

# Ameritron ALS-1300

## 1200-watt NO TUNE

### TMOS-FET AMPLIFIER



The Ameritron ALS-1300 is a 160 through 15-meter 1200-watt output solid-state amplifier. An optional user-installed MOD-10MK filter assembly extends operation to 12- and 10-meters. The ALS-1300 uses eight 50-volt conservatively rated linear RF MOSFETS. These 50-volt linear FET's produce an exceptionally clean signal compared to other solid-state amplifiers. Fan speed is regulated by temperature sensors assuring conservative cooling with minimum noise.

Nominal driving power is 90 watts for 1200-watts output (approximately 11 dB gain) on most bands. The compact 10.5" wide by 6.75" high amplifier package (depth only 19") fits nearly any station configuration. The attractive desk-top amplifier unit weighs only 22 pounds.

An external 50-volt 50-ampere regulated switching power supply powers the ALS-1300. The supply is wired for 240 VAC (200-260 VAC, 50-60 Hz, 15 amperes), but can be rewired for 120 VAC operation for lighter duty operation.

# Table of Contents

<b>TABLE OF CONTENTS .....</b>	<b>2</b>
<b>AMPLIFIER FEATURES .....</b>	<b>3</b>
<b>POWER SUPPLY .....</b>	<b>4</b>
Power Line Requirements .....	4
Power Supply Features.....	4
Power Supply Location .....	4
<b>GENERAL INFORMATION .....</b>	<b>5</b>
Amplifier.....	5
Power Supply .....	5
<b>INSTALLATION.....</b>	<b>5</b>
Airflow .....	6
<b>INTERCONNECTION WIRING.....</b>	<b>7</b>
<b>AMPLIFIER REAR PANEL .....</b>	<b>8</b>
<b>FRONT PANEL .....</b>	<b>9</b>
<b>OPERATION.....</b>	<b>10</b>
<b>MARS OR CAP OPERATION .....</b>	<b>11</b>
<b>INITIAL OPERATION .....</b>	<b>12</b>
<b>CIRCUIT BOARDS.....</b>	<b>14</b>
<b>TECHNICAL INFORMATION.....</b>	<b>26</b>

## Amplifier Features

This amplifier provides the following standard features:

- Eight conservatively rated, very linear 50-volt MOSFET transistors
- Operational in a few seconds. No long filament warm-up time
- Clean layout with easy-to-service modular construction
- Front panel LEDs indicate band, faults, ALC and transmitting status
- Quiet variable-speed forced air cooling system
- Power amplifier module balance metering
- Power amplifier module current and voltage metering
- PEP forward power and PEP reflected power metering
- Reflected power protection
- Bandswitch error protection
- Standard negative going ALC output with front panel adjustment
- ALC metering and an ALC LED indicator
- 5 milliseconds receive-to-transmit relay switching
- Adjustable Forward and Reflected peak meter hold time
- Adjustable meter brightness
- Fully regulated external power supply
- Compact size 19" deep x 6.75" high x 10.5" wide
- Weight amplifier section 23 pounds

## Options

- MOD10-MK: Enables 12/10 meter operation. User-installed.
- QSK-5 PIN Diode Switch for silent QSK operation
- ARI-500 Amplifier Radio Interface for auto band-switching with your transceiver

## Power Supply

The power supply for the ALS-1300 is a voltage regulated current limited supply. It contains 14-volt positive and negative supplies as well as dual 50-volt 25-ampere continuous (30-ampere peak) fully current limited supplies. Each PA (power amplifier) module in the ALS-1300 operates from the separate 50-volt sources, giving a total dc input power rating of 2500 watts to the power amplifier modules.

Power supply to amplifier interconnections are through a heavy-duty cable using a large Cinch Jones connector.

## Power Line Requirements

This amplifier ships wired for 200-260 Vac. The maximum average power line current is 12 amperes at 240 volts. Two 250-volt 15-ampere fuses fuse the power line.

**Note:** 120-volt power mains operation is possible with a reduction in CW or RTTY power. Because average power is very low, SSB operation is minimally affected by 120 volt operation. Fuse size should be 25 amperes maximum at 120VAC.

## Power Supply Features

- Efficient operation from 200-260 volts ac (12 amperes minimum) and 100-135 volts (20 amperes minimum)
- Wide range of power line frequencies, 40-400 Hz
- Fully regulated current-limited outputs
- Step-start to limit stress on power supply components
- Exceptional filtering and RFI suppression
- Compact size 13.25" deep x 6.75" high x 10.5" wide
- Light weight design 15 pounds

## Power Supply Location

Locate the power supply in a convenient ventilated area near the amplifier location. Do not place the power supply next to sensitive equipment like audio processors, transceivers, or microphones. For safety, ground the wing nut stud on the supply rear to your station ground buss. The station ground buss should comply with national electrical codes. These codes dictate that station grounds must be bonded to the power mains entrance ground. A station ground that is *not* bonded to the mains ground does *not* offer lightning protection!

## General Information

### Amplifier

The Ameritron ALS-1300 is a solid-state 1200-watt nominal RF output power 1.8-22 MHz amplifier (1.8-30 MHz with optional MOD-10MK). This power is peak envelope power, which is the same as actual carrier power on CW. The ALS-1300 uses eight exceptionally low-distortion push-pull parallel MRF-150 or equivalent RF power TMOS transistors. The ALS-1300 meets or exceeds all FCC rules governing amateur radio external power amplifiers.

Two temperature sensors on each PA (power amplifier) module track FET and heatsink temperatures and provide fan speed control for heatsink cooling as well as FET bias control.

Harmonic suppression comes from push-pull operation of linear devices, and a series of high quality 5-pole low-pass filters. This amplifier exceeds all FCC mandated harmonic requirements.

Antenna switching is through a sequenced pair of miniature relays on a plug in board. Relay switching time is approximately five milliseconds. The ALS-1300 “relay” jack sources 12 volts when open circuit, and the relay jack current upon closure is less than 20 mA. **Note:** Five milliseconds is fast enough for QSK operation. Due to mechanic relays and relay noise, Ameritron still recommends the Ameritron QSK-5 T/R Switch for QSK operation. The QSK-5 uses Pin Diodes that switch much faster and quieter than relays.

This amplifier includes two dual-movement cross-needle meters. This is the equivalent to having four panel meters. The left hand meter is a dual power amplifier current meter. The right hand meter continuously displays forward RF peak envelope power on one dedicated scale, while the second movement is switch selected between reflected power, combiner mismatch voltage, ALC, and the drain voltage of each power amplifier.

While this amplifier will run more than 1200 watts PEP output, linearity will suffer. Ameritron recommends running no more than 1200 watts peak power for maximum linearity, where this amplifier will have comparable IM performance to the best vacuum tube linear amplifiers. The characteristics of linear high-voltage FET's are very much like those of triode vacuum tubes.

### Power Supply

The ALS-1300 external power supply normally operates from 200-260 volts at 50-400 Hz. It connects to the amplifier through a single cable. The power supply should be located in a cool spot away from sensitive audio systems or cables.

### Installation

Please look your amplifier and power supply over carefully. Locate the air inlet and outlet areas of the amplifier. The cooling air inlet is on the right side as viewed from the normal operating position (front view). The warm air outlet is on the left side of the amplifier. While the outlet air won't be noticeably warm, it is never a good idea to have it blow into heat sensitive equipment such as transceivers or other power amplifiers. Have the same consideration for the ALS-1300 amplifier and power supply. Be sure the air inlet temperature is not substantially above normal room temperature. Ideally the air inlet temperature should be kept below 32° C or 90° F, although inlet temperatures up to 41° C or 106° F are permissible. If ambient temperatures exceed these limits it might become necessary to reduce duty cycle or power.

***Warning: Do not block cooling air inlets and outlets!  
Never expose the amplifier to water or mist.***

## **Airflow**

The amplifier must have a clear area to the sides and top for proper airflow, and to the rear for interconnection wiring. It is especially important to avoid obstructions that block the air inlet on the top left and both lower sides. Two inches of clearance is normally adequate for full ventilation. Keep any papers or loose objects that might impede airflow away from the air inlets and outlets.

Locate the amplifier and power supply away from sensitive equipment such as microphones, audio processing equipment, or low level audio or radio frequency amplifiers. Normally the best location for the power supply is below the operating desk and away from antenna feedlines. This will keep fan noise and any RF coupling to a minimum.

The power supply is factory wired for 200-260 Vac. It uses a standard NEMA-6-15P 15-ampere 240-volt plug. The round center pin is the safety ground. Do not remove the safety ground.

**CAUTION! Before** connecting the power supply to an electrical outlet, always be sure you have completed the following four steps:

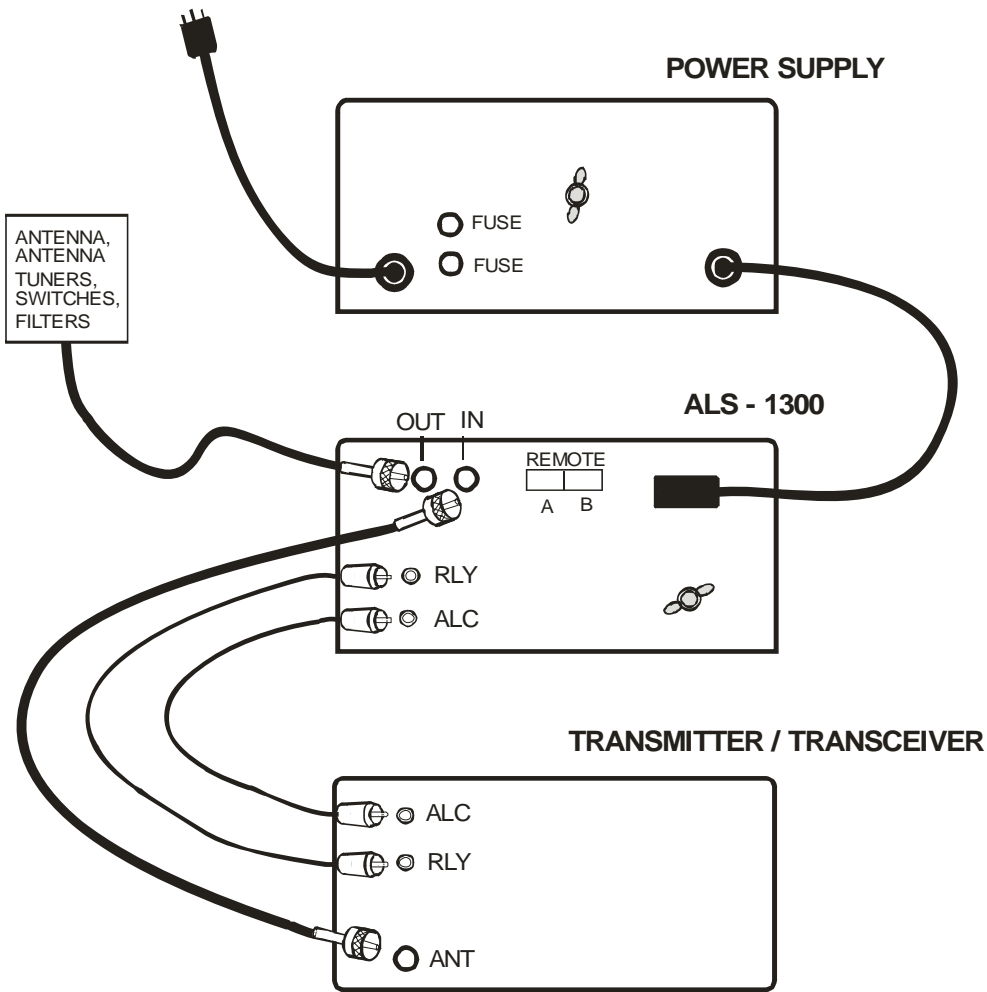
1. Insert the **15-ampere 250V fuses** into the two black fuse caps.
2. Insert the fuse and cap assemblies into the power supply's fuse holders. The fuses lock in place with a slight turn.
3. Connect the power supply to the amplifier.
4. Be sure the amplifier power switch is turned *off*.

***Caution! Fuses have both voltage and current ratings. Use only 250V rated fuses in this device. The voltage rating generally is marked on fuses. DO NOT use automotive-type low voltage fuses in any power line application. For 240-volt operation 15-ampere fast-blow fuses are required.***

***Warning: Never insert the power supply cord into the outlet unless the above four steps have been completed!!***

Position the amplifier at the desired location on your operating desk such that you have access to the rear panel, and connect the rear panel cables. Do not connect the power mains at this time!

# Interconnection Wiring



Interconnections Figure 1

## INTERCONNECTIONS

## Amplifier Rear Panel

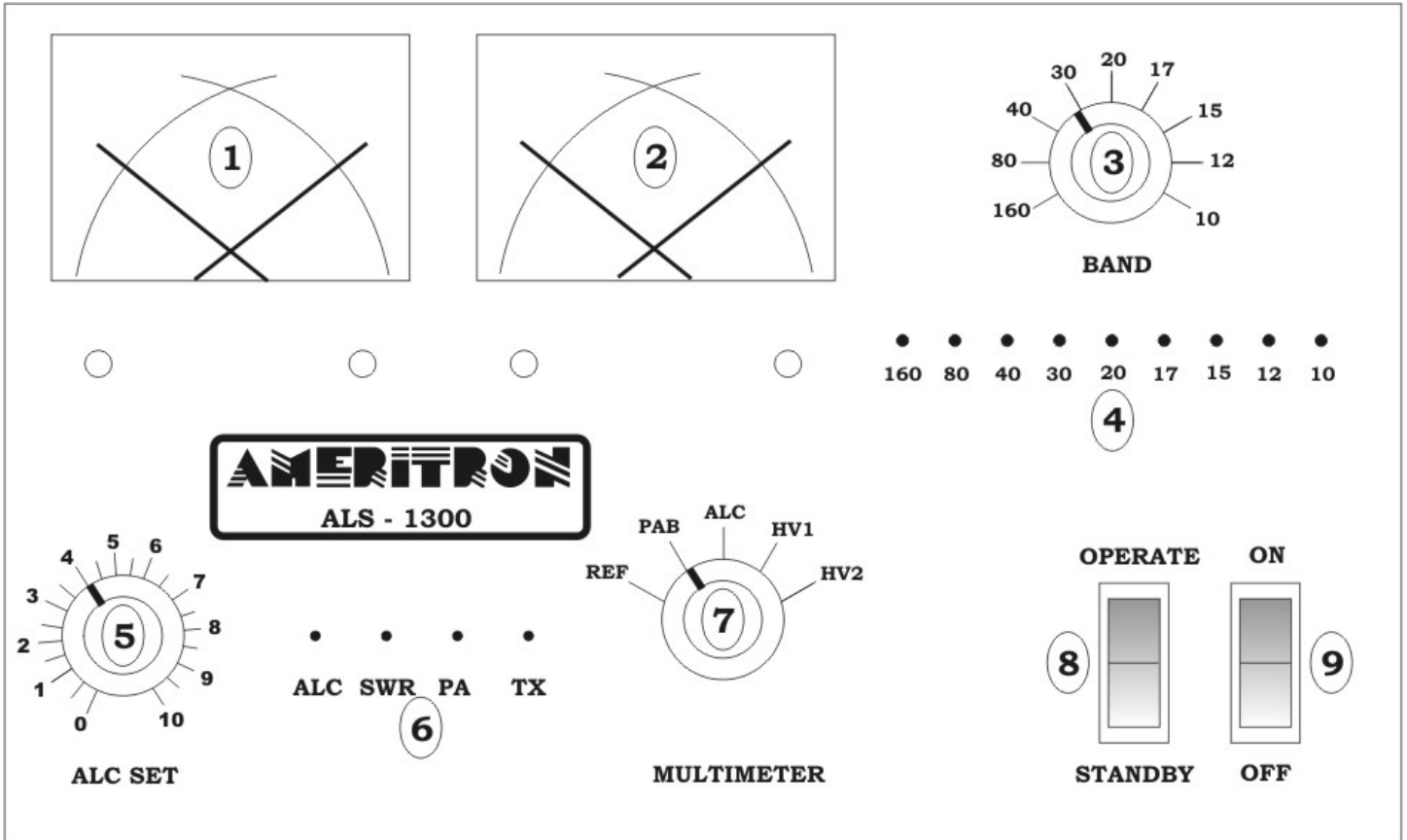
**PWR SUPPLY** To prevent connecting the power plug wrong, the large black multi-pin connector is indexed by an offset in the two round pins. One round index hole is closer to the outer connector edge. Mate the round pins and holes and seat the male plug fully onto the amplifier rear panel pins.

<b>ALC</b>	Optional connection. Connects to radio ALC input. Mandatory if using a radio over 100 watts.
<b>RLY</b>	Connect to radio amplifier keying line. Radio must pull this line below 2 volts to transmit.
<b>GND</b>	Connect to station ground buss. This connection is for safety.
<b>IN</b>	Connect through good 50-ohm coaxial cable to radio's antenna output connector. This can be a smaller cable like RG-58/U.
<b>OUT</b>	To 50-ohm antenna, antenna tuner, power meter. This is the high power output. 50-ohm coaxial cable must safely handle 1200-watts.
<b>REMOTE</b>	Interfaces for optional ARI-500 Amplifier Radio Interface.

- 1.) Connect the station electrical safety ground to the rear panel wing nuts. National safety codes require the station ground to be bonded to the power mains safety ground at the building entrance.
- 2.) Connect the power supply to the amplifier.
- 3.) Connect the RLY line to the transceiver's accessory RELAY or XMT port. This port must pull low for transmit, and be open circuit when receiving. Relay control voltage from the ALS-1300 is 12 volts positive with only 15 mA current. You should always check your transceiver's manual, but almost any standard transceiver directly interfaces to this amplifier.
- 4.) Connect the OUT (output) port to the appropriate point in your station. This is the high power RF output cable. This connection would go to your 1500-watt rated Power/SWR meter, antenna, or antenna matching device. Good quality Mini-8 or RG-8X cables are acceptable for anything but RTTY use, although larger RG-8 style cables are normally preferred. ***Your antenna matching system must connect to this port.***
- 5.) Connect the IN connector to your transceiver. Do not install any active antenna matching devices on this port. In general short and direct cable connections are best, although high quality cables can be very long without adversely effecting performance. RG-58/U or Mini-8 (RG-8X) style cables are acceptable. ***You should never use a tuner of any type on the amplifier input, nor should you drive this amplifier with over 100 watts peak envelope power. Never use a non-FCC accepted device with this amplifier.***
- 6.) The ALC line is optional, but recommended. Without ALC you must monitor your drive power so that you don't overdrive the amplifier which will cause intermodulation distortion. The ALS-1300 ALC circuit monitors the RF output power and reflected power.
- 7.) Operate the bandswitch manually during initial testing. Do not connect band decoders or computer interfaces until initial tests are completed.



# Front Panel



Amplifier Front Figure 2

## Front Panel Operation

Two dual-movement cross-needle meters are illuminated with LEDs  
J4 determines the brightness of the LEDs. J4 is located on the MB1 board Fig 8 page 19

**Left hand meter** (Fig 2.1 page 9) is a dual current meter. It monitors current on PA “A” and PA “B”

**Right hand meter** (Fig 2.2 page 9) continually monitors forward RF peak output on one scale, while the second scale monitors reflective peak power, combiner mismatch, ALC, and each power amplifier operating voltage.

The forward and reflected meters have a peak hold circuit. This circuit allows the meters enough time to respond to voice peaks, making it a true peak reading wattmeter. The Peak hold time is adjustable. (Fig 8 page 19). **Note:** Changing the peak hold time to a faster needle movement will prevent the Forward and Reflected meters from reading Peak Output Power. It is recommended that you keep the factory default settings.

**Band Select Switch** (Fig 2.3 Page 9) selects either the correct low pass filter for each band, or remote control operation. The nine LEDs (Fig 2.4 page 9) verify which low pass filter has been selected. **Note:** The 10 and 12 Meter Band LEDs will illuminate but operation requires the 10/12 meter conversion (MOD-10MK). When using the external ARI-500 for auto band switching the, Band Select Switch must be in the Remote position.

**ALC SET** (Fig 2.5 page 9) limits the output of the amplifier to a safe level when the rear ALC Jack is connected to the transceiver’s ALC input. The ALS-1300 produces an ALC control voltage of 0 to –4 volts DC.

**ALC Indicator** (Fig 2.6 page 9) illuminates when the ALC circuit begins producing a negative voltage at the rear panel ALC jack.

**SWR Indicator** (Fig 2.6 page 9) illuminates when the Antenna VSWR reaches an unsafe level for the amplifier. When this occurs, the amplifier reverts to Standby. Moving the Standby/Operate switch to Standby and then back to Operate resets the SWR overload circuit. The VSWR overload circuit will activate at 200 watts reflective power.

**PA Indicator** (Fig 2.6 page 9) illuminates when there is a mismatch between the two power amplifier modules. When this occurs, the amplifier reverts to Standby.

**SWR and PA LEDs** illuminate when the Band Select Switch is in the wrong Position or there is a problem with the Low Pass Filter circuit. This places the amplifier into Standby.

**TX Indicator** (Fig 2.6 page 9) illuminates when the rear panel relay jack is grounded. This places the amplifier into the Operate condition. The transceiver will not receive when this light is on.

**Multimeter Switch** (Fig 2.7 page 9)

Multimeter switch positions are monitored on the right hand meter, right scale.

**REF** Monitors reflected power. Meter reading is 0 to 500 watts. SWR is read where the forward and reflected needles intersect.

**PAB** Monitors the difference between power amplifier Module A and power amplifier Module B. A difference of 200 watts will place the amplifier into Standby. Meter reading is the 0 to 500 scale

**ALC** Monitors the ALC voltage on the rear panel ALC Jack. Meter reading is the 0-70 scale which corresponds to 0 to -7 volts.

**HV1** Monitors the operating voltage on the Power Amplifier Module “A”. Meter reads on the 0 to 70 scale. Should read 48-50 volts

**HV2** Monitors the operating voltage on the Power Amplifier Module ‘B’. Meter reads on the 0 to 70 scale. Should read 48-50 volts

**OPERATE/ STANDBY SWITCH** (Fig 2.8 page 9). In Standby, disables the relay line from the transceiver. The amplifier is bypassed. This allows tuning the antenna or checking the transceiver’s RF power. The Forward and Reflected meter readings are still operating, fans continue to run and the operating voltage is present when the power switch is on. In Operate, places the amplifier into transmit when the relay line is pulled low.

**ON / Off Switch** (Fig 2.9 page 9) When Off, all operating voltages, fan and meters are disabled. The amplifier is in by-pass mode. **Note:** There is still AC power on the On/off switch. Remove the Power Supply’s line cord from the power mains before removing the amplifier or power supply cover.

## Operation

This amplifier is very simple to operate. Once you have established proper connections please set the amplifier (Fig. 2, ref 3) to one of the following bands:

Band	Frequency Range	Notes
160	1.8 - <b>2.1</b> MHz	
80	3.2 - <b>4.2</b> MHz	
40	6.0 - <b>7.5</b> MHz	
30	7.5 - <b>14.0</b> MHz	US domestic power limit is 200 watts maximum
20	13.5 – <b>14.5</b> MHz	
17	14.5 – <b>19.0</b> MHz	
15	19.0 – <b>22.0</b> MHz	
12	22.0 – <b>25.0</b> MHz	Export Only. Requires user-installed MOD-10MK for US domestic operation.
10	28.0 – <b>30.0</b> MHz	Export Only. Requires user-installed MOD-10MK for US domestic operation.

**Frequency Limits Table 1**

**Caution:** This amplifier is not suitable for 27 MHz operation. Damage to the expensive power amplifier transistors will occur if attempts are made to use this amplifier in the 25-28 MHz frequency range.

## MARS or CAP Operation

For licensed amateur radio operators participating in Military Affiliate Radio Systems, this amplifier is suitable for MARS and CAP operation on all frequencies between 1.8 and 22 MHz with some precautions. The upper frequency limits are in bold type in the table above. Do not operate above the bold-type frequency limits in the table above or PA (power amplifier) damage may occur. It is permissible to operate below those limits if you provide additional external harmonic suppression for authorized services such as MARS and CAP.

When operated outside the frequency limits above, harmonic suppression might not meet acceptable limits. You may have to use additional external 2<sup>nd</sup> harmonic filtering. Ameritron guarantees to exceed FCC part 97.307 harmonic suppression standards only inside the frequency ranges listed above. Contact Ameritron with your specific requirements. Ameritron requires proof of a valid MARS or CAP license as well as your own amateur radio license for technical assistance.

## 12/10 Meter Operation

Operation on the 12 meter and 10 meter ham bands requires the installation of the optional MOD-10MK low pass filter assembly. The MOD-10MK is installed on export models of the ALS-1300, but is NOT included on amplifiers shipped within the US. Upon proof of a valid US amateur radio license, a MOD-10MK may be purchased from Ameritron. The MOD-10MK can be installed in the amplifier in minutes using just a Phillips-head screwdriver. Installation instructions are provided with the MOD-10MK.

## Initial Operation

Double-check all wiring and connections (fig. 1) before turning power on. It always pays to be safe. If you are sure you have connected your amplifier correctly, follow the procedures below. The following steps only need to be done on an initial checkout:

1. Place the **MULTIMETER** switch (fig.2 ref 7) in the **HV2** position. Place the **ALC SET** control (fig.2 ref 5) fully clockwise (10 on scale).
2. With the **STANDBY/OPERATE** switch (fig.2 ref 8) on **STANDBY**, turn the power switch (ref 9) **ON**.
3. There will be a 3-5 second step-start circuit delay, and then a click as the power supply turns on. HV2 (fig.2, ref 2) should immediately rise to nearly full scale, and after a slight delay you should hear another click. The meters and **BAND LEDS** (fig.2, ref 4) will light up.
4. The HV meter (fig.2, ref 2) should read between 48 and 50 volts.
5. Change the meter switch (fig.2 ref 7) to **HV1**. The voltage should be the same as in step 4.
6. Rotate the **BAND** switch (fig.2 ref 3) through all positions. For any model purchased in the USA, only the 160, 80, 40, 30, 20, 17, and 15-meter bands will actually operate. US operation on 12- and 10-meters requires the optional user-installed MOD-10MK filter assembly.
7. Change the meter switch (ref 7) to **REF**. This will read reflected power.
8. Provide a low power (~10 watt) unmodulated carrier from your transceiver using FM, AM, RTTY, or CW. Verify that the VSWR of *the antenna system* is low. You should see almost no deflection on the reflected power scale (fig.1 ref 2). If you see reflected power, check your RF cables or antenna system. **Note: You must not use a tuner in your transceiver or between your transceiver and the ALS-1300 amplifier to match the antenna system. Any antenna matching must be between the amplifier and**

**the antenna, and the antenna tuner must be able to handle at least 1200 watts of carrier or peak envelope power.**

9. Place the amplifier in **OPERATE** (fig.2 ref 8). Be sure the BAND selected on the amplifier matches the band selected on the transceiver.
10. Place the transmitter or transceiver into transmit in FM, AM, RTTY, or CW modes. The green **TX** LED (fig.2 ref 6) should light. The forward power (fig.2 ref 2) should increase to approximately ten times the initial reading, the reflected power should remain low, and the PA current should increase slightly on both scales of the current meter (fig.2 ref 1). No other lights should illuminate.
11. Briefly increase drive power (no more than 100 watts) until the ALS-1300 output is 1200 watts.
12. If ALC is connected between the amplifier and transceiver, rotate the ALS-1300 front panel ALC control counter-clockwise until the ALS-1300 output power just begins to drop.
13. After you have verified all of this, the amplifier is ready to operate.

## **Technical Questions:**

Call 662-323-8211 or go to [www.ameritron.com](http://www.ameritron.com) help desk for operation or technical questions.

If service is ever needed send product to Ameritron 116 Willow Rd, Starkville, MS 39759. Include a phone number, email, return address and a brief description of the problem.

## Circuit Boards

There are ten basic circuit boards plus two power amplifier modules in the ALS-1300. The text below gives a brief description of each board's function.

### 2KWF

The 2KWF is a high power low pass filter. It is the very large board with large toroids and a few air wound inductors. This board contains filter SWR fault detection, power amplifier unbalance detection, and multiple high power low pass 5-pole filters. Additionally two smaller boards, the antenna relay board **RLY** and the PA combiner board **CMB**, attach directly to the low pass filter board.

### BS1

The BS1 is located behind the **BAND** switch. It provides all band selection functions as well as band indicators.

### CB1

The CB1 is located near the front of the amplifier just behind the meters. The CB1 control board provides most control functions. This includes bias, fan speed, overload protection, and transmit-receive relay sequencing. It is the hub for nearly all functions and interfaces.

### CMB

This board combines the outputs of the two 600-watt PA modules. It is a traditional 50-ohm "magic T" combiner with an output-matching transformer.

### FL10

The FL10 filter assembly (MOD-10MK) is optional and only appears in export models. It enables 10- and 12-meter operation.

### MB1

The MB1 is located behind the front panel below the meters. It contains peak-envelope-power detection circuits, multi-meter switching, fault indicators, and ALC circuits. There are four power meter adjustments on this board; forward power, reflected power, forward peak hold time, and reflected peak hold time. Shunts on a header located on the board's upper edge adjust panel meter brightness.

## PA Boards

PA boards are located on top of the heatsinks under the filter-board shield panel. There are no user adjustments on these boards.

### PD8

The PD8 is located on the right side of the amplifier just above the panel containing the cooling fans. It contains a power splitter and two 5 dB attenuator pads. The splitter and attenuator pads isolate the two power amplifiers from each other, and terminate the PA inputs in 50 ohms over a wide range of frequencies. This is necessary to stabilize the PA modules. Do not remove or bypass the attenuators.

## RJ45

The RJ45 board mounts on the rear panel. It contains two RJ-45 jacks used for remote control operation.

## RLY

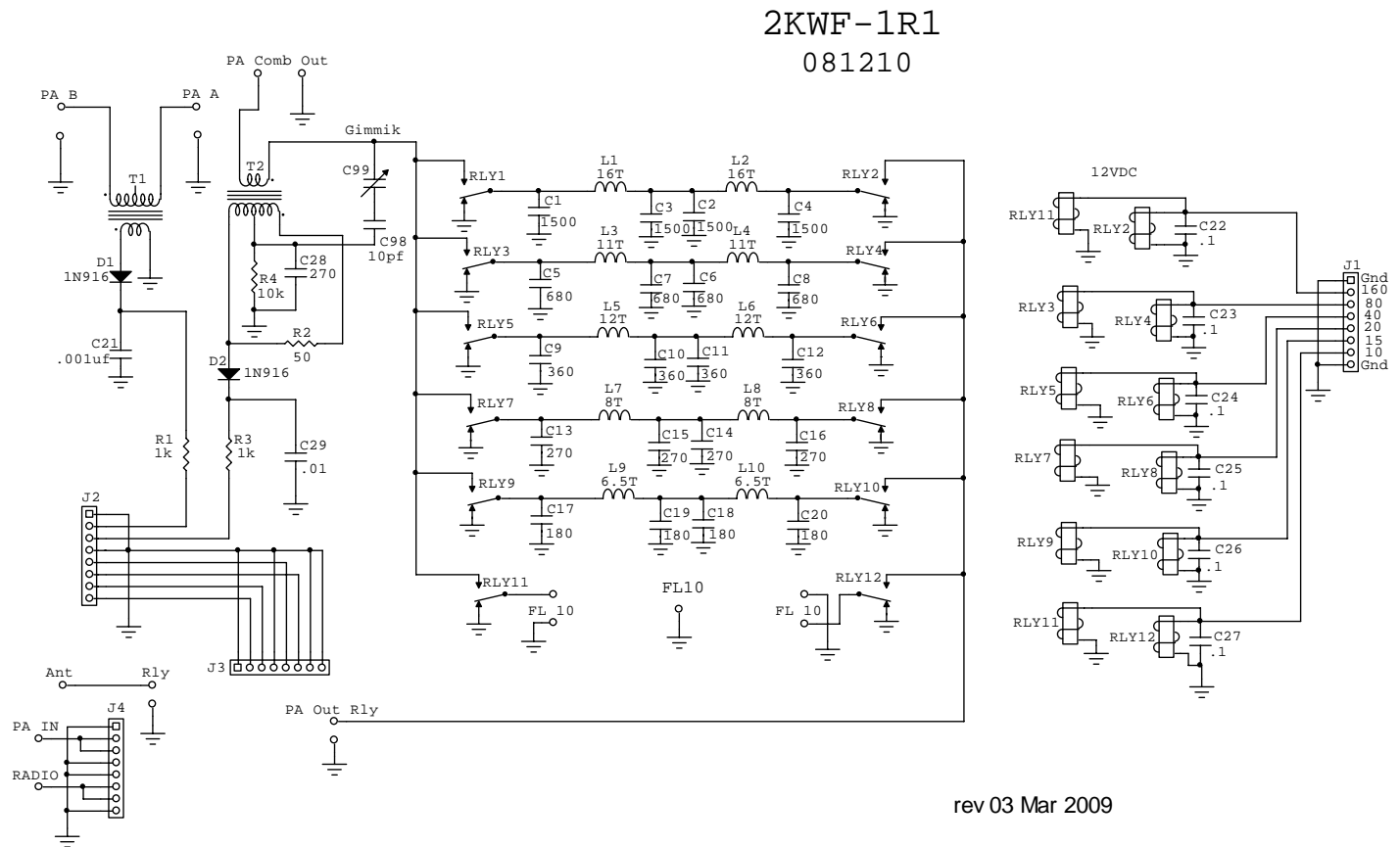
The RLY board contains two transmit and receive relays - one for RF output switching and the other for RF input switching. T/R relays activate with a low on terminals K (key) J1-3 and RJ1-7. The **CB1** board contains the relay timing controls.

## SWR

The SWR board is on the rear panel in front of the RF output connector. It is a traditional 50-ohm directional coupler. The null adjustment is accessible through a rear panel hole.

## Schematics

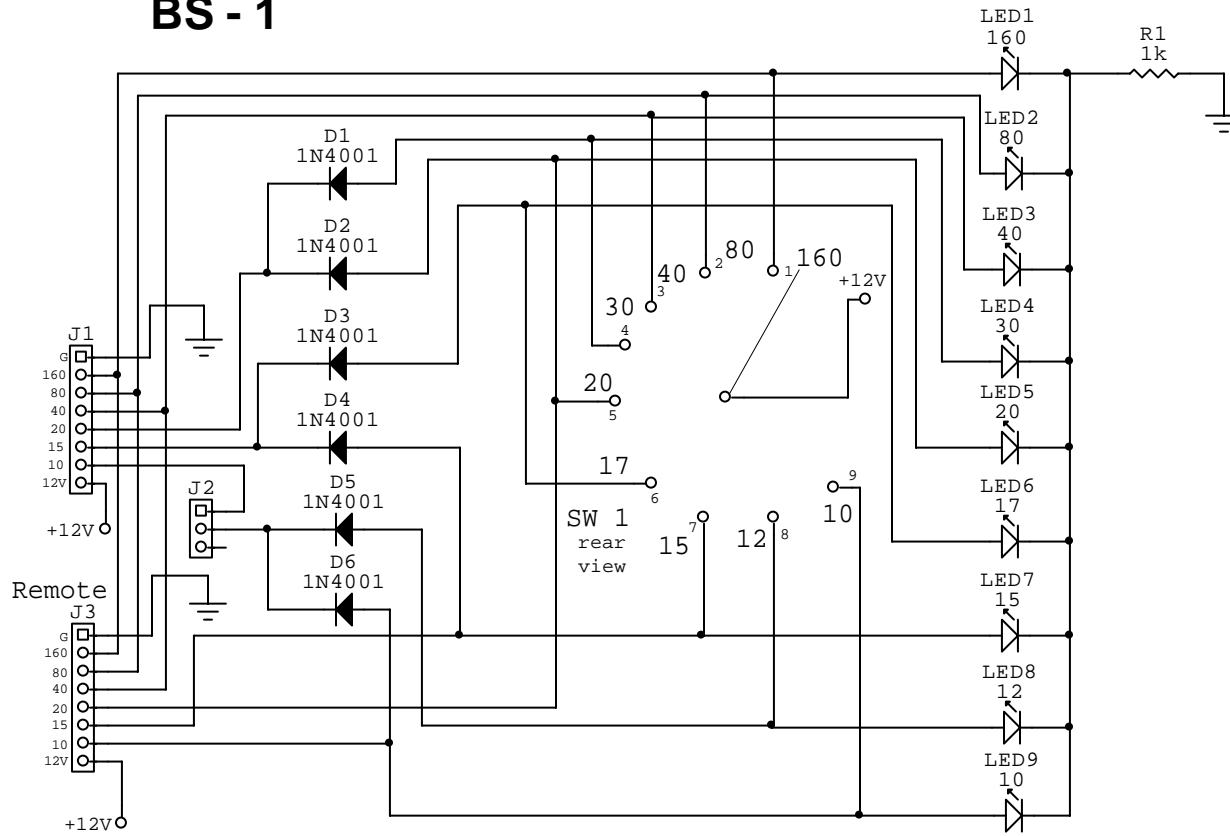
### Filter 2KWF



2KWF output filter Figure 3

# Bandswitch BS1

## BS - 1



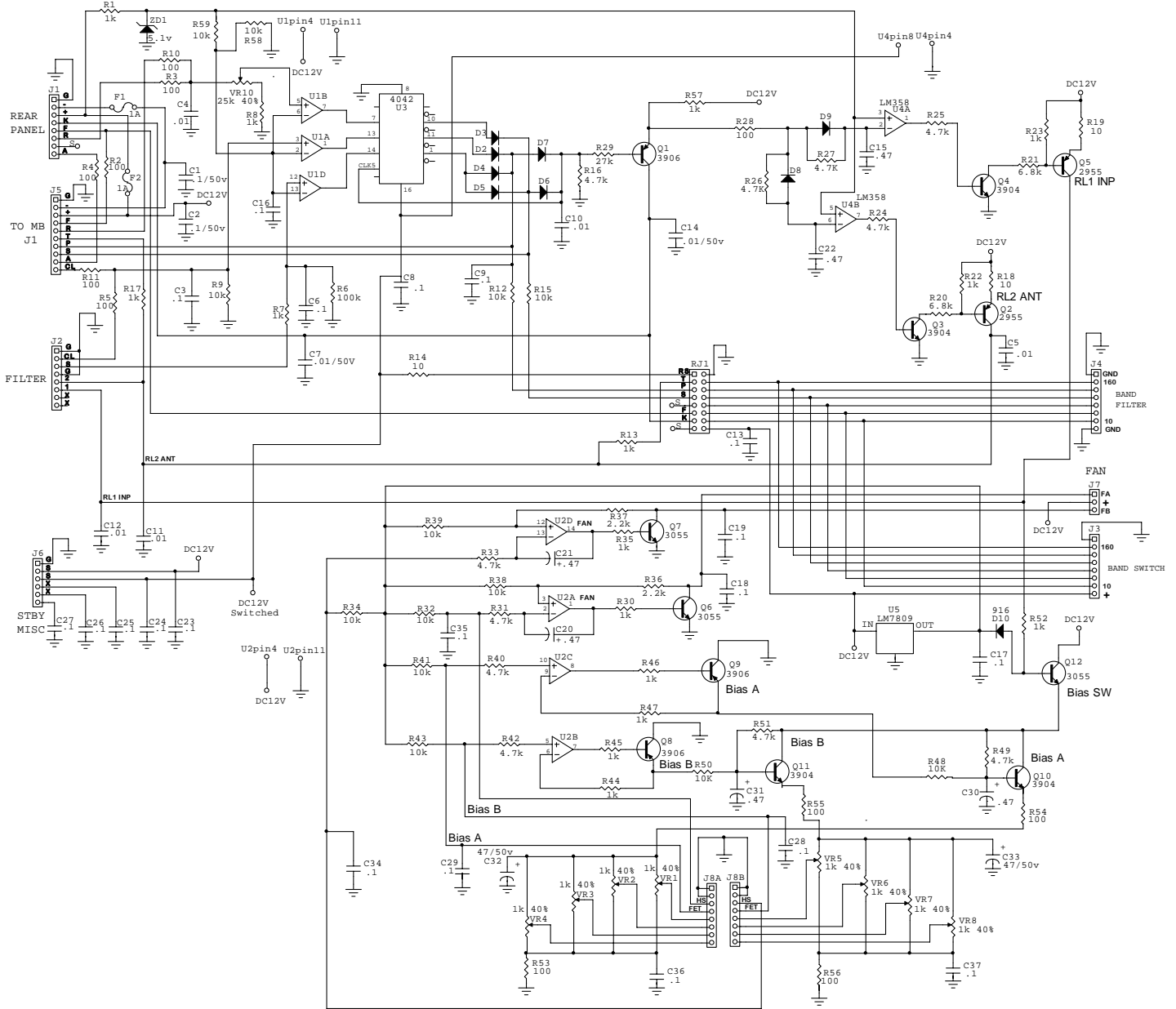
7 July 2008

BS1 bandswitch figure 4



# Control Board CB1

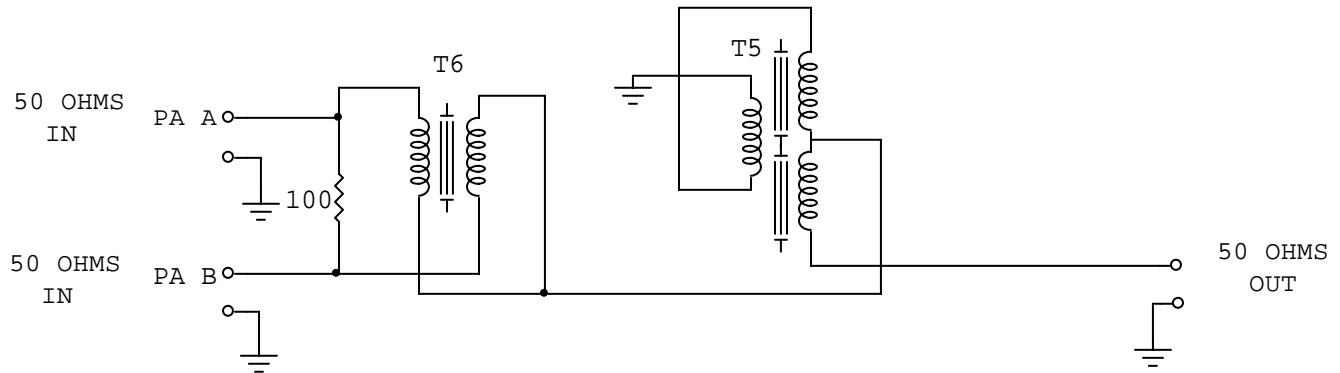
CB1 rev2.1 090227



CB1 control board Figure 5

## Combiner 2000 watt CMB

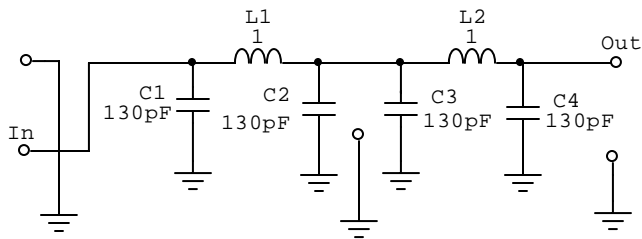
CMB 081217 rev0a



CMB combiner board Figure 6

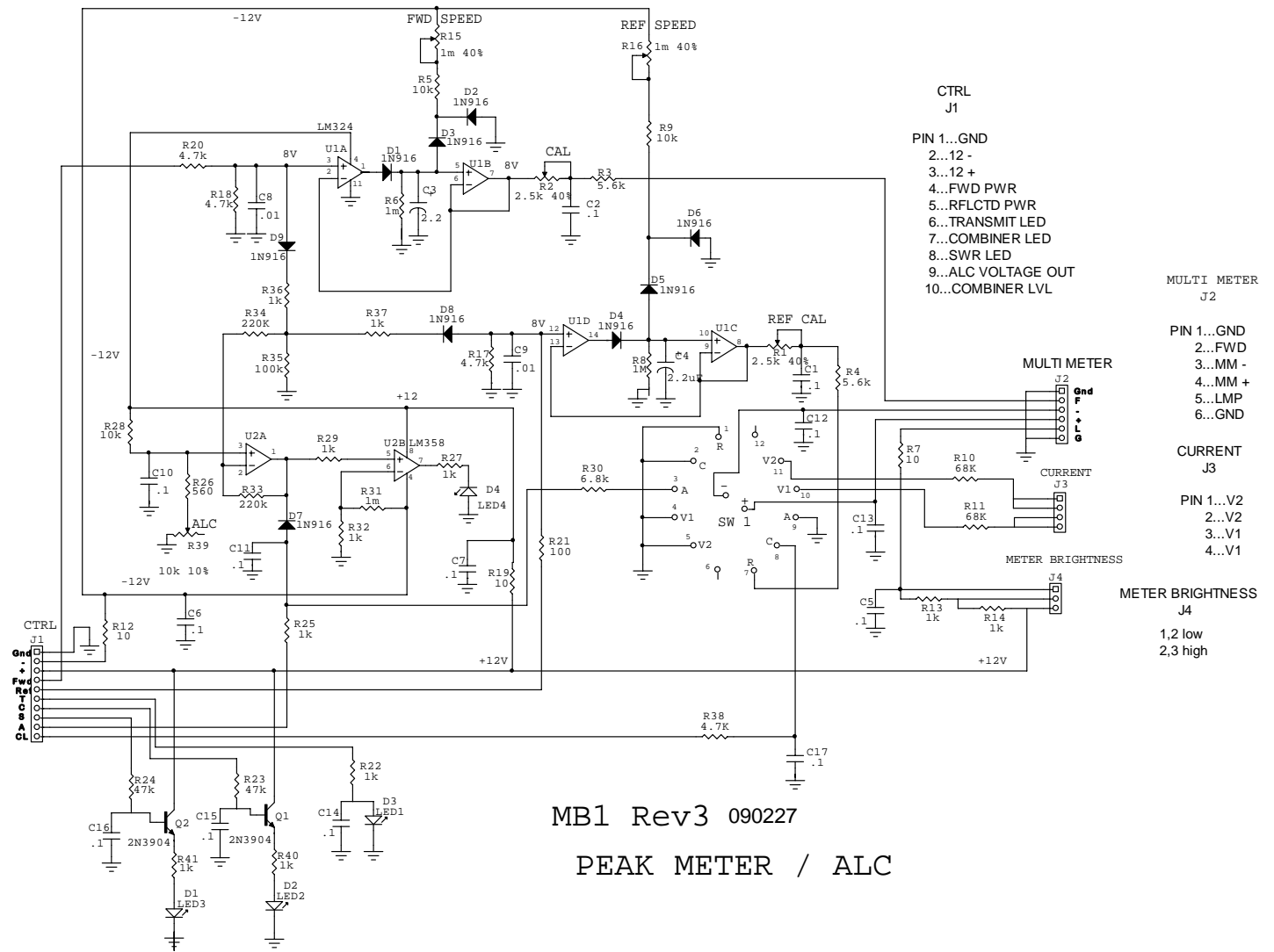
## Filter FL10

FL10 081210



FL10 filter 10 meter Figure 7

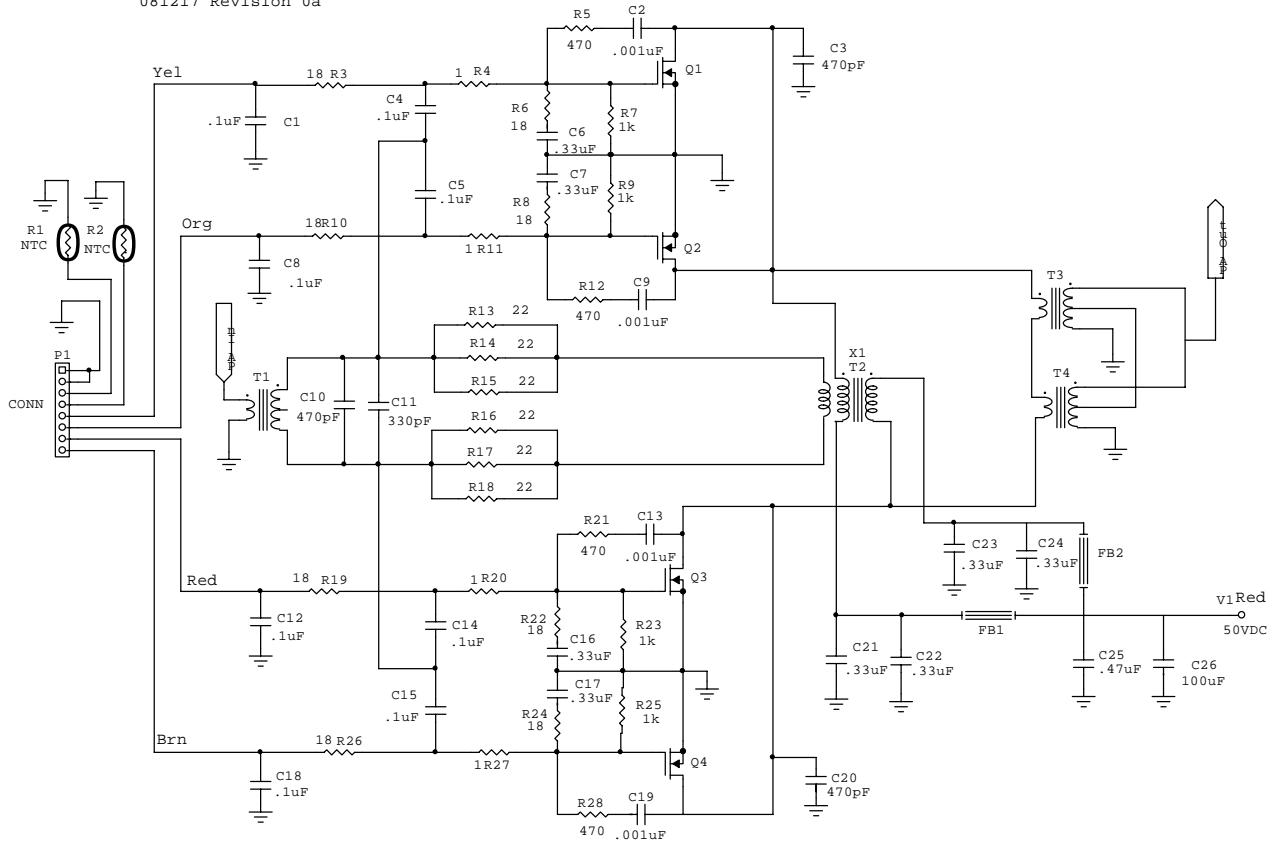
# Metering Board MB1



MB1 alc/metering board Figure 8

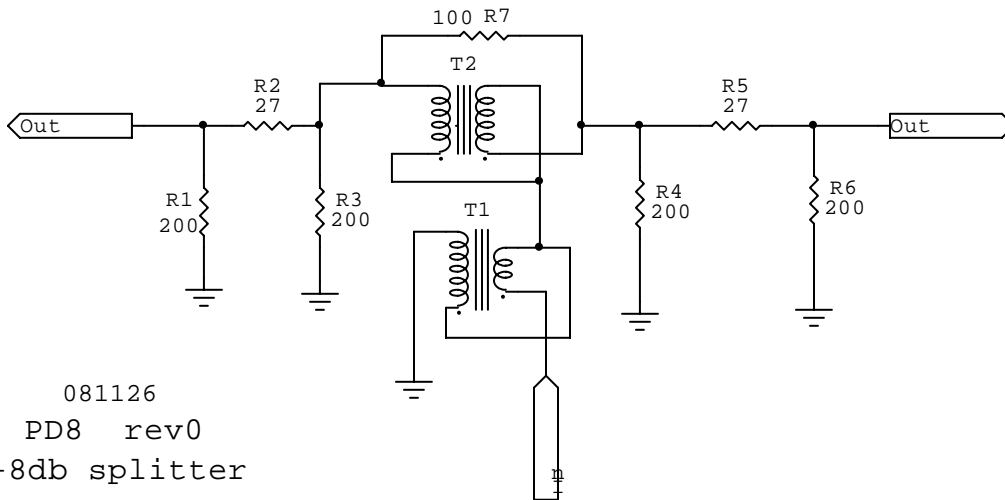
# PA Module

PAM-600  
081217 Revision 0a



PAM power amplifier module Figure 9

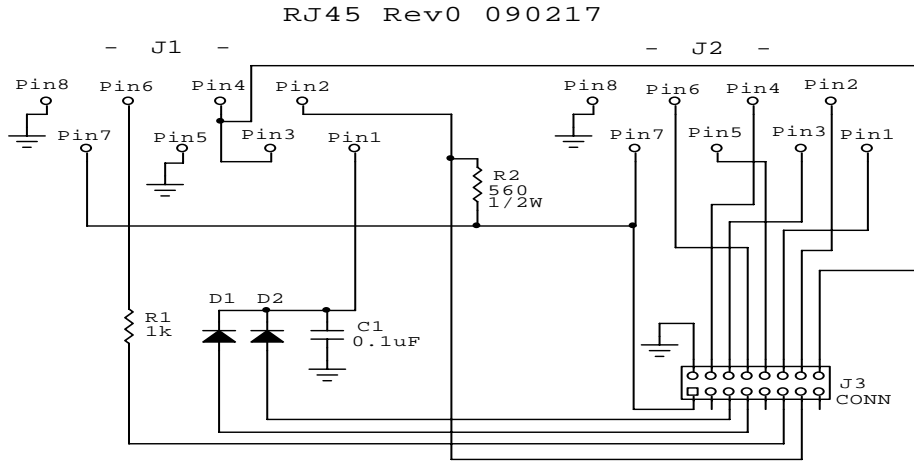
# Power Divider PD8



081126  
PD8 rev0  
-8db splitter

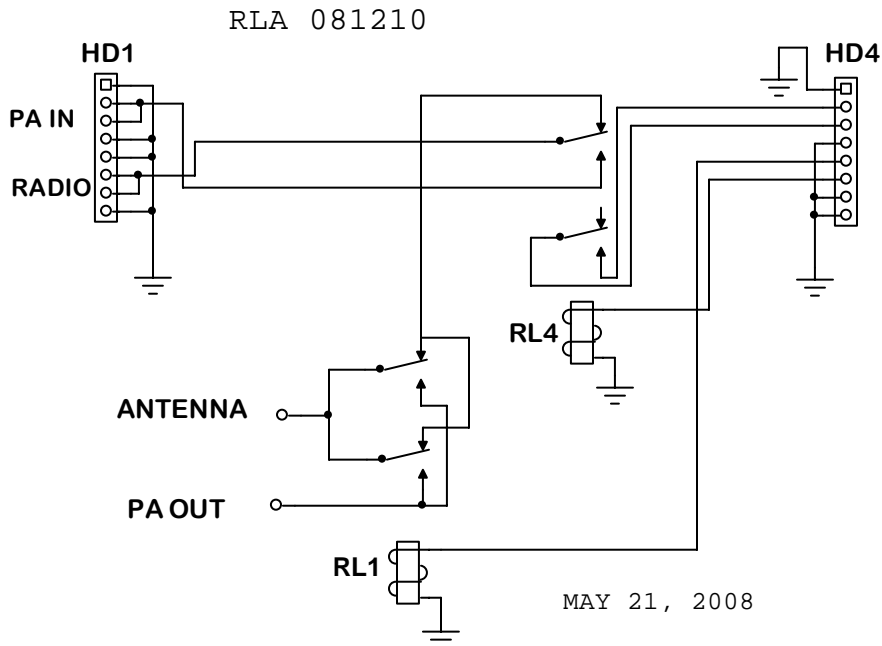
PD8 power divider Figure 10

# Interface Connections RJ45

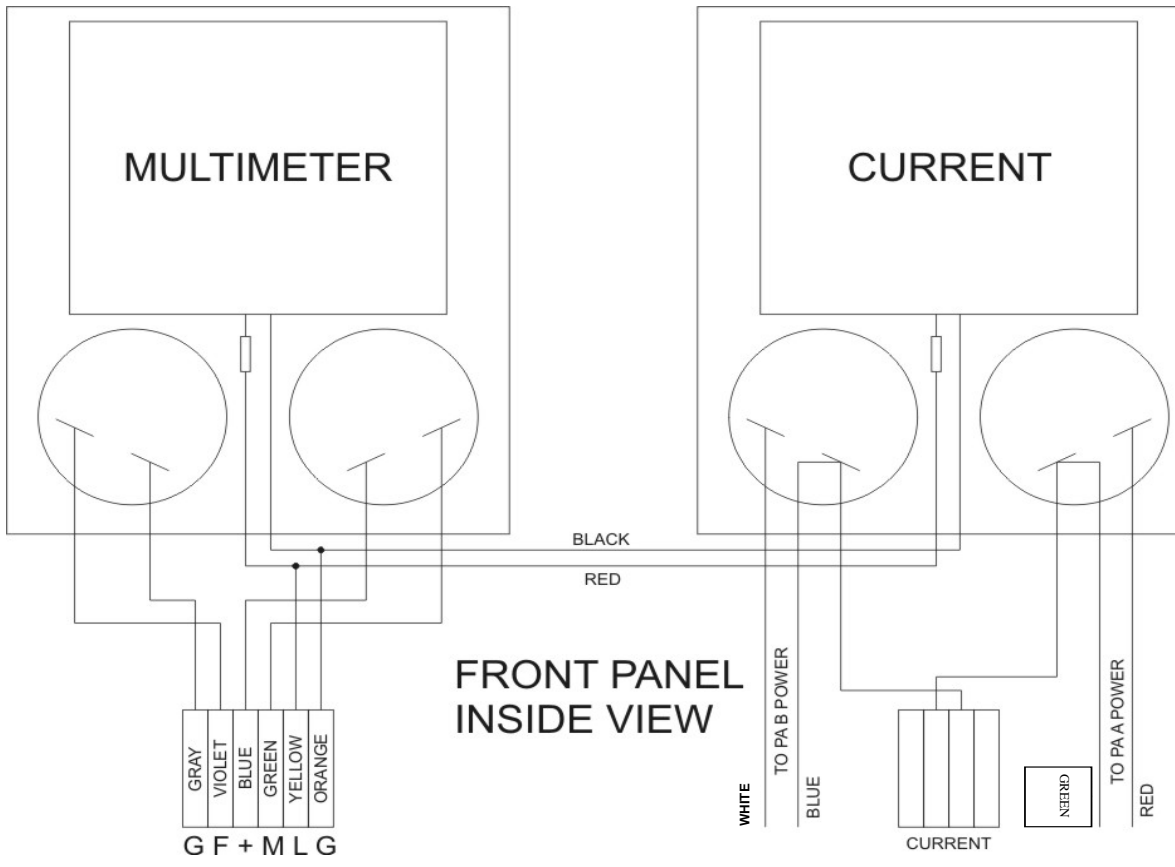


RJ45 interface Figure 11

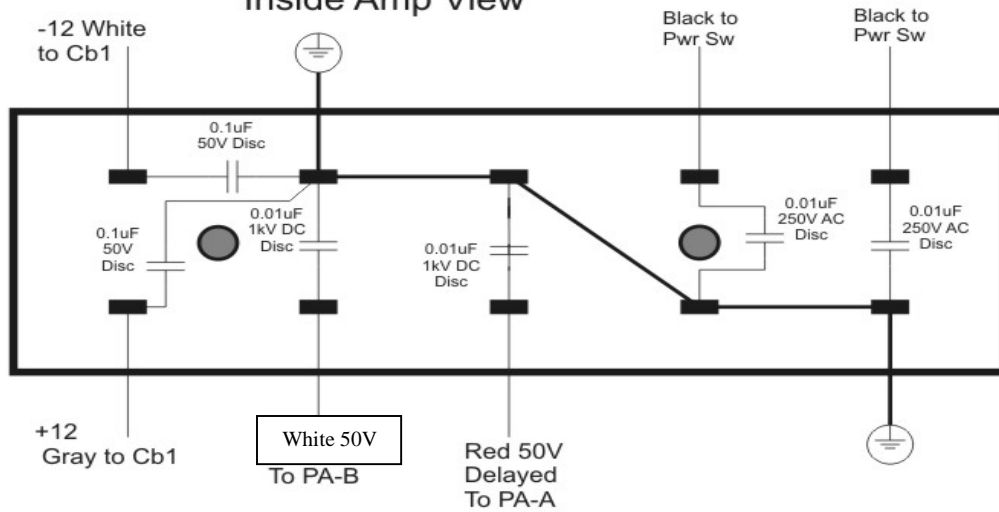
# Relay Board



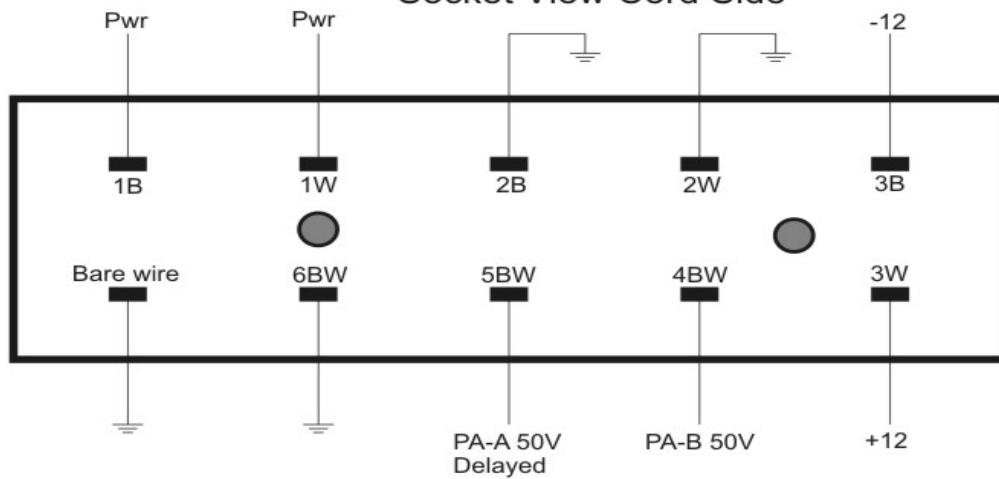
RLY antenna relay Figure 12

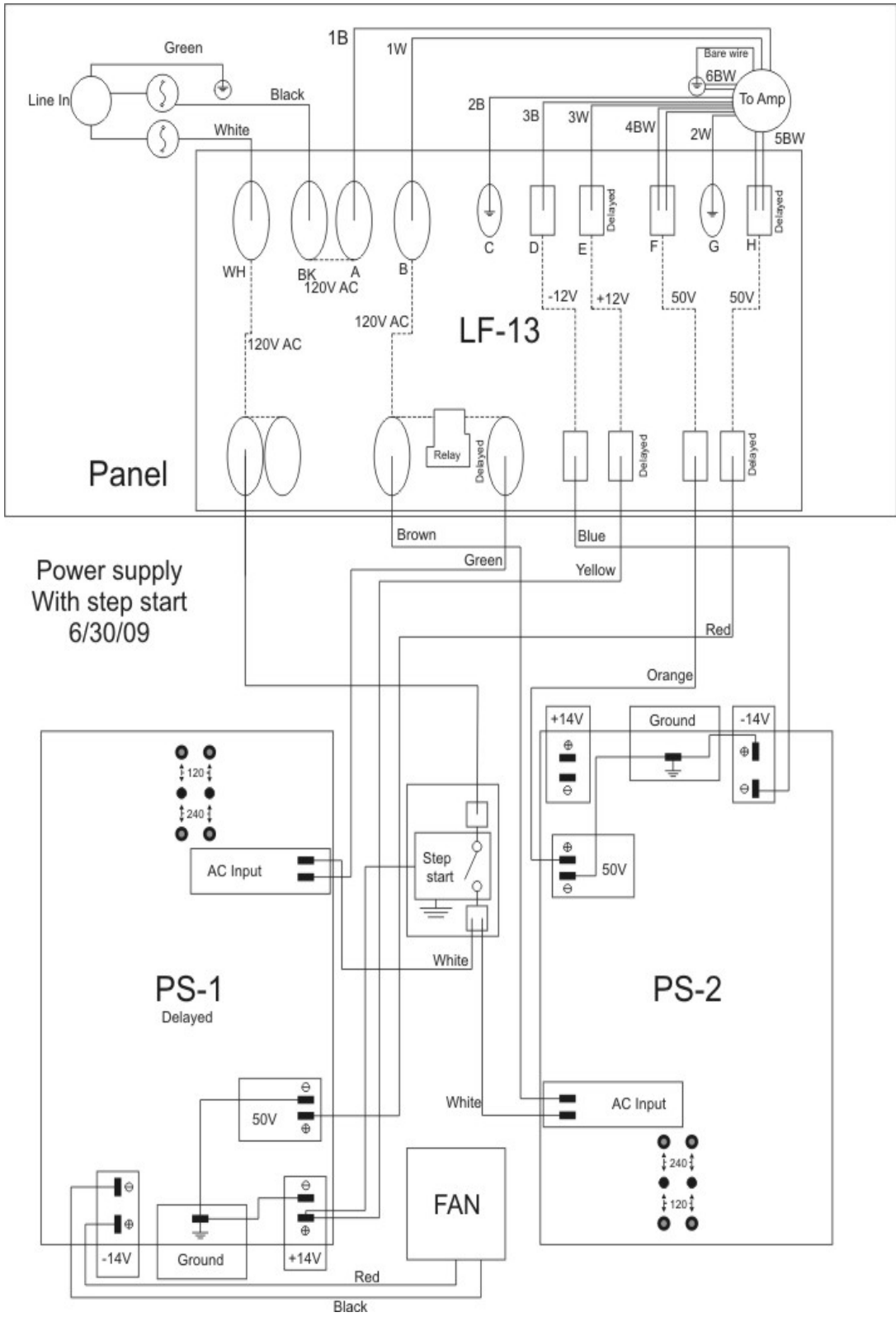


### Inside Amp View



### Socket View Cord Side







## Reference figures and drawings

Interconnections Figure 1 .....	7
Amplifier Front Figure 2.....	9
2KWF output filter Figure 3 .....	15
BS1 bandswitch figure 4.....	16
CB1 control board Figure 5 .....	17
CMB combiner board Figure 6.....	18
FL10 filter 10 meter Figure 7.....	18
MB1 alc/metering board Figure 8.....	19
PAM power amplifier module Figure 9.....	20
PD8 power divider Figure 10.....	20
RJ45 interface Figure 11 .....	21
RLY antenna relay Figure 12.....	21
Meter Wiring .....	22
Power Plug Wiring .....	23
Power Supply Wiring .....	24

## Tables

Frequency Limits Table 1 .....	<a href="#">1140</a>
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## **Exhibit V Operational description HO82WUALS13**

### **ALS-1300 Technical and Operational Overview**

The ALS-1300 is an amateur radio multiband radio frequency linear power amplifier. This device requires certification. This device complies with technical standards of CFR Title 47 part 97.317(a) and (b).

#### **General Operation**

This linear amplifier covers the 160, 80, 40, 30, 20, 17 and 15-meter amateur bands. Up to 100 watts exciter power is applied to relay RLY1 on circuit board RLY. When power is on and the standby switch is in the operate position, and when the rear panel RELAY control line is held low (below 1 volt), exciter power is routed through RLY1 to the PD8 power divider board.

#### **Power Division**

The PD8 power divider board splits the signal path equally between two 600-watt power amplifier modules. The PD8 circuit board consists of a conventional T power divider, components T2 and R7. This T splits the signal into two equal level signals. Each signal path has a 5 dB attenuator consisting of high power resistors R1 through R6. The 5-dB attenuators on each output port terminate the T in 50 ohms and provide an additional 10 dB of input port isolation between the two PA modules. With a 50-ohm source, in excess of 30 dB port-to-port isolation occurs between PA module inputs. A minimum of 16 dB isolation occurs regardless of input port termination. The attenuators also work in concert with the magic-T to provide a 50-ohm input termination for each PA module. The 50-ohm termination and input port isolation results in unconditionally stable PA modules.

#### **PA Amplifiers**

Power amplification comes from two 600-watt power amplifier modules. Each PA module (PAM-600) consists of four MFR-150 field effect transistors. Each MRF-150 has between 200 mA to 400 mA quiescent current. Transistor conduction angle is slightly over 180 degrees, providing linear class AB operation. The normal dc drain operating voltage is approximately 50 volts with four FET's per module in push-pull parallel. Both modules employ significant negative feedback to improve linearity and stability. The FET's have direct resistive voltage feedback across each individual transistor from drain to gate, as well as push-pull transformer (T2) coupled feedback common to the push-pull circuit. These feedback circuits improve gain flatness, linearity, and stability. Push-pull operation, negative feedback, and linear biasing of FET's provide significant pre-filter harmonic suppression.

#### **Cooling and Temperature**

The four power FET's in each module mount on a forced-air cooled aluminum heatsink. Four dc fans cool the heatsink. Two thermistors (R1 heatsink, R2 transistor) sense the temperature of the power amplifier transistors and their heat sinks. Transistor temperature sensor R2 regulates bias voltage, reducing bias voltage when

transistor temperature increases. This bias feedback system keeps transistor quiescent current stable independent of transistor junction temperatures. These thermistors also feed a comparator that removes drive when transistor temperature becomes unsafe.

The second set of thermistors, R1, monitor heatsink temperatures. Voltage from thermistor R1 regulates fan speed, increasing airflow as the heat sink warms.

## **Combiner CMB**

Each PAM-600 delivers a rated maximum of 600 watts peak envelope power into a 50-ohm load. Each PA module feeds a 50-ohm high power combiner CMB that isolates the two outputs. A 50-watt 100-ohm power resistor dissipates signal level errors between the PA modules.

Voltage step down transformer T1 senses voltage across combiner dump resistor R1. *T1 is located on the 2KWF lowpass filter board.* This voltage, representing PA combiner unbalance, appears on the front panel multimeter as a “PAB” (power amplifier balance) indication. PA unbalance sample voltage also feeds a comparator on the CB1 control board. This comparator disables the PA in the event the power amplifiers become significantly unbalanced, and illuminates the PA front panel light.

## **2KWF Lowpass Filter Assembly**

The output of the high power combiner goes into the 2KWF lowpass filter assembly. Power enters through a directional coupler consisting of T2, C28, 98 and 99, and R2. This system detects power amplifier termination errors. Any significant error will trip the power amplifiers off. A comparator on the CB1 control board monitors directional coupler termination errors. Such errors normally come from selecting the wrong filter for the exciter’s operating band, or having a poor load SWR on the amplifier.

5-pole lowpass filter 2KWF further reduces harmonics. Harmonic levels are significantly below levels mandated by FCC rules governing amateur radio service.

The CB1 control board contains all protection comparators (U1) and latches (U3). In the event of an operational fault, latches lock out the amplifier and illuminate a warning light on the front panel. CB1 also contains bias, relay sequencing, and fan speed controls.

Frequencies above 21.5 MHz are disabled in units sold in the United States and possessions.

## **SWR**

The SWR board is a standard 50-ohm directional coupler. It samples line current and line voltage, vectorially summing them before detection. The resulting voltages represent forward and reflected power, or mismatch of the ideal 50 ohm load.

## **AMERITRON**

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### **LIMITED WARRANTY**

Ameritron warrants to the original purchaser that this product shall be free from defects in material or workmanship for one year from the date of original purchase.

During the warranty period, Ameritron (or an authorized Ameritron service facility) will provide free of charge both parts and labor necessary to correct defects in material or workmanship.

To obtain such warranty service, the original purchaser must:

- (1) Complete and send in the Warranty Registration Card.
- (2) Notify Ameritron or its nearest authorized service facility, as soon as possible after discovery of a possible defect, of:
  - (a) the model number and serial number, if any;
  - (b) the identity of the seller and the approximate date of purchase;
  - (c) a detailed description of the problem, including details on the equipment.
- (3) Deliver the product to the Ameritron or the nearest authorized service facility, or ship the same in its original container or equivalent, fully insured and with shipping charges prepaid.

Correct maintenance, repair, and use are important to obtain proper performance from this product. Therefore, carefully read the Instruction Manual. This warranty does not apply to any defect that Ameritron determines is due to:

- (1) Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specifications of the original parts.
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