EQUIPMENT MANUAL

Product Functional Specifications and Installation Manual

AUDIO CONTROL AMPLIFIER

MODEL 438-[ ]

AND

ALL DETAIL PART NUMBERS

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IMPORTANT NOTICE

Chelton Avionics Inc. doing business as Wulfsberg Electronics Inc. doing business as Cobham Avionics will be responsible for full distribution and revisions of ICA's (Instructions for Continued Airworthiness).

CHANGE RECORD

DATE	CHANGE	CHECK	APPROVAL
2-21-06	ORIGINAL DOCUMENT RELEASED	SF	AP
6-5-06	Revision A: Added dB Systems reference paragraph and TSO approved performance standards paragraph to Section 1.0, Operating Instructions and Equipment Limitation (paragraphs 1 & 2) (Type IV).	SF	AP
6-7-06	Revision B: Added document “438-16-2 for ITAR controlled models” and “438-4-1 for ITAR controlled models – Section 4.0, Calibration Test Procedures (first and second paragraphs). Corrected typos: “Refer to Environmental Qualification Form, Table 4” was “Table 2”. Unit Connector, Part No. for P50 (50-pin) was “MD50M4BOV3O” – is now “MD50M4BOV30” (zero) – Table 2, Mating Connectors. Document “438-16-1” was “438-16” – Table 4, Environmental Qualification Form. (Type IV)	SF	AP
10-23-08	Revision 1.03: Incorp ECR1 438-16: Updated Figure 1 to latest issue (includes 438—007 and 438-008); Updated Figure 3 to latest issue. Updated document format to NAT standard.	SC	AP
6-26-09	Revision 1.04: Incorp ECR1 438-16-1: Added Detail Part Number Description table.	ZP	AP
SEE TITLE PAGE	Revision 1.05: Incorp. ECR2 438-16. Updated Figure 1, outline, to current rev. Added ICA responsibility notice. Cobham was NAT Seattle. ? NAT-S ENG 217 Geoff Melton 2011.01.13 11:17:00 -08'00'	? NAT-S ENG 201 Scot Ford 2011.01.14 17:37:14 -08'00'	? NAT SEATTLE 109 Zack Pahlman 2011.01.17 11:52:07 -08'00'

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MODEL 438-[ ]

1.0 OPERATING INSTRUCTIONS AND EQUIPMENT LIMITATIONS

This document makes references to dB Systems, Inc. and NAT Seattle, Inc. Please note that dB Systems, Inc. and NAT Seattle, Inc. have been changed to Cobham. For all references to dB Systems, Inc. or NAT Seattle, Inc. herein, substitute Cobham.

The Model 438-[ ] Audio Control Amplifier is a remotely controlled, electronic unit which operates upon command from switches and potentiometers in the cockpit. The Model 438-[ ] is capable of switching and separately controlling the volume for up to 12 receiver inputs. It also switches five sidetone inputs and an interphone line. In addition, two unswitches and unmuted inputs are provided to accommodate an aural warning input and an auxiliary input. Headphone and selected speaker outputs are isolated and a cockpit voice recorder (CVR) output is provided from the headphone and interphone microphone audio. Microphone audio can be recorded on the cockpit voice recorder at all times with the Model 438-[ ] (e.g., the interphone microphone to CVR audio channel is unswitched and unmuted). A Pilot Select COMM output (PSC) produces a summation of COMM1 through COMM 4, DME 1 and 2, and the MKR 1 and 2 receiver inputs and is compatible with the Model 240, 250, or 251 PSC audio input channel (or equivalent). PSC allows passengers to hear pilot selected audio if desired.

The speaker channel is powered through an internal fuse, separate from the headphone channel so that a failure of the speaker channel will not disable the headphone channel.

Receiver and operating modes are electronically switched. Ground signals, applied by manual switches in the cockpit, enable the electronic switches in the Model 438-[ ]. An electronic attenuator is employed in each of the 12 receiver input channels. Every receiver input attenuator has approximately 30 dB of range and is controlled by a volume control potentiometer in the cockpit. Zero to 1K ohm linear taper pots are required for each volume receiver control (maximum volume with maximum resistance).

Selective voice or code filtering is provided on four of the receiver audio inputs, intended for ADF and NAV audio. The filter function is electronically controlled by ground signals from the cockpit Voice-Off-Indent switch.

A Voice Activated switch is incorporated, in series with the microphone input, to reduce interphone noise. This feature allows Hot Interphone operation without ambient noise being coupled into the amplifier when the pilot is not talking. The threshold of voice activations may be adjusted by an internal potentiometer screwdriver adjustment. It is factory set at 100 millivolts and adjustable from 15 to 350 millivolts. A 0 to 10K ohm external VOX threshold potentiometer can be connected (maximum threshold with minimum resistance).

Operating modes of the Model 438-[ ] are listed in Table 1 and are established when a ground signal is applied to the connector pin listed.

The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only if performed under 14 CFR part 43 or the applicable airworthiness requirements.

Table 1. Model 438-[ ] Operating Modes

Pin No.	Identification	Function
P40-18	Speaker Switch	Connects selected audio to the cockpit speaker.
P40-6	INPH Hot Switch	Connects microphone input to the interphone line if PTT is not selected.
P40-14	INPH to SPKR Switch	Connects interphone audio to cockpit speaker if SPKR is selected.
P40-16	PTT Switch	Opens the microphone to interphone circuit and the interphone to headphone circuit and mutes the speaker audio.
P40-11	Voice Switch	Enables notch filter to reject Ident Tone on NAV and ADF audio inputs.
P40-12	Ident Switch	Enables bandpass filter to emphasize Ident Tone.
P50-6, 7, 9, 10, 11, 12, 13, 23, 24, 27, 28, 29	Receiver Switches	Connects selected receiver audio to the internal attenuating, mixing, filtering, and amplifying circuitry.
P50-22	PA Key	Connects PA sidetone input to the headphones, CVR, and cockpit speaker (if SPKR is selected).

Table 2. Model 438-[ ] Detail Part Number Descriptions

Detail Part Number	Description of Detail
Base Model	No differences.
001	Provides a higher SPKR, lower HDPH AW/AUX than the base model.
002	Provides different listening levels than the base model. Receiver and sidetone audio output levels are 40 mW. Substitute (from base model) 3.00 V_{RMS} SDTN to HDPH output, 2.30 V_{RMS} COMM, MKR 1, 2, and DME 1, 2 to HDPH outputs.
003	Provides interphone operating levels for 8-station interphone system (37-ohm interphone line). This unit provides more interphone audio to the speaker and headphone than the base model, and increases the receiver levels to compensate for increased load on the receivers by multistation Model 438's.
004	Custom calibration for a 5 station interphone system (60-ohm interphone line).
005	Custom configuration for a 7 station interphone system (16-ohm interphone line) that uses Model 907 Audio Switching Unit to control interphone line connections between the stations. The receiver levels are also increased to compensate for the receiver levels are also increased to compensate for the increased load on the receivers by the multistation Model 438's. The AUX input is used for the interphone input and the INPH OUT is used for interphone output (no input).

Table 2. Model 438-[ ] Detail Part Number Descriptions (Continued)

Detail Part Number	Description of Detail
006	Provides a 2.7dB lower SPKR AW/AUX level than the base model.
007	Provides interphone operating levels for 4-station interphone system (75-ohm interphone line). This unit provides more interphone audio to the speaker and headphone than the base model, and increases the receiver levels to compensate for increased load on the receivers by multistation Model 438's.
008	Provides interphone operating levels for 4-station interphone system (75-ohm interphone line). This unit provides more interphone audio to the speaker and headphone than the base model, and increases the receiver levels to compensate for increased load on the receivers by multistation Model 438's.

Three separate electronic attenuators are employed in the Model 438-[ ] for audio master volume control. One of them controls the level for both the headphone and speaker audio, another controls the level for XMT and PA sidetone audio, and another controls the interphone audio level. All three master attenuators have approximately 30 dB of range, controlled by volume control potentiometers in the cockpit. Zero to 10,000 ohm linear taper pots are required (maximum volume with maximum resistance).

All outputs (including the headphone and speaker outputs) of the Model 438-[ ] are open and short circuit protected.

The speaker amplifier in the Model 438-[ ] is rated at 10 Watts into 4 ohms. This is a peak rating intended for speech and music. The continuous rating of the amplifier is 1 Watt into 4 ohms for sine wave operation.

All internal screwdriver potentiometer adjustments of the Model 438-[ ] are set to factory standards. If it is necessary to change a setting, refer to the calibration section of the Acceptance Test Procedure, Document No. 438-4.

The amplifiers are adjusted for acceptable listening output levels into the proper loads with receiver inputs of 7.75 volts RMS. This input level is realized when receivers are set for 100 milliwatts into 600 ohms. If 7.75 volts RMS is greatly exceeded at the inputs, the audio will become distorted due to peak clipping and audio bleedthrough will be noticed. The amplifiers will not be damaged however.

An important feature of the Model 438-[ ] is the Emergency Mode of Operation. The Model 438-[ ] automatically goes into this mode when the supply power to the unit is interrupted. In the case of a critical electronic failure within the unit, the Emergency Mode of Operation can be implemented by opening the switch (EMERGENCY switch) normally connecting pins P40-9 and P40-3. In the Emergency Mode of Operation, the audio selected from COMM1 and 2, SDTN 1 and 2, and AURAL WARNING inputs is passed directly to the headphone output with 23 dB of attenuation into 150 ohm headphone load.

2.0 SPECIFICATIONS

The Model 438-[ ] is intended for airplanes with two cockpit audio stations. Two Model 438-[ ] amplifiers are installed, one for each audio station. The receiver outputs are connected to both Model 438-[ ] receiver inputs. The receiver input impedance of the Model 438-[ ] is 2,000 ohms so when the two specifications are installed, the receiver sees 1,000 ohms. Input specifications are expressed in volts RMS, rather than milliwatts, to avoid any misunderstanding

INPUTS:

COMM: 4 dual audio inputs for receiver and sidetone. Receiver inputs level is 7.75 V_{RMS} and sidetone is 3.9 V_{RMS}, both switched simultaneously.

PA SDTN: This is a switched audio input compatible with the PA sidetone output of Model 240, 250, 251 (or equivalent), which provides a 2.00 V_{RMS} audio sidetone signal produced from MIC (PA) to cabin paging.

RCVR: 4 signal, switched audio inputs for MKR, DME, etc. Input level is 7.75 V_{RMS}.

MIC: The microphone input, used for interphone mode, supplies bias and is compatible with carbon and amplified dynamic microphones. Voice activated within 1.5 milliseconds by a circuit which provides 30dB minimum attenuation within 2 seconds after speech (15 to 350 millivolt threshold range). Microphone audio from this input is channeled directly to the CVR output amplifier. If interface to low impedance microphones is desired, use Model 213 or Model 263 microphone amplifier.

FLTR: 4 single, switched audio inputs for NAV, ADF, etc. 7.75 V_{RMS} inputs have selected filtering, switched by the Voice-Off-Ident switch.

Voice: 1,020 ±5 Hz, 30 dB 100 Hz notch
Off: No filtering; normal bandwidth operation
Ident: 1,020, ±5 Hz Ident; Tone emphasis

AUX: 1 unswitched and unmuted auxiliary input, factory set to accommodate 1.00 V_{RMS}. An internal potentiometer screwdriver adjustment may be changed for higher or lower auxiliary levels.

AW: This is an unswitched and unmuted input compatible with the aural warning output of Model 630 (or equivalent), which provides aural warning tones.

MASTER VOLUME: Controls level of all 12 receiver audio inputs to the speaker, headphone, and cockpit voice recorder outputs. Volume control range is 30 dB (minimum) controlled by a 10,000 ohm 1/2 Watt, linear taper pot. Maximum volume is with maximum resistance.

SIDETONE VOLUME: Controls level of all 5 sidetone audio inputs to the speaker, headphone, and cockpit voice recorder outputs. Range and control same as MASTER VOLUME specification.

INTERPHONE VOLUME: Controls level of interphone audio input to the speaker, headphone, and cockpit voice recorder outputs. Range and control same as MASTER VOLUME specification.

RECEIVER VOLUME: (One electronic attenuator per receiver input). Controls level of the respective receiver audio input before subject to control of the MASTER VOLUME electronic attentuator. Volume control range is 25 dB (minimum) controlled by a 1K ohm (500 ohm for two Model 438-[ ] amplifiers connected in parallel), 1/2 Watt, linear taper pot. Maximum volume is with maximum resistance.

OUTPUTS:

SPEAKER: The speaker amplifier is designed for speech signals and has both a Rated Power and a Continuous Power specification. The continuous rating is the power the amplifier can continuously deliver with a sine wave. The Rated Power is the peak power it can deliver

without clipping. Bench testing and adjustment may require brief periods of sine wave operation above the continuous rating; those periods should be limited to 1 minute to prevent amplifier damage.

Load	Rated Power	Continuous Power
4 ohm	10 Watts	1 Watt
8 ohm	8 Watts	0.8 Watt

HEADPHONE: The headphone amplifier has a Rated Power specification of 107 milliwatts into 150 ohms and a Continuous Power specification of 27 milliwatts into 150 ohms (1 Watt into 8 ohms for Model 438 MOD D and above).

COCKPIT VOICE RECORDER: The CVR will deliver 1.7 milliwatts into 600 ohms continuously. Rated and continuous power ratings are the same.

PILOT COMM: This Pilot Select COMM output will deliver 1.7 milliwatts into 600 ohms continuously. Rated and continuous power ratings are the same.

INTERPHONE: The INPH output will deliver 1.5 milliwatts into 430 ohms continuously. Rated and continuous power are the same.

FREQUENCY RESPONSE: Flat within 3 dB from 350 Hz to 6,000 Hz.

HARMONIC DISTORTION: Less than 3 percent distortion, all outputs

ISOLATION BETWEEN CHANNELS: 60 dB

OUTPUT NOISE: Greater than 55 dB below rated, all outputs.

POWER SUPPLY: 28 VDC, 1 ampere maximum

OPERATING TEMPERATURE: From –55 to +70 degrees C.

OPERATING ALTITUDE: To 70,000 feet.

QUALIFIED TO:

FAR PART 21, TSO-C50c

RTCA DO-160B: Refer to Environmental Qualification Form, Table 4.

2.1 Physical

Installation dimensions are shown on the Model 438-[ ] outline drawing (Figure 1). The amplifier enclosure is designed for installation in a King rack assembly no. 071-4004-00. The unit and rack assembly can be mounted in any position compatible with the rack assembly because the unit fits into the rack assembly in only one position. No shock or vibration isolators are required.

The Model 438-[ ] and the rack assembly can be mounted to a metal or plastic surface, but is necessary to ground the case to the metal aircraft structure. When mounting to a plastic surface, use a grounding strap. The case is finished with an electrically conductive film so it is not necessary to remove the film for electrical bonding.

2.2 Electrical

Connections to the Model 438-[ ] are made through two “D” subminiature connectors. Each mating connector manufactured by Positronic Industries, Inc. has part numbers for the complete connector assembly. The part numbers are listed below.

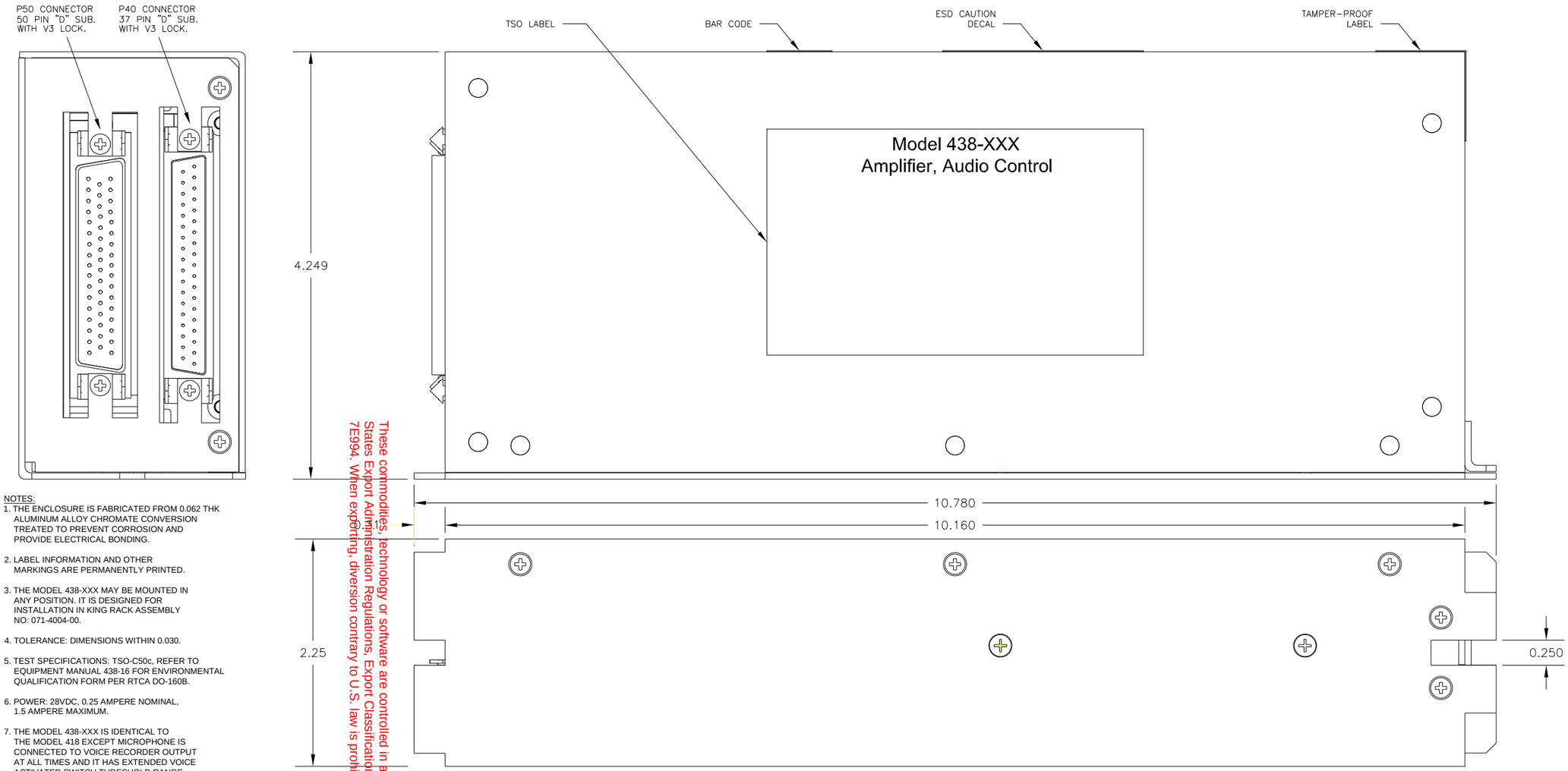
Table 3. Mating Connectors

CONNECTOR KITS WITH POSITRONIC V-LOCK SYSTEM			
Connector	**Unit Connector Part No.**	**Mating Connector Part No.**	**Contacts Part No.**
P40 (37-pin)	POSITRONIC MD37M4BOV30	POSITRONIC RD37F10JVLO USE MS22520/2-01 CRIMP TOOL, POSITIONER 2-08	SUPPLIED WITH MATING CONNECTOR
P50 (50-pin)	POSITRONIC MD50M4BOV30	POSITRONIC RD50F10JVLO USE MS22520/2-01 CRIMP TOOL, POSITIONER 2-08	SUPPLIED WITH MATING CONNECTOR

Numeric pin identification and wiring diagrams are shown in Section 3.0. Shielded wire must be used where indicated on the diagrams. AWG 24-26 size wire should be used for all connections except those to the input power, power ground, and speaker amplifier output where AWG 20-22 size should be used at pins 8, 10, 35, and 37 of P40.

The control switches shown will switch low current loads and should have a DC rating of 28 VDC. Typical switches for this application include Alco MTA series.

The 12 receiver volume control pots required (one each for both Model 438-[ ] amplifiers) are linear taper, zero to 1,000 ohms (500 ohms when two 438’s are connected in parallel), 1/2 Watt or greater. The Master, Sidetone, and Interphone volume control pots required are linear taper, zero to 10,000 ohms, 1/2 Watt or greater. Electrically, the pots are wired to provide maximum resistance to the Model 438-[ ] for full volume (fully clockwise rotation).



NOTES:

1. THE ENCLOSURE IS FABRICATED FROM 0.062 THK ALUMINUM ALLOY CHROMATE CONVERSION TREATED TO PREVENT CORROSION AND PROVIDE ELECTRICAL BONDING.

2. LABEL INFORMATION AND OTHER MARKINGS ARE PERMANENTLY PRINTED.

3. THE MODEL 438-XXX MAY BE MOUNTED IN ANY POSITION. IT IS DESIGNED FOR INSTALLATION IN KING RACK ASSEMBLY NO: 071-4004-00.

4. TOLERANCE: DIMENSIONS WITHIN 0.030.

5. TEST SPECIFICATIONS: TSO-C50c, REFER TO EQUIPMENT MANUAL 438-16 FOR ENVIRONMENTAL QUALIFICATION FORM PER RTCA DO-160B.

6. POWER: 28VDC, 0.25 AMPERE NOMINAL, 1.5 AMPERE MAXIMUM.

7. THE MODEL 438-XXX IS IDENTICAL TO THE MODEL 418 EXCEPT MICROPHONE IS CONNECTED TO VOICE RECORDER OUTPUT AT ALL TIMES AND IT HAS EXTENDED VOICE ACTIVATED SWITCH THRESHOLD RANGE.

8. REFERENCE DRAWINGS:
   438-8 QUAL TEST REPORT
   438-16 EQUIPMENT MANUAL

9. WEIGHT MODEL 438-XXX:
   MOD A, B & C: 2.0 lbs
   MOD D, E & F: 1.6 lbs

10. THE MODEL 438-XXX PROVIDES ELECTRONIC AUDIO CONTROL FOR ONE PILOT STATION. AUDIO INPUTS: 4 TRANSCEIVER WITH SIDETONE, 8 RECEIVER, PA SIDETONE, UNSWITCHED AND UNMUTED INPUTS FOR AURAL WARNING AND AUXILIARY, VOICE ACTIVATED MICROPHONE AND AN INTERPHONE LINE. INPUTS ARE ISOLATED, MIXED, FILTERED AND AVAILABLE TO THE SELECTED AUDIO OUTPUT. OUTPUTS: HEADPHONE, SPEAKER, INTERPHONE, VOICE RECORDER AND PILOT SELECTED COM AUDIO. ELECTRONIC ATTENUATORS ARE PROVIDED FOR REMOTE VOLUME CONTROL OF ALL SWITCHED INPUTS AND OUTPUTS TO HEADPHONE AND SPEAKER.

11. THE APPLICABLE DETAIL PART NUMBER (e.g. "001" FOR DETAIL P/N 001) IS PRINTED IN THE DETAIL BLOCK ON THE LABEL, OR THE DETAIL BLOCK IS LEFT BLANK IN THE CASE WHERE THERE IS NO ASSOCIATED DETAIL PART NUMBER. REFER TO BUILD STANDARD FOR MOD STATUS.

DETAIL P/N	DESCRIPTION OF DETAIL PART NO. (DIFFERENCES FROM BASE MODEL)
NO STAMP	BASE MODEL
001	SPKR AW/AUX LEVELS 5.1 dB HIGHER, HDPH AW/AUX LEVELS 2.2 dB LOWER.
002	LEARJET 31A AUDIO LEVELS.
003	FOR 4 TO 7 STATION INTERPHONE WITH ADDITIONAL RCVR GAIN.
004	CALIBRATION FOR CUSTOM 5 STATION INTERPHONE CONFIGURATION.
005	FOR 7 STATION INTERPHONE SYSTEM USED WITH MODEL 907 SWITCHING UNIT.
006	SAME AS BASEMODEL BUT WITH CUSTOM AW LEVEL CALIBRATION FOR PREMIER 1.
007	SAME AS BASEMODEL BUT CALIBRATED FOR 6 INTERPHONE LOADS.
008	SAME AS BASEMODEL BUT CALIBRATED FOR 6 INTERPHONE LOADS.

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Figure 1. Outline, Model 438-[ ] Audio Control Amplifier

3.0 PIN IDENTIFICATION

Table 4. Connector Pin Identification

P40 (37-pin connector)

1	INPH SQUELCH (see pin 25)	20	INPH VOLUME
2	MIC HI	21	MASTER VOLUME
3	EMERG CONTROL (see pin 9)	22	MIC LO
4	HDPH HI	23	HDPH LO
5	CVR HI	24	CVR LO
6	INPH HOT SWITCH	25	INTERNAL VAS POT (see pin 1)
7	INPH HI	26	INPH HI
8	28 VDC	27	AUDIO COMMON
9	28 VDC (ISOLATED, see pin 3)	28	AUDIO COMMON
10	POWER GROUND	29	AUDIO COMMON
11	VOICE SWITCH	30	AUDIO COMMON
12	IDENT SWITCH	31	AUDIO COMMON
13	no connection	32	AUDIO COMMON
14	INPH to SPKR SWITCH	33	AUDIO COMMON
15	no connection	34	AUDIO COMMON
16	PTT (MUTE) SWITCH	35	SPKR LO
17	no connection	36	PLT SEL COMM HI
18	SPKR SWITCH	37	SPKR HI
19	CHASSIS GROUND		

P50 (50-pin connector)

1	PA SDTN	26	AUDIO COMMON
2	COMM 3 HI	27	NAV 1 SWITCH
3	COMM 2 HI	28	DME 2 SWITCH
4	COMM 2 SDTN	29	MKR 1 SWITCH
5	COMM 4 HI	30	MKR 1 HI
6	COMM 1 SWITCH	31	NAV 2 HI
7	COMM 3 SWITCH	32	NAV 1 HI
8	AUDIO COMMON	33	DME 2 HI
9	ADF 2 SWITCH	34	AUX AUDIO HI
10	ADF 1 SWITCH	35	AURAL WARN HI
11	NAV 2 SWITCH	36	COMM 3 VOLUME
12	MKR 2 SWITCH	37	COMM 4 VOLUME
13	DME 1 SWITCH	38	COMM 2 VOLUME
14	ADF 1 HI	39	DME 1 VOLUME
15	ADF 2 HI	40	COMM 1 VOLUME
16	MKR 2 HI	41	SDTN VOLUME
17	DME 1 HI	42	AUDIO COMMON
18	COMM 1 HI	43	AUDIO COMMON
19	COMM 1 SDTN	44	NAV 2 VOLUME
20	COMM 3 SDTN	45	NAV 1 VOLUME
21	COMM 4 SDTN	46	MKR 1 VOLUME
22	PA KEY	47	MKR 2 VOLUME
23	COMM 4 SWITCH	48	ADF 1 VOLUME
24	COMM 2 SWITCH	49	ADF 2 VOLUME
25	AUDIO COMMON	50	DME 2 VOLUME

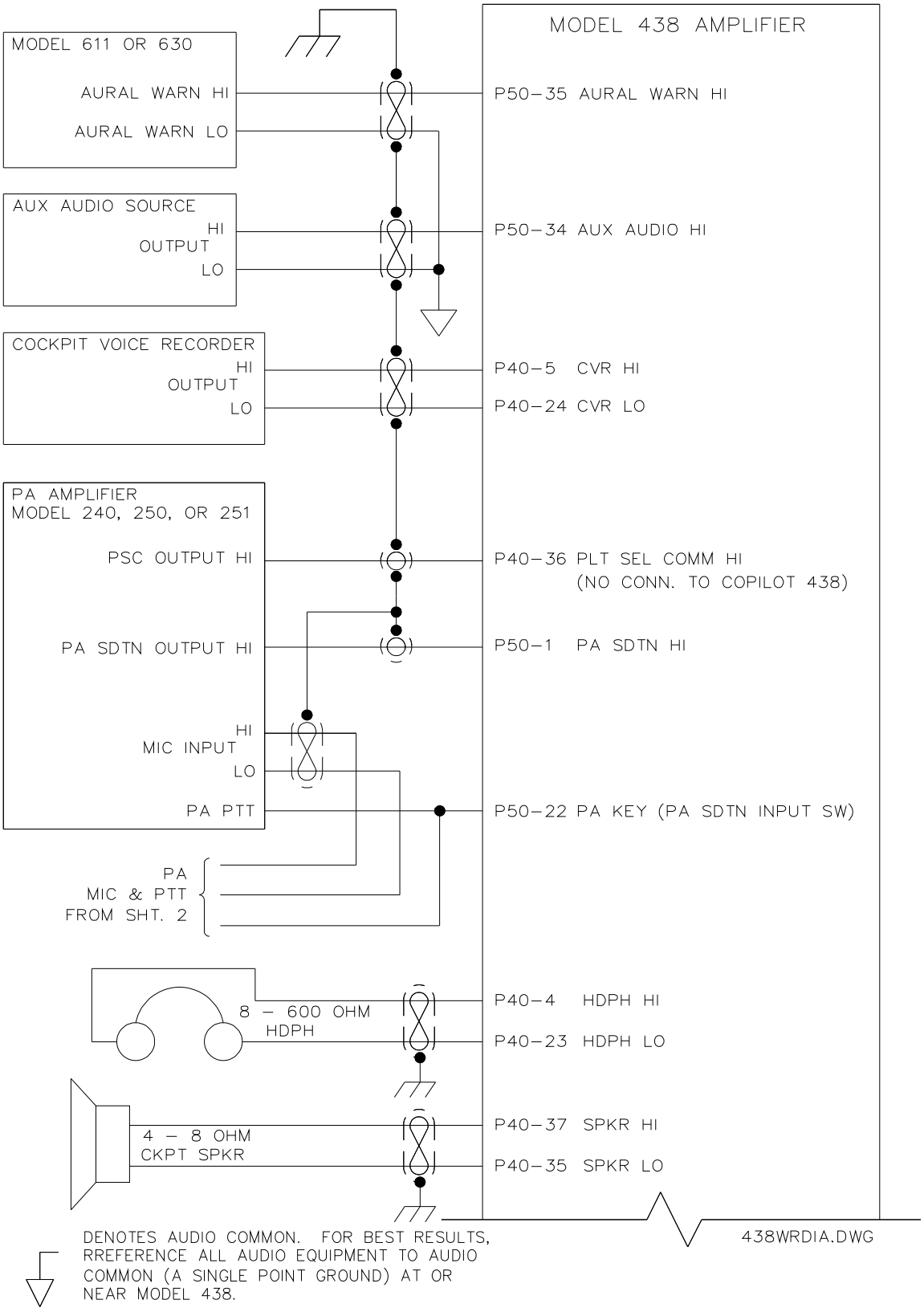
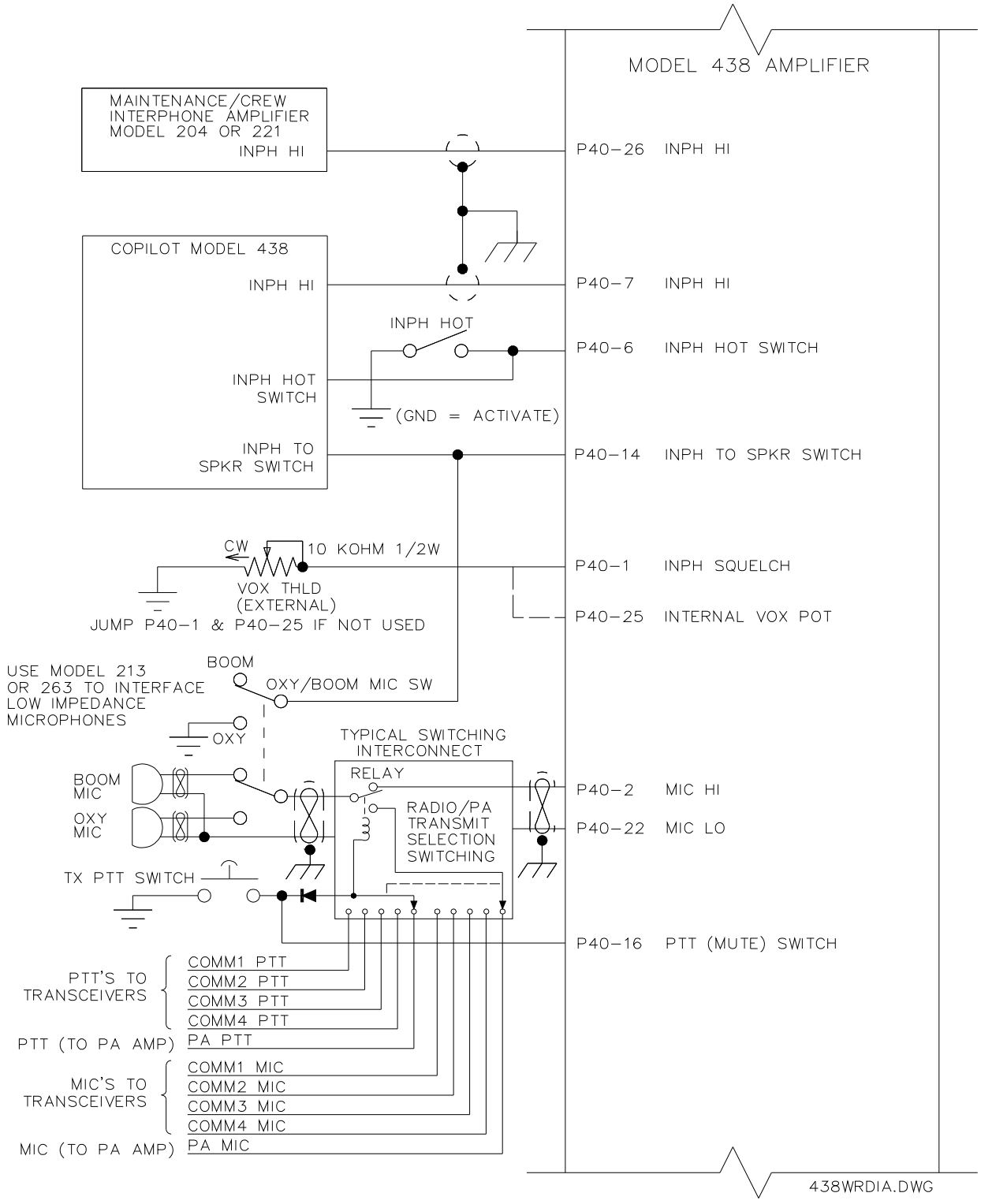


Figure 2. Wiring Diagram



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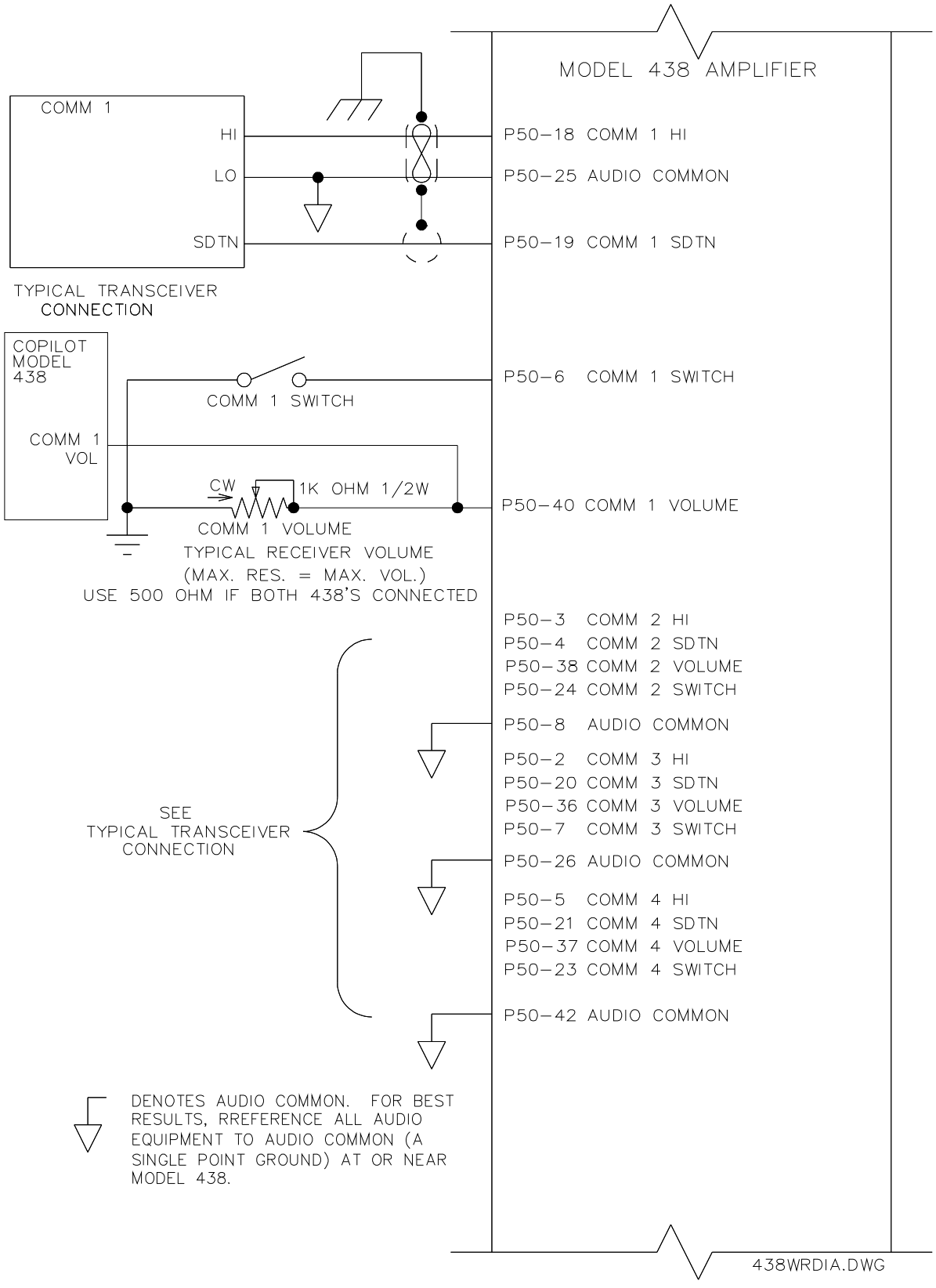

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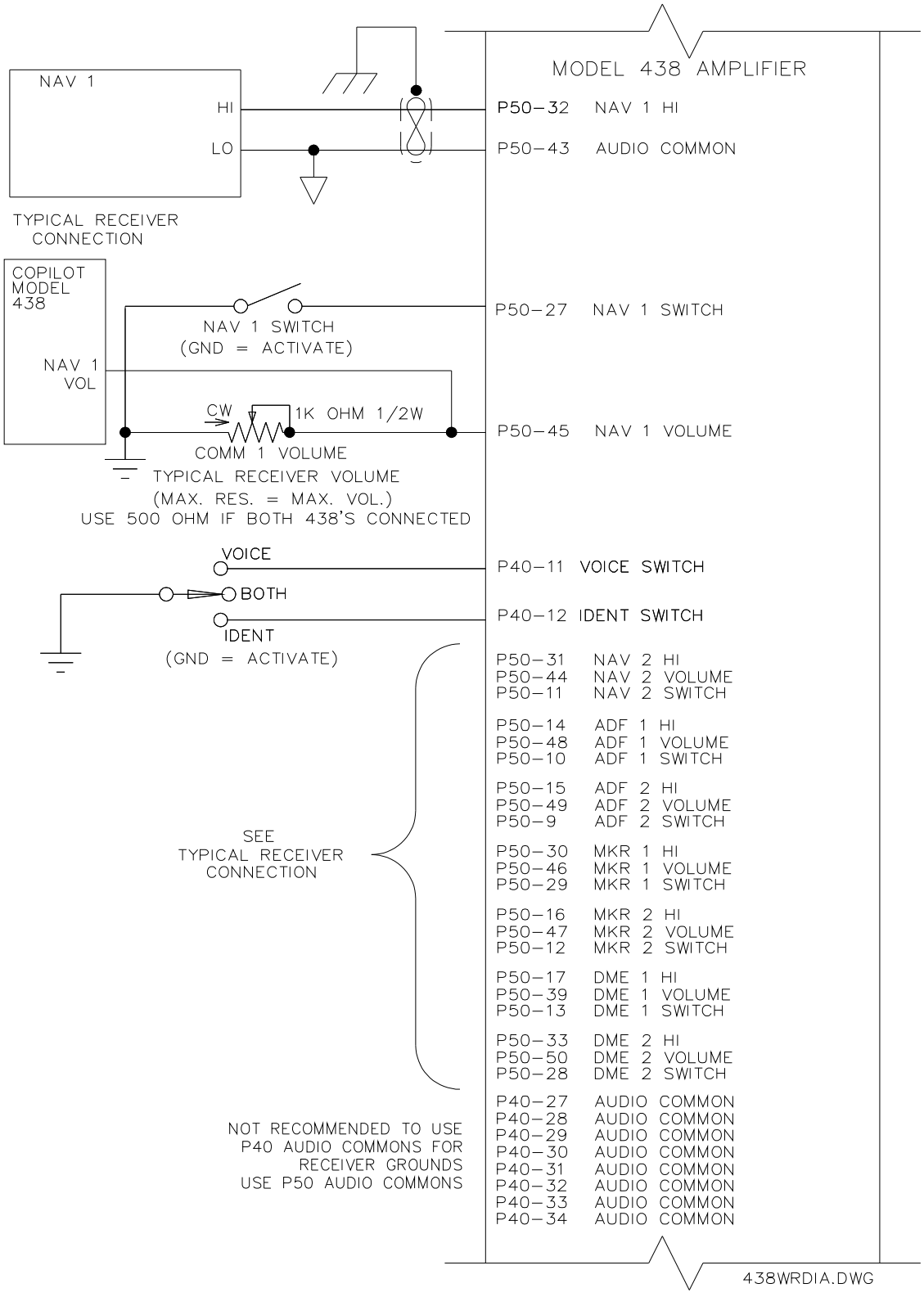

Figure 2. Wiring Diagram
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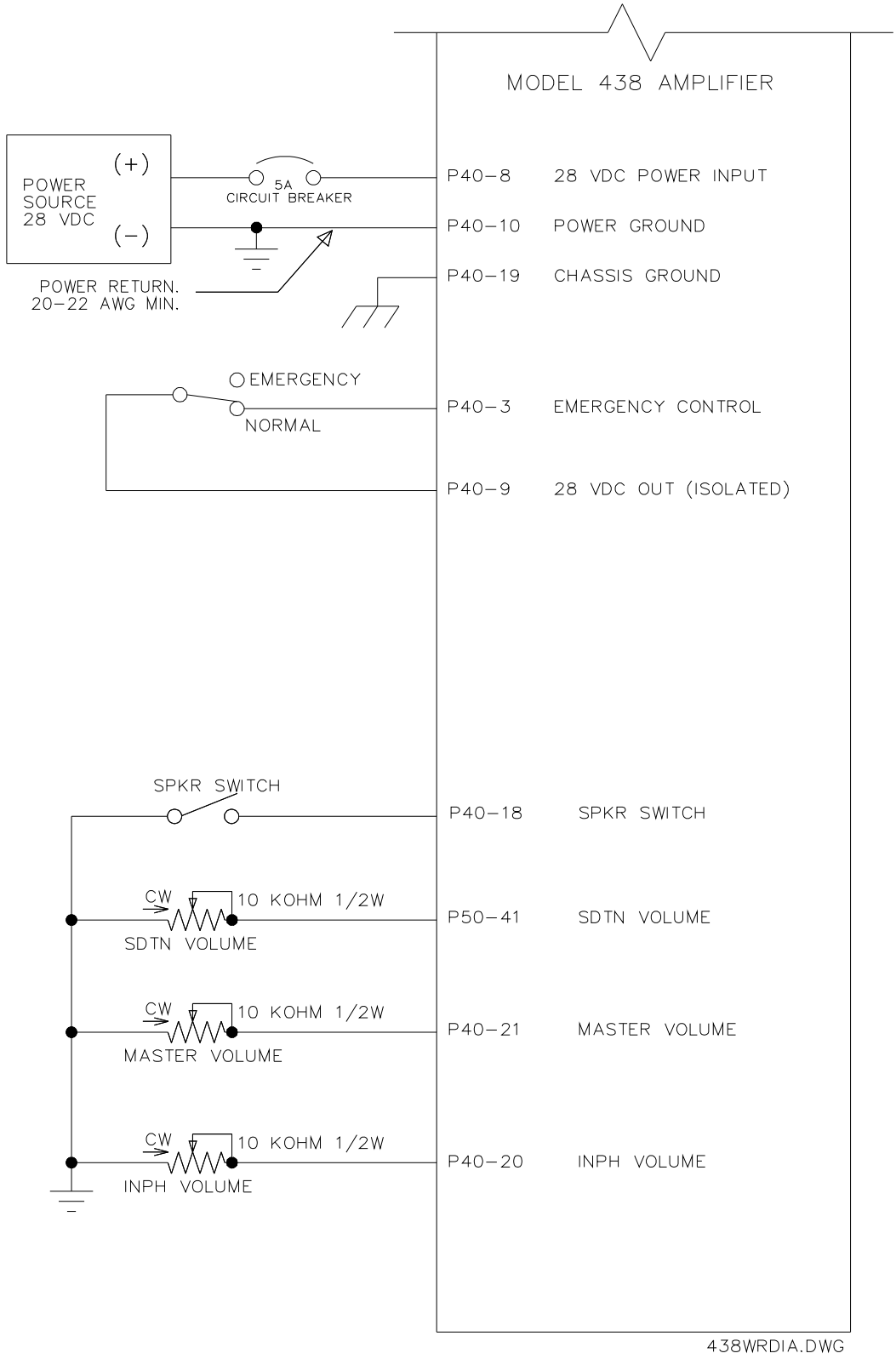

Figure 2. Wiring Diagram
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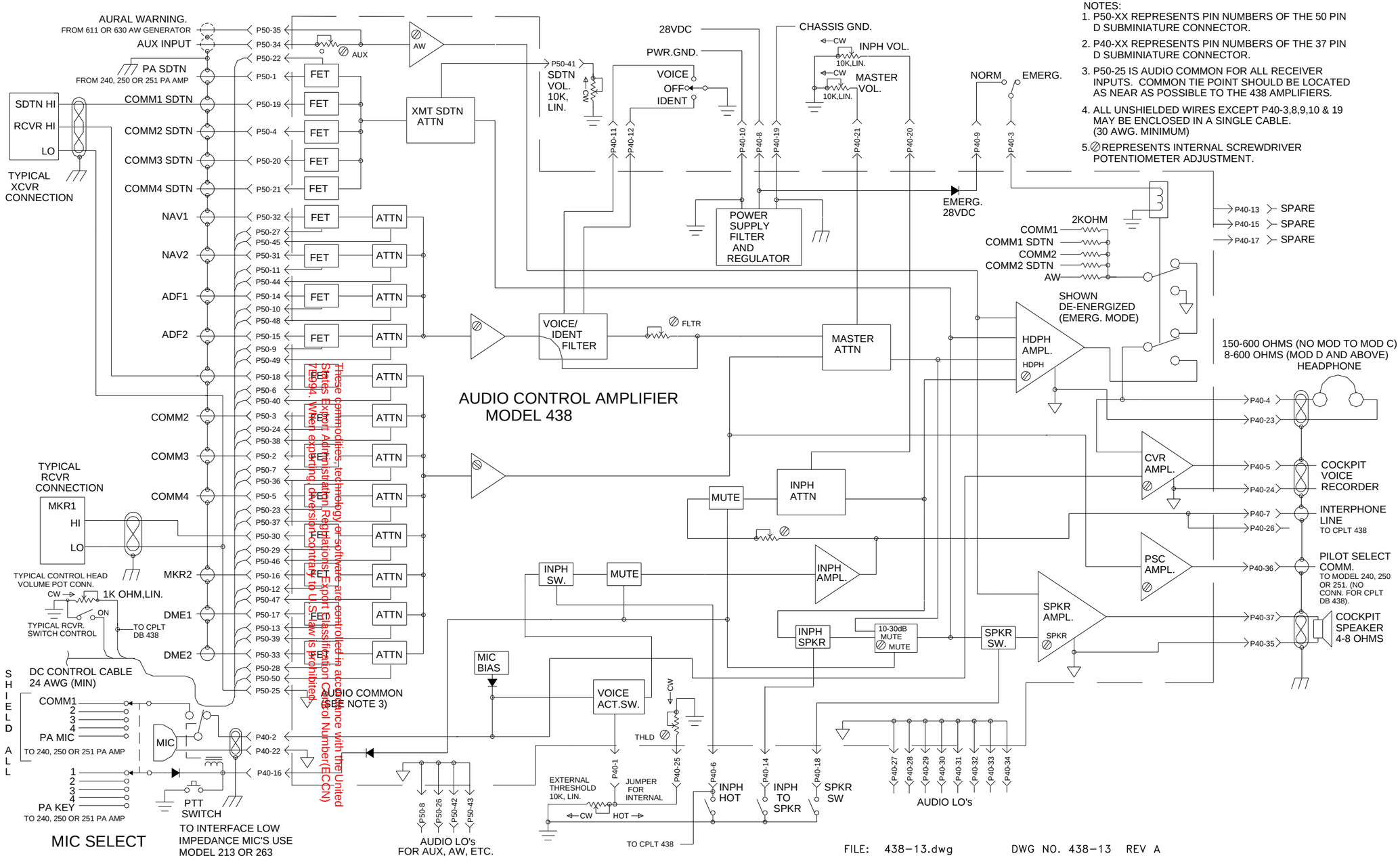

Figure 3. MODEL 438 Block Diagram

4.0 CALIBRATION AND TEST PROCEDURES

Calibration procedures are included in documents 438-4 and 438-4-1 (for ITAR controlled models), Acceptance Test Procedure.

Schematics, PCB assembly drawings, and parts lists, are contained within document 438-16 and 438-16-2 (for ITAR controlled models) for purposes of troubleshooting and repair by the factory.

No scheduled maintenance is required.

Table 5. Environmental Qualification Form

NOMENCLATURE: AUDIO CONTROL AMPLIFIER

TYPE/MODEL/PART NO.: MODEL 438-[ ] TSO NUMBER: TSO-C50c

MANUFACTURERS SPECIFICATION AND/OR OTHER APPLICABLE SPECIFICATION:
Document No. 438-16-1, Equipment Manual

MANUFACTURER: NAT SEATTLE, INC.

ADDRESS: 22125 17TH AVE SE, SUITE 107, BOTHELL, WA 98021

Conditions	DO-160B Section/ Paragraph	Description of Conducted Tests
Temperature and altitude Low temperature High temperature Altitude	4.0 4.5.1 4.5.3 4.6.1	Equipment meets requirements of Category F2 similarity to the Model 418 amplifier. (see also temperature variation) (see also temperature variation) .
Temperature variation	5.0	Equipment meets requirements of Category B by similarity to the Model 438 amplifier.
Humidity	6.0	Equipment meets requirements of Category A by similarity to the Model 418 amplifier.
Operational shocks and Crash safety Operational shocks Crash safety	7.0 7.2 7.3	Equipment meets requirements of DO-160B, paragraphs 7.2.1, 7.3.1, 7.3.2, and 7.3.2.2 by similarity to the Model 418 amplifier.
Vibration	8.0	Equipment meets requirements (without shock mounts) of Categories J, L, and O (DO-160B, table 8-1) by similarity to the Model 418 amplifier.
Explosion proofness	9.0	Equipment identified as Category X, no test required.
Waterproofness	10.0	Equipment identified as Category X, no test required.
Fluids susceptibility	11.0	Equipment identified as Category X, no test required.
Sand and dust	12.0	Equipment identified as Category X, no test required.
Fungus resistance	13.0	Equipment identified as Category X, no test required.
Salt spray	14.0	Equipment identified as Category X, no test required.

Table 5. Environmental Qualification Form
(continued)

TYPE/MODEL/PART NO.: MODEL 438-[ ]

Conditions	DO-160B Section/ Paragraph	Description of Conducted Tests
Magnetic effect	15.0	Equipment identifed as "X", no test required.
Power input	16.0	Equipment qualified to Categories B and Z by similarity to the Model 418.
Voltage spike	17.0	Equipment meets requirements of Category A by similarity to the Model 418.
Audio frequency conducted susceptibility	18.0	Equipment meets requirements of Category A by similarity to the Model 418.
Induced signal susceptibility	19.0	Equipment meets requirements of Category A by similarity to the Model 418.
Radio frequency susceptibility	20.0	Equipment meets requirements of Category A by similarity to the Model 418.
Emission of radio frequency energy	21.0	Equipment meets requirements of Category A by similarity to the Model 418.
Lightning induced transient susceptibility	22.0	Equipment meets requirements of Category L by similarity to the Model 418.
Lightning direct effects	23.0	Equipment identified as Category X, no test required.
Icing	24.0	Equipment identified as Category X, no test required.

Other Tests:

Acceptance Tests according to dB Systems Procedure 438-4 and performance tests in accordance with RTCA Document DO-170, Appendix D were conducted to verify complete and proper operation of the Model 438 qualification test unit S/N 101. The Model 438-[ ] MOD D was tested to RTCA DO-214 and dB Systems Procedure 438-4 to verify complete and proper operation of the Model 438 qualification test unit S/N 3069.

Remarks:

- Tests of DO-160B, Sections 4.0 (paragraphs 4.5.1 and 4.5.3), 5.0, 16.0, and 18.0 were conducted on the Model 418 amplifier at dB Systems, Inc. in Redmond, Washington
- Tests of DO160B, Sections 4.0 (paragraph 4.6.1), 6.0, 7.0, 8.0, 17.0, 19.0, 20.0, and 21.0 were conducted on the Model 418 amplifier at Sundstrand Data Control, Inc. in Redmond, Washington.
- Tests of D0-160B, Section 22.0 were conducted on the Model 418 amplifier at Beech Aircraft Corporation in Wichita, Kansas.
- The Model 438-[ ] MOD D redesign was qualified by similarity to the Model 456-[ ] Audio Control Amplifier. All tests conducted on the Model 456-[ ] are summarized in dB Systems Document No. 438-8 Appendix B.
- The Model 438-[ ] MOD D was retested to RTCA DO-160C sections 7.0 and 8.0 at Primex Aerospace in Redmond, Washington. Section 8.0 category L was extended from 150Hz to 2000Hz. Section 7.2 was tested to a level of 20g in 6 directions while operating.