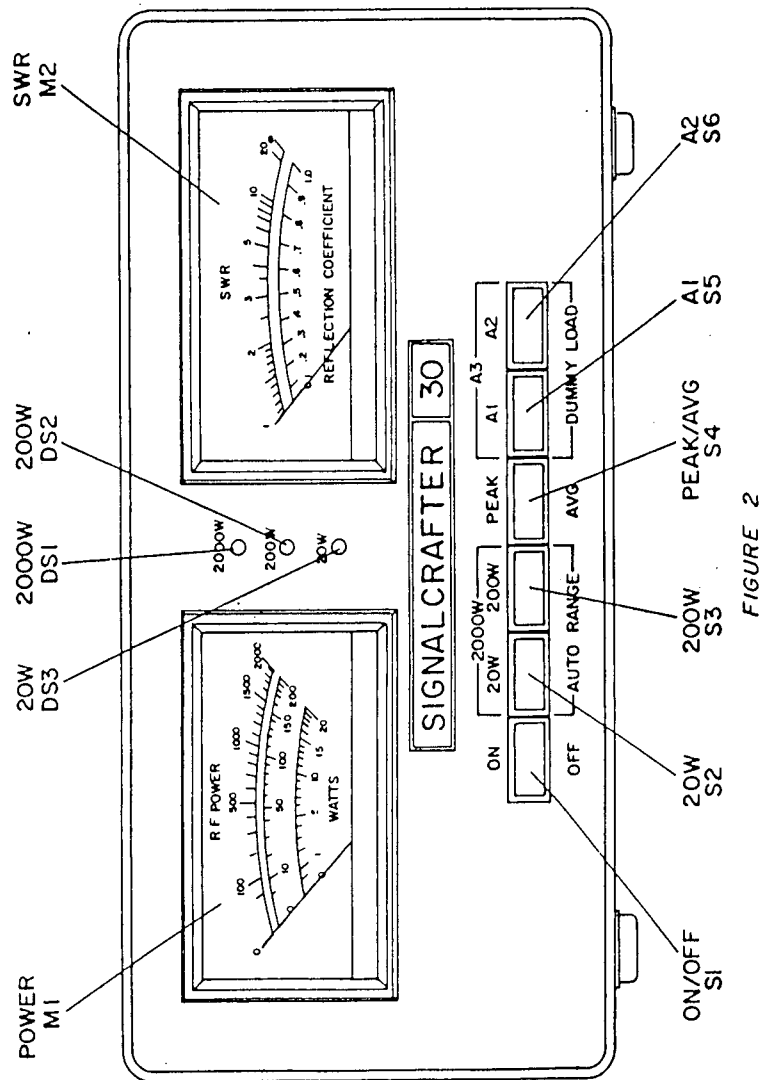


FIGURE 2

Signalcrafters recommends the following sequence or check list be used until you have gained familiarity with all the Model 30's operating controls and features. Figure 2 identifies the operating controls by name and Reference Designation for your aid. Figure 3 identifies the rear panel connections while figure 4 identifies the proper orientation of the Directional Coupler in relation to INPUT and OUTPUT.

1. Prior to an initial trial of the instrument, re-check the hook-up. Be sure the RF is passing through the Directional Coupler in the correct direction. This is left to right as you face the instrument. If the coupler is remote mounted, make sure the connecting leads are properly oriented. If there is an error in the hook-up, the meter reading will be meaningless.
2. Note that all push-button switches are equipped with self-indicating flags that remain visible only when the switch is pushed all the way in. The AC power switch flag is ORANGE; all others are WHITE. Now operate all the switches so that NO flags are showing.
3. Plug in the the AC power cord and press in the AC power switch. The ORANGE flag will remain visible and the 20W (watt) LED should light. The Model 30 is now set to read average power. To measure peak power, press in the PEAK/AVG switch, so the WHITE flag is visible. The computer will now re-adjust from the 20W (watt) to the 200W (watt) or to the 2000W (watt) range automatically as you increase transmitter power output, and the appropriate LED indicator will tell you which range to read on the RF power meter. In the AUTO RANGE mode there is never a danger of overscale readings, due to the fast acting comparator circuits. If you desire to stay on the 20W (watt) range, simply press the 20W (watt) switch all the way in,

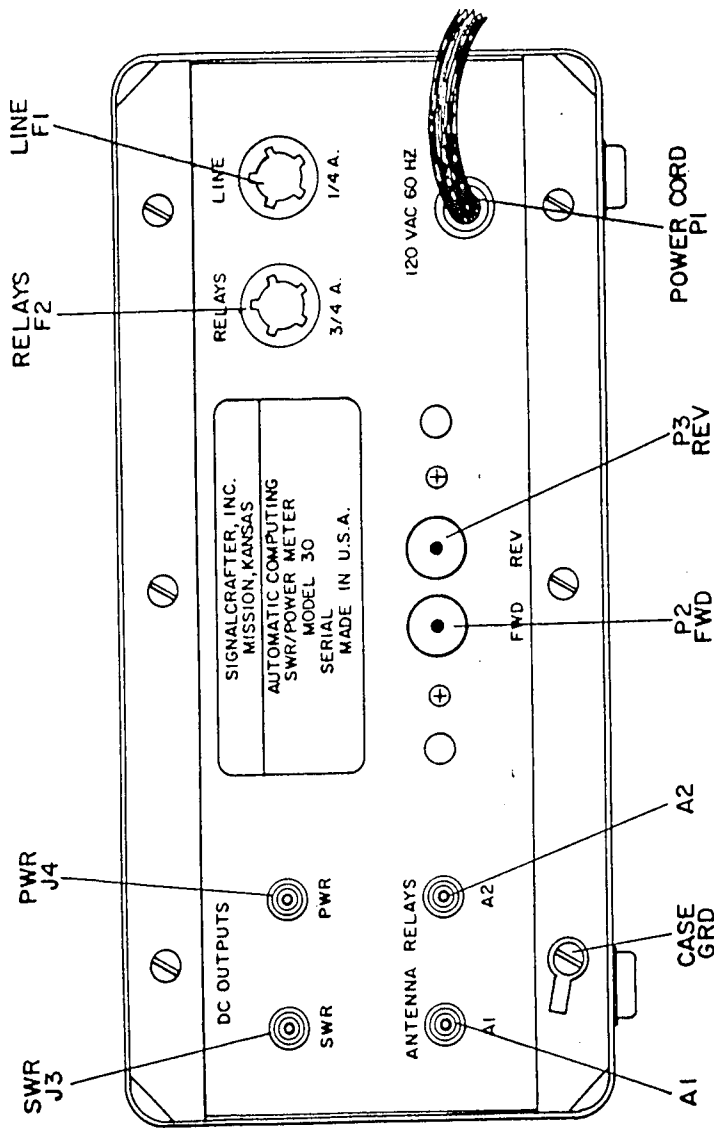


FIGURE 3

displaying the WHITE flag. Similarly, the 200W (watt) range may be manually selected, or by pressing in both switches to display both WHITE flags, the 2000W (watt) range is manually selected. Occasionally you may want to return to the 20W (watt) power range in the AUTO RANGE mode, this is accomplished by a momentary push on either power range switch. In any event, the appropriate LED indicator will light and tell you which power scale to read. Just a little practice will reveal the true simplicity of this convenient power range adjustment, should the switch settings at first seem slightly confusing.

4. Apply a small amount of RF power and observe the SWR meter. If an antenna tuner is used, tune for the minimum SWR. During tuning, the forward power may change a lot. Ignore the forward power changes and watch only the SWR meter. The automatic SWR computer circuits deal with the changing power levels for you. You will find that tune up is much easier than before if you have been using a conventional SWR meter, since no manual meter adjustments are involved.
5. Once the SWR is minimized, the proper load is being presented to the transmitter. Now tune up the transmitter for maximum performance, selecting the appropriate power range manually or automatically, as you prefer. You need not re-adjust the antenna tuner since the adjustments are quite independent. Remember that the LED indicator will always tell you which power scale to read regardless of the power range switch settings.

It should be noted also that forward powers above 20 WATTS produce the most accurate SWR measurements. This is due to a natural characteristic of diode detectors as used in the Directional Coupler to lose

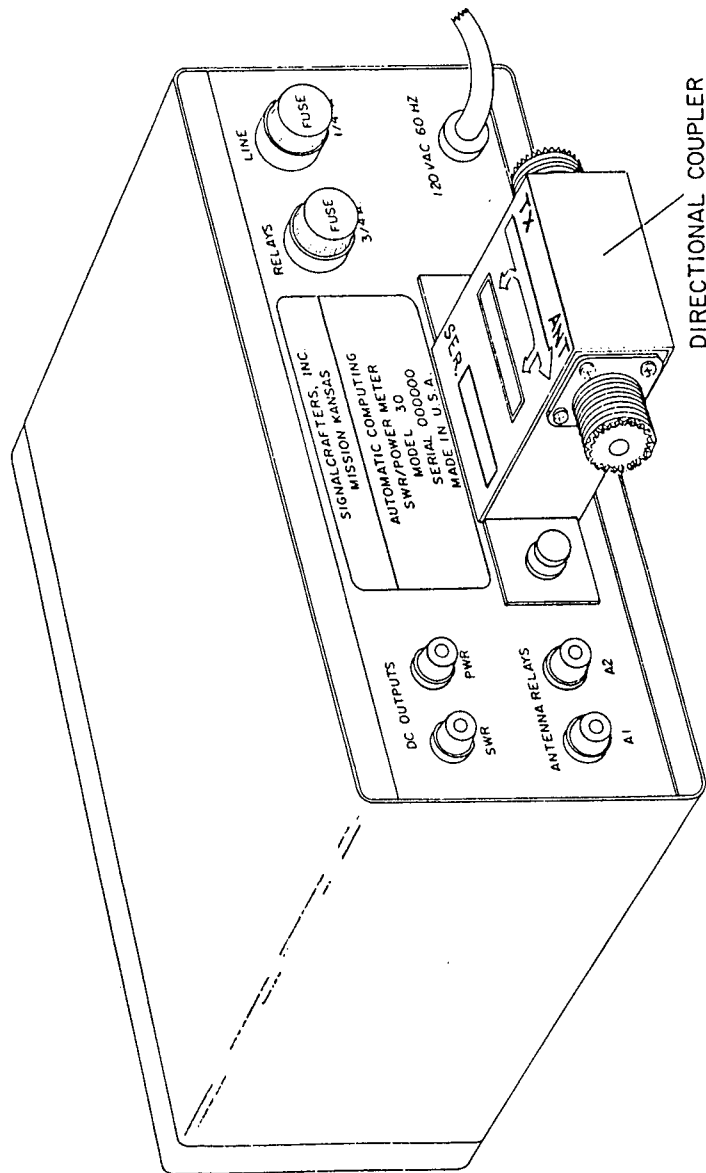


FIGURE 4

efficiency at very low powers. This however, does not detract from the utility of the instrument in determining the lowest SWR while using very low transmitter power levels.

6. The PEAK/AVG switch changes the Model 30 circuits from fast attack/slow release in the PEAK mode, typically used for measuring peak power during SSB operation, to fast attack/fast release in the AVG mode, typically used for measuring CW or other steady state carrier power.

SOME INTERESTING EFFECTS

The wide natural dynamic range of the SWR computer used in the Model 30 at times will provide a large SWR indication with very little forward power. This uncommon sight, compared to the usual SWR meter or dual watt meter, may be wrongly considered to be a malfunction of the Model 30. It is, instead, a proper function and quite useful, since it allows for an SWR check with very little transmitter output. Quite often, carrier leak from an exciter may be amplified by the linear amplifier to a level that will operate the Model 30 SWR/PWR Meter while "touching up" the antenna tuner, without creating much interference on the band.

In the event you are unable to obtain a low SWR at low power output, but you can obtain a low SWR at high power output, you have reason to suspect your transmitter of spurious output at a frequency removed from the carrier. The spurious output undoubtedly "sees" a large mismatch at the antenna or antenna tuner and if large enough, may operate the SWR computer. This effect goes away at higher transmitter powers since the computer will then be more responsive to the larger forward and relative smaller reflected powers at carrier frequency where your antenna system provides a better matched load for your transmitter.

SPECIFICATIONS

Push-to-Talk Transients: It seems that some SSB transceivers generate an RF "click" or pulse of RF power when the Push-to-Talk button is pressed. The impulse is short and usually causes no problems on the air, but the fast responding AUTO RANGE circuits of the Model 30 responds to this and may up-range the instrument, to a higher than required range. Also, if the PEAK/AVG switch is in the PEAK, position, the fast attack/slow release detector will measure the peak power in the pulse. It is a normal effect and not a malfunction of the Model 30. To reset to a lower power range, simply press either power range switch momentarily, or use the appropriate manual power range.

Atmospherics. During electrical storms static impulses travel down the transmission line from the antenna. These wide band signals are sometimes strong enough to activate the SWR computer. The SWR computer interprets these signals as "reflected" and displays a high SWR, sometimes greater than full scale. Such indications should be taken as a warning to ground the antenna system and shut the station down. Large static charges can damage the Directional Coupler, as well as other equipment in the station.

NOTE

If your needs should change after you have ordered your Model 30 SWR/Power Meter and the desired Directional Coupler, consult your local Dealer or the factory for the full line of Directional Couplers for VHF, UHF, QRP, and different impedances available from Signalcrafters, Inc.

For Specifications of the Accessory Directional Couplers See the Signalcrafters, Inc. Catalog for details.

ELECTRICAL:

Frequency Range: Dependent upon the Directional Coupler purchased, with SWR/Power Meter. *

Insertion SWR: Less than 1.05 to 1.0. Dependent upon the Directional Coupler purchased.

Impedance. 50 to 52 Ohms, or 75 Ohms, dependent upon the Directional Coupler purchased, with SWR/Power Meter.

Indicators: Two meters plus three (red) LED - RF Range indicators, 20W, 200W, and 2000W.

RF POWER - WATTS Meter: Three scales, 0 - 20 WATTS, 0 - 200 WATTS, and 0 - 2000 WATTS,

Meter Response: Related to mode selected:
AVG(Average) - Fast attack/fast release,
PEAK - Fast attack/slow release.

Accuracy: $\pm 6\%$ at full scale, at 1:1 SWR.

SWR - REFLECTION COEFFICIENT Meter:

Two scales : SWR - 1 to Infinity.
REFLECTION COEFFICIENT - 0.1 to 1.0.

Controls. Six self-indicating push buttons, providing power ON/OFF control, manual or automatic range selection, power metering mode PEAK/AVG, and antenna or dummy load selection,(see OPERATING Section for functional description of operation.

*Model HF231-Directional Coupler, 1.8 - 30MHz, 50-52 Ohms, 2KW.

SIGNALCRAFTERS MODEL 30

SPECIFICATIONS (CONT)

ELECTRICAL (Cont):

Connectors:

2 - Male, RCA Type, phono connectors, (mating with connectors on Directional Coupler), input to SWR/Power Meter.

2- Female, RCA Type, phono connectors, output to Signalcrafters Model 51, Relay Box, 12 volts a.c., 250 milliamperes max.

2 - Female, RCA Type, phono connectors, output to remote, Power and/or SWR indicators, 0-1 Volt d.c. - 10K Ohms, internal resistance. Output to Signalcrafters Model 40, Audio - Tuner for audible tune-up indication.

Power Requirements:

120 Volts a.c., 60 Hz (Domestic Model 30), 120/240 Volt a.c., 50/60 Hz (Export Model 30E).

MECHANICAL:

Color: Two-tone epoxy finish, Gray/Charcoal, with brushed Aluminum trim.

Dimensions:

Width - 8-1/2 in. (21.6 cm),
Height - 4-1/2 in. (10.8 cm),
Depth - 5 in. (12.7 cm), (Directional Coupler NOT in place). 7 in. (17.8 cm), (Directional Coupler, installed).

Weight:

5 lbs (2.27 kg).

SIGNALCRAFTERS MODEL 30

PARTS LIST

The following list of parts is provided for your information should repair or replacement parts be required.

Part Numbers:

Part numbers listed are those of the applicable manufacturer and in most cases are standard off-the-shelf items, available through a well stocked distributor.

Manufacturers Code.

Listed below are, manufacturer's codes used in this parts list for your ease in identifying the various replacement parts. The code appears in parentheses after the description.

| | |
|------|--|
| A001 | Allen-Bradley |
| B001 | Bussman Mfg. |
| B002 | Belden Corporation |
| C002 | Centralab |
| C003 | CTS |
| F002 | Fairchild Semiconductor |
| I001 | Illinois Capacitor Sales |
| I002 | ITT Semiconductor |
| K001 | Kemet |
| M002 | Mouser Electronics |
| M003 | Motorola Semiconductor Products, Inc. |
| N001 | National Semiconductors |
| S001 | Signalcrafters, Inc. |
| S002 | Switchcraft |
| S004 | H.H.Smith Co. |
| T001 | Texas Instruments Semiconductor Division |

Note: For other mechanical parts it is recommended that the unit be returned to the Factory for service.

SIGNALCRAFTERS MODEL 30

| REFERENCE DESIGNATION | PART NUMBER | DESCRIPTION | QTY REQ |
|-----------------------|--------------------|---|---------|
| CR1,2,3,4 | 1N914 | SEMICONDUCTOR,DIODE,SILICON (1002) | 4 |
| CR5,6,7,8 | 1N4002 | SEMICONDUCTOR,DIODE,SILICON,POWER (F002) | 4 |
| C1,2,4,6,7 | 21EW001 | CAPACITOR,CERAMIC DISC,0.001 UF,100 VDCW (M002) | 5 |
| C3 | 21EW005 | CAPACITOR,CERAMIC DISC,0.005 UF,100 VDCW (M002) | 1 |
| C5 | T3638685 M035AS | CAPACITOR,ELECTROLYTIC,TANTALUM,6 UF ±20%, 35 VDCW (K001) | 1 |
| C8 | 21EW010 | CAPACITOR,CERAMIC DISC,0.01 UF,100 VDCW (M002) | 1 |
| C9 | T362B226 M006AS | CAPACITOR,ELECTROLYTIC,TANTALUM,22 UF ±20%, 6 VDCW (K001) | 1 |
| C10,11 | 477RAR016A | CAPACITOR,ELECTROLYTIC,ALUM.,470 UF,16 VDCW (1001) | 2 |
| C12,13 | DD102G | CAPACITOR,CERAMIC DISC,0.001 UF,GMV,1000 VDCW (C002) | 2 |
| C14 | 21EW020 | CAPACITOR,CERAMIC DISC,0.02 UF,100 VDCW (M002) | 1 |
| F1 | AGC-1/4 | FUSE,CARTRIDGE,1/4 AMP (B001) | 1 |
| F2 | AGC-3/4 | FUSE,CARTRIDGE,3/4 AMP (B001) | 1 |
| J1,2 3,4 | 3502-FP | CONNECTOR,RECEPTACLE,FEMALE,RCA TYPE,PHONO (S002) | 4 |
| M1 | S40101 | METER,RF POWER,SPECIAL,3 SCALES,0-20,0-200, 0-2000 (Signalcrafters,Inc - S001) | 1 |
| M2 | S40102 | METER,SWR/REFLECTION COEFFICIENT,SPECIAL (Signalcrafters,Inc. - S001) | 1 |
| P1 | 17237 | CONNECTOR,PLUG,AC,3-PRONG,MOLDED,6 FT.LONG GRAY VINYL (B002) | 1 |
| P2,3 | 3502 | CONNECTOR,PLUG,MALE,RCA TYPE,PHONO (S002) | 2 |
| P4 | 1576 | CONNECTOR,FEMALE,1/4 IN.SPADE LUG,CRIMP (S004) | 1 |
| Q1,2 | 2N3904 | SEMICONDUCTOR,TRANSISTOR,SILICON (T001) | 2 |
| Q3,4 | 2N5457 | SEMICONDUCTOR,TRANSISTOR,SILICON (M003) | 2 |
| R1,2,3,4 | CB1045 | RESISTOR,FIXED,COMP,100K OHMS ±5%,1/4W (A001) | 4 |
| R5,6,22,23 | CB1825 | RESISTOR,FIXED,COMP,1,800 OHMS ±5%,1/4W (A001) | 4 |
| R7 | CB1545 | RESISTOR,FIXED,COMP,130K OHMS ±5%,1/4W (A001) | 1 |
| R8 | | NOT ASSIGNED | |
| R9,10 | CB4745 | RESISTOR,FIXED,COMP,470K OHMS ±5%,1/4W (A001) | 2 |
| R11 | CB1845 | RESISTOR,FIXED,COMP,180K OHMS ±5%,1/4W (A001) | 1 |

SIGNALCRAFTERS MODEL 30

| REFERENCE DESIGNATION | PART NUMBER | DESCRIPTION | QTY REQ |
|-----------------------|-------------|--|---------|
| R12,17,35 | CB1055 | RESISTOR,FIXED,COMP,1 MEGOHM ±5%,1/4W (A001) | 3 |
| R13,15 | CB2035 | RESISTOR,FIXED,COMP,20K OHMS ±5%,1/4W (A001) | 2 |
| R14,18 | CB9115 | RESISTOR,FIXED,COMP,910 OHMS ±5%,1/4W (A001) | 2 |
| R16,20 | CB1035 | RESISTOR,FIXED,COMP,10K OHMS ±5%,1/4W (A001) | 2 |
| R19 | | NOT ASSIGNED | |
| R21 | CB1545 | RESISTOR,FIXED,COMP,150K OHMS ±5%,1/4W (A001) | 1 |
| R24,25,26 | CB1515 | RESISTOR,FIXED,COMP,150 OHMS, ±5%,1/4W (A001) | 3 |
| R27 | 375Y-504 | RESISTOR,VARIABLE,CERMET,500K OHMS (C003) | 1 |
| R28,32 | 375Y-104 | RESISTOR,VARIABLE,CERMET,100K OHMS (C003) | 2 |
| R29 | 375Y-254 | RESISTOR,VARIABLE,CERMET,250K OHMS (C003) | 1 |
| R30 | 375Y-103 | RESISTOR,VARIABLE,CERMET,10K OHMS (C003) | 1 |
| R31 | 375Y-503 | RESISTOR,VARIABLE,CERMET,50K OHMS (C003) | 1 |
| R33 | CB2235 | RESISTOR,FIXED,COMP,22K OHMS ±5%,1/4W (A001) | 1 |
| R34 | CB6835 | RESISTOR,FIXED,COMP,68K OHMS ±5%,1/4W (A001) | 1 |
| R36 | GB4715 | RESISTOR,FIXED,COMP,470K OHMS, ±5%,1W (A001) | 1 |
| S1,2,3,4,5,6 | A10070 | SWITCH,PUSH-BUTTON,6 STATION,LOCKING, MECHANICAL FLAGS (Signalcrafters,Inc.-S001) | 1 |
| TB1 | 1089 | STRIP,TERMINAL (S004) | 1 |
| TB2 | 864 | STRIP,TERMINAL (S004) | 1 |
| T1 | A10009 | TRANSFORMER,POWER,120V AC,50/60HZ PRIMARY, 12-0-12 V SECONDARY (Signalcrafters,Inc.-S001) | 1 |
| U1 | DF-955 | SEMICONDUCTOR,INTEGRATED CIRCUIT,SPECIAL, CUSTOM POWER METER (Signalcrafters,Inc.-S001) | 1 |
| U2 | LM324N | SEMICONDUCTOR,INTEGRATED CIRCUIT,QUAD OP AMPL, (N001) | 1 |
| U3 | LM741CN | SEMICONDUCTOR,INTEGRATED CIRCUIT,SINGLE OP AMPL (N001) | 1 |
| VR1 | 1N4739A | SEMICONDUCTOR,DIODE,ZENER,9 V,±5%,1W (M003) | 1 |
| VR2 | LM7805CT | SEMICONDUCTOR,INTEGRATED CIRCUIT,VOLTAGE REGULATOR,±5% (N001) | 1 |
| XF1,2 | HKP | FUSEHOLDER,PANEL MOUNTING (B001) | 2 |

NOTE

DIRECTIONAL COUPLER IS NOT FIELD REPAIRABLE. IN THE EVENT OF TROUBLE UNIT MUST BE RETURNED TO FACTORY FOR REPAIR AND RECALIBRATION.

SIGNALCRAFTERS MODEL 30

BLOCK DIAGRAM

The Block Diagram, Figure 5, shows the various circuit elements in a simplified, functional and signal flow diagram, to aid in troubleshooting should it be necessary.

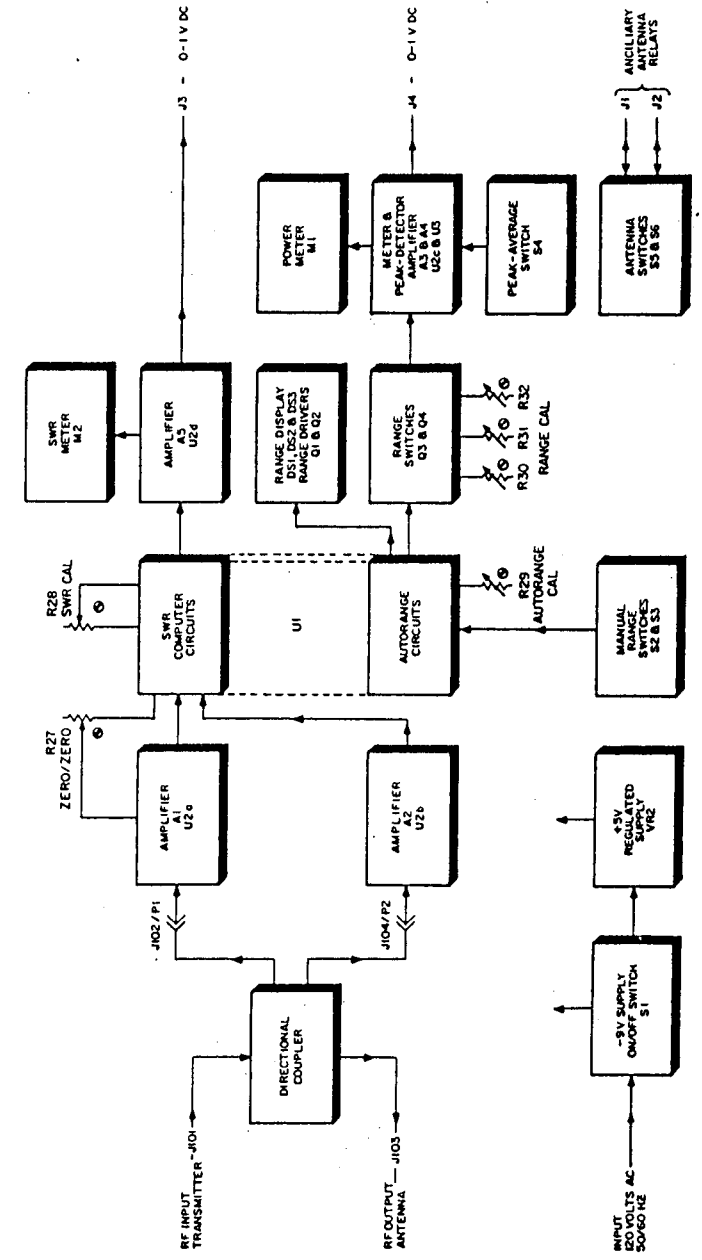


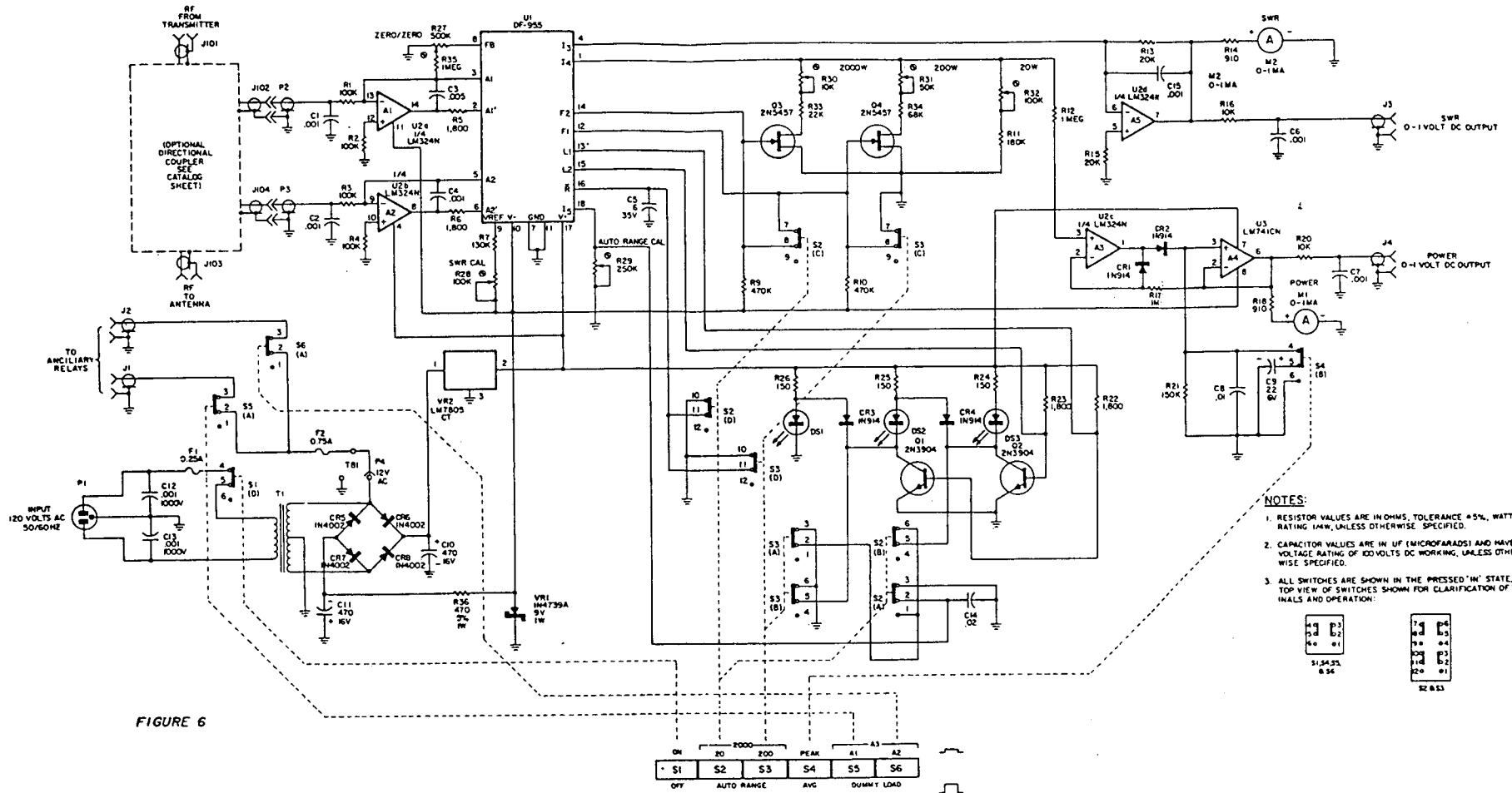
FIGURE 5

SIGNALCRAFTERS MODEL 30

SCHEMATIC DIAGRAM

The Schematic Diagram, Figure 6, illustrates the circuit configuration of the Model 30 SWR/Power Meter. The schematic diagram is invaluable for trouble-shooting should the need arise. The schematic diagram together with the parts list should enable a technician to make repairs to the SWR/Power Meter should it ever be necessary. The Directional Coupler is not field repairable and should be returned to the factory for repair and recalibration if a trouble should result.

SIGNALCRAFTERS MODEL 30



- NOTES:**
1. RESISTOR VALUES ARE IN OHMS, TOLERANCE ±5%, WATTAGE RATING 1/4W, UNLESS OTHERWISE SPECIFIED.
 2. CAPACITOR VALUES ARE IN UF (MICROFARADS) AND HAVE A VOLTAGE RATING OF 100 VOLTS DC WORKING, UNLESS OTHERWISE SPECIFIED.
 3. ALL SWITCHES ARE SHOWN IN THE PRESSED 'IN' STATE. TOP VIEW OF SWITCHES SHOWN FOR CLARIFICATION OF TERMINALS AND OPERATION:

