

Con/Air Switcher

Model CAS-1

– INSTALLATION AND OPERATION –

*This documentation is valid for
Con/Air Switcher hardware version 1.0 with firmware version 2.0*

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Section I — Safety Information / Warranty

I.1 Safety Information



WARNING!

The Con/Air Switcher model CAS-1 should be installed only by qualified technical personnel. An attempt to install this device by a person who is not technically qualified could result in a hazardous condition to the installer or other personnel, and/or damage to the CAS-1 or other equipment. Please ensure that proper safety precautions have been made before installing this device.

The CAS-1 is designed for indoor use in a dry location. Installation and operation in other locations could be hazardous.

Section 2 — System Description

2.1 General Description

The introduction of audio processing and transmission equipment using digital technology created a new problem for the radio broadcaster. Most digital audio equipment has an inherent delay from input to output, typically in the order of 5 to 50 milliseconds. If this equipment is installed in a station's "air chain" (between the station's source equipment and the transmitter) the "on air" audio will lag the live audio coming from the mixing console by a few milliseconds. This delay is small and for most purposes insignificant. However, if monitoring "off air," live announcers will hear their own voice delayed in their headphones. While unnoticed by anyone else, this delay can be very distracting to the announcer. A simple solution is to switch the announcer's headphone monitoring point to "off console," a point before the delay is introduced. The problem with this solution is that a failure in the air chain processing, studio-to-transmitter link or transmitter itself may not be immediately detected by the announcer. Also, the console audio may sound relatively thin and "unprocessed" compared to the off-air audio. Therefore in most circumstances, this is an unsatisfactory solution.

The Con/Air Switcher solves this problem. It is basically a two input/one output stereo switcher controlled by the control room's microphone relay. When the microphone relay is turned off, air audio is heard in the announcer's headphones. When the microphone relay is turned on, console audio is heard in the announcer's headphones. This way, the announcer hears the "off air" audio in the headphones at all times except when his or her voice is on the air. The following block diagram shows more details of the Con/Air Switcher:

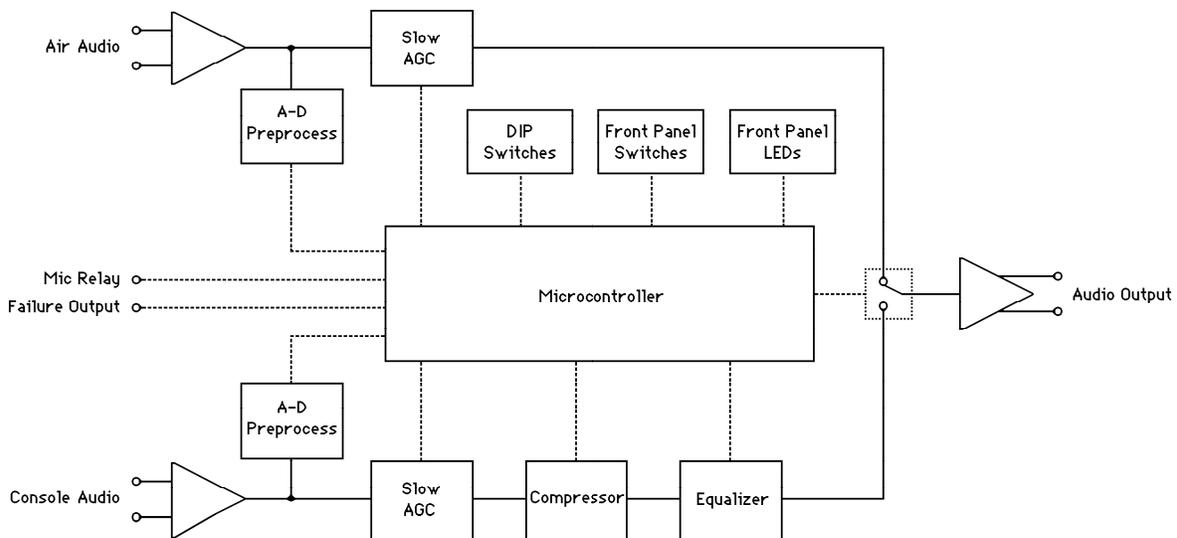


Figure 2.1 - System Block Diagram

To make the console audio more closely match the "processed" sound of the off-air audio, a compressor/equalizer is contained in the "console" side of the Con/Air Switcher. Use of this processing is optional. A variable amount of compression can be added as well as bass and treble cut and boost. Operators can adjust the processing to their own tastes. A "Recall Presets" button is included to allow the operator to quickly return to a user-defined set of conditions. If desired, the Con/Air Switcher compression and equalization settings may be set and locked with an internal jumper which disables the front panel switches.

Another feature of the Con/Air Switcher is a correlation detection circuit that can notify the operator if the air audio fails to correlate with the console audio. This can be used to alert the operator to an air failure during console monitoring, when it might otherwise go undetected. A front panel "AIR FAILURE" LED illuminates to warn the operator

that one or both air channels may have failed. In addition, an output is provided to control external devices (such as the Sine Systems MBC-1 Message Board Controller) in the event of an air audio failure.

Optionally, the Con/Air Switcher can be made to automatically switch back to the off-air position if a correlation failure occurs after the microphone relay has turned on. This allows the operator to be notified of a possible problem by actually hearing the air audio. If the audio does not correlate at the time the microphone is turned on, it is assumed that the operator has just heard the air audio and is aware of any problem that may exist. In this case the Con/Air Switcher remains in the console position as long as the microphone is turned on even if a correlation failure is detected.

2.2 Physical Description of the System

The Con/Air Switcher is 7.29 inches wide, 1.52 inches tall and 6 inches deep. The front panel of the main unit contains seven pushbutton switches used to adjust compression and equalization in the "console" position and three LED indicators used to display the operating status. The rear panel contains four screw-terminal connectors used to attach the wall-plug power supply and microphone switching contacts as well as the various audio inputs and outputs.

An optional rack mounting conversion kit (CAS-RK) allows the CAS-1 to be mounted in a standard 19 inch equipment rack.

2.3 Electrical Description of the System

2.3.1 Front-Panel Switches

The front panel of the Con/Air Switcher contains seven pushbutton switches. Six switches are used to control audio processing of the console audio. Two switches are used to adjust bass, two are used to adjust treble, and two are used to adjust compression. These switches are enabled only when the Con/Air Switcher is in the "console" position. When these switches are pressed, a beep is heard at the audio output. When end-of-range is reached for a given function, three short beeps are heard. These switches may be disabled if desired with an internal programming switch.

The remaining front panel switch is used to recall user presets. A particular combination of settings for bass, treble and compression can be stored in non-volatile memory by the user and can be recalled by pressing this switch. This allows the operator to quickly recall a "reference" set of conditions.

2.3.2 Front-Panel Indicators

The front panel of the Con/Air Switcher contains three LED indicators:

- A green "AIR" LED illuminates when the Con/Air Switcher is monitoring off-air audio.
- A yellow "CONSOLE" LED illuminates when the Con/Air Switcher is monitoring console audio.
- A red "AIR FAILURE" LED illuminates when either channel of the console audio fails to correlate with the corresponding channel of air audio.

2.3.3 Circuit Description

The power supply converts 24 volts AC to ± 12 volts and +5 volts DC. Q1, D1 and R1 form a shunt regulator for the -12 volt side.

U9 and U10 are conventional differential-input op-amp circuits. Gain is set by RN11 and RN13. Both feed U11 which performs all audio switching, gain control and equalization. U3 and U4 are balanced output drivers. Note that the actual audio input level to U11 is approximately -13 dBv and the output level of U11 is approximately -26 dBv (at 0 VU). The parameters for U11 are controlled by the main microprocessor, U7, and are loaded by a serial peripheral interface (SPI) buss. Clock is on U11 pin 1, data is on U11 pin 28 and there is an "ID" or "load" signal on U11 pin 27. Clock rate is 1 MHz.

U5 and U6 are precision rectifiers/integrators used to measure the level of the audio input signals and supply the A-D converters in the microprocessor with a proportional DC voltage. R9 and R10 establish a reference for the A-D converter.

Section 3 — Installation

3.1 System Includes

The Con/Air Switcher package contains these items:

- Con/Air Switcher model CAS-1
- 24 volt AC wall-plug transformer
- screw-terminal connectors
- operation manual

3.2 Installing the Unit

The Con/Air Switcher is designed to be placed almost anywhere. It generates little heat and can be mounted in just about any convenient location where the ambient temperature does not exceed 120°F. It can be table-top installed as supplied or an optional rack-mount kit may be used.

3.2.1 Screw-Terminal Connectors

All electrical connections to the Con/Air Switcher are made with four jacks on the rear panel. Polarized screw-terminal connectors for these jacks are supplied. After connections are made to the screw-terminals, the supplied connector shells should be installed. Each shell is made in two halves and clamps around the screw-terminal connector. Note that the openings in the shell are non-symmetrical so the screw-terminal connector must be oriented properly for the shell to snap closed. Inside one half of the shell is a small holder for a nylon tie-wrap (supplied). This may be used to secure the cable to the shell for strain relief.

Each screw-terminal connector contains two locking screws which may be used to secure the connector to the Con/Air Switcher case.

3.2.2 Power Supply Connection

The Con/Air Switcher is powered by 24 volts AC. The included wall-plug power transformer should be used. Using a two-conductor cable with at 26 gauge wire or larger (not supplied) connect the screw terminals on the wall-plug transformer to the terminals labeled 24 V AC on the right-hand rear panel connector.

3.2.3 Audio Inputs

The audio input connections are made on the left two connectors on the rear panel. The audio from the console and air monitor may be balanced or unbalanced. As factory set, the "0 VU" audio level for both the console and air monitor audio should be in the range of +2 dBv to +8 dBv. The Con/Air Switcher will self-adjust for audio in this level range. If desired, the Con/Air Switcher can be set for different input levels on either the AIR input, the CONSOLE input, or both. On the main PC board there are two resistor networks in sockets. Resistor network RN13 sets the input level range for the CONSOLE audio and RN11 set the input level range for the AIR audio. The factory value for both resistors is 47K (the network contains 4 isolated resistors of 47K ohms each). The following table shows the necessary resistor values required for (0 VU) level ranges from -15 dBv to +8 dBv.

Value: Input Level Range (for 0 VU):

47K	+2 dBv to +8 dBv (factory value)
33K	-1 dBv to +5 dBv
22K	-5 dBv to +1 dBv
15K	-8 dBv to -2 dBv
10K	-11 dBv to -5 dBv
6.8K	-15 dBv to -9 dBv (recommended for "consumer level" audio)

If a resistor network of correct value is not available, four 1/4 watt resistors may be used instead. Stand the resistors up side by side in the socket with one lead folded over the body. For best common mode rejection, the resistors should be matched to within 1% in value.

3.2.4 Audio Output

The audio output appears on the jack labeled SWITCHER OUTPUT. The output is balanced and may be terminated with 600 ohms or may be left unterminated. The "0 VU" output level is approximately +2 dBm.



WARNING!

If unbalanced output is desired, use the ground terminal and either the "+" or "-" terminal. DO NOT ground the "+" or "-" terminal or excessive audio distortion will result.

3.2.5 Mic Relay Input

The input that switches the source audio between "console" and "air" is the connection labeled MIC RELAY. Connecting this terminal to GROUND switches the source the the "console" position. This may be done with a relay contact or an open-collector.

3.2.6 Correlation Failure Output

The terminal labeled FAIL. OUT is an open-collector output which is activated when either air channel fails to correlate with the corresponding console channel. This can be used to control external indicators. The open-collector is rated at 250 milliamperes and can control up to 30 volts DC.

If it is more convenient to have a 5 volt logic-level output, the following simple modification can be made:



After Q2 is removed, the new parts can be installed vertically using the same holes in the PC board. The zener diode helps to protect against voltage transients and the 100 ohm resistor acts to limit current. This circuit will drive most solid-state relays directly without the need of an external voltage source.

3.2.7 Setting DIP Programming Switches

The Con/Air Switcher contains an internal DIP switch to allow the user to select various options. These are indicated as follows: (> indicates factory setting)

- 1) On Correlation Failure:
 - > off:Indicate only
 - on: Indicate and switch audio to "air" if failure occurs while in "console" :
- 2) Front Panel Bass, Treble and Compression Switches
 - > off:Enabled
 - on: Disabled
- 3) Correlation Failure Sensitivity
 - > off:High
 - on: Low
- 4) Compression Speed
 - > off:Fast
 - on: Medium
- 5) Air ALC
 - > off:Enabled
 - on: Disabled
- 6) Console ALC
 - > off:Enabled
 - on: Disabled
- 7) Reserved
- 8) Reserved

Section 4 — Operation

4.1 Adjusting Bass and Treble

The switches labeled BASS and TREBLE are used to adjust the frequency response of the "console" audio. These switches can be operated only while the Con/Air Switcher is in the "console" position and they only affect the console audio. The "air" frequency response remains "flat" at all times regardless of console frequency response.

These are the thirteen possible settings for bass and treble frequency response:

-12 dB, -10 dB, -8 dB, -6 dB, -4 dB, -2 dB, 0 dB, +2 dB, +4 dB, +6 dB, +8 dB, +10 dB, +12 dB

When the BASS or TREBLE switches are pressed, a short beep is heard at the audio output. When end-of-range is reached (-12 dB or +12 dB), three short beeps are heard.

A simple way to reach "0 dB" frequency response is to push the "up" switch several times until the "three beep" end-of-range signal is heard. Then push the "down" button six times.

4.2 Adjusting Compression

The switches labeled COMPRESSION are used to adjust the dynamic range compression of the "console" audio. These switches can be operated only while the Con/Air Switcher is in the "console" position and they only affect the console audio. The "air" audio remains "uncompressed" at all times regardless of console compression.

These are the seven possible settings for compression:

0 dB, 2 dB, 4 dB, 6 dB, 8 dB, 10 dB, 12 dB

When the COMPRESSION switches are pressed, a short beep is heard at the audio output. When end-of-range is reached (0 dB or 12 dB), three short beeps are heard.

4.3 Recalling Presets

One specific set of values for bass, treble and compression may be stored in non-volatile memory in the Con/Air Switcher. These can be recalled by pushing the RECALL PRESETS switch when the Con/Air Switcher is in the "console" position. See Section 4.3.1 for instructions on how to store presets. The factory stored presets are 0 dB bass equalization, 0 dB treble equalization, and 8 dB compression. These can be changed at any time.

4.4 Saving Presets

In order to save presets for bass, treble and compression, remove the PC board from the case and then reconnect the right-hand connector. This supplies power to the board and accesses the MIC RELAY contacts. Set the Con/Air Switcher to the "console" position by grounding the MIC RELAY contact. Adjust the BASS, TREBLE and COMPRESSION switches as desired. Then push the "SAVE PRESETS" switch on the top of the PC board near the DIP switches. This stores the current settings to non-volatile memory. Disconnect the power connector, reinstall the PC board in the case and reinstall the rear panel. The saved settings can be recalled at any time by pushing the RECALL PRESETS switch on the front panel when the Con/Air Switcher is in the "console" position.

4.5 Reading Firmware Version

If it ever becomes necessary to verify the version number of the firmware installed in the CAS-1 microprocessor, push the COMPRESSION "up" and "down" switches at the same time. One or more of the three front panel LEDs will come on. The firmware version can be determined from the following table:

CONSOLE:	AIR:	AIR FAILURE:	Firmware Version:
off	off	on	1
off	on	off	2
off	on	on	3
on	off	off	4
on	off	on	5
on	on	off	6
on	on	on	7

Section 5 — Troubleshooting and Repair

5.1 Common Problems and Possible Solutions

Problem: Console and Air levels do not match.

Solution: The CAS-1 will automatically adjust level over a 6 dB range but the level may be outside that range. Check input levels and verify that level-programming resistors are set to the correct value. See the operation section for more information

Problem: Console or Air signal is distorted.

Solution: Again, check input levels and verify that level-programming resistors are set to the correct value. See the operation section for more information.

Problem: Sometimes in the CONSOLE position, the CAS-1 switches back to AIR while the microphone is still on.

Solution: The "Switch To Air On Air Failure" mode may be programmed. Check to see if switch 1 on the DIP switch is set to the ON position. See the installation section for more information.

5.2 Factory Service Policy

These policies are effective August 1999 and are subject to change without prior notice.

5.2.1 Factory Warranty

Sine Systems, Inc. guarantees our products to be free from manufacturing defect for a period of one year from the original date of purchase from Sine Systems, Inc. This warranty covers the parts and labor necessary to repair the product to factory specifications. This warranty does not cover damage by lightning, normal wear, misuse, neglect, improper installation, failure to follow instructions, accidents, alterations, unauthorized repair, damage during transit, fire, flood, tornado, hurricane or acts of God and/or nature.

5.2.2 Factory Return Policy

The factory return policy only applies to equipment purchased directly from Sine Systems, Inc. Equipment purchased through a third party (dealer) is subject to the return policy of the dealer and arrangements for return or exchange must be handled through the dealer.

Sine Systems policy on returns and exchanges with the factory is broken down according to the following schedule:

30 days "no questions asked"

During the first thirty days from the date that equipment ships from our factory we will accept it back for a full refund less shipping charges provided that the equipment is still in new, resellable condition with no cosmetic damage. This does not constitute an evaluation program. It is for legitimate purchases only.

less than 60 days, may be returned less 15% restocking fee

Between 31 and 60 days from the time we ship the equipment, we will accept unmodified equipment back for a refund less shipping charges and 15% of the invoice cost. This is to cover the cost of restocking the items which must then be sold at a discount as reconditioned instead of new.

no return after 60 days

We will recondition the equipment for you according to our repair rates but we will not accept it for refund or exchange after 60 days from the initial purchase.

5.2.3 Factory Service Policy

Sine Systems is proud to offer same day repair service on all of our products. When we receive damaged equipment, we will repair it and ship it back the same day it arrives. Because we offer immediate service, we do not send loaner equipment. If we cannot immediately repair equipment and return it, we may ship a loaner unit at our discretion.

While we do not require prior authorization on repairs, we suggest that you verify our shipping address before returning equipment for repair. Sine Systems is not responsible for items lost in transport or delivered to the wrong address. Emergency service may be made available on weekends or holidays, at our discretion, if arrangements are made with us in advance.

5.2.4 Warranty Service

There is no charge for repair service on items covered under warranty. You are responsible for shipping charges to return damaged equipment to us for repair. Damage due to negligence, lightning or other acts of nature are not covered under warranty.

5.2.5 Service Rates

For service not covered under warranty we have a flat rate repair fee. Flat rate repairs cover only components that fail electrically. Mechanical damage will be assessed on a per repair basis. Repair charges typically fall into one of these categories. Shipping fees are not covered in the repair rate.

Minor programming adjustments or no damage, \$50 plus shipping

Sometimes a system works exactly like it is supposed to when we get it or it can be fixed through a simple adjustment in firmware. We will do our best to identify intermittent hardware problems and correct them. The fee covers the time it takes our technician to thoroughly inspect and test the equipment.

Minor repairs are up to \$150 plus shipping

Five or fewer defective components are replaced in a minor to moderate repair. This accounts for most of our repairs. These repairs may cost less depending on the components replaced and the amount of time required to complete the repair.

Moderate repairs are \$250 plus shipping

Six to ten defective components are replaced in a major repair. Again, we may charge less depending on the components replaced and the amount of time required to complete repairs.

Major repairs cost more than \$250 plus shipping

This occurs rarely but it can happen. If the equipment has blown traces and scorch marks from burned components, it's a safe bet that it will take several components and quite a bit of bench time to repair. We assess this type of repair on a per incident basis.

Damaged beyond recognition, assessed on a per case basis

Hopefully you have insurance. In cases where the board is so badly damaged that it is not worth repairing we may, at our discretion, offer to replace the destroyed circuit board. The options and costs vary widely in these cases so we will call with options.

All repairs must be billed to a credit card or shipped COD. Specify which you prefer with your request for service. At your request, we will call with the total amount of the repair (including applicable shipping charges) so that suitable payment can be arranged before a COD shipment. If you need a COD total, do not forget to include a telephone number where you can be contacted.

5.2.6 Instructions for Factory Service

Please include a note with any specific information available about the equipment failure as an aid to our technicians. Pack equipment carefully to avoid further damage in shipping. We are not responsible for damage during transport.

When returning a system with multiple components, we strongly suggest that you return the entire system. We will repair the parts that are returned but lightning is rarely selective enough to damage only a single part of a system.

Be sure to include a street address for return shipping by UPS. The repair will be delayed if you neglect to give us enough information to return your equipment--this actually happens! If you prefer a carrier other than UPS or wish us to bill to your shipping account, we can usually accommodate these requests. Many carriers do not accept COD shipments so credit card billing may be required for carriers other than UPS. If you do not specify otherwise, return shipments will be made by the UPS equivalent of the received shipping method (i.e. Ground shipment, 2nd Day, Overnight).

We suggest that you verify our shipping address before sending equipment for repair. Same day service does not apply if you ship to an incorrect address and/or the carrier delivers the equipment too late in the day for repairs to be completed. Sine Systems is not responsible for equipment that is not delivered to our factory. It will be your responsibility to contact the carrier to retrieve your improperly delivered equipment.

Section 6 — Specifications

6.1 Electrical Specifications

Ports

Balanced Audio In/Out (3.5mm screw terminal connectors)
Control & Logic I/O (3.5mm screw terminal connectors)
AC Power 3.5mm screw terminal connectors)

Switches

Bass/Treble/Compression (momentary pushbutton)
User adjustable options (internal DIP switches)

Indicators

Air (green)
Console (yellow)
Air Failure (red)

Power Required

5.5 watts (230 milliamperes at 24 volts AC)

Audio Inputs (CONSOLE and AIR)

Actively balanced, High Impedance (>20K ohms)
Automatic input level adjustment over a 6 dB range
+2 dBv to +8 dBv (factory setting)
-1 dBv to +5 dBv
-5 dBv to +1 dBv
-8 dBv to -2 dBv
-11 dBv to -5 dBv
-15 dBv to -9 dBv

Audio Output

Actively balanced
Source Impedance 94 ohms, Load Impedance 600 ohms to unloaded
Approximately +2 dBm (at 0 VU)

Console Side Processing

High Frequency Equalization:	-12 dB to +12 dB in 2 dB steps (13 steps total)
Low Frequency Equalization:	-12 dB to +12 dB in 2 dB steps (13 steps total)
Compression:	0 dB to 12 dB in 2 dB steps (7 steps total)

Microphone Relay Input

Activate by open-collector, 5 volt logic level, or dry contact pull down to ground.
Switches to CONSOLE position when activated.

Air Failure Alarm Output

Open collector output can control up to 30 volts DC at up to 250 milliamperes

6.2 Mechanical Specifications

Dimensions

7.25" (w) x 6.5" (d) x 1.50" (h)

can be mounted in standard 19" EIA rack with optional rack mounting panel

Weight

3 lbs.