



## 86 - 108 MHz 1kW Amplifier Model 10/1000 Handbook



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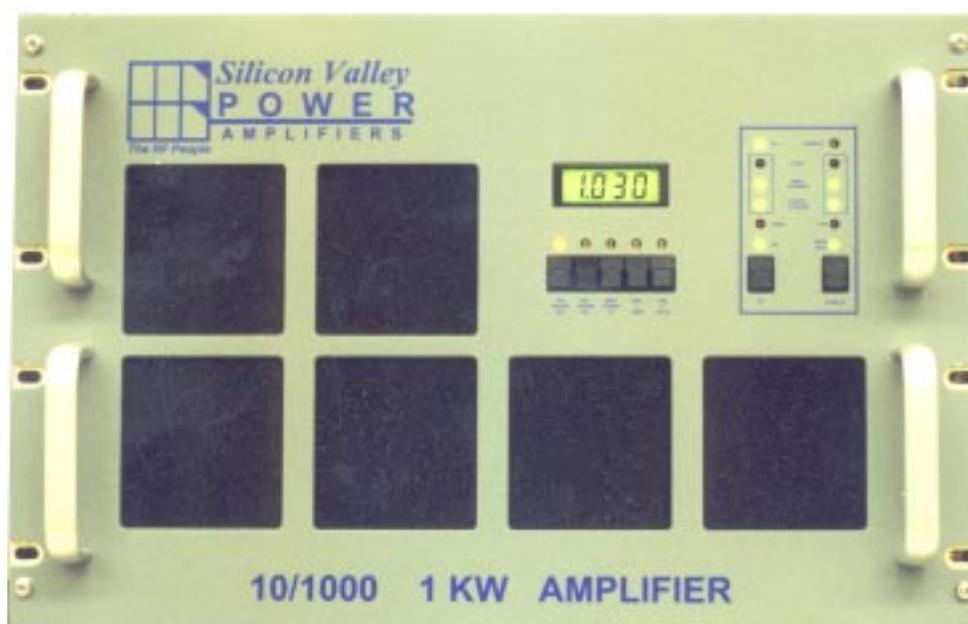
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## 1. GENERAL

1.01 This manual provides a physical and functional description of the 10/1000 Frequency Modulation (FM) Broadcast Amplifier and the information necessary for effective installation, operation and field maintenance.

### 1.02 Features:

- ◆ Drive requirement less than 10 watts.
- ◆ Foldback protection against high VSWR.
- ◆ Output power constant even for wide swings of line voltage.
- ◆ Rear panel relay contacts for muting.
- ◆ Front panel LCD display of Forward, Reverse and Drive Power, Voltage and Current.
- ◆ Front panel status indicators of major functional modules.
- ◆ Remote On-Standby control via rear panel connector.
- ◆ Remote Gain control
- ◆ Remote monitoring of major parameters.
- ◆ Safety Interlocks.
- ◆ Industry standard solid state FM amplifier modules.
- ◆ Light weight and compact design simplifies transportation and installation.
- ◆ Modular construction for ease of maintenance.





## 2. PHYSICAL DESCRIPTION

### 2.01 Overview and physical description

The 10/1000 FM Broadcast Amplifier is an integrated system incorporating all the metering and control, ac to dc power conversion, cooling, and RF amplification necessary for installation as a component in a new or existing broadcast system. The amplifier is supplied as a single chassis, which takes up 12.25" of rack space and is 18" deep excluding connectors. Total weight of the amplifier is less than 70 lbs. Rack mount slides and all connectors except RF In and RF Out are supplied.

The front panel has an LCD display and five switches to select which parameter is to be displayed. In addition there are two columns of LEDs which show the status of all the major elements at a glance.

The amplifier modules are cooled by forcing air across the vanes of the heat sink, the air is supplied via six screened openings in the front panel.

All connections are made at the rear of the amplifier. AC input is a 30 amp Hubbel connector, the RF Input is a female Type N connector, RF Output can be either a 7/8 flange connector or a female HN connector. Monitoring and remote control is via a 25 pin D connector. Contacts of an internal relay are brought out to a terminal strip for use as muting contacts or as status indicators, the relay switches when the amplifier is turned ON as opposed to being in Standby. There are two 20A circuit breakers, one in each leg of the ac supply.

### 3. FUNCTIONAL DESCRIPTION

#### 3.01 Overview.

The 10/1000 contains two 500 watt RF amplifier modules which are driven in parallel. Their outputs are combined for a 1kW output capability. The combined output is passed through a lowpass filter to reduce spurious and harmonic signals to below the FCC mandated limits, then through a Directional Coupler immediately before the RF Output connector.

RF input to the 10/1000 is via a female Type N connector on the rear panel and goes to a 150 watt pre-amplifier the output of which goes through a 2 way splitter to feed the boosted signal to the two 500 watt RF amplifier modules. The cable lengths and signal paths are carefully controlled to ensure the parallel signals do not get out of phase.

The 500 watt modules operate from 48Vdc which is supplied by a switch mode power supply PS1. The pre-amplifier and the fans are driven by the same 48V supply. In order to allow the power amplifier modules to come up under no-load conditions we recommend you turn on your exciter via the relay contacts on the rear panel. PS1 is activated by the Metering and Control (M&C) circuitry located on the right side panel, this assembly continuously monitors several parameters and will shut the amplifier down when instructed or when any of the pre-programmed limits are exceeded. Under normal circumstances, in the On condition, the M&C PCA sends a signal to the Relay PCA to maintain a “low” on the Remote On input pins of PS1. The 48V relay on the Relay PCA is activated when PS1 turns on.

The M&C PCA is powered by a 5V supply (PS2) that is always on while the amplifier is connected to the ac line. When ac is first applied the M&C assembly checks for fault conditions and checks the status of the “Interlocks” line, pin 18 on the Interface connector: if everything is OK it sends the signal to PS1 to turn on. Front panel switches control the LCD display and can be used to switch the amplifier between On and Standby.

The two output signals from the Directional Coupler are converted by the M&C PCA into displays and are also buffered and transferred to the Interface connector for remote monitoring of Forward and Reverse Power. The Directional Coupler Reverse Power signal also goes to the pre-amplifier via the Gain Control piggyback board, if the reflected power gets to be too high the pre-amplifier reduces its’ output thereby reducing the overall output of the 10/1000, and will eventually shut the amplifier down if the reflected power becomes unacceptably high.

Two columns of LED status indicators on the front panel give an instant visual check of the operating status of each of the two power amplifier modules, the main 48V power supply and the Combiner Temperature and Fan Fault warning indicators. If the Combiner gets too hot, usually caused by an overload due to imbalance, a thermal switch will trip and will shut the amplifier down, leaving this red LED illuminated. If the fan provides insufficient air the red Fan Fault indicator will come on and provide a “low” on the user interface for remote warning, but will not shut the amplifier down.

**The amplifier will not turn on unless pin 18 on the interface connector is “high”** and the combiner temperature is within acceptable limits, the green Interlock LED provides a visual check.

### 3.02. Pre-Amplifier

There are two modules associated with the Preamplifier, one module is the amplifier itself, it is mounted on a heatsink mounted on the side panel, the other is a piggyback circuit mounted on the pre-amp. The amplifier has approximately 13 dB of gain, operates from 48V and typically draws about 4 amps from PS1.

The power output of the pre-amplifier is a direct function of the input power, but it can be controlled via the Gain Control pin in the user interface (Interface connector). The voltage on the Gain Control pin is translated into a lower voltage in the piggyback circuit and is fed to the bias of the preamplifier; as the voltage on the Gain Control pin is increased the bias is lowered, which reduces the gain of the preamplifier. Furthermore, if the signal from the Directional Coupler Reflected Power output exceeds a pre-set value, indicating high load VSWR for the 10/1000, the piggyback circuit will similarly reduce the bias on the preamplifier to reduce the total output of the 10/1000 amplifier. Both the gain control and this foldback mechanism affect the bias circuitry in the Pre-Amplifier. In the event that the amplifier is delivering less than the normal output power it is essential that the user check the setting of the gain control (if used) and the status of the load before increasing the input drive power. The preamplifier is capable of delivering 165 watts, the Output Power Amplifier modules have an absolute max input power rating of 30 watts, so it is imperative that the input power to the 10/1000 be limited to 10 watts max.

The front panel display of Drive Power is actually an estimated value. The 500 watt Power Amplifier modules each contain detectors on their inputs, we use the output of one of these detectors to generate the Drive power signal to the Metering & Control PCA.

### 3.03. 500 watt Power Amplifier module

This solid state amplifier is a standard component which is supplied to major transmitter manufacturers in large quantities for use principally as an IPA in high power tube transmitters. It contains two MOSFET transistors operating in quadrature in a single stage arrangement capable of continuous operation at 800 watts at a baseplate temperature of 50°C. The internal control circuitry incorporates several protective features:- surge and reverse connection diodes, overvoltage trip, overtemperature trip, and is pre-set at the factory to limit the output power to 575 watts. There is also an internal directional coupler and foldback circuitry for protection against high VSWR. The input to this module is rated at 30 watts max., higher input drive will damage the module and invalidate the warranty.

RF Input to the module is via a BNC connector at one end of the module. On the same face plate are the module serial number and the manufacturing date code. At the other end of the module the RF Output connector is a female Type N, there is also a 25A fuse, and a row of terminals for DC and control signals. The connections for the 48Vdc are the extreme right terminals. The rectified signals from the directional coupler are available as analog voltages labelled FWD PWR and REV PWR. A similar signal from a sample of the input RF is labelled DRV PWR. The FAULT terminal goes low if any of the trips or foldback circuits operate.

There are no user serviceable components within the 500 watt power amplifier module, opening the module will invalidate the warranty, in the event of failure the module should be returned to the factory for service.

### 3.04. Combiner and Directional Coupler

The two way combiner and the harmonic filter are connected to the directional coupler and the



output connector. The output is a 7/8" flange connector on the rear panel of the PA unit. The two inputs to the combiner are female Type N connectors and the combining and filtering through an L-C network is factory adjusted for optimum results. If one of the 500 watt modules fails, partially or completely, the 10/1000 can continue to operate at a reduced power level, the imbalance causes power to be dumped into internal high wattage resistors within the combiner, which are bolted to an aluminum heat spreader. If the combiner temperature exceeds 85°C a thermal trip will operate which will shut down the whole amplifier until the temperature drops below 50°C, this is intended to protect the combiner components from irrevocable damage. It is possible to continue operating 6dB down from normal transmission level, which implies dumping several hundred watts into these resistors, but it is usually worth reducing the input power and accepting a lower power level output that will keep the temperature of the combiner within its operating limits and thus stay on the air continuously. We can usually ship you a loaner module overnight to substitute for the damaged one, so you will only be at reduced power for a few hours, it is not worth stressing the combiner trying to get the maximum possible power out under fault conditions.

The Directional Coupler is integrated with the flange connector. The Forward and Reverse Power signals are detected and rectified and are brought out of the Directional Coupler via a 2 pin connector to go to the M&C circuitry and to the foldback input on the Pre-Amp module.

### 3.05 Metering and Control

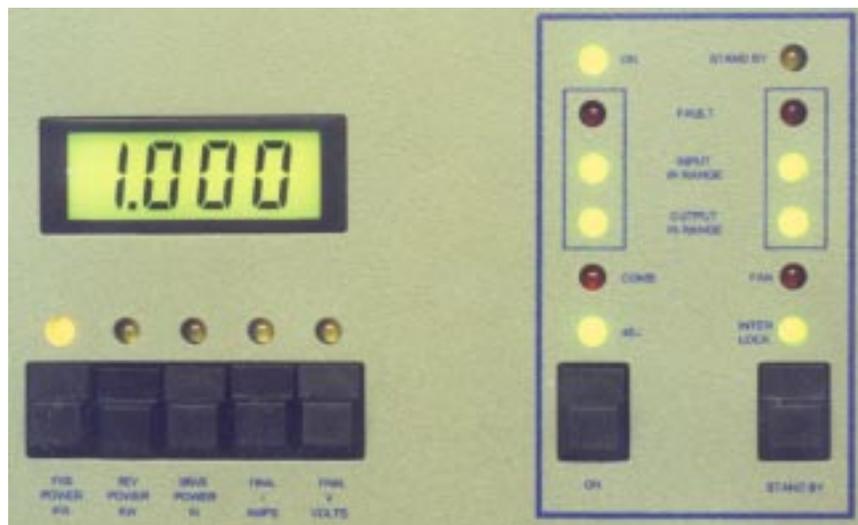
The functions of this assembly, located on the right side panel, are:-

- ◆ to ensure conditions are acceptable to turn the amplifier on,
- ◆ to monitor the performance of the various components of the 10/1000,
- ◆ to present the required Front Panel display,
- ◆ to interface to the user through the Interface connector, and
- ◆ to take such action as is warranted in the event of an abnormal condition arising.

The +5V power supply (PS2) is wired across the ac input, and activates the M&C PCA when applied. The two cross-connected gates (flip-flop) in the lower left of the schematic will come up in the state determined by the jumper J1, usually this default condition is the ON state, with the "ON" line low and the "OFF" line high. The analog switch shown in the lower right side of the schematic is connected to OFF and pin 18 on the Interface connector (the Interlocks pin), if both inputs are high the output of this switch will put a high on pin 5 of the ten pin connector J1, which is the Remote ON signal for PS1.

Closing switch S6 (Standby) or applying a momentary high to pin 16 of the Interface connector (Remote OFF) will reverse the state of the flip-flop and cancel the Remote On signal to PS1 and thus put the amplifier into Standby. Similarly, if the combiner temperature switch closes it puts a low on pin 18 of the Interface connector (the Interlocks pin) via a diode on the indicator PCB mounted behind the front panel, which inhibits the analog switch and cancels the Remote ON signal to PS1.

Capacitor C1 ensures that when power is applied the 3-1/2 digit LCD panel meter displays Forward Power in kW. The analog switch labelled FWD PWR on the schematic receives a high from the Forward Power flip flop, which allows the analog signal on pin 8 of the ten pin connector J1 through to the + side of the meter circuit op amp. The same high allows the op amp output through the metering analog switch to pin 4 of J2 which goes to the panel meter. To calibrate the



meter reading adjust pot R37 which sets the differential voltage on the - side of the metering op amp. The Forward Power signal coming in on pin 8 of J1 is applied to another op amp, the output of which is connected to pin 19 of the Interface connector for remote monitoring of Forward Power.

Selecting S2 thru S5 will switch the meter to display the selected parameter. The Interface signals are always present on the Interface connector no matter which parameter is selected for front panel display.

If the FAULT input on pin 3 of J1 goes low pin 15 on the Interface connector will go low. This is a warning indicator only, the amplifier will not turn off.

### 3.06 Relay Board

This module is inappropriately named. The major function is to boost the signal from the M&C PCA that turns on PS1. To turn the power supply off we have to short two of the pins on the control interface, opening them turns the supply on. We use an optocoupler to short the pins but the operating current of the optocoupler is more than the Metering and Control PCA can supply so we pass the signal through a TTL inverter that can handle the required current.

The muting relay is located on this assembly, it is a 48V DPST relay which is activated when PS1 turns on. One set of contacts is made available on the rear panel for muting. There are two LEDs on this assembly, the green one indicates the presence of the +5V from PS2, the red one turns on with the remote Power On signal.

### 3.07 Status Indicators.

Each of the two 500 watt modules is monitored by the Indicator PCA, which compares the Forward Power signal from the module to a reference and turns on a green LED when the output exceeds approximately 80% of full power capability. Similarly, the Drive Power signal from each module is monitored and the green LED comes on when the input reaches a minimum acceptable value. (This is a de facto indicator of the performance of the Pre-Amplifier module.) The "Output in Range" and "Input in Range" indicators can be adjusted to your own requirements quite simply. Connect your In-Line wattmeter for an accurate measurement of output power. Remove the four bolts holding the front panel. Reduce the input drive to the point where the output is as low as you would ever want it to operate continuously and adjust pots R12 and R31 until the "Output in Range" LED goes out. Adjust R6 and R9 until the "Input power in Range" LEDs go out. Raise the output power until the reading is as high as you would ever want it to go and adjust R10 and R29 until the Output LED goes out, adjust R4 and R7 until the Input LEDs go out. Set the Output Power to where you want it to be, calibrate the LCD meter if necessary, replace the front panel. If a module generates a FAULT signal the Indicator PCA turns on a red warning LED. There are four possible reasons for the Fault light to come on:- one or the other of the 500 watt modules is generating a Fault signal (see section 3.03), the main fan is not operating, or the combiner temperature is excessive.

The Indicator PCA compares the 48V line against pre-set values and turns on the green LED only if the voltage is within acceptable limits. This is an indicator only, no action is taken if the supply voltage is not within tolerance.

One input is connected to the Combiner Temperature switch and will turn on a red warning LED if the switch operates, another input is connected to a fan fault indicator which is illuminated if the fan fails to deliver a sufficient volume of air to keep the amplifier cool, this is an early warning



signal, any time this LED comes on in normal operation the cause should immediately be investigated because without adequate cooling the 500 watt modules will overheat and the internal thermal switches may not trip fast enough to prevent serious damage to the MOSFETs.

Finally, one LED is labelled "Interlock" and should be green at all times. The amplifier will never turn on if the Interlocks light is not on. Pin 18 on the User Interface **MUST** be high for the amplifier to operate.

### 3.08 Cooling systems

Air enters via six filtered openings in the front panel and is exhausted through the mesh rear panel. A high volume 48V fan forces air across the heatsink fins of the two amplifier modules. PS1 has its own cooling fan and also draws air through the front panel screening filter and exhausts through the rear.

The air switch is a microswitch with a vane on the actuator. When the fan stops running the switch closes to ground to illuminate the front panel LED and give a low on the interface connector. This only an alarm, it does not shut the amplifier down.

It is always good practice to keep the filter elements clean, they can be gently vacuumed from the front to remove most of the trapped particles.

### 3.09 Gain Control.

Please refer to attached schematic.

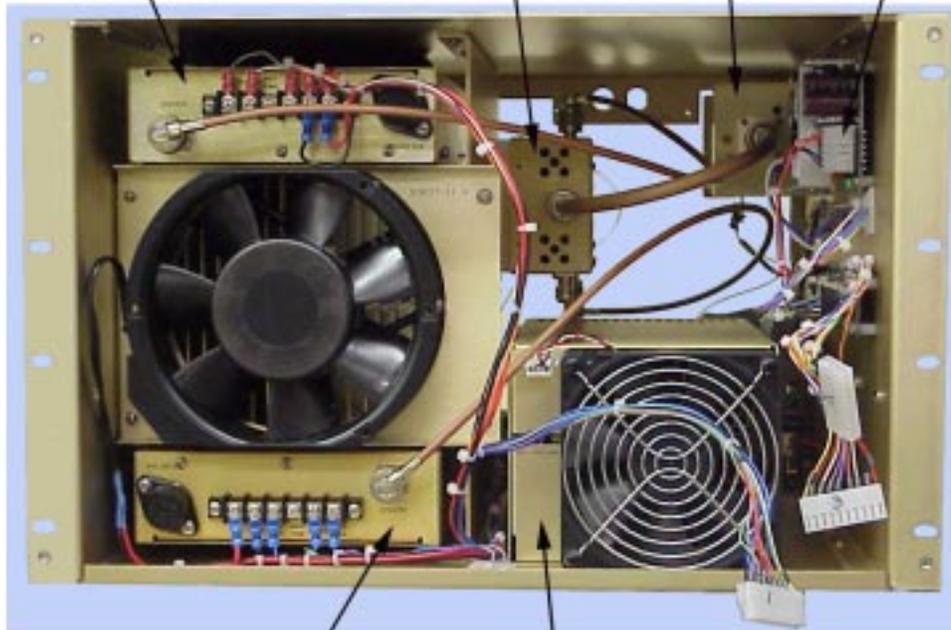
The external gain control is specified at 0V for full gain, + 5V for full attenuation.

**500w Power Amplifier module**

**Combiner**

**Directional  
Coupler**

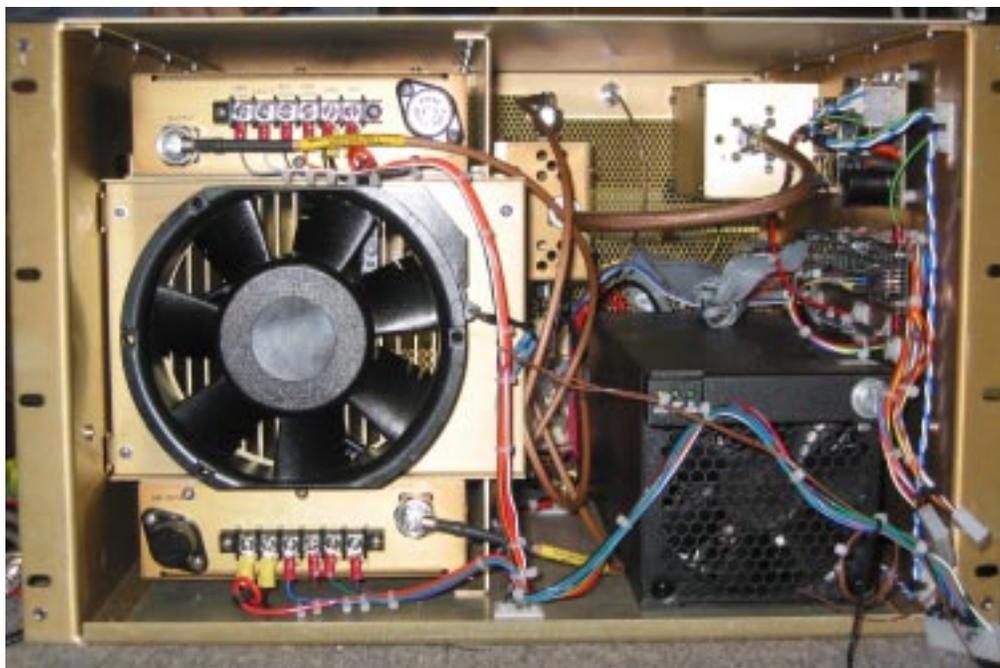
**+5V Supply**



**500w Power  
Amplifier Module**

**+48V Supply**

**10/1000 amplifier with front panel removed**



## 4. INSTALLATION & OPERATION

### 4.01 Unpacking

Carefully examine the container for shipping damage. The amplifier is thoroughly tested, inspected and carefully packed at the factory and is shipped insured. Any damage should be noted on the delivery documents and a claim filed with the carrier, as well as with the factory.

The amplifier is shipped complete with all connectors and interconnecting cables. Check each container for small packages with connectors in them. AC power cables are not supplied as everyone has their own unique needs, but we do supply the mating twist lock connector.

Remove everything from the container and set it and the foam supports aside against possible future shipping needs.

### 4.02 Installation

Mount the slide hardware Left and Right Stationary Sections in your 19" rack with the hardware provided. See figure 4-1. Slide the chassis into the rack (two people).

Connect the antenna or dummy load to the 7/8" flange connector. You may want to connect your external power meter at this time.

Connect the exciter to the female Type N connector RF INPUT. If you plan to use the muting feature the relay contacts are on the rear panel of the PSU.

Wire up the female 30A twist lock connector to your ac cable.

Ensure your exciter is muted or turned down very low.

### 4.03 Start up

*CAUTION:- BOTH LEGS OF THE AC INPUT ARE ARE ON SEPARATE BREAKERS, IF YOU CONNECT ACROSS TWO PHASES OF 110V TO GET THE 208V IT IS POSSIBLE TO TRIP ONE BREAKER AND STILL HAVE 110V PRESENT ON THE OTHER LEG. ALWAYS DISCONNECT THE AC CONNECTOR BEFORE WORKING INSIDE THE AMPLIFIER.*

Insert the twist lock ac connector. The amplifier should come up in the ON state showing Forward Power of zero, with no green lights on the Front Panel except the "48V" and "Interlock" indicators, and no red lights. You should hear the fans start up and should be able to feel air movement out of the rear of the chassis.

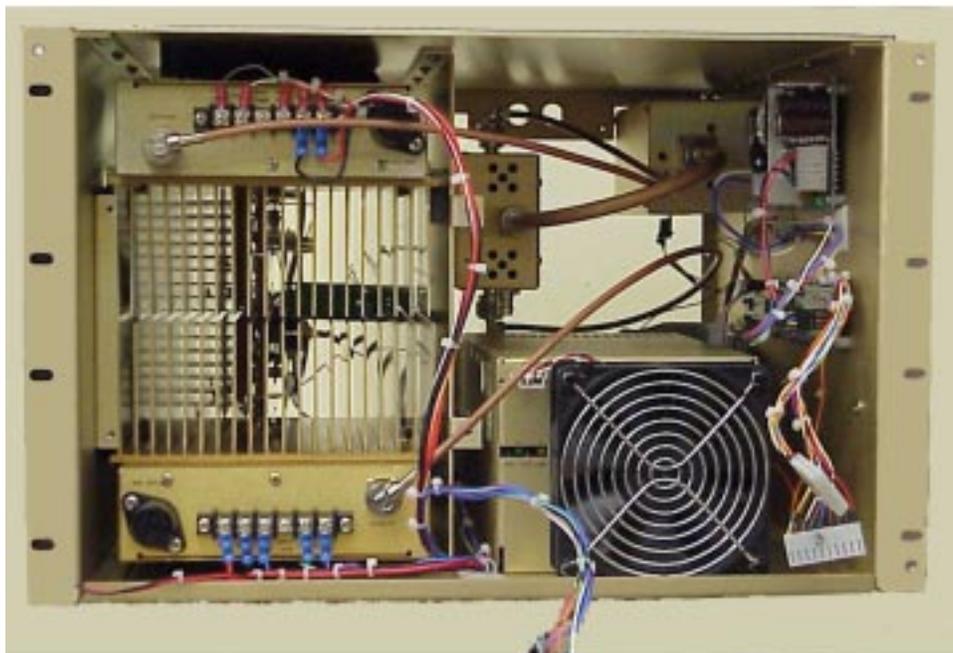
The amplifier is shipped with a connector for the remote interface, which provides the interlock jumper across pins 24 (+5v) and pin 18 (interlocks). It also has a 10k pot wired across +5v, Ground and the gain control (pin 4). This pot is factory pre-set so that with ten watts input your amplifier will deliver the full power that you requested at your operating frequency. This 1 1/2 turn pot gives fine control of your output power should you wish to adjust it.

If the amplifier only goes into Standby and will not respond to the ON button it is most probably because the Interlocks connection has not been made on the "INTERFACE" connector, pin 18 must be high for the amplifier to turn on.

With the amplifier ON, check the front panel displays, the only meaningful readings should be the Voltage and Current readings for the 48V power supply.

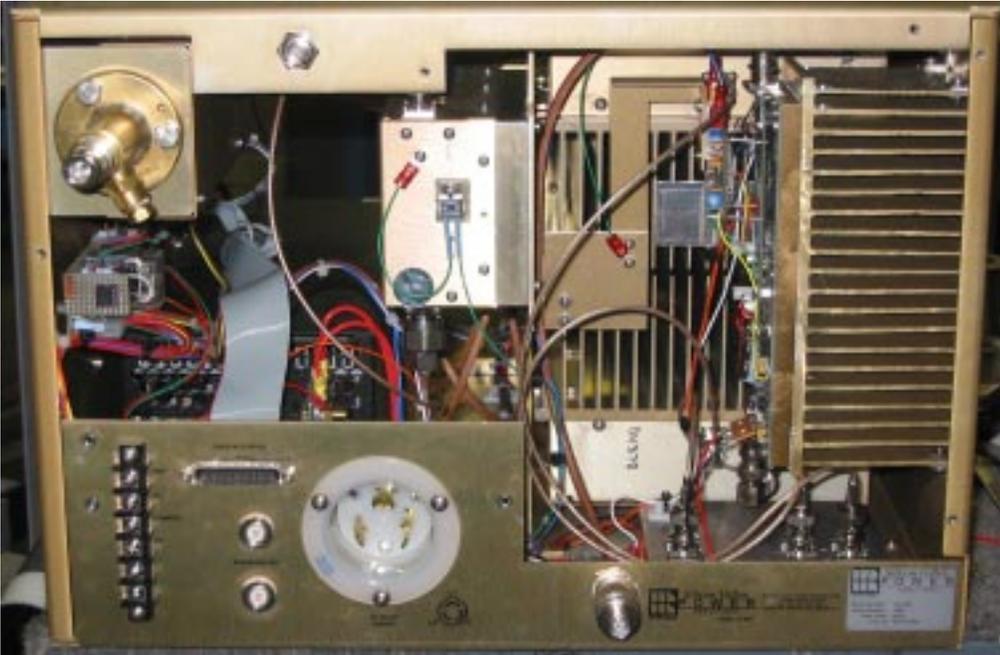
Switch to Standby, the fan should go off and the Voltage and Current readings should collapse.

Go back to ON. Start to increase the input power, all readings should become meaningful except the Reverse Power. Continue to increase and watch for the green LEDs to light on the status indicators, at this time output power and drive power should both be measurable but may not be accurate when compared with external meters.



**10/1000 Amplifier with the front panel and fan plate removed**

At about 80% power everything should be operating normally. Switch to Standby and observe the orderly shut down of the system, then switch back on and the amplifier should recover. Continue to increase input power to full operating power, **do not exceed 10 watts input power**. Compare the measured parameters with those entered by the factory in this operations manual, the readings were taken after extended operation at your requested frequency and power level. If you use the user interface for remote control and metering we strongly recommend you use the gain control for setting and controlling output power, with a fixed ten watts of drive from your exciter, rather than trying to adjust output power by tweaking the exciter output. The reason is that the pre-amp transfer characteristic with fixed bias has a very sharp slope, a small change in exciter output can make a noticeable change in amplifier power, which means that if your exciter is sensitive to temperature or line voltage variation the output of the 10/1000 amplifier can vary considerably over a 24 hour period.



## 5. MAINTENANCE

### 5.01 Routine maintenance

We advise regular cleaning of the input air filters, and constant monitoring and recording of such parameters as Drive Power, Power Supply Voltage and Current at your measured operating output power so as to spot trends before they develop into problems.

### 5.02 Access.

#### 5.02.01 Power Supplies

The AC connector should be removed before opening the chassis.

Remove the front panel (4 screws), disconnect the connectors to the Indicator PCA and the LCD display and set the front panel aside. Remove the rear screen.

The supplies are clearly visible and accessible, and are secured with appropriate Phillips head screws.

The 48V supply can only be removed from the front. Remove the four screws that secure it to the bottom panel. From the rear undo the electrical connections at the terminal blocks, not at the supply, and lift the whole supply out with all the wiring.

The 5V supply is mounted on the right side panel and is readily accessed from the front of the amplifier.

The air filter can be removed if necessary by removing the front panel (four screws), Rinsing in warm soapy water followed by clear warm water should be all that is ever required to remove the accumulated grit.

*Troubleshooting note. Both power supplies have LED indicators which show whether the supply has ac power. The 48V supply has three LEDs which can usually be seen through the front panel filter mesh. The yellow one indicates it is getting ac, the right green one indicates it is delivering dc power, the center light is a temperature alarm, green is OK.*

#### 5.02.02 Fan.

Remove the front panel of the amplifier by removing the four corner screws. Disconnect the connectors to the Indicator PCA and the LCD display and set the front panel aside.

Disconnect the push on connector to the fan. Remove the fan mounting plate by removing four screws. The fan is easily removed from the fan mounting plate.

#### 5.02.03 Output Power Modules

With the fan mounting plate removed (see 5.02.02) both modules are visible. To remove either of them, disconnect the output N connector, disconnect the five wires from the terminal strip and slide the module towards you until you can reach the connector on the far end of the module. Disconnect the coax cable BNC connector and continue to slide the module towards you until it clears the chassis.

#### 5.02.04 Pre-Amplifier Module

Access is via the rear of the chassis.

Remove the protective mesh screen which is held in with six bolts.

The Pre-amplifier module is on the right of the chassis as observed from the rear and is secured to the side wall.

Disconnect the wires from the terminal block and unbolt the module from the side panel. Disconnect the BNC connectors from the two output power modules.

#### 5.02.05 **Combiner.**

First remove the upper power amplifier module as in 5.02.03

Access is required to the rear of the chassis.

Disconnect the RF OUTPUT.

Remove the rear protective mesh screen which is held in with six bolts.

Disconnect the three RF connectors and the wire that carries the Overtemp warning. Unbolt the combiner from the center panel (interplate).

#### 5.02.06 **Directional Coupler.**

Access is required to the rear and the side of the chassis.

Disconnect the RF OUTPUT.

Remove the rear protective mesh screen which is held in with six bolts.

The Directional Coupler is bolted to the side of the chassis.

Disconnect the Forward and Reverse Power connections and the RF cable, unfasten the screws and remove the unit.

#### 5.02.07 **Relay PCA.**

The relay PCA is mounted on the right side panel low down at the rear. Note there are two LEDs on this assembly. The green one indicates it is receiving 5v, the red one lights when the amplifier is in the ON state. The assembly is secured by two screws and all connections are through a snap in connector.

### 5.03 **Meter Calibration**

The response of the output Directional Coupler is not flat across the whole FM frequency band so some adjustment may be necessary when changing frequency. Also, the coupling is a function of I but power is a function of  $I^2$  so the dc output curve diverges from the output power curve. Most users operate at a fixed frequency and power level, and only concern themselves when there are changes from the established normal readings. However, when switching frequencies or changing to a different power level it may be necessary to re-calibrate the meter for optimum accuracy. Remove the front panel but do not disconnect the connections to the Indicator PCA or the LCD Display. Using external meters set the amplifier up at the required frequency and power level. Set the display to show FWD PWR. The M&C PCA is mounted on the right side panel. Adjust potentiometer R37, which is at the far end of the M&C PCA towards the bottom of the PCB, until the reading is as close as you can get to the reading on your expensive external meter. Relocate the front cover without tightening the screws and allow 15 minutes for everything to temperature stabilise again. If the reading has drifted you can repeat the procedure, making only minor adjustments, until you are satisfied.

Potentiometer R34 controls the reverse Power reading, R31 controls the Drive Power reading and R47 (extreme right) controls Current readings and should not require re-adjusting.

Finally replace the front panel and tighten it down.

## 6. REPAIR SERVICE

### 6.01 Warranty Service

The limited warranty covers parts and labor to the original purchaser for three years on everything except the two power supplies which are covered by their manufacturers one year warranties. Damage caused by misuse, abuse or shipping is specifically excluded from the warranty. Minor deviations from specifications which do not affect the performance are excluded from the warranty. Before returning material please contact the factory at 775 335 8273 for a Return Material Authorization (RMA) number. Any containers received without RMA numbers will be refused. Ship all material prepaid and addressed to the address on the RMA form.

To expedite the repair it is imperative you mark the outside of the container with the RMA number, include a note with your name, company name, address and phone number, preferably taped to the item being returned, and if possible include a brief description of the failure and any significant events which may have preceded it. If returning the item from outside the United States make sure all the relevant paperwork clearly states that the item is "US made goods being returned for repair". Please state if you have a preference for which carrier we use to return the item.

Take precautions to prevent shipping damage, particularly for modules.

### 6.02 Out of warranty service.

Silicon Valley Power Amplifier Corp. provides prompt service for out-of-warranty equipment, the return procedures are the same as described above. Labor charges are at the current shop rate with a minimum charge of two hours.

### 6.03 Warranty Statement.

SILICON VALLEY POWER AMPLIFIER CORPORATION (SELLER) warrants its products free from defects in material and workmanship and to meet performance specifications provided that:

(A) SELLERS liability under this warranty is limited to repairing or replacing, at its option, any product delivered hereunder not conforming to this warranty.

(B) This warranty is limited to a period of one year on amplifiers, two years on RF amplifier modules.

(C) Minor deviations from specifications which do not affect performance are excluded from this Warranty, and

(D) SELLER shall be liable under this warranty only if:

(1.) It is promptly notified in writing by the Buyer upon discovery of the failure of any product to conform to this warranty,

(2.) The product is returned to the SELLER, transportation charges prepaid by the Buyer,

(3.) The product is received by the SELLER not later than ten days after the last day of the warranty period, and,

(4.) SELLER examination of the product discloses to SELLERS reasonable satisfaction that such defects or failures as may exist have not been caused by misuse, neglect, improper installation, repair, alteration, accident or shipping.

The Buyer will prepay freight to and from SELLER on products serviced hereunder at SELLERS plant: but SELLER may, at its option, elect to perform any repairs at the Buyers place of business.

The foregoing constitutes SELLERS entire warranty expressed, implied and/or statutory, except as to title, and states the full extent of SELLERS liability to the Buyer or to any other party for any breach of such warranty and for damages, whether direct, special, incidental or consequential: and, other than as expressly provided in this document no warranties, express or implied, including any warranty of merchantability or of fitness for a particular purpose, are made. No employee, representative or agent of the SELLER has any authority, expressed or implied, to alter or supplement the terms of this warranty.

## 7 TECHNICAL INFORMATION

### 7.01 User Interface

Pin #	Signal	
1	not used	
2	not used	
3	PA V	Buffered voltage, 1 % of measured power supply voltage.
4	GAIN	Gain Control. 0V or open for full gain. 5V for full attenuation.
5	not used	
6	not used	
7	not used	
8	not used	
9	ON	Logic high (TTL) indicates amplifier is in ON state.
10	RMT ON	Momentary logic (TTL) high will turn amplifier ON.
11	GND	Ground
12	DRV PWR	Positive dc voltage proportional to drive power (typ .6V = 10W)
13	not used	
14	not used	
15	FAULT	Logic low if any module develops a fault.
16	RMT OFF	Momentary logic (TTL) high will turn amplifier OFF.
17	not used	
18	INTERLOCK	Inhibits operation unless high. (Normally jumpered to pin 24 )
19	FWD PWR	Positive dc voltage proportional to Forward Power (typ 1.5V = 1kW)
20	GND	Ground
21	STANDBY	Logic high (TTL) indicates amplifier is in Standby state.
22	REV PWR	Positive dc voltage proportional to Reverse Power (typ 1.5V = 1kW)
23	not used	
24	5VDC	+ 5v via 1k resistor
25	PA I	Analog voltage proportional to the current drawn from the main 48V supply

### 7.02 Power Supplies

The power supplies carry a one year manufacturers warranty, which is passed through. Typically repairs on out of warranty supplies take 4-6 weeks. We operate an exchange service where we can ship you a replacement supply for the cost of the repair, you send yours direct to the manufacturer who returns it to us to replenish our stock.

The 5V supply is made by Condor and is available from Jameco, 1355 Shoreway Blvd., Belmont, CA 94002, their part number is 138878, Call 800 831 4242 or fax 650 592 2503. This is a 40W supply and is a massive overkill for the application.

The 48Vdc supply is made by Cherokee International, 2842 Dow Ave., Tustin, CA 92780-7246, phone (714) 544 6665, fax (714) 838 4742. Model number is CAR3010L1 with rear studs.

**7.03 Technical manual revision history**

Original issue        1999

Rev A. Oct 2001. Changed to 3 kW Cherokee power supply, optocoupler activated.

Rev B. Aug. 2002. New pre-amp and controller.

## 8. DIAGRAMS AND TABLES

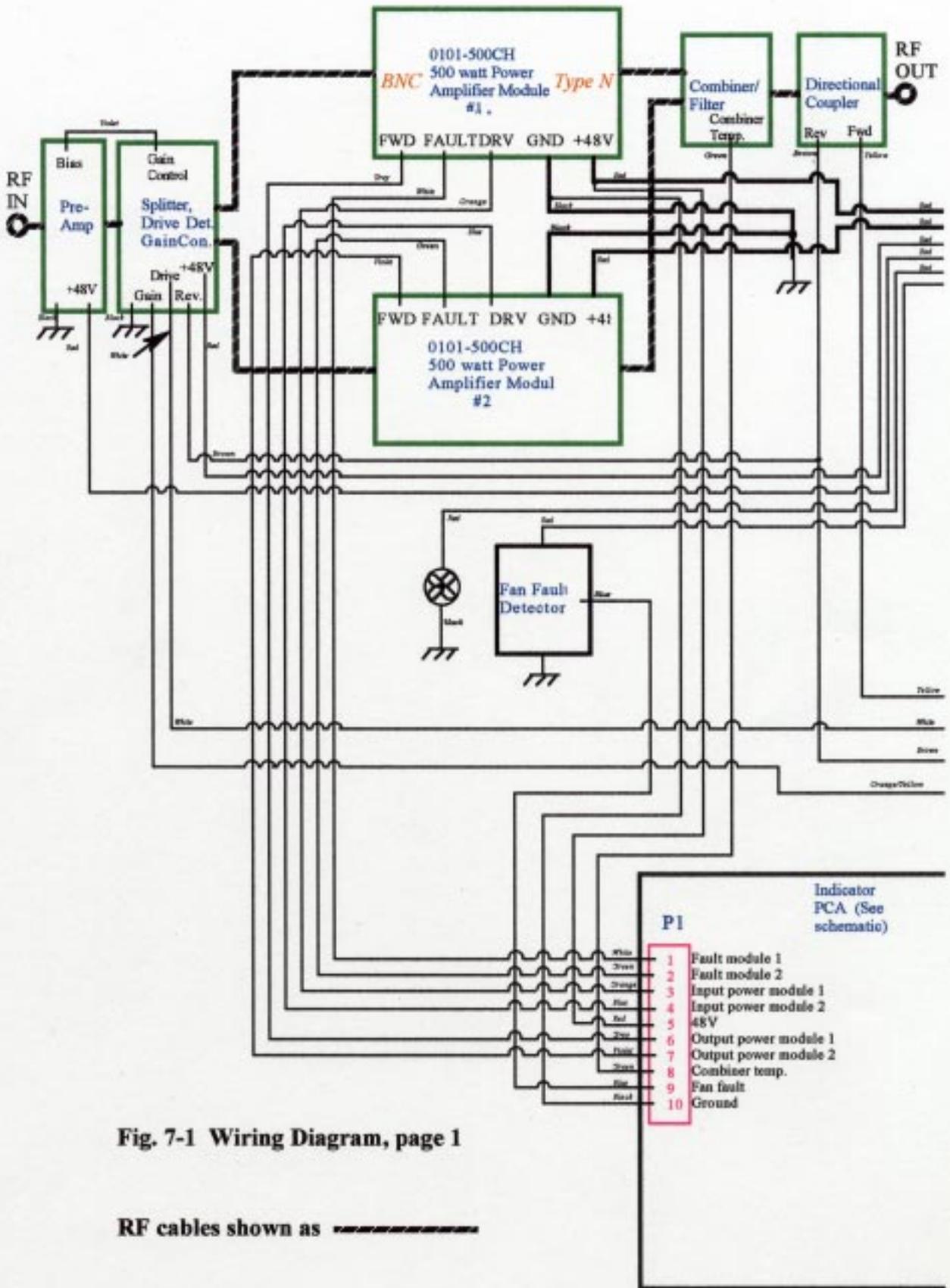


Fig. 7-1 Wiring Diagram, page 1

RF cables shown as

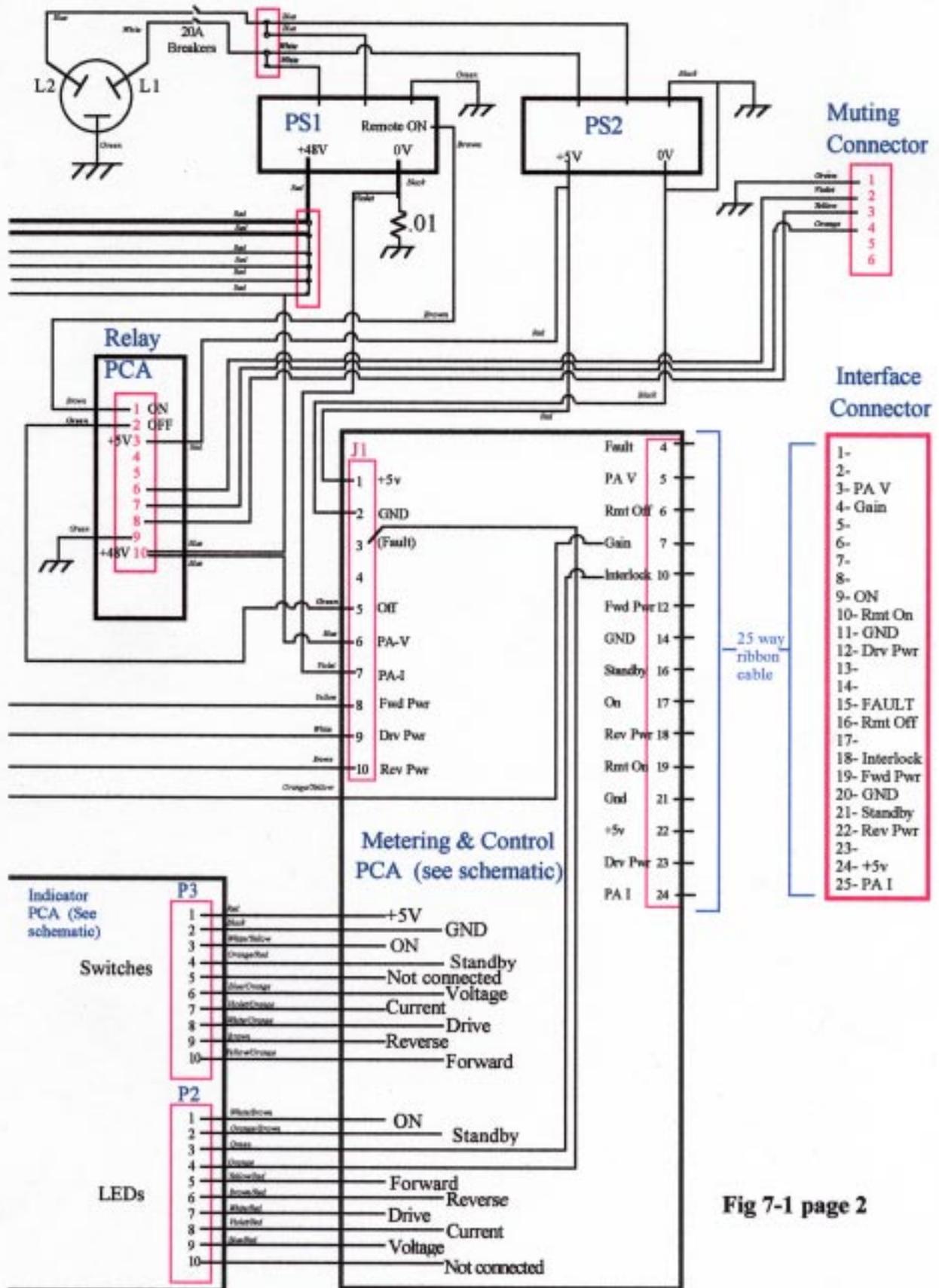


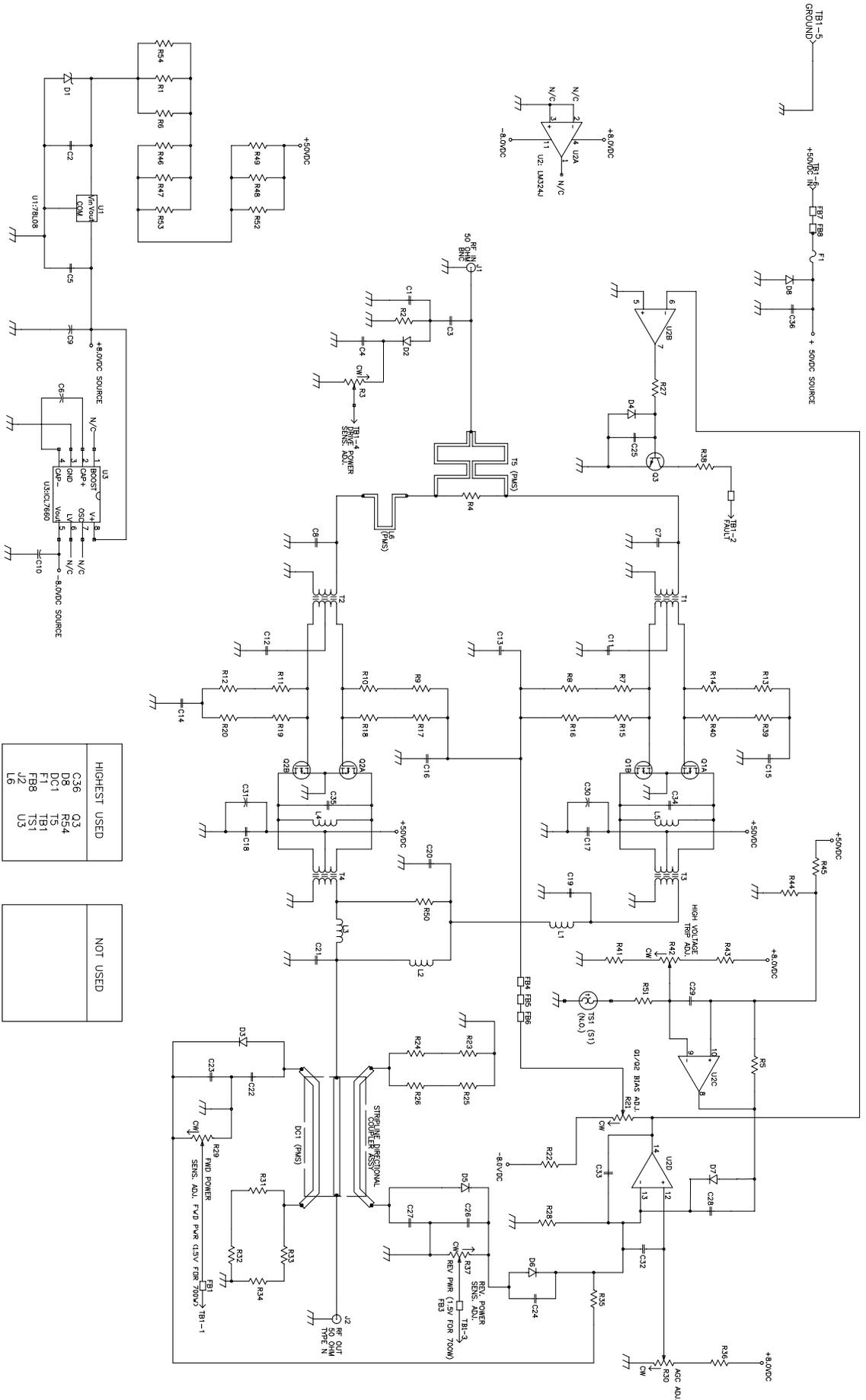
Fig 7-1 page 2

			1	EA	320107	IC VOLT CONV SOIC-8 ICL7660CSA	U3	50
			1	EA	320102	IC QUAD OP AMP SOIC-14 LM324AN	U2	49
			1	EA	320101	IC VOLT REG 8VDC 100MA SOT-89	U1	48
			1	EA	250112	THERMOSTAT 80C N.O. 67F080	TS1	47
			1	EA	100485	TRANSFORMER TRI-FI	T5	46
			2	EA	100056	TRANSFORMER RF 400W	T3 & T4	45
			2	EA	100455	TRANSFORMER RF I/P 10W	T1 & T2	44
			3	EA	208302	RESISTOR 3K OHM 1/8W 5% 1206	R52	43
			1	EA	208100	RESISTOR 10 OHM 1/8W 5% 1206	R51	42
			1	EA	207101	RESISTOR 100 OHM 250W 5% FLANG	R50	41
			3	EA	208103	RESISTOR 10K OHM 1/8W 5% 1206	R41	40
			1	EA	208471	RESISTOR 470 OHM 1/8W 5% 1206	R38	39
			2	EA	208104	RESISTOR 100K OHM 1/8 5% 1206	R36 & R45	38
			1	EA	208822	RESISTOR 3.3K OHM 1/8W 5% 1206	R35	37
			1	EA	208332	RESISTOR 3.3K OHM 1/8W 5% 1206	R27	36
			4	EA	208820	RESISTOR 82 OHM 1/8W 5% 1206	R24, R26, R31 & R33	35
			4	EA	208120	RESISTOR 12 OHM 1/8W 5% 1206	R23, R25, R32 & R34	34
			2	EA	208102	RESISTOR 1K OHM 1/8W 5% 1206	R22 & R28	33
			16	EA	208220	RESISTOR 22 OHM 1/8W 5% 1206	R7-R19, R29, R39 & R40	32
			1	EA	208105	RESISTOR 1M OHM 1/8W 5% 1206	R5	31
			1	EA	207103	RESISTOR 100 OHM 20W 5% TO-220	R4	30
			6	EA	200106	POTENTIOMETER 10K OHM ST-4B	R3, R21, R29, R30, R37 & R42	29
			1	EA	208513	RESISTOR 51K OHM 1/8W 5% 1206	R2	28
			6	EA	208302	RESISTOR 3K OHM 1/8W 5% 1206	R1, R6, R7, R46, R48 & R49	27
			1	EA	2N3904S	TRANSISTOR NPN SMT	Q3	26
			2	EA	MRF151G	TRANSISTOR RF POWER	Q1 & Q2	25
			2	EA	100059	INDUCTOR AIR WOUND 700W 4T	L5 & L6	24
			2	EA	100057	INDUCTOR AIR WOUND 700W OP	L2 & L3	23
			1	EA	100058	INDUCTOR AIR WOUND 700W 90D	L1	22
			1	EA	420107	CONNECTOR TYPE N FEMALE CHASSIS	J2	21
			1	EA	420110	CONNECTOR BNC FEM CHASSIS SQFL	J1	20
			1	EA	230105	FUSE 30A 500VAC KLM-39 UL/CSA	F1	19
			1	EA	510203	PCB FAB DIR COUPLER TOP FM RAD	DC1	18
			2	EA	HP2800	DIODE HOT CARRIER	D3 & D4	17
			4	EA	1N4148	DIODE SMALL SIG	D2, D4, D6 & D7	16
			1	EA	310155	DIODE ZENER 12V 1W 5% DL-41	D1	15
			1	EA	210104	CAPACITOR 47UF 100V 20% ELECT RAD	C30	14
			2	EA	211031	CAP 150PF 300V 5% MULT POR 1111	C22 & C27	13
			1	EA	213271	CAP 33PF 350V 5% MC MICA MCM01	C21	12
			1	EA	213390	CAP 39PF 350V 5% MC MICA MCM01	C20	11
			1	EA	213120	CAP 12PF 350V 5% MC MICA MCM01	C19	10
			2	EA	213102	CAP 1000PF 350V 10% MC MICA MCM01	C17 & C18	9
			2	EA	210116	CAP 47UF 16V 20% ELECT SMT	C9 & C10	8
			2	EA	211028	CAP 82PF 500V 5% MULT POR 1111	C7 & C8	7
			1	EA	210115	CAP 4.7UF 50V 20% ELECT SMT	C6	6
			1	EA	211005	CAP 1.5PF 0850 NPO ±.5 CER	C3	5
			2	EA	210104	CAP 47UF 100V 20% ELECT RAD 20MM	C34 & C35	4
			17	EA	210103	CAP 0.01UF 1KV 20% DISC CER 0.37 LS	C2, C4, C5, C11-C16, C23-C26, C28, C29, C32 & C36	3
			1	EA	211021	CAP 33PF 500V 5% MULT POR 1111	C1	2
			1	-	100029	PCB 700W	-	1
-04	-03	-02	-01	U/M	PART NUMBER	DESCRIPTION	DESIGNATION(S)	ITEM NO.
QTY PER ASSY				U/M	PART LIST			

# BILL OF MATERIAL

## AMPLIFIER RF 88-108M 700W CEL

### 8.02 Bill of Material, 700W FM Module



NOTES:  
 1. NUMEROUS UN-DESIGNED FERRITE BEADS EXIST ON HARNESS WIRES IN THIS AMPLIFIER MODULE. MOST INFORMATION ON A PARTICULAR ASSY SEE SWA ASSY DWG 800223-01 FOR MORE.

SCHEMATIC DIAGRAM  
 AMPLIFIER RF 88-108MHZ 700W

8.03 Schematic, 700W FM Module

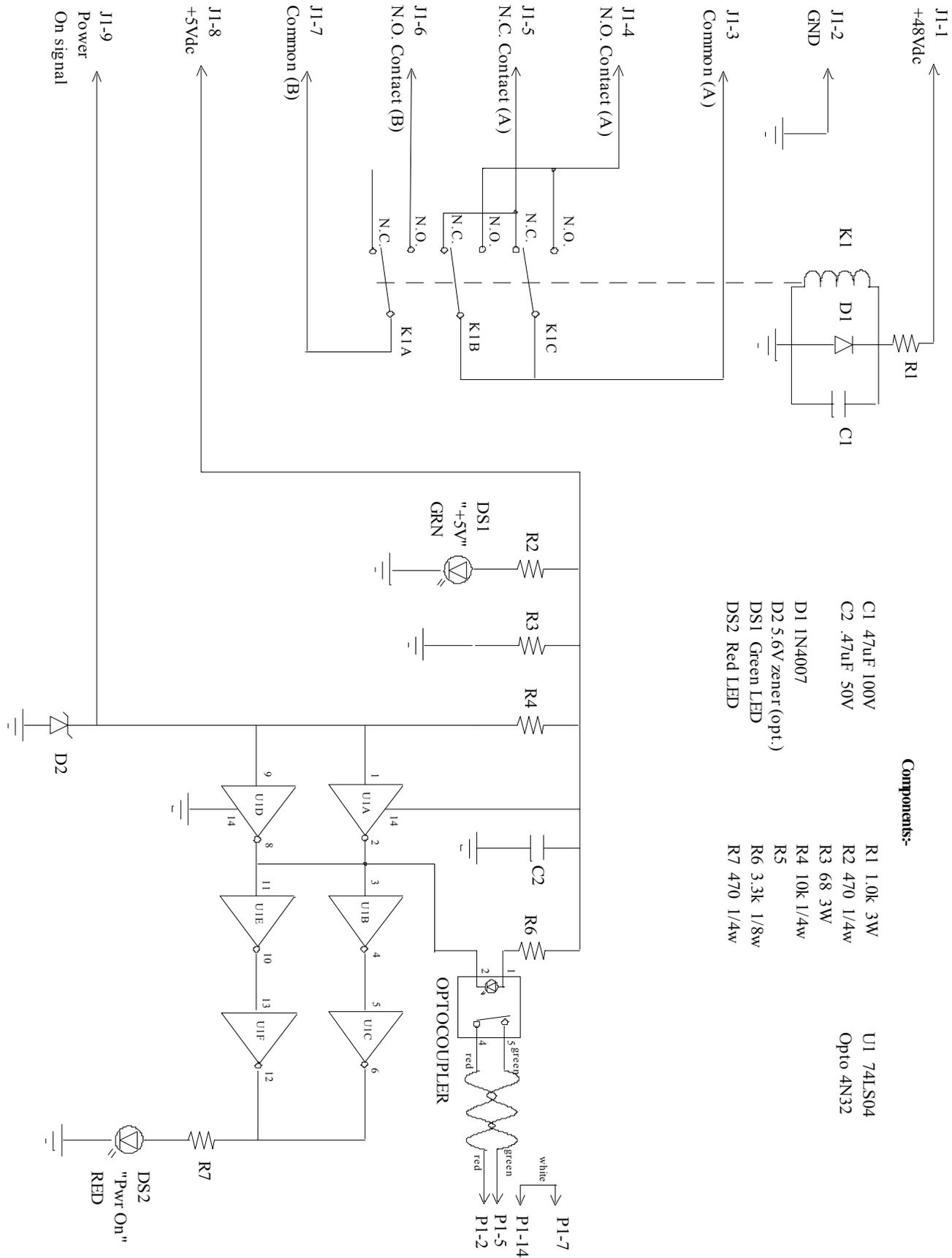
Metering and Control Board Parts List

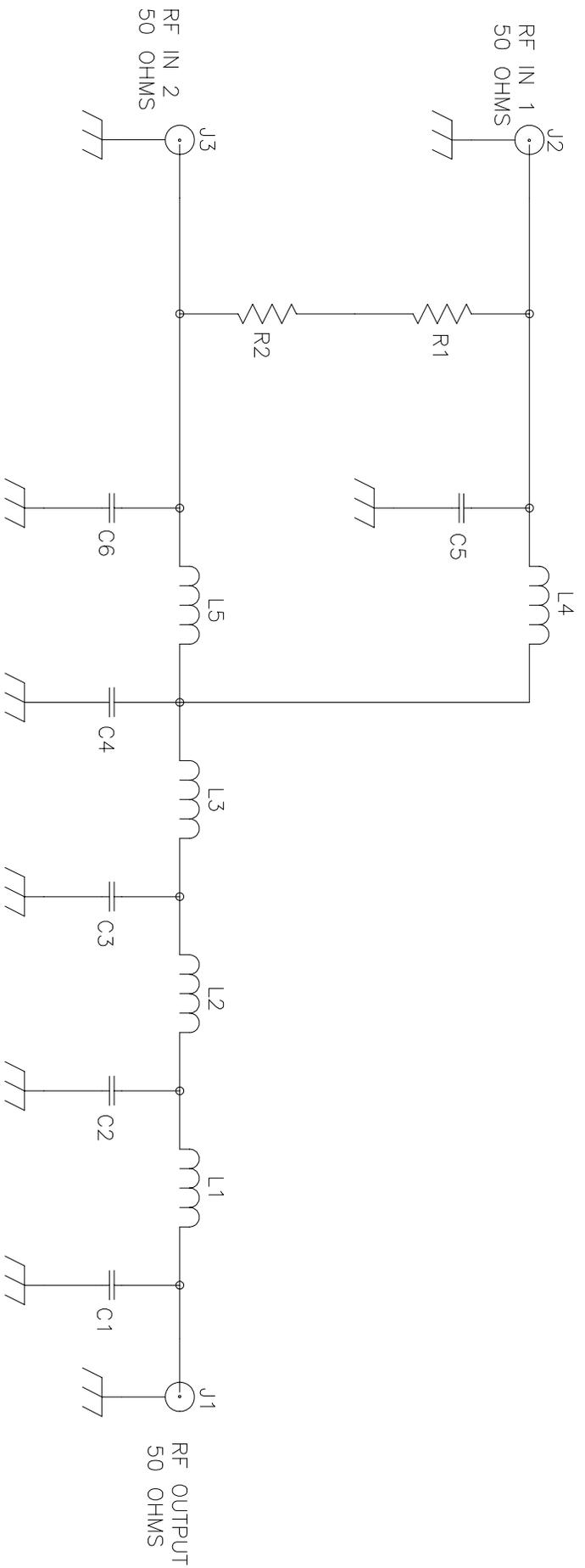
Part Number	Designation	Description	Supplier Part Number
210109	C1-2	Capacitor, 10uF, 16V, 20%, Tant, SMT	Digikey PCS3106CT-ND
215050	C3-34	Capacitor, .01uF, 50V, 10%, X7R	Kemet C0805C103JSGAC7800
340106	D6-13	Diode, LED, Yellow, T-1-3/4 Diff M1	Mouser592-SLR56YY3
310154	D1-5, 14-21	Diode, Switching, 75V PIU, SMT	Diodes Inc DL4148
301020	Q1-7	Transistor, NPN, SOT-23	Digikey FMM3904CT-ND
208105	R4-8	Resistor, 1Mohm, 1/8w,5%, 1206	Rohm MCR18JW105
208103	R1-3, 9-10, 14,16,18,20,21 24,28,40, 41,52,55	Resistor, 10Kohm, 1/8w,5%, 1206	Rohm MCR18JW103
208221	R11-13,15,17,19,22,23	Resistor, 220 ohm, 1/8w,5%, 1206	Rohm MCR18JW221
208393	R27	Resistor, 39Kohm, 1/8w,5%, 1206	Rohm MCR18JW393
208102	R26,42-5,49-51,54	Resistor, 1Kohm, 1/8w,5%, 1206	Rohm MCR18JW102
208152	R29	Resistor, 1.5Kohm, 1/8w,5%, 1206	Rohm MCR18JW152
208121	R33	Resistor, 120 ohm, 1/8w,5%, 1206	Rohm MCR18JW121
208223	R46	Resistor, 22Kohm, 1/8w,5%, 1206	Rohm MCR18JW223
208104	R25	Resistor, 100Kohm, 1/8w,5%, 1206	Rohm MCR18JW104
208504	R35	Resistor, 500Kohm, 1/8w,5%, 1206	Rohm MCR18JW504
208563	R53	Resistor, 56Kohm, 1/8w,5%, 1206	Rohm MCR18JW563
200106	R31,37,47	Potentiometer, 10Kohm ST-4B	Garrett GAE103MT
200112	R34	Potentiometer, 1Mohm ST-4B	Garrett GAE105MT
430606	S1-7	Switch, SPDT Pushbutton, Blk	Hamilton HallmarkMP0IR02CBE
320114	U1-3	Quad NOR gate,, SOIC	SGS Thomson 4001SM
320113	U4-6	IC Quad Bilateral Switch SOIC 4066B	Mouser 511-4066BM
320102	U7-8	IC Quad Op Amp SOIC-14 LM324A	Digikey LM324AM-ND

Note - All switches and LEDs are actually on the Indicator PCA; they are shown on the accompanying schematic for clarity.



# 8.06 Schematic and Parts List, Relay Board

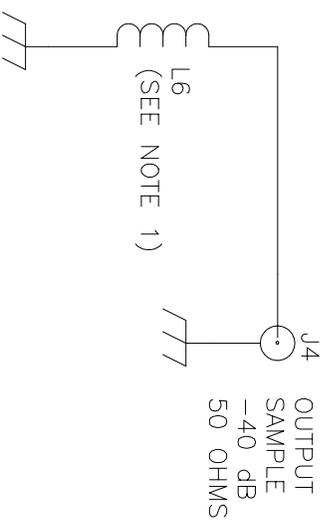




- NOTES:  
 1. L6 CONSISTS OF WIRE LOOP LOCATED NEAR J1

HIGHEST USED	NOT USED
C6	L6
J4	R2

HIGHEST USED	NOT USED

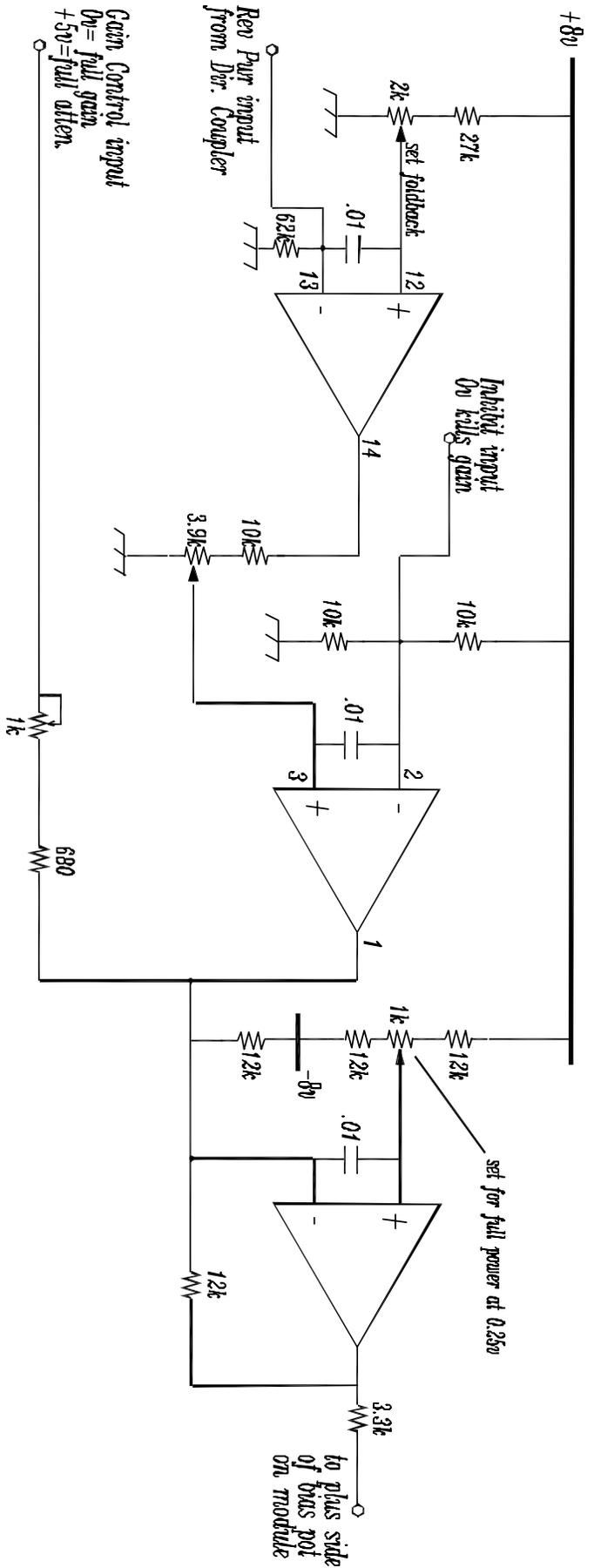


### SCHEMATIC DIAGRAM

COMBINER RF 2-W 1KW 86-108 MHZ 50 OHM

8.07 Schematic, High Power Output RF Combiner and Low Pass Filter





Requires change to two resistors on 150 watt module

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DRAWN	RM	SAN JOSE, CA 95112 U.S.A. <td>-</td>	-
ELEC	8/12/02	SPECIFICATION CONTROL DRAWING	
MECH		PIGGYBACK GAIN CONTROL 86-108-150H12	
Q/A		SIZE DRAWING NO. 640207-CH	
		CAD FILE NO. 640207-02.DRW	SHEET 1 OF 1

