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Installation and Operation Manual



SS 6.1 MLR/BNC BNC Switcher/Router with Mechanical Latching Relays

Firmware Version 0.2 and above

Manual update: 5/16/2024

If you need a firmware upgrade, contact Broadcast Tools[®]

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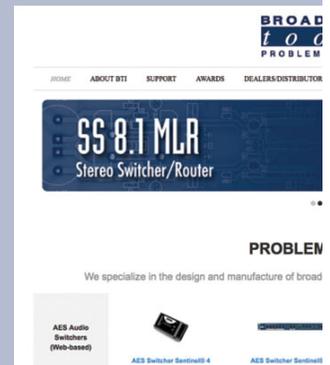
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INTRODUCTION

Thank you for your purchase of a Broadcast Tools® SS 6.1 MLR/BNC transparent six input, one output BNC switcher/router (referred to as the SS 6.1 MLR/BNC 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® SS 6.1 MLR/BNC.

SAFETY INFORMATION

Only qualified technical personnel should install the SS 6.1 MLR/BNC. 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 SS 6.1 MLR/BNC 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 SS 6.1 MLR/BNC. 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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E-mail: support@broadcasttools.com

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CAUTION!

Broadcast Tools® Products, as with any electronic device, can fail without warning. Do not use this product in applications where a life threatening condition could result due to failure.

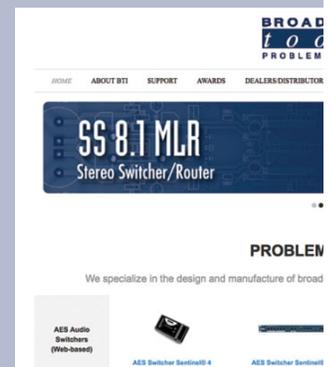


NOTE:

This manual should be read thoroughly before installation and operation.

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INTRODUCTION

Product Overview

The SS 6.1 MLR/BNC is a transparent six input, one output BNC audio switcher/router with mechanical latching relays. The SS 6.1 MLR/BNC is perfect for all types of passive signal switching via front panel switches, contact closures, RS-232 serial or Ethernet (TCP/UDP) commands. Switching is accomplished with mechanical latching gold contact relays, which means that the unit can route a signal in either direction or it will keep routing signal even after losing power. Due to the passive nature of the switching, any input level and impedance can be used. Inputs may be balanced or unbalanced, while output levels, impedance, distortion, noise, and balancing will match that of the selected input. The SS 6.1 MLR/BNC can be controlled and monitored locally and/or with simple contact closures to ground, front panel switches, multi-drop RS-232 serial or Ethernet (TCP/UDP) commands.

Features/Benefits

- Front panel input channel selection push buttons with active channel LED indicators.
- Front panel “Enable/Mute” switch can be configured to provide a safety interlock for the front panel selection push buttons, or Mute.
- Audio/signal switching via mechanical latching sealed relays utilizing 2-form-C bifurcated – crossbars with silver alloy gold overlay contacts.
- Six BNC audio input jacks and one BNC audio output jack.
- Removable euro-block screw terminal connectors are used for remote control connections. Necessary mating plugs are supplied.
- Remote control via opto-isolated inputs. Accepts contact closures, 5-volt TTL/CMOS logic levels. Ethernet TCP/UDP, and/or the multi-drop RS-232 serial port.
- Six SPST normally open relay contacts with common for remote channel status.
- Power-up selection of inputs to outputs, mute or last source selected.
- If power is lost, the last selected channel is passed to the output.
- Fully RFI proofed.
- Surge protected internal power supply, includes 9 VDC universal desktop power adapter with IEC inlet and domestic power cord.
- Up to two units may be mounted on the optional RA-1 rack shelf. Desktop and wall mounting is also possible.

Applications

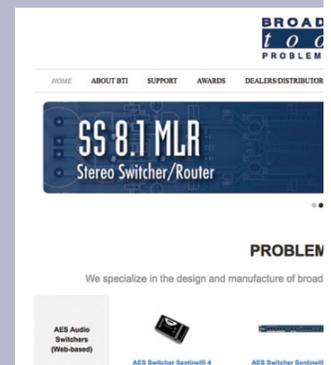
Switching/routing applications include Composite stereo audio (MPX), NTSC video signals, Analog and/or AES3id audio sources, Studio selection, Audio processing selection, Exciter input selection, STL source selection.

Inspection

Please examine your SS 6.1 MLR/BNC 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 contains the SS 6.1 MLR/BNC, a modular cable with 9-pin “S9” female D-sub adapter, a 7-foot BLUE straight-through CAT 5 cable, a 7-foot GRAY crossover CAT 5 cable, and a 9.0 VDC universal desktop power supply with IEC AC inlet and domestic power cable. Manuals can be downloaded from our web site.

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OVERVIEW

Installation

Surge Protection

The SS 6.1 MLR/BNC 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 SS 6.1 MLR/BNC 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 SS 6.1 MLR/BNC to a UPS standby power system. A UPS, like the BE600M1 from APC helps to minimize the risk to the SS 6.1 MLR/BNC and provides power during a power outage.

NOTE: If power is lost, the last selected channel is passed to the output.

Power

Connect the 2.1mm barrel type center positive power connector into the unit and the 9 VDC power supply with IEC inlet into a 100-240 Vac 50-60 Hz power source. Never use any type of power supply other than the specified/supplied power supply.

Chassis Ground screw (CHS GND): The #6-32 sized chassis ground screw should be tied to the station (house) or system ground.

Installation/Operation

Input, Mute and Enable push buttons

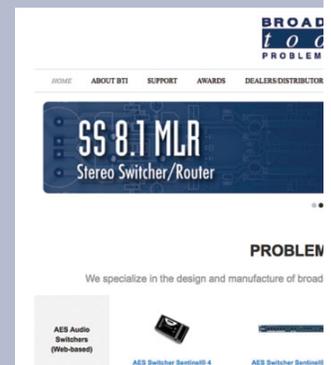
Each of the six inputs and mute can be selected via its front panel push button labelled “1”, “2”, “3”, “4”, “5”, “6” and “Mute/Enable” respectively. Each input push button has a built-in LED indicator which will illuminate when the channel is selected. When an input channel is selected, the previous channel is deselected (interlock mode). The “Mute/Enable” (safety) push button can be configured as a Mute switch (default) or enabled to require the user to hold down the enable (MUTE) push button while selecting any of the other front panel push buttons.

LED indicators

- “PWR” LED: Lit when power is applied and blinks when serial data is active. (Green)
- “LINK” LED: Lit when a TCP connection over Ethernet is active (Green).
- Channel (1-6”) LEDs: Lit when the channel is selected/routed to the output. (Green)
- Mute LED: Lit when the output is muted. (Green)

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INSTALLATION

I/O Connections

The rear panel contains all the input, output, Ethernet, RS-232 serial, and remote-control connectors. The multi-drop RS-232 serial port is equipped with a modular RJ-11 jack and an “S9” modular to DB9 adapter/cable.

BNC Inputs and Output

Input 1 BNC	Input 2 BNC	Input 3 BNC	Input 4 BNC	Input 5 BNC	Input 6 BNC	Output BNC
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Switching/signal routing is balanced, both conductors for each signal are passively switched via mechanical latching relays. Input sources that are NOT selected are terminated with a 75-ohm resistor. If you do not require this load applied to the deselected sources, they may be removed from each channel. Channel 1 = R30, channel 2 = R32, channel 3, R34, channel 4 = R36, channel 5, R35, and channel 6 = R37.

Remote Control Inputs

The SS 6.1 MLR/BNC interfaces to external equipment through removable euro-block screw terminals. The terminals accommodate wire sizes from 16 - 28 AWG solid or stranded wire. Before installing a wire, remove the euro-block 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.

The SS 6.1 MLR/BNC six opto-isolated remote-control inputs accept momentary contact closures (or sustained, if break before make); open collector or TTL/CMOS input logic levels.

Remote Control Inputs

Input 1 (S1)	Input 2 (S2)	Input 3 (S4)	Input 4 (S5)	Input 5 (S5)	Input 6 (S6)	Input Common	Ground
-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	--------

(Bottom Row, TB3)

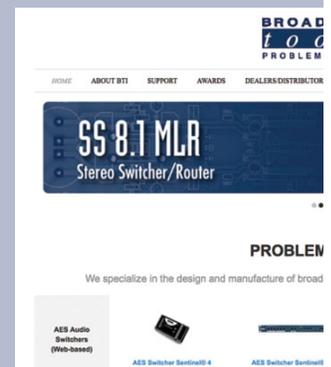
The SS 6.1 MLR/BNC has six opto-isolated remote-control inputs. For example, triggering remote control input 1 would turn ON Input 1 and turn OFF any previously selected input on SS 6.1 MLR/BNC until a front panel source switch is pressed, a different remote-control input is activated, the unit is powered up and/or a serial/Ethernet command is received from a PC or other device.

By default, the remote-control inputs are configured for “dry” operation using an internal 5V source and can be triggered by momentary closures to ground (Gnd). Alternatively, they can be configured for “wet” operation which requires an external DC voltage (5-24 VDC) to be applied to the remote-control input in-order to trigger it. To configure a remote-control input for “wet” operation move the jumper on the inputs three-position header from pins 1-2 to pins 2-3. This connects the anode of the opto-isolator through a 2.2k ohm current limiting resistor to the “Input Common” pin where you can connect the external positive voltage source or digital output (+5-24 VDC). Connecting the remote-control input pin (cathode) to the negative or ground terminal through a switch, relay, or digital output on the external system will trigger in the input. JP1 configures Input 1, JP2 input 2, etc.

For remote control-only applications the SS 6.1 MLR/BNC can be configured via dipswitches for remote control via “sustained” contact closures. See the “Configuration Dipswitch Setup” section of this manual for more information.

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INSTALLATION

Relay Outputs

The SS 6.1 MLR/BNC has six normally open relay outputs that are used to indicate channel selection status. K1 indicates for Input 1, K2 indicates for Input 2, etc. The status relay output for the selected channel will connect to the relay common providing a return for an LED indicator, TTL/CMOS logic, or relay.

Relay Outputs

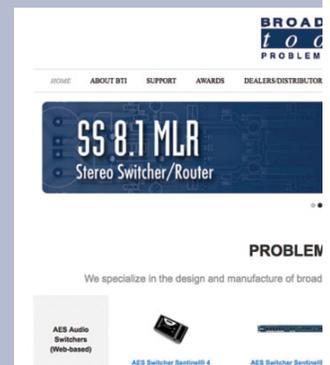
K1	K2	K3	K4	K5	K6	Relay Common	Ground
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(Top row, TB3)

CAUTION! Installation of the SS 6.1 MLR/BNC 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: For wiring information, refer to the grids in this section of the manual, the silk-screen text on the rear panel of the product or the fractional schematic in the appendix.

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RS-232 Serial Port (RJ-11 Jack)

This RJ-11 jack is used to connect the SS 6.1 MLR/BNC to a computer's COM port for RS-232 serial operation using the included reverse modular cable with 9-pin "S9" female D-sub adapter. If your PC does not have a built-in RS-232 serial port but does have USB, then a USB-to-serial adapter cable is a good way to add serial capability. We recommend USB-to-serial adapter cables that use the FTDI chipset and have had good results with the model "SBT-FTDI" from Sabrent.

LAN/NET Ethernet Port (RJ45 Jack)

This 10/100 Ethernet port is used to connect the SS 6.1 MLR/BNC to a computer for configuration and control via telnet/TCP, or UDP socket connections. See the "Ethernet" and "Programming" sections of this manual for more information.

Resetting Ethernet Settings to Defaults

Network Defaults may be restored by depressing the recessed front panel Def. (Defaults) push button, applying power to the unit, and holding down the push button for five seconds after power up.

Configuration Jumper Setup

JP8 Enable/Mute Configuration, 4-pin header

Mute Mode = Jumpers installed on pins 1&2 and 3&4. Front panel Mute switch enabled. (Factory default)

Enable Mode = Jumper installed on pins 2&3. Front panel ENABLE push button active.

NOTE: In Enable mode, the enable push button must be held in/closed to operate any of the other front panel push buttons and isn't associated with any of the remote-control functions.

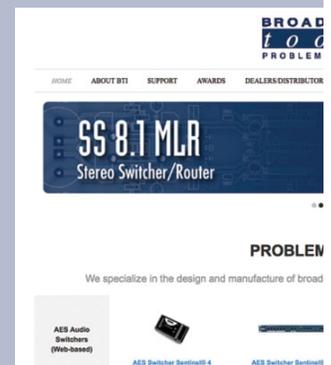
JP1-6 Remote Control Input Dry/Wet, 3-pin headers

Dry = Jumper installed on pins 1 and 2. Compatible with dry contacts, switches, and open collector outputs (Factory default)

Wet = Jumper installed on pins 2 and 3. Compatible with +3.3 to 24 VDC signals, or +25-48 VDC via an external 3.3K ohm resistor) wet inputs. Default = Dry (+5 volt with pull-up internally sourced) Momentary or sustained.

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Configuration DIP-Switch Setup

Follow the tables below for front panel dipswitch (SW11) configuration options.

Unit ID	SW11-1	SW11-2	SW11-3
ID 0 *	OFF	OFF	OFF
ID 1	ON	OFF	OFF
ID 2	OFF	ON	OFF
ID 3	ON	ON	OFF
ID 4	OFF	OFF	ON
ID 5	ON	OFF	ON
ID 6	OFF	ON	ON
ID 7	ON	ON	ON

Baud Rate	SW11-4	SW11-5
2400	ON	OFF
9600 *	OFF	OFF
19200	OFF	ON
38400	ON	ON

Power Up	SW11-6
User selected	ON
Last source selected *	OFF

Remote Control	SW11-7
Sustained Control	ON
Momentary Control *	OFF

Note: To select an input at power-up with SW9-6 ON, hold down the front panel push-button for the desired input channel or mute until the front panel LEDs flash.

Remote control operation mode: Momentary Control: Pulse S1 (Input 1) to select channel 1, the same holds true for each input. Sustained Control: hold S1 (Input 1) on to select channel 1, release it to Mute.

Note: * Denotes factory default setting.

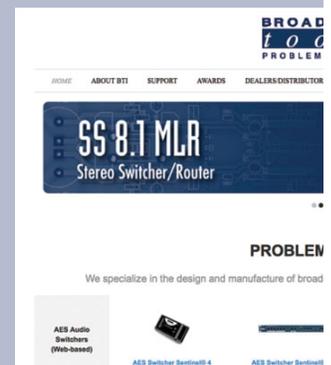


NOTE:

After changing any DIP-switch, please repower the unit.

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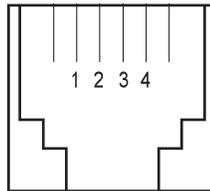
SERIAL/ETHERNET OPERATION

RS-232 Serial Control

Connect one end of the 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. The default protocol is as follows: 9600, N, 8, 1 (other baud rates are user selectable). Select the desired unit ID address for each unit using the configuration DIP-switches, zero is the factory default setting. Never duplicate addresses.

Note: If your PC does not have a built-in RS-232 serial port but does have USB, then a USB-to-serial adapter cable is a good way to add serial capability. We recommend USB-to-serial adapter cables that use the FTDI chipset and have had good results with the model “SBT-FTDI” from Sabrent.

RJ-11 Adapter Pin	DB-9 D-SUB Pin #	Product's point of view Function Name.
4	3	RS-232 Receive
3	2	RS-232 Transmit
2	5	Ground



Modular connector's point of view.

Serial/Ethernet Commands

The switcher may be controlled and monitored via RS-232 serial or TCP/UDP Ethernet using burst string commands or by the embedded menu.

- Where the
- < * > Denotes start of string character
 - < u > Unit ID (address, 0 through 7)
 - < ii > Input channel (01, 02, 03, 04, 05, or 06).
 - < o > Output channel (1)

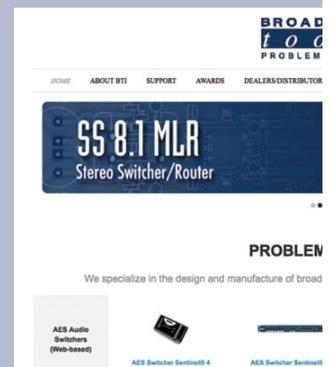
- *u_{ii} - Switch to input ii
- *u_{MA} - Mute output
- *0MM - Go to setup menu, see menu operation section of the manual for more information. Unit ID 0 only.

(NOTE: The setup menu times out after 60 seconds of keyboard inactivity).

- Examples:
- *006 This string would turn on channel 6 for a switcher set to unit ID 0.
 - *0MM Accesses the setup menu.
 - *POLL Returns unit ID address in appropriate time slot.
 - *uSL Sends audio status for all inputs: SuLo,x,x,x,x,x,x<CR><LF>

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OPERATION

- *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)
- *uCPS Power up audio state: save power up state now
- *uDxx Delay xx seconds before processing the next command.
- *uDLxxx Delay xxx seconds before processing next command.

Menu Operation

```
Broadcast Tools(R) SS 6.1 MLR/BNC, v0.2 - Setup Menu

1 - Lock/Unlock Front Panel          - Now:UNLOCKED

S - Turn ON audio input
M - Turn OFF audio

V - Save Audio State for Power Up
C - Show Configuration and Status
F - Set Factory Defaults

Audio Status: Present - Channel 3

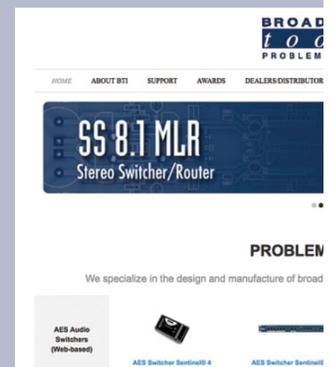
Enter Selection, or Q to quit:
```

To enter menu mode send the command: *0MM

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 input channel one.

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Ethernet Setup and Operation

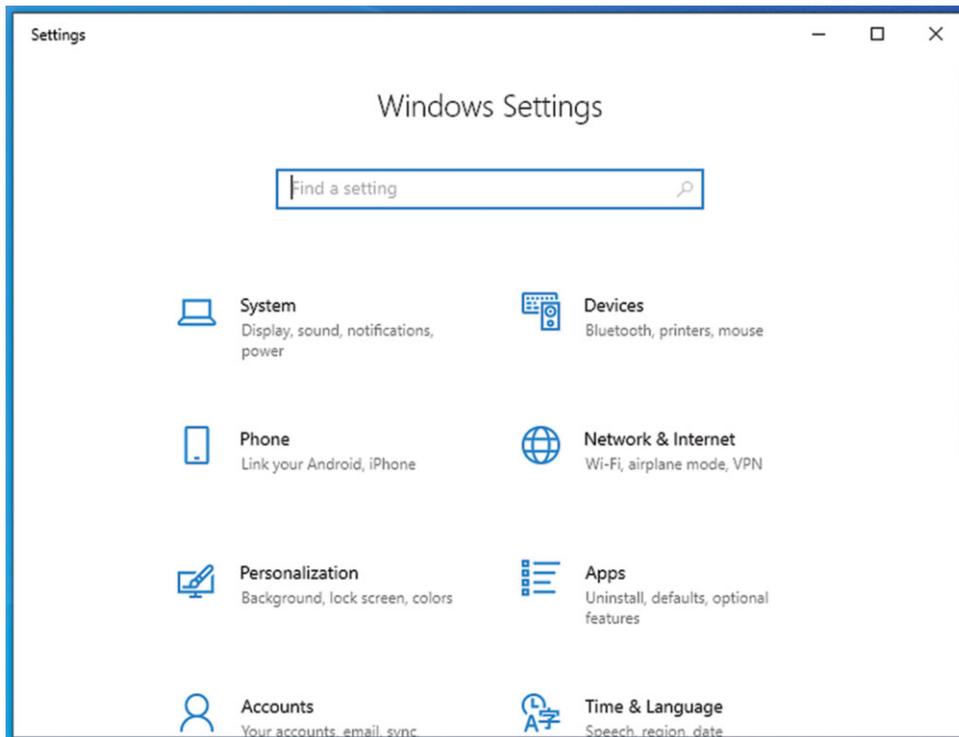
Ethernet “Quick Start” Guide

CAUTION! If you are not familiar with Ethernet enabled equipment, it may be useful to contact your IT department, network administrator or network consultant for assistance. Assigning an IP address already in use by another device may cause problems with your network!

Instructions for changing the IP address of the computer that will be used for the configuration of this product are given here. Note that these instructions are specifically for computers with the Windows 10 operating system but will also work with Windows 7. For setup using other operating systems, refer to the appropriate OS user’s manual.

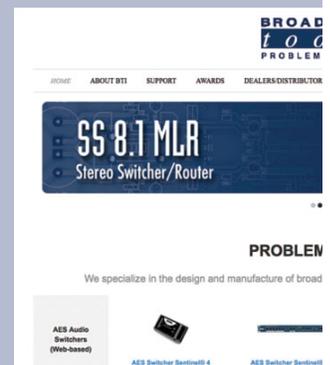
NOTE: We recommend the use of Chrome, Firefox, or Safari as your browser.

Step 1: Open the control panel by clicking on the Start Menu, click on Settings, then click on Network & Internet.

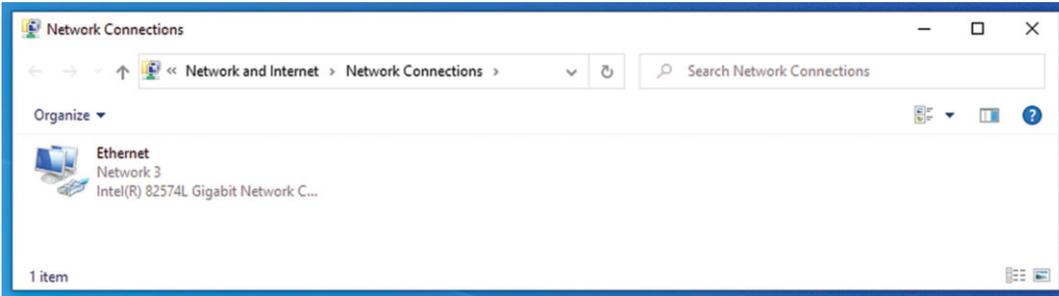


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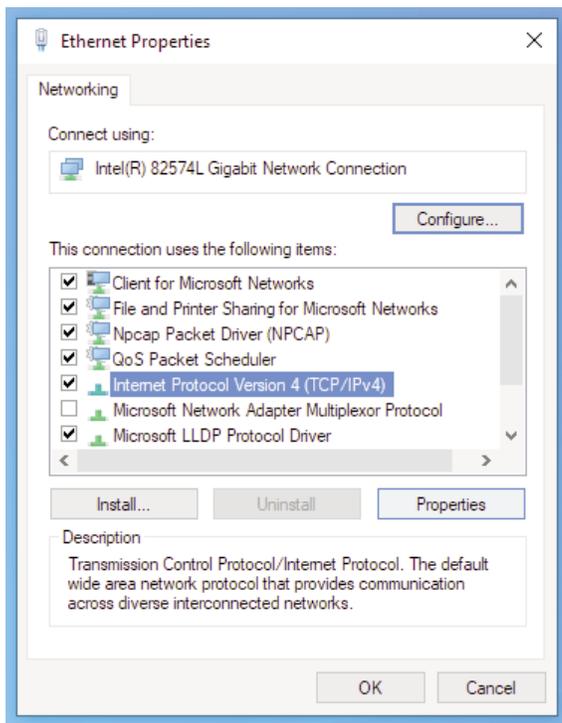
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Step 2: Under Advanced Network Settings click Change adapter settings. The Network Connections windows will pop up, as shown below.

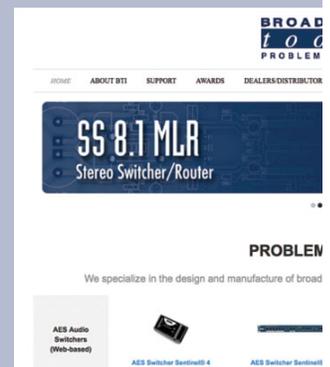


Step 3: Right click on the icon labeled Local Area Connection or Ethernet. A menu will appear. Select the option at the bottom of the menu labeled Properties. The Ethernet Properties window will appear.

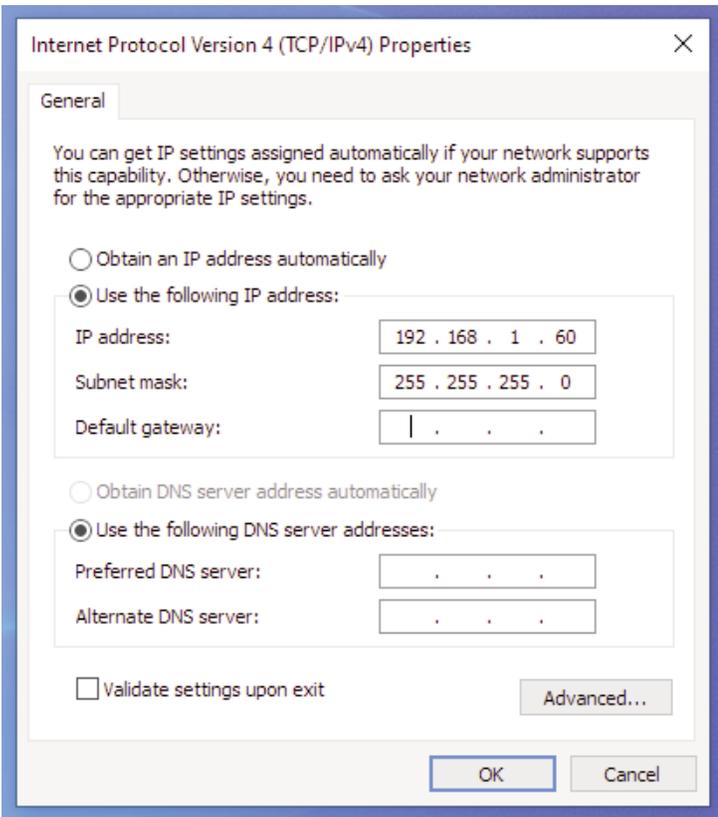


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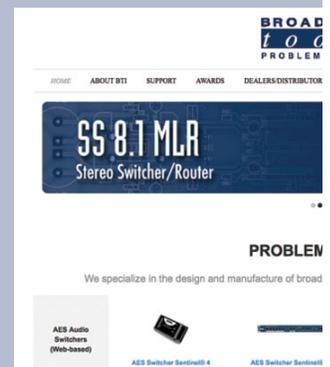
Step 4: On the Local Area Connection Properties page, double click on Internet Protocol (TCP/IPv4) to display properties.



Step 5: Before making any changes to the network settings, write down the current settings (or screen capture the page and print) so that they can be restored once the unit is configured. Next, select the radio button labeled “Use the following IP address” and type in the IP address 192.168.1.60. Type in the subnet mask of 255.255.255.0. Leave the default gateway field blank. Click OK to apply the new settings.

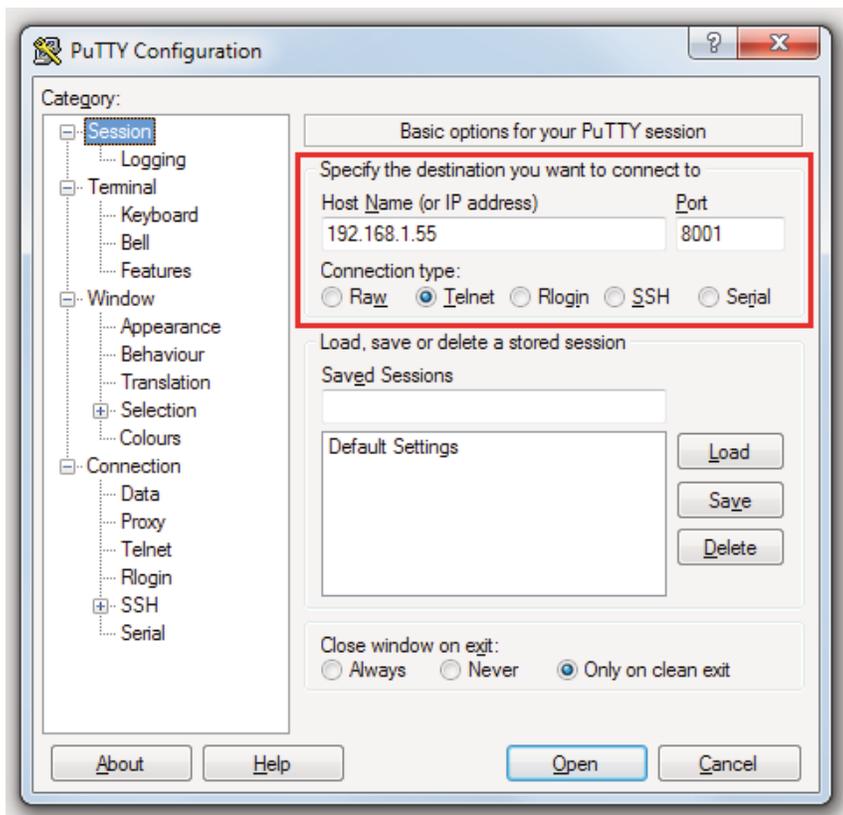
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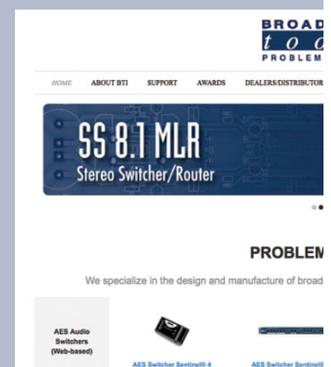
Connecting via the Ethernet “LAN/NET” port:

1. Connect the supplied GRAY colored XOVER cable between the PC’s Ethernet port and the products “LAN/NET” network RJ45 jack.
2. Connect the included power supply to the SS 6.1 MLR/BNC. Verify that the green PWR LED is lit and the green “LINK” LED to the left of the “LAN/NET” Network RJ45 jack is illuminated.
3. Open terminal application PuTTY configured for a Telnet connection type to host 192.168.1.55 port 8001.
4. In PuTTY configuration > Terminal > Line discipline options set Local echo “Force on” and Local line editing to “Force off”.
5. Click okay to connect to the SS 6.1 MLR/BNC and type *0mm into the terminal window and press return to bring up the Menu. See: “Serial/Ethernet” section of this manual.



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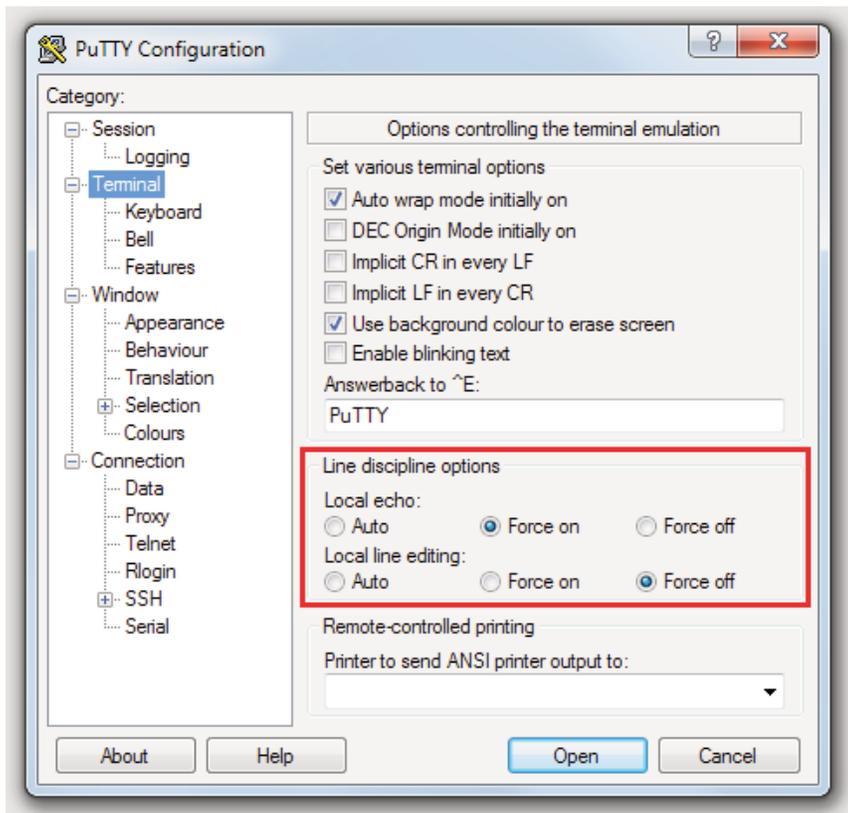
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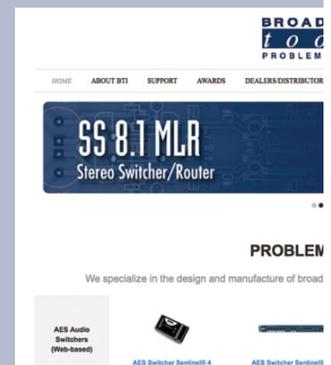
Changing network settings on the Ethernet “LAN/NET” port:

NOTE: We recommend the use of Chrome, Firefox, or Safari for as your browser.

1. Connect the supplied GRAY colored XOVER cable between the PC’s Ethernet port and the products “LAN/NET” network RJ45 jack.
2. Connect the included power supply to the SS 6.1 MLR/BNC. Verify that the green PWR LED is lit and the green “LINK” LED to the left of the “LAN/NET” Network RJ45 jack is illuminated.
3. Open a web browser window and navigate to the SS 6.1 MLR/BNC’s default IP address: <http://192.168.1.55>
4. When prompted to login, use the default login and password.
Login: admin Password: 1234
5. To change the network settings, choose “Local IP Config” from the side bar.



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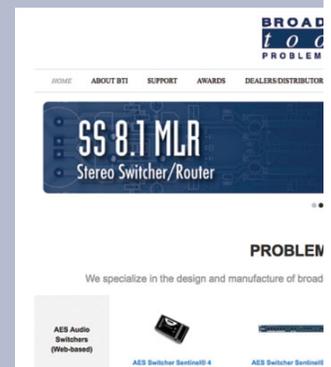


Specifications

Inputs/Outputs:	Any input level and impedance can be used. Inputs may be balanced or unbalanced. Output levels, impedance, distortion, noise, and balancing will match that of the selected input.
Switching Method:	Passive. Mechanical latching sealed relays utilizing 2-form-C bifurcated-crossbar silver alloy contacts with gold overlay.
Logic:	Flash microprocessor with non-volatile memory.
Operation Control:	Front Panel: Momentary switches. Remote: Optically isolated (+3.3 to 24 VDC, or +25-48 VDC via an external 3.3K ohm resistor) wet input. Default = Dry (+5 volt pull-up internally sourced) Momentary or sustained. Serial: Multi-drop RS-232, 2400, 9600, 19200, 38400 8,N,1. Ethernet: RJ45 10/100, TCP or UDP socket connections.
Status:	Front Panel: LED Indicators integrated into switches.
Remote:	Six channel status relay outputs. SPST normally open, 1-amp @ 30 VDC maximum. Refer to the fractional schematic and/or text on the rear panel for connection details.
Interfacing:	Audio/Signal I/O: balanced BNC connectors. Unused inputs terminated with 75-ohm resistors. Remote control: (2) 8-position pluggable screw terminal blocks, mating connectors supplied. Serial: RJ-11 jack. Reversed RJ11 modular cable/female "S9" 9-pin D-Sub adapter supplied. Ethernet: RJ45, cat5 cable supplied.
Power Requirements:	9 VDC @ >500 ma. International input voltage power supply with domestic power cord supplied.
Operating Environment:	32°F/0°C-122°F/50°C; 0%-95% non-condensing relative humidity; 10,000ft/3048m.
Physical Dimensions:	5.66" x 7.125" x 1.58", aluminum extrusion chassis with (4) #6-32 screw thread mounting holes for optional RA-1 rack shelf.
Weight:	2.0 lb.
Shipping Weight:	3.0 lb.
Options:	RA-1 rack shelf, holds three units (1-RU), filler panels supplied.
Declaration of Conformity:	Email support@broadcasttools.com for more information.

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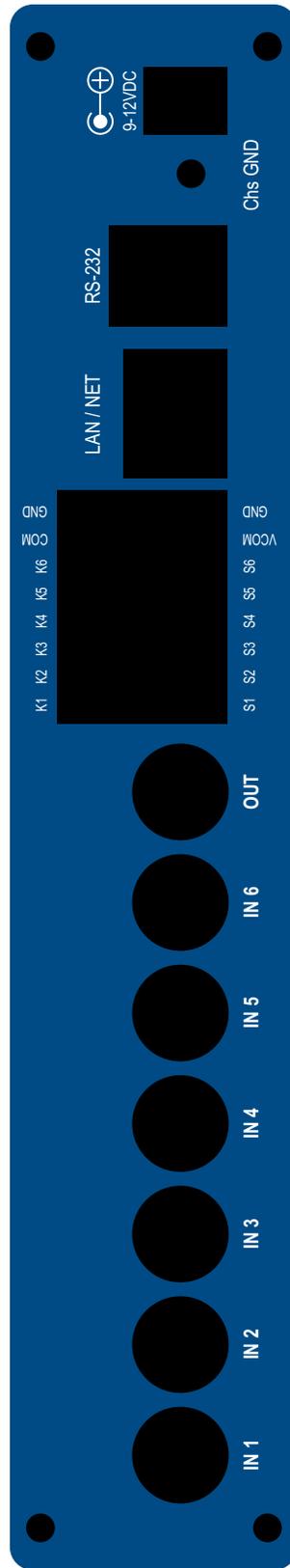
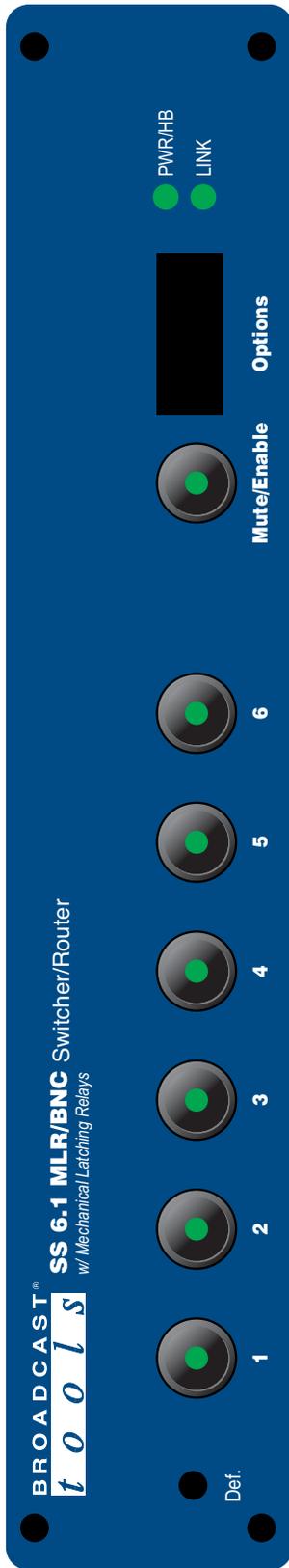
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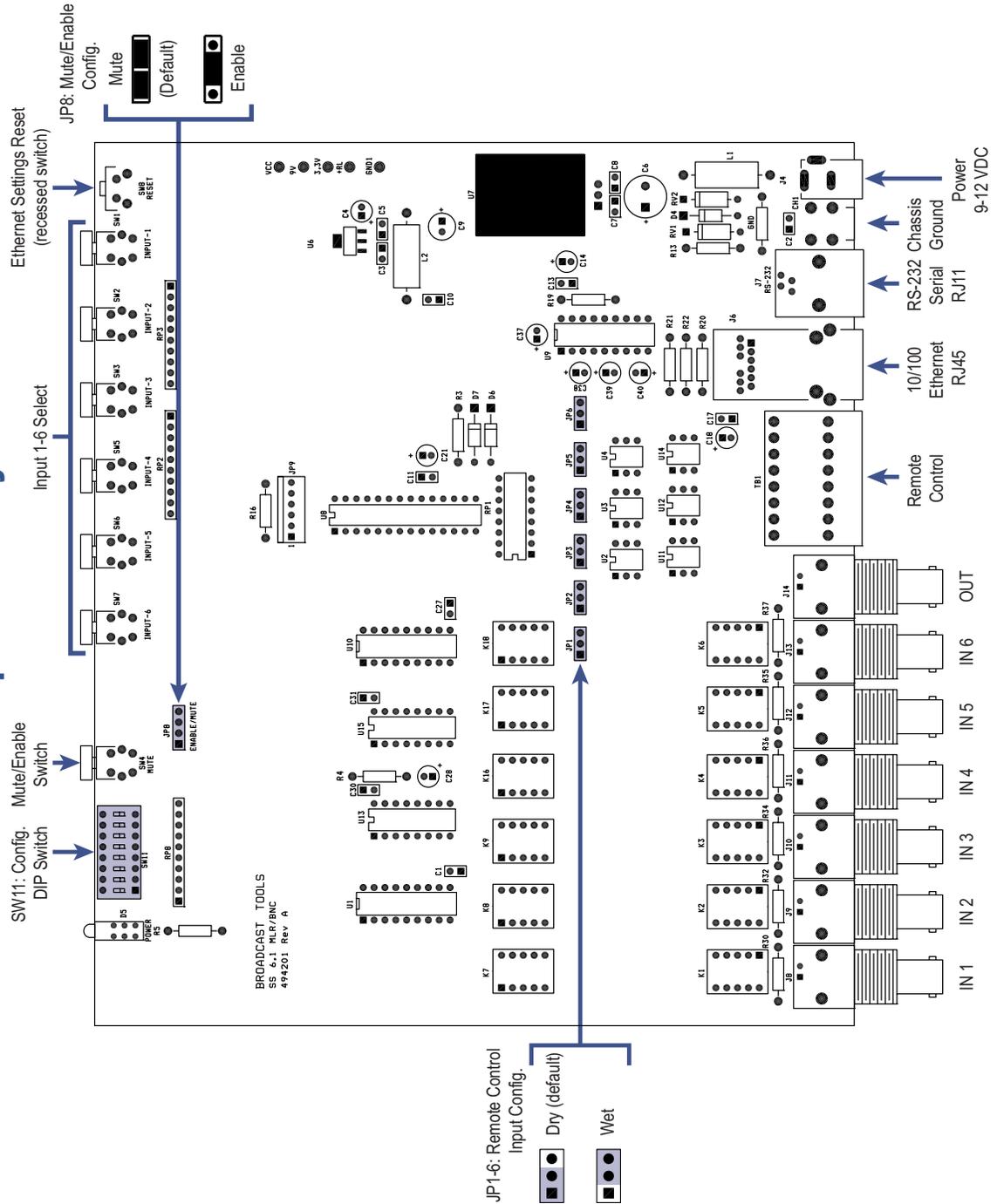
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Component Layout



Functional Diagram

