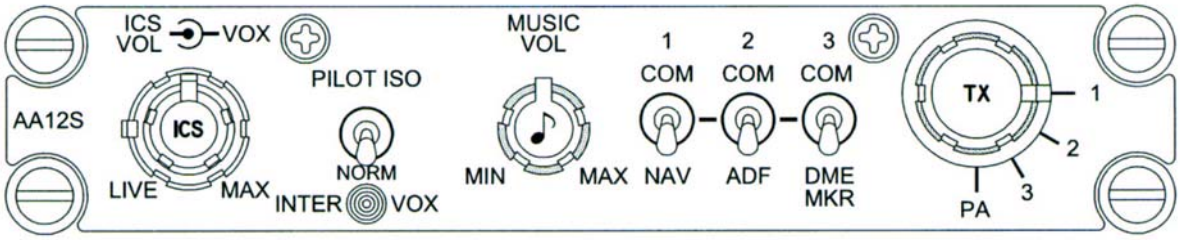
SM69

AA12S Series
Compact Audio Controller



INSTALLATION AND OPERATION MANUAL

REV 4.00 October 13, 2005

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Periodically NAT will release manual amendments. In order to maintain the most accurate and up to date manual these amendments should be carried out immediately upon receipt and recorded on the following amendment record.

AMENDMENT RECORD

Amendment Number	Amendment Date	Section(s) Changed	Date Entered	Entered By
806-0001	Oct 14/05	1,3		**Performed at factory**

Insert any Amendment Instruction sheets after this page.

INSTALL_OPS
MANUAL AMENDMENT

Manual: SM69 (AA12S)	**Amendment #: 1**
Document # SM69\Install_Ops\809-0001	**Amendment Date:** Oct 14, 2005

The purpose of this amendment is to change the Revision of the manual to 4.00 (to reflect its status as a 2-part manual), and to correct a Direct Audio statement (removed from Section 3.3.1, added to Section 1.2.1.

NB. This amendment can be performed on both Rev 1.00 **OR** Rev 4.00 of this manual.

Amendment Instructions:

1

Remove Pages	Replace With Pages
1-1 and 1-2 Rev 1.00 or 4.00	1-1 and 1-2 Rev 4.00 Amendment # 1
3-1 to 3-4 Rev 1.00 or 4.00	3-1 to 3-4 Rev 4.00 Amendment # 1

2 Update the Amendment Record sheet at the front of the manual.

3 Insert this page into the manual after the Amendment Record sheet (page ii).

Manual Amendment ends after the following amended pages

Table of Contents

Section 1 Description

1.1 Introduction

Information in this section consists of the functional and operational procedures for the AA12S Series Compact Audio Controllers.

The information in this manual is applicable to all models unless otherwise specified.

1.2 General Information

The AA12S is a compact Dzus-mounted audio controller with an integral 4-place stereo voice-activated intercom. It provides intercom capabilities for the pilot, co-pilot and two passengers (PAX). The AA12S accepts stereo music inputs from either portable or fixed entertainment systems to produce high quality stereo headset output.

Radio functions include selectable transmit capability for pilot and co-pilot on 3 COM radios and a PA. Receive audio selections include COM1, COM2, COM3, MKR, NAV, ADF, and DME.

1.2.1 Features

All four mics have individual VOX gating. Each gate may also be activated with the corresponding ICS keyline.

ICS muting is automatic during radio transmission.

The unit is supplied to suit a standard NAT bidirectional ICS audio TIE line for multi-unit interface (configuration dependent). The crew and PAX are always connected except in the case of Pilot ISO mode, when the pilot is disconnected from the ICS tie line.

If required, one or more receiver audio inputs may be configured at the factory prior to ordering as (an) unswitched Direct Audio input(s). A new part number may be assigned. Contact NAT Product Support for further information.

1.2.2 Installation Adjustments

The following audio levels can be adjusted at the time of installation, or during service by an approved dealer, using individual level trimpots.

- Music Mute level
- ICS Bass level
- RX volume level
- Music Bass level
- Sidetone level
- ICS Balance
- RX Balance
- Music Balance

1.3 Specifications

1.3.1 Electrical Specifications

Power Supply

Input voltage	11-30 Vdc operating. Linear regulator with reverse and over voltage protection.
Internal supply	11 Vdc
Nominal Lighting Voltage	27.5 Vdc @ 200 mA max (AA12S-001) 13.5 Vdc @ 400 mA max (AA12S-004)
Nom. Operating Voltages (one input for both)	27.5 Vdc @ 600 mA max 13.8 Vdc @ 600 mA max
Maximum Operating	30.3 Vdc
Minimum Operating	11.0 Vdc

Note: The AA12S is not designed to operate under emergency electrical system conditions for 14 Vdc operation.

Input Signals

Mic:

Quantity	4 (Pilot, Copilot, 2 Passengers)
Rated level	250 mVrms nominal (125 to 500 mVrms)
Impedance	150 Ohm ±10 %
Circuitry type	unbalanced

TX Keyline:

Quantity	2 (Pilot, Copilot)
Rated level	ground activates keyline, <20 mA source current

ICS Keyline:

Quantity	4 (Pilot, Copilot, 2 Passengers)
Rated level	ground activates keyline, <1 mA source current

Receive Audio:

Quantity	7 (3 COM, 4 NAV)
Rated level	2.5 Vrms nominal (1.3 to 5.0 Vrms)
Impedance	1 kOhm ±10 % (1 to 3 kOhm for sidetone)
Circuitry type	unbalanced

Music Inputs:

Quantity	2 (left channel, right channel)
Rated level	1.4 Vrms nominal (850 mVrms to 2.4 Vrms)
Impedance	11 kOhm ±10 %
Circuitry type	unbalanced

Bidirectional Signals

ICS TIE Channel:

Quantity	1
Rated level	340 mVrms nominal (170 to 680 mVrms)
Impedance	2 kOhm ±10 %
Circuitry type	unbalanced

Output Signals

Phones:

Quantity	4 (Pilot, Copilot, 2 Passengers)
Rated level	>5.5 Vrms (>100 mW, RX, ICS and music) >0.7 Vrms (TX sidetone, adjustable) 1.5 Vrms nominal (Pilot ISO mode) >0.2 Vrms (Automatic failsafe mode)
Impedance	300 Ohm ±10 %
Circuitry type	transformer, unbalanced

Mics:

Quantity	4 (COM1, COM2, COM3 and PA)
Rated level	250 mVrms ±10 %
Impedance	150 Ohm nominal
Circuitry type	direct throughline via relay

Keylines:

Quantity	4 (COM1, COM2, COM3 and PA)
Rated level	<1 A
Circuitry type	grounded relay contact

Audio Performance

As per RTCA DO-170 Product Classification 1a except where noted.

***** Manufacturers Specification ****** Exceeds DO-170 requirement

Rated Output Power (each stereo channel) 100 mW min. into 300 Ω

Audio freq. Response:

Receive	≤3dB down from 350 - 6000 Hz
Intercom	≤3dB down from 350 - 3000 Hz
ICS Tie	≤3dB down from 350 - 3000 Hz
Music	≤3dB down from 300 - 15000 Hz (Music Bass control at mid setting)
Distortion	≤10%, ≤3 % typical (350 to 6000 Hz)

Input - Input crosstalk	-37 dB max*
Input - Output crosstalk	-55 dB max
Input - Mic crosstalk	<200 µVrms*

Audio noise	-60 dB max**
Output Regulation	≤3 dB variance (350 to 6000 Hz)
Audio Communication	Loud & Clear
ICS Volume controls	<35 dB range*, 40 dB nominal
Music Volume controls	<35 dB range*, 40 dB nominal
Receive Input impedance	1 kΩ ±10 %
Mic Input impedance	150 Ω ±10 %
Music Input impedance	11 kΩ ±10 %
ICS Tie Line	2 kΩ ±10 %

1.3.2 Physical Specifications

Width	4.95" (125.7 mm) max, behind panel
Depth	5.80" (147.3 mm) max, behind panel
Height	1.15" (29.2 mm) max
Weight	1.2 lb (0.50 kg) max
Mounting	Dzus rail, four fasteners, 5.366" horizontal spacing, and 0.750" vertical spacing
Faceplate	Lighted panel is laser-engraved acrylic edge lit with blue-white backlighting
Material/Finish	Brushed aluminum with chromate conversion
Connectors	One 25-pin female D-min connector with jackposts One 44-pin male high-density D-min connector with jackposts
Installation Kit	AA12S-IKC

1.3.3 Environmental Specifications

Temperature	-20 °C to +55 °C
Altitude	50,000 ft
Shock	6g/11ms, 20g/11ms

Safety of Flight requirements per RTCA DO-160D Environmental Conditions
DO-160D Env. Cat. [(A1)(D1)X]BXB[(SMB)(UF)]XXXXXXZBAXXXMXXXX

1.3.4 Unit Nomenclature

Variants of the AA12S series Compact Audio Controllers are identified as follows:

1.3.4.1 Unassigned Options

These portions of the designator may be assigned to future special options.

1.3.4.2 Lighting Voltage

This portion of the designator refers to the lighting voltage of the specific model.

00**1** = 28 Vdc lighting

00**4** = 14 Vdc lighting

End of section 1

Section 2 Installation

2.1 Introduction

Information in this section consists of: unpacking and inspection procedures, installation procedures, post-installation checks, and installation drawings.

2.2 Unpacking and Inspection

Unpack the equipment carefully and locate the warranty card. Inspect the unit visually for damage due to shipping and report all such claims immediately to the carrier involved. Note that each unit should have the following:

- AA12S Series Compact Audio Controller
- Warranty Card
- Operator's Manual
- Release certification

Verify that all items are present before proceeding and report any shortage immediately to your supplier.

2.2.1 Warranty

Complete the warranty card information and send it to NAT when the installation is complete. If you fail to complete the warranty card, the warranty will be activated on date of shipment from NAT.

Note: An appropriately rated facility, e.g. Certified Aircraft Repair Station, must install this equipment in accordance with applicable regulations. NAT Ltd's warranty is not valid unless the equipment is installed by an authorized NAT Dealer. Failure to follow any of the installation instructions, or installation by a non-certified individual or agency will void the warranty, and may result in a non-airworthy installation.

2.3 Installation Procedures

2.3.1 Warnings

Do not bundle any lines from this unit with transmitter coax lines. Do not bundle any audio or DC power lines from this unit with 400 Hz synchro wiring or AC power lines. Do not position this unit or wiring from this unit next to any device with a strong alternating magnetic field such as an inverter, or significant audio interference will result.

2.3.2 Cautions

In all installations, use shielded cable exactly as shown and ground as indicated. Significant ground loop and noise problems may result from not following these guidelines.

The shielding and routing of the MIC and ICS TIE LINES used in the AA12S installation **is very critical** and poor performance of the aircraft audio system will result if these issues are not handled properly.

The operation of the VOX intercom can be severely degraded by the quality and type or mix of microphones used in the aircraft. If one user has a very 'hot' microphone, it will present more electrical signal to the VOX circuit and the VOX SQUELCH will have to be set to quiet this microphone. The other microphones may not be able to generate enough electrical energy to overcome this VOX SQUELCH setting, and will break up or not be heard at all.

2.3.3 Notes

Audio performance can be impaired by the introduction of airframe electrical noise at the headset jack locations. For best results, all headset jacks should be fully isolated from the airframe.

2.3.4 Cabling and Wiring

All unshielded wire should be MIL-W-22759 or equivalent. For shielded wire applications, use Tefzel MIL-C-27500 shielded wire with solder sleeves (for shield terminations) to make the most compact and easily terminated interconnect. Follow the wiring diagrams in Section 2.6 as required.

Allow 3 inches from the end of the wire to the shield termination to allow the hood to be easily installed. Note that the hood is a ‘clamshell’ hood, and is installed after the wiring is complete.

All wiring should be at least 22 AWG, except power and ground lines, which should be at least 20 AWG. Ensure that all ground connections are clean and well secured.

2.3.5 Post-Installation Checks

If any preset requires adjustment, be sure this is carried out before the aircraft leaves, and that the unit and its mating connector are secured before departure. Make all required log book entries, electrical load, weight and balance amendments and other paperwork as required by your local regulatory agency.

2.3.5.1 Voltage/Resistance Checks

Check the following:

a) P101 pin **<1>** for avionics buss voltage.

b) P101 pin **<16>** for continuity to ground.

c) P101 pins **<9> <10> <11>** and **<12>** for continuity to ground when the relevant switch is closed. (Also check pins **<13>** and **<14>** if switches are installed in these positions.)

d) P301 pin **<5>** for avionics lighting bus voltage relative to ground (with lighting on).

e) P301 pin **<17>** for continuity to ground.

2.3.5.2 Power On Checks

a) Install the AA12S and power up the ship's systems. Turn on the radios and accessories required for the system.

b) Check for correct radio audio and adjust for acceptable level.

c) Run through all installed functions, and check the ICS and TX functions for all users. Refer to Section 3 for specific operation details.

Note: Significantly different headsets may have different mic characteristics.

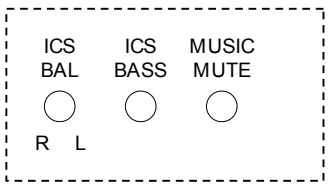
d) If any preset requires adjustment, be sure this is carried out before the aircraft leaves, and that the unit and its mating connector are secured before departure. Make all required log book entries, electrical load, weight and balance amendments and other paperwork as required by your local regulatory agency.

2.3.6 Adjustments

The internal adjustments that can be varied are located along the sides of the unit and are accessed through necessary switches and trimpots.

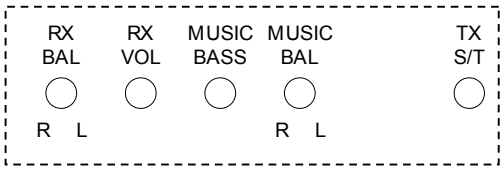
Note: The unit is shipped from the factory with all internal adjustments set to the normal test levels. Once installed in the aircraft, it may be desirable to change some of these settings to best suit the local operating environment.

2.3.6.1 Left Side Adjustments



The adjustments found on the left side of the unit are:
ICS BAL R L, which controls the ICS Balance;
ICS BASS, which controls the ICS bass level;
and MUSIC MUTE, which controls the Music mute level.

2.3.6.2 Right Side Adjustments



The adjustments found on the right side of the unit are:
TX S/T, which controls the sidetone level;
RX BAL R L, which controls the RX Balance;
RX VOL, which controls the RX volume level;
MUSIC BASS, which controls the Music Bass level;
and MUSIC BAL R L, which controls the Music balance.

Upon satisfactory completion of all performance checks, make the required log entries and complete the necessary Regulatory Agency paperwork before releasing the aircraft for service.

2.4 Continued Airworthiness

Maintenance of the AA12S is 'on condition' only. Periodic maintenance of this product is not required.

2.5 Accessories Required But Not Supplied

Installation kit p/n AA12S-IKC (crimp) is required to complete the installation. The kit consists of one 44-Pin D-min Female Crimp Kit (NAT Part # D44SL-IKC) and one 25-Pin D-min Male Crimp Kit (NAT Part # D25PL-IKC).

The **D44SL-IKC** consists of:

Quantity	Description	NAT Part #
1	D-min 44 Socket Housing	20-20-044
44	Mini D Crimp Socket	20-26-703
1*	Jack Screw Set	20-27-002
1*	Lock Clip Set	20-27-004
1	25 pin Connector Hood	20-29-026

The **D25PL-IKC** consists of:

Quantity	Description	NAT Part #
1	D-min 25 Pin Housing	20-11-025
25	MS Crimp Pin	20-26-891
1*	Jack Screw Set	20-27-002
1*	Lock Clip Set	20-27-004
1	25 Pin Connector Hood	20-29-026

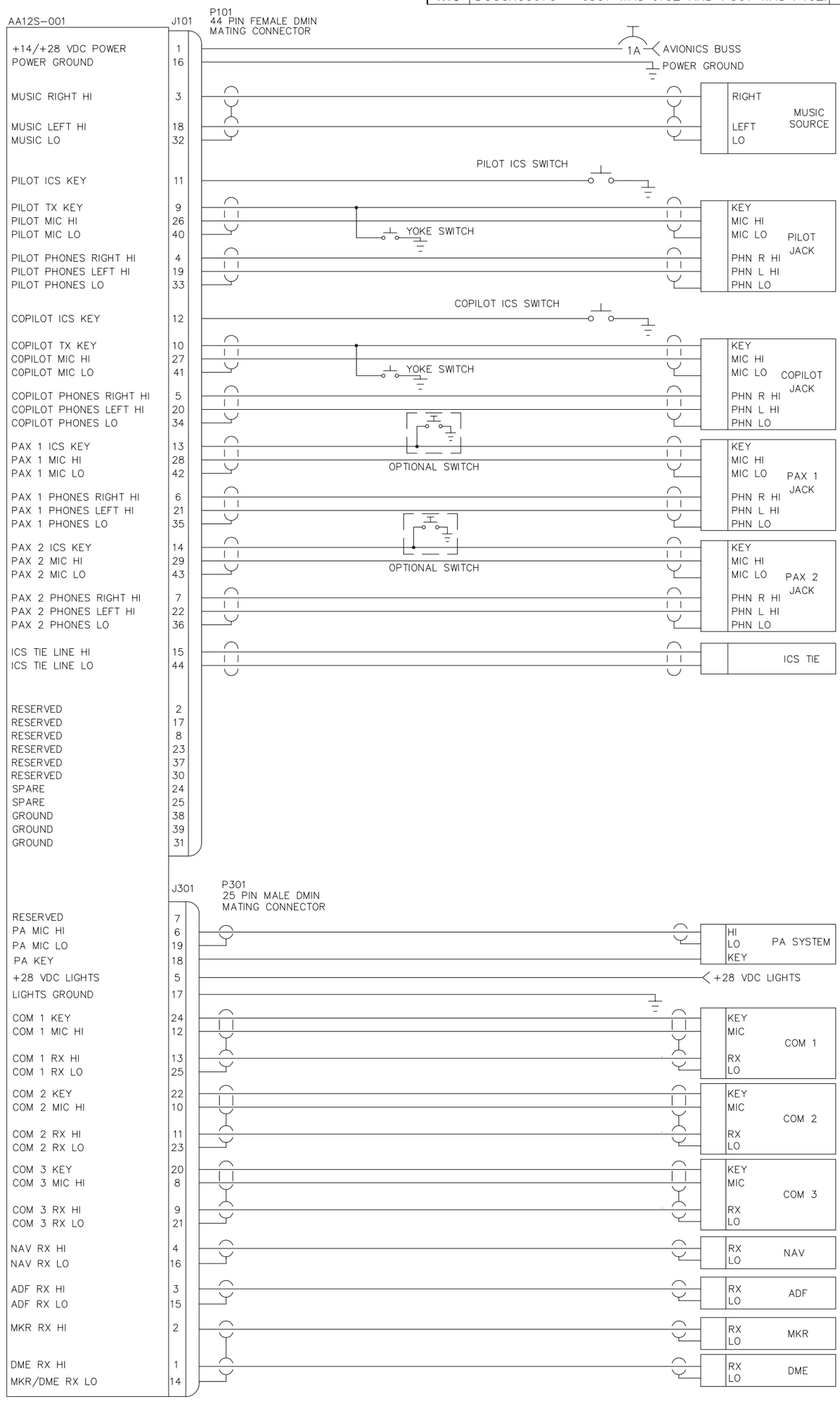
* Use as required.

2.6 Installation Drawings

DRAWING	REV.	DESCRIPTION	TYPE	SERIAL #
AA12S\001\403-0	1.10	AA12S Compact Audio Controller	Interconnect	All
AA12S\001\405-0	1.10	AA12S Compact Audio Controller	Connector Map	All
AA12S\001\905-0	1.10	AA12S Compact Audio Controller	Faceplate	All
AA12S\001\922-0	1.10	AA12S Compact Audio Controller	Mech. Installation	All

Section 2 ends after these Drawings

REVISIONS			
REV	DESCRIPTION	DATE	BY
1.10	DOCCR00670 – J301 WAS J102 AND P301 WAS P102.	MAR 10/04	MWS



NOTES:

1. ALL WIRES SHOULD BE 22 AWG UNLESS OTHERWISE SPECIFIED. ALL WIRE SHOULD BE IN ACCORDANCE WITH MIL-W-22759. ALL SHIELDED WIRE/CABLE SHOULD BE IN ACCORDANCE WITH MIL-C-27500.

DEFINITIONS:

RESERVED:

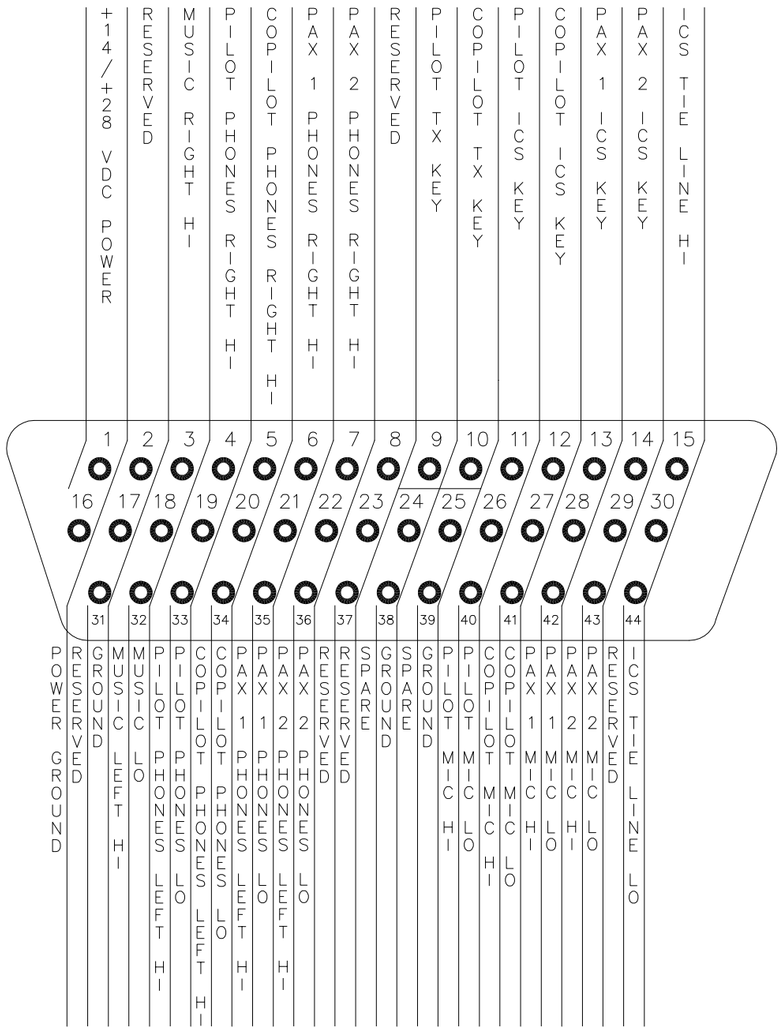
MAY BE CONNECTED AND USED IN FUTURE. THE CIRCUITRY MAY BE PRESENT OR ADDED TO ACTIVATE THE FUNCTION. THE PIN MAY BE USED FOR TEST PURPOSES. THERE IS NO EXTERNAL CONNECTION.

DESIGNED	KV/KEH	NORTHERN AIRBORNE TECHNOLOGY LTD.				
DRAWN	TAT					
DATE	SEP 22/03	TITLE	COMPACT STEREO AUDIO CONTROLLER			
CHECKED	NAT 249					
APPROVED	NAT 501	SIZE B	CAGE CODE 3AB01	PART NO. AA12S-001	REV. 1.10	SHEET 1/1
FILE	403-0.DWG	DWG. TYPE	INTERCONNECT	DWG. NO.	AA12S\001\403-0	

REVISIONS			
REV	DESCRIPTION	DATE	BY
1.10	DOCCR00670 – P301 WAS P102.	MAR 10/04	MWS

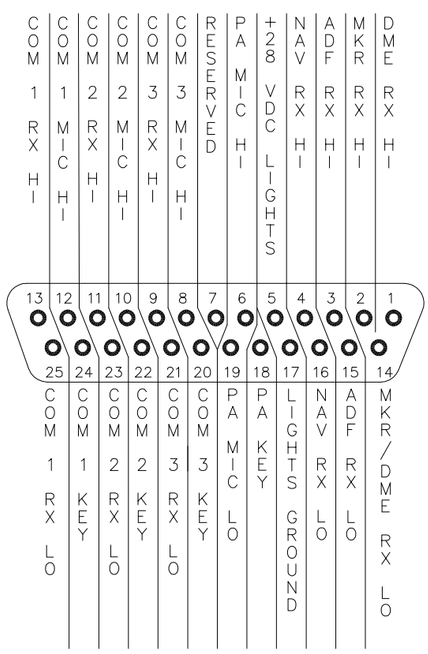
P101

44 PIN FEMALE DMIN
MATING CONNECTOR



P301

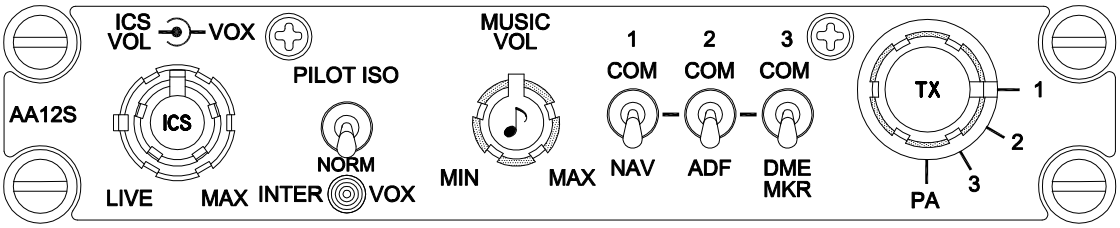
25 PIN MALE DMIN
MATING CONNECTOR



VIEW IS FROM REAR OF AIRFRAME CONNECTOR

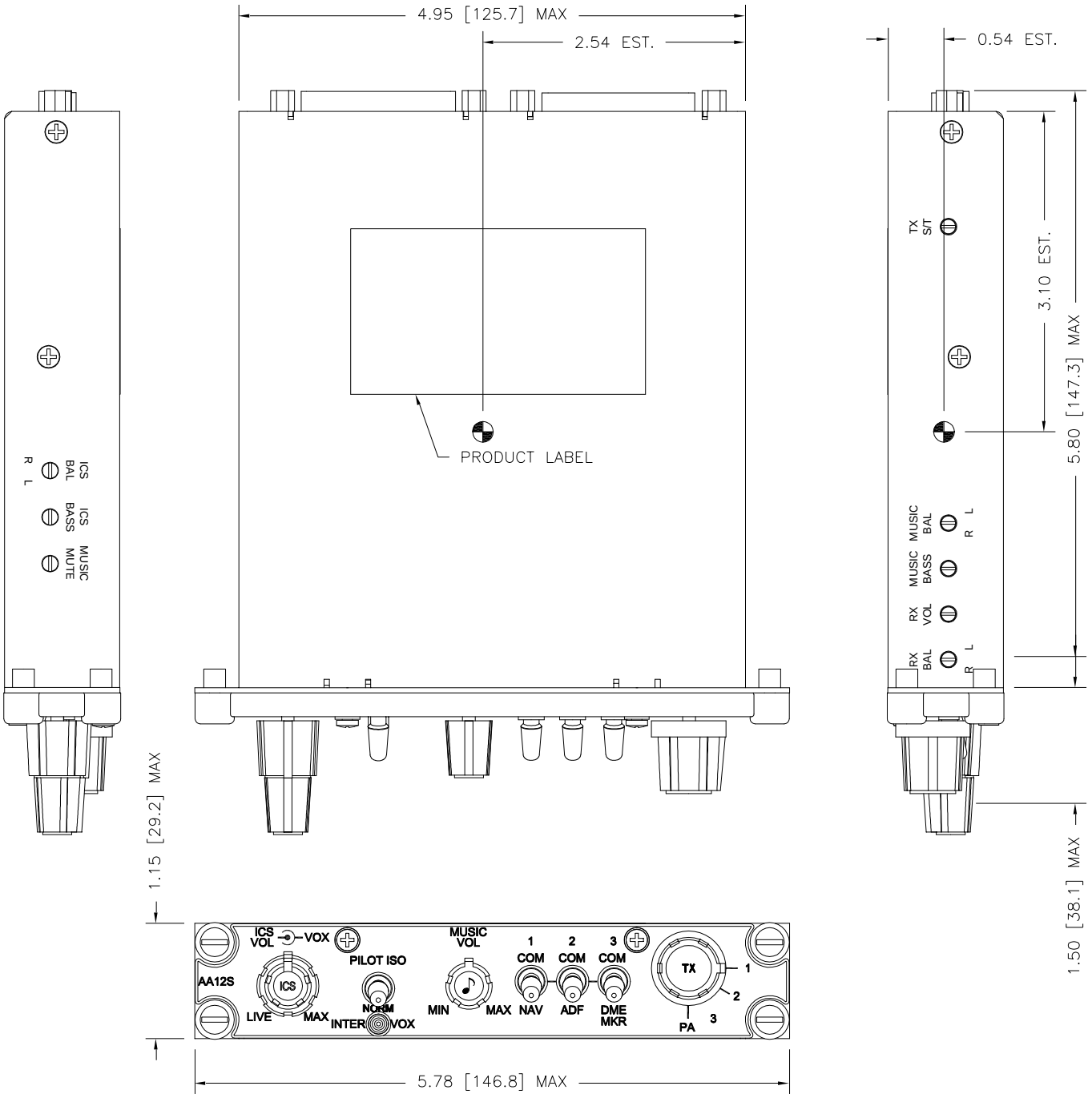
DESIGNED	KV/KEH	nat NORTHERN AIRBORNE TECHNOLOGY LTD.				
DRAWN	TAT					
DATE	~~OCT 17/03~~	TITLE	COMPACT STEREO AUDIO CONTROLLER			
CHECKED	NAT 249					
APPROVED	NAT 501	SIZE B	CAGE CODE 3AB01	PART NO. AA12S–001	REV. 1.10	SHEET 1/1
FILE	405–0.DWG	DWG. TYPE	CONNECTOR MAP	DWG. NO.	AA12S\001\405–0	

REVISIONS			
REV	DESCRIPTION	DATE	BY
1.10	DOCCR00711 – TEXT POSITIONS LIVE/MAX AND MIN/MAX MOVED.	APR 1/04	TAT



DESIGNED	KV	nat NORTHERN AIRBORNE TECHNOLOGY LTD.				
DRAWN	TAT					
DATE	SEP 5/03	TITLE	COMPACT STEREO AUDIO CONTROLLER			
CHECKED	NAT 265 / NAT 249					
APPROVED	NAT 501	SIZE A	CAGE CODE 3AB01	PART NO. AA12S–001	REV. 1.10	SHEET 1/1
FILE	905–0.DWG	DWG. TYPE	FACEPLATE	DWG. NO.	AA12S\001\905–0	

REVISIONS			
REV	DESCRIPTION	DATE	BY
1.10	DOCCR00879 – CHG'D ADJ HOLE LABELS ON COVER.	JUN 23/04	MWS



NOTES:
1. DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5M–1994

DIMENSIONS ARE INCHES [mm]	DESIGNED	KEH	nat NORTHERN AIRBORNE TECHNOLOGY LTD.
THIRD ANGLE PROJECTION	DRAWN	TAT	
	DATE	NOV 4/03	TITLE: COMPACT STEREO AUDIO CONTROLLER
MASS: 1.2 lbs. (0.5 Kg) MAX	CHECKED	NAT 249	
MATERIAL: –	APPROVED	NAT 501	SIZE A | CAGE CODE 3AB01 | PART NO. AA12S–001 | REV. 1.10 | SHEET 1/1
FINISH: CHROMATE CONVERSION	FILE 922–0.DWG	DWG. TYPE MECH. INSTALLATION	DWG. NO. AA12S\001\922–0

Section 3 Operation

3.1 Introduction

Information in this section consists of the functional and operational procedures for the AA12S Series Compact Audio Controllers.

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3.2 General Information

The AA12S is a compact Dzus-mounted audio controller with an integral 4-place stereo voice-activated intercom. It provides intercom capabilities for the pilot, copilot and two passengers (PAX). The AA12S accepts stereo music inputs from either portable or fixed entertainment systems to produce high quality stereo headset output.

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3.2.1 Features

All four mics have individual VOX gating. Each gate may also be activated with the corresponding ICS keyline.

ICS muting is automatic during radio transmission.

The unit is supplied to suit a standard NAT bidirectional ICS audio TIE line for multi-unit interface (configuration dependent). The crew and PAX are always connected except in the case of Pilot ISO mode, when the pilot is disconnected from the ICS tie line.

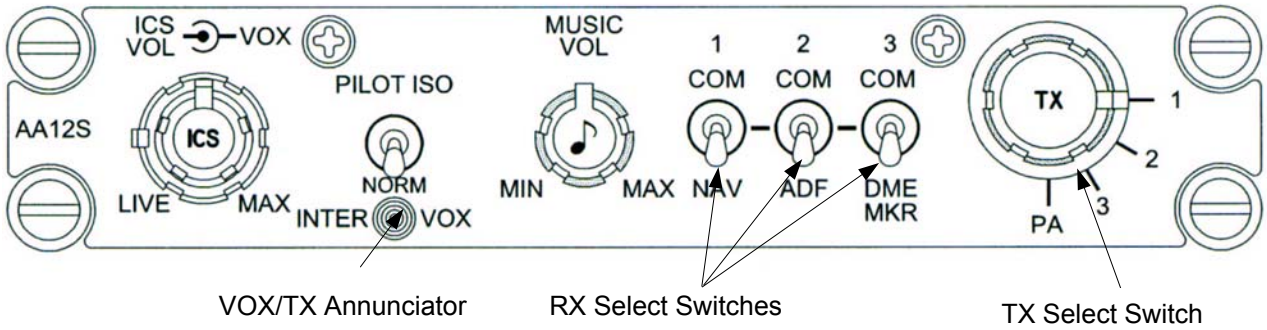
3.2.2 Installation Adjustments

The following audio levels can be adjusted at the time of installation, or during service by an approved dealer, using individual level trimpots.

- Music Mute level
- ICS Bass level
- RX volume level
- Music Bass level
- Sidetone level
- ICS Balance
- RX Balance
- Music Balance

3.3 Operation Specifics

3.3.1 Radio Selection



3.3.1.1 Receive

The AA12S is typically configured to select the RX audio from three transceivers and up to four additional receivers.

The RX Select switches are white double-throw centre-off switches. Receiver audio can be selected by setting the appropriate RX select switch to the down position.

Transceiver audio can either be selected by setting the appropriate RX select switch to the up position, or as a function of the TX select switch. The transceiver that is selected by the TX select switch is also automatically selected for receive. Receive/sidetone audio for the selected COM is automatically provided.

When a switch is in the centre-off position, no transceiver/receiver audio is selected.

3.3.1.2 Transmit

The TX select switch is a 4-position rotary control that provides radio selection for up to three transceivers and a PA. By selecting the desired transceiver and pressing the external TX PTT switch, the AA12S is activated for transmit operation, connecting the respective mic to the selected transceiver. The transceiver that is selected by the TX select switch is also automatically selected for receive. The front panel annunciator will illuminate green to indicate transmit operation (see section 3.1.3.)

TX selections are available only to the pilot and copilot. Activation of either TX PTT input connects the user's MIC to the selected COM, and activates the output PTT to the selected COM. When PTT is pressed, all audio except the sidetone of the selected COM and NAV inputs is removed from the headphone of the particular PTT user. The sidetone of the active COM is provided from the COM radio.

The PA position provides PA mic audio and PA keyline to an external amplifier (e.g. AA21, AA23, PA250) for use as either a Loudhailer or Passenger Address system.

A priority transmission feature allows the pilot to override the co-pilot.

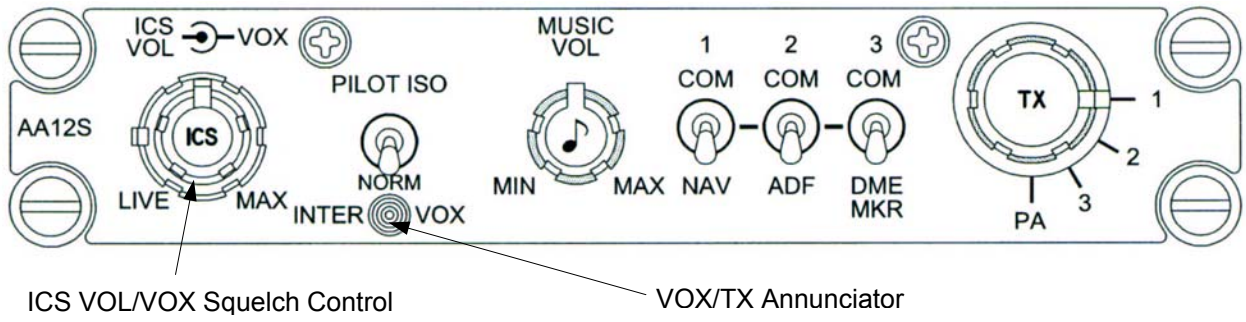
3.3.1.3 VOX/TX Annunciator

The VOX/TX Annunciator is a bicolour LED that indicates the intercom status.

During VOX activity, the annunciator LED is illuminated **red**. If TX is keyed with no ICS or sidetone, the annunciator LED is illuminated **green**. If TX is keyed with mic or sidetone, the combination of red and green will cause the LED to appear **amber**.

Note: If the LED is still illuminated green after transmission is concluded, this indicates a possible stuck mic.

3.3.2 Intercom



The VOX and ICS VOL control is a fluted concentric knob, with the ICS volume on the centre knob, and the VOX control on the outer knob.

3.3.2.1 VOX Control

The VOX control is used to set the level of audio required to activate the microphones.

The AA12S provides three modes of intercom operation, selected by the position of the VOX control.

LIVE ICS When the VOX control is positioned fully counter-clockwise (ccw), all mics will be live, and any sound picked up by the microphone(s) will be processed by the ICS system

KEYED ICS When the VOX control is positioned fully clockwise (cw), the intercom will be in a keyed-only mode.

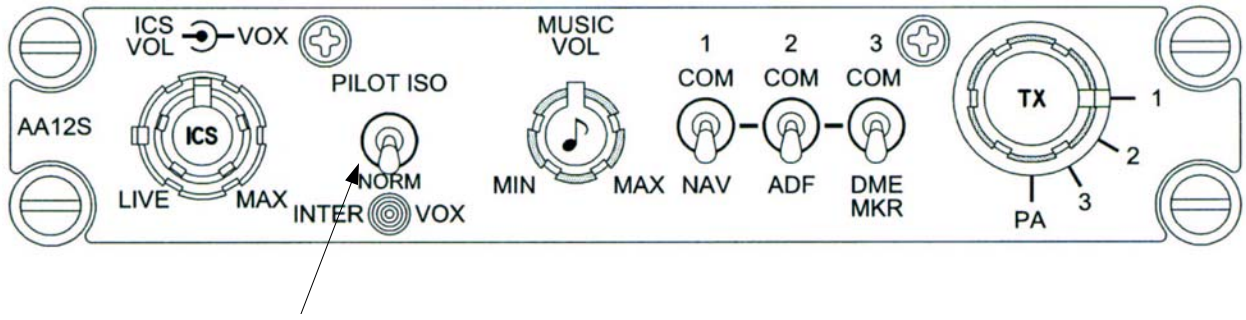
VOX ICS When the VOX control is positioned between fully cw and fully ccw, the intercom is in VOX mode. To establish the VOX threshold, rotate the control ccw until the LED turns red, and then rotate the control cw until the LED goes dark. Continue turning the control cw until the desired voice sensitivity is set.

3.3.2.2 ICS Volume Control

The ICS VOL control, which has a line to mark rotational position, is at minimum volume when fully ccw. As the knob is rotated cw, the ICS volume for crew and PAX increases.

The ICS is muted during transmit operations.

3.3.3 PILOT ISO / NORM Modes



Pilot Isolate Switch

The PILOT ISO/NORM control is a red, two-position toggle switch that allows selection of either NORM (Normal) or PILOT ISO (Pilot Isolate).

In NORM mode (default) everyone on the system can talk to each other, listen to music, and hear all selected radio audio.

The PILOT ISO mode separates the pilot from the intercom network, allowing confidential radio communications without interference from the copilot or passenger intercom or music, while maintaining complete control of all the radio functions of the audio panel. The copilot and passengers retain normal intercom and music functions.

Note: In PILOT ISO mode, the receive/sidetone levels may require adjustment at the audio source.

3.3.4 Entertainment Audio

The AA12S accepts stereo music input from portable entertainment units, CD players or other integrated on-board systems. The stereo output delivers music to stereo, or standard monaural, general aviation headsets (installation dependent).

Music muting occurs during any radio or intercom activity.

3.3.5 Automatic Fail-safe

In the event of a power failure, automatic fail-safe operation will be activated. This routes the pilot's phones, mic audio, and mic PTT directly to the COM radio selected by the position of the TX rotary selector switch, and selected audio inputs. Copilot and passengers will have no ICS, music, or receive functions.

In the unlikely event of an AA12S circuit failure that results in a communication failure, the automatic fail-safe mode can be enabled by pulling the AA12S circuit breaker.

Note: In Automatic Fail-Safe mode, the receive/sidetone levels may require adjustment at the audio source.

The pilot should confirm that all aspects of Automatic Fail-Safe operation are working before accepting the aircraft into service.

End of section 3