AirWave™

AIRWAVE™ DIGITAL

AirWave Universal Power Supply

(99-1016-1 & 99-1016-1X)

Technical Manual

PR&E 75-43

Revision A • 6/00

HARRIS

Broadcast Communications Division

The AirWave Universal Power Supply

Safety Instructions

1. **Read All Instructions.** All safety and operating instructions must be read before operating the product.

2. **Retain All Instructions.** All safety and operating instructions must be retained for future reference.

3. **Heed All Warnings.** All warnings on the product and those listed in the operating instructions must be adhered to.

4. **Follow All Instructions.** All operating and product usage instructions must be followed.

5. **Heat.** This product must be situated away from any heat sources such as radiators, heat registers, stoves, or other products (including power amplifiers) that produce heat.

6. **Ventilation.** Slots and openings in the product are provided for ventilation. They ensure reliable operation of the product, keeping it from overheating. These openings must not be blocked nor covered during operation. This product should not be placed into a rack unless proper ventilation is provided through following the manufacturer's recommended installation procedures.

7. **Water and Moisture.** Do not use this product near water—for example; near a bath tub, wash bowl, kitchen sink or laundry tub; in a wet basement; or near a swimming pool or the like.

8. **Attachments.** Do not use any attachments not recommended by the product manufacturer as they may cause hazards.

9. **Power Sources.** This product must be operated from the type of power source indicated on the marking label and in the installation instructions. If you are not sure of the type of power supplied to your facility, consult your local power company.

10. **Grounding and Polarization.** This product is equipped with a polarized AC plug with integral safety ground pin. Do not defeat the safety ground in any manner.

11. **Power Cord Protection.** Power supply cords must be routed so that they are not likely to be walked on nor pinched by items placed upon or against them. Pay particular attention to the cords at AC wall plugs and convenience receptacles, and at the point where the cord plugs into the product.

12. **Lightning.** For added protection for this product during a lightning storm, or when it is left unattended and unused for long periods of time, unplug it from the AC wall outlet. This will prevent damage to the product due to lightning and power line surges.

13. **Overloading.** Do not overload AC wall outlets, extension cords, or integral convenience outlets as this can result in a fire or electric shock hazard.

14. **Object and Liquid Entry.** Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short-out parts that could result in a fire or electric shock. Never spill liquid of any kind on the product.

15. **Accessories.** Do not place this product on an unstable cart, stand, tripod, bracket, or table. The product may fall, causing serious damage to a child or adult, and serious damage to the product. Any mounting of the product needs to follow manufacturer's installation instructions.

16. **A Product and Cart Combination** should be moved with care. Quick stops, excessive force, and uneven surfaces may cause the product and the cart combination to overturn.

17. **Servicing.** Refer all servicing to qualified servicing personnel.

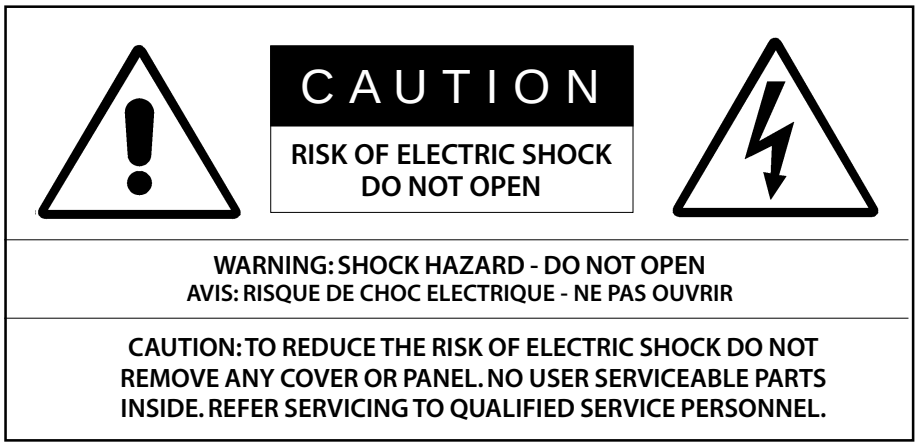
18. **Damage Requiring Service.** Unplug this product from the wall AC outlet and refer servicing to qualified service personnel under the following conditions:
    a. When the AC cord or plug is damaged.
    b. If liquid has been spilled or objects have fallen into the product.
    c. If the product has been exposed to rain or water.
    d. If the product does not operate normally (following operating instructions).
    e. If the product has been dropped or damaged in any way.
    f. When the product exhibits a distinct change in performance. This indicates a need for service.

19. **Replacement Parts.** When replacement parts are required, be sure the service technician has used replacement parts specified by the manufacturer or that have the same characteristics as the original parts. Unauthorized substitutions may result in fire, electric shock, or other hazards.

20. **Safety Check.** Upon completion of any repairs to this product, ask the service technician to perform safety checks to determine that the product is in proper operating condition.

21. **Cleaning.** Do not use liquid cleaners or aerosol cleaners. Use only a damp cloth for cleaning.

Hazard / Warning Label Identification



WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THE POWER SUPPLY OR CONSOLE TO RAIN OR MOISTURE.

The **Exclamation Point symbol**, within an equilateral triangle, alerts the user to the presence of important operating and maintenance (servicing) instructions in product literature and instruction manuals.

The **Lightning Flash With Arrowhead symbol**, within an equilateral triangle, alerts the user to the presence of uninsulated dangerous voltage within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock.

WARNING—This equipment generates, uses and can radiate radio frequency energy. If not installed and used in accordance with the instructions in this manual it may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device (pursuant to Subpart J of Part 15 FCC Rules), which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

General Information

The power supply delivers five regulated output voltages (+5 volts, +12 volts, +16 volts, -16 volts and +45 volts) for use by the AirWave or AW Digital console and condenser microphones.

SPECIFICATIONS

Console Power Requirements
AirWave-12: 150 watts
AirWave-20: 200 watts
AW Digital-12: 200 watts
AW Digital-20: 250 watts
(Fully loaded with standard modules, measured at 115 VAC, ±8%, 50/60 Hz*)*

Maximum Operating Temperature
<40ºC (104ºF) ambient, near heat sink

Main fuse rating
2.25 amps @ 115 VAC (UL)
1.25 amp @ 230 VAC (IEC)

Output voltages

Phantom power:	+45 VDC @ 0.100 Amp
Audio power:	±16 VDC @ 1.00 Amp (each)
Logic power:	+5 VDC @ 6.5 Amps
	+12 VDC @ 4.0 Amps

Ground
Chassis grounded through AC cord. DC voltages floating from chassis.

Power Connection
AC input: 6 foot IEC cord
DC output: Keyed multi-pin connector

Chassis Size
7" H x 14" W (with rack face, 19"W) x 13" D (including rear heat sink)

WARRANTY INFORMATION

The AirWave Universal Power Supply carries a manufacturer's warranty which is subject to these guidelines and limitations:

A) Except as expressly excluded herein, Harris Corporation ("Seller") warrants equipment of its own manufacture against faulty workmanship or the use of defective materials for a period of one (1) year from date of shipment to Buyer. The liability of the Seller under this Warranty is limited to replacing, repairing or issuing credit (at the Seller's discretion) for any equipment, provided that Seller is promptly notified in writing within five (5) days upon discovery of such defects by Buyer, and Seller's examination of such equipment shall disclose to its satisfaction that such defects existed at the time shipment was originally made by Seller, and Buyer returns the defective equipment to Seller's place of business in Carlsbad, California, packaging and transportation prepaid, with return packaging and transport guaranteed.

B) Equipment furnished by Seller, but manufactured by another, shall be warranted only to the extent provided by the other manufacturer.

C) Thermal filament devices (such as lamps and fuses) are expressly excluded from this warranty.

D) The warranty period on equipment or parts repaired or replaced under warranty shall expire upon the expiration date of the original warranty.

E) This Warranty is void for equipment which has been subject to abuse, improper installation, improper operation, improper or omitted maintenance, alteration, accident, negligence (in use, storage, transportation or handling), operation not in accordance with Seller's operation and service instructions, or operation outside of the environmental conditions specified by Seller.

F) This Warranty is the only warranty made by Seller, and is in lieu of all other warranties, including merchantability and fitness for a particular purpose, whether expressed of implied, except as to title and to the expressed specifications contained in this manual. Seller's sole liability for any equipment failure or any breach of this Warranty is as set forth in subparagraph A) above; Seller shall not be liable or responsible for any business loss or interruption, or other consequential damages of any nature whatsoever, resulting from any equipment failure or breach of this warranty.

Installation

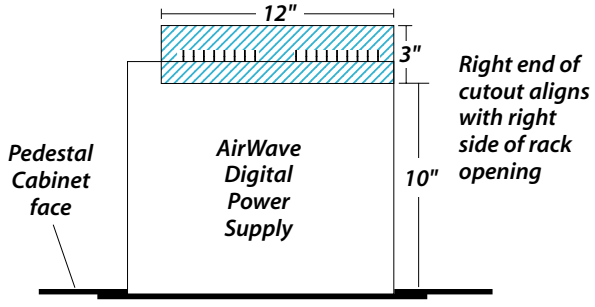
The AirWave Universal Power Supply (AUPS) uses seven inches of EIA rack space. It is convection cooled to eliminate fan noise and the associated dust buildup caused by a fan.

There are no front panel controls or indicators on the AUPS. The supply is designed to be turned on, and left turned on, for the life of the product. The power switch is on the rear panel, just above the AC input connector. The console's DC cable connects using a single locking and keyed Molex connector, also on the back panel.

The cabinetry must allow for sufficient airflow to convection cool the AUPS. This can be done by installing the AUPS above the cabinet floor and by using 1¾ inch ventilation panels to fill one rack space immediately above and below the AUPS. When mounted at the cabinet floor, a 12" x 3" ventilation cutout is required.

The mounting of electronic equipment below the AUPS is not recommended.

Convection Cooling Cutout for the Power Supply Heat Sinks



GENERAL GUIDELINES

Locate the rear panel of the AUPS within six feet of an orange-colored isolated-ground AC mains wall outlet. This outlet must supply 115 VAC or 230 VAC (±8%), 50/60 Hz at a minimum of 3 amperes without sagging. Plugging the AUPS into an extension cord or outlet strip is not recommended. Longer IEC power cords are available for direct connection of the AUPS to the wall outlet. The third-pin "U-ground" on the AC cord must always be connected to the wall outlet for safety.

Note: Route the AC cord as far as possible from all audio wiring. In no case should the AC cord parallel any audio wiring. If audio wires must be in close proximity to the AC cord, route them to cross the cord at a 90º angles.

The DC power cable is hard-wired to the console's motherboard with a keyed multi-pin Molex connector that mates with the rear panel connector on the AUPS. Since this cable carries only DC voltage, there are no special requirements for routing near audio cabling.

Keep all audio devices a minimum of six inches from the AUPS chassis, as hum from the power transformer's magnetic field could be coupled into the audio device.

POWER SUPPLY CONNECTION

Connect the mainframe to the power supply **before** plugging in and turning on the supply. Since the unit is designed for 24-hour-a-day operation, the mains AC switch is on the AC input housing.

Turning on the supply will illuminate the clock/timer display and the Off lamps on the modules.

REDUNDANT SUPPLY USAGE

The Redundant Power Supply Coupler Unit (99-1074) is used whenever redundant power supply protection is desired. The Coupler uses diodes to combine the DC output voltages from two power supplies with the higher voltage of the two supplying the majority of the current to the console. In the event of a voltage failure, redundant power is instantaneously supplied from the second supply and the Coupler's Remote Power Fail Indicator is illuminated.

The Coupler should be installed between the two console power supplies. It is interconnected using the two cables supplied with the coupler. The power supplies and console connect directly to the coupler's rear panel connectors.

The high current diodes in the coupler have a very low forward voltage drop and, therefore, do not add significantly to the power supply system's heat dissipation. However, the second power supply in a redundant system does add approximately 50 watts of heat due to the excitation current consumed by the power transformers.

Equipment Description

Refer to the power supply schematics in the following discussion of the power supply components.

POWER SUPPLY PROTECTION

The power supply is protected by:

- an AC mains fuse in the power switch module,
- auto-resetting thermal breakers in the transformer,
- fuses on the transformer's critical secondaries,
- using self-protecting current-limiting regulators.

CIRCUIT DESCRIPTION

AC power is applied to the AUPS through a power entry module containing the power switch, the AC mains fuse and a power line filter.

The power transformer has four secondary windings. Three are wired to bridge rectifiers (CR1, CR2, CR3) and filter caps mounted to the chassis floor. The fourth secondary connects to a bridge rectifier (CR6) and filter caps on the regulator circuit card.

All voltage regulators fasten to the two heat sinks. Each is mounted at the rear edge of the circuit card.

The DC output voltages provided are:

- +5 volts @ 6.5 A for the console logic circuits
- +12 volts @ 4.0 A for the clock/timer and lamps
- ±16 volts @ 1.0 A each for the audio circuits
- +45 volts @ 0.10 A for condenser microphones.

The +5 volt (U2) and +12 volt (U1) regulator circuits are identical, with only their output voltage divider resistor values being different. The ±16 volt regulator circuit (U3 and U4) employs a dual voltage tracking device (U5) to monitor the regulated voltage outputs. If either voltage drops, the other will follow, keeping the two voltages equal.

The microphone phantom voltage supply uses a pass-transistor design (Q1, Q2, CR5). Zener diode CR5 clamps the base voltage of Q1 and the collector of Q2 to a maximum of +47 volts. Q1 and Q2 automatically adjust the current, keeping the supply voltage constant. The nominal output voltage will typically be +45 volts.

Maintenance & Service

The only maintenance requirements for the AUPS is to periodically check that the vent openings on the top of the chassis are not blocked and that there is no dust buildup on the heat sink fins. There are no user-serviceable components inside the power supply. *Refer all internal servicing to qualified service personnel.*

MAINS FUSE REPLACEMENT

The only user field-replaceable component is the mains fuse. It is located within the power entry module on the rear of the chassis. The AC cord must be unplugged from the power entry module to access the fuse.

Use a small flatblade screwdriver to pry open the top of the module's coverplate. This will hinge down out of the way to reveal the red fuse holder labeled PRSR. Note the orientation of the text on the fuse holder (115V or 230V) before extracting it from the switch module.

Caution: For continued protection against the risk of fire, replace only with the same type of fuse.

For 115 VAC systems, use only a 2.25 amp slo-blo 3AG 250 volt UL-type fuse.

For 230 VAC systems, use only a 1.25 amp slo-blo 250 volt IEC-approved fuse.

Reinstall the fuse holder in the same orientation as removed. Verify that the line voltage in use appears in the cutout after the module's coverplate is snapped back into place.

Make sure that the power switch is in the off position (**O**) and then insert the AC cord. Plug the AC cord into the AC socket, then switch the supply on (**1**).

If the fuse immediately blows again, switch the power supply off, then unplug the DC power cable to isolate the power supply from the console. Replace the fuse and switch the power supply on.

If this fuse blows, a serious problem is indicated within the power supply. If the fuse does not blow, then a problem exists within the console or mainframe. In either case, refer further servicing to qualified service personnel.

Caution: The following servicing instructions are for use by qualified service personnel only. To reduce the risk of electric shock, do not perform any servicing, other than the mains fuse replacement, unless you are qualified to do so.

Refer all internal servicing to qualified service personnel.

INTERNAL FUSE REPLACEMENT

There are three internal fuses protecting the power transformer's secondaries. F2 (1A, 3AG slo-blo) is in the +48 volt supply while F3 and F4 (both 5A, 3AG slo-blo) are in the + and -16 volt supply, respectively. To access these fuses, unplug and remove from the power supply from the rack and remove the top cover.

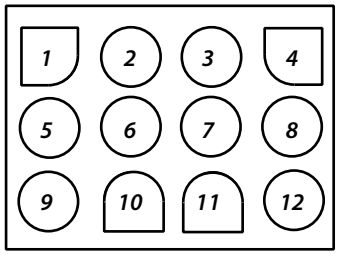
Caution: Replace these fuses only with the same rating and type fuse.

POWER SUPPLY SERVICING

There are no voltage adjustments in the power supply. Output voltages are set through resistive voltage dividers on the control pins of the voltage regulators. If the power supply is plugged into a known good AC outlet and the power switch is on, yet all console lamps and LEDs are off, most likely the AC mains fuse has blown.

If that fuse is good, suspect that one of the thermal breakers in the transformer has been activated. The thermal breakers will reset once the temperature drops in the transformer (which may take up to half an hour). This indicates there is insufficient airflow around the power supply or that excessive current is being drawn by the mainframe.

Power Supply Voltage Test Points



Molex Power Connector, rear panel view

Molex Connector Voltages

PIN	SIGNAL	WIRE COLOR
1	*+45 V, phantom*	*Green/Black*
2	*+16 V, audio*	*Red*
3	*Phantom GND*	*Green*
4	*Audio GND*	*Black*
5	*Audio GND*	*White*
6	*-16 V, audio*	*White/Black*
7	*+12 V, Lamps*	*Red/Black*
8	*+5 V, Logic*	*Orange*
9	*Logic GND*	*Blue*
10	*Boost V*	*N/A*
11	*16V HI-Z*	*N/A*
12	*No Connection*	*N/A*

In either case, unplug the mainframe power cable before turning the supply on again. Then measure the output voltages on the rear panel Molex connector. If any voltages are out of tolerance or missing, it indicates a circuit failure in the power supply.

Note: The + and -16 volt regulators track one another, so both will be at the same voltage. Additionally, the transformer secondaries feeding these regulators are fused internally.

To service the supply, unplug the AC cord and remove the power supply from the rack mount. Remove the top cover. The regulator board is vertically mounted to the heat sink at the rear of the supply. Servicing of the regulator components can be accomplished only with the circuit board removed.

CIRCUIT BOARD REMOVAL

To remove the circuit board:

1) Disconnect the internal Molex connector attached to the circuit card.
2) Detach the circuit card/heat sink assembly from the chassis by removing all associated rear panel screws.
3) Remove the circuit card mounting and regulator-to-heat sink screws.
4) Depress the rear panel Molex connector mounting ears, then carefully separate the circuit card from the heat sink.

When replacing any of the regulators, first reattach the circuit board to the heat sink assembly. This assures proper alignment of the device mounting holes with the heat sink before soldering.

SERVICING THE 16 VOLT REGULATOR CIRCUIT

A problem in either the + or -16 volt regulator circuit will cause both circuits to react the same as the two track one another's output voltage.

Output tracking is used to prevent damage to audio circuit components through unbalanced supply voltages. While troubleshooting, if unplugging the mainframe did not change the fault condition—typically low voltage on both ±16 volt outputs, then the voltage tracking must be disabled.

Follow these steps to disable voltage tracking to service either the + or -16 volt regulator circuit:

1) Unplug and remove the supply from the rack, and remove the top cover.

2) Defeat the ±16 volt output tracking by removing opto-coupler U5 from its IC socket.

3) Turn the supply back on and re-measure the 16 volt outputs to determine which regulator circuit is faulty.

4) Repair the faulty regulator and then verify both ±16 volts are present on the outputs.

5) Replace U5, and retest the ±16 volts, before reconnecting the console to the supply.

AIRWAVE UNIVERSAL POWER SUPPLY (99-1016-1 & 99-1016-1X) PARTS LIST

P/N	Reference #	Part Description
1-3.83	*R7*	*3.83 ohm resistor, 1/4 watt*
1-38.30	*R14*	*38.3 ohm resistor, 1/4 watt*
1-1000	*R1, R6, R15*	*100 ohm resistor, 1/4 watt*
1-1001	*R3*	*1K resistor, 1/4 watt*
1-1002	*R12, R13*	*10k resistor, 1/4 watt*
1-1211	*R8, R11*	*1.21k resistor, 1/4 watt*
1-1372	*R20*	*13.7k resistor, 1/4 watt*
1-2370	*R5, R10*	*237 ohm resistor, 1/4 watt*
1-3321	*R4*	*3.32k ohm resistor, 1/4 watt*
1-3402	*R9*	*34k resistor, 1/4 watt*
1-3651	*R19*	*3.65k resistor, 1/4 watt*
1-4991	*R21, R22*	*4.99k resistor, 1/4 watt*
1-8870	*R2, R23*	*887 ohm resistor, 1/4 watt*
3-472	*R18*	*4.7k resistor, 1/2 watt*
4-102	*R16, R17*	*1k resistor, 1 watt*
7-24	*Q2*	*MPSA06, NPN transistor*
7-32	*Q1*	*TIP122, Darlington transistor*
11-17	*CR1-4*	*1N4004 rectifier*
11-38	*CR6*	*RS403L-BS95, diode bridge*
11-50	*CR5*	*1N4756A, 47v zener*
11-53	*CR1 - 3 (chassis)*	*FPIR3205 bridge, fast recovery*
20-106	*U2*	*MIC29712BT, adj. regulator*
20-107	*U1, U3, U4*	*MIC29502BT, adj. regulator*
29-10	*U5, U6, U7*	*PS2506 dual opto-isolator*
30-8	*F2 (chassis)*	*1 amp, 3AG slo-blo fuse*
30-10	*F3,F4 (chassis)*	*5 amp, 3AG slo-blo fuse*
30-13	*---*	*IEC Power Cord*
30-42	*F1 (chassis)*	*2.25 amp, 3AG slo-blo (115 VAC)*
30-46	*F1 (chassis)*	*1.25 amp, IEC slo-blo (230 VAC)*
30-108	*PEM1 (chassis)*	*Power entry module*
48-124	*T1 (chassis)*	*Power Transformer*
60-40	*C1, C2*	*470 / 75v electrolytic capacitor*
60-45	*C8 - C11*	*1 / 50v electrolytic capacitor*
60-76	*C4 - C7*	*22 / 25 v electrolytic capacitor*
60-97	*C3*	*22 / 63 v electrolytic capacitor*
60-134	*C2 (chassis)*	*150k / 16 v electrolytic capacitor*
60-135	*C3, C4 (chassis)*	*29k / 25 v electrolytic capacitor*
60-137	*C1 (chassis)*	*100k / 25 v electrolytic capacitor*