Operating Manual and Programming Reference

Model SR10, SR11 & SR12 Switching Systems

STANFORD RESEARCH SYSTEMS

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Safety and Preparation for Use

WARNING!

Dangerous voltages, capable of causing injury or death, are present in this instrument. Use extreme caution whenever the instrument is cover is removed. Do not remove the cover while the unit is plugged in to a live outlet.

Line Voltage

The SR10, SR11 and SR12 operate from a 90 to 264 Vrms AC power source having a line frequency of 47 to 63 Hz.

Line Cord

The SR10, SR11 and SR12 has a detachable, three-wire power cord for connection to the power source and to a protective ground. The exposed metal parts of the instrument are connected to the outlet ground to protect against electrical shock. Always use an outlet which has a properly connected protective ground.

Power Switch

The power switch is located on the rear panel of the unit, in the lower right hand corner. Turn on the unit by pressing the top of the switch in.

Ventilation

SR10, SR11 and SR12 require ventilation to maintain proper operation. Do not block the vents in the chassis or the unit may not operate properly.

Chapter 1 Introduction

The Audio Switching Systems line consists of 3 different models. SR10 is a 12 channel balanced input switch that can connect one of 12 input channels to output A or B. SR11 is a 12 channel balanced output switch that can connect A or B inputs to one or more of 12 output channels. SR12 is a 12 channel unbalanced switch that can be configured as either an input or output switch. All models can be cascaded to other switch boxes to create larger switch matrixes. Audio Switchers are only controllable over a computer interface; there are front panel indicators that show the switch configuration and status, but no controls.

XLR Connector Pinout
Male and female XLR connectors have different pinouts, as shown below.
(XLR connector schematics)

XLR connectors are normally wired to a shielded twisted pair cable to allow them to connect balanced (differential) signals, although they can be used for unbalanced (single ended) signals as well. Typically XLR male connectors are used for outputs and XLR female connectors are used for inputs.

BNC Connector Pinout
The BNC connectors for SR12 are configured as shown below.
(BNC schematic)

BNC connectors are used for unbalanced (single ended) signals. The shield of the BNC is not connected directly to chassis to help prevent ground loops. Instead it is connected through a capacitor to help control noise. Both the shield and center conductor are switched.

SR10 Input Switch Box
(front & rear panel picture)
The SR10 input switcher has 2 male XLR connectors (A & B) and 12 XLR female connectors (Ch1 – Ch12). In addition there are 2 male and 2 female connectors on the rear panel that connect to the A & B signals that can be used to cascade multiple SR10 switch boxes.

(Schematic)
The relays of SR10 can connect any of the 12 input channels to either A or B. When used with SR1 these are normally connected to the A & B XLR inputs, allowing it measure 12 or more channels. Similarly they can be used to expand the inputs of other single or dual channel devices.

SR11 Output Switch Box
(front & rear panel picture)
The SR11 input switcher has 2 female XLR connectors (A & B) and 12 XLR male connectors (Ch1 – Ch12). In addition there are 2 male and 2 female connectors on the rear panel that connect to the A & B signals that can be used to cascade multiple SR11 switch boxes.

(Schematic)
The relays of SR11 can connect A or B to any of the 12 output channels. When used with SR1 these are normally connected to the A & B XLR outputs, allowing it output to 12 or more channels. Similarly they can be used to expand the outputs of other single or dual channel devices.

SR12 BNC Switch Box
(front & rear panel picture)
The SR12 BNC switch box can be configured as either an input or output switchbox by an internal jumper. It has A & B BNC connectors and another set of 12 BNC connectors (Ch1 – Ch12) that

are inputs or outputs depending on the configuration. In addition there are 4 BNC connectors on the rear panel that connect to the A & B signals that can be used to cascade multiple SR12 switch boxes.

(Schematic)
When configured as an input switch the SR12 relays can connect any of the 12 input channels to either A or B. When configured as an output the relays can connect A or B to any of the 12 output channels.

When used with SR1 these are normally connected to the A & B inputs or outputs, allowing it output or measure 12 or more channels. Similarly they can be used to expand the inputs and outputs of other single or dual channel devices.

Front Panel

Besides the 14 front panel connectors (A, B, Ch1 – Ch12) there are indicator LEDs to indicate the operating condition of the SR10, SR11 and SR12. These are broken into two groups: active channel indicators and status indicators.

Active Channel Indicators
LED's over the A & B connectors will be illuminated to indicate that that connector is connected to one of Ch1 – Ch12. The A LEDs are green; the B LEDs are orange. Green and orange LEDs over each of Ch1 – Ch12 indicate if it is connected to A (green), B (orange) or neither (none). (A|B & Ch1 picture)

Status Indicators
Three status indicator LEDs on the right side to indicate the status of the SR10, SR11 and SR12. (status indicator picture)

ERR: (red) This is lit to indicate that an execution or command error has occurred. See the Programming section for detailed information on errors.

ACT: (green) This is lit to indicate there is activity over one of the computer interfaces, either a command from the controlling computer or a response from the switcher.

PWR: (green) This indicates that power is on.

Rear Panel

Besides the 4 rear panel signal connectors (A & B), the power and computer interface connectors and the configuration switches are on the rear panel.

Power Entry Module
The power entry module is used to switch power and filter high frequency noise from entering or leaving the instrument. SR10, SR11 and SR12 use a detachable three wire power cord for connection to the power source and protective ground. All exposed metal parts of the unit are connected to the outlet ground to protect against electrical shock. Always use an outlet that has a properly connected protective ground.

SR10, SR11 and SR12 operate from 90 – 264 V_{RMS} AC power source with a line frequency between 47 and 63 Hz. They are internally fused and draw <10W.

After power is connected, power is turned on by pressing the bottom of the power switch. After turning on the power, the front panel LEDs will cycle through one at a time, perform self tests and begin operation.

Computer Interfaces
The audio switchers are controlled by one of three different computer interfaces: RS-232, GPIB (IEEE-488) or Ethernet. These will be described in detail in Chapter 2.

RS-232 Out: The 9 pin RS-232 Out connector is configured as a DTE (transmit on pin 2, receive on pin 3) and is used when multiple units are cascaded over RS-232. The baud rate is fixed at 9600 baud, with a word length of 8 bits, no parity and one stop bit. Flow control (hand shaking) is not used.

RS-232 In: The 9 pin RS-232 In connector is configured as a DCE (transmit on pin 3, receive on pin 2) and is used to connect to a controlling device or the RS-232 Out of another unit. The baud rate is fixed at 9600 baud, with a word length of 8 bits, no parity and one stop bit. Flow control (hand shaking) is not used.

IEEE-488: (GPIB) The 24 pin IEEE-488 connector allows a controlling device to control the unit over the IEEE-488 (GPIB) instrument bus.

LAN (Ethernet): The LAN (RJ-45 or Ethernet) connector allows the unit to be controlled over Ethernet using TCP/IP. It supports 10 or 100 Base-T Ethernet connections. Two methods are available for Ethernet control: a simple socket or a web page.

There are two LEDs on the LAN connector that indicate the LAN operating conditions. The orange LED on the left indicates connectivity. If it is not lit, this indicates that the cable is disconnected from the LAN. The green LED on the right flashes to indicate LAN traffic.

LAN Reset Button
This used to reset the IP parameters of the LAN interface to their factory defaults. It is accessed by using a small screwdriver or a bent paperclip. When the button has been pressed, the front panel orange LEDs with flash on and off for about 5 seconds to indicate the unit has reset its LAN parameters.

Control DIP Switch
Most of the parameters of the computer interfaces are controlled over these switches including the active interface and addresses. See Chapter 2 for detailed information on the switch settings.

Chassis Ground Connector
This is used to ensure that a good ground connection is made between measurement devices and multiple switch units.

Chapter 2 Operation

Power On

When power is first applied the Audio Switcher the unit will cycle through all of the front panel LEDs from left to right, one at a time and perform its internal self tests. After this it will load the default settings.

Self Test

The internal self tests check the operating condition of the Audio Switcher. If there is a problem during the self test the LEDs will flash to indicate the fault condition. If a fault condition exists, the unit is non-operational. Contact SRS for service information.

Fault Condition	Flash Pattern
Configuration Error	Orange and green flash alternately
Self Test Error	3 status LEDs flash alternately with rest of LEDs

The self tests can also be run using the *TST command with the test status returned as a single decimal value. If the returned value is zero there were no errors detected. Otherwise the returned value is the encoded value of the test register described below.

bit	Meaning
0	3.3V power supply fail
1	5V power supply fail
2	12V power supply fail
3-7	Reserved for further expansion

Power on State

On power-on the switch box is configured as listed below. All output queues, event status registers and enable registers are cleared and the parser is set to the idle state. See Chapter 3 for detailed information.

Definition	Power on State
Input Switcher	All open
Output Switcher	All open
Debounce	Enabled
Tokens	Off
ESE Register	cleared
SRE Register	cleared
SWSE Resister	cleared

Switch Configuration

The Audio Switchers can be either an input or an output switch that have different allowed configurations. SR10 is always configured as an input switch; SR11 is always configured as an output switch. SR12 can be configured as either an input or output switch depending on an internal configuration jumper.

Input switch box

Only one channel can be connected to A or B at a time. If a previous setting conflicts with the current switch setting, the last command sent will override the previous setting.

Output switch box
Multiple channels can be connected to either A or B. However, a channel cannot be simultaneously connected to A and B. If a previous setting conflicts with the current switch code, the last command sent will override the previous setting.

Setting SR12 to Input or Output
Sr12 is configured as an input or output switch box depending on the position of jumper J202 inside of the SR12 chassis at power on. SR12 will behave the same as SR10 if configured as an input and the same as SR11 if configured as an output.

To set the jumper, remove the top cover (11 screws on the top & sides). Install the jumper to configure SR12 as an output or remove it to configure it as an input. (picture)

Computer Control

The Audio Switchers are controlled by one of three different computer interfaces: RS-232, GPIB (IEEE-488) or Ethernet. Ethernet control is either a simple socket interface or a web page. The active interface is set on the rear panel using the DIP switch settings R1, R2 & R3 as listed below. Only the selected interface is active (excluding the serial down stream RS-232 interface; see that section below).

If the interface switch setting is changed while the audio switcher is on, the interface is re-initialized to its power on reset condition. All input buffers and output queues are cleared and the selected communication port is re-initialized. The web interface is active for all selected interfaces. For GPIB and RS-232 it is always set to auto negotiate 10/100 Base T. For the TCP/IP settings it is set as indicated.

Selected Interface

Interface	R3	R2	R1
RS-232	1	0	0
GPIB	0	1	0
TCP/IP auto 10/100	0	0	1
TCP/IP 10	0	1	1
TCP/IP 100	1	0	1

RS-232 Interface

The Audio Switchers have two RS-232 interfaces, allowing multiple units to be controlled over a single serial interface in a daisy chain fashion. Commands can take a form that includes a “chain address” to identify that a command is addressed to that unit. Commands that aren’t addressed to that unit are retransmitted on the RS-232 Out connector to subsequent units. Responses can be passed up the serial daisy chain back to the host. Up to 16 switch boxes can be connected together in this fashion, addressed by the chain address on the rear panel DIP switch.

All RS-232 communications have a fixed baud rate of 9600, with a word length of 8 bits, no parity and one stop bit. Flow control (hand shaking) is not used. The 9 pin RS-232 In connector is configured as a DCE (transmit on pin 3, receive on pin 2) and is used to connect to the controlling device or the RS-232 Out of another unit. The 9 pin RS-232 Out connector is configured as a DTE (transmit on pin 2, receive on pin 3) and is connected to the RS-232 in of the next unit when multiple units are cascaded.

Commands are parsed by each switch box to see if they are to be executed locally (by that unit) or should be passed to the next unit in the chain. Responses from a down stream switch unit are immediately passed to the upstream output queue of selected interface. If the response from a down stream switch box is interleaved with a response from the “local” box the RER error bit is

set in the Switcher Status Register. See the Daisy Chain Flow Control in Chapter 3 for details on implementation.

The serial daisy chaining is active for all interfaces (except the web page) no matter which interface is connected to the computer. So it is possible to make a hybrid interface using GPIB or Ethernet as connection to the computer and RS-232 daisy chaining to connect to the rest of the switches. This allows for a large number of switch boxes being controlled over any interface.

Chain Address

Address	S3	S2	S1	S0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

GPIB Interface

The Audio Switchers support the IEEE-488.1 (1978) (GPIB) interface standard. It also supports the required common commands from IEEE-488.2 (1987) standard. Before attempting to communicate with the Audio Switchers the GPIB address must be set.

The GPIB address is set on the rear panel using the DIP switch settings A0 – A4, which can be set from 0 to 30, allowing up to 31 separate switches to be connected (total of input & output) on a single bus.

GPIB Address

Address	A4	A3	A2	A1	A0
0	0	0	0	0	0
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	0	1	1
…	…	…	…	…	…
27	1	1	0	1	1
28	1	1	1	0	0
29	1	1	1	0	1
30	1	1	1	1	0

TCP/IP Interface

The Audio switchers come standard with an RJ-45 connector for connecting to an Ethernet based local are network (LAN) using standard Cat-5 or Cat-6 cable. It supports 10 or 100 Base-T Ethernet connections. Very large switching systems can be controlled over Ethernet. Two methods of control are available over the Ethernet: a simple, raw socket or a web page.

Before attempting to communicate with the Audio switcher over a LAN, it is necessary to configure the connection speed (normally set to auto 10/100) and the Ethernet IP parameters.

Audio switchers support static IP parameters only. These are set up on the Audio Switcher configuration Web pages using a web browser. See the “Configuring Ethernet Parameters” section for details on this.

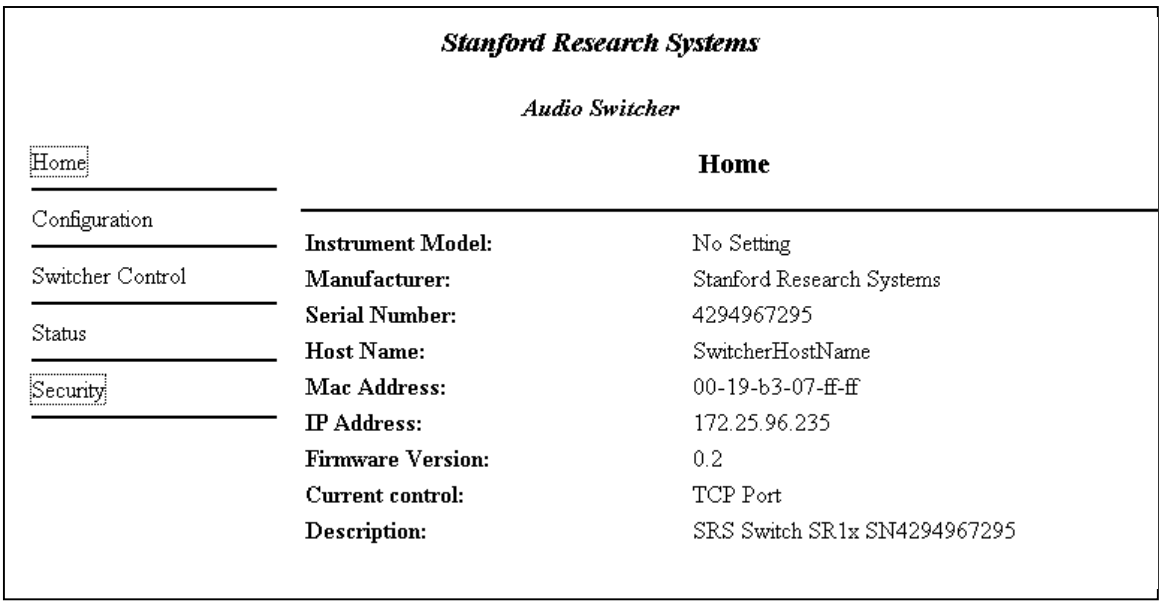
Socket Interface

The Audio Switchers support a simple, raw socket interface with a default port address of 600. This port uses the same commands as the RS-232 and GPIB interfaces. Before attempting to communicate with the Audio Switchers the IP parameters must be set.

The socket interface resembles RS-232 communication more than GPIB communication in that there is no method for the Audio Switchers to generate service requests of the host. If required, polling should be used to determine the status of the unit.

Web Interface

The web interface is made up of 5 different web pages: the Home, Configuration, Switcher Control, Status and Security pages.

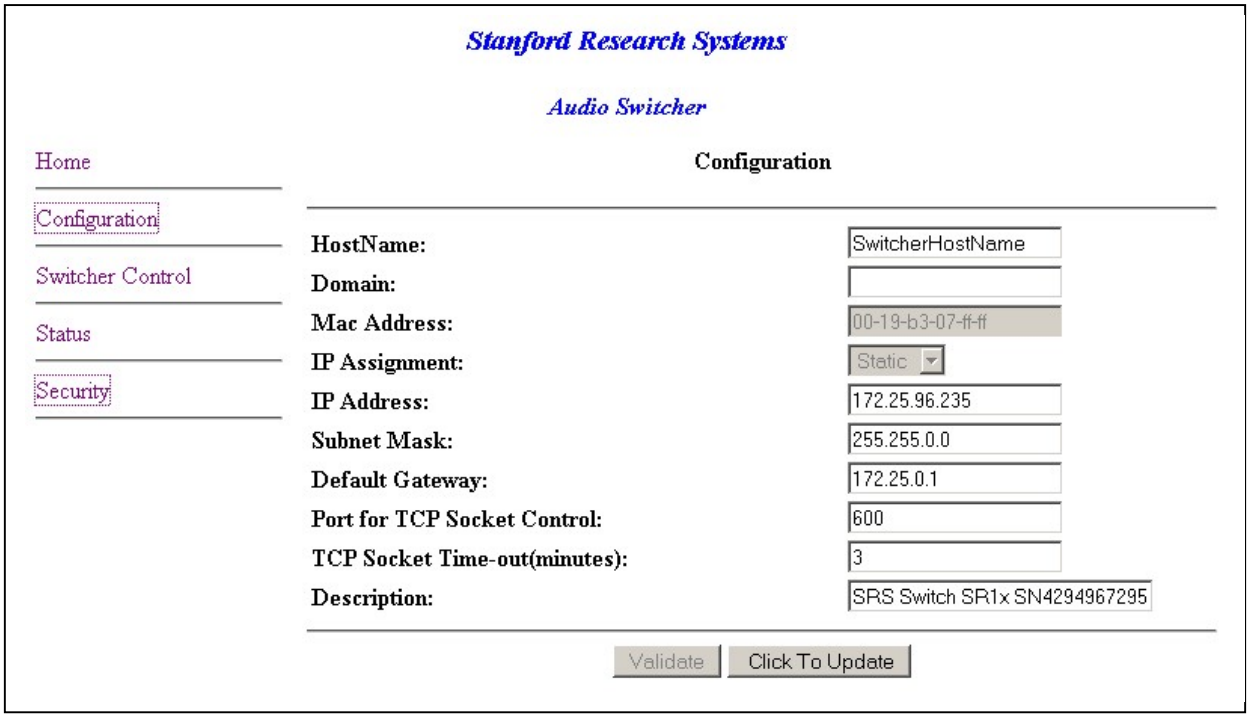


Home Page

This page shows the Audio Switchers basic information in a read only format and hyperlinks to the remainder of the web pages. Note that the hyperlinks (left side of the page) are available for all of the web pages.

Instrument Model	SR10, SR11 or SR12. Set at the factory
Manufacturer	Stanford Research Systems.
Serial Number	Set at the factory.
Host Name	Initially “SwitcherHostName”
MAC Address	Set at the factory
IP Address	Initially 172.25.96.235 (default value)
Firmware Version	Set at the factory.
Current Control	Set by rear panel DIP switches.

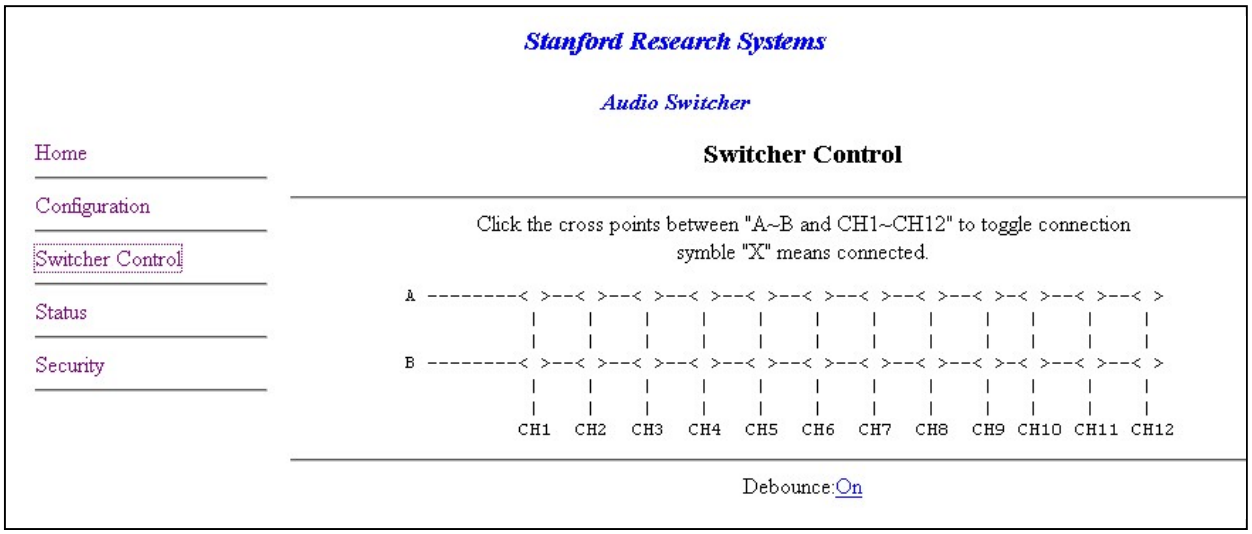
Product Description	Initially the model number and serial number.



Configuration Page

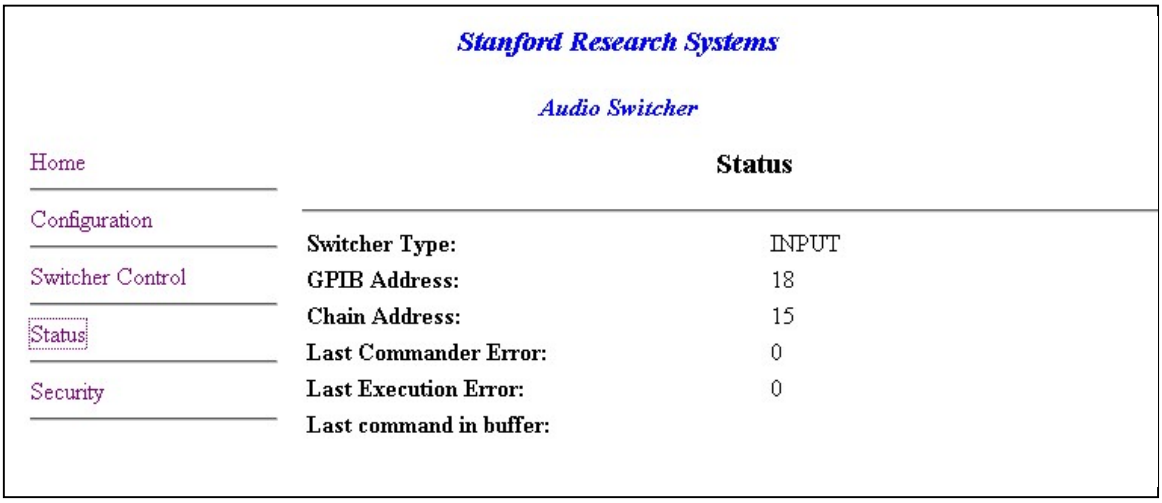
This page allows the user to set the IP parameters to interface the Audio Switcher to their network. See the section on “Configuring Ethernet Parameters” for details on their use.

Host Name	Initially “SwitcherHostName”.
Domain	Initially blank.
MAC Address	Set at the factory.
IP Assignment	Static. SR10, SR11 and SR12 only support static IP address assignment.
IP Address	Initially “172.25.96.235”
Subnet Mask	Initially “255.255.0.0”
Default Gateway	Initially “172.25.0.1”
TCP Socket Control Port	600 (default)
Description	Initially “SRS Switch Srx SN4294967295”



Switcher Control Page

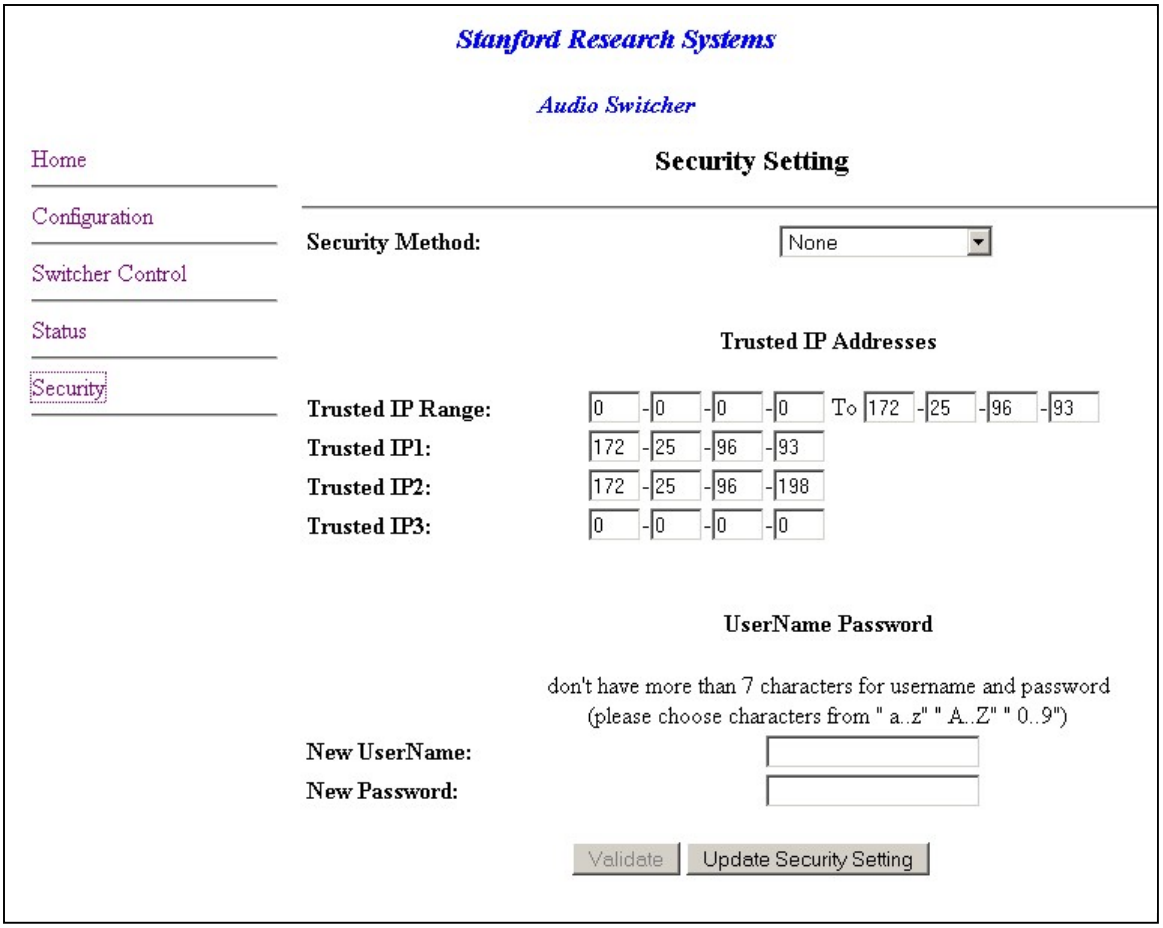
This page allows the user to set the Audio Switcher switches. See the programming section for a description of the different functions.



Switcher Status Page

This shows the current status of the Audio Switcher. It can be particularly useful in debugging programs.

Switcher Type	Always INPUT for SR10, OUTPUT for SR11 and either for SR12, depending on the internal jumper setting. See “Setting SR12 to Input or Output”.
GPIB Address	Set by rear panel DIP switches.
Chain Address	Set by rear panel DIP switches.
Last Command Error	See the LCME? Command in the programming section.
Last Execution Error	See the LEXE? Command in the programming section.
Last command in buffer	Shows the last command received by the selected interface.



Switcher Security Setting Page

The page allows the user to select and configure the desired security method. See the section on "Network Security" for details on their use.

Security Methods	None, IP checking, UserID_Password or IP + UserID_Password
Trusted IP Range	An inclusive range of IP addresses that are allowed to control the switcher.
Trusted IP1, 2, 3	A specific IP addresses that are allowed control the switcher.
New UserName	< 7 character, case sensitive user name. Initially blank.
New Password	< 7 character, case sensitive password. Initially blank.

Configuring Ethernet Parameters

Before attempting to communicate with the Audio switcher over a LAN, it is necessary to configure the connection speed (normally set to auto 10/100) and the Ethernet IP parameters. Audio switchers support static IP parameters only. These are set up on the Audio Switcher configuration Web pages using a web browser.

Before connecting the Audio Switcher to your LAN, contact your system administrator for information for the proper method of configuration of networked instruments on your network. Again remember that the Audio Switchers only support static IP addresses.

1) Turn off power to the Audio Switcher and computer. Connect one end of a Cat 5 or Cat 6 **crossover** Ethernet network cable to the Audio Switcher and the other end directly to the Ethernet port on the computer. Set the Switcher interface to **TCP/IP auto 10/100**. Turn power on to the Audio Switcher and computer.

2) Go to your computers Internet Protocol Properties page. Write down your current settings since you will need to temporarily modify them to configure the Audio Switcher's IP parameters. In particular record these: Auto IP Address?, IP Address and Subnet Mask.

3) Set your computers Auto IP Address to fixed. Set the IP address to **172.25.xx.xx**, where xx are anything except **96.235**. Set the Subnet Mask to **255.255.0.0**

4) Launch the computers web browser. Enter the Audio Switchers default address: **172.25.96.235** in the address field and press **Enter.** This should take you to the Audio Switchers Home Page.

4) Click on "IP Configure". Enter the following parameters. You must enter the required parameters.

Host Name	(optional) May be left blank.
Domain	(optional) May be left blank.
Subnet Mask	(required)
Default Gateway	(required)
TCP Socket Control Port 600	(optional) If you want to use the socket interface at a different port number.
Description	(optional) Enter text to identify the switcher.

5) Click on the **Click To Update** button to update the IP Configuration.

The unit will reconfigure its IP parameters. Enter the new IP address to your web browser and navigate to the "IP Configure" page. Click on the **Validate** button to confirm the new IP Configuration. If you do not validate the parameters within 10 minutes, the unit will revert to the previous settings.

Resetting Ethernet Parameters

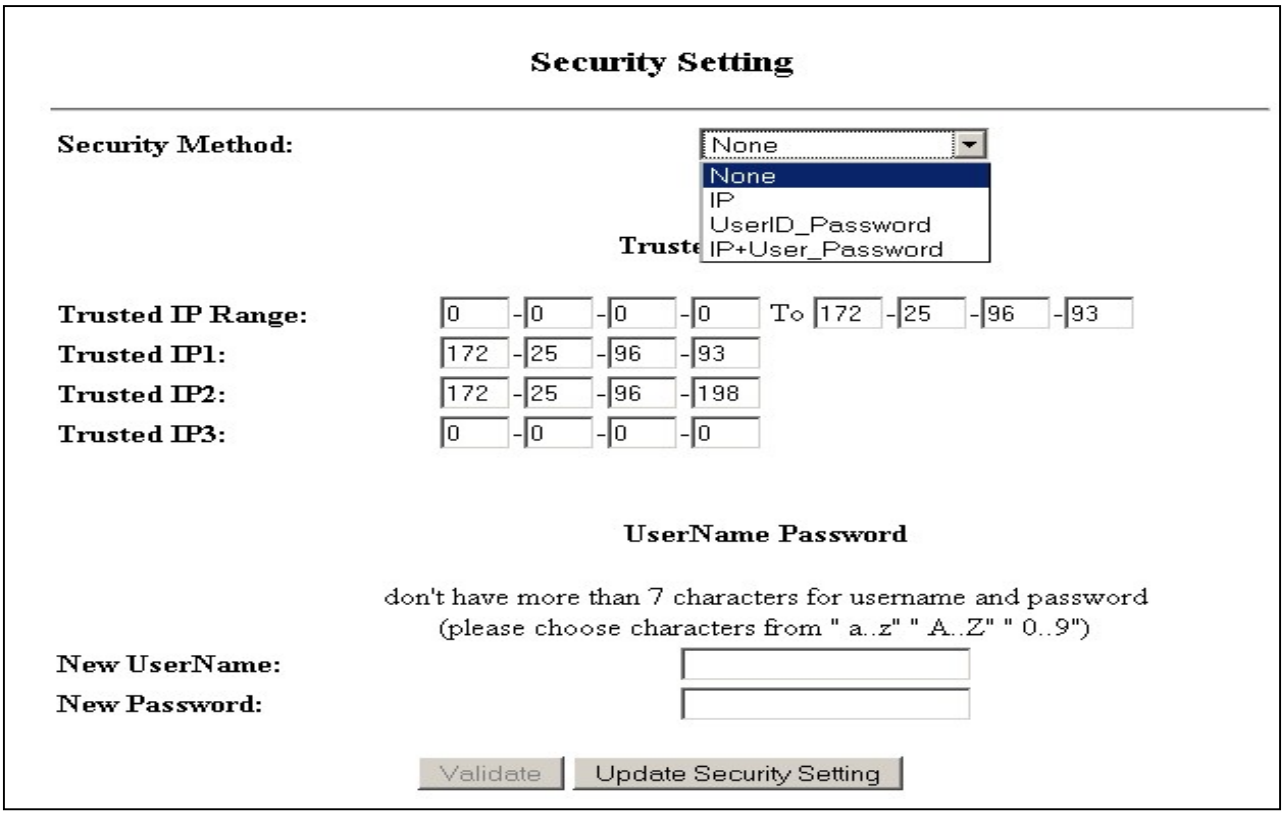
If you need to reset the Audio Switcher IP parameters to their defaults, use a small screwdriver or bent paper clip to press the LAN Reset button on the back panel. This will restore all of the IP parameters including security settings, to their default values. When the LAN Reset Button has been pressed, the orange front panel LEDs with flash on and off for about 5 seconds to indicate the unit has reset its LAN parameters.

Network Security

Network security is an important consideration for all TCP/IP networks. The Audio Switchers provide two optional security controls: Trusted IP addresses and Password protection. If these

methods are not sufficient it will be necessary to provide it at a higher level on your network. A possible implementation for this could involve setting up a firewall and operating the Audio Switchers behind it.

Security Method
There are 4 possible settings: None, IP Range Checking, Password Protection or Both. Select the desired method.



Switcher Security Setting Page

Trusted IP Addresses
You can set a range of Trusted IP Addresses and/or three single IP Addresses. Setting a range of addresses is useful if you are working with dynamically assigned addresses, since the exact address you will be using will change.

Password Protection
To use Password Protection you must first assign a password and user name. Each of these are made up of 7 or fewer characters (a..z, A..Z and 0..9) and are case sensitive.

Updating Security Settings
To update the security settings follow these steps:

1) Select the **Security Method**.
2) Enter **Trusted IP Addresses** if desired.
3) Enter the **New User Name** and **New Password** if desired.
4) Click on the **Update Security Setting** button to update the password and user name.

5) (no password protection) If you are operating from a trusted IP address (if enabled) the web page should be visible. Click on the **Validate** button to confirm the new trusted addresses. If you do not validate the parameters within 2 minutes, the unit will revert to the previous settings.

(password protection) You will need to enter the new password and user name to access Home Page. Click on “Security” then the **Validate** button to confirm the new password and user name. If you do not validate the parameters within 2 minutes, the unit will revert to the previous settings.

Resetting Network Security

If you need to reset the Audio Switcher network security parameters to their defaults and can not access the Audio Switcher Web page due to an invalid IP address or do not know the current User Name and Password, follow the procedure described under Resetting IP Parameters.

Chapter 3 Programming

Device Clear

Regardless of interface, the communication interface can be cleared “out of band” from normal command path. This allows the host computer to reset the interface to a known state regardless of the current interface or commands. All of these functions cause the switcher to flush its input queue and output buffer, reset the parser to the idle state and terminate any current commands.

GPIB: If the selected interface is GPIB (IEEE-488), the IEEE-488 DCL (Device Clear) or SDC (Selected Device Clear) interface messages will clear the interface and re-initialize the GPIB interface chip.

RS-232: If the selected interface is RS-232, an RS-232 <break> signal (space level (0) for at least one full character frame) will clear the interface and re-initialize the host serial interface. In addition, the down stream serial port is re-initialized and an RS-232 <break> signal is transmitted to reset the interface of any downstream switch boxes.

TCP/IP: If the selected interface is TCP/IP, an ASCII <255> code will clear the interface and re-initialize the TCP/IP Port.

Queues and Buffers

Host Port

There is a single input buffer and a single output queue that is used by the selected interface for the Host port.

The Input buffer is limited to 128 bytes. Commands that exceed this size will be discarded and set the IBF bit of the Switcher Status Register to indicate a buffer overrun.

The Output Queue is also limited to 128 bytes. Responses that exceed this size set the OQF bit of the Switcher Status Register to indicate that the queue is full.

Down Stream (Daisy Chain) Port

The down stream serial port has a 128 byte long output queue and a one (1) byte input buffer. The input buffer is only a single character since any received data is immediately placed the upstream output queue. If a response from the down stream serial port is mingled with a local response the RER bit of the Switcher Status Register is set to indicate the error.

Commands that are to be passed to the Down Stream (Daisy Chain) Port are copied from the input buffer to the down stream output queue after a command terminator has been received. At that point the entire command is copied to the down stream output queue. No other commands can be copied to the down stream output queue until it has been completely emptied. Additional commands that are to be passed remain in the input buffer until the down stream output queue has emptied. If the input buffer overruns it will generate an IBF error in the Switcher Status Register to indicate a buffer overrun.

Daisy Chain Control Flow

Make sure that all responses from the addressed switch box have completed before sending a query to another switch box in a serial daisy chain.

Power on State

On power-on the switch box is configured as listed below. All output queues, event status registers and enable registers are cleared and the parser is set to the idle state.

Definition	Power on State
Input Switch	All set to NONE (open)
Output Switch	All set to NONE (open)
Debounce	Enabled
Tokens	Off
ESE Register	cleared
SRE Register	cleared
SWSE Resister	cleared

Commands

This section describes the commands that control the switch boxes for all interfaces except the switch box web page. The audio switcher supports IEEE 488.1 and the common commands of IEEE 488.2. All commands and responses are ASCII strings.

There are a few special commands that will act on all switch boxes in a serial daisy chain, described at the end of the section. These are referred to as global commands, as opposed to individual commands that are directed to a specific switch box address. Globe commands cannot be mixed with individual commands in one line. See the Global Commands section for more information.

To accommodate the daisy chain addressing structure individual commands are constructed in the form:

:XX:command

where
:XX: is the optional daisy chain switch box address of the box the command should be executed and
command is one of the individual commands listed below.

A individual command can be issued in full format *("**:XX: command**")* or partial format ("***command***" without the preceding command path).

Multiple individual commands can be issued in one line, using ";"as a command separator and <return> or <new line> as indicator of end of line.

For multiple commands addressing a daisy chain structure only the first command can use the optional box address (***:XX:)***. All remaining commands prior to <return> or <new line> must be issued in partial format and refer to the box address of the first command.

If the first command doesn't use the optional box address ***(:XX:)***, it and all subsequent commands on that line refer to the switch box that received the command.

Command Syntax

All command names are 4 characters long and are case insensitive. IEEE-488.2 defines commands that begin with "*" followed by 3 characters.

The four letter mnemonic (shown in CAPS) in each command sequence specifies the command. The rest of the sequence consists of parameters. Parameters shown in { } are not always required. Generally, parameters in { } are required to set a value in the switch box. Multiple parameters are separated by commas.

Commands can take the set or query form depending on whether the “?” follows the command. Commands that may ONLY be queried always have the “?” after the mnemonic. Set only commands have no “?” and commands that may be set or queried have “(?)” after the mnemonic.

Parameters shown in { } or [ ] are not always required. Parameters shown in { } are required to set a value and are omitted for queries (they are the return value). Parameters shown in [ ] are optional for both set and query commands. Parameters listed without any brackets are always required. Do not send ( ), { } or
[ ] as part of the command.

For RS-232 commands are terminated by either <CR> (ASCII 13) or <LF> (ASCII 10) characters. For GPIB commands are terminated by <LF> or <EOI> or <LF-EOI>. Execution of commands does not begin until the command terminator is received.

The following table summarizes the notation used in the command description.

Symbol	Definition
i,j	integers
z,y	literal tokens
b	string
(?)	required for queries; illegal for set only commands
{var}	required parameter for set commands; illegal for queries
[var]	optional parameter for both set & query commands

Integers

Integer parameters follow “C-language” style. Decimal integers are indicated by beginning with a non-zero digit (1-9). Octal integers are indicated with a leading zero digit (0). Hexadecimal integers have a leading 0x or 0X.

For example 12, 0xC and 014 all represent the integer 12.

Tokens

Tokens are indicated as word-integer pairs, such a CH1 1. For set commands token parameters must be either the exact word indicated (case insensitive) or the corresponding integer. For example to enable tokens the following commands are equivalent:

TOKN ON -- or -- TOKN 1

For queries that can return token values the return format is specified by the TOKN command.

Floating Point Values

There are no commands that accept or return floating point values in the audio switcher. A command with a floating point value as an argument will generate a command error (bit CMF of the Standard Event Status Register).

IEEE 488.2 Common Commands

***IDN? Identification Query**
Returns the switch box identification string “StanfordResearchSystems,*Srid*,*sn*,*vn*; where *Srid* is Sr10, Sr11 or Sr12, *sn* is the x digit serial number and *vn* is the 3 digit firmware version number of the unit.

***RST Reset Command**
This command sets the switch box to its default state, as listed below. All output queues, event status registers and enable registers are unaffected.

Definition	Default State
Input Switch	All set to NONE (open)
Output Switch	All set to NONE (open)
Debounce	Enabled
Tokens	Off

***TST? Self-Test Query**
Runs the internal self tests. After the tests are completed the test status is returned as a single decimal value. If the returned value is zero there were no errors detected. Otherwise the returned value is the encoded value of the test register described below.

bit	Meaning
0	3.3V power supply fail
1	5V power supply fail
2	12V power supply fail
3	

***CLS Clear Status Command**
Immediately clears the ESR, SWSR registers. Does not affect the output Queue.

***ESE (?) [i] {j} Standard Event Status Enable Register**
Sets (queries) the Standard Event Status Enable Register {to j}. If [i] is included, it sets (queries) bit i {to j}.

***ESR? [i] Query Standard Event Status Register**
Queries the Standard Event Status Register value. If [i] is included, it returns bit i. Reading clears the bit(s) queried by this command.

***SRE (?) [i] {j} Serial Request Enable Register**
Sets (queries) the Service Request Enable Register value {to j}. If [i] is included, it sets (queries) bit i {to j}.

***STB? [i] Query Serial Pole Status Byte**
Queries the Serial Pole Status Byte. If [i] is included, it returns bit i. Reading does not clear the bit(s) queried by this command.

***OPC (?) Operation Complete Command**
Sets the Operation Complete (OPC) bit in Event Status Register.
The query *OPC? writes a “1” to the output queue when complete but does not set the OPC bit.

***WAI Wait-to-Continue Command**
Stop executing commands that follow “*WAI” until commands issued prior to “*WAI” are completely executed and finished. Equivalent to a no-op.

Interface Commands

TOKN (?) {z} Enable Token Response
Sets (queries) the Token Query mode {to z = (OFF 0, ON 1)}

When the Token Query mode is enabled, all queries will return tokens (i.e. on, off, A, B, None). When disabled queries will be represented as integers (i.e. 0, 1, 2, -1).

LEXE? Query Last Execution Error
Returns an integer that indicates the last execution error since the last LEXE? or power-on per the table below.

Value	Definition
0	No execution error since last LEXE?
1	Invalid value
2	Invalid token
3	Invalid bit
4	Invalid box command

LCME? Query Last Command Parser Error
Returns an integer that indicates the last command parser error the last LCME? or power-on per the table below.

Value	Definition
0	No parser error since last LCME?
1	Illegal command
2	Undefined command
3	Illegal query
4	Illegal Set
5	Missing parameter(s)
6	Extra parameters
7	Null parameter
8	Input buffer overflow
9	Illegal floating point value
10	Illegal integer value
11	Illegal token integer
12	Unknown token
13	Illegal hex block
14	Unknown token
101	Illegal first character
102	Illegal box address
103	Invalid box address
255	Internal error

Switch Control Commands

The following commands control the switch boxes. Any differences between the commands behavior for input or output switch boxes is listed here. Sr12 will behave the same as SR10 if configured as an input and the same as SR11 if configured as an output.

SWCH (?) z, {i} **Multi Switch Command**
Sets (queries) switch (A 0, B 1) {to switch code i}

The switch code is a number that identifies which channel(s) should be connected. Switches are indicated in a binary sequence as listed below. If a 1 is set for that switches position, that switch is closed; otherwise it is open.

Switch	Value
1	1
2	2
3	4
4	8
5	16
6	32
7	64
8	128
9	256
10	512
11	1024
12	2048

This command is used to set or query all switches for A or B with a single command. This is particularly useful for output switches since multiple switches can be set simultaneously. This command behaves differently for input and output switches.

Input switch box: Only one switch can be set to A or B at a time. If a previous setting conflicts with the current switch code, the last command sent will override the previous setting. If more than one switch is set in the switch code an execution error is generated.

Output switch box: Multiple channels can be set to either A or B. However a channel cannot be set simultaneously to A and B. If a previous setting conflicts with the current switch code, the last command sent will override the previous setting.

OUTC (?) z, {y} **Set Output Channel** **(Output Switch only)**
Sets (queries) output channel (ch1 1, ch2 2, ch3 3… ch12 12) {to A 0, B 1, NONE –1}

This command connects an output to A, B or NONE (disconnected). If a previous setting conflicts with the OUTC command, the last command will override the previous setting.

OUTS? z **Output Switch Status** **(Output Switch only)**
Queries which channels are connected to (A 0, B 1). The return is in the switch code format from the SWCH command.

INCH (?) z, {y} **Set Input Channel** **(Input Switch only)**
Sets (queries) input channel (ch1 1, ch2 2, ch3 3… ch12 12) {to A 0, B 1, NONE –1}

This command connects an input to A, B or NONE (disconnected). If more than one channel is connected to A or B, the last issued command will override the previous one.

SWSR? [i] **Query Switcher Status Register**
Returns the value of the Switcher Status Register. If [i] is included, it returns bit i. Reading clears the bit(s) queried by this command.

SWSE (?) [i] {j} **Switcher Status Enable Register**
Sets (queries) the Switcher Status Enable Register {to j}. If [i] is included, it sets (queries) bit i {to j}.

DBNC (?) {z} **Enable Switch Debounce**
Enables (queries) the relay debounce function (on 1, off 0).

The Switch Debounce function is used to avoid having multiple channels momentarily connected together while changing switch settings. If enabled, it ensures that each relay has fully switched, including the relay contact bounce, before proceeding to the next command. This ensures “break before make” functionality. This instruction adds 30 - 90 ms to a switch command.

If Switch Debounce is disabled, commands will be executed as soon as they have been received with no delay for contact bounce.

Global Commands:

These commands are used to control multiple switch boxes when connected in an RS-232 daisy chain configuration. They mimic reset and communication reset functions. When received, these commands are executed by the local switch box and are sent to the next box in the daisy chain. These commands are only valid in the partial format (4 letters mnemonic without ***:XX:***).

MRST Master Reset

This command mimics the *RST command. In addition to executing the *RST functions this command will be repeated to the RS-232 output port to subsequent switch boxes.

This command sets the switch box to its default state, as indicated in the *RST command. All output queues, event status registers and enable registers are unaffected.

BRAK Master Break

This command re-initializes the down stream serial port and flushes its input queue and output buffer. It then sends an RS-232 <break> command to the RS-232 output port to reset the interface of any downstream switch boxes. It has no effect on the up-stream or host port

Hidden commands:

The following commands are used configure the switch boxes during manufacturing.

$MAC (?) {i-i-i-i-i-i} **MAC Address**
Sets (queries) the switch box MAC address. {i} is an integer between 0 – 255. The hyphen between each integer is required for the command and is included with the query.

$SER (?) {i} **Serial Number**
Sets (queries) the units serial number. {i} is a unsigned 16 bit integer between 0 – 65535.

$MDL (?) {b} **Model number**
Sets (queries) the units model name {SR10, SR11, SR12).
SR10, SR11 or SR12 are strings.

Register Model

The SR10, SR11 and SR12 follow the hierarchical IEEE-488.2 format. A block diagram of the status register array is shown on fig…

There are three categories of status registers: Event Registers, Enable Registers and Summary Registers.

Event Registers

These read-only registers record the occurrence of defined events within the Audio Switch Box. If the event occurs, the corresponding bit is set to 1. Upon querying an event register any bits read are cleared. These bits are known as “sticky bits” since once set, they remain set until they are read.

Standard Event Status Byte Register, Switcher Status Byte Register

Enable Registers

These read/write registers define a bit wise mask for their corresponding event register. If any bit position is set in an event register while the same bit is set in the enable register, then the corresponding summary bit message is set. Enable registers default to cleared (all zeros) on power on.

Standard Event Enable Register, Switcher Enable Register, Service Request Enable Register

Summary Registers

These read-only registers are made up of bits that may be set in other registers. These bits may or may not be sticky.

Serial Pole Status Byte Register (STB)

This is an 8-bit register defined by IEEE-488.2. It can be read by a GPIB serial pole or by the *STB? command. This register is a summary of the switch box status registers.

Bits in the Serial Pole Status Byte register are not cleared by the *STB? query. These bits are only cleared by reading the underlying event registers or by clearing the corresponding enable registers.

Serial Pole Status Byte Register

Weight	Bit	Flag
1	0	SWSB
2	1	undef (0)
4	2	undef (0)
8	3	IDLE
16	4	MAV
32	5	ESB
64	6	RQS/MSS
128	7	undef (0)

SWSB: Switcher Status Byte Summary Bit
Indicates whether one or more of the enabled events in the Standard Event Status Register is true.

IDLE: Parser Idle
Indicates the input buffer is empty and the command parser is idle. Can be used to synchronize serial daisy chain responses.

MAV: Message Available
Indicates whether or not the output queue has any data pending for the host.

ESB: Event Status bit
Indicates whether one or more of the enabled events in the Standard Event Status Register is true.

RQS: IEEE-488 Request Service message
Indicates this device is requesting service.

MSS Master Summary Status.
Indicated whether one or more of the enabled status messages in the Serial Pole Status Byte register is true.

Service Request Enable Register (SRE)

This is an 8 bit register defined by IEEE-488.2. This register is set and queried by the *SRE (?) command.

Each bit in the SRE corresponds to a bit in the STB register. It acts as a bit-wise AND of the STB flag to generate MSS/RQS. Bit 6 of the SRE is undefined since it corresponds to the RQS/MSS bit. Setting it has no effect and reading it returns 0. At power-on this register is cleared.

Standard Event Status Resister (ESR)

This is an 8 bit register defined by IEEE-488.2. This register is set and queried by the *ESR (?) command. These event flags are “sticky bits” that are set by the corresponding event and are cleared only by reading the register or with the *CLS command. Reading a single bit with *ESR (?) i only clears bit i.

Standard Event Status Resister

Weight	Bit	Flag
1	0	OPC
2	1	undef (1)
4	2	QYE
8	3	DDE
16	4	EXE
32	5	CME
64	6	undef (0)
128	7	PON

OPC: Operation Complete
Set by the *OPC command.

QYE: Query Error
Indicates an attempt to read data when no data is available or pending (GPIB only) or data in the output queue has been lost.

DDE: Device Dependent Error
Undefined for SR10/SR11/SR12

EXE: Execution Error
Indicates an error in a command that was successfully parsed. Out of range parameters are an example. The error code can be queried with LEXE?

CME: Command Error
Indicates a parser detected error. An incorrect command is an example. The error code can be queried with LCME?

PON: Power On
Indicates that an off to on transition has occurred.

Standard Event Enable Register (ESE)

This is an 8 bit register defined by IEEE-488.2. This register is set and queried by the *ESE (?) command.

Each bit in the SRE acts as a bit wise AND with the ESR register to produce the single bit ESB message in the Serial Pole Status Byte. At power-on this register is cleared.

Switcher Status Register (SWSR)

This is an 8 bit register that monitors specific switch box specific actions. This register is read and queried by the SWSR (?) command. These event flags are “sticky bits” that are set by the corresponding event and are cleared only by reading the register or with the *CLS command. Reading a single bit with SWSR (?) i only clears bit i.

Switcher Status Register

Weight	Bit	Flag
1	0	HPO
2	1	RER
4	2	OQF
8	3	IBF
16	4	HFE
32	5	DPO
64	6	SFE
128	7	undef (0)

HPO: Host Serial Port Overrun
Set when an incoming serial data byte on the Host serial port is lost due to internal processor latency. Causes the input buffer to be flushed.

RER: Response Error
Set when a response from the down stream serial port is mingled with a local response switch box. Causes the output queue to be flushed.

OQF: Output Queue Full
Set when the Output queue is full. This is normally caused by the host sending multiple queries without reading the responses.

If the queue is full because of local queries, a command terminator is appended at the end of queue so the host can process the message.

If the queue filled because of a down stream query being passed to the host, no command terminator is added; only the OQF bit is set.

IBF: Input Buffer Full
Set when the input buffer has 128 bytes of data.
A command terminator is appended to the end of buffer so the command parser can process the message. Normally processing the message will generate a command or execution error, since the message was truncated

HFE: Host Serial Port Frame Error
Set when an incoming serial data byte on the Host serial port is missing the stop bit.

DPO: Down Stream Serial Port Overrun
Set when an incoming serial data byte on the Down Stream (Daisy Chain) serial port is lost due to internal processor latency. No changes are made to any buffers or queues and the data byte is lost.

SFE: Down Stream Serial Port Frame Error.
Set when an incoming serial data byte on the Down Stream (Daisy Chain) serial port is missing the stop bit.

Switcher Status Enable Register (SWSE)

This is an 8 bit enable register. This register is set and queried by the SWSE (?) command.

Each bit in the SRE acts as a bit wise AND with the SWSR register to produce the single bit SWSB message in the Serial Pole Status Byte. At power-on this register is cleared.