

AMERITRON ALS-600/S

600 WATT NO TUNE
TMOS-FET AMPLIFIER

INSTRUCTION MANUAL



AMERITRON

116 WILLOW ROAD
STARKVILLE, MS 39759 USA
662-323-8211

Table of Contents

ALS-600 Specifications.....	4
Optional Accessories.....	5
ALS-600 Features.....	6
Power Supply Features.....	8
ALS-600PS.....	8
ALS-600SPS.....	8
ALS-600PS and ALS-600SPS.....	8
General Information.....	9
Amplifier.....	9
Power Supply.....	9
Export Modifications.....	10
Amplifier Circuitry.....	10
Wattmeter Circuits.....	10
ALC (Automatic Level Control).....	10
Thermal Overload.....	11
Load Fault Indicator.....	12
SWR Considerations.....	12
Power Supply Circuitry (ALS-600PS).....	13
Line Voltage Modifications.....	13
High Voltage Section.....	14
Primary Circuit.....	14
Low Voltage Circuits.....	14
Switching Power Supply Circuitry (ALS-600SPS).....	15
Line Voltage.....	15
High Voltage Section.....	16
Primary Circuit.....	16
Low Voltage Circuits.....	16
Installation.....	16
Amplifier Location.....	16
Power Supply Location.....	16
Grounding.....	17

Power Requirements.....	17
Interconnections.....	18
Operation.....	20
Duty Cycle Considerations... ..	20
ALC Set-Up.....	20
SSB Operation.....	20
CW Operation.....	21
RTTY, FM and Other High Duty Cycle Operation.....	21
AM Operation.....	22
Drive Power Requirements.....	22
ALS-600 Remote Control Operation and Automatic Band Tracking.....	24
ALS-500RC Remote Control Operation.....	25
ARI-500 Automatic Transceiver Frequency Tracking.....	25
Periodic Maintenance.....	25
Technical Assistance.....	26
ALS-600 Parts Lists & Schematics.....	27
Meter/ALC Board.....	27
PA Board.....	29
Output Filter Board.....	30
LED Board.....	34
SWR Detect Board.....	35
ALS-600 Chassis Components.....	36
ALS-600PS Parts Lists & Schematics.....	38
Power Supply Board.....	38
ALS-600PS Chassis Components.....	39
ALS-600SPS Wiring Diagram.....	40
ALS-600SPS Schematic	41

ALS-600 SPECIFICATIONS

Output Power:	600 Watts PEP SSB, 500 Watts CW typical
Frequency Coverage:	1.5 to 22 MHz (10/12 Meters with MOD-10MB)
Driving Power Required:	100 watts maximum
Input SWR:	1.5:1 maximum
Spurious Outputs:	Greater than 45 dB down
Intermodulation Distortion:	Greater than 25 dB down
SWR Protection:	Amplifier is bypassed if reflected power exceeds 75 watts. Prevents amplifier damage if you select the wrong band or wrong antenna, or have high SWR
Over Power Protection:	If output forward power or reflected power exceeds safe level, output power is automatically reduced by controlling the exciter ALC.
Metering (ALS-600):	Illuminated Cross-Needle SWR/Wattmeter -- lets you read SWR, and forward and reflected peak power simultaneously
Metering (Power Supply):	Illuminated Cross-Needle Meter monitors voltage and current of 50 VDC line.
Operate/Standby Switch:	Lets you run "barefoot", or instantly switch to full power.
ALC Controls:	Front Panel - exclusive Ameritron feature -- lets you adjust your amplifier output power. Rear Panel – sets ALC range to match your transceiver.
T/R Relay Drive Rqmts:	Must support 12VDC at 100ma maximum, ground to enable
Indicators:	Transmit, ALC and Load Fault LED indicators to keep you informed.
Accessory Power:	Rear panel 12 VDC/200 ma RCA-type output jack for powering low current accessories.

- Power Supply:** Separate ALS-600PS or ALS-600SPS power supply can be placed conveniently out of the way and plugged into your nearest 120 VAC outlet -- no special wiring needed. Supplies 50 VDC at 25 amps to ALS-600 amplifier.
- The ALS-600PS includes an exclusive Multi-Voltage Power Transformer to compensate for stressful high line voltage and performance robbing low line voltage. Both the ALS-600PS and ALS-600SPS power supplies can be configured for 120VAC or 240VAC operation.
- Step-Start Current Inrush Protection extends the life of power supply components.
- Power Requirements:** 100-130VAC or 220-250VAC, 50/60 Hz. Wired for 120VAC. The ALS-600PS draws less than 12 amps at 120VAC, and less than 6 amps at 230 VAC. The ALS-600SPS draws less than 14 amps at 120VAC, and less than 7 amps at 240VAC
- Dimensions (ALS-600):** 6"H x 9.5"W x 12"D (takes up less desktop space than your transceiver)
- Dimensions (Power Supply):** 6"H x 9.5"W x 14"D -- can be placed conveniently out-of-way.
- Weight (ALS-600):** 12.5 pounds
- Weight (ALS-600PS):** 32.5 pounds (linear power supply)
- Weight (ALS-600SPS):** 10 pounds (switching power supply)

OPTIONAL ACCESSORIES

- MOD-10MB Modification Kit for 10/12 meters
- QSK-5 High Power Pin Diode T/R Switch
- ALS-500RC Remote Control Head for ALS-600 (Ser. No. 14378 and higher)
- ARI-500 Automatic Band Switch for ALS-600 (Ser. No. 14378 and higher)
 - ARI-500 Interface Cables. Check with Ameritron for pre-made cables for popular transceivers.

- ARB-704 Amplifier-to-Transceiver Interface
 - PNP-8D cable for FT-1000, (MP), 900, 767GX, 920, 990, 747GX
 - PNP-8M cable for FT-890, 840, 817, 857/D, 897/D
 - PNP-35 cable for FT-100/D
 - PNP-5M cable for FT-847
 - PNP-7D cable for TS-440, 690, 450, 180, 140, 950, 130, 870, 2000, 50, 120, 530, 430, 830, 949, 570
 - PNP-13D cable for IC-706/703/7000 series
 - PNP-7DK cable for TS-930
 - PNP-8MK cable for TS-480
 - PNP-5D cable for FT-980
 - PNP-8DI cable for ICOM ACC Jack
 - Check with Ameritron for additional cables as they become available

ALS-600 AMPLIFIER FEATURES

Rugged devices. The ALS-600 uses four rugged MRF-150 RF power FETs

All solid-state means instant warm-up. No-wait amplifier operation.

No tune operation. No tuning is necessary. A simple one knob band selector switch permits operation on frequencies between 1.5 and 22 MHz (24-30 MHz with MOD-10MB Modification Kit for 10/12 meters).

ALC protection. The output and reflected power levels control the exciter ALC voltage. This helps prevent damage to the amplifier.

Front panel ALC control. This unique Ameritron feature allows easy front panel adjustment of the ALC threshold to control power output.

Load Error Protection. The PA load impedance is monitored and the amplifier is bypassed if the band switch or the external load is incorrect.

Illuminated Power/SWR meter. The ALS-600 has an illuminated cross-needle peak reading RF power meter. Accurate directional coupler and peak storage circuits give simultaneous forward and reflected peak power readings while simultaneously indicating load SWR.

Operate/Standby switch. This switch allows the amplifier to be by-passed for "barefoot" operation without turning the main power switch off and on.

Transmit, ALC and Load Fault Indicator LED's. Front panel LED's provide an indication of amplifier status during operation.

12 volt auxiliary jack. This jack supplies +12v at 200 ma to operate low current accessories.

Thermal Overload Protection. The transmit relay in the amplifier is disabled if excessive heatsink temperatures are reached.

Compact size. The ALS-600 weighs only 12.5 pounds and measures 6"H x 9.5"W x 12"D.

Remote Amplifier Operation. The ALS-600 amplifier can be tucked out of the way when used with the optional ALS-500RC Remote Control Head. The ALS-500RC provides band switching, transmit and load fault indicators, output power monitoring, and fault re-setting in a compact control and display unit.

Automatic Transceiver Frequency Tracking. The optional ARI-500 Automatic Band Switch unit interfaces frequency band information for most transceivers to the ALS-600. So as you change frequency bands on your transceiver, the ALS-600 automatically follows these band changes. The ARI-500 may be configured for automatic fault re-setting of the ALS-600 if desired. These features make the ARI-500 particularly convenient for contest operations. The ARI-500 Automatic Band Switch includes an input for the ALS-500RC Remote Control Head, so both may be used simultaneously if desired.

POWER SUPPLY FEATURES

ALS-600PS

Multi-voltage heavy duty transformer. A unique "buck-boost" winding allows compensation for up to six different power line voltages centered on 115 and 230 volts. This versatile Ameritron feature maintains optimum voltages on the amplifier components for maximum performance and life.

Choke input filtering. The ALS-600PS standard power supply uses an input choke to provide a low power factor to the power lines. This reduces the peak currents drawn from the line and improves the voltage regulation of the supply.

ALS-600SPS

Light weight. The ALS-600SPS is a light weight switching power supply to use with the ALS-600 amplifier. It is 1/3rd the weight of the ALS-600PS linear power supply. The ALS-600 amplifier with the ALS-600SPS switching power supply is ideal for travel.

Hash free. The specially designed switching and filter circuit makes the power supply hash free.

Simple power line voltage options. The power supply will safely operate from 90-135 VAC in the 120 VAC setting, and 185-260 VAC in the 240 VAC setting.

ALS-600PS and ALS-600SPS

Step-start circuit. This circuit uses a relay and resistor to limit the inrush current to the power supply. This circuit extends the life of the power supply components.

Current and output voltage metering. An illuminated cross needle meter monitors the output voltage and current of the 50 volt output line.

GENERAL INFORMATION

Amplifier

The Ameritron ALS-600 is a 600 watt nominal output, solid state, linear amplifier using state-of-the-art, high voltage, RF TMOS FET devices in the power output section. The ALS-600 provides continuous frequency coverage from 1.5 through 22 MHz with no tuning required. Broad-band 5 pole low pass filters provide output harmonic suppression in excess of all FCC requirements. The MOD-10B kit provides operation up to 30 MHz (copy of a valid amateur license is required to purchase the MOD-10B).

The ALS-600 uses four MRF-150 FET's operating at 50 volts in a double ended push-pull parallel output configuration. High quality RF components combine with an accurate peak detecting directional coupler, front panel adjustable ALC circuit with automatic SWR foldback, and one switch frequency selection to make this one of the easiest to operate amplifiers available. The matching power supply, an ALS-600PS or ALS-600SPS, is shipped factory wired for 120 volt, 50/60 Hz power mains. The power supplies are easily converted to other supply voltages between 100 and 240 volts.

Low Pass Filter Selection

Low pass filter networks must be selected for the different HF frequency ranges in order to meet FCC requirements. The ALS-600 uses relay-selected low pass filter networks to permit the selection of the proper filter networks by three different methods:

- The FREQ switch on the front panel of the ALS-600
- The band switch on the optional ALS-500RC Remote Control Head
- Automatically by the optional ARI-500 Automatic Band Switch

Power Supply

The ALS-600PS power supply is designed to power the ALS-600 amplifier from 50 to 60 hertz AC power mains that range from 100-130 VAC and 210-240 VAC. The ALS-600SPS has a terminal strip where the AC voltages can be selected as either 120 or 240 volts 50/60 Hz, and will safely operate from 90-135 VAC in the 120 setting, and 185-260 VAC in the 240 VAC setting. All ALS-600PS/ALS-600SPS supplies are wired for standard 120 volt systems and are shipped with a NEMA 5-15P three wire plug.

Both power supplies provide the power required to operate the ALS-600 in typical continuous amateur service at 600 watt output levels. The ALS-600PS/SPS power supplies provide the three DC voltages required by the amplifier unit. The high voltage section supplies approximately 50 volts at a load current of 25 amperes.

10/12 Meter Modification

A simple modification allows operation on frequencies up to 30 MHz. A parts kit to make this modification is available by sending a written request for the MOD-10MB modification kit, along with a copy of your valid amateur license to Ameritron. There is a nominal charge for this kit. Export models are shipped with this modification installed. The ALS-600(S)Y is the export model for 115-130 VAC operation and the ALS-600(S)X is the export model for 220-240 VAC operation.

AMPLIFIER CIRCUITRY

Wattmeter Circuits

The BIAS/WM/ALC board contains the peak power detector circuits. The rear panel directional coupler connects to IC101D/C. IC101D/C drives Q101/102 to charge C103/106 to the peak voltage from the directional coupler. C103/106 is lightly loaded by IC101A/B and R103/107. This allows enough "hang" time for the meter to accurately indicate peak power levels.

Accurate forward peak power readings are obtained under mismatched load conditions when the reflected power is deducted from the forward power readings.

The average and peak envelope power values are EQUAL on CW, FSK and FM (modes that do not have amplitude changes in the carrier). The average power level of voice or other complex waveform signals has NO SET RATIO of peak to average power.

ALC (Automatic Level Control)

The ALC circuit functions by using a comparator (IC103A) to reduce the exciter drive power if the output power of the ALS-600 exceeds a preset value. The ALC circuit also reduces the drive power if the SWR increases while operating with the ALC controlling the amplifier output power level. The ALS-600 ALC output should be connected to the proper exciter external ALC connection point with a shielded audio type cable. Consult the exciter manual for the proper exciter connection details.

Operation at high audio gain levels on SSB with ALC has the same effect as an RF speech compressor. RF compression increases SSB "talk power". Background noise pickup also increases when the exciter gain is operated at high levels to increase compression. Audio distortion does not normally occur with this type of speech processing if the ALC circuit in the exciter is properly designed.

Do not attempt to limit the CW power more than a few percent solely with the amplifier ALC circuit. Using the amplifier ALC to reduce CW power levels may result in pumping of the output power during dots and dashes. The "ALC SET" control will be correctly

adjusted when the "ALC" LED gives a small flash while transmitting on CW. This can be accomplished by adjusting the "ALC SET" control on the front panel so that the "ALC" LED just barely lights when the desired power level (500 watts maximum) is reached with a steady carrier.

The ALC circuit can be used to reduce power by any amount on constant amplitude carrier modes such as RTTY or FM. The ALC cannot cause modulation distortion or pumping on these modes.

Never use the ALC to control the level of AM transmissions. Using the amplifier's ALC circuit to control AM output power will cause pumping of carrier amplitude on AM transmissions during modulation.

The ALC indicator on the front panel of the ALS-600 is driven by comparator IC3B. Resistors R24 and R25 set the turn-on level of the front panel "ALC" indicator. Factory selected resistor values cause the "ALC" LED to illuminate as soon as negative ALC voltage begins to appear at the ALC output jack.

If the exciter used with this amplifier does not "fold back" until appreciable ALC voltage is developed, the "ALC" LED may become fully lit even under operating conditions that are producing very light ALC action.

Caution: There are no industry standards for transceiver or exciter ALC input voltage levels, input resistance, or attack and decay times. While every attempt has been made to make the ALC circuit in this amplifier compatible with various exciters, the exact operation of the ALC circuit will vary with the exciters response to external ALC control voltages. This ALC circuit will function with negative voltage ALC control systems requiring less than 10 volts.

Thermal Overload

The ALS-600 has a built in thermal cut-out that by-passes the amplifier if excessive heat sink temperature is produced. This circuit minimizes the risk of excessive temperature damage to the FET's and other components.

If the amplifier "XMT" LED remains lit while the amplifier suddenly stops transmitting, the thermal overload has probably tripped. If the thermal overload has tripped, full exciter power will appear on the RF output meter.

The thermal overload resets automatically and all amplifier functions are restored when heat sink temperature returns to a safe value. The usual cause of thermal overload is excessive heat buildup during a transmission period longer than a few minutes. To correct this condition, be sure that the power level and duty cycle limits are being followed, the SWR is as low as possible, and cooling is not being hampered by air flow restriction or excessive inlet air temperatures.

Load Fault Indicator

The "LOAD FAULT" LED indicator will light and the amplifier will be bypassed if the band switch is set on the wrong frequency range, if the load SWR is excessive, or if the output power level is excessive.

To reset a "LOAD FAULT" indication:

1. Determine and correct the cause of the problem.
2. Place the amplifier "STANDBY-OPERATE" switch to "STANDBY" and then back to "OPERATE".

Note: When the ARI-500 is used, the STANDBY-OPERATE switch is under control of the ARI-500. The amplifier will automatically be put in OPERATE when the transceiver is keyed, regardless of the STANDBY-OPERATE switch position on the ALS-600. When a fault occurs, the ARI-500 can be configured to automatically re-set the ALS-600 after approximately 5-seconds. If the ARI-500 is not configured for automatic amplifier fault re-set, you must cycle the amplifier power switch OFF and then ON to re-set the fault circuitry.

Note: When the ALS-500RC Remote Control Head is used (with or without the ARI-500), the STANDBY-OPERATE function is controlled by the POWER OFF-ON switch on the ALS-500RC.

The load fault detector circuit is located on the output filter board and measures the reflected power presented by the output filter network and the SWR directional coupler. The sensitivity of the circuit is adjusted by R304 and R601. C324 is a factory adjustment that controls the impedance of the detector circuit. This capacitor is adjusted for minimum detector voltage on 7 MHz with a 50 ohm load. Do not adjust any components in this circuit without consulting the factory.

SWR Considerations

A high SWR (Standing Wave Ratio) causes higher voltages and/or currents to appear at the output connector of the amplifier. This problem occurs with all amplifiers regardless of whether tubes or semiconductors are used in the output stage.

Vacuum tube amplifiers have the reputation of handling a high SWR quite well. This reputation probably exists for two reasons: First, most vacuum tube amplifiers use adjustable output networks. Second, nearly all vacuum tubes handle momentary overloads extremely well.

In tube amplifiers with tunable Pi or Pi-L networks, the only components affected by a high load SWR are those between the loading adjustment capacitor and the output connector. When the output network is properly adjusted, the SWR cannot affect tube life.

The TMOS FET devices used in the ALS-600 have nearly the same momentary overload tolerance as vacuum tubes. The low pass output network in the ALS-600 is much broader in bandwidth and less sensitive to load changes than the networks used in tube type amplifiers.

This makes the ALS-600 much less sensitive to frequency and SWR changes than the best "no-tune" tube amplifiers but not as good as adjustable pi-networks. The ALS-600's multiple section output network and push-pull output configuration offers much better harmonic suppression than most tube amplifiers regardless of load SWR.

The only danger presented by a high SWR in this amplifier is that the current and power dissipation in the output devices may exceed safe limits. Lengthy operation with high SWR at high power levels can result in heat damage and failure of the FET devices. If the reflected power exceeds 50 watts the power level should be reduced until the reflected power indicated on the internal meter is 50 watts or less on peaks. At approximately 75 watts of reflected power the internal safety circuitry will disable the amplifier.

ALS-600PS POWER SUPPLY CIRCUITRY (ALS-600PS)

Line Voltage Modifications

The line input voltage of the ALS-600PS can be changed by moving jumper wires on the power supply printed circuit board to new locations. The ALS-600PS is wired for standard 120 VAC operation unless otherwise indicated.

Warning: *Never unplug the power cable from the amplifier while the power supply is connected to the power line. AC power line voltage is present on the power cable connector pins.*

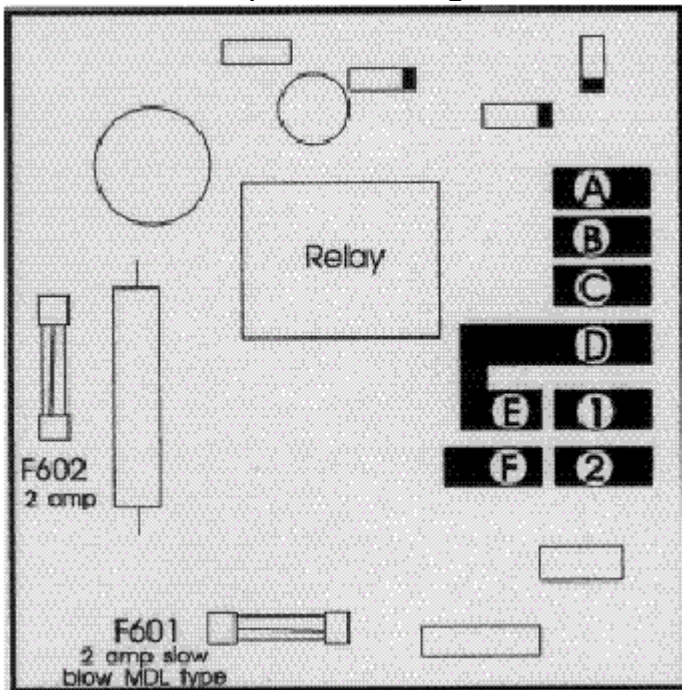
Warning: *Never remove the cover of the power supply while it is connected to the power line.*

Refer to the following chart for the proper location of the primary wiring. This chart lists the proper jumper connections for different ranges of MAXIMUM line voltage.

It is always best to **carefully** measure your AC line voltage prior to setting the voltage strapping. The standard line voltage in the USA is NOT 110 and 220 volts. It is almost ALWAYS above 120 volts or 240 volts.

Caution: *Never exceed the voltage in this chart for each wiring configuration. If the output voltage of this supply exceeds 65 volts, damage to the amplifier may occur.*

ALS-600PS Power Supply Board Jumper Pad Diagram



For the following line voltages
jumper the correct pads.

AC LINE VOLTAGE RANGE	PRIMARY	BUCK BOOST
95-110	A TO B C TO D	E TO 2 F TO 1
105-120	A TO B C TO D	E TO F
115-130	A TO B C TO D	E TO 1 F TO 2
200-220	B TO C	E TO 2 F TO 1
210-230	B TO C	E TO F
220-240	B TO C	E TO 1 F TO 2

High Voltage Section

The high voltage section of the ALS-600PS uses a full wave bridge rectifier. DC filtering is accomplished with a large swinging choke (T1) and a high quality computer grade capacitor (C5). A pair of 100 ohm resistors (R5,6) absorb enough bleeder current to prevent the output voltage from soaring under low load currents. The output voltage and current of this section are monitored by a illuminated dual needle meter (M2a/2b).

Primary Circuit

10 ohm resistor (R602) limits the line current during the filter capacitor charge time to lower the stress on the power supply components. When the 14 volt control line approaches full voltage relay (RLY601) bypasses the 10 ohm resistor (R602) and applies full line voltage to the transformer primary. The 10 ohm resistor is protected from supply shorts by a 2 amp slow-blow fuse (F601) during the start-up.

A separate 10 volt transformer winding can be connected to either oppose or add to the power line voltage. This allows the 115 volt maximum voltage primary windings to be adjusted to provide the proper voltage. Use of the buck-boost winding allows maximum primary voltages of 100, 110, or 120 volts maximum voltage or 210, 220, and 230 volts maximum voltage at either 50 or 60 hertz.

The primary circuits are fused by two fuses (F1, F2) that are rated at 15 amperes at 100 volts, 12 amperes from 110 to 120 volts or 8 amperes from 220 to 240 volts. Since the current demand and the power factor of this supply are so low Ameritron does not recommend operating this supply on the higher voltage lines (210 to 240 volts) unless lower voltages are unavailable.

Low Voltage Circuits

The low voltage power supply sections supply 14 volts positive at 2 amperes maximum with a full wave grounded center tap supply for control, lights and also to power the bias voltage regulator and the circuitry of the Bias/Wattmeter board in the ALS-600. This low voltage circuit is protected by a 2 ampere fuse (F602) located on the power supply printed circuit board.

A separate half wave rectifier supplies the low current necessary to operate the ALC circuitry in the ALS-600. This circuit is protected by a 10 ohm 1/4 watt resistor (R601).

SWITCHING POWER SUPPLY CIRCUITRY (ALS-600SPS)

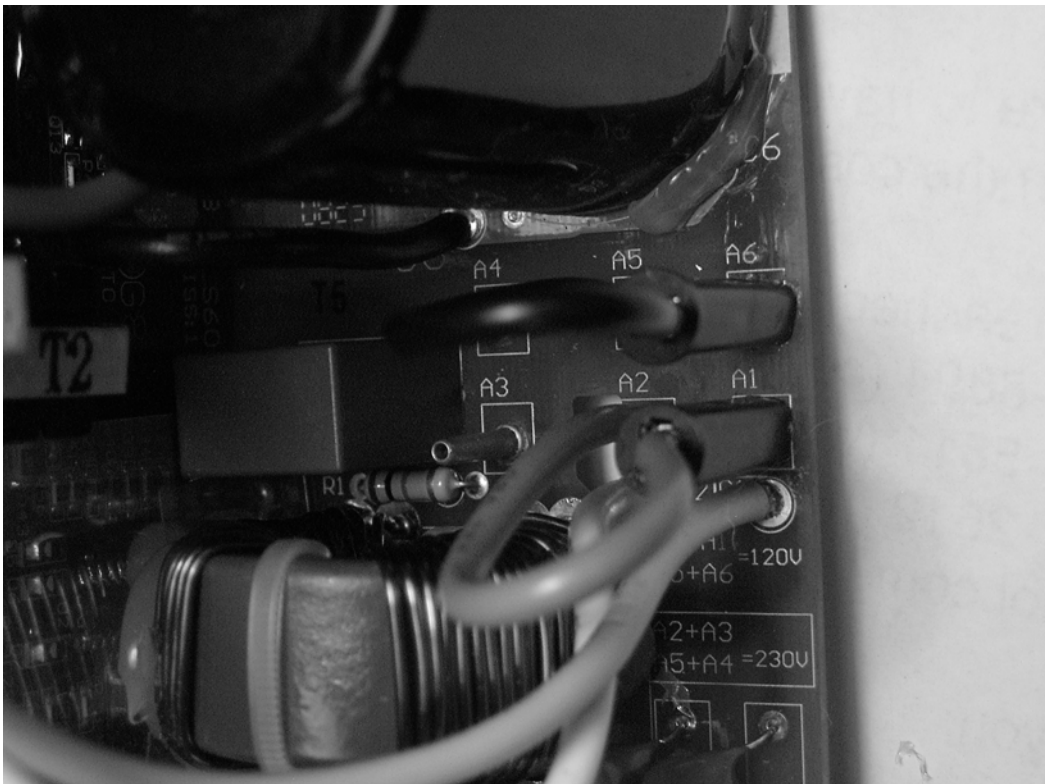
Line Voltage

The input AC line voltage for the ALS-600SPS can be changed by moving jumpers located at the front of the unit under the current and voltage meter. The ALS-600SPS is factory wired for 120 VAC operation unless otherwise indicated.

Warning: *Never unplug the power cable from the amplifier while the power supply is connected to the power line. AC power line voltage is present on the power cable connector pins.*

Warning: *Never remove the cover of the power supply while it is connected to the power line.*

Refer to the picture (shown in factory wired 120V position) for the proper location of the jumpers. The 120V position (A5 to A6 and A2 to A1) will allow the power supply to work from 90-135 VAC. The 240V position (A5 to A4 and A2 to A3) will allow the power supply to work from 185-260 VAC. To change the power supply from 120V to 240V, unplug the connector from A6 and install it on A4 then unplug the connector from A1 and install it on A3.



High Voltage Section

The High voltage section of the ALS-600SPS uses high current switching circuit with superior filtering to produce a high current DC voltage. This line is protected by F1 on the printed circuit board.

Primary Circuit

A 10 ohm resistor limits the line current during start-up, which lowers the stress on the power supply components. When the -14 volt control line approaches full voltage, a relay bypasses the 10 ohm resistor and applies full line voltage to the primary. The 10 ohm resistor is protected from supply shorts by a 2 amp slow blow fuse during start-up. An input over-current circuit will disable the power supply at approximately 16 amps of input AC current.

The primary circuits are fused by two fuses located on the back panel of the switching power supply. The fuses are rated at 15 amps on 120 volts, or 8 amps on 240 volts.

Low Voltage Circuits

The low voltage power supply sections supply 14 volts positive at 2 amperes maximum for control of lights, bias voltage regulator and the Bias/Wattmeter board in the ALS-600.

A separate 12 volts negative supply is used to operate inrush relay and the ALC circuit of the ALS-600.

INSTALLATION

Amplifier Location

Do not locate this amplifier in excessively warm locations, near heating vents or near radiators. Be sure that air can circulate freely around and through the amplifier cabinet. Do not obstruct the air inlets at the rear of the amplifier and the outlet air holes on the lower right side of the amplifier cabinet.

The best location for the amplifier is one that allows the meters to be easily read and the controls accessed during operation. The length of the interconnecting control and ALC cables are not critical. These should be made from good quality shielded cables. Low level audio cables, sold for use with home theater equipment, are ideal. The RF input and output cables should be kept as short as possible.

Power Supply Location

The best location for the power supply is one that is away from devices that are sensitive to magnetic fields. The meter should be visible and fuses should be accessible for

service. Do not obstruct the air inlets at the rear of the power supply and the outlet air holes on the upper right corner of the power supply cabinet.

Caution: *The choke in the ALS-600PS power supply emits strong magnetic fields. Never place magnetic tapes, computer disks or other magnetic sensitive devices within 18 inches of the cabinet of the ALS-600PS.*

Grounding

The station ground buss should be connected to a good earth and RF ground. Use the heaviest and shortest connections possible. The best ground leads are smooth and have a large surface area. Braiding (including standard coaxial cable shield) has a higher RF resistance and should be avoided unless the lead needs to be flexible. The best conductors for ground connections are copper flashing or copper foil. Solid copper wire can be used and will closely approximate copper flashing if multiple ground leads are used and separated at least a few inches. Water pipes can be used for an earth connection if the plumbing is composed of *all* metallic pipes. The water meter or any other insulated junction should be bypassed with a jumper wire clamped to the pipe at both sides of the meter.

Multiple ground connections are superior to a single ground connection. Ameritron has a technical information sheet with additional suggestions for grounding. No grounding terminal is provided for the power supply since it does not generate any RF signals. A safety ground is provided by the power line neutral ground through the line cord and plug.

Warning: *Never remove or defeat the electrical safety ground connection on the power supply plug or a shock hazard may develop.*

Power Requirements

Caution: *The ALS-600 is not designed for operation from a 12 VDC power source.*

The ALS-600PS/SPS power supplies are designed to match the ALS-600 amplifier. They provides 50 volts DC at 25 amperes along with 12 volts positive and negative at low current for the control and bias circuits of the amplifier.

The ALS-600PS linear power supply requires less than 12 amps at 120 VAC, or less than 6 amps for 240 VAC. The output voltage of the ALS-600PS supply should be kept below 65 VDC at no load for maximum component life. If the no load output voltage of the ALS-600PS exceeds 65 VDC, you must change the input line voltage of the ALS-600PS. Refer to the "Line Voltage Modifications" section in this manual. The ALS-600SPS switching power supply requires less than 15 amps at 120VAC, or less than 8 amps at 240 VAC. The ALS-600SPS no-load voltage should stay within one-volt of 50 volts.

INTERCONNECTIONS

1. Connect the RF (antenna) output of the exciter to the RF IN (SO-239) of the ALS-600 with a good quality 50 ohm cable capable of handling 100 watts.
2. Connect the station antenna system to the RF OUT (SO-239) connector with good quality 50 ohm coax that will safely carry 600 watts.
3. Use shielded audio-type cable with standard male phono (RCA) connectors to connect the RELAY jack of the ALS-600 to the transceiver or transmitter normally open amplifier relay terminal. This connection has 12 volts open circuit and supplies less than 100 mA of current when pulled to ground. There is a back pulse canceling diode in the amplifier for exciter protection.

Note: The Ameritron ARB-704 Amplifier-to-Transceiver Interface provides plug-and-play control between almost any transceiver solid-state or relay keying outputs, and any Ameritron amplifier using transceiver-specific plug-and-play cables.

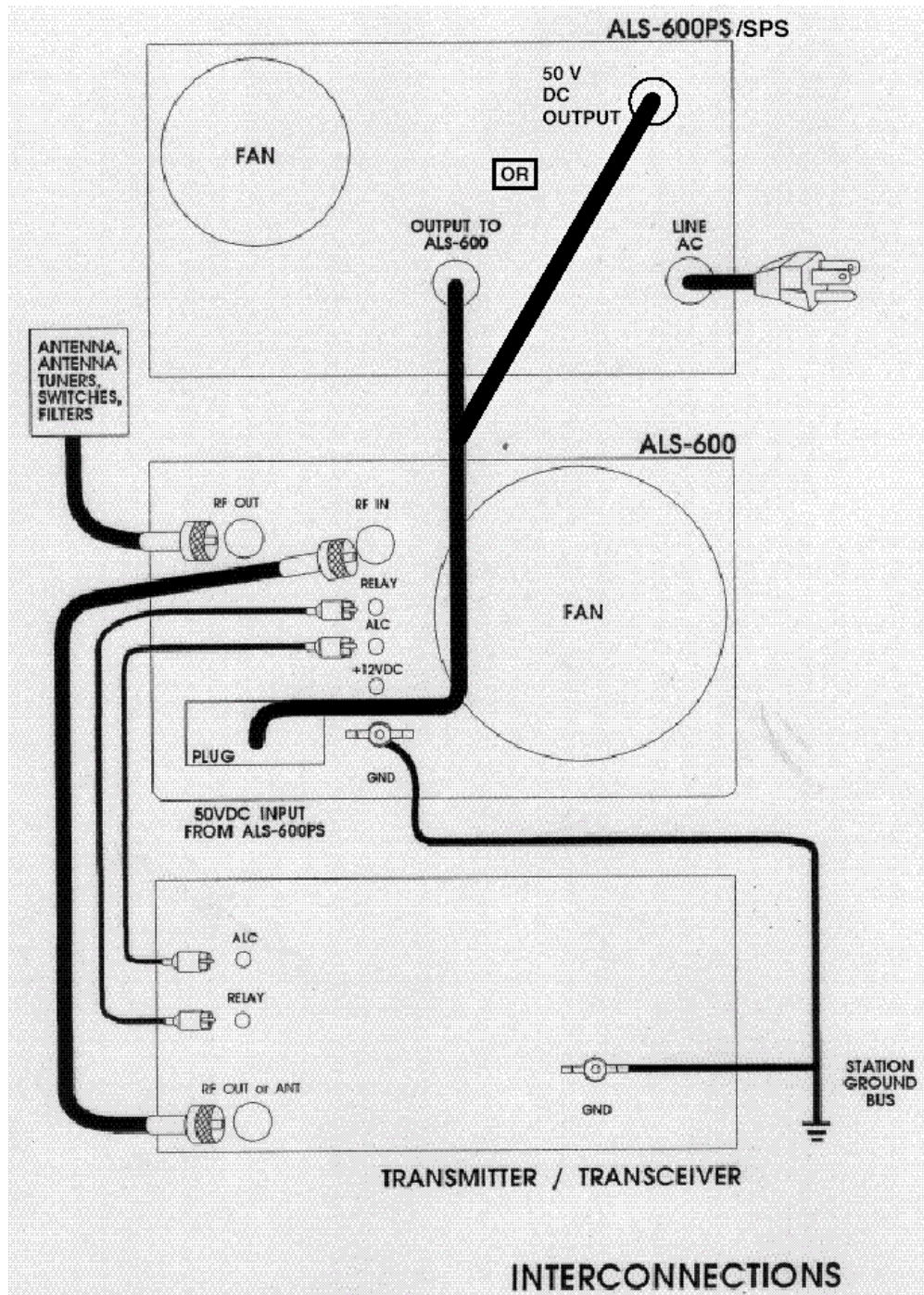
Note: The Ameritron ARi-500 Automatic Band Switch provides a low level keying interface between your transceiver and the ALS-600s. Refer to the ARI-500 manual for more information.

4. Connect the ground stud (GND) on the amplifier to the station ground buss with as short a lead as practical.
5. Connect the ALC jack to the exciter ALC terminals with a shielded audio-type cable using standard phono connectors.

Note: The Ameritron ARB-704 Amplifier-to-Transceiver Interface provides the ALC interface for transceivers where ALC is only available through their accessory socket.

6. Connect the female power connector from the ALS-600PS/SPS supply to the multi-pin male connector on the ALS-600 rear chassis.
7. The 12V connector can be used to supply 12-14 VDC at less than 200 ma for station accessories.

Note: If using either the ALS-500RC Remote Control Head or the ARI-500 Automatic Band Switch, refer to those manuals for interconnection information with the ALS-600.



OPERATION

Duty-Cycle Considerations

The ALS-600PS linear power supply is equipped with a front panel switch labeled Normal/RTTY. This switch is used in the normal position for SSB and CW operation. The RTTY position is used for continuous carrier modes. This position limits the voltage to about 42VDC no load, thereby limiting the output power to 350 watts. In the RTTY position, the amplifier can be operated for 10 minutes key down with a 50% duty cycle. The ALS-600SPS switching power supply does not have this Normal/RTTY switch.

Note: Ensure that you limit your ALS-600 output power to 350 watts maximum for RTTY or other continuous carrier modes.

ALC Set-Up

The Amplifier's back panel has an ALC limit control that limits the amount of ALC voltage sent to the transceiver. This is necessary because there is not a standard transceiver ALC voltage. To set the ALC limit control, adjust the ALC set knob on front of the amplifier to 10 (fully clockwise), and the ALC limit control on the back of the amplifier fully counter-clockwise as viewed from the rear (or just disconnect the ALC cable). Key your transceiver and apply enough drive into the amplifier until the amplifier's power meter reads about 500 watts. This will result in approximately 600 watts PEP output power.

Note: The amplifier's power meter should never exceed 700 watts, and the drive level must not exceed 100 watts.

Plug the ALC cable into the back of the amplifier (if not already done). Turn the ALC set knob (on front of amplifier) to 0 (fully counter-clockwise). Key amplifier with RF applied. Adjust the ALC limit control (on back of amplifier) until the ALC light on the front of the amplifier just comes on. No other adjustment needs to be done to the ALC limit control unless a different transceiver is used. All ALC adjustments can now be made with the ALC Set control on the front of the amplifier.

The following sections describe how to adjust the exciter and ALC control for proper operation. If ALC is not used, the exciter output controls must be used to limit the power to the levels described in the text that follows (drive power must never exceed 100 watts).

SSB Operation

SSB voice operation normally does not have transmit time limits. Reflected power levels should be kept below 50 watts peak on SSB.

To set the proper SSB operating level, first set the ALC SET control fully clockwise. While using normal modulation, increase your transceiver's output power (not to exceed

100 watts peak) until the desired amplifier peak output power occurs. The "ALC SET" control should then be adjusted until the amplifier's RF output power just begins to drop.

CW Operation

The exciter output should be restricted to a level that limits the amplifier to 500 watts output on a steady carrier or 50 watts reflected power, whichever is greater. Also, the ALC should not be used to control the power level more than a few percent on CW. The ALC LED should just barely flash on CW.

Begin by setting the ALC SET control fully clockwise. Begin with minimum RF output power from your transceiver, and gradually increase your transceiver's output power until the amplifier outputs 500 watts. Now, send a series of "dits" and rotate the ALC SET control counter-clockwise until the ALC LED just barely flashes.

Note: The ALS-600 T/R relay enable time is typically 15 milliseconds. Many transceivers permit setting a time delay between their relay-control output, and the actual full-power RF output. If your transceiver has this capability, set this delay to 20 milliseconds to ensure you don't transmit before the amplifier relay fully energizes (which can result in the loss of part of the first Morse character).

Note: Transceivers should only be used in semi break-in mode when controlling the ALS-600 T/R relay. QSK (full break-in) operation is available with the Ameritron QSK-5 external solid-state T/R switch.

RTTY, FM and Other High Duty Cycle

The transmitting duty cycle, ambient temperature, supply voltage, fan speed and the load SWR all play important roles in determining the transmit time limit on high duty cycle modes.

To minimize noise, Ameritron uses only enough fan speed to cool the ALS-600 for typical amateur usage. If heavy duty cycle operation is planned, the following guidelines should be followed.

The output power can be reduced to assist with cooling. This is not the most effective method of improving performance since the power must be reduced 5 times to cut the heat dissipation in half. The exciter output should be restricted to a power level where less than 200 watts output or 25 watts reflected power is obtained on long duty cycle modes.

The fan speed should be increased by replacing or supplementing the airflow from the standard fan. A fan that delivers at least 80 CFM airflow at .1" of static pressure will double the cooling and allow 500 watt RTTY transmissions with 2 minute on, one minute off duty cycles.

The power supply high voltage output can be reduced to increase the efficiency at lower output levels. At 30 volts the ALS-600 will deliver 275 watts of output power. This allows a 100% duty cycle with any fan delivering more than 40 CFM at .08" of static pressure, or a 5 minute on, two minute off duty cycle with the standard fan. Consult the factory if you wish to reduce the high voltage output.level.

Either the exciter drive level or the amplifier "ALC SET" control can be adjusted to limit the power output in the RTTY and FM modes.

AM Operation

AM operation requires that the carrier power of any linear amplifier be restricted to one fourth of the peak envelope output power. With this amplifier, the maximum carrier power on AM should be set for no more than 150 watts.

Proper modulation AM is indicated by observing the ratio of unmodulated carrier power to the power indicated on voice modulation peaks. This should be approximately 4:1.

Never use the ALC to control the power on AM. The "ALC SET" control should be set to the maximum clockwise position.

Drive Power Requirements

The ALS-600 requires less than 100 watts of drive to produce full output power. Exceeding 100 watts of drive for short periods of time will cause distortion and increase the bandwidth of the transmitted signal. Exceeding 100 watts of drive for long periods of time may cause component failures.

Follow these instructions in numerical order. Consult the exciter manual if necessary.

Be sure the power supply transformer is correctly wired for your line voltage. See the "Line Voltage Modifications" section for wiring details.

1. Set the ALS-600 front panel switches as follows:
ON-OFF to OFF
OPERATE-STANDBY to STANDBY
2. Plug the AC line cord into the proper voltage outlet.
3. Place the power switch in the ON position. The meter lamps should light and the power supply and amplifier fans should start.
4. Check the voltage on the power supply meter. The **ALS-600PS** voltage should be between 55 and 65 volts at this step. If the voltage is outside this range then check

the line voltage with an accurate meter and make sure the power supply primary wiring is correct. The **ALS-600SPS** should be between 49 to 51 volts at this step.

5. Set the ALS-600 frequency range switch to the same frequency as the exciter.
6. With the amplifier still in STANDBY, transmit into the expected 50 ohm RF load with the exciter. Measure the SWR on the amplifier's SWR scale or with an external SWR indicator.

Caution: *Do not operate this amplifier at full power with an SWR above 2:1. See the SWR Considerations section.*

7. Place the amplifier in the OPERATE position. The TRANSMIT LED should light when the exciter is keyed. With no RF drive, the idling current should be less than 1 amp on the power supply meter.
8. The ALC control is properly adjusted if the ALC LED just flashes when the desired peak output power is reached. The audio or power output control on the exciter can be adjusted to control how "heavily" the ALC is used. The higher the exciter power (gain) control is adjusted, the more compression the ALC circuit provides.

The best signal quality occurs when the ALC LED occasionally flashes. The most SSB signal "punch" will occur if the LED continuously flashes.

Full output levels of 500 watts CW should be obtained with drive levels of under 100 watts. Peak envelope output levels on SSB may reach as high as 800 watts depending on voice and exciter characteristics. The lowest IMD and splatter will be obtained if the amplifier is operated at an output level slightly below the maximum level obtainable.

ALS-600 Remote Control Operation and Automatic Band Tracking

ALS-600 amplifiers with Serial Number 14378 and higher include the capability for remote control and automatic band tracking using the optional ALS-500RC Remote Control Head, and ARI-500 Automatic Band Switch.

ALS-500RC Remote Control Operation

The optional Ameritron ALS-500RC Remote Control Head allows the amplifier to be located away from the operating position, yet still provides access to the amplifier's frequency selection and Fault re-set function. The ALS-500RC also provides a RF output meter (power output equals 10x the reading), and LEDs to indicate DC PWR, TX (transmit) and O/L (fault/overload). The ALS-500RC connects to the ALS-600 via the two REMOTE RJ45 jacks on the front of the amplifier. Keying of the amplifier can be

either through the normal key jack on the back of the amplifier, or via the RLY jack on the ALS-500RC Remote Control Head.

Note: The ALS-500RC power meter double terminates the internal ALS-600 RF power meter resulting in the ALS-600 RF power meter reading approximately ½-power. As the ALS-500RC is normally used with a remotely operated ALS-600 amplifier, the amplifier low meter reading can be ignored.

Refer to the ALS-500RC Instruction Manual for more details on remote operation of the ALS-600.

ARI-500 Automatic Transceiver Frequency Tracking

The optional ARI-500 Automatic Band Switch is designed to automatically select the correct frequency range on the ALS-600 by reading the frequency or band data from the transceiver. The ARI-500 is compatible with most Icom, Yaesu, and Kenwood transceivers, the Elecraft K3 transceiver, and other transceivers with compatible interfaces. The ARI-500 interfaces to the ALS-600 via the two RJ45 jacks on the front of the amplifier. Amplifier keying is provided through the low drive current interface of the ARI-500. The ARI-500 also controls the ALS-600 STANDBY-OPERATE functionality, automatically switching the amplifier to OPERATE when the transceiver is keyed. LED indicators on the ARI-500 provide information on connectivity between the ARI-500, the ALS-600 and your transceiver. The ARI-500 also provides automatic Fault resetting if desired. Finally, the ARI-500 may be used with or without the ALS-500RC Remote Control Head, depending on your specific needs.

Note: If the ALS-500RC Remote Control Head is used with the ARI-500, the ARI-500 auto-reset capability is defeated as the ALS-500RC provides manual reset capability.

Refer to the ARI-500 Instruction Manual for more detailed operational details.

Periodic Maintenance

The lack of extremely high voltages in this unit eliminates the chance of dirt and dust causing high voltage arcing. The only requirement for periodic maintenance is to monitor the amount of dirt and dust in the amplifier and the power supply. Whenever there is a noticeable accumulation of dust that may affect cooling, air can be used to blowout the equipment.

The fan area on the amplifier should be inspected every few months if the amplifier is operated in a very dusty environment. If there is a large amount of dust on the fan it is probably a good time to blow the dust out of the amplifier and power supply with moderate air pressure.

A soft bristled brush and a small amount of alcohol can be used to clean stubborn dust from the fan screen or the other components. Be careful not to get any cleaning compounds on the relay contacts or the switches.

Caution: Never remove the cover of the amplifier or the power supply, with the power supply plugged in to the electrical outlet.

Technical Assistance

Technical assistance is available by calling (662) 323-8211 during our normal business hours (8:00 to 4:30 Central Time on weekdays) for questions that are not answered by the technical information sheets. We are happy to provide personal assistance if you need more detailed help. Please have the following information available so that we can accurately assist you with any problems:

1. The model and serial number of the unit.
2. The date of purchase and the dealer.
3. A brief description of the station equipment and antenna system.
4. A complete description of the problem along with any abnormal meter readings.

Written assistance is also available. Due to time delays in processing mail, please allow at least three weeks for a written reply. See warranty page for mailing address.

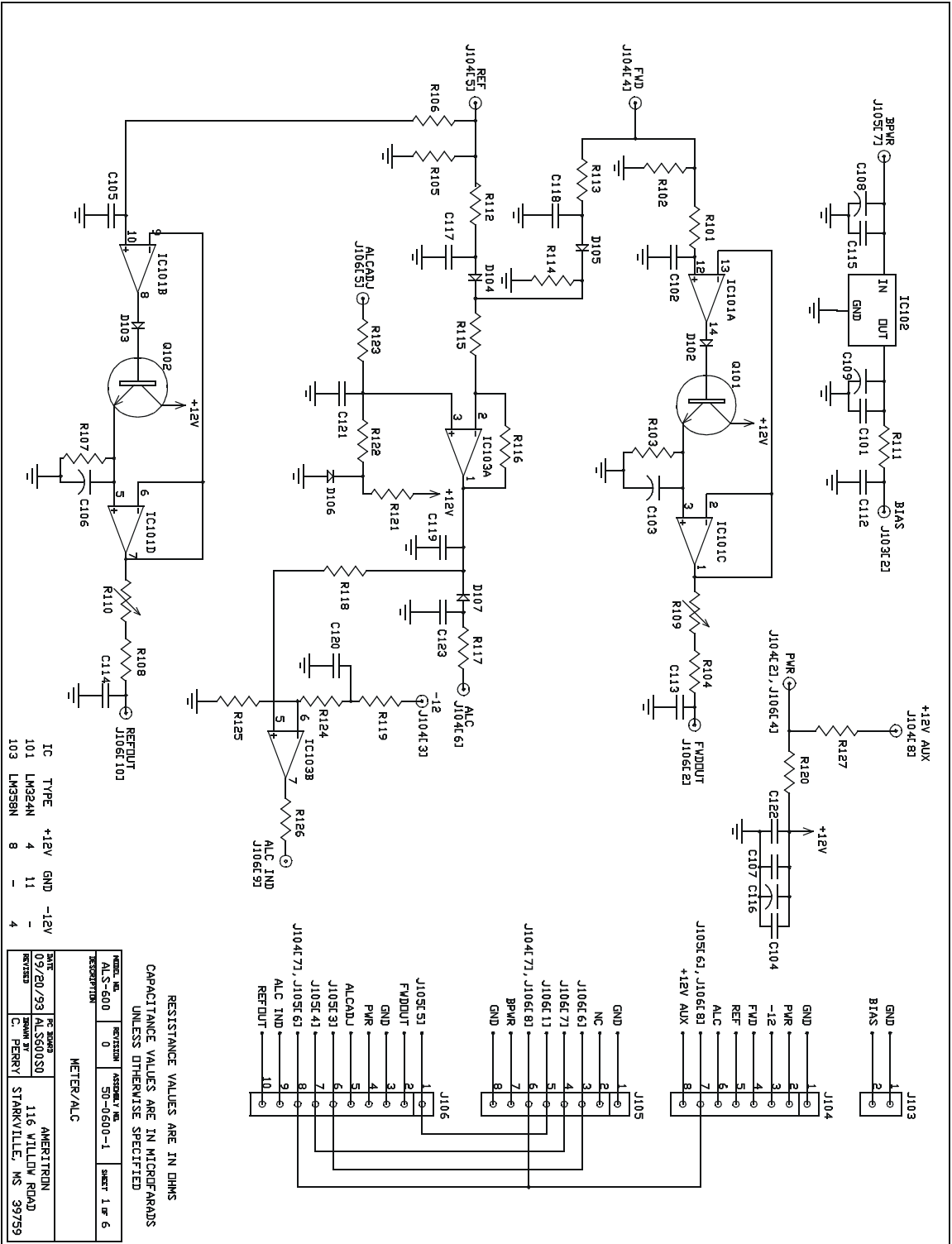
AMERITRON
116 Willow Road
Starkville, MS 39759
Tel: (662) 323-8211
Fax: (662) 323-6551

ALS-600 PARTS LISTS & SCHEMATICS

Meter/ALC Board

50-0600-1

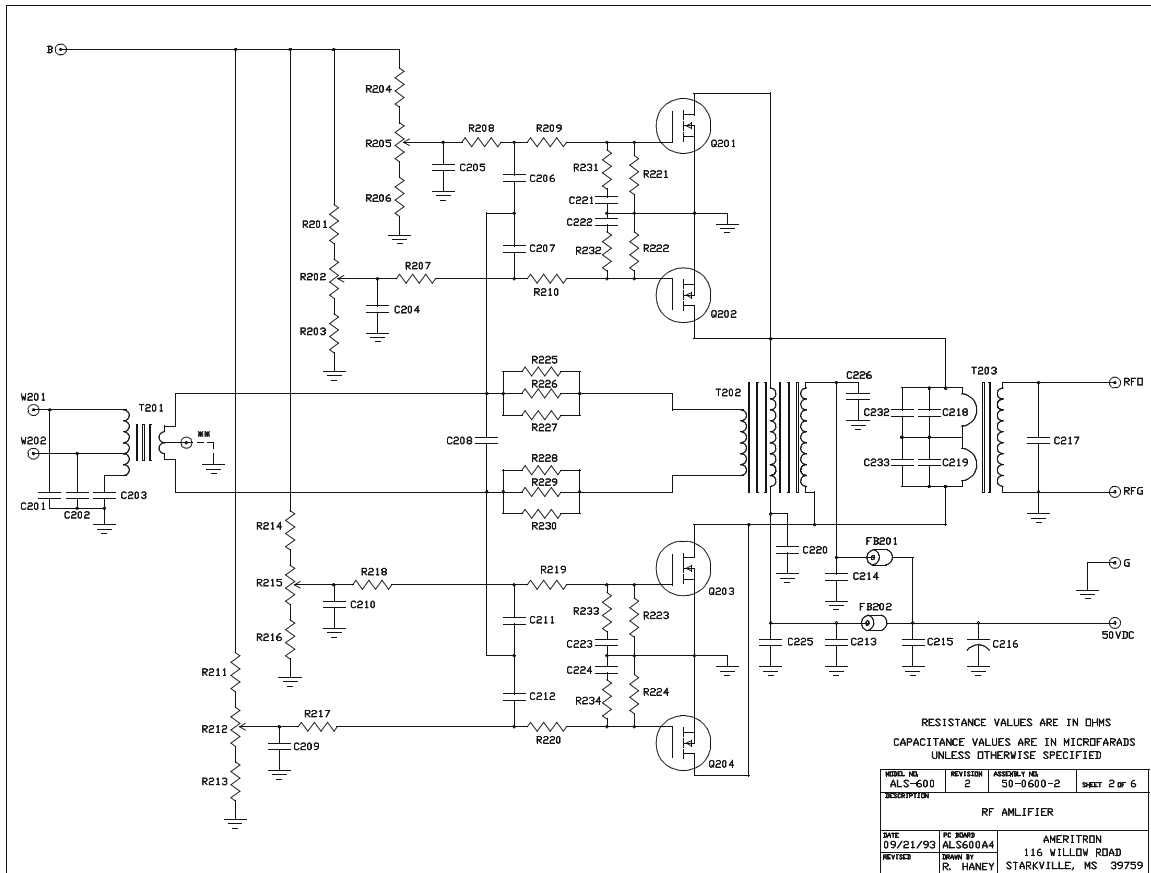
Designator	Description	Part number
C101,102,104,105,109, 107,112-115,117-123	.01 uF 50V disc	200-0416
C103,106	2.2 uF 50V radial lead electrolytic	203-0225
C108,116	47 uF 50V tantalum	203-0530
C110,111	not used	
D101	not used	
D102-105,107	1N34A diode	300-0346
D106	5.1V 1/2W Zener diode 1N4734	301-4734
IC101	quad op-amp LM324N	311-0324
IC102	8V REG 75L08ACP	307-0012
IC103	dual op-amp LM358AN	311-0725
J103	2 pin header	612-0102
J104,105	8 pin header	612-0108
J106	10 pin header	612-0110
Q101,102	2N3904	305-0645
R101,106,115	4.7K 1/2 watt	101-3470
R102	1M 1/4 watt	100-6100
R103,107	470K 1/4 watt	100-2470
R104,105,108,113	22K 1/4 watt	100-4220
R109	50K trim pot	104-0400
R110	5K trim pot	104-5020
R111,119,120,123,127	10 ohm 1/2 watt	101-1100
R112	3.3K ohm 1/4 watt	100-3330
R114	6.8K 1/4 watt	100-3680
R115	100K ohm 1/4 watt	100-5100
R116	1M ohm 1/4 watt	100-5220
R117,118,125	1K 1/4 watt	100-3100
R121	33 ohm 1/2 watt	101-1330
R122	2.2K 1/4 watt	100-3200
R124	1K ohm 1/4 watt	100-6100
R126	470 ohm 1/4 watt	100-2470



PA Board

50-0600-2

Designator	Description	Part Number
C201-203,217	not used	
C204-207,209-212	.1 uF 50V disc	200-0745
C208	470 pF 500V DM 15	208-5440
C213,214,220-226	.33 uF 100V multiplier	205-1334
C215	47 uF 100V mylar	201-1474
C216	100 uF 100V radial lead electrolytic	203-1007
C218,219,232,233	360 pF 500V	208-5688-1
FB201,202	ferrite bead w/Teflon sleeving	403-0508
Q201-204	MRF-150 RF TMOS FET	305-6150
R201,204,214,211	3.3K 1/4 watt	100-3330
R202,205,212,215	5K trim pot	104-2520
R203,206,213,216,221-224	1K 1/2 watt	100-3100
R207,208,217,218,231-234	18 ohm 1/2 watt	101-1180
R209,210,219,220	1 ohm 1/2 watt	101-1010
R225-230	22 ohm 2 watt MOX	103-2220
T201	input transformer	406-2600
T202	feedback transformer	406-2601
T203	output transformer pair	406-2602

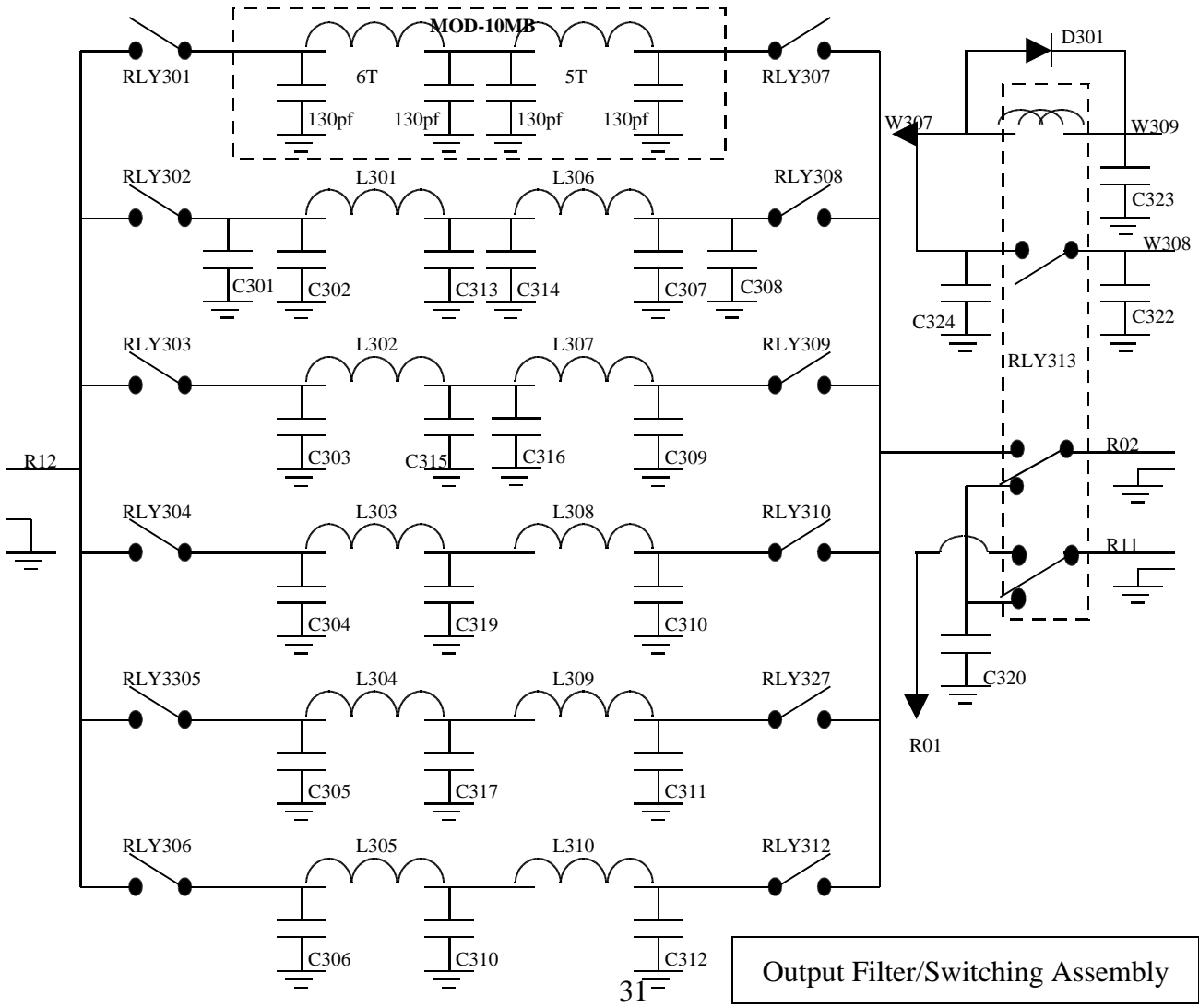
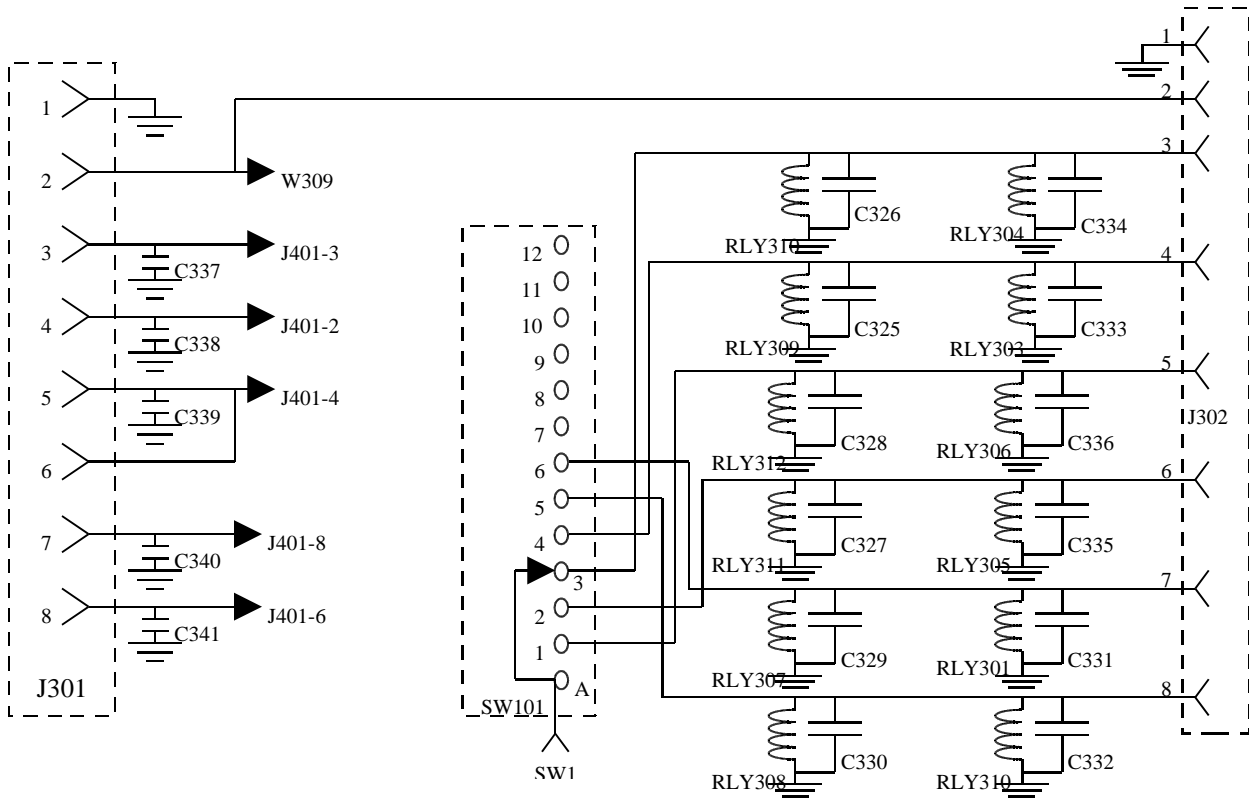


Output Filter Board

50-0600-3

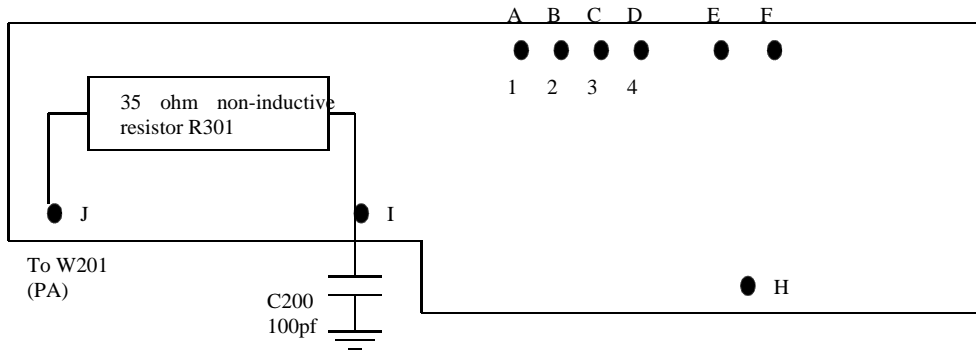
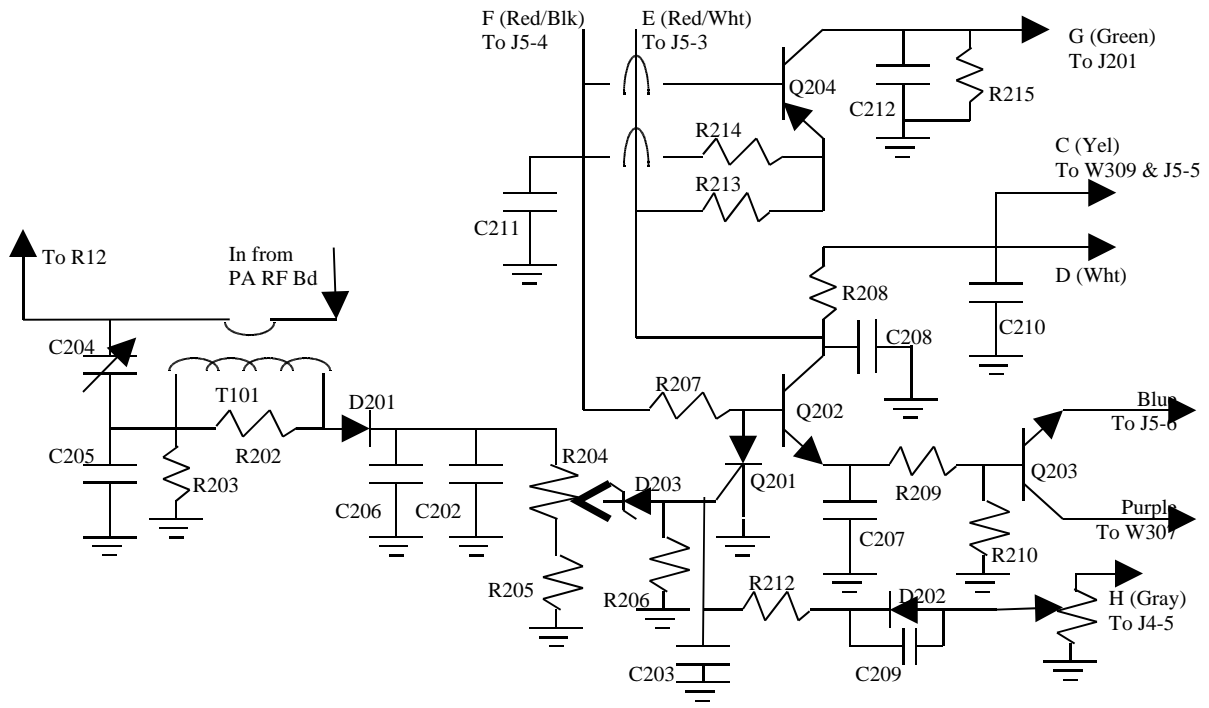
Designator	Description	Part Number
C301,308	not used	
C302,307	180 pF* 1000V SM-19	252-0180
C303,309	270 pF* 1000V SM-19	252-0270
C304,310	360 pF* 1000V SM-19	252-0360
C305,311,319	680 pF* 1000V SM-19	252-0680
C306,312,317	1500 pF* 1000V SM-19	252-1150
C313,314	160 pF* 1000V SM-19	252-0160
C315,316	220 pF* 1000V SM-19	252-0220
C318	2700 pF* 1000V SM-19	252-1270
C320	100 pF 500V mica	
C321-341	.01 uF 100V disc	200-2100-1
L301,306	8.5 turn 1/2" ID air wound	10-13850
L302,307	8 pass toroid	10-14168
L303,308	10 pass toroid	10-14161
L304,309	14 pass toroid	10-14214
L305,310	22 pass toroid	10-14222
J301,302	Jack, RJ45/641	610-6028
RLY313	3PDT 12 Vdc coil relay	408-6140
RLY301-312	1PDT 12VDC relay	408-1216
R01	35 ohm 50 watt non-inductive resistor	103-2230
SW301	bandswitch	SW25000448
	10-pin header connector	612-0810
	10-pin input/output connector	612-2010

- Critical components.



862-ALS600-9 Rev 0

R202	82 ohm 1/2 watt	101-1820
R203	3.3K 1/4 watt	100-3330
R204	2.5K sub horz. Trimpot	104-2520
R205	2.2K 1/4 watt	100-3220
R206	10K ohm 1/4 watt	100-4100
R207	470 ohm 1/4 watt	100-2470
R208	10 ohm 1/2 watt	101-1100
R209	1K 1/4 watt	100-3100
R210, R214, R215	10K 1/4 watt	100-4100
R211	50K trim-pot	
R212	3.3K 1/4 watt	
R213	100 ohm 1/4-watt	
C202	0.33uf	
C204	3-12 pF 500V trim cap	204-0150
C205	150 pF 500V DM15	208-5396
C203, 206-212	0.01uf 100V ceramic disk capacitor	200-2100-1
Q201	2N6564	321-6564
Q202,203	2N3904	305-0645
Q204	MPS A92	
D201	1N270	
D202	1N4007	300-4007
D203	1N752A	
T101	SWR Transformer	



LED Board

50-0600-4

Designator

CR401

CR402

CR403

J401

R401

R402

Description

Green LED

Yellow LED

Red LED

10 pin header

470 ohm 1/4 watt

1K potentiometer

Part Number

320-0500

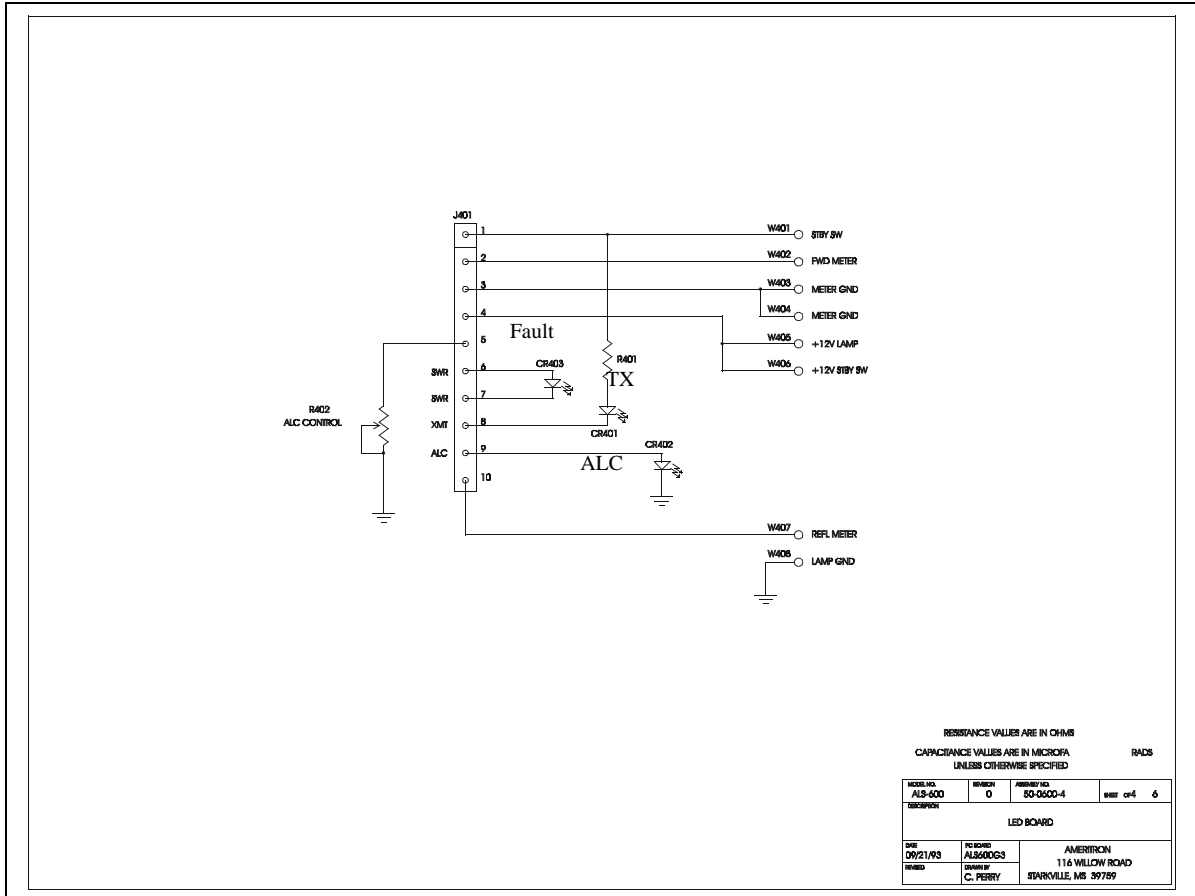
320-0300

320-0522-1

612-0110

100-2470

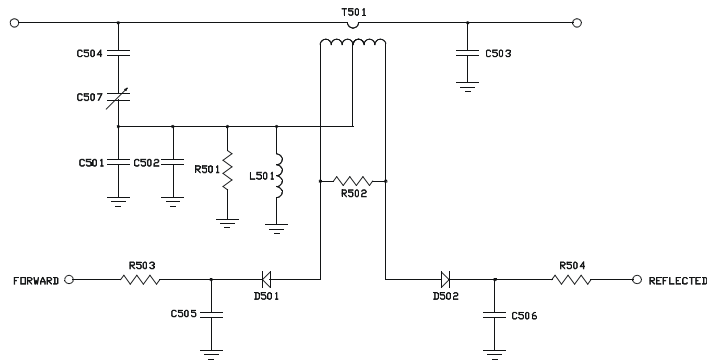
105-1301



SWR Detect Board

50-0600-5

Designator	Description	Part Number
C501,502	150 pF 1KV disc cap	200-2150
C503	not used	
C504	33 pF 1KV Disc	200-2033
C505,506	.01 uF 50 Vdc	200-0416
C507	3-12 pF 500V TrimCap	200-0416
D501,502	1N34A or equiv.	300-0346
R501	3.3K 1/4 watt	100-3330
R502	68 ohm 2 watt mox	103-6800
R503,504	not used	
T501	Pickup Toroid	10-14136

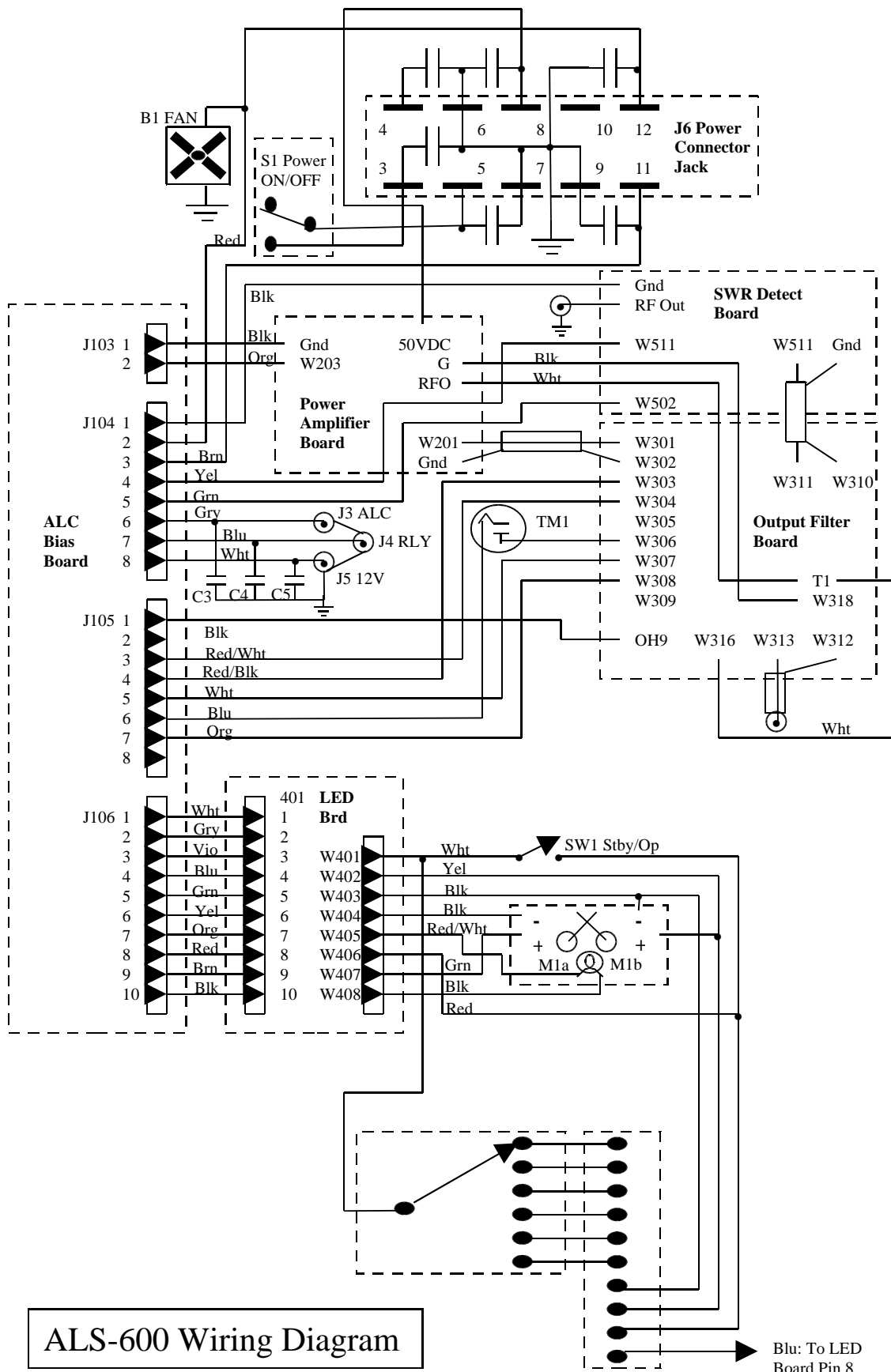


RESISTANCE VALUES ARE IN OHMS
CAPACITANCE VALUES ARE IN MICROFARADS
UNLESS OTHERWISE SPECIFIED

MODEL NO.	REVISION	ASSEMBLY NO.	SHEET
ALS-600	0	50-0600-5	5 of 6
DESCRIPTION			
SWR DETECTOR			
DATE	PC BOARD	AMERITRON	
09/21/93	MSWRDC_0	116 WILLOW ROAD	
DESIGNED BY	DRAWN BY	STARKVILLE, MS 39759	
C. PERRY			

ALS-600 Chassis Components

Designator	Description	Part Number
B1	4.5" fan, 12VDC	410-3132
for B1	fan filter screen	410-4600
C1-C5	.01 50V disc capacitor	200-2100-1
C6-C7	.01 250Vac capacitor	200-2100-2B
C8	.01 KV disc capacitor	200-2100-2C
J1,J2	SO-239 jacks	610-2005T
J3-J5	phonojacks	600-1003
J6	Power connector plug	610-5012
M1a, M1b	1000W/250W cross needle meter	400-3588
R1	1K Potentiometer	162-3100-1
R2	470 Ohm 1/4 Watt resistor	100-2470
SW1,SW2	rocker switch	507-1151
TM1	Thermal overload switch	590-1160



ALS-600 Wiring Diagram

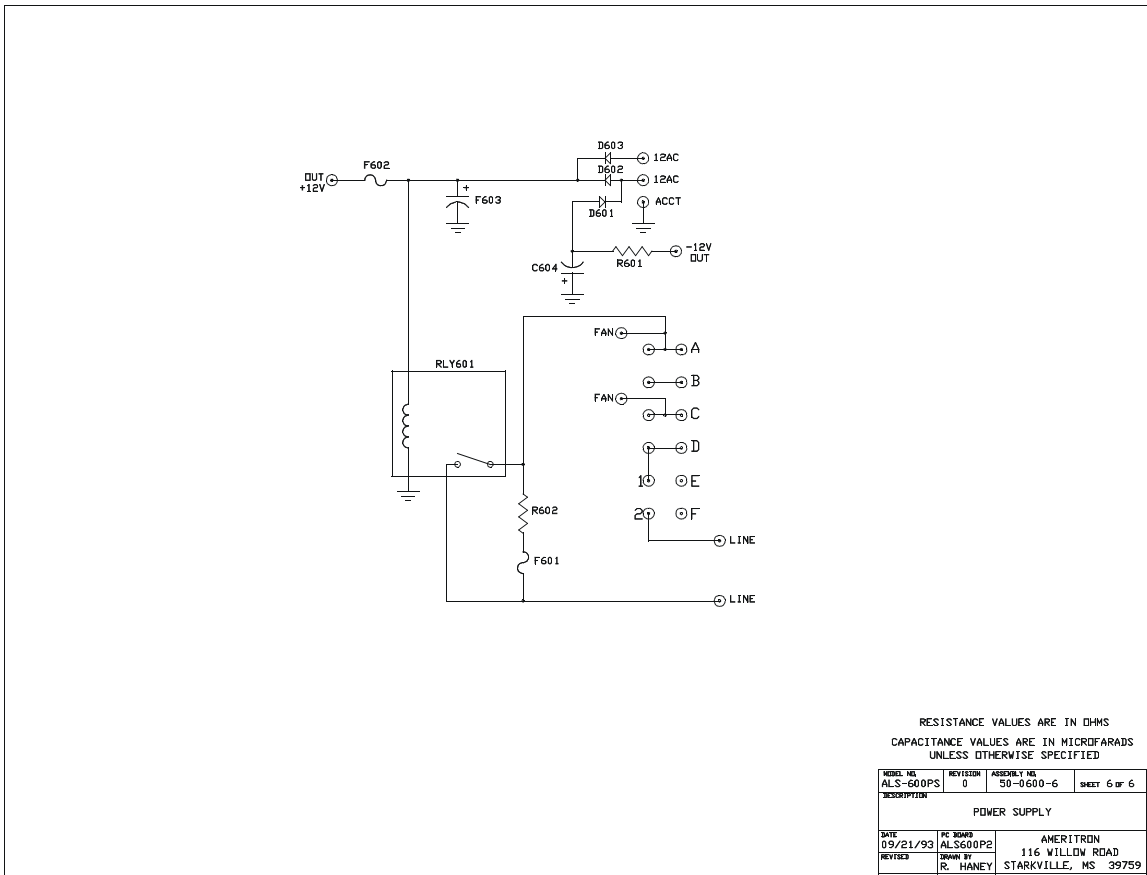
Blu: To LED Board Pin 8

ALS-600PS PARTS LISTS & SCHEMATICS

Power Supply Board

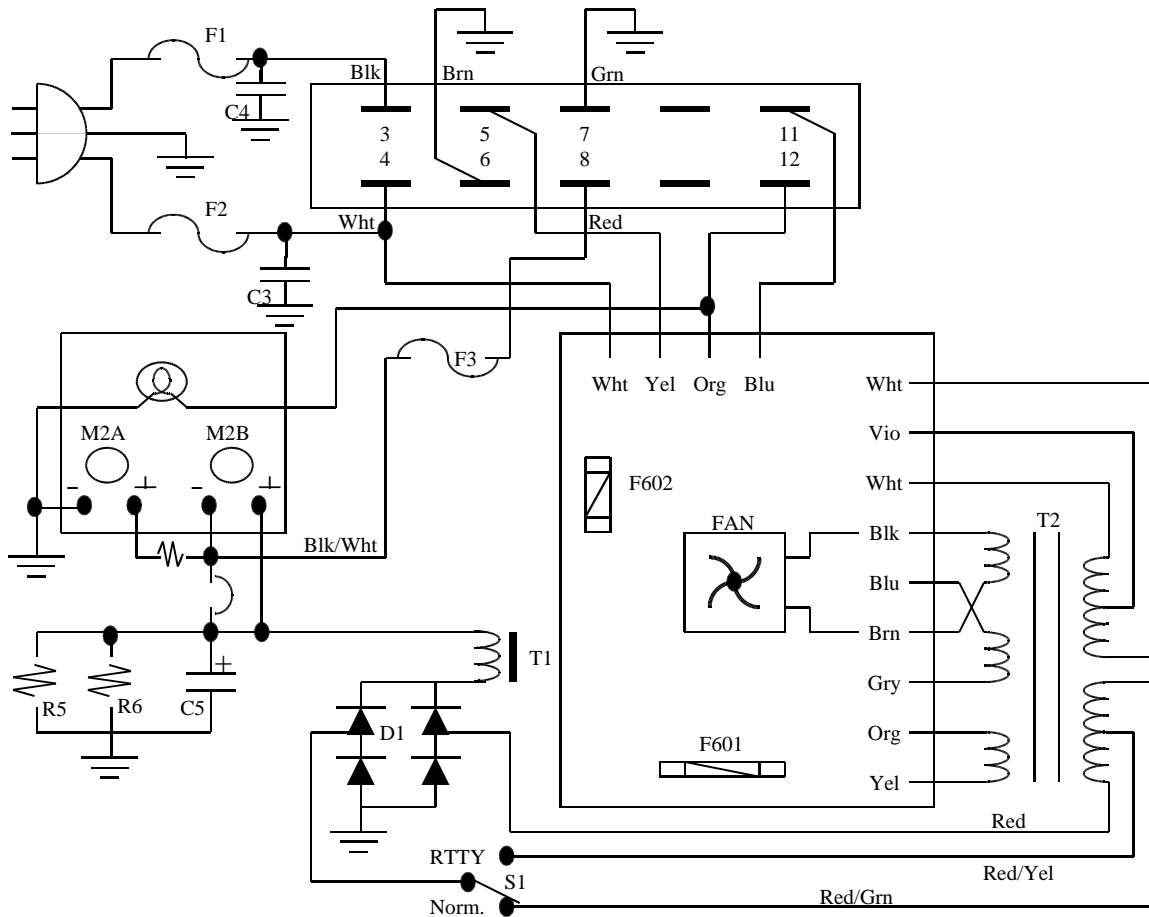
50-0600-6

Designator	Description	Part Number
C603	2200 uF 25V radial lead	203-0207
C604	220 uF 25V radial lead	203-0565
D601-603	1N4007 or equiv.	300-0266
F601	2 amp slow blow NIDL type	755-1102
F602	2 amp fast blow	755-1150
R601	10 ohm 1/2 watt	101-1100
R602	10 ohm 10 watt	103-9702
RLY601	12Vdc SPST NO relay	408-6148

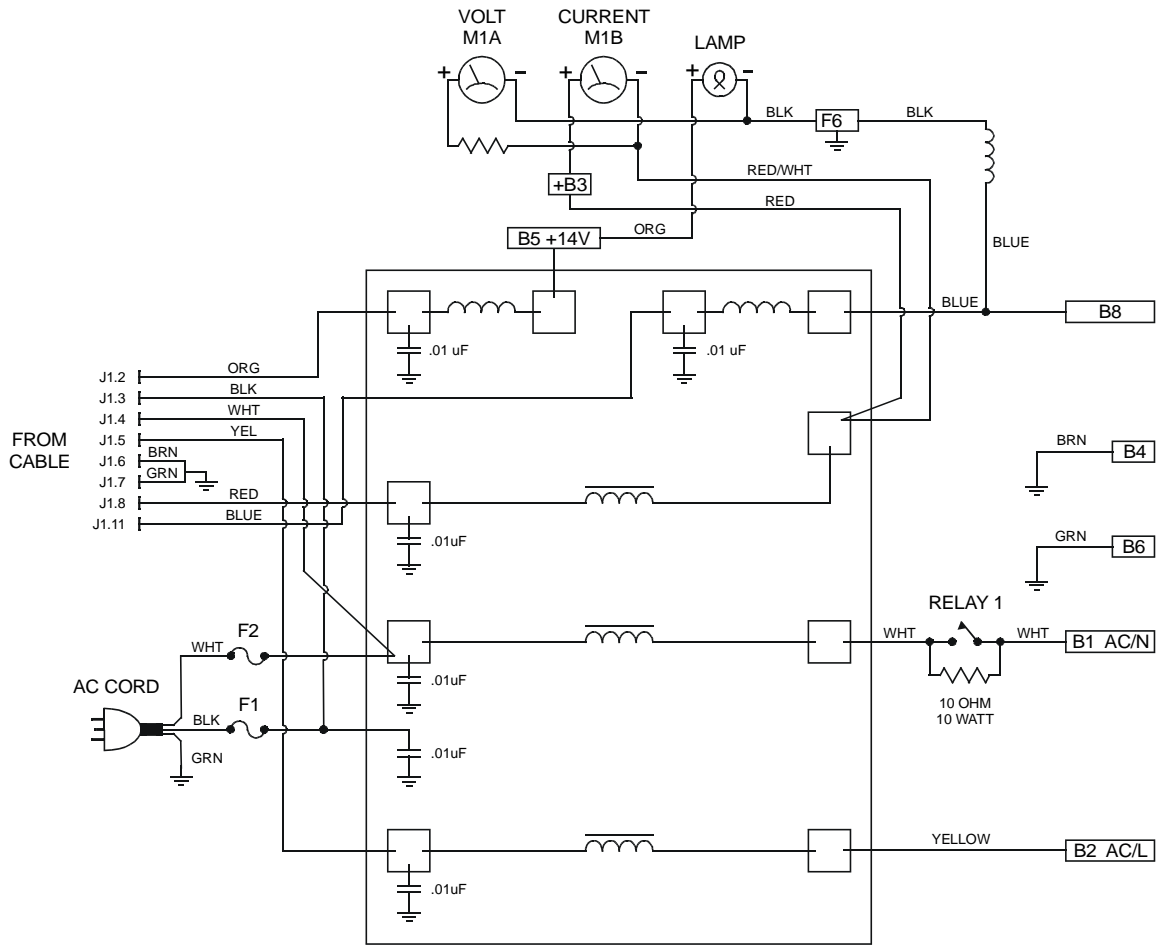


ALS-600PS Chassis Components

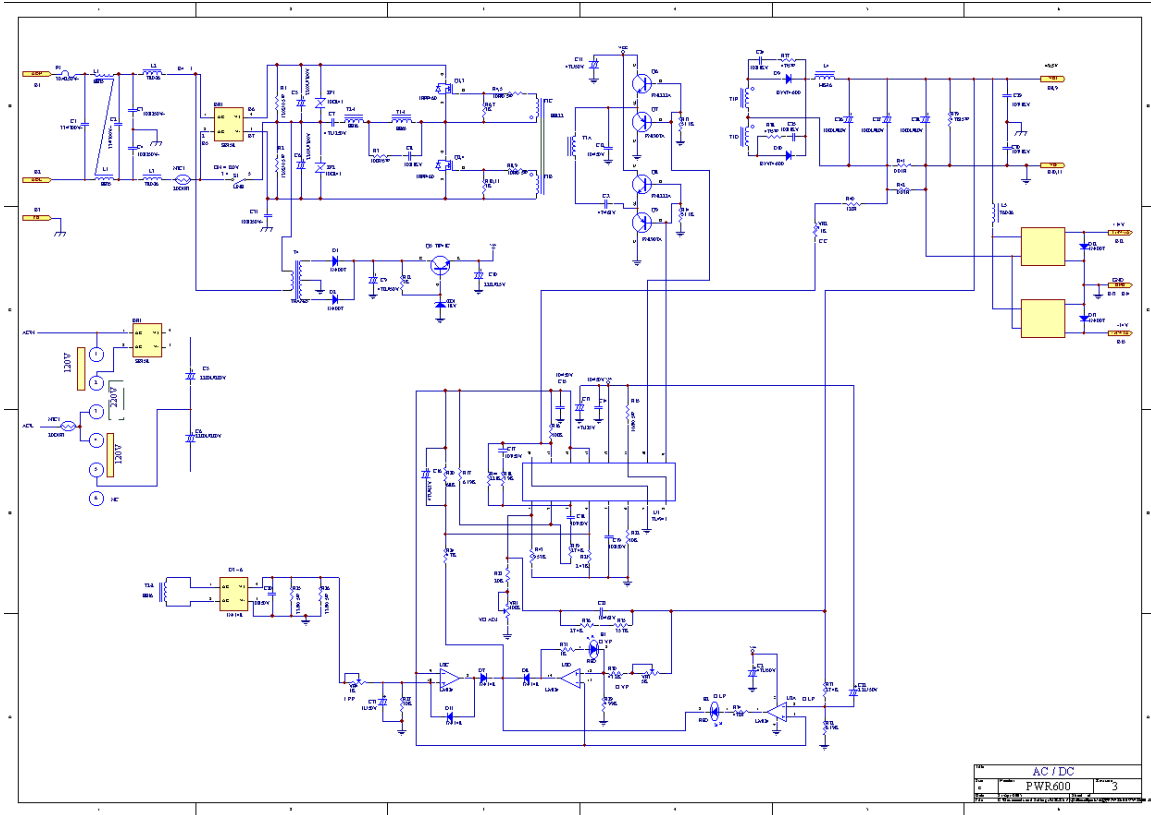
Designator	Description	Part Number
B2	3" muffin fan	410-3583
for B2	fan guard	410-4584
C5	27000 uF 75 Vdc capacitor & mounting bracket	270-8270-2 735-0159
C3,4	.01 uF 250 Vac disc capacitor	200-2100-1B
D1	50 amp bridge rectifier	300-9200
F601	2 amp slowblow IvIDL type	755-1102
F602	2 amp AGC	755-0102
F1,2	15 amp fuses for 95-110 Vac, 12 amp fuses for 105-130 Vac or 8 amp fuses for 200-240 Vac operation	755-0115-1 755-1112-1 755-0108-1
F3	25 amp high voltage	755-0125-1
for F3-5	chassis mount fuse holders	755-2148
M2a, M2b	dual needle 60 volt / 25 ampere scale	400-3600
P1	Power supply plug	610-6012
R3	200K 1/4 watt resistor	100-5300
R5,6	100 ohm 50 watt resistor	113-2100-1
T1	choke	406-1646
T2	power transformer	406-1246
S1	2P2P Switch	507-1262



ALS-600SPS Wiring diagram



ALS-600SPS Schematic



DISCLAIMER

Information in this manual is designed for **user purposes only** and is *not* intended to supersede information contained in customer regulations, technical manuals/documents, positional handbooks, or other official publications. The copy of this manual provided to the customer will *not* be updated to reflect current data.

Customers using this manual should report errors or omissions, recommendations for improvements, or other comments to Ameritron 116 Willow Road, Starkville, MS 39759. Phone: (662) 323-8211; FAX: (662) 323-6551. Business hours: M-F 8-4:30 CST.

AMERITRON

**116 Willow Road
Starkville, MS 39759 USA
662-323-8211**

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.
- (2) Misuse, abuse, neglect or improper installation.
- (3) Accidental or intentional damage.

All implied warranties, if any, terminate one (1) year from the date of the original purchase.

The foregoing constitutes Ameritron's entire obligation with respect to this product, and the original purchaser and any user or owner shall have no remedy and no claim for incidental or consequential damages. Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental or consequential damage, so the above limitation and exclusion may not apply to you.

This warranty gives specific legal rights and you may also have other rights, which vary from state to state.