BROADCAST tools®
INC

PROBLEM SOLVED

Installation and Operation Manual

ACS 4.1
Four input, one output stereo matrix audio switcher

Manual update: 7/23/2013
Firmware Version 1.2 and above. If you need a firmware upgrade, contact Broadcast Tools®

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INTRODUCTION

Thank you for your purchase of a BROADCAST TOOLS® ACS 4.1 four input, one output stereo matrix audio switcher (referred to as the ACS 4.1 throughout this manual). We're confident that this product will give you many years of dependable service. This manual is intended to give you all the information needed to install and operate the BROADCAST TOOLS® ACS 4.1.

SAFETY INFORMATION

Only qualified technical personnel should install the ACS 4.1. Any 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 or damage to the ACS 4.1 or other equipment. Please ensure that proper safety precautions have been taken before installing this device. If you are unfamiliar with this type of equipment, please contact a properly qualified engineer to handle the installation and setup of the ACS 4.1. Broadcast Tools, Inc., is unable to support NON-Broadcast Tools software, hardware or NON-Broadcast Tools computer/hardware/software problems. If you experience these problems, please research your hardware/software instruction manuals or contact the manufacturers technical support department.

WHO TO CONTACT FOR HELP

If you have any questions regarding your product or you need assistance, please contact your distributor from whom you purchased this equipment.

If you would like more information about Broadcast Tools® products, you may reach us at:

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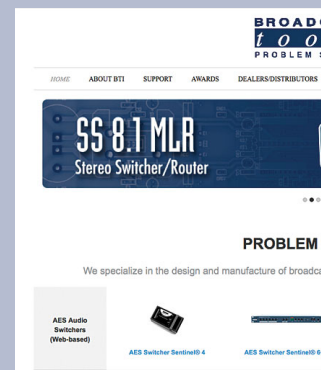
NOTE:

This manual should be read thoroughly before installation and operation.

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INTRODUCTION

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Product Overview

The ACS 4.1 provides matrix audio switching of 4 stereo inputs to one stereo output. Matrix switching allows any/or all inputs to be assigned to one output. The ACS 4.1 has eight GPI inputs that may be used for remote control operation or as PIP triggers, four open collector channel status outputs, and a built-in silence sensor with a dedicated open collector status output. The ACS 4.1 may be controlled via front panel switches, contact closures, logic and/or the multi-drop RS-232 serial port (control via USB or Ethernet with optional devices). Installation is simplified with plug-in euroblock screw terminals.

Features/Benefits

- True matrix switching, any or all inputs may be assigned to the output.
- Front panel multi-turn input level trimmers.
- Electronically balanced stereo inputs.
- Electronically balanced adjustable stereo output.
- Any input may be controlled from either the front panel, contact closures, logic or the multi-drop RS-232 serial port.
- Internal silence sensor with front panel LED indicators; separate silence sensor open collector output, adjustable alarm threshold level, delay duration and restore duration.
- Front panel input selection switches are provided for each input channel with separate input indicator LED's
- Power-up selection of inputs to outputs, mute or last source selected.
- 8 input GPI port (PIP or Remote Control) with LED indicator.
- 4 open collector channel status outputs.
- Logic functions via microprocessor and non-volatile memory
- Most configuration options via dip-switches.
- Fully RFI proofed.
- Surge protected internal power supply, universal switching +/-15VDC power supply with domestic connectors supplied. International connectors optional.
- Up to three units may be mounted on the optional RA-1 rack shelf. Desktop and wall mounting is also possible.

Applications

Automation source switching with eight trigger inputs; Studio selection and routing; Audio processing selection; Satellite audio channel switching and console monitor input and output selection.

Inspection

Please examine your ACS 4.1 carefully for any damage that may have been sustained during shipping. If any damage is present, please notify the shipper immediately and retain the packaging for inspection by the shipper. The package should contain the ACS 4.1, a modular cable with 9-pin "S9" female D-sub adapter, and a +/-15 VDC wall power supply with domestic connector. Manuals may be downloaded from our web site.

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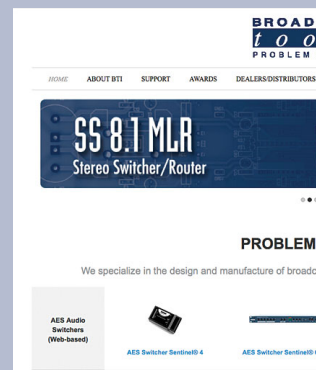
Installation

Surge Protection
The ACS 4.1 has built-in resistance to voltage changes; we recommend that you use a power surge protector or line conditioner on the incoming AC line. Lightning strikes and/or other high voltage surges may damage your ACS 4.1 and connected equipment if it is not properly protected. For lightning protection devices, check out www.polyphaser.com and www.itwlinx.com.

UPS Standby Power System
We recommend that you connect your ACS 4.1 to a UPS system. A UPS helps minimize the risk to the ACS 4.1 and provides power during a power outage.

Installation/Operation

Input selection and Mute push buttons
Each push button represents an input to be routed to the switcher's output. Each push button has an associated LED indicator, which will illuminate when that particular channel is selected. The Mute button is located to the right of the Input 4 button and is recessed to prevent accidental/unauthorized muting.

Input channels may be configured for the audio switching modes:

Overlap (default): Overlaps the selected (first) audio input with the audio from the new audio input while the button for the new source is held down. Both channels will be fed to the output until the button for the new audio input is released, at which time the first audio source will be switched off.

Interlock: Connects one input the output, selecting an input disconnects all other inputs from the output.

Mix: Multiple inputs may be routed to the output – Push the input button once to connect, to mute press again while holding down the mute button.

Audio Inputs
Each of the 4 stereo inputs are balanced bridging (20KΩ) at a nominal line level of +4dBu. Multi-turn level controls are provided for each channel.

Audio Outputs
The ACS 4.1 provides one stereo output. The stereo output is adjustable and may be configured as a mono-sum (dual-mono.)

Silence Sensor

The ACS 4.1's output has a built-in silence detector that monitors the sum of the stereo channel. The factory default delay is set at 10 seconds, with a threshold of -30 dB, while the restore time is set at 2 seconds. Upon silence detection the "OCSS" open collector output and the SS LED will activate for the duration of the silence. Serial data is also sent on the loss and restoration of audio.

The sensor may be programmed for:

- Silence sense threshold. The audio level below which is consider silence. This may be set to -20 dBu, -25 dBu, -30 dBu or -35 dBu.
- Number of seconds of silence that must be present before an alarm state is reached (Acquire delay.)
- Number of seconds that valid audio must be present before an alarm state is cleared (Restore delay).

LED indicators

- "PWR/HB" LED: Illuminates when power is applied and blinks when serial data is active.
- "PIP" LED: Flashes to indicate PIP activity.
- "SS": Silence Sensor indicator LED, lit when silence is detected. The silence sensor must be enabled for this to function.
- "ACT" LED: Real-time output audio activity indicator, lit when output audio is above threshold.

Power

Connect the 3-pin AMP-style latching power connector to the unit and the +/-15 VDC switching power supply with domestic connector into a 120 Vac 50-60 Hz power source. Never use any type of power supply other than the specified/supplied power supply.

I/O Connections

The rear panel contains all the inputs, outputs and remote control interfacing connectors. The multi-drop serial port is equipped with a modular RJ-11 jack.
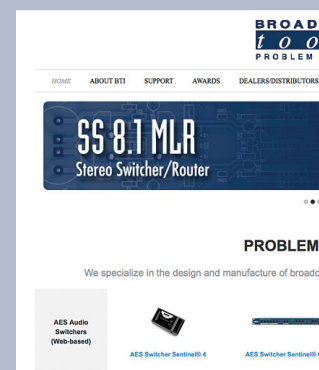
Audio Connections

The ACS 4.1 interfaces to external equipment through removable euroblock screw terminals. The terminals accommodate wire sizes from 16 - 28 AWG solid or stranded wire. Before installing a wire, remove the euroblock screw terminal plug and turn each capture screw fully counterclockwise. Strip each conductor to a length of 0.25" and insert the conductor fully into the terminal. Turn the capture screw fully clockwise to secure the conductor.

Input 1 (Top row, TB1)					Input 4 (Top row, TB2)					Output (Top row, TB3)				
2L-	2L+	Gnd	2R-	2R+	4L-	4L+	Gnd	4R-	4R+	OL-	OL+	Gnd	OR-	OR+
1L-	1L+	Gnd	1R-	1R+	3L-	3L+	Gnd	3R-	3R+					
Input 2 (Bottom row, TB1)					Input 3 (Bottom row, TB2)					See Open Collector Outputs (Bottom Row, TB3)				

CAUTION: In no case should either the + or - outputs be connected to ground. The input impedance is 20KΩ, 600Ω terminations may be installed on the connector.

Audio Input and Output Level Adjustment

Once the input and output connections have been made, the input levels can be adjusted. The switcher is factory set for unity. Recommended input levels would be in the range of 0 dBu to +8 dBu. Should input levels need to be changed, trimmers are accessible from the front panel. Each stereo input is labeled and has one trimmer per channel.

Calibrating audio levels on the switcher:

1 – Remove power from the unit and remove the circuit board from the chassis.
2 – Feed a reference signal into input channel 1. A 2khz sine wave test tone at +4 dBu is used at the factory. Connect a Hi-Z dB meter to the TEST jack JP3.
3 – Reapply power. Adjust the left and right input 1 trimmers to a zero level on your dB meter.
4 – Disconnect the dB meter and connect a balanced stereo input dB meter to the output. Adjust the output trimmers (R14, R15) for the desired output level. +4 dBu is set at the factory. Make sure input 1 is selected.
5 – Once input 1 and the output have been calibrated the rest of the inputs maybe adjusted.

PIP (GPI)/Remote Control Inputs

The ACS 4.1 has eight status inputs that may be configured for PIP ("triggers") or remote control operation and accept momentary contact closures (sustained, if break before make); open collector or TTL/CMOS input logic levels. In addition to the PIP/remote control inputs located on TB4, the silence sense tally open collector is also present (OC-SS).

(Top Row, TB4)

| PIP6	PIP7	PIP8	OC-SS	DGND
STEP	MACRO	EAS		
PIP1	PIP2	PIP3	PIP4	PIP5
IN-1	IN-2	IN-3	IN-4	MUTE

(Bottom Row, TB4)

The operation mode is set by the SW6-7 Dip-switch, when SW6-7 is OFF the unit is in remote control mode and when SW6-7 in ON the unit is in PIP mode. The PIP/remote control connections to the switcher are found on the top and bottom rows of the connector TB4. Each channel may be selected by a momentary contact to ground. Each channel is pulled high (5-volts) through a 22K resistor.

In remote control mode the inputs are triggered by momentary closure to (pulsing) to ground (low.) For example, in overlap or mix mode pulsing the "MUTE" input to ground would turn off the output of the ACS 4.1 by muting all of its input channels until a front panel source switch is pressed, a different remote control input is activated, the unit is powered up and/or a serial command is received from a PC or other serial device.

Pulsing the "STEP" input to ground will step the unit one source for each low to high transition on this input. Automatic timed sequencing may be accomplished by holding the step input low. The unit will then step to each source at a user programmable rate from 1 to 99 seconds (10 seconds by default). The last step channel is user programmable and is set to 4 by default. This feature may be used to sequence through multiple station air monitor signals for a program on-hold feed.
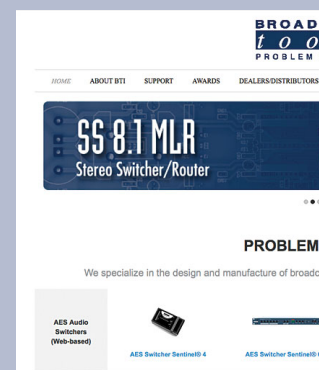
The ACS 4.1 is also capable of being used for EAS audio insertion. This feature is enabled by setting the EAS controlled input channel via RS232 to the desired audio input channel (see the Serial Operation section of this manual for more information.) Once an input channel has been

designated the ACS 4.1 will automatically switch to that input for the duration of a sustained closure to ground on the "PIP8/EAS" remote control input. When an EAS controlled input channel is configured PIP8 is disabled.

Open Collector Outputs

The ACS 4.1 has four open collector outputs that are used to indicate channel selection status. OC1 indicates for Input 1, OC2 indicates for Input 2, etc. The status open collector (OCx) output for the selected channel will go low providing a return for an LED indicator, TTL/CMOS logic or relay. External pull-up resistors may be required in some installations.

See Above
(Top row, TB3)

OC1	OC2	GND	OC3	OC4

Open Collectors
(Bottom Row, TB3)

CAUTION!

Installation of the ACS 4.1 in high RF environments should be performed with care. The station ground should be connected to the designated chassis ground terminal using a 20 to 24-gauge wire.

NOTE:

Note: For wiring information, refer to the grids in this section of the manual, the silkscreen text on the rear panel of the product or the fractional schematic in the appendix.

INSTALLATION

Configuration Jumpers

JP2:   Stereo: Disables mono-summing of switcher output*.
          Mono: Enables mono-summing of switcher output.

Configuration Dip-switch Setup

Follow the tables below for SW6 dip-switch configuration options.

Unit ID	SW6-1	SW6-2
ID 0 *	OFF	OFF
ID 1	ON	OFF
ID 2	OFF	ON
ID 3	ON	ON

Baud Rate	SW6-3
9600 *	OFF
38400	ON

Audio Switch Mode	SW6-4	SW6-5
Overlap*	OFF	OFF
Interlock	ON	OFF
Interlock	OFF	ON
Mix	ON	ON

Power Up	SW6-6
User selected	ON
Last source selected *	OFF

Note: To select an input at power-up with SW6-6 ON, hold down the push-button for the desired input channel or mute until the front panel LED's flash.

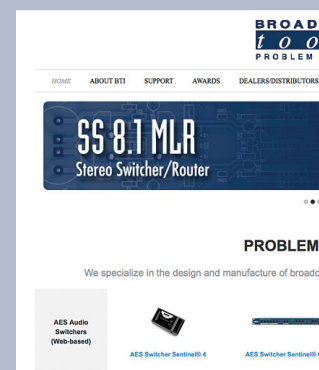| Operation Mode	SW6-7
Remote Control	OFF
PIP*	ON

- Remote control operation mode: PIP inputs are used for remote control.
- PIP mode: activity on any of the PIP inputs will generate a serial status string in the PIP format. For use with automation software.

Note: **After changing any dip-switch, please repower the unit.**
Note: *** Denotes factory setting.**

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INSTALLATION

SERIAL OPERATION

RS-232 Control

Connect one end of the reverse modular cable to the RJ11 jack on the rear panel of the product and the other end to the RJ11 to the jack on the "S9" 9-pin female D-sub adapter. Connect the 9-pin female D-sub "S9" adapter to the COM port of the controlling PC. Note: An optional USB to RS-232 adapter cable may be required if your PC isn't equipped with a RS-232 COM port. The default protocol is as follows: 9600, N, 8, 1 (38400 baud is selectable.)

Select the desired unit ID address for each unit using the configure Dip-switches, zero is the factory default setting. Never duplicate addresses.

RJ-11 Adapter Pin	DB-9 Female Pin Number	Product's Point of Function Name
4	3	RS-232 Receive
3	2	RS-232 Transmit
2	5	Ground

1 2 3 4
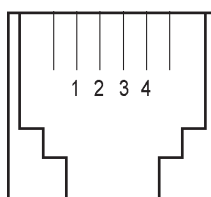
Modular Jack
Pin Numbers

Serial Commands

The switcher may be controlled and monitored by burst serial strings or by the embedded menu.

Where the	< * > Denotes start of string character
	< u > Unit ID (address, 0 through 3)
	< ii > Input channel (01, 02, 03, 04 or M (MUTE)).
	< o > Output channel (1)
*uMM	Go to setup menu, see menu operation section of the manual for more information.
*uii	Turn on input ii
*uiio	Apply input ii to output o
*uMA	Mute all inputs.
*uMo	Mute output o
*uiiMo	Mute input ii for output o
*uii5	For input ii, set output 1 on without affecting any other
*uii7	For input ii, set output 1 off without affecting any other
*uMVmm	Save macro mm
*uMLmm	Load macro mm
*POLL	Returns unit ID address in appropriate time slot.
*uSL	Sends audio status for all inputs: SuLo,x,x,x,x<CR><LF>
*uSPii	Sends PIP status for input ii: SuP,ii,x
*uSPA	Sends PIP status for all inputs: SuP,A,x,x,x,x<CR><LF>

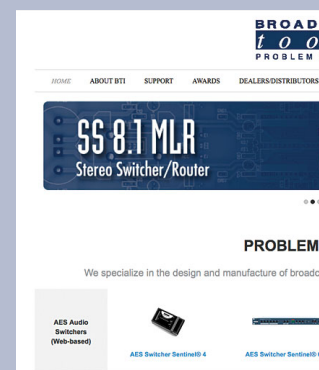|	
*uSS	Sends status of silence sensor: SuS,a<CR><LF>
	a = 1 = not silent, 0 is silent
*uU	Sends unit firmware version: <name><version><lf>
*uY	Display configuration.
*uZx	Echo character x to serial control port - for debugging command strings
*uCEx	Enable error and good responses if x = Y (default N)
*uCDEF	Reset to factory defaults.
*uCLx	Lock front panel: x = L (Lock) x = U (Unlock)
*uCIIttt	Sets PIP minimum pulse length ttt: 000 - 255 => off to 2.55 seconds.
*uCPS	Power up audio state: save power up state now
*uCSLx	Sets silence sensor detection threshold to Off, -20, -25, -30 dB (0,1,2,3)
*uCSAtttt	Sets silence sensor acquire delay to tttt seconds (0, 2-255)
*uCSBtttt	Sets silence sensor restore delay to tttt seconds (0, 2-255)
*uCSCtt	Sets step interval in seconds 1-99 seconds.
*uCSSt	Sets last step channel 1-4 (0 disables step feature.)
*uCSEi	Sets EAS controlled input channel (i) to 1-4 or 0 for off. This allows you to assign one input channel that will be switched to with sustained closure to ground on the PIP8/EAS remote control input from an EAS encoder for EAS audio insertion with the ACS 4.1.
*uDxx	Delay xx seconds before processing next command.
*uDLxxx	Delay xxx seconds before processing next command.

Menu Operation

```
Broadcast Tools(R) ACS 4.1, v1.2 - Setup Menu

1 - Set PIP Minimum Hold Time(0 - 2.55 sec)    - Now:0.05
2 - Set Silence Sense Acquire Delay (sec)      - Now:  10
3 - Set Silence Sense Restore Delay (sec)      - Now:   2
4 - Set Silence Sense Threshold                - Now:-30 dBu
5 - Set Stepping Interval (sec 1-99)           - Now:   1
6 - Set Last Step Channel                      - Now:   3
7 - Lock/Unlock Front Panel                    - Now:UNLOCKED
8 - Set EAS input channel                      - Now:   3
S - Turn ON audio input
M - Turn OFF audio
V - Save Audio Macro
L - Load Audio Macro
C - Show Configuration and Status
F - Set To Factory Defaults
```

To select a menu function, simply enter the letter on the left side of the menu and wait for the prompt. Example: Type the letter "S" Response: Enter Input Channel: Entering a 1 would select channel 1.

OPERATION

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SPECIFICATIONS

Input Levels:	Max +25 dBu, balanced, bridging. 20k
Output Level:	Stereo balanced +27dBu @ 10K

Frequency Response:	20 to 20 kHz; +/- .0.15dB
Signal/Noise Ratio:	>-85 dB nominal, weighted 20 to 22Khz
Distortion:	Less than 0.01% THD
IMD (250/7khz):	Less than 0.005% IMD
Crosstalk:	-80 dB @ 1khz / -75 dB @ 10 kHz from adjacent off channel.
Switching Method:	Digitally controlled professional level analog switch arrays.
Logic:	Flash microprocessor with non-volatile memory.

Operation Control: Front Panel - Momentary switches.
Remote - Momentary or sustained, compatible with 5 volts CMOS/TTL logic, open collector or contact closures to ground.
Serial - Multi-drop RS-232, 9600, 38400
8,N,1.

Status: Front Panel - LED Indicators.
Remote – Four channel open collector status outputs. One Silence Sense open collector output. Refer to the fractional schematic and/or text on the rear panel for connection details.

Interfacing: I/O and Remote control - Rear panel pluggable screw terminals. Mating connectors supplied.
RS-232 - (RJ-11) Reversed modular cable/female "S9" 9-pin D-Sub adapter supplied.

Power Requirements: Universal switching power supply with domestic AC connector supplied. International connectors optional. +/-15 VDC 400mA output with 3-pin AMP-style latching power connector.

Physical Dimensions: 5.65" x 7.10" x 1.575" (WDH) Aluminum chassis w/ 4 - 4-40 mounting holes.

Weight: 2.0 lb.

Shipping Weight: 3.0 lb.

Options: RA-1 rack shelf, holds three units (1-RU) / Filler panels supplied.

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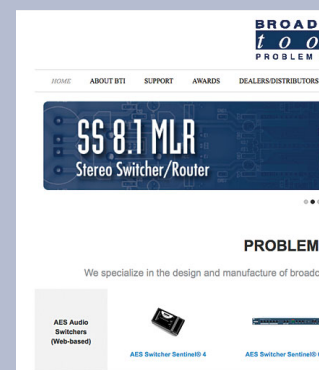
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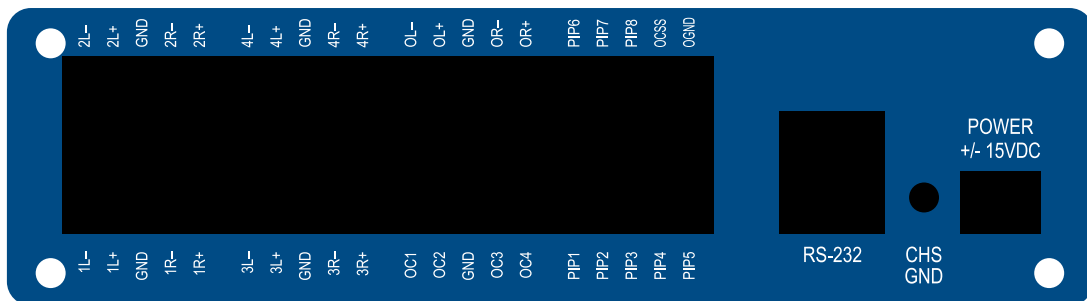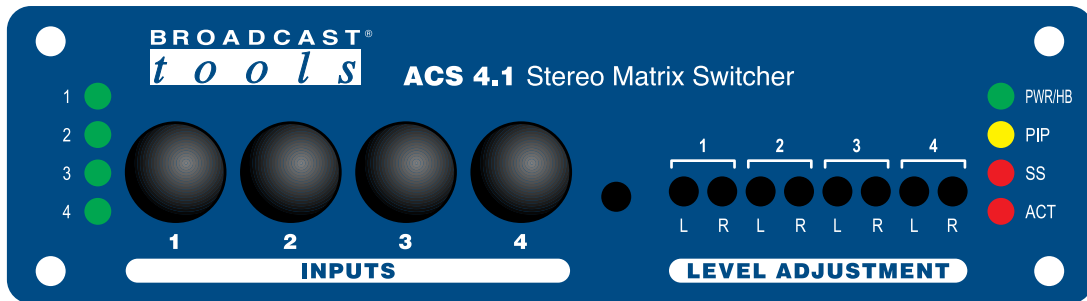
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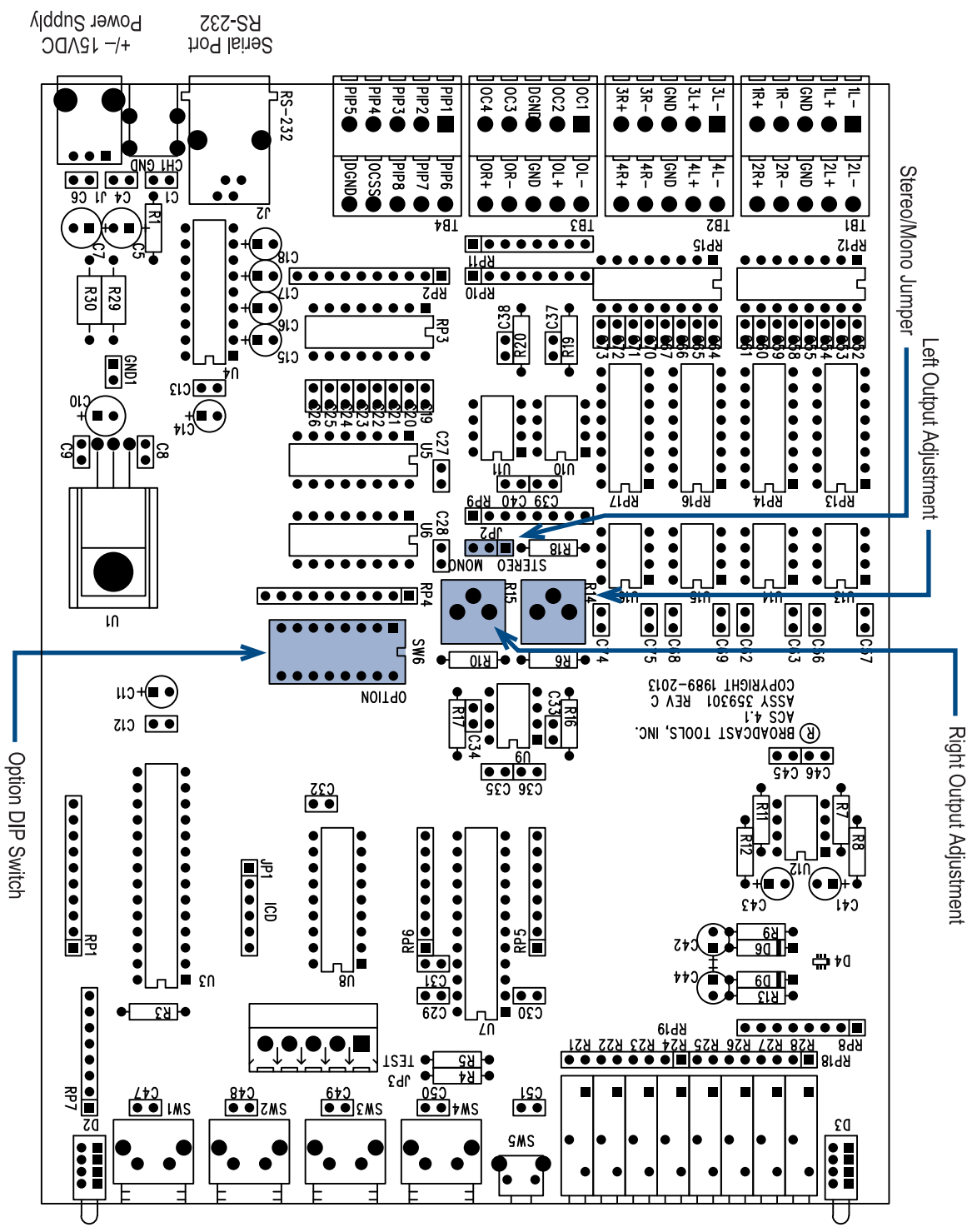
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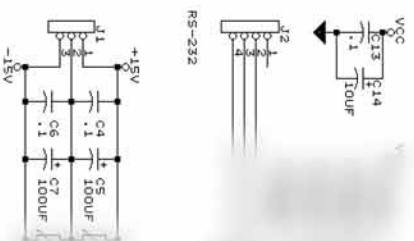support@broadcasttools.com **e-mail**
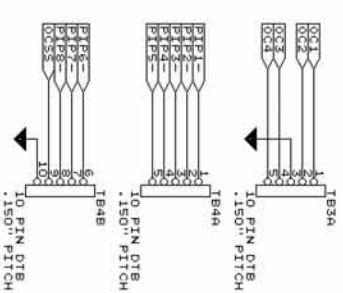www.broadcasttools.com **website**

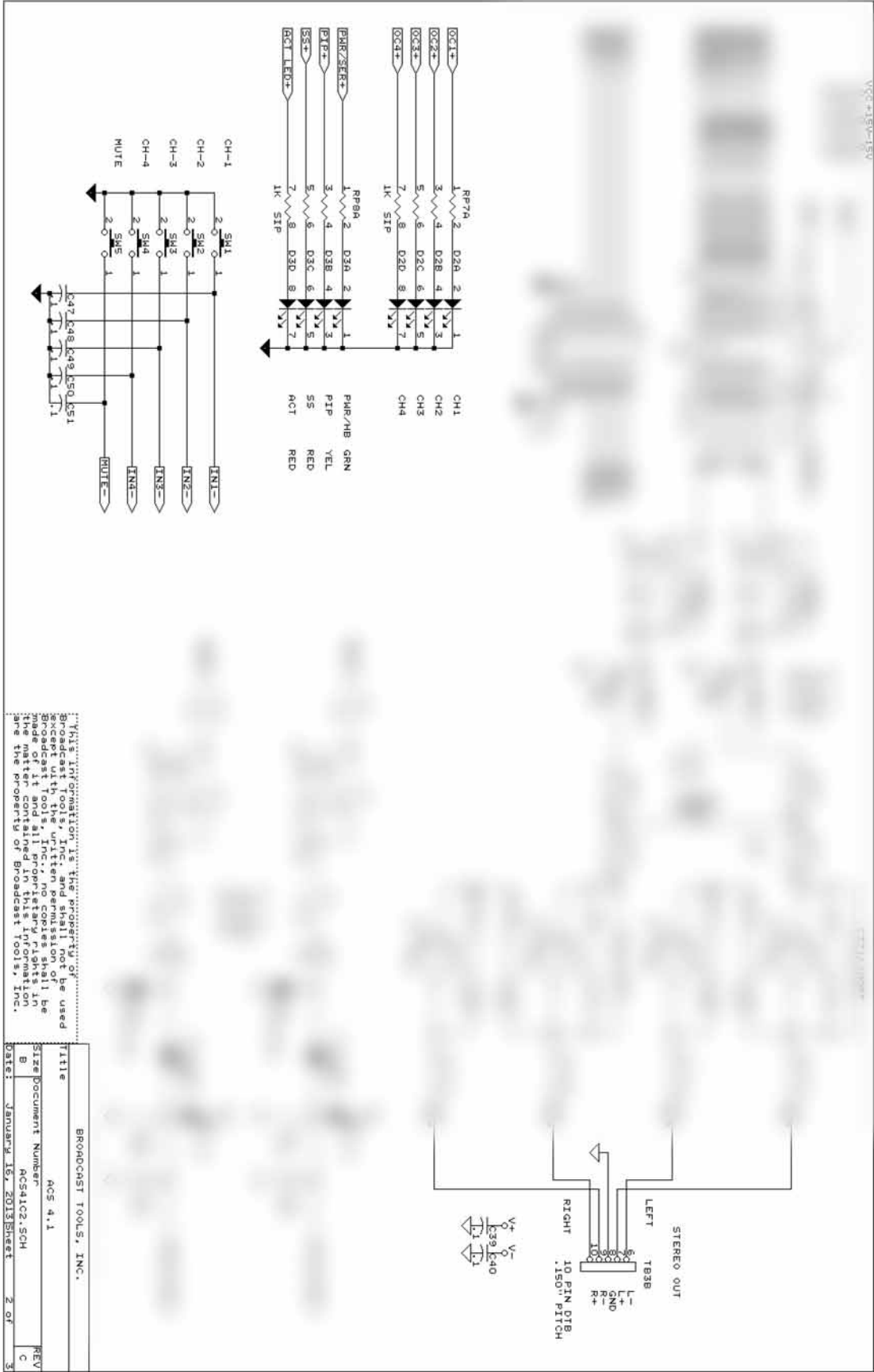**e-mail:** support@broadcasttools.com   **voice:** 360.854.9559   **fax:** 866.783.1742

Broadcast Tools® ACS 4.1

Component Layout

+/– 15VDC
Power Supply

Serial Port
RS-232

Stereo/Mono Jumper

Left Output Adjustment

Right Output Adjustment

Option DIP Switch

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ACS 4.1
Stereo Matrix Switcher

Fractional Schematic

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	Title		
	ACS 4.1		
Size	Document Number		REV
B	ACS41C1.SCH		C
Date:	January 16, 2013	Sheet	1 of 3

ACS 4.1
Stereo Matrix Switcher

Fractional Schematic

Modification date: 02/26/13

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Title	ACS 4.1		
Size	Document Number		REV
B	ACS41C2.SCH		C
Date:	January 16, 2013	Sheet	2 of	3

Fractional Schematic

Title		
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Size	Document Number	REV
B	ACS41C3.SCH	C
Date:	January 16, 2013	Sheet 3 of 3