



GAI-TRONICS® CORPORATION
A HUBBELL COMPANY

Model XAAB002A Audio Accessory Box Installation and Service Manual

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Scope of Manual

This manual offers descriptive data and service information for the GAI-Tronics Model XAAB002A Audio Accessory Box. Service diagrams and printed circuit board details are a part of this service manual.

Nomenclature

The model number, located on the nameplate on the bottom, specifically identifies GAI-Tronics equipment. If additional options are ordered, the option will be identified on the circuit board.

Ordering Replacement Parts

When ordering replacement parts or requesting equipment information, please include the complete identification number. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part and sufficient description of the desired component to identify it. Order parts from:

Customer Service

GAI-Tronics Corporation

400 E. Wyomissing Ave.

Mohnton, PA 19540

US: 800-492-1212

Outside US: 610-777-1374

Service and Repair

Inoperative or malfunctioning equipment should be returned to the factory for repair. Please call **1-800-492-1212** to obtain a Return Authorization number, published repair prices, and shipping instructions.

NOTE: A purchase order or credit card number is required prior to processing non-warranty repairs.

Features and Benefits of the Audio Accessory Box

Feature	Benefit
Multiple dispatch microphones are possible	Effortless changing of microphones preferred by different shift operators.
Radio/telephone interface	Allows dispatch over radio and telephone simultaneously with the same headset
Small, compact size	Fits easily into most set-up configurations and uses little desk top space
Efficient, streamlined microphone connections	Eliminates messy, jury-rigged microphone hook-ups
Top cover can also be used as a mounting bracket	Allows multiple mounting configurations for customized set-up
Use with remote desktop controller or stand-alone.	Provides flexibility by connecting directly to the radio for stationary or mobile applications.

FCC Interference Warning

The FCC requires that manuals pertaining to Class A and Class B computing devices must contain warnings about possible interference with local residential radio and TV reception. This warning reads as follows:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Safe Handling of CMOS Integrated Circuit Devices

Many of the integrated circuit devices used in communications equipment are of the Complementary Metal Oxide Semiconductor (CMOS) type. Because of their high open circuit impedance, CMOS integrated circuits are vulnerable to damage from static charges. Care must be taken handling, shipping, and servicing them and the assemblies in which they are used.

Even though protection devices are provided in CMOS integrated circuit inputs, the protection is effective only against overvoltage in the hundreds of volts range such as is encountered in an operating system. In a system, circuit elements distribute static charges and load the CMOS circuits, decreasing the chance of damage. However, CMOS circuits can be damaged by improper handling of the modules, even in a system.

To avoid damage to circuits, observe the following handling, shipping, and servicing precautions:

1. Prior to and while servicing a circuit module, particularly after moving within the service area, momentarily touch both hands to a bare metal, earth-grounded surface. This will discharge any static charge that may have accumulated on the person doing the servicing.

NOTE: Wearing a conductive wrist strap will minimize static build-up during servicing.

2. Whenever possible, avoid touching any electrically conductive parts of the circuit module with your hands.
3. Power down the unit before installing or removing the circuit module.
4. When servicing a circuit module, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) because they contribute to static build-up. Similarly, disconnect the test probe prior to removing the ground lead.
5. All electrically powered test equipment should be grounded. Apply the ground lead from the test equipment to the circuit module before connecting the test probe.
6. If a circuit module is removed from the system, it is desirable to lay it on a conductive surface (such as a sheet of aluminum foil) which is connected to ground through 100k of resistance.
7. When soldering, be sure the soldering iron is grounded, and has a grounded tip.
8. Prior to connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary in the replacement of an integrated circuit device), be sure to discharge any static build-up as described in procedure 1. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch pins on the CMOS device and associated board wiring.
9. When replacing a CMOS integrated circuit device, leave the device in its conductive rail container or conductive foam until it is to be inserted into the printed circuit module.
10. All low impedance test equipment (such as pulse generators, etc.) should be connected to CMOS device inputs after power is applied to the CMOS circuitry. Similarly, such low impedance equipment should be disconnected before power is turned off.
11. Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a similar material (aluminum foil may be used). **Never use non-conductive material** for packaging these modules.

Performance Specifications

Color	Black
Physical size	1.55 H × 6.40 W × 4.25 D inches
Shipping weight	3 lbs.
Power input	9.0 to 16.0 V dc, 100 mA, maximum
Receive audio input.....	100 mV ac nominal
Transmit audio output.....	80 mV ac nominal into 600 ohms

Environment:

Ambient temperature, operation	0° C to 60° C
Ambient temperature, storage.....	-40° C to 100° C
Ambient humidity, non-condensing.....	90%

Microphone inputs with respect to 80 mV ac output:

Desk mic, selectable.....	25 mV ac or 800 mV ac
Ixx Handset, nominal	25 mV ac
Boom mic, selectable	200 μV ac or 850 μV ac or 15 mV ac
Headset mic, selectable	25 mV ac or 800 mV ac

Nominal microphone gain selections:

Desk mic	+10 dB or -20 dB
Ixx Handset	+10 dB or unity
Boom mic	+51 dB or +40 dB or +15 dB
Headset mic	+10 dB or -20 dB
Noise floor (S+N/N)	Greater than -45 dB below rated output except high gain on boom mic
Logic output levels.....	5-volt, CMOS-compatible
Audio distortion.....	Less than 2% THD

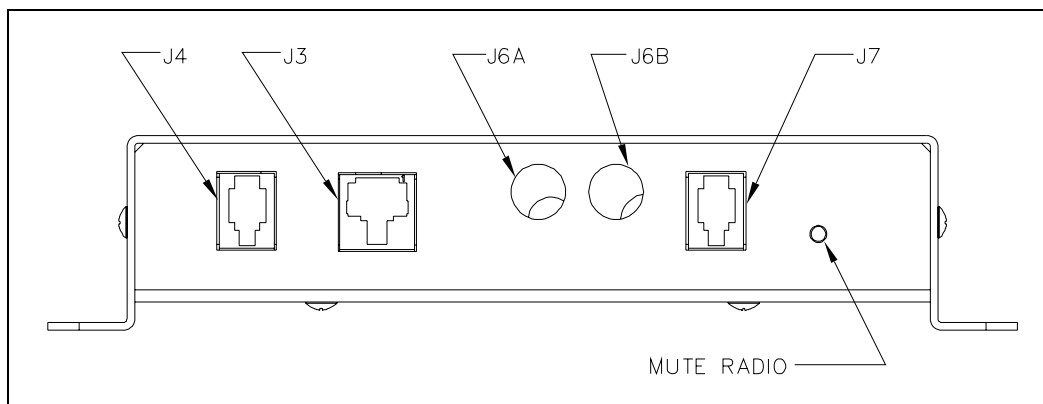
Physical Description

The GAI-Tronics Model XAAB002A Audio Accessory Box measures 1.55 H × 6.40 W × 4.25 D inches. It contains five connectors and an optional mute radio push button on the front panel, and the rear panel contains six connectors. A seventh connector, J10, is an available option. It is shipped with a 9-volt dc wall plug-in power supply, a 7-foot RJ45 male-male 8-pin modular cable (mirror-connected), a 6-foot 4-pin retractile cord, and a dc power connector.

The XAAB002A also includes a cover that can be used as a bracket in specific mounting arrangements described in the Installation section. Optional accessories, such as microphones, headsets, footswitches, etc. must be ordered separately.

Front Panel

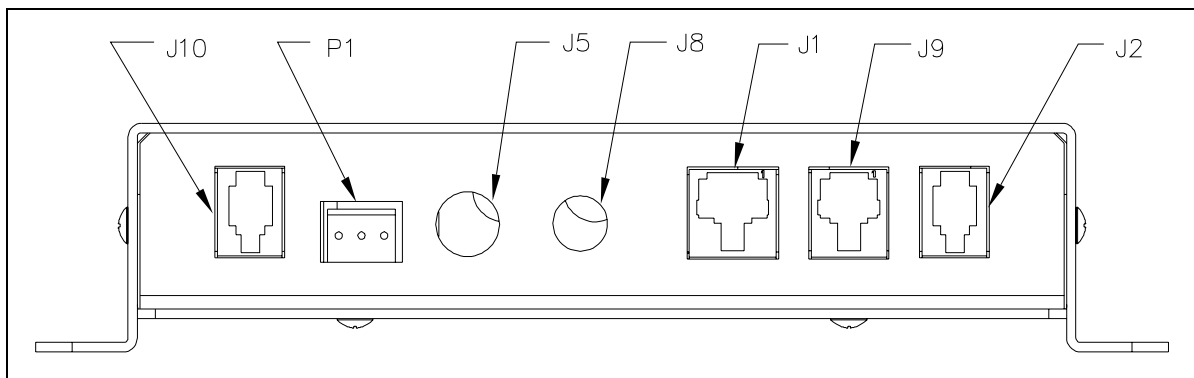
Refer to the figure below for the locations of the connectors and optional mute push button on the front panel of the accessory box.



Model XAAB002A Audio Accessory Box - Front Panel

Rear Panel

The rear panel of the accessory box is shown below. Note that connector J10 is optional.



Model XAAB002A Audio Accessory Box - Rear Panel

Connector Pin Descriptions

J1, 8-pin Output Connector, Motorola Standard, Mirrored Connector

J1 is the main output connector to the radio, a console, or an Advanced desk set (towards radio). The pin-out is mirrored with respect to a Motorola standard 8-pin modular mic jack. See the pin-out below.

NOTE: Mirrored pin-out (opposite of pin-to-pin) is used on output connectors so a standard off-the-shelf male-male modular cable will connect properly.

Table 1. J1, 8-Pin Output Connector Pin-out

Pin No.	Function
1	RX audio from radio to handset and headset. Nominal level = 100 mV ac
2	Handset off-hook logic low output towards radio (or console)
3	PTT logic low output towards radio
4	TX audio output towards radio Nominal level = 80 mV ac
5	Audio ground
6	Monitor logic output towards radio
7	Not connected
8	DC power input (from some radios or consoles)

J2, GAI-Tronics Ixx Handset Output, Mirrored Connector

J2 is the GAI-Tronics handset “through-function” output connector. The accessory box can be placed electrically between the handset and its respective desk set. This enables the audio accessory box to control handset functions. J2 is mirrored for easy connection to the desk set handset jack. The pin-out for J2 is shown below.

NOTE: Mirrored pin-out (opposite of pin-to-pin) is used on output connectors so a standard off-the-shelf male-male modular cable will connect properly.

Table 2. J2, GAI-Tronics Handset Output Pin-out

Pin No.	Function
1	Audio ground
2	Handset analog logic functions
3	RX audio from radio. Nominal level = 100 mV ac
4	TX audio towards radio. Nominal level = 25 mV ac

J3, Desk Microphone, 8-pin Modular, Motorola Standard

J3 is the connector for the desktop microphone, Model XDM002A. The pin-out matches the Motorola standard 8-pin modular desk mic.

Table 3. J3 Desk Mic Connector Pin-out

Pin No.	Function
1	Not connected
2	Not connected
3	Monitor logic input from desk mic
4	Audio ground
5	TX audio towards radio. Nominal level = 80 mV ac
6	PTT logic low output towards radio
7	Not connected
8	RX audio from radio. Nominal level = 100 mV ac

J4, GAI-Tronics Handset, 4-pin Modular Connector

J4 is the connector for the GAI-Tronics handset.

Table 4. J4 GAI-Tronics Handset Connector Pin-out

Pin No.	Function
1	TX audio towards radio. Nominal level = 25 mV ac
2	RX audio from radio. Nominal level = 100 mV ac
3	Handset analog logic functions
4	Audio ground

J5, Boom Microphone Audio, RCA-type, Phono-Jack Connector

J5 is an RCA-type audio jack that is used as the connector for a boom, a Model XGM002A Gooseneck Microphone, or a Model XDM003A Desktop Mic.

Table 5. J5 Boom Microphone Audio, Phono-Jack Connector Pin Function Descriptions

Pin Description	Function
Center pin	TX audio input
Outer shield	Audio ground

J6A and J6B, Headset Dual 1/4-inch Telephone Plug, Carbon Standard Connector

J6A and J6B are headset connections for ‘carbon standard’ (twin 1/4-inch) phone plugs. These connectors will accommodate low impedance, electret, or amplified-dynamic type headsets such as Model XHS0003A with XCC003A Coiled Cord. PTT on the ring terminals is also supported.

Table 6. J6A and J6B Headset Dual Telephone Plug Connector Pin Function Descriptions

Pin Description	Function
Tips	TX audio towards radio
Sleeves	RX audio from radio
Rings	PTT logic sense

J7, Alternate Headset, 4-pin Modular, Carbon Standard Connector

J7 is parallel to J6/J7. This is the 4-pin modular headset connection for the GAI-Tronics Model XHS002A Headset. The pin descriptions are shown in the table below.

Table 7. J7 Alternate Headset Connector Pin Function Descriptions

Pin Description	Function
1 Red wire	TX audio
2 White wire	RX audio
3 Green wire	RX audio
4 Black wire	TX audio

J8, Power Input, 2.0 mm Barrel Jack Connector

J8 is a barrel-type power connector for external 9 to 16 V dc. The center post is positive. This is the preferred power input for optimum performance.

Table 8. J8 Power Input Pin-out

Pin Description	Function
Center pin	9–16 V dc input, positive
Outer barrel	Ground, negative

J9, 6-pin Modular Alternate Output, Kenwood Standard Connector

The J9 is the alternate main output connector in a mirrored 6-pin mirrored jack that is connected to plug-and-play with Kenwood radios.

Table 9. J9 Modular Alternate Output Pin-out

Pin No.	Function
1	Monitor logic output towards radio
2	TX audio output towards radio. Nominal level = 80 mV ac
3	Audio ground
4	PTT logic low output towards radio.
5	Logic ground
6	Not connected

J10, Telephone Handset I/O, Carbon Standard Connector

NOTE: Pin-out matches telephone handset end.

The J10 is the handset output connector where a carbon standard telephone handset cord is plugged in for the telephone dispatch option. The headset hears the audio from the telephone party as well as the radio. The telephone off-hook and dialing must be done manually by the radio user.

Table 10. J10 Telephone Handset I/O Pin-out

Pin Description		Function
1	Black wire	TX audio –
2	Green wire	RX audio
3	White wire	RX audio
4	Red wire	TX audio +

P1, Footswitch Connector

P1 is the connection for the GAI-Tronics Model XFS002A Footswitch. It supports the monitor and PTT functions.

Table 11. P1 Footswitch Connector Pin-out

Pin No.	Function
1	Footswitch PTT (transmitter key-up) logic low input
2	Logic ground
3	Footswitch monitor logic low input

Accessories

Description	Part No.
Desktop Microphone	XDM002A
Desktop Microphone, Heavy-duty	XDM003A
Headset	XHS002A
Headset (requires XCC003A Coiled Cord)	XHS003A
Coiled Cord (with PTT switch)	XCC003A
Gooseneck Microphone, Lightweight	XGM002A
Gooseneck Microphone, Heavy-duty	XGM003A
Footswitch	XFS002A
DC Power Supply (replacement)	XPS002A

Functional Description

The GAI-Tronics Model XAAB002A Audio Accessory Box is an appliance for consolidating various audio input/output devices associated with two-way dispatch radio service. Audio paths through the device are enabled as needed depending on the device being used at any given time, and are configured for the optimal signal levels associated with currently available microphones, headsets and handsets.

Several operating parameters vary the signal levels and logical behavior of the various devices. They are selectable with programming switches.

After initial installation of the Audio Accessory Box, no user interface is required. For information on the operation of the various accessories, refer to the associated user manuals.

Functions

Push-to-Talk (PTT - Radio Key-up)

Push-to-talk can be initiated from the paddle on the desk mic, the TRANSMIT bar on the desk set, handset PTT bar, the footswitch, or a PTT button associated with a headset. PTT is sensed individually at each mic connector, and this action routes the transmit audio through the path associated with that type of mic. See Table 12. Jumper Settings on page 15 in the Description section.

Monitor

Monitor is operated from the same sources as above. This function is used primarily in analog radio where two or more radio systems share a common channel frequency. The monitor pedal on the footswitch can also be used to momentarily mute audio coming from the telephone party. See Programming Settings in the Installation section.

Mute

The optional mute switch on the front panel momentarily mutes radio receive audio to the headset.

Off-Hook Output (J1 – pin 2)

The off-hook output located on J1 (8-pin output connector) is asserted when either the handset connected to the J4 (GAI-Tronics handset connector) is taken off-hook, or when a headset is connected to J6A and J6B (headset dual ¼-inch telephone plug). This signal is used by the audio accessory box to select the correct microphone and may be used to route audio appropriately in the connected unit. When a GAI-Tronics handset is not connected to J4 or is not able to be placed on-hook, it appears that the handset is off-hook to the audio accessory box. Therefore, when not using a GAI-Tronics handset, the internal jumper, JU1, must be in.

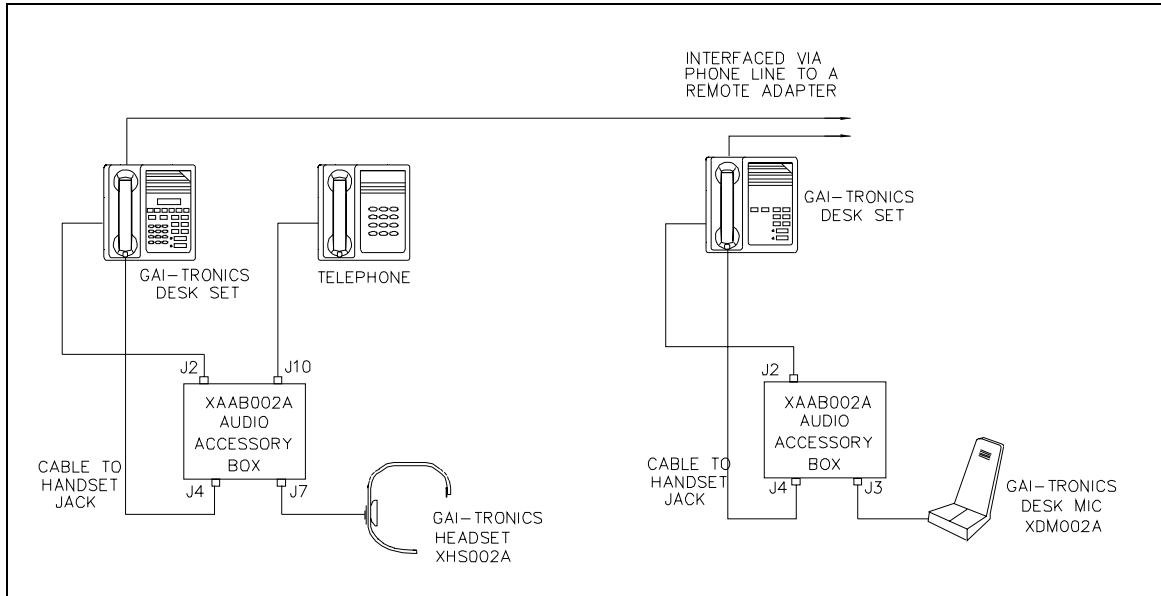
Always allow a short delay before speaking to allow time for the radio channel to be established. The TRANSMIT button or handset PTT bar must be held down while talking to the radio user and released to listen. When the transmission is completed, the TRANSMIT LED extinguishes and the desk set returns to the receive mode.

Telephone Interface

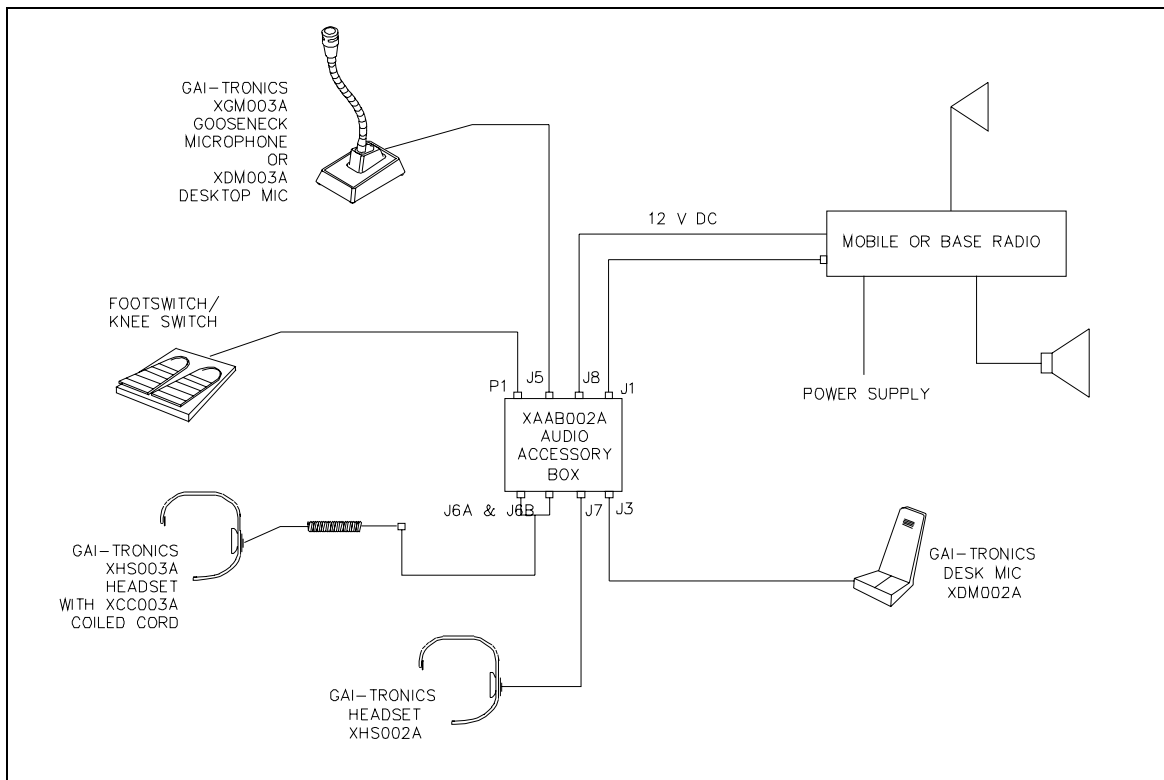
This feature allows the operator to use a common headset/microphone for both radio and telephone operation. No telephone-to-radio patching will occur. The radio communication can be muted during a telephone communication by pressing the MUTE RADIO push button on the unit's front panel.

NOTE: The telephone must be in off-hook mode for the headset to be active.

Planning the Installation



Sample installation diagrams for the XAAB002A when used with desktop controllers



Sample installation diagram for the XAAB002A when used directly with radio

Mechanical Receipt Inspection

The XAAB002A Audio Accessory Box is shipped in a cardboard container with inserts. Thoroughly inspect it as soon as possible after delivery. In-transit damage should be immediately reported to the transportation company.

Mounting

The Audio Accessory Box can sit on a desktop or can be mounted to the side or under the desk by means of mounting screws through the top cover piece. In this case, the chassis bottom piece is rotated 180° and secured upside down into the cover after the cover has been mounted under the desk or tabletop.

Equipment Required

Test Equipment

- RF service monitor
- #1 Phillips screwdriver
- 1/8-inch flat blade screwdriver

Documentation

- instruction manuals from optional accessories
- these installation instructions

Cable Installation Safety Considerations

Interconnecting, communications, and Class 2 dc power cables should be separated from electrical light or other Class I circuits by at least 2 inches. The exception is where Class I wiring or power circuits are run in a raceway, or are metal-sheathed or metal-clad, or are permanently separated from the conductors of the other circuitry by a continuous and firmly fixed nonconductor such as porcelain tubes or flexible tubing in addition to the insulation on the wire. Communications cables and in-building wiring should be listed and marked for the purpose according to NEC Article 800.

Power Connections

Plug in the supplied wall transformer and connect the power into J8 on the XAAB002A. For direct mobile radio use, connect 12 V dc from the radio to the audio accessory box via the dc connector provided (which plugs into J8).

Programming Settings

The various microphone gains and logic polarities are set up with programming switches located on the PCBA. The cover must be removed to gain access to these switches. Refer to the following tables. The internal programming switch parameters are as follows:

Table 12. Jumper Settings

Jumper	Position	Function
JU1	IN (shorted) OUT (Not shorted)	Handset not connected to J4 - does not generate off-hook Handset is connected to J4.
JU2	IN (shorted) OUT (Not shorted)	Handset mic is always on. Handset mic is PTT-controlled.
JU3	IN (shorted) OUT (Not shorted)	Desk mic is always on. Desk mic is PTT-controlled.
JU4	IN (shorted) OUT (Not shorted)	Boom mic is always on. Boom mic is PTT-controlled.
JU5	IN (shorted) OUT (Not shorted)	Headset mic is always on. Headset mic is PTT-controlled.
JU6	IN (shorted) OUT (Not shorted)	Headset RX level is normal. Headset RX level - Add 10 dB.

Table 13. SWA Switch Settings

Switch	Position	Function
SWA-1	On Off	Not used
SWA-2	On Off	Mic loop-back test Normal
SWA-3	On Off	BOOM MIC - add 25 dB gain SWA-3 and SWA-4 = fixed gain
SWA-4	On Off	BOOM MIC - add 36 dB gain SWA-3 and SWA-4 = fixed gain
SWA-5	On Off	HEADSET MIC - add 10 dB gain 20 dB loss
SWA-6	On Off	DESK MIC 10 dB gain 20 dB loss
SWA-7	On Off	Ixx HANDSET MIC 10 dB gain Unity gain
SWA-8	On Off	Bias voltage to BOOM MIC No bias voltage

Table 14. SWB Switch Settings

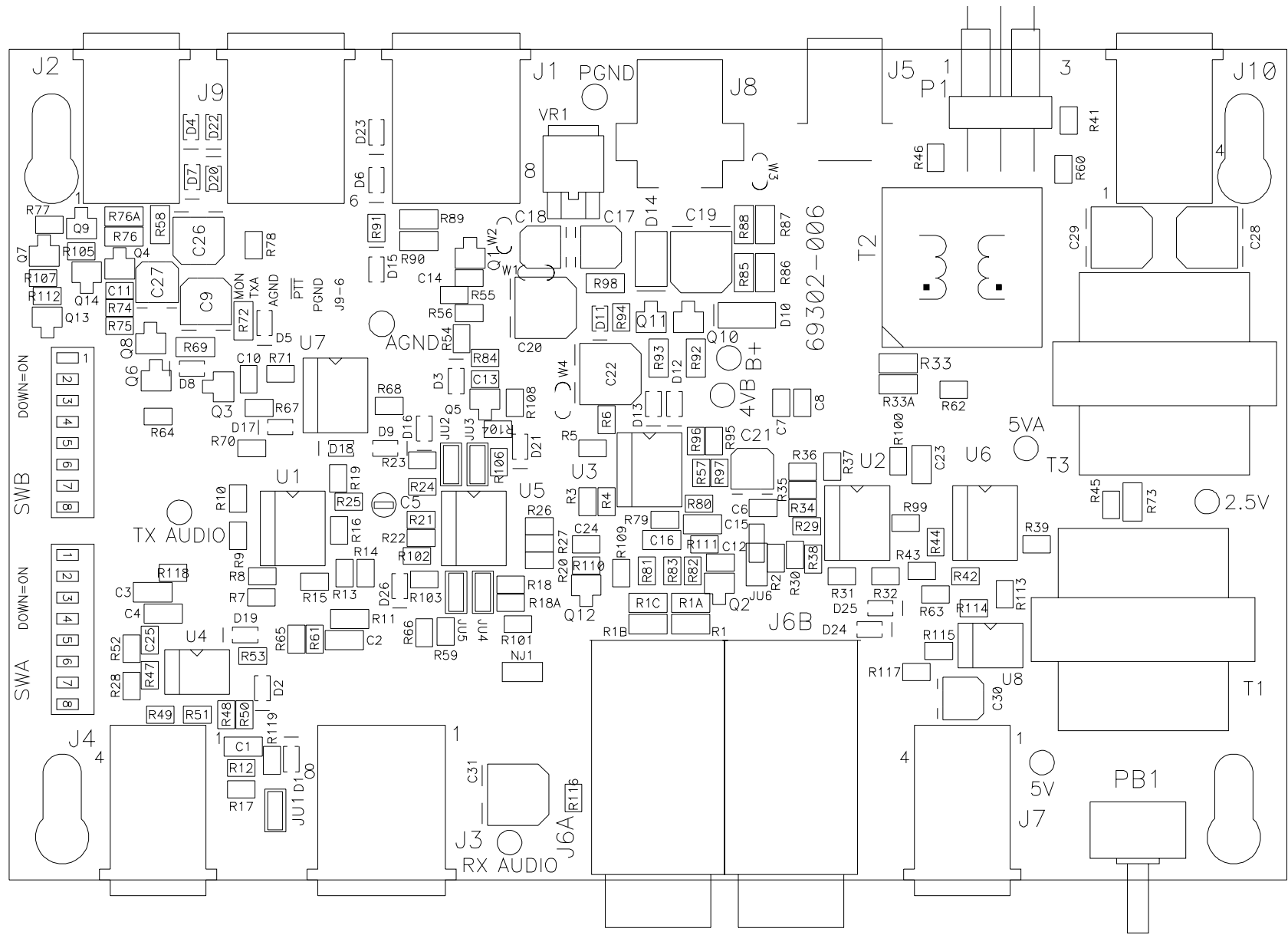
Switch	Position	Function
SWB-1	On Off	Enable DC POWER input from DESK MIC AUX POWER only
SWB-2	On Off	HEADSET sense generates Ixx OFF-HOOK No effect on off hook
SWB-3	On Off	Lock HEADSET SENSE gating function ON Normal
SWB-4	On Off	FOOTSW TRANSMIT enables DESK MIC DESK MIC enabled only with desk mic PTT
SWB-5	On Off	FOOTSW TRANSMIT enables BOOM MIC BOOM MIC disable
SWB-6	On Off	FOOTSW MONITOR mutes TELEPHONE RX audio No mute
SWB-7	On Off	DESK MIC OUT MONITOR logic LOW Output logic HI
SWB-8	On Off	DESK MIC INPUT MONITOR logic LOW Input logic HI

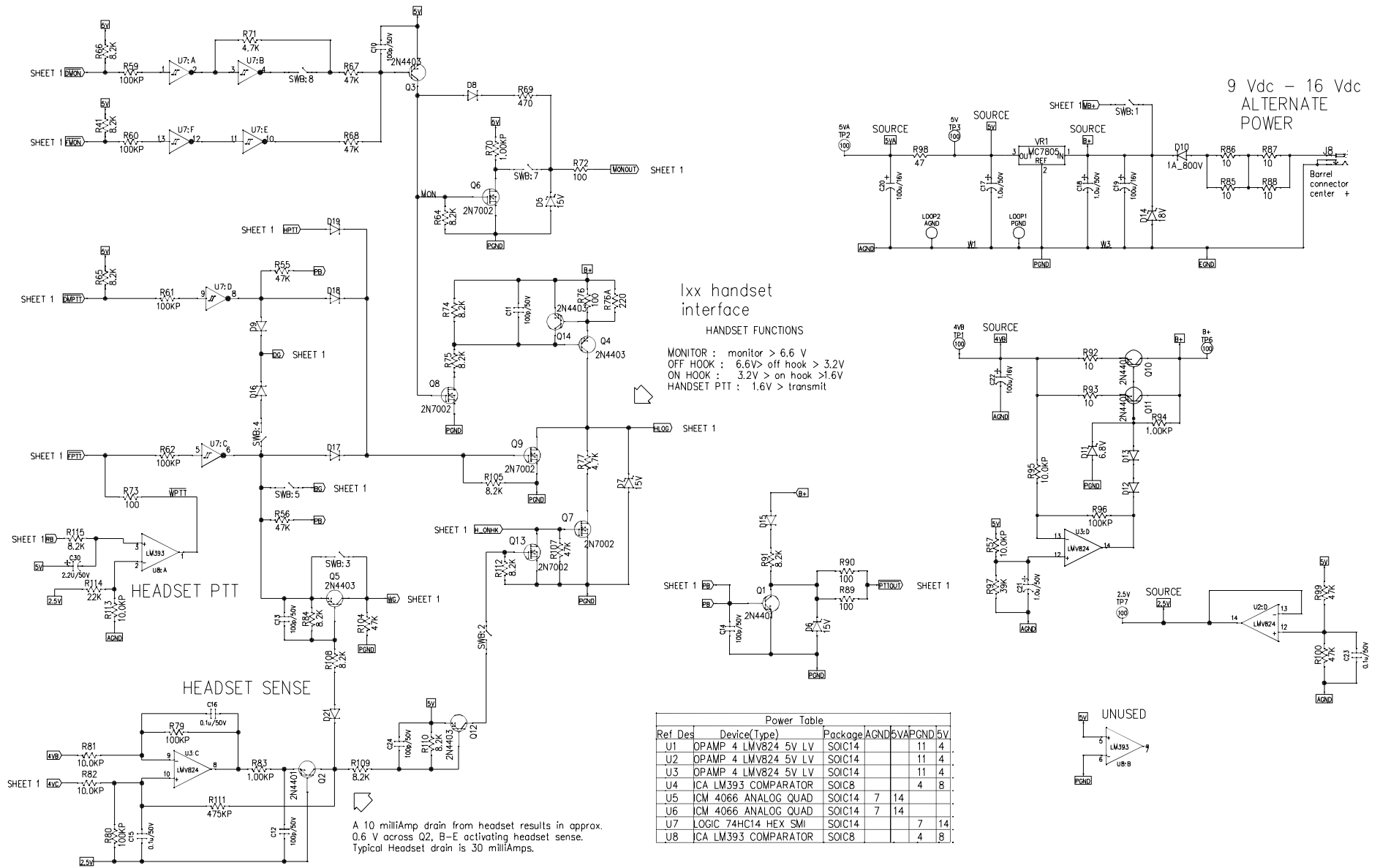
Troubleshooting the Model XAAB002A Audio Accessory Box

The following is a list of potential problems you may encounter and possible solutions.

Problem	Possible Solution
Microphone PTT switch will not key up the transmitter.	Check the logic polarity required by the radio. This unit outputs a 5-volt logic low.
No TX audio from headset.	Headset may be high impedance (electret or ceramic mic) and not able to trip headset sense circuitry. Try SWB-3 switched to ON.
Headset inoperable	Headset may not conform to 'carbon standard' connector pin-out. Check connector pin functions.
	Headset may require an amplifier or adapter cable supplied by the headset manufacturer.
Telephone interface option is not working.	Telephone set must conform to carbon standard, sometimes referred to as POTS.

NOTES:





Schematic Diagram - Sheet 2

Definitions and Acronyms

Term	Definition
Boom Mic	A dispatch center microphone suspended from a movable boom so as to position it in mid-air at face level to the operator. Usually contains a dynamic-type microphone element.
Carbon Standard	PSTN network standard for telephone instruments that features a 50 ohm handset receiver element. Off-hook state must exhibit between 8 and 20 mA dc and have a ringer impedance of 11 kilohms or higher. Hybrid isolation must be 10 dB or better over the voice band.
CSQ	Carrier squelch
Dynamic Microphone	A low impedance, low level microphone element requiring high gain interface amplifiers.
Electret	A medium impedance, wide frequency range microphone element requiring a bias voltage supply.
Ixx	GAI-Tronics desk set products such as ILD, ITR, IDR, etc.
Monitor	Action taken to disable the CTCSS or CDCSS system in order to determine if the radio channel is being currently used by other channel licensees.
POTS	Plain Old Telephone Set: Refers to carbon standard telephone sets having carbon button microphone elements (low impedance) and dynamic earpiece elements.
PSTN	Public Switched Telephone Network
PTT	Push-To-Talk (transmitter key-up)
RF	Radio Frequency: High frequency energy emitted by an electronic device.
RX	Receive or receiver
TX	Transmit or transmitter

