



Broadcast Devices, Inc.

***AES-402 Automatic Digital Audio Switcher/DA/Digital to Analog Converter***

**Technical Reference Manual**



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## Introduction

The AES-402 Digital Audio System comprises of a two input AES compatible switcher, four output digital audio DA and digital to analog converter. The unit also has status and diagnostic error indicators for troubleshooting. The AES-402 is intended for use at unattended transmitter sites or for virtually any digital switching, distribution and/or D/A conversion application. The unit has the capability to automatically switch inputs upon detection of loss of clock, digital error flags and/or silence sense. In addition to these features, the unit can function as an interface standards converter. As shipped from the factory the unit is supplied with XLR balanced connectors. For unbalanced use such as the 75 ohm unbalanced AES standard for digital audio transmission transformer adapters are available from Broadcast Devices, Inc. for conversion of the AES-402 I/O to unbalanced 75 ohm operation.



### I. Unpacking

Carefully inspect the unit after unpacking and make certain that no damage has occurred during shipping. If damage is noted, contact the shipper immediately and file a claim for damages. Each unit is carefully packed and carries full insurance against damage. Inspect the packing list and make sure that the contents of the package match those described on the packing list.

### II. Installation and Connections

Select a space in suitable E.I.A. standard rack to locate the unit. Determine the local electrical power supply voltage. As supplied from the factory, your AES-402 is setup for 100 – 240 V.A.C. 50 - 60 Hz. No external adjustment for local power standards is necessary if power available conforms to the above rating. The AES-402 utilizes a switch mode power supply and automatically adjusts for local power entry. Make connections to the unit following good engineering practice. Supply power to the unit utilizing a three pronged grounded outlet. Do not lift the electrical ground to the unit at the power receptacle as this will result in a safety hazard. In the event of ground loops, lift the ground at the offending connection only. Make certain that the unit is afforded proper ventilation in the area of the top cover vent.

#### A. Digital Interface

The AES-402 inputs are balanced XLR connections conforming to the AES standard. Each XLR connection is terminated at 110 ohms as per the standard. The balanced digital outputs are also XLR connections which provide 110-ohm transformer coupled source impedance as per the AES standard. To unbalance any input or output unbalanced termination adapters can be purchased from Broadcast Devices, Inc. Order P/N 75 – XLRM for inputs and P/N 75-XLRF for output connections. All BDI adapters utilize BNC female interface for application to 75 ohm BNC connectorized cabling.

#### B. Analog Interface

There is provided on the rear of the unit a left/right balanced analog output. This output is suitable for driving 600-ohm balanced lines and is short circuit protected. A headphone jack and volume

control buttons are provided on the front panel of the unit for confidence monitoring of the incoming feed. XLR balanced outputs conform to + 4 dBm output referenced to – 20 dBFS digital output.

### **III. Features and Operation**

The AES-402 Digital Audio System is designed to select one of two AES3 compatible feeds and route it to up to four balanced digital outputs. It also contains a high quality digital to analog converter providing a balanced left and right output. The unit features a front panel headphone output and volume control for easy confidence monitoring. The AES-402 can be used as a totally automatic switcher sensing loss of clock or any error displayed on the front panel to command the switcher to select the alternate feed. In addition to digital error switching, the unit features a silence sense circuit for switching upon audio failure conditions. All automatic switching functions are user defined and can be initialized with a simple DIP switch setting upon installation of the unit. Command of the switcher can also be performed manually at the front panel or remotely. Remote control of the unit is accessed through the rear panel 9 pin D connector for simple momentary closure or through the RS232/485 serial interfaces on the rear panel of the unit. For simple momentary ground closure to the appropriate pin selects channels and error reset. Status of channel selected and error flag is also available at this connector. Refer to the connection table 3 for connection information. The interface is compatible with open collector command. The AES-402 supplies +5 V.D.C. for powering open collector actuators. The AES-402 unit includes power fail feed through of the selected input to AES output #4. With no power connected to the unit, the AES-402 will pass the A input signal to the #4 AES output through dry relay contacts. Upon power application the relays energize and AES #4 output receives its signal from the last selected input before power was removed. An optional delay is provided to prevent the unit from switching on momentary interruptions that can occur in external equipment. Through application of a DIP switch the unit can either switch immediately upon detection of digital errors or wait 5 seconds and then switch. This delay prevents the unit from switching under transient conditions.

### **IV. Initial Operating Set up**

Attach input and output connections to the unit using the appropriate connector. Plug the remote control plug in and tighten the connector screws in place. You may select any or all of the error flag and/or silence sense switching which will command the switcher to switch to the alternate path. Refer to *AES-402 DIP Switch Programming Guide of Operation* on page 5 for switch options. Refer to the factory default section of the table for supplied switch conditions. If the default conditions are satisfactory for your intended use no further changes need to be made. In order to change the DIP SW 1, 2 settings remove the front panel by removing 1 - #4-40 Phillips head screw in of the top cover located in the front center of the cover and 4 - #6-32 front panel screws. The front panel can now be removed and the DIP switches located which are on the front panel PC board. Other error flags and the silence sense error are selected by placing the designated DIP switches to the on position. Once DIP switch positions are selected the unit is ready to be powered up for operation. When the silence sense error is selected for switching, there are several configurations possible. It is possible to monitor both left and right channels and switch upon complete audio loss or to have the silence sensor switch upon loss of left or right channel individually. This feature was added so that non correlated audio feeds can cause the silence sensor to switch where one feed may take precedence over another. Selection of L+R, Left, or Right only audio is done by DIP SW S1 selection.

## ***Initial Power Application***

Once power is applied and a valid AES bit stream is applied to the selected input, the unit will default to “MAN” mode of operation. The LED indicator over the “MAN” button should be illuminated. In addition, the channel selected LED indicator will be lit or flashing which indicates audio level under threshold for at least 5 seconds. This feature allows the user to determine if audio level is sufficient to drive the unit or for troubleshooting purposes. This feature can be defeated if desired by setting DIP SW1-6 to the OFF position. In the OFF position the unit will always indicate channel selection with a steady lighted indication. There should also be an indication of sample frequency. The AES-402 supports any sample rate between 32 and 192 KHz. Standard sample rates are indicated on the front panel under “Sample Rate” and non standard sample rates are indicated with the “OTHER” LED indication being illuminated. Press the error-reset button to clear any errors that might be indicated. If the digital audio stream feeding the active channel of the unit is valid and no errors occur the unit is ready for to be placed in the automatic mode if desired. If any of these errors occur after depressing the error-reset button, then the feed to the unit is defective and should be investigated. If all is in order, the unit is now ready for operation. All that is left to do is to select the desired feed and then if desired, place the unit in automatic switch mode by depressing the “AUTO” mode button. The LED indicator will light indicating automatic control of the switcher. The unit will remain in this mode until an error is detected, loss of lock occurs, silence or is detected. If any of these events occur, the unit will switch to the alternate path and remain there until the error reset is performed from the front panel or remotely. When in AUTO mode and an error occurs the unit will go to manual mode and the “MAN” button and error indication will flash to indicate that an error has occurred. To clear the error, depress the “ERROR” button. If the error clears the “ERROR” button LED will extinguish, error indicators will extinguish and the “MAN” button will remain illuminated until the “AUTO” button is depressed.

## **Description of AES-402 Optional Programming Functions**

**S1-1 Front Panel Button Defeat** – When set to on will cause the A/B, MAN and AUTO buttons to be non operational. Rear panel GPIO and serial remote control are still available when this switch is turned on.

**S1 -2, 3 Time Delay** – Sets the time delay that the silence sensor will wait before switching. Time delay can be set to 30, 60, 90 or 120 seconds.

**S1-4, 5 Silence Detector Channel** – Can be set to monitor both (L+R) or left only/right only. When set to both, the silence detector will switch to the alternate path if one or both channels signal level fall below threshold for the time delay set. For Left or Right only the silence sensor will only switch after the channel being monitored times out. The unselected channel is ignored.

**S1-6 Silence Indication on A/B Buttons** – Will cause the selected channel button to flash if audio level falls below threshold for more than 15 seconds. Set to off for steady on condition of A/B buttons.

**S1-8 Serial Remote Control** – Turns on serial remote control functionality.

**S2-1 AES ERROR Switching delay** – when enabled ignores all momentary digital errors under 5 seconds in duration – eliminates inadvertent switching on transient events. When switched to off position switcher switches channels immediately upon detection of any digital error flags enabled by S2-2, 3, 5

**S2-2 Unlock Error** - When set to on will cause the switcher to switch as per S2-1 setting for an unlock condition.

**S2-3 Parity Error** – When set to on will cause the switcher to switch as per S2-1 setting for a parity error in the incoming digital audio stream.

**S2-5 CRC Error** – When set to on will cause the switcher to switch as per S2-1 setting for CRC error of incoming digital audio stream.

**S2-6 Audio Bit** – When set to on will cause the switcher to switch as per S2-1 setting if the digital audio stream audio bit is set to 0 which denotes non audio payload data. When this setting is set to on the analog output is muted.

**S2-7 Non PCM Audio** – When set to on causes the switcher to switch as per S2-1 setting when non PCM audio streams are detected such as Dolby E and AC-3 formats. To use the switcher and digital DA for non PCM audio formats set S2-6, S2-7, S1-4 and S1-5 to off position. This will allow the AES-402 unit to act as a manual digital audio switcher for non PCM audio streams and defeats the silence sensor which cannot be used in the is mode of operation.

## **AES-402 DIP Switch Programming Guide of Operation Table 1.**

S1-1 OFF = Front Panel Button Disables A/B and AUTO/MAN Buttons - Factory Default – ON

Silence Sensor Time out Parameters:

S1-3	S1-2	Silence Timeout (SEC)
OFF	OFF	120
OFF	ON	90
ON	OFF	60
ON	ON	30 Factory Default

S1-4 Silence Detector L Channel - ON = Silence detection enabled

S1-5 Silence Detector R Channel - ON = Silence detection enabled

S1-6 Silence Indication on A/B Select buttons - ON = Enabled – Factory Default ON

S1-7 Unused

S1-8 Serial Control Enable - ON = Enabled - Factory Default ON

Digital Parameter Switch Selection:

S2-1 AES Error Switching Delay – Factory Default ON

S2-2 Unlock – ON - Factory Default ON

S2-3 Parity – ON -Factory Default ON

S2-4 - UNUSED -

S2-5 CRC

S2-6 Audio Bit

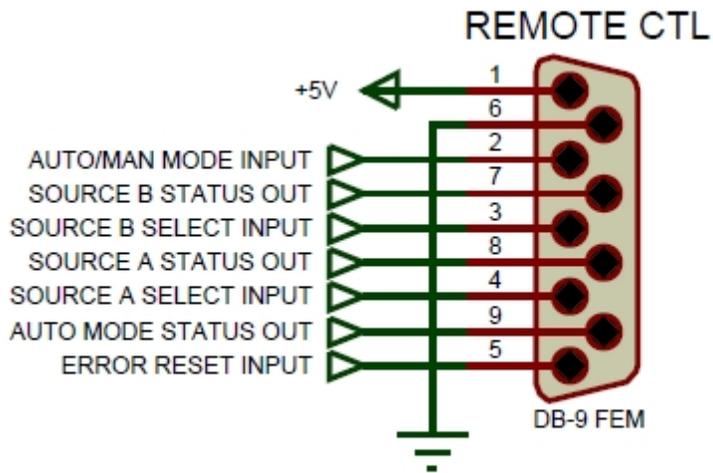
S2-7 Non-PCM Audio

S2-9

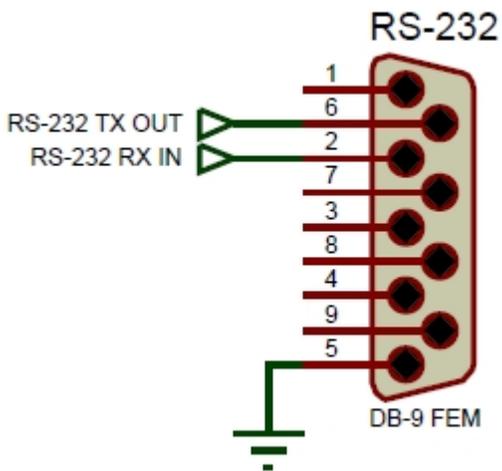
**Remote Control – Parallel/GPIO DB9F Connection Table 2.**

- Pin 1 +5 VDC @100mA.
- Pin 2 Auto Mode Select
- Pin 3 Select B Input
- Pin 4 Select A Input
- Pin 5 Error Reset
- Pin 6 Status Common
- Pin 7 Status – “B” Selected
- Pin 8 Status - “A” Selected
- Pin 9 Auto Mode Status

Command input pins 2, 3, 4, 5 require a momentary closure to ground. Status connections open collector outputs which require a 5 VDC pull up.



**Remote Control RS-232 Connection Diagram**



## V. Specifications

Digital Inputs:	Two – XLR
Digital Outputs:	Four – XLR
Analog Output:	Balanced L/R XLR + 4 dBm 600 Ohms – Rear Panel
Headphone out:	600 Ohm unbalanced - Front Panel
Sample Rate Range:	8 – 192 KHz, Auto Detect and Lock
D/A Converter Resolution:	Up to 24 bits
Remote Control:	Momentary ground closure selects channels and reset to auto mode operation or RS-232/485 Serial
Remote Status:	Channel Select Open Collector Output
Remote Control Connectors:	DB9F throughout
Front Panel Controls:	7 - Momentary Push buttons - Switcher Selection, Error Reset, Auto/Manual Mode Operation Select, Volume Up/Down
Front Panel Indicators:	Sample Rate, Lock Loss, Error Flags, Channel Status, Auto/Manual Mode
Power Requirements:	100 - 240 V.A.C. @ 0.25A; 50 – 60 Hz.
Operating Environment:	0 – 60 Degrees Celsius Non Condensing Atmosphere
Physical:	19"W X 8"D X 1.75"H Mounted via Standard E.I.A. 19" rack one rack unit occupied. Weight: 8 LBS

### FCC Certification Statement:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## **VI. Warranty**

Broadcast Devices, Inc. products are warranted against failure due to faulty materials or workmanship for a period of one year from the date of shipment from Broadcast Devices, Inc. dock. The warranty covers repair or replacement of defective parts at the factory, provided the unit has been returned prepaid by the user. All shipments to the factory shall have affixed to the outside of the container a return authorization number obtained from the factory. The above warranty is void if the unit has been modified by the user outside of any recommendations from the factory or if the unit has been abused or operated outside of its electrical or environmental specifications. If customer conducted field tests suggest that the unit may be faulty, whether or not the unit is in warranty, a full report of the difficulty should be sent to Broadcast Devices, Inc. factory. The factory may suggest further tests or authorize return for factory evaluation. Please email: [customer.service@broadcast-devices.com](mailto:customer.service@broadcast-devices.com)

Units sent to the factory should be well packed and shipped to Broadcast Devices, Inc. – Check [www.broadcast-devices.com](http://www.broadcast-devices.com) for current shipping address. Remember to affix the R.A. number to the outside of the carton. Any packages received without such R.A. number will be refused. Note: freight collect shipments will also be refused. When the unit has been received, inspected and tested, the customer will receive a report of the findings along with a quotation for recommended repairs, which are found falling outside of the standard warranty. Units returned for in-warranty repairs, which are found not to be defective will be subject to an evaluation and handling charge. In-warranty units will be repaired at no charge and returned via prepaid freight.

Out-of-warranty units needing repair require a purchase order and will be invoiced for parts, labor, and shipping charges.

When ordering replacement part, always specify A) Part Description, and Quantity; B) Date of Purchase, Where Purchased; C) Any Special Shipping Instructions. Always specify a street address, as shipping companies cannot deliver to a postal box.

Broadcast Devices, Inc. is not responsible for any other manufacturer's warranty on original equipment. Nor are we responsible for any failure, damage, or loss of property that may occur due to the installation or operation of our equipment outside of recommended specifications.

Broadcast Devices, Inc. reserves the right to change materials, specifications, and features from time to time. [www.broadcast-devices.com](http://www.broadcast-devices.com)

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