SIERRA VIDEO SYSTEMS

Tahoe Series 20 Routing Switchers Models 2010V, 2010VA, 2010VAA, 2010A, 2010AA, 2020V, 2020VA, 2020VAA, 2020A,2020AA

User's Manual

sierravideosystems

TAHOE SERIES 20 ROUTING SWITCHERS

User's Manual

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1

Introduction

Before You Begin

There are several terms and acronyms that you should become familiar with before reading this manual. They are shown below.

Term/Acronym	Definition
Crosspoint	The electronic switch that assigns one of the inputs on the matrix crosspoint modules to an output.
Destination	The output of a routing switcher connected to a device that receives signals from the output of the switcher.
Input	Connected to the source that provides the signal to the switcher.
Matrix	The crosspoint array of the switcher module that selects which input is selected to an output.
Output	Connects the signal to the destination device.
Protocol	The command structure used on a serial bus to affect a switch or multiple switches on the routing switcher.
Routing Switcher	Consists of one or more crosspoint modules that switch together, or sometimes independently, to connect the desired signals through the switcher.
Source	The signal that is connected to the input of the routing switcher.
Serial Port	The 9-pin RS232 connector that allow you to control the switcher using a standard personal computer or other external device. Sends control protocol commands in ASCII.

Warnings & Safety Regulations

The information in the following section provides important warnings and safety guidelines for both the operator and service personnel. Specific warnings and cautions may be found throughout this manual. Please read and follow the important safety precautions noting especially those instructions relating to risk of fire, electrical shock and injury to persons.

Any instructions in this manual that require opening the equipment cover or enclosure are intended for use by qualified service personnel only. To reduce the risk of electrical shock, do not perform any servicing other than what is contained in the operating instructions unless you are qualified.

Warnings

- Heed all warnings on the unit and in the operating instructions.
- Disconnect AC power before installing any options.
- Do not use this product in or near water.
- This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting inputs and outputs.
- Route power cords and other cables so that they are not likely to be damaged, or create a hazard.
- Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch unsafe connections and components when the power is on.
- To avoid fire hazard, use only the specified type, correct voltage, and current rating of fuse. Always refer fuse replacement to qualified service personnel.
- Have qualified personnel perform safety checks after any completed service
- This is an FCC class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take necessary measures.

Cautions

- Use the proper AC voltage to supply power to the switcher. When installing equipment, do not attach the power cord to building surfaces.
- To prevent damage to equipment when replacing fuses, locate and correct trouble that caused the fuse to blow before applying power.
- Use only the recommended interconnect cables to connect the switcher to other frames.
- Follow static precautions at all times when handling the equipment.

Cautions (continued)

- Leave the side, top, and bottom of the frame clear for air convection cooling and to allow room for cabling. Slot and openings in the frame are provided for ventilation and should not be blocked.
- Only an authorized Sierra Video Systems technician should service the switchers. Any user who makes changes or modifications to the unit without the expressed approval of the Sierra Video Systems will void the warranty.

Power Supply Cords

North American Power Supply Cords

This equipment is supplied with North American power cords with molded grounded plug (NEMA-15P) at one end and molded grounding connector (IEC 320-C13) at the other end. Conductors are CEE color coded, light blue (neutral), brown (line), and green/yellow (ground). Operation of the equipment at voltages exceeding 130VAC will require power supply cords that comply with NEMA configurations.

International Power Supply Cords

If shipped outside North America, this equipment is supplied with molded ground connector (IEC 320-C13) at one end and stripped connectors (50/5mm) at the other end. Connections are CEE color coded, light blue (neutral), brown (line), and green/yellow (ground). Other IEC 320-C13 type power cords can be used if they comply with safety regulations of the country in which they are installed.

EMC Regulatory Notices

Federal Communications Commission (FCC) Part 15 Information: This device complies with Part 15 of the FCC standard rules. Operation is subject to the following conditions:

This device may not cause harmful interference

This device must accept any interference received including interference that may cause undesirable operations.

Delivery Damage Inspection

Carefully inspect the frame and exterior components to be sure that there has been no shipping damage. Make sure all modules are seated correctly and have not detached during shipment. Also, make sure the input buffer modules on the rear panel are secure.

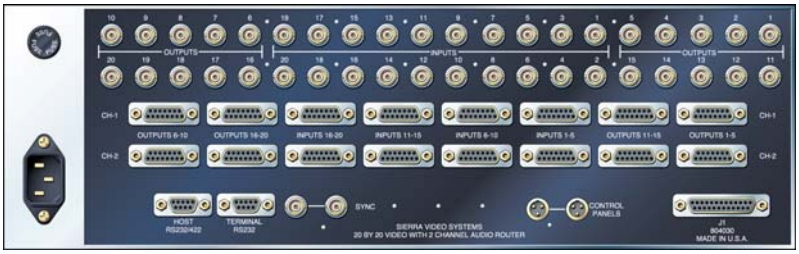
Tahoe Family Overview

Introduction

The Tahoe Family is Sierra Video Systems' most extensive line of analog routing switchers, setting the standard in mid-sized switchers for more than a decade. Tahoe frames can be populated with limited modules, providing flexibility for future expansion.

Tahoe routing switchers can contain video and audio in one frame or video in one frame and audio in a separate frame with the frames connected together by a J1 connecting cable. Tahoe routing switchers can be video or audio only. Multiple frames can be connected together (up to 8 levels) under the same Tahoe control system. For multiple frames, only one Tahoe serial control module is required.

An RS-232/422 serial interface control and a RS-485 control panel network that can accept up to 64 panels on a simple twisted pair gives the Tahoe extensive control options. With battery backed-up RAM protection of all personality and crosspoint information, 256 salvo registers capable of holding 800 or more crosspoints, the Tahoe family can endure the most demanding of applications.



Model Suffix Designations

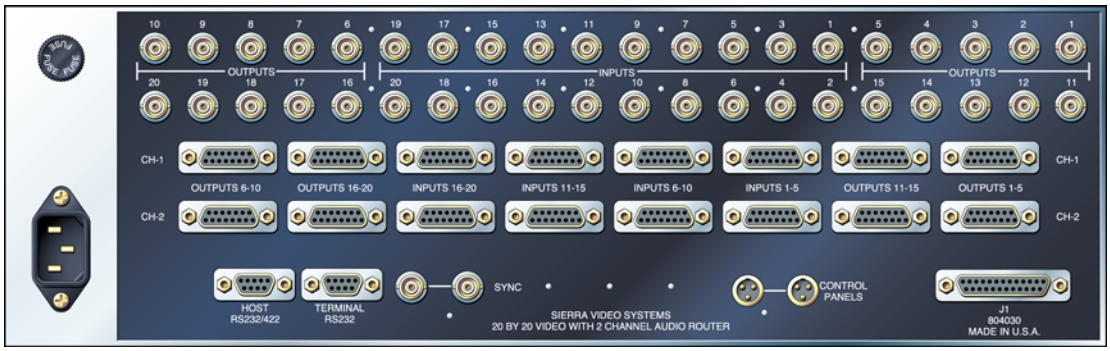
Model Suffix Designations	
V	Analog video (50MHz bandwidth)
2020	Matrix size 20x20
A, AA…	Number of analog audio channels-1 channel per “A”
R	Redundant Power Supplies

Tahoe Series System Components

This User's Manual provides installation and operation information for the Tahoe Series 20x Routing Switchers. Front and Rear panel illustrations are provided in the following subsections for each switcher model. Take time to familiarize yourself with the location of your switcher model features.

Component	Tahoe Family Series 20x Switchers
	▪ 804030 Frame ▪ 2020V, 2020VA, 2020VAA, 2020A, 2020AA, 2010V, 2010VA, 2010VAA, 2010A, 2010AA
Frame	▪ *Video and /or Audio contained in one frame* ▪ Power Supply(ies) ▪ Video Module(s) 504034 ▪ Audio Module(s) 504035 ▪ Processor Module 504001
Accessory Kit	▪ User’s Manual ▪ Fuses ▪ Power Cord ▪ Software Disk

Frame 804030



Note
The Tahoe model shown here and in the subsequent sections are fully populated video and / or audio matrices. In some cases, these frames may be configured with fewer video channels and perhaps no audio. i.e. Tahoe models also offer redundant power supplies. Consult the rear panel serial number and model number to verify your order and product. **The system you receive is customized for the size & type requested at time of purchase from Sierra Video Systems.**

Factors Affecting Quality of Results

There are many factors affecting the quality of results when signals are transmitted from a source to a destination.

- Signal cables — Use only the best quality cables to avoid interference and degraded signal quality and elevated noise levels.
- Sockets and connectors of the sources and destinations — Use only the highest quality, since "zero ohm" connection resistance is the target. Connectors should also match the required impedance (75 ohm in video) to minimize return loss.
- Amplifying circuitry — Must have quality performance when the desired end result is high linearity, low distortion, and low noise.
- Distance between sources and destinations — Plays a major role in the final result. For long distances (over 15 meters) between sources and destinations, special measures should be taken to avoid high frequency cable losses. These measures include using higher quality cables and/or adding line cable equalizing amplifiers.
- Interference from neighboring electrical appliances — These can have an adverse affect on signal quality. Balanced audio lines are less prone to interference, but unbalanced audio should be installed away from any main power lines, electric motors, transmitters, etc. even when the cables are shielded.

CAUTION!

Only an authorized Sierra Video Systems technician can service the switchers. Any user who makes changes or modifications to the unit without the expressed approval of the manufacturer will void the warranty

Use the proper AC voltage to supply power to the switcher.

Use only the recommended interconnect cables to connect the switcher to other frames.

Chapter

2

Installation

Introduction

Carefully inspect the frame to ensure that there has been no shipping damage. Make sure all shipping material is removed from the router frame.

The routing switcher described in this manual can be rack mounted in a standard 19" (RU) EIA rack assembly and includes rack "ears" at the ends of the front of the frame. None of the switcher models require spacing above or below the unit for ventilation. If ample space exists, a 1RU spacing gap is recommended.

Rack Mounting

To rack mount the routing switcher, simply place the unit's rack ears against the rack rails of the rack, and insert proper rack screws through each of the holes in the rack ears. Always rack mount the routing switcher prior to plugging the unit into a power receptacle or attaching any cables.

Dimensions

Frame	Height	Depth	Width
804030	3 RU (5.25”)	16 ½”	19”

Connecting To Video Devices

Video sources and output devices (such as monitors, or recorders) may be connected to the routing switchers through the BNC type connectors located on the back of the unit. Keep in mind that the output signal format will be that of the input signal format.

All signal connections that use more than one cable interconnecting between devices should be of equal timing length (example: cables between a camera and the switcher should have the same time delay).

Unused outputs do not need to be terminated.

Connecting To Audio Devices

Audio sources and output devices (such as amplifiers or recorders) are connected to the switchers through 15 pin D connectors located at, and marked, on the rear of the switcher.

INPUTS 1-5			INPUTS 6-10			INPUTS 11-15			INPUTS 16-20		
PIN		FUNCTION	PIN		FUNCTION	PIN		FUNCTION	PIN		FUNCTION
1		GROUND	1		GROUND	1		GROUND	1		GROUND
	9	INPUT 5+		9	INPUT 10+		9	INPUT 15+		9	INPUT 20+
2		INPUT 5-	2		INPUT 10-	2		INPUT 15-	2		INPUT 20-
	10	GROUND		10	GROUND		10	GROUND		10	GROUND
3		INPUT 4+	3		INPUT 9+	3		INPUT 14+	3		INPUT 19+
	11	INPUT 4-		11	INPUT 9-		11	INPUT 14-		11	INPUT 19-
4		GROUND	4		GROUND	4		GROUND	4		GROUND
	12	INPUT 3+		12	INPUT 8+		12	INPUT 13+		12	INPUT 18+
5		INPUT 3-	5		INPUT 8-	5		INPUT 13-	5		INPUT 18-
	13	GROUND		13	GROUND		13	GROUND		13	GROUND
6		INPUT 2+	6		INPUT 7+	6		INPUT 12+	6		INPUT 17+
	14	INPUT 2-		14	INPUT 7-		14	INPUT 12-		14	INPUT 17-
7		GROUND	7		GROUND	7		GROUND	7		GROUND
	15	INPUT 1+		15	INPUT 6+		15	INPUT 11+		15	INPUT 16+
8		INPUT 1-	8		INPUT 6-	8		INPUT 11-	8		INPUT 16-

OUTPUTS 1-5			OUTPUTS 6-10			OUTPUTS11-15			OUTPUTS16-20		
PIN		FUNCTION	PIN		FUNCTION	PIN		FUNCTION	PIN		FUNCTION
1		GROUND	1		GROUND	1		GROUND	1		GROUND
	9	INPUT 5+		9	INPUT 10+		9	INPUT 15+		9	INPUT 20+
2		INPUT 5-	2		INPUT 10-	2		INPUT 15-	2		INPUT 20-
	10	GROUND		10	GROUND		10	GROUND		10	GROUND
3		INPUT 4+	3		INPUT 9+	3		INPUT 14+	3		INPUT 19+
	11	INPUT 4-		11	INPUT 9-		11	INPUT 14-		11	INPUT 19-
4		GROUND	4		GROUND	4		GROUND	4		GROUND
	12	INPUT 3+		12	INPUT 8+		12	INPUT 13+		12	INPUT 18+
5		INPUT 3-	5		INPUT 8-	5		INPUT 13-	5		INPUT 18-
	13	GROUND		13	GROUND		13	GROUND		13	GROUND
6		INPUT 2+	6		INPUT 7+	6		INPUT 12+	6		INPUT 17+
	14	INPUT 2-		14	INPUT 7-		14	INPUT 12-		14	INPUT 17-
7		GROUND	7		GROUND	7		GROUND	7		GROUND
	15	INPUT 1+		15	INPUT 6+		15	INPUT 11+		15	INPUT 16+
8		INPUT 1-	8		INPUT 6-	8		INPUT 11-	8		INPUT 16-

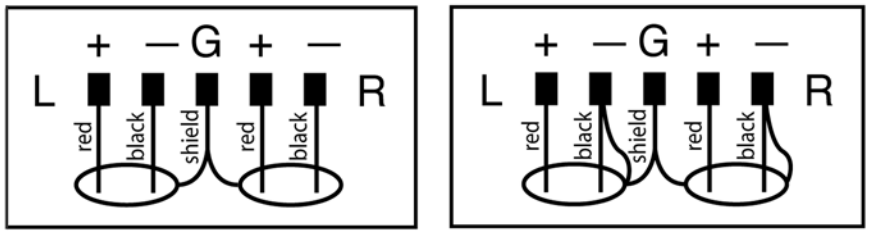
*

Balanced/Unbalanced Audio Connections

All audio sources from the routing switcher are balanced audio. Connect the balanced audio to the balanced input of your destination device(s).

If this is a 2-channel system used for stereo audio, ensure that you keep the same phase relationship. Connect the positive designated pin to the same relative pin on the destination device of both channels.

To connect an unbalanced device to the switcher, first place a jumper between the negative (-) and the ground on the switcher (jumper not included.) Then connect the device positive (+) to positive (+) and shield to ground as shown in the graphic below.



Balanced Unbalanced

For unbalanced sources, connect the unbalanced source to one side of the balanced input and ground. The other input does not have to be grounded. Note, always use the same side of the balanced input for stereo.

Audio Adjustments

There are no “user adjustable” audio gains. The circuit is designed for unity gain.

Audio Follow Video and Breakaway Audio Configurations

Video and Audio signals are switched by separate crosspoint modules. Audio can be switched following the video or separately after the breakaway. Audio channels can be configured to “breakaway” from each other (left and right, ect.).

J1 Connector

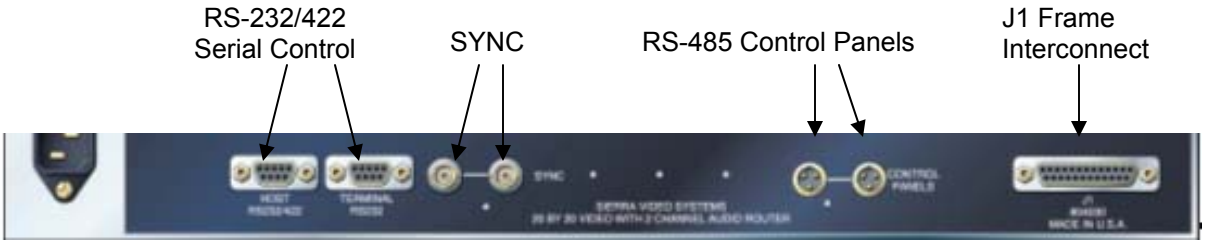
The connector labeled J1 on the back panel is used to connect other routing devices to the router, such as an RS-422 machine control switcher.

Contact the factory for correct configuration before adding other devices that were not part of your original configuration.

Connecting Peripherals

Control panels, sync inputs, and power are all connected to the rear of the frame. The peripherals area may vary depending on the model size and type.

Tahoe series routing switchers offer redundant power supplies but must be specified prior to order.



Note:

Rear Panels vary according to model. See back panel for precise detail.

Sync Input

There are two BNC connectors labeled "SYNC". This is a "looping" input for sync referencing. Connect either composite sync or video with sync to either BNC. If desired, use the second BNC to loop the signal to another device. If the loop is not used, terminate the second BNC with 75 ohms. If no sync is available, the routing switcher will switch at a random point rather than during the vertical interval of the reference signal.

AC Power Connections

Tahoe series routing switchers offer redundant power supplies but must be specified prior to order. Voltage selection must be specified prior to order.

Turn on power to the frame ONLY AFTER all video and control connections have been completed as described below.

Control Processor Dip Switch Settings

In a multi-frame system, only one processor is needed to control the entire router.

The processor module, in a Tahoe series frame, is located in the bottom PC board slot as shown;

Your switcher has been configured at the factory for the settings you are most likely to need. However, if you want to configure the switcher differently, you can do so by setting the switches located on the processor board (behind the front panel). Dip Switches and their action are given in the table that follows. Dip Switches are shown in their factory default settings.

Router Control Processor Dip Switch Settings Label (LB04001-03)

Terminal port speed (S1):
- *9.6K baud 1 off
- 19.2K baud 1 on

Terminal port initial protocol (S1):
- *Terminal 2 off
- Host 2 on

Host port speed (S1):
- 1.2K baud 4 off 3 off
- *9.6K baud 4 off 3 on
- 38.4K baud 4 on 3 off
- 115.2K baud 4 on 3 on

Host port word length (S1):
- 7 data bits 5 off
- *8 data bits 5 on

Host port parity type (S1):
- *Even 6 off
- Odd 6 on

Host port parity (S1):
- *Disabled 7 off
- Enabled 7 on

Host port send Xon/Xoff (S1):
- Disabled 8 off
- *Enabled 8 on

Host protocol send X (or X, Y and V) command (S2):
- Initially Disabled (U1 enables) 1 off
- *Initially Enabled (U0 disables) 1 on

Panel RS-485 port speed (S2):
- 9.6K baud 2 off
- *31.25K baud 2 on

Software download and update (S2):
- *Normal operation 3 off
- Download new software 3 on

Host port initial protocol (S2):
- Terminal 5 off
- *Host 5 on

Host protocol router status commands (S2):
- *X command only (GRIP compatible) 6 off
- X, Y, and V commands (use shortest) 6 on

Force crosspoint initialization (S2):
- *Restore previous crosspoints 7 off
- Initialize crosspoints 1-1, 2-2, 3-3, etc. 7 on

Initialize non-volatile memory (S2):
- *Normal operation 8 off
- Clear all settings 8 on

* = Factory setting. S2 switch 4 is unused.

Note:

Changing any Dip Switch causes an automatic reset after a few seconds.

Names

Source, Destination, and level names can be applied using two methods. Names can be applied using the GRIP program (See the GRIP manual for details on naming), or names can be applied using the serial port (See the Generic Protocol section of this manual).

Salvos

A Salvo is a group of Sources and Destinations that are stored in the routing switcher and switched by a single “Salvo Take” command. GRIP Routing Software allows up to 40 Salvos to be named and stored in the routing switcher. The salvo name will be displayed in the Salvo register. Salvos are made and stored in the router using the Sierra Video Systems Software program GRIP. See the GRIP manual for details on creating and storing salvos.

Chapter

3

Operation

Control System Overview

The Tahoe Family's three port control system incorporates many powerful features, while retaining control compatibility with many leading third party control systems and with earlier generation SVS routing switchers. The control system uses an intuitive interface for routing switcher control and configuration, passwording, salvo setup, multiple input/output configuration and name configuration. Windows based, client/server software is IP addressable and supports event timing and bitmap icons. Up to 64 control panels can be linked at any one time, daisy-chained on a single RS-485 network. A variety of control panel styles are available including single-bus, X-Y, simple keypad, color LCD multi-bus, and fully programmable panels.

Connectors associated with the system's internal control computer are located on the rear of the routing switcher frames. When systems are ordered with more than one frame, only one frame will have a control computer module installed. The following pertains to the frame that contains the master control CPU processor, 504001. Additional frames will need to be installed and connected to the master processor as described in the installation section above (J1 connector).

Serial Control Ports

The internal control CPU processor has three serial ports for Terminal, Host, and RS-485 control panel protocol. These three serial ports are used for overall routing switcher system personalities, local or networked PC computer control, and control panel network operation. Terminal Protocol is a human-readable protocol while Host Protocol is a machine-friendly protocol. The three serial ports are shipped with a factory default as described in Chapter 2.

Pin functions and wiring are described below.

RS-232 PC to Router Wiring	
PC Pin #	Router Pin #
2	2
3	3
5	1 or 9

Host & Terminal Port Installation		
Pin	**RS-232**	**RS-422**
1	**Ground**	Ground
2	**Transmit**	Transmit (-)
3	**Receive** **(Tied to pin 8)**	Receive (+)
4	Not used	Not used
5	Not used	Not used
6	Not used	Not used
7	Not used	Transmit (+)
8	**Receive**	Receive (-)
9	**Ground**	Ground

Control Panels **(RS-485)**

Tahoe Family video routing switcher frames have two male 3-pin connectors labeled “Control Panels” on the rear. These connectors are “looped” together.

The maximum system cable length is 2,000 feet (310m) when the RS-485 network operates at the higher speed of 31.25K baud. The maximum system cable length is 5,000 feet (1,524m) when operated at 9600 baud. Consult your Control Panel Manual for more detailed information.

If you make your own interconnect cables, Pin 2 is Ground. Pin 1 and 3 connect pin for pin.

RS-485 Interconnect Cable

Power Up

Once all signal and control connections have been made, turn on the power switch. AC to the router is indicated by an LED above the power switch. If you have power up problems ensure that the AC fuse on the back of the switcher is seated properly.

On power up, the controller will restore the routing switcher to the last state it was in before the power was turned off including all configuration settings as well as crosspoint switcher status.

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Chapter

4

Communication Protocol

Introduction

The protocol uses the 7-bit ASCII character set, usually sent over an RS232-C or RS422 serial link — 9600 bps is recommended with 8 data bits and no parity. The protocol is compact, with few characters required to cause switch changes to occur. It is also human-readable and thus easy to understand and use. Several different crosspoint switch request commands are defined, so that the one that is most compact for any given switcher and application can be chosen.

The protocol is useful with both very small and very large routing switchers. The sizes of the numbers representing inputs, outputs, and levels are not fixed, but can be as large or small as necessary. Special provisions allow numbers to be packed one after another with no intervening delimiter character, in order to make the protocol compact, as long as each number is the largest size necessary for that particular switcher.

All input, output, and level numbers begin at number 1, not 0.

Generic Protocol

Commands are sent to a routing switcher in a group called a command string. A command string can contain zero or more commands, limited only by the size of the receive buffer of the router, whose size depends on the particular router model.

A command string consists of a leader string of asterisk characters, zero, or more commands, and a trailer string of exclamation marks. Larger routers require two leader (**) and trailer (!!) characters, while small routers require only one, in order to make the protocol compact for those routers. The remainder of this document gives examples using doubled characters. Note that two leader/trailer characters may be sent to small routers even when only one is required, and they will still work fine.

If a leader character (**) is encountered within the command string being processed by a router, the command string up to that point is discarded and a new command string is expected. This ensures that a router will always act on a complete command string sent to it, even if the previous one was never completely received.

When a command string is received, it is not acted upon (but rather, is merely buffered up) until the final trailer character (!) character of the command string is received. At that time, the routing switcher begins to execute the commands within the string.

The protocol uses only 7-bit ASCII characters. The 8th bit of received characters is treated as if it is 0. Within the command string, certain ASCII characters may be present and are ignored: any ASCII character whose code is *less than* the SPACE character (includes all control characters and the SPACE character) and the DEL (ASCII 7F) character. Alphabetic characters within the command string may be in either upper-case or lower-case letters. The router always *sends* upper case characters, except for character strings such as input, output, and level names, which may have lower case characters in them.

When sending commands *to* the router, SPACE characters are optional, but if used may only appear before and after each individual command and NOT embedded within an individual command. Within command strings sent *from* the router, a single SPACE character appears before and after each individual command. SPACES may also appear in character strings, such as input, output, and level names.

Certain commands (R, Q, L, and G) have character strings that appear as arguments. The first three, “R”, “Q”, and “L”, have character strings only in commands sent *from* the router, and these character strings are always terminated with a ~ (tilde) character. No special character marks the start of these strings, they simply begin at the appropriate point within the command. The “G” command, on the other hand, uses the ~ (tilde) character to mark both the *start and end* of a character string argument.

Just before the router begins executing a command string, it sends a leader (**) to the host (the same number as are required in commands from the host). As it executes the commands, some of them may generate additional output back to the host. These command response characters are always preceded and followed by a space character, making the response string easily human-readable.

After the command string has been executed, the routing switcher returns the string " **OK** " (with a single space character before and after the word "OK"), followed by the trailer (!!) and a CR (carriage return, ASCII 0D) character, to the host. This indicates that the command has executed successfully. If an error occurs within any command of a command string, the remainder of the command string is ignored and the router returns the string " **ERROR** ", followed by *an optional descriptive string* followed by a string of trailer characters and a CR character, to the host. An error can be caused by an unknown command name or bad arguments to a command.

The simplest possible command string would be:**!! which consists of the leader and trailer characters but no commands between them. This command string would generate the response:

** OK !!<CR>

This can be useful for verifying that the serial link to the router is operational. In routers requiring only one leader/trailer character, the simplest command string would be: *! which would generate the response:

* OK !<CR>

(To determine whether a particular router uses one or two leader/trailer characters, send it "!!**" and check the response to see which of the above two responses it is. It won’t hurt to always use two even if only one is required.)

The simplest error response is one with no optional descriptive string. For example, this command string:

** XXX !! might generate this response from the router:

** ERROR Syntax: No Number:XX !!

The descriptive string always ends with a colon and up to three characters from the command string that caused the error. Generally, the error can be assumed to have occurred just before these characters

Leader and Trailer

The simplest possible command string would be “**!!” which consists of the leader and trailer characters but no command between them. This command string would generate the response “**OK!!” followed by “CR”. This can be useful for verifying that the serial link to the switcher is operational.

The following is the set of commands available for sending to the router, a subset of which may be implemented in any given routing switcher.

Syntax	Example	Description
R	R	Router Reset
I	I	Capabilities Inquiry
Q	Q	Model Name and Software Version Inquiry
L	L	Matrix Size and Level Names Inquiry
O	O5	Output Status inquiry
N	N5	Input Status inquiry
S	S	Status inquiry
C	C	Clear matrix
K	K9999	Set Password to Change Protected Settings
M	M139	Set Remote Address
U {0 1}	U0	Update request on/off
V out,in,in…	V3,1,2,2	Connect levels
W lvl,in,in…	W1,4,19	Connect outputs
X out,in,lvl	X12,9,2	Connect crosspoint
Y out,in	Y1,7	Connect AFV
Z in in…	Z13,12,8	Connect AFV
D numsyncs	D300	Delay vertical sync intervals
T {A-Z}	TB	Trigger a Salvo Connect sequence
P {A-Z}	PBY1,7~	Preset a Salvo connect sequence
B	B21	Output Lock inquiry or change
F	F5	Field Delay for crosspoint output
HOST	HOST0	Select Host or Terminal Protocol
G	G1,10~	The command "**G**" is used to query or modify a router configuration parameter or parameters.

“R”: Router Reset

Use this command to force the routing switcher to reset, by sending it the command "**RESET**". If an administrator password has been set (using the “G ADMIN_PASSWORD” command described later in this document), then the password must be sent in a “K” message prior to sending this command, else this command will generate an error. For example, the command:

**RESET!!

would initiate a reset (if the password has been entered, if required), and when the router finished the reset operation, something like this would be received, just as if the router had powered up:

** RESET Tahoe Vx.xx (C) 2000~ !!<CR>

“I”: Capabilities Inquiry

The command "**I**" requests that command capability information be returned to the host. The information is sent as a string of characters. The first characters are a space followed by "**I**", the next characters are the letters of the commands that are implemented and available in this router, and the last character is "~" (tilde). Do not count on the characters being in any specific order. Search all characters for a particular one.

All routing switchers implement the **I, L, S, and X** commands. The Q command will eventually be added to all.

For example, the command:

**I!!

might return the following string:

** ILSX~ OK !!<CR>

indicating that the router supports the **I, L, S, and X** commands from the host.

“Q”: Model Name and Software Version Inquiry

The command "**Q**" requests that the router model name and software version number string be returned to the host. The information is sent as a string of characters. The first characters are a space followed by "**Q**", the next characters are the router model name, terminated by a "~" (tilde). Following this are the characters of the software version number string, again terminated by a "~" (tilde).

For example, the command:

**Q!!

might return the following string:

** QSmall~V2.1~ OK !!<CR>

indicating that the router model name is "Small" and the software version number is "V2.1".

“L”: Matrix Size and Level Names Inquiry

The command "**L**" requests that matrix size (Nout, Nlvl, Nin) and level name information (lvl1, lvl2, etc.) be returned to the host. The information is sent as a string of characters. The first characters are a space followed by "**L**", some optional values described below, then the number of outputs (Nout), a comma, the number of levels (Nlvl), a comma, the number of inputs (Nin), a comma, and then the level names, each terminated by a "~" (tilde), and the last followed by two tildes.

For example, the command:

**L!!

might return the following string:

** L64,3,32,VIDEO~AudioL~AudioR~~ OK !!<CR>

indicating that the router has 64 outputs, 3 levels, and 32 inputs, and the levels are named "VIDEO", "AudioL", and "AudioR".

"O": Output Status Inquiry

The command "**O**" requests that matrix status information for a single output be returned to the host. The status information is sent as a "Y" command or a "V" command or as a sequence of L "X" commands, where L=number of levels.

For example, the command:

**O5!!

to a 3-level router might have the following three commands as its response:

** X65,23,1 X5,-,2 X5,0,3 !!

Note the dash, indicating that on level 2, output 65 is not connected to an input. Also note the 0, indicating that the connection on level 3 is either unknown or that output 65 doesn't exist or isn't mapped on level 3.

Or, a 3-level router might have the following single command as its response:

** V65,23,-,0 !!

which has the same information as the three X commands in the previous example.

If the router has only one level, or if all levels are connected the same, the router might instead use the **Y** command. For example:

** Y65,23 !!

"N": Input Status Inquiry

The command "**N**" requests that matrix status information for a single input be returned to the host. This command is only useful on those router levels that allow an input to be connected to at most one output. The status information is sent as a "Y" command or a sequence of L "X" commands, where L=number of levels that allow an input to be connected to at most one output (each such level generates a single "X" command of status). Thus, a 6-level router with three single-output-per input levels would generate 3 "X" commands of status command output. A router that has *all of its levels* as single-output-per-input may return a single "Y" command instead of individual "X" commands if all of the levels are connected to the *same output*. The "X" and "Y" commands are formatted exactly as with the "**O**" command.

For example, the command:

**N4!!

to a router might have the following three commands as its response:

** X12,4,2 X-,4,3 X0,4,4 !!

giving the status of levels 2, 3, and 4 (level 1 presumably not being a single-output-per-input level). Note that on level 3 the ë-ë (dash) indicates that the input is disconnected, and on level 4 the 0 indicates that the connection to the input is either unknown or that input does not exist or is not available on that level.

If the router has only one level, or if all levels are connected the same, it might instead use the **Y** command. For example:

** Y12,4 !!

"S": Status Inquiry

Use command S to request that status information be returned to the host. The status information is sent as a string of L x O substrings, where L = number of levels and O = number of outputs. Each level/output combination generates a single substring of status.

Thus, a 21-level 16 output router would generate 2x16 = 32 substrings of status command output. The length of each substring depends on the size of the particular switcher involved. Larger switchers use bigger numbers for inputs, outputs, and levels.

The first substring of status is for level 1 output 2, etc.; however, each substring contains the level and output numbers, so the sequence in which the data is sent is not important). The first characters of each substring are a space followed by “X”, then the output number, a comma character, the input number connected to the output (or 0 if no connection exists), another comma, and finally the level number at which the input-output pair is connected. For example, the command:

****S!!**

might have the following two substrings at the beginning of its response:

****x01, 12, 1 x02, 02, 1!!**

This indicates that output 1 is connected to input 12 on level 1, and that output 2 is connected to input 2 on level 1.

The number of digits used for each number is generally the maximum number of digits ever required for that particular switcher. Thus, a switcher with between 10 and 99 inputs would use two digits for the input number, and a switcher with less than 10 levels would use one digit for the level number.

“C”: Clear Matrix

Use command C to request that the switcher matrix be cleared so that all outputs are disconnected from inputs (in switchers where this is possible) or else all outputs at all levels have input 1 as their source. This command can take several seconds to execute (depending on the size of the switcher matrix). In order to help ensure that this command isn’t accidentally executed, it requires four additional characters following the “C” character, to spell out the word “CLEAR” in full. For example, the command:

****CLEAR!!**

would clear the matrix and when finished — the following response would be generated:

****OK!!<CR>**

“K”: Set Password

The command "**K**" is followed by a password, which may be 0 to *cancel* the previous password, thus causing no password to be specified, or, it may be a value between 1 and 9999 to supply a password, which remains in effect until another password (or password 0) is supplied in another “K” command. The password is stored by the router under the remote address specified using an “M” command, or under the *control portís* remote address if an “M” command was not specified before the “K” command in the same command string as the “K” command. The password that is set remains in effect until another “K” command is received from the same remote address.

It would be used to establish a password for a remote address, to be used for such things as locking and unlocking outputs and modifying the router configuration. When the router receives a protected command (one which requires use of a password) from a remote address, it compares the current password for that remote address with the password required to execute the protected command. Protected commands consist of many of the “G” commands that change router configuration, as well as *take* and *salvo trigger* commands when the output to be taken is locked. In the former case, the administrator

password is the one that must be sent in the “K” command to permit the router configuration to be changed, while in the latter case the password that was used to lock the output is the one that must be sent in the “K” command to permit the *take* to occur.

Refer to the “B” command and the “G ADMIN_PASSWORD” command (in a separate document) for more information.

For example, the command:

** M197 K1777 !!

requests that password 1777 be stored as the current password for remote address 197. The command:

** M197 Y7,9 !!

requests that output 7 be connected to input 9, using the password stored for remote address 197 as the output lockout override password. The *take* will succeed if output 9 is either not locked or is locked with password 1777. Otherwise, the *take* will fail.

“M”: Set Remote Address

The command "**M**" is followed by a remote address value, and it sets the remote address to be used by all remaining commands in the current command string. This command is supported on larger routers. It would be used when a client/server software system on a router control port permits multiple remote users to send commands to the router through that control port. In such a system, the server software that talks to the control port can insert an “M” command at the beginning of each command string it sends to the router on behalf of its clients. The server would assign a different address to each of its clients. The router uses the address to control access to and modification of protected resources. The “M” command will typically work in conjunction with the “K” command, which allows a password to be sent to the router. Some commands, such as those that allow modification of router configuration settings, might require entry of an administrator password before allowing the router configuration to be modified. The “K” command is used to send the password, but the router must be able to record that password in association with a particular remote user. The router would save the password as the one established by the remote address specified in the “M” command. The examples below show how this would work.

If the “M” command is not present in a control string received on a serial port, the address assigned to the *serial port itself* is used as the address for all commands in that command string.

The “M” command works on an honor system. There is nothing to keep a remote device from forging a false address. This conforms with the philosophy of providing protection mechanisms that are not designed to be totally hack-proof, but rather, are designed under the assumption that controlling devices will honor the system. A dedicated hacker can always hack into the system if he chooses. Note, however, that the server in a client/server relationship can provide a great deal of added security for the system, forcing the correct “M” command to be sent each time, and filtering out bogus “M” commands received from clients.

When the router receives an “M” command in a command string, it echoes the same “M” command in its response. This allows the server connected to the serial port to parse the received response string and determine to which client it should route the response.

Normally the server will assign remote addresses to its clients. However, it should always provide a way to send these addresses to the client, because the client needs to know its address in order to know how to interpret some responses. By simply passing each “M” response command received from the router back to the client, the server can let the client know what its address is.

For example, the command:

** M139 K9664 !!

establishes password 9664 as the password for remote address 139. The response to this command string would be:

** M139 OK !!

If remote address 13 later sends the command:

** M139 Y8,27 !!

to request that output 8 be connected to input 27, the router would check to see if output 8 has been locked. If so, the router compares the password of remote address 139 (which has previously been set to 96643) to the password that was used to lock output 8. If they match, the connection request succeeds, but if they don't match, output 8 is left unchanged.

"U": Update Request on/off

The command "**U**" turns on or off the automatic sending of output change reports. The command letter must be followed by either a number 0, 1, or 2 to specify the new automatic change report state, as follows:

0: Automatic output change reporting is turned off.

1: Automatic output change reporting is turned on. Crosspoint change commands do not immediately report changed status, but instead, the report comes up to a few seconds after the crosspoint change command is received.

2: Automatic output change reporting is turned on, and crosspoint change commands immediately report changed status as part of the response to the command.

Output change reports are automatic messages sent to the host whenever an output is crosspoint status (i.e. connected source) is changed.

For example, the command:

**U1!!

turns on automatic output change reporting. When a crosspoint is changed, the following message might be received:

** X5,17,3 !!<CR>

indicating that output 5 is now connected to input 17 on level 3. Alternatively, if the router has only a single level or if all levels of the output are connected the same, it might send:

** Y5,17 !!<CR>

indicating that output 5 is now connected to input 17. Alternatively, newer routers might use the "V" command instead of "X" commands to report a change:

** V5,17,12,0 !!<CR>

indicating that output 5 is now connected to input 17 on level 1, to input 12 on level 2, and does not exist or is not available on level 3.

To turn off output change reporting, use the command:

**U0!!

The difference between an argument value of 1 versus 2 has to do with the response generated by the router when it receives a crosspoint connect command ("V", "W", "X", "Y", or "Z" command). For example, suppose the router sends the following crosspoint connect commands in a single command sequence:

** Y1,18 Y8,34 !!

If U1 is in effect, the response to this command will be:

** OK !!<CR>

and then sometime later, perhaps up to several seconds later, the crosspoint change reports will be sent as separate command sequences for each output:

** Y1,18 !!<CR>

** Y8,34 !!<CR>

On the other hand, if U2 is in effect, the response to the original crosspoint change command sequence will be:

** Y1,18 Y8,34 OK !!<CR>

and no additional crosspoint change reports will be sent because they already HAVE been sent. The U2 mode of operation is generally more convenient because it produces

more immediate feedback to the controlling device that is sending a crosspoint change command. The U1 mode of operation is provided for compatibility with older control systems.

"V": Connect Levels

The command "**V**" is used to request that a connection be made. It must be followed by an output number, a comma, and a comma-separated list of input numbers, one for each level, up to the number of levels in the router. Fewer than the number of levels may be specified if desired, and the remaining levels will be left unchanged.

For example, the command:

**V12,7,8,9!!

says that connections are to be made to output 12: from input 7 on level 1, input 8 on level 2, and input 9 on level 3.
An input number of 0 means the output connection is to be left *unchanged*.
An input number of ë-ë (dash) means the output is to be *disconnected*. If the router does not support disconnected outputs, the output connection will be left unchanged.

"W": Connect Outputs

The command "**W**" is used to request that a connection be made. It must be followed by a level number, a comma, and a comma-separated list of input numbers, one for each output, up to the number of outputs in the router. Fewer than the number of outputs may be specified if desired, and the remaining outputs will be left unchanged.

For example, the command:

**W1,17,3,9!!

says that connections are to be made on level 1: from input 17 to output 1, input 3 to output 2, and input 9 to output 3.
If the level number is specified as "0", this means that the connection is to be made on **all levels** (AFV).
For example, the command:

**W0,8,3,7!!

says that connections are to be made on all levels: from input 8 to output 1, input 3 to output 2, and input 7 to output 3.
An input number of 0 means the output connection is to be left *unchanged*.
An input number of ë-ë (dash) means the output is to be *disconnected*. If the router does not support disconnected outputs, the output connection will be left unchanged.
It is an error to request connection of an input or output that doesn't exist on the specified level, even if the input or output does exist on some other level. However, if the level number is "0", any input or output may be used as long as it exists on at least one level, and in that case no connection will be made on any level on which the input and output does not exist. If the requested connection has an output or input number that isn't mapped to a physical connector (on virtual-mapped routers) on one or more levels, those levels are simply not changed.
If "U2" is in effect (see "U" command), the response will include one or more V, Y, or X commands to report the new status of the outputs. The response will be the same as if "O" commands were issued for the outputs immediately following the "W" command. No response is generated if this command is being used to define a salvo.

"X": Connect Crosspoint

Use command X to request that a connection be made. It must be followed by an output number, a comma, an input number, a comma, and a level number. For example:

****X8, 3, 2!!**

This string says that a connection is to be made between output 8 and input 3 on level 2. If the level number is specified as “0”, this means that the connection is to be made on all levels (AFV). For example, the command:

****X8, 3, 0!!**

This string says that a connection is to be made between output 8 and input 3 on all levels.

“Y”: Connect AFV

Use command Y to request that a connection be made. It must be followed by an output number, a comma, and an input number. The connection is made on all levels (AFV). For example, the command:

****Y2, 8!!**

This string says that input 8 is to be connected to output 2 on all levels.

“Z”: Connect AFV

The command "**Z**" is used to request that a connection be made. It must be followed by a comma-separated list of input numbers, one for each output, up to the number of outputs in the router. Fewer than the number of outputs may be specified if desired, and the remaining outputs will be left unchanged. The connection is made on all levels (AFV).

For example, the command:

**Z4,18,7!!

says that input 4 is to be connected to output 1 on all levels, input 18 to output 2 on all levels, and input 7 to output 3 on all levels.
An input number of 0 means the output connection is to be left *unchanged*.
An input number of ë-ë (dash) means the output is to be *disconnected*. If the router does not support disconnected outputs, the output connection will be left unchanged.
Any input or (implied) output number may be specified as long as it exists on at least one level. No connection will be made on any level on which an input or (implied) output number does not exist. If the requested connection has an output or input number that isn’t mapped to a physical connector (on virtual-mapped routers) on one or more levels, those levels are simply not changed.
If “U2” is in effect (see “U” command), the response will include one or more V, Y, or X commands to report the new status of the outputs. The response will be the same as if “O” commands were issued for the outputs immediately following the “Z” command. No response is generated if this command is being used to define a salvo.

“D”: Delay vertical sync intervals

The command "**D**" is used to delay before continuing execution of the commands that follow. It must be followed by a number giving the number of vertical sync intervals by which to delay. If the number is 1, the delay will be to the VERY NEXT vertical sync interval. If the number is 0, no delay occurs. The number must be no larger than 255. Note that this command will also delay the time at which the remaining command responses and the trailer character are returned to the host.

For example, the command:

** Y1,5 D200 D100 Y1,6 S !!

says that input 5 is to be connected to output 1 on all levels, then a delay of 300 (=200+100) sync intervals is to occur, then input 6 is to be connected to output 1 on all levels, then a status response is to be returned.
It is generally recommended that the host computer be responsible for timing the initiation of commands, rather than using this command to do the job. The host computer can simply send the appropriate commands at the appropriate times. The "P" and "T" commands described below can aid in ensuring that lengthy connect sequences aren't delayed due to the time it takes to send them to the router.

“T”: Trigger a Salvo

The command "**T**" is used to trigger a previously set up *salvo* (set using the "**P**" command above). It must be followed by a register letter from A to Z or a register number from 1 to 256 giving the *register* to be triggered.

For example, the command:

** TB D180 TC !!

says to trigger salvo register B (same as 2), delay 180 sync intervals, then trigger salvo register C (same as 3). When the register is triggered, this means that the connect commands stored in it take effect.
If a salvo is triggered and it attempts to connect a locked output or port, or a disallowed input/output pair, or a port to itself, the salvo trigger operation is aborted, no crosspoint changes are performed, and an error is reported: “ERROR Salvo Has Locked Xpts”.

“P”: Preset a Salvo

The command "**P**" is used to set up a *salvo*, which is a series of connect commands for later execution with the "**T**" command. It must be followed by a register letter from A to Z or a register number from 1 to 256 giving the *register* into which the connect sequence is to be stored, followed by zero or more *connect commands* (V, W, X, Y, or Z), followed by a "~" (tilde) character.

Registers A-Z are the same registers as 1-26. The letter designators are allowed to shorten up the command sequence slightly, so that “T” commands can be sent in compact form if one of the first 26 registers is used.

For example, the command:

** PB X2,5,0 Z7 ~ !!

says that two connect commands (output 2 to input 5 AFV, and output 1 to input 7 AFV) are to be stored into salvo register B (i.e. register 2). Another example:

** P239 Y5,7 ~ !!

says that one connect command (output 5 to input 7 AFV) is to be stored in salvo register 239.
Only *supported connect commands* (those connect commands whose command letters appear in the "I" command response) may follow the register letter up to the tilde character. The connect commands do not take effect until the register is *triggered* using the **"T"** command below.
The maximum allowed number of connect commands is determined by the particular router. In all cases where this command is implemented, there is guaranteed to be space available to store at least two complete switch matrices AT ONE LEVEL. If more connect commands are received than there is space available to store them, the error response string "FULL ERROR Salvo Space Full" is sent to the host, and only the first part of the salvo is stored. For example:

** FULL ERROR Salvo Space Full !!

says that the salvo request filled memory and the salvo could not be completely stored.

“B”: Output Lock inquiry or change

The command "**B**" requests that lock information for the specified output be returned to the host, and optionally that the lock status of that output be changed. Whenever the router receives a “B” command, it sends one back.

In routers that support the “B” command, the router reports changes to output lock status using the “B” command, not the “G OUTPUT_LOCK” command.

When an output is locked, it cannot be routed to a new input unless the password sent using the “K” command matches the password used to lock the output.

In virtual-mapped routers, this command applies lockouts to *virtual destinations* rather than *physical outputs*, so the word “output” should be replaced with “destination” in this command description.

If the “password” and “lock” arguments are both 0, this is a query for lock status of the specified output. A “B” command is sent to report the lock status.

If the “password” argument is not 0, this is a request to change the lock status of the specified output. After changing the lock status, a “B” command is sent to report the new lock status, so a response occurs regardless of which form of the “B” command is sent to the router.

When requesting that lock status be changed, if “lock” is 0, this is a request to unlock the output, and if “lock” is 1, this is a request to lock the output. An attempt to lock an output that is already locked, or to unlock an output that is already unlocked, fails, as does an attempt to unlock an output using a password that is different from the password that the output was locked with and is not the administrator password. Any use of a password larger than 9999 also fails. In any of those cases, the output lock status remains unchanged and an error response is generated. The “B” command response will indicate that the output still has the same lock state as before.

In the “B” command response that is sent by the router, the “password” argument is the current lock password for the output (1-9999), or is 0 if the output is not locked, and the “lock” argument is 0 if the output is not locked, or 1 if it is locked.

When locking an unlocked output, the specified password is recorded by the router as the lock password for that output. When unlocking a locked output, the specified password is compared by the router to the lock password for the output. If they match, or if the specified password is the administrator password, the output is unlocked, else it remains locked. Attempting to lock an already-locked output, or unlock an already-unlocked output, has no effect on the lock state of that output.

Whenever a *take* is done, the router checks to see if the specified output for the *take* has been locked. If so, the current password of the control port that sent the *take* request (as set with the “K” command) is compared to the output’s lock password. If they match, the *take* is allowed, but if not, the *take* has no effect. The *administrator password may NOT be used in lieu of the output’s lock password to do a take,* so if a controlling device sends the administrator password in a “K” command, that will not permit the device to reroute locked outputs (but it can use the administrator password to unlock locked outputs using the “B” command).

Output lockouts apply on *all levels.* On virtual-mapped routers, a level may be left out of a lockout by making sure the level is unmapped for the destination being locked.

As with all router configuration parameters, the output lockout data is stored in non-volatile storage and thus is retained across router power-ups. When a router is first initialized at the factory, all outputs are set to be unlocked.

This command provides the same functionality as the “G OUTPUT_LOCK” command. This command, which was added at router software version V5.06, is preferred over that command. Note that the output lock version number is not present in this command.

Since output lock status changes frequently, it is not really useful to cache output lock status for outputs, so the output lock version number is not really useful.

For example, to request whether or not output 21 is locked:

** B21,0,0 !!

The response might be:

** B21,0,0 OK !!

indicating that output 21 is NOT locked. Or, the response might be:

** B21,6741,1 OK !!

indicating that output 21 is locked with password 6741. To clear this lockout:

** B21,6741,0 !!

To lock output 96 using password 439:

** B96,439,1 !!

If successful, the response would be:

** B96,439,1 OK !!

If output 122 becomes locked using password 235, the following change report would be sent by the router:

** B122,235,1 !!

“F”: Field Delay

The command "**F**" is used to specify the delay between the time a crosspoint change request is received by the router and the time the crosspoint switch actually occurs. It must be followed by a number giving the number of video fields of delay desired. If the number is smaller than the smallest delay that the router can handle, the smallest delay is used instead. If it is larger than the largest delay the router can handle, the largest delay is used instead. Note that this command does not cause a delay in command processing, as the “D” command does.

To understand this command more fully, consider the way that router software will typically handle a crosspoint command. The last character of the command string, the final “!” (exclamation) character, is received somewhere in a particular video field, call it video field 7. The router parses the command string and, for each crosspoint it contains, it puts the crosspoint in a buffer that is marked to be delivered to the crosspoint hardware on a particular video field. Suppose that previously, an “F5” command has been received. Then crosspoint commands whose final “!” command string character was received on video field 7 would be placed in a buffer that is marked to be delivered to the crosspoint hardware at video field 13 (7+5+1=13).

To understand the reason for adding 1 in the previous sum, consider an “F0” command: it would ask for output at the very next video field, field 8 in our case. So, it is necessary to add the “F” argument plus 1 to the field number on which the crosspoint command is received to get the field number at which the crosspoint will be output.

A typical router will have a minimum delay that is between 1 and 2 fields. Suppose a crosspoint command is received just before a vertical field mark. The software may be able to prepare the crosspoint data and send it to the hardware when that vertical field mark occurs, but the hardware itself typically has a one-field delay in it, so the soonest that such a crosspoint would switch would be one field (plus a little) from when it was received. If the command were received towards the beginning of a field rather than the end of a field, the delay would be closer to two fields. Industry parlance is to call this a one-field delay, because only *full fields* of delay are counted.

The *delayfields* argument of this command takes into account the hardware delay. So, if a router has a minimum delay, including the hardware delay, of one full field, as described in the previous paragraph, then a *delayfields* value of 1 causes this minimum delay to be used. A *delayfields* value of 0 will also cause this minimum delay, because the router uses its minimum if a smaller value is specified. A *delayfields* value of 2,

however, will add one more field to the minimum possible delay. Thus, *delayfields* specifies the *number of full fields* of delay between end-of-crosspoint-command-string-received and crosspoint-switch-occurs. Note that the actual minimum value of *delayfields* depends on the particular router model.

Routers typically have a limit to the number of crosspoint commands they can process in one field. First, there is an inherent delay in *sending* the command to the router, but beyond that, the router requires time to parse the command and buffer up the crosspoint data, plus it requires time to deliver the buffered data to the hardware when the desired video field arrives. Each individual router has documentation to describe its limitations on how many crosspoints it can process in a given amount of time.

Larger values for *delayfields* give the router more time to process commands. Although the long-term average number of crosspoints that can be processed per unit of time is unchanged, a larger *delayfields* value can improve router performance during a short burst of many crosspoint commands. For example, suppose a large number of crosspoint commands is sent to the router in a single large command. If *delayfields* is small, the router typically wonít have time to parse and process all these crosspoint commands and place the data in the crosspoint delivery buffer before the target video field arrives. By making *delayfields* larger, the user can give the router more time to process the crosspoint commands.

If too many crosspoint commands are received and the router is not able to process them fast enough, it will output the crosspoint connections as soon as it can. Unexpected delays in crosspoint output are a sign that the router is being pushed beyond its limits.

The *fielddelay* value applies to the *entire router,* not just to the control port on which the “F” command is received. It is therefore recommended that a single value be settled on for the *fielddelay* value, rather than changing the value constantly depending on needs. Once changed, the router records the value in non-volatile memory and uses it each time it is powered up, so it is only necessary to change it one time.

Even though a crosspoint isnít changed until the *fielddelay* time has elapsed, the router records the new crosspoint state *immediately upon receiving the crosspoint change request,* so a controlling device may receive a report of a crosspoint change before the change has actually taken effect, and this is more likely to happen the larger *fielddelay* is. Since routers currently make no guarantees about when they will report a crosspoint change anyway, this behavior is usually of no concern. There is a case where this could cause problems. If the *fielddelay* value were to be changed while two different devices were changing the same output, it is possible for the router to report the incorrect input value for that output. This would happen if the earlier device that changed the output did so before the *fielddelay* value was changed, and the later device that changed the output did so after the *fielddelay* value was reduced but soon enough that its input value would be sent to the crosspoint hardware before that of the earlier device. A bit later, the earlier deviceís input value is sent to the crosspoint hardware, but the router has recorded the later deviceís input value as being the one in effect. To prevent this scenario, we recommend that an appropriate *fielddelay* value be chosen, set, and left alone.

Here is an example of an “F” command:

```
** F5 Y1,5 X2,6,3 !!
```

This says that input 5 is to be connected to output 1 on all levels and input 6 is to be connected to output 2 on level 3, after a delay of 5 fields from the beginning of the field that follows receipt of the “!” character.

Basic "G" Command:

Action	From	Syntax
Modify	**Host**	**G command_name { arguments… } ~**
Query	**Host**	**G command_name { arguments… } ~**
Query Response	**Router**	**G command_name { arguments… } ~**

Modify is Protected: **Yes**
Report Changes: **No**

The command "**G**" is used to query or modify a router configuration parameter or parameters.

Summary lines at the start of each command section describe, for each type of command action (Modify, Query, or Query Response), whether the command is sent to the router or from the router and what the *syntax* of the command is. They also indicate whether or not the *modify* form of the command is password-protected or not ("Modify is Protected") and whether or not the command participates in automatic reporting of parameter changes ("Report Changes") as described under the "G REPORT_CHANGES" command.

Each command has three possible syntax forms:

1. *Modify: this form is sent to the router to modify a parameter value*
2. *Query:* this form is sent to the router to query for a parameter value
3. *Query Response:* this form is sent *by the router* to report the value of a parameter in response to receiving a Query or in response to a change in the parameter value when automatic reporting of parameter changes is turned on.

Generally, the command arguments identify the parameter that is being queried or modified, and provide its new value if it is being modified. The first argument following the "G" command character is a *command name.* Additional arguments may be required for some command names to completely specify the parameter in question. After those, one or more additional *optional* arguments may give a new value for the parameter. All arguments are separated from one another by commas.

When the *Modify* form of the command is used and if the new value is a valid value, the router will change the parameter value to this new value, providing that "Modify is Protected" says "No" or the administrator password has been sent using the "K" command. It will then report the new value to all router control ports that have requested these reports, providing that "Report Changes" says "Yes". If a new value is provided that is an illegal value, the parameter is left unchanged and no "G" command is sent.

When the *Query* form of the command is used, the *Query Response* form of the command is returned to the control port that sent the *Query* command, reporting the current value of the parameter. The *Query* form of a command is normally the same as the *Modify* form except that the new parameter values are not included. The *Query Response* form of a command is normally the same as the *Modify* form (but of course the sender and receiver are reversed in these two cases).

Some "G" commands may initiate an action or report the occurrence of an event, instead of querying or changing a router parameter.

Commas are used to separate arguments in the "G" command.

Space characters should not appear within the "G" command arguments, except when they appear within strings. Also, a single space character is allowed after the "G" character itself. When a "G" command is sent by the router, it will always include this space, but the space is optional when sending a "G" command to the router.

Character string arguments are delimited on both sides by a *tilde* ('~') character. Generally character strings may contain any printable ASCII character except *tilde, asterisk,* and *exclamation.*

Every “G” command must be terminated with a *tilde* (‘~’) character. This allows a command parser to ignore any received “G” command that has a command_name that it doesn’t know about.

The “G” commands available for any given router may vary, depending on the router model. The “G SUPPORTED” command allows controllers to find out whether particular “G” commands are supported by a given router or not.

A router may be sent “G” commands that it doesn’t understand. It will simply ignore them and generate an ERROR response.

VAR: Modify or query system variables

Action	From	Syntax
Modify	**Host**	**G VAR,<varname>,<value>[,<value>…]~**
Query	**Host**	**G VAR,<varname>~**
Query Response	**Router**	**(same as Modify)**

Modify is Protected: **Yes**
Report Changes: **No**

The “G VAR“ command is used to change or query system variables that control specific features of the router. The variable being affected is specified using its name, and only one variable at a time can be targeted by this command. The features being controlled are typically system options that allow the user to control special hardware or software enhancements to the router code.

The *Modify* command has two or more arguments, the name of the variable to be changed and the new value of that variable. Most variables have only a single value associated with them, but it is possible for a variable to be multi-valued, in which case the number of <value> arguments may be two or more.

The *Query* command has the variable name whose value is to be queried as the only argument.

The *Query Response* command has the same argument structure as the *Modify* command.

Each different router may support different variables. The supported variables may grow over time, as enhancements are added to this protocol, so command parsers should generally ignore unknown variable names. The routers themselves will ignore any command that is received with an unknown variable name or an invalid variable value. Use the “G VARQRY” command to find out which variables a particular router actually supports. Refer to documentation for each router for a description of the variables.

A variable value is typically an unsigned decimal number, but may also be a signed decimal number. The “G VARQRY” command can be used to determine the allowed range of values.

For example, to query for the value of a variable named “VI_DELAY”:

** G VAR,VI_DELAY~ !!

The response command might be:

** G VAR,VI_DELAY,4~ !!

To set the “HD_SLAVE” variable to 1:

** G VAR,HD_SLAVE,1~ !!

VAR1: Modify or query single-dimensional array variables

Action	From	Syntax
Modify	**Host**	**G VAR1,<varname>,<index>,<value>[,<value>…]~**
Query	**Host**	**G VAR1,<varname>,<index>~**
Query Response	**Router**	**(same as Modify)**

Modify is Protected: **Yes**
Report Changes: **No**

The “G VAR1“ command is used to change or query single-dimensional array variables that control specific features of the router. The variable being affected is specified using its name and an array index that varies from a minimum value (typically 0 or 1) to some maximum value, and only one such variable at a time can be targeted by this command. The features being controlled are typically options that allow the user to control special hardware or software enhancements as a function of router level, input number, or output number, although the array variable is general-purpose in nature and will be used whenever a single-dimensional array is appropriate.

The *Modify* command has three or more arguments, the name of the array variable to be changed, the index within the array of the variable to be changed, and the new value of that variable. Most variables have only a single value associated with them, but it is possible for a variable to be multi-valued, in which case the number of <value> arguments may be two or more.

The *Query* command has the name and index of the array variable whose value is to be queried as its two arguments.

The *Query Response* command has the same argument structure as the *Modify* command.

Each different router may support different single-dimensional array variables. The supported single-dimensional array variables may grow over time, as enhancements are added to this protocol, so command parsers should generally ignore unknown variable names and out-of-range index values. The routers themselves will ignore any command that is received with an unknown variable name, an index that is out of range, or an invalid variable value. Use the “G VAR1QRY” command to find out which single-dimensional array variables a particular router actually supports, and what the valid index range is. Refer to documentation for each router for a description of the variables.

A variable value is typically an unsigned decimal number, but may also be a signed decimal number. The “G VAR1QRY” command can be used to determine the allowed range of values.

For example, to query for the value of the fifth element of an array variable named “SYNC_SOURCE”:

** G VAR1,SYNC_SOURCE,5~ !!

The response command (or a command to set the variable to this value) might be:

** G VAR1,SYNC_SOURCE,5,3~ !!

VAR2: Modify or query two-dimensional array variables

Action	From	Syntax
Modify	**Host**	**G**
VAR2,<varname>,<index1>,<index2>,<value>[,<value>…]~		
Query	**Host**	**G**
VAR2,<varname>,<index1>,<index2>~		
Query Response	**Router**	**(same as Modify)**

Modify is Protected: **Yes**
Report Changes: **No**

The “G VAR2“ command is used to change or query two-dimensional array variables that control specific features of the router. The variable being affected is specified using its name and two array indexes that vary from minimum values (typically 0 or 1) to some maximum values, and only one such variable at a time can be targeted by this command. The features being controlled are typically options that allow the user to control special hardware or software enhancements as a function of router level and either input or output number, although the array variable is general-purpose in nature and will be used whenever a two-dimensional array is appropriate.

The *Modify* command has four or more arguments, the name of the array variable to be changed, the two indexes within the array of the variable to be changed, and the new value of that variable. Most variables have only a single value associated with them, but it is possible for a variable to be multi-valued, in which case the number of <value> arguments may be two or more.

The *Query* command has the name and the two indexes of the array variable whose value is to be queried as its three arguments.

The *Query Response* command has the same argument structure as the *Modify* command.

Each different router may support different two-dimensional array variables. The supported two-dimensional array variables may grow over time, as enhancements are added to this protocol, so command parsers should generally ignore unknown variable names and out-of-range index values. The routers themselves will ignore any command that is received with an unknown variable name, with an index that is out of range, or an invalid variable value. Use the “G VAR2QRY” command to find out which two-dimensional array variables a particular router actually supports, and what the valid index range is. Refer to documentation for each router for a description of the variables.

A variable value is typically an unsigned decimal number, but may also be a signed decimal number. The “G VAR2QRY” command can be used to determine the allowed range of values.

For example, to query for the value of the (3,87) the element of an array variable named “GAIN”:

** G VAR2,GAIN,3,87~ !!

The response command (or a command to set the variable to this value) might be:

** G VAR2,GAIN,3,87,29~ !!

Details of the “G” command can be found on our website or by contacting the factory.

Chapter

5

Troubleshooting

Introduction

NOTES:

If the output signal is disturbed or interrupted by electromagnetic interference, the signal should return and stabilize when the interference ends. If not, turn the power switch off and on again to reset the switcher.

If the following recommended actions still do not result in satisfactory operation, please consult your Sierra Video Systems Dealer.

Power and Indicators

Problem	Remedy
No power	▪ Confirm that the rocker switch is in the “ON” position, and that the power lamp is illuminated. ▪ Confirm that power connections are secured at the switcher and at the receptacle. Make sure the receptacle is active, with the proper mains voltage. ▪ If there is still no power, check the fuse. Remove power cord from the AC outlet and from the switcher and then remove the fuse holder located above the power connector. Confirm that the fuse is good by looking at the fuse wire connected to the ends of the fuse. If the wire is separated, replace the fuse.

Video Signal

Problem	Remedy
No video at the output device, regardless of input selected.	▪ Confirm that your sources and destination device are powered on and connected properly. Video signals connected to the input of the switcher should be of an identical signal format as the output of your source. Video signals at the output of your switcher should be of an identical signal form required by your video monitor or recorder. ▪ Confirm that any other switchers in the signal path have the proper input and/or output selected. ▪ Use a Video Tester to test the video path leading to/from your Matrix Switcher. ▪ Replace the video crosspoint module with one that is known to be functional.
Video level is too high or too dim.	▪ Verify that the video line is terminated with a precision 75 ohm impedance, otherwise it results in a video level that is too high or too low when looping is performed and the termination is not within 1% of 75 ohms. ▪ Confirm that the connecting cables are of high quality, properly built and terminated with 75 ohms. Check level controls located on your source input device or output monitor or recorder. ▪ Replace the video crosspoint module with one that is known to be functional.

Problem	Remedy
Noise bars are "rolling" up or down in the output image or: Low Frequency hum in the audio output of the audio	Hum bars (ground loop) are caused by a difference in the ground potential of any two or more devices connected to your signal path. Passing that voltage difference through any available interconnection, including your video cables, creates hum bars in the picture and/or hum in the audio. WARNING! Do not disconnect the ground from any piece of video equipment in your signal path! Check the following to remove hum bars: ▪ Confirm that all interconnected equipment is connected to the same phase of power, if possible. ▪ Remove equipment connected to that phase that may introduce noise, such as motors, generators, etc. ▪ Disconnect all interconnect cables and reconnect them one at a time until the ground loop reappears. Disconnect the cable, or insert an isolation transformer in the signal path.

Audio Signal

Problem	Remedy
No audio at the destination device, regardless of source selected	▪ Confirm that your sources and destination device are powered on and connected properly. Audio signals connected to the input of your switcher should be properly wired from the output of your source. Audio signals connected to the output of your switcher should be properly wired to the input of your destination device. ▪ Confirm that any other amplifiers in the signal path have the proper source and/or destination selected. Pay special attention to input amplifiers that may be built into your destination device. ▪ Replace the audio crosspoint module with one that is known to be functional.
Audio level is too low	▪ Confirm that the connecting cables are of high quality and properly built. Take special care in noting the wiring configuration of balanced to unbalanced cables (if possible use a matching transformers). ▪ Check level controls located on your source input device or output monitor or recorder. ▪ Replace the audio crosspoint module with one that is known to be functional.

Control

Problem	Remedy
No control of Matrix Switcher from PC software	▪ Confirm the correct wiring of the connecting cable. Be sure to use the serial adaptor provided if using a standard PC serial cable. ▪ Confirm that all Dip Switches on the control processor are set properly. See Dip switch settings on page 14. ▪ Confirm that the baud rate of your computer COM port is set to the same as that of your Matrix Switcher (9600-Baud recommended). Confirm that the proper COM port is selected in the control software. ▪ Use a terminal emulator program to send ****!!** commands and check for ****OK!!** response. ▪ If the PC is controlling the switcher, the problem is with the switcher.

Switching Malfunctions

Problem	Remedy
The switcher succeeds in switching a number of sources then fails to switch one.	Malfunction in the particular source or cable assembly. NOTE: The most common failure mode in transferring the signal of an audio source is a break in the connecting wire. ▪ Disconnect the source from a channel that is switching successfully and connect the suspect source to it. If the channel continues to switch successfully, then there is something wrong with the Matrix Switcher or the suspect source was not connected properly. If it does not continue to switch successfully, then there is something wrong with the source or cable assembly.
The Matrix Switcher turns ON but will not switch at all	▪ Check the LEDs on the serial processor board. If they are not counting, the control module is dead. If the control panel is not lit, check the ribbon cable connection between the panel and the processor control module.

Chapter

6

Theory of Operation

Introduction

The Tahoe 16 Series routing switchers can be configured using three different modules, video, audio, and the processor modules. Your router includes a combination of all or some of these modules. Schematics and circuit descriptions for each module are described in the following section.

Module Description	Part Number
Serial Control Module	504001
20x10 Video Crosspoint Module	504034
20x10 Audio Crosspoint Module	504035

*** Schematics are at the end of this chapter.**

Serial Control Module 504001

The 504001 is a plug-in circuit module used as a controller for a variety of Sierra Video Systems routing systems. The processor chosen for the 504001 is the Motorola MC68302 microprocessor running at 16.5 MHz. This processor has 3 serial control channels built in.

The 504001 controls the switching matrix by means of a parallel interface. This interface is designed to have the proper timing characteristics required by the switching matrix.

Serial channel #1 is designed to connect to a RS-485 panel network. Up to 64 control panels can be “daisy-chained” on this network. A variety of different panel types can be used, and are available from Sierra Video Systems. The RS-485 network can be operated at either 9600 baud or 31250 baud. The factory default baud rate is 31250.

Serial channel #2 is the Terminal port, and can be either RS-232 or RS-422, depending on the board stuffing options. This port conforms to SVS Terminal Protocol and can be addressed using the windows program “Hyper Term”.

Serial channel #3 is the Host port. The Host port can also be RS-232 or RS-485 depending on the board stuffing options. This port conforms to SVS Host Protocol as

described in the Communication Protocol section of this manual and can be addressed using the SVS windows program “GRIP”.

Two 8-bit dip switches allow the user to make configuration choices. See the section on Dip Switch settings.

Power-Up Reset

The power-up reset signal is used to reset the MC68302 under certain conditions. The primary source of reset is U24, an MC34064 low-voltage detector. This 3 terminal device detects when the Vcc voltage is below a threshold level and pulls the output to ground. This condition should arise only when the router is first turned on and the DC voltage ramps up from the power supply. This signal grounds the enable of ½ of a LS244 bus driver (12), which simultaneously drives low two outputs which are connected to HALT and RESET on the MC68302.

The secondary source of reset is the watchdog timer output from the MC68302 itself. If some internal mechanism of the software fails and the watchdog is not reset periodically, the watchdog output will pulse low and cause a reset. This signal is also connected to the enable input of the same LS244.

The software cannot distinguish one form of reset from the other.

Chip Select Decodes

The MC68302 offers 4 chip select decodes. After power-up, the base address and range of these chip selects can be changed by writing to internal control registers in the MC68302. Initially, the MC68302 will begin by fetching instructions from the EPROM, and one of the first things it does is set the range and address of the other chip selects properly.

The first three chip selects are used by the EPROM (U2), the static RAM (U3) and the battery RAM (U4). The last chip select is treated specially and described in the next section.

The EPROM and both RAMs are connected directly to the MC68302’s address and data bus since it is being used in the 8-bit mode. This is one of the advantages of the MC68302 as it does not require bus buffers or any additional logic to interface to these memory parts.

The MC68302 offers selectable DTACK generation and wait state internal on a per-chip select basis. The 504001 uses internal DTACK and 1 wait state for CSO, CS1, and CS2.

Chip Select 3

Chip select #3 is futher decoded to select whether the memory access is to the LEDs, the dip switches, or the matrix interface. ½ of an LS139 (U13) is used for this purpose. Address lines A16 and A17 evenly divide the portion of memory allocated to CS3 into 4 parts.

The two dip switch input enables and the LED latch enable are directly compatible with the HC541 drivers and HC573 latch; so that these enabling signals go to those parts directly.

The matrix address and data latches, U5 and U6, however, need to have an enable of the oppsite polarity to ensure that the data is valid when it is latched. A portion of U15 inverts this signal so that data will be valid when latched.

DTACK Generator

Chip selects 0, 1, and 2 use the internal DTACK generation circuit of the MC68302 and therefore no special circuitry is needed. (Because of this, an external DTACK signal must not appear after any of these chip selects are asserted).

The matrix interface has special timing requirements. These time delays are too long to be provided by the MC68302 wait state or DTACK generator. This special timing is generated externally using U14, U15, and U12.

The basic operation of the circuit is U14, which counts up to 32 starting from 0 whenever a CS3 cycle is initiated. At this count it returns DTACK to the MC68302 which terminates the memory cycle.

U14 is a 74F579 binary counter being clocked by CLKO at a 60 nanosecond rate. It is held in permanent reset (count = 0) whenever CS3 is high.(U15 provides an inverter to keep the counter reset). As soon as CS3 falls low, indicating an access to any of the 4 peripherals in this memory area, U14 begins counting up. U14 continues counting up until it reaches a count of 8, at which point the output of U15-6 goes high because U15-4 is high but U15-5 is low. U14 continues counting until it reaches a count of 16, at which point U15-5 is high, but U15-4 is now low, so U15-6 is still high. Eventually U14 reaches a count of 24, at which point both pin 4 and pin 5 of U15 are high, so the output falls low. The net effect of this is to generate a strobe enable signal to the matrix which lasts for approximately 860 nanoseconds. This strobe enable signal is fed into U7, which decodes which of the 8 levels of strobe are desired based on the setting of address lines A6, A7, and A8. But U14 has not yet finished counting; in fact the memory access to this region is not terminated until DTACK has been recognized by the processor. U14 continues counting until it reaches a count of 32, whereupon it drives U15-10 high, which becomes inverted, and drives U12-19 low, which asserts the DTACK signal to the processor.

Within several clock periods the MC68302 recognizes the DTACK and terminates the memory cycle. It removes CS3 assertion, which immediately returns U14 to the held-in-reset-count state. U14 returns to 0, and the entire process can then repeat with another memory cycle.

Because 8 clocks are provided at the start of each cycle before the matrix strobe is asserted, a 480 nanosecond leading-edge delay is provided for data setup. The strobe signal lasts almost 900 nanoseconds, and is followed by another 480 nanosecond delay during which the data remains stable. After this 1.8 microsecond, the cycle is complete and could begin again.

Matrix Interface

The routing switcher interface consists of three parallel groups of lines; input select, bus select and strobe(s).

U5 latches the D0 through D7 processor lines during each matrix interface cycle. This provides selection capability of up to 256 inputs. At the same time U6 latches address lines A0 through A7. This provides control of up to 256 output buses.

The input select and bus select data is asserted for a total of 1800 ns. During the first 600 ns of this time the strobe lines are all low. During the second 600 ns period one strobe is asserted high. During the final 600 ns all the strobe outputs are low again.

For each crosspoint that must be set, the above cycle is repeated. After the MC68302 receives a vertical interrupt, only those crosspoints in the matrix whose state must be changed since the last verticle interrupt are changed. When no new changes are required the outputs of U5, U6, and U7 remain static.

Vertical interrupt occurs at line 6 (for NTSC or line 3 for PAL). The processor can output 32 crosspoint changes per 64 microsecond TV line. A 256 output system can be entirely reconfigured by line 14, well before the beginning of the active picture.

Vertical Interrupt Generator

Sync, video black or any composite video source can be used as a locking input to the 504001 module. The signal is AC coupled to Q2, an emitter follower. Q2 provides a low

impedance output to sync separator Q1. The output of Q1 is inverted sync. U23E and U23F form a low pass filter which separates vertical sync from the signal. U23D performs several functions. When sync is present at its input, it acts as an inverter. If no sync is present at the output of U23E, it may be in either state it is AC coupled by C1 to U23D. U23D then functions as a free running oscillator. The oscillator is made by the resistive feedback around U23D and the value of C1. The oscillator does not function when sync is present because the input to U23D is driven by U23E to the full 5V input range. This overdrives the oscillator mode which uses the much lower (about 1V) hysteresis range of U23. U23D's output drives the DREQ input of the MC68302.

Serial Interfaces

The RS485 control panel network is interfaced to by U16, an EIA RS485 transceiver. The RS485 network is terminated on the 504001 by a complex network. R101 provides a simple resistive load. R103 in conjunction with D15 and D16 provides a lower impedance termination as the peak to peak swing across the line exceeds the forward drop of the diodes. C26 was selected to reduce ringing. This complex termination performs much better than the usual single 100 ohm resistor used with RS485 lines. It was optimized for 31250 rate and Belden 8451 cable. At 31250 baud, 64 panels can operate over a combined cable length of 2000 ft. At 9600 baud, the cable total length can be up to 5000 ft.

Power Supply

Most of the circuits on the 504001 are powered by +5VDC. The RS232 interface circuits use + and -12VDC. Low voltage AC enters the module. It is then rectified and filtered. Three terminal fixed voltage regulators are used to provide the required ages.

Video Crosspoint Module 504034

The 504034, 20 x10 video crosspoint module is a plug-in module that is a complete video switching module containing; input buffers, crosspoint array, output amplifiers, control logic and power supply. It is the basic building block for the video portion of the Tahoe Series 20 routing switcher. The 504034 is available in a standard bandwidth of 50 MHz.

Input buffers

Each of the 20 video inputs has a separate wide band video buffer (U4). R1 provides a DC reference to the input of the buffer. R22 and C35 form a snubber network which compensates for the phase shift loading affect the crosspoint buses have on the output of the buffer.

Crosspoint Matrix

The crosspoints on the 504034 are configured from individual 4 by 1 IC crosspoint chips,HA4314's. Each switching IC has 3 control inputs. The "A" and "B" inputs select "1 of 4" inputs for that IC. The third control input is a CS (chip select). By using the chip select input, multiple 4 by 1 IC's can be linked to form a larger bus.

The output of each crosspoint chip passes through a PIN diode (D9) before being bussed together. The PIN diode blocks the off capacitance of the 7 deselected chips and has an extremely low forward impedance. The common bus of eight diodes has an FET (Q1) configured as a constant current source connected as a load for the bus.

Output Amplifiers

The output amplifier circuit is based on a current mode feedback amplifier IC. The standard 504034 uses an 60Mhz EL2020 (Elantec) or CLC430 (Comlinear) for this function. R5 and C3 are a snubber network which controls peaking on the crosspoint bus.

The gain of the output amplifier is adjusted by a 15 turn control (R7). R9, a 75 ohm 1% resistor provides the required output line driving impedance.

Control Circuits

The 504034 is usually controlled by a centralized control processor module which may be in the same frame as the 504034 or in another frame in the overall system. Each of the data inputs to the 504034 is in series with a 4.7K resistor. This serves two functions. It protects the logic circuits on the 504034 CMOS inputs from static over voltage or static damage. Second, it protects the bus in the system from a failure on an individual 504034 module.

U3 is a 4 line to 16 line decoder. Its output determines which bus on the 504034 is being addressed by the central controller. The strobe input (J1-6S) is centered timing wise in the data time that appears on the other logic lines to the 504034.

Power Supply

Low voltage AC enters the 504034 on J3 pins 27 and 28. If dual supplies are used, low voltage AC from the second supply enters the 504034 on J3 pins 25 and 26. The low voltage AC is rectified (D1 through D8) and filtered (C7 and C8) to unregulated DC. U11 provides +5VDC for the logic circuits. U12 is a 7805 and provides +5VDC to the analog circuits. U10 is a 7905 and provides -5VDC to the analog circuits.

Audio Crosspoint Module 504035

The 504035, 20 x 10 audio crosspoint module is a plug in module that is a complete audio switching module containing; input buffers, crosspoint array, output amplifiers, control logic and power supply. It is the basic building block for the audio portion of the Tahoe series 20 routing switchers. The 504035 employs balanced audio switching. The advantages include; higher internal levels to achieve very high dynamic range (over 100db), lower crosstalk, no audio ground current, and no switching transients. The 504035 has a bandwidth of about 500KHz. This allows it to be used for switching time code at even the fastest machine shuttle speeds.

Input Buffers

Each one of the 20 audio inputs is buffered by a dual low noise op-amp (U1). The circuit provides 40db of common mode rejection. The circuit gain is set by 1% resistor values.

Crosspoint Matrix

The crosspoints on the 504035 module are configured from individual 4 by 1 IC crosspoint chips. Each switching IC has 3 control inputs. The “A” and “B” inputs select “1 of 4” inputs for that IC. The third control input is a CS (chip select). By using the chip select input, multiple 4 by 1 IC’S can be linked to form a larger bus.

Output Amplifiers

The output amplifier circuit is based on another dual low noise op-amp. The circuit is also configured to reject up to 40 db of common mode signal. This includes common mode crosstalk (which is immeasurable below 15 KHz) and switching transients. The output circuit has a gain of 10db to offset the deliberate loss introduced by the input network.

Control Circuits

The 504035 is usually controlled by a centralized control processor module which may be in the same frame as the 504035 or in another frame in the overall system. Each of the data inputs to the 504035 is in series with a 4.7K resistor. This serves two functions. It protects the logic circuits on the 504035 CMOS inputs from static over voltage or static

damage. Second, it protects the bus in the system from a failure on an individual 504035 module.

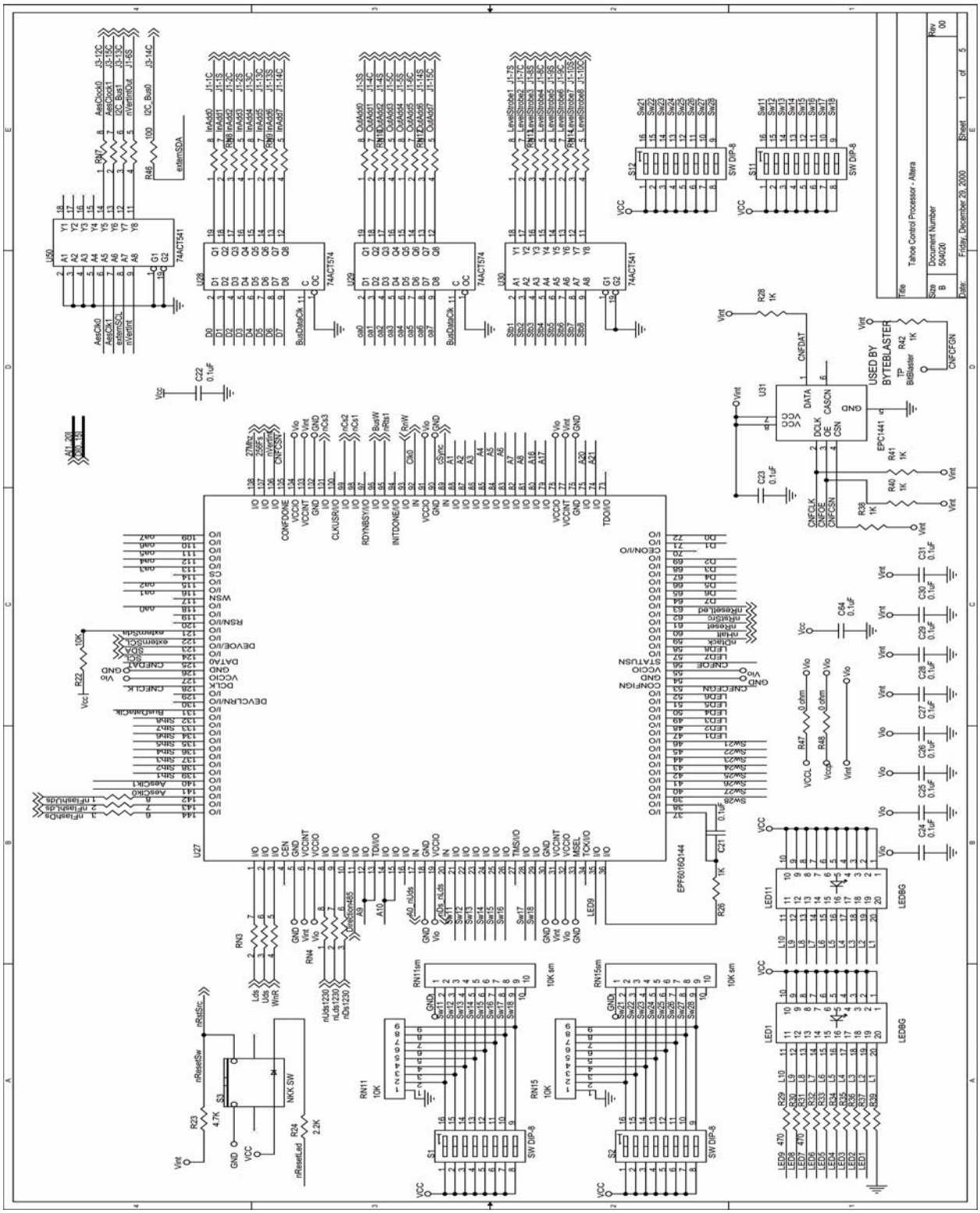
U6 is a 4 line to 16 line decoder. Its output determines which bus on the 504035 is being addressed by the central controller. The strobe input (J1-6S) is centered timing wise in the data time that appears on the other logic lines to the 504035.

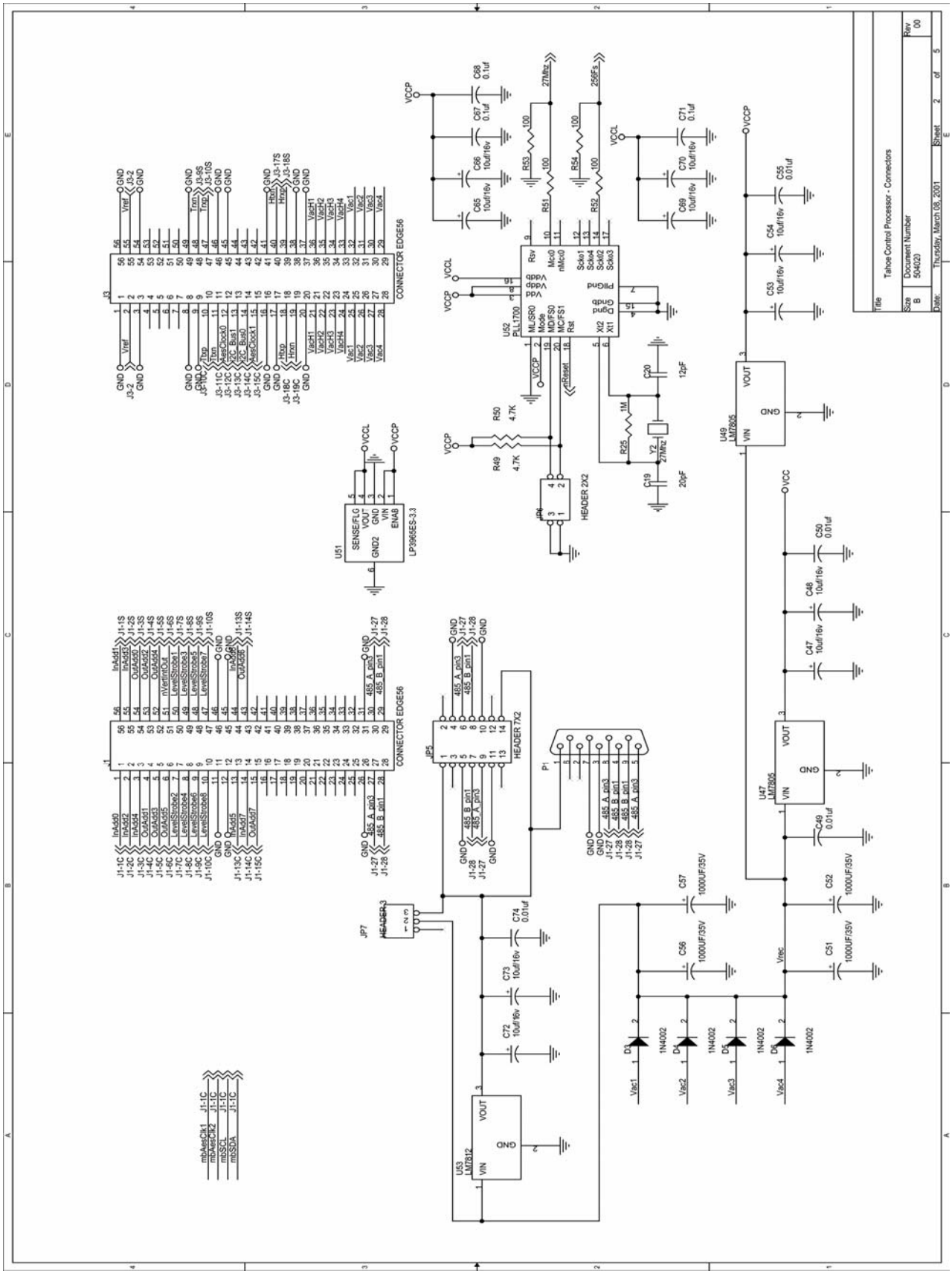
Power Supply

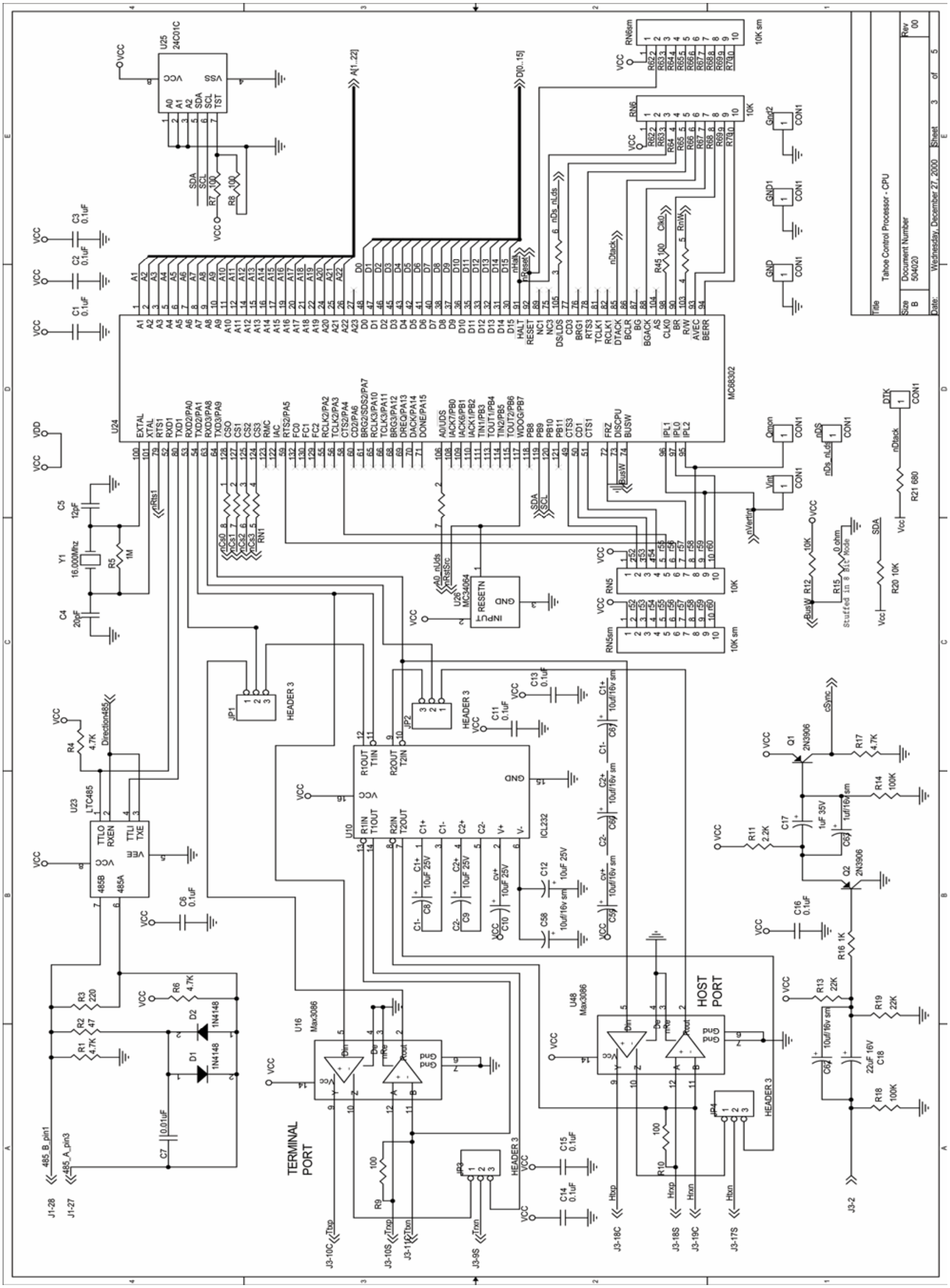
Low voltage AC enters the 504035 on J3 pins 27 and 28. If dual supplies are used, low voltage AC from the second supply enters the 504035 on J3 pins 25 and 26. The low voltage AC is rectified (D1 through D8) and filtered (C1 and C2) to unregulated DC. U10 provides +5VDC for the logic circuits and switching array. U11 provides -5VDC for the switching array. U12 is a 78M15 and provides +15VDC to the analog circuits. U13 is a 79M15 and provides -15VDC to the analog circuits.

Schematics

504001




Title
Tahoe Control Processor - Connectors
Size
B
Document Number
S04023
Rev
00
Date:
Thursday, March 08, 2001
Sheet
2
of
5
CONNECTOR EDGE56
HEADER 7X2
HEADER 2X2
HEADER 3
LP3965ES-3.3
LM7812
LM7805
PLL1700
1N4002
1000UF/35V
10uf/16v
0.01uf
0.1uf
12pF
20pF
27Mhz
4.7K
1M
100
VCCL
VCCP
VCC
Vtrec
Vec1
Vec2
Vec3
Vec4
mbAesClk1
mbAesClk2
mbSCL
mbSDA



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Size
B
Document Number
504020
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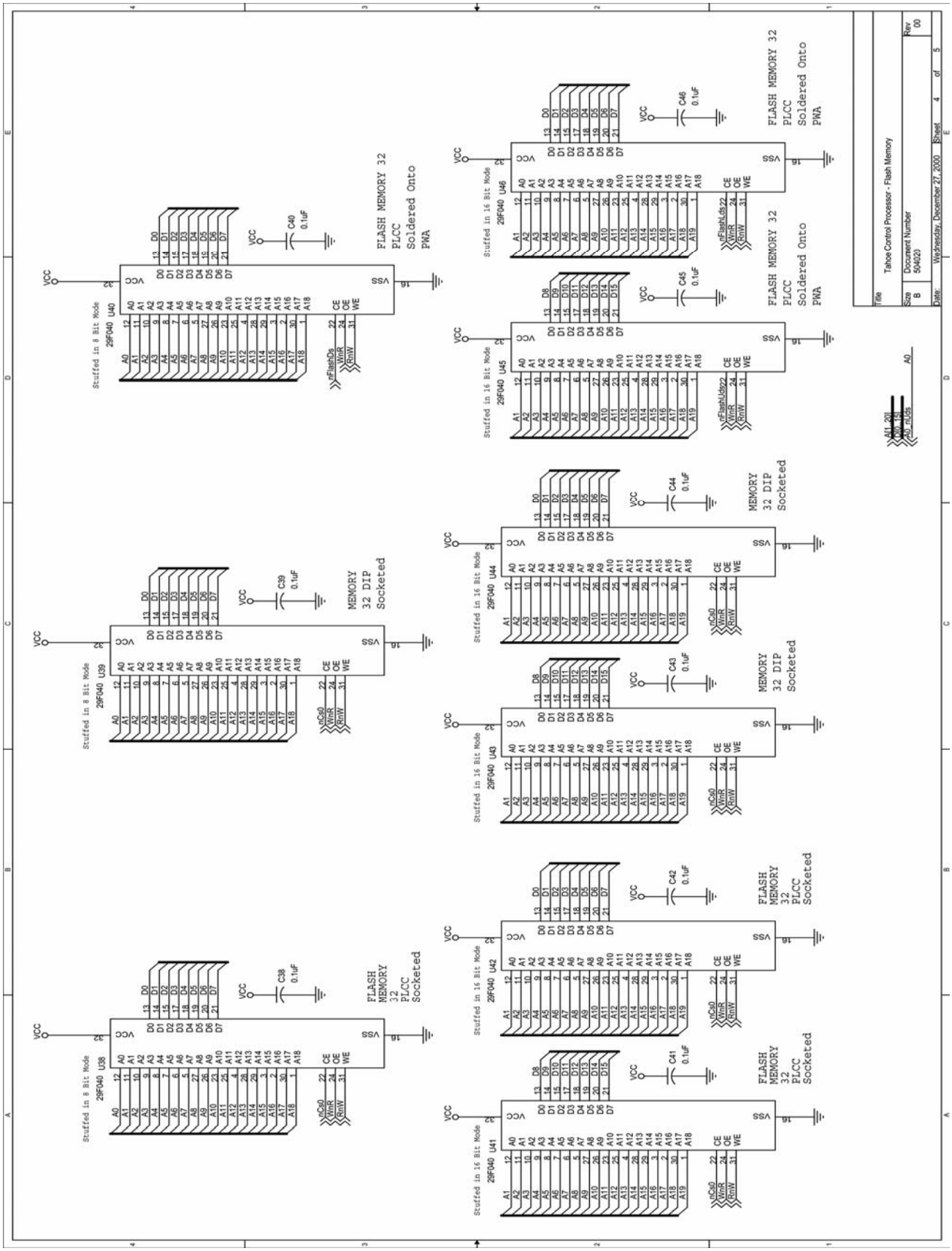
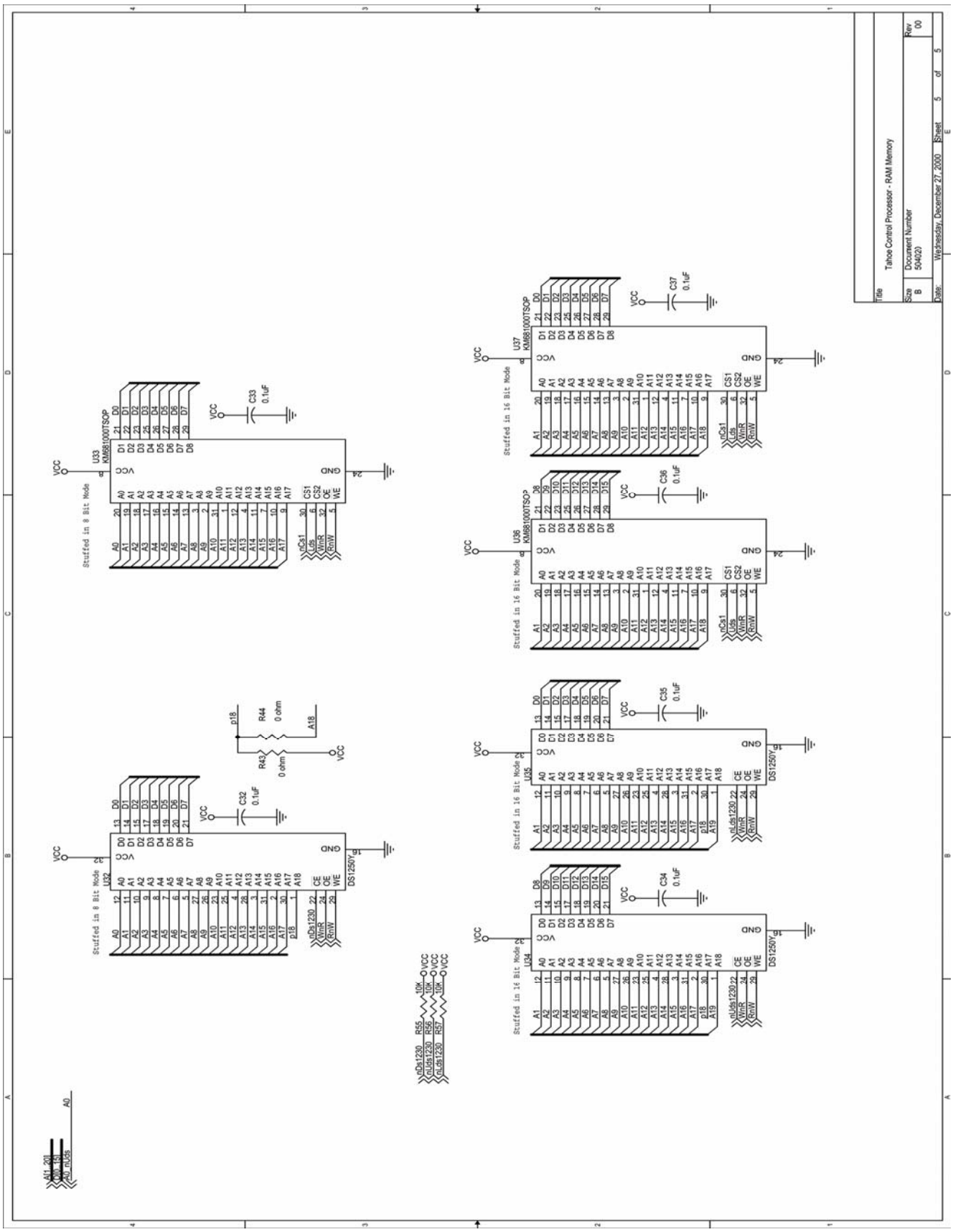
Date:
Wednesday, December 27, 2000
Sheet
3
of
5
MC68302
ICL232
LTC485
TERMINAL PORT
HOST PORT


Tahoe Control Processor - Flash Memory
Document Number
50402
Rev
00
Wednesday, December 27, 2000
Sheet
4
of
5
FLASH MEMORY 32
PLCC
Soldered Onto
PWA
MEMORY
32 DIP
Socketed
FLASH
MEMORY
32
PLCC
Socketed
Stuffed in 8 Bit Mode
Stuffed in 16 Bit Mode
29F040
VCC
VSS
nFlashCs
nFlashUds
nCs0
WnR
RnW
CE
OE
WE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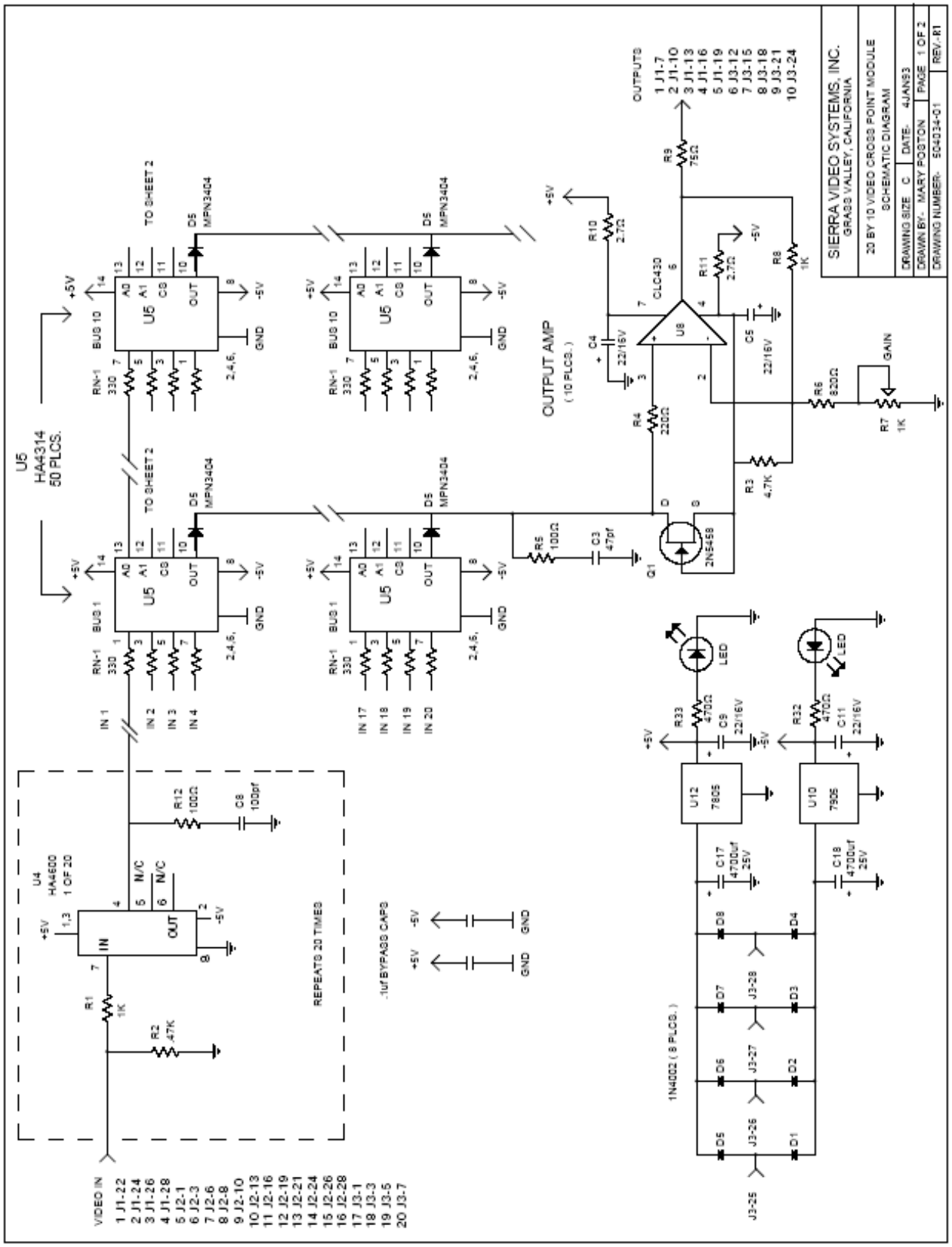
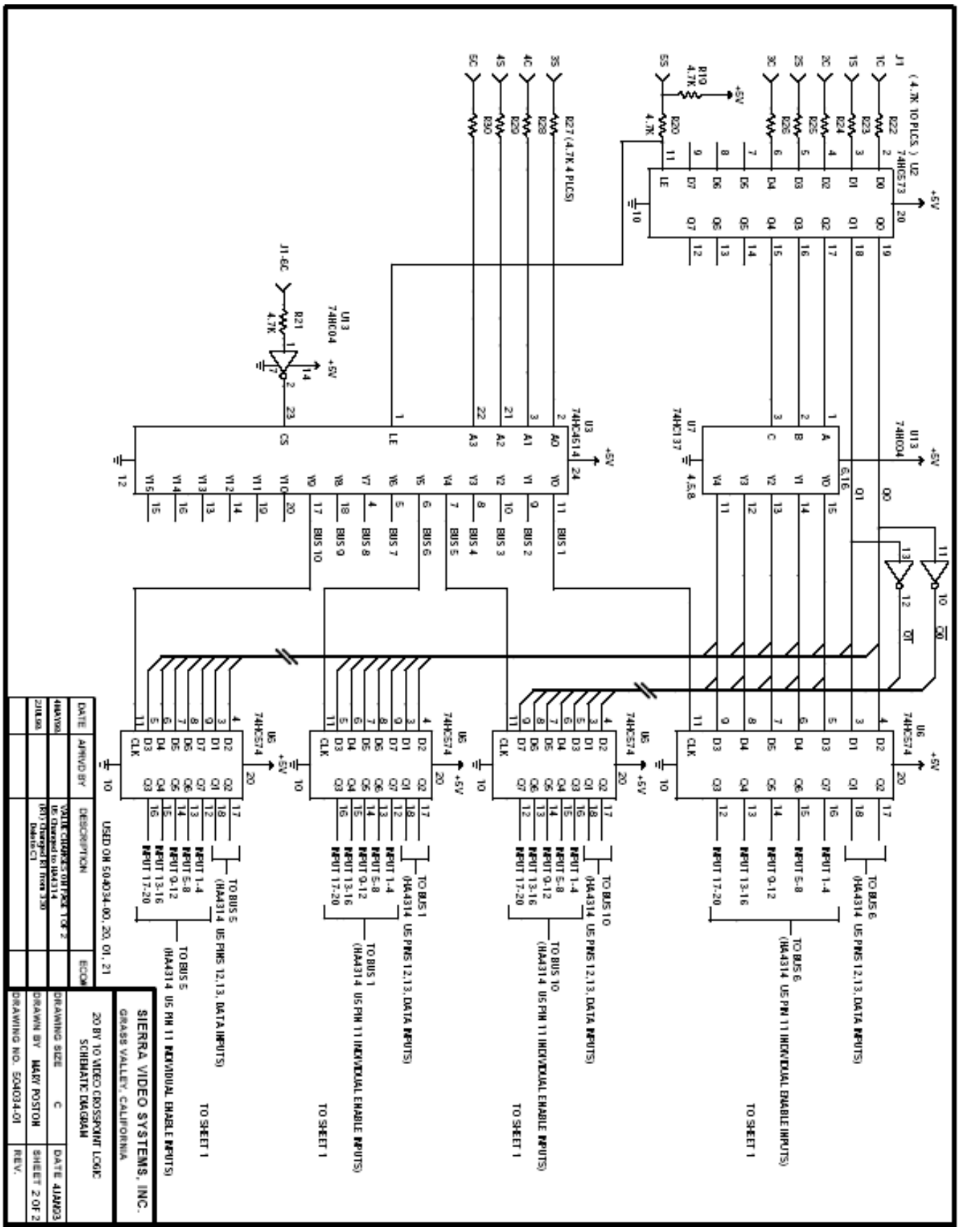
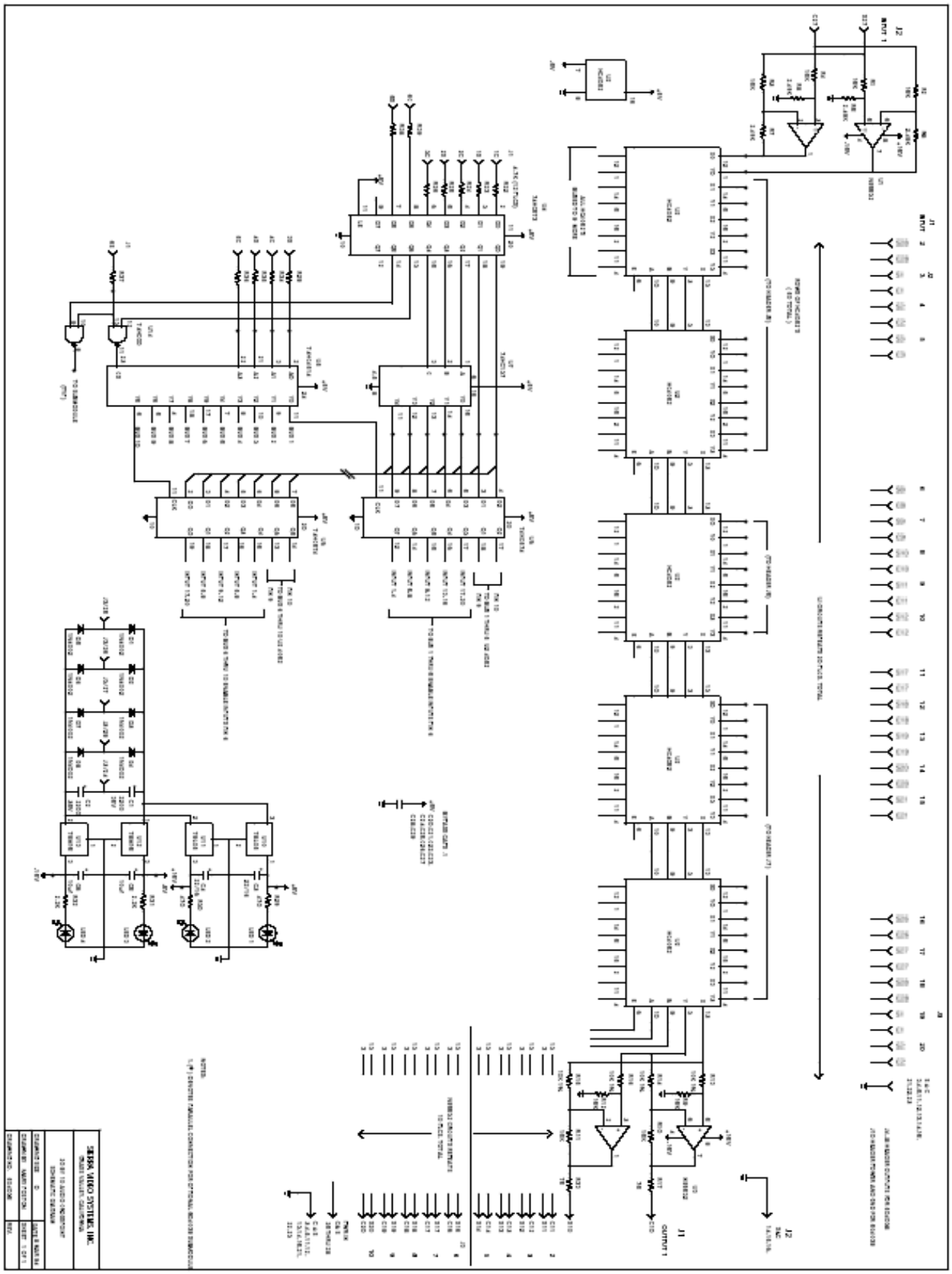
Size
B
Document Number
504(2)
Rev
00
Date:
Wednesday, December 27, 2000
Sheet
5
of
5
Stuffed in 8 Bit Mode
Stuffed in 16 Bit Mode
KM681000TSOP
DS1250Y
VCC
GND
C32
C33
C34
C35
C36
C37
0.1uF
R43
R44
0 ohm
R55
R56
R57
10K
nUds1230
nCs1
nLds
WnR
RnW
A0
A1
A18
p18

504034


SIERRA VIDEO SYSTEMS, INC.
GRASS VALLEY, CALIFORNIA
20 BY 10 VIDEO CROSS POINT MODULE
SCHEMATIC DIAGRAM
DRAWING SIZE C
DATE: 4JAN93
DRAWN BY- MARY POSTON
PAGE 1 OF 2
DRAWING NUMBER- 504034-01
REV.-R1
U6 HA4314 50 PLCS.
OUTPUT AMP (10 PLCS.)
REPEATS 20 TIMES
.1uf BYPASS CAPS
1N4002 (8 PLCS.)
VIDEO IN
1 J1-22
2 J1-24
3 J1-26
4 J1-28
5 J2-1
6 J2-3
7 J2-6
8 J2-8
9 J2-10
10 J2-13
11 J2-16
12 J2-19
13 J2-21
14 J2-24
15 J2-26
16 J2-28
17 J3-1
18 J3-3
19 J3-5
20 J3-7
OUTPUTS
1 J1-7
2 J1-10
3 J1-13
4 J1-16
5 J1-19
6 J3-12
7 J3-15
8 J3-18
9 J3-21
10 J3-24
GAIN
TO SHEET 2


SIERRA VIDEO SYSTEMS, INC.
GRASS VALLEY, CALIFORNIA
20 BY 10 VIDEO CROSSPOINT LOGIC
SCHEMATIC DIAGRAM
DRAWING SIZE C
DRAWN BY MARY POSTON
DRAWING NO. 504034-01
DATE 4JAN03
SHEET 2 OF 2
REV.
USED ON 504034-00, 20, 01, 21
TO SHEET 1
TO BUS 5 (HA4314 U5 PINS 12,13, DATA INPUTS)
TO BUS 6 (HA4314 U5 PINS 12,13, DATA INPUTS)
TO BUS 1 (HA4314 U5 PINS 12,13, DATA INPUTS)
TO BUS 10 (HA4314 U5 PIN 11 INDIVIDUAL ENABLE INPUTS)
TO BUS 1 (HA4314 U5 PIN 11 INDIVIDUAL ENABLE INPUTS)
TO BUS 5 (HA4314 U5 PIN 11 INDIVIDUAL ENABLE INPUTS)
U13 74HC04
U7 74HC137
U3 74HC4514
U5 74HC574
U6 74HC574
U2 74HC573
U1 74HC04
R27 (4.7K 4 PLCS)
R19 4.7K
R20 4.7K
R21 4.7K
J1 (4.7K 10 PLCS.)
J1-6C
+5V

504035



Chapter 7

Specifications

Audio Specifications

Audio	
Nominal Input Level	+4 dbm
Maximum Input Level	+ 24 dbm
Input Impedance	15k ohms, balanced
Common Mode Rejection	≥ 40 db @ 60 Hz
Nominal Output Level	+4 dbm
Maximum Output Level	+24 dbm into 150 ohms
Output Source Impedance	150 ohms, balanced
Voltage Gain	Unity ± 0.1db (High Z load)
Frequency Response	20Hz to 20kHz ± 0.1 db
Bandwidth	100 kHz
S/N Ratio (20 Hz to 20 kHz)	110 db ref. To +24 dbm
Crosstalk (all inputs hostile)	≥ 80db @ 15 kHz
IM & THD (20Hz to 20 kHz)	≤0.05% to +24 dbm

Video Specifications

Video	
Nominal Input Video Level	1 V p-p
Maximum Input Video Level	1.5 V p-p
Input Impedance	75 ohms
Input Return Loss	≥ 40 db @ 5 MHz
Superimposed DC	± 5 V
External Sync	Color Black to 4 V p-p
Nominal Output Video Level	1 V p-p
Maximum Output Video Level	1.5 V p-p
Output Impedance	75 ohms
Output Return Loss	≥ 35 db @ 5 MHz
DC on Signal	± 50 mV
Gain	Unity (± 2 db adj.)
Response	± 0.1 db to 5 MHz; + 0/- 3 db, 5 – 50 MHz
Diff. Phase Error	± 0.1 degree @ 3.58 or 4.43 MHz
Diff. Gain Error	± 0.1 % @ 3.58 or 4.43 MHz
Crosstalk (all hostile)	≥ 60db @ 5 MHz
S/N Ratio	≥ 80db @ 5 MHz
Response, wide bandwidth option	+ 0/- 3 db to 200 MHz
Crosstalk (adjacent hostile) wide bandwidth option	≥ 45db @ 50 MHz

Chapter

8

Software Upgrades

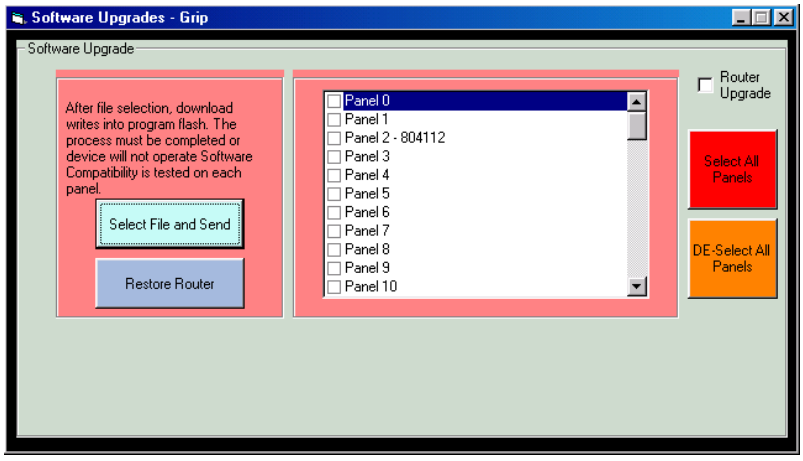
Introduction

From time to time software upgrades will be available from SVS. Check our web site (sierravideo.com) for available downloads, or contact the factory.
Tahoe series router processors can be upgraded via the 9 pin serial port on the router's Host port. Upgrades are accomplished using the GRIP program. For details on software upgrades refer to the GRIP manual.

Operation

Download the software upgrade to a folder on your PC. Open G.R.I.P. and click on "Router Configuration" from the drop down list, select "Software upgrades".

The following window will be displayed;



Place a check in the Router Upgrade box and press "Select File and Send". Select the upgrade file you downloaded and press OK.

A status bar will be displayed indicating file transfer.

Depending on the speed of your PC's processor, this upgrade may take several minutes.

Chapter 9

Warranty

A. General

Buyer assumes all responsibility for ascertaining the suitability of Sierra Video (hereinafter "SVS") products for Buyer's intended use. No product sold by SVS is designed or manufactured for use in any manner or under any conditions other than those described in SVS's instruction manuals and other printed material for each particular product. If any product is used or applied in a manner or under conditions not specifically authorized by such written materials or if any product is used by unqualified or improperly trained personnel, Buyer agrees that SVS shall have no liability of any kind arising from such use, and Buyer agrees to indemnify and hold SVS harmless from any claims of third parties arising from such use, and Buyer shall provide SVS with counsel of SVS's choice to defend against such claims.

B. Limited Warranty

1. This limited warranty applies only to the original purchaser and is non-transferable. This limited warranty begins on the date of purchase and will be in effect for seven (7) years for new equipment and for three (3) years for "Factory Refurbished" equipment. Power Supplies and fans are warranted for three (3) years from the date of purchase for new equipment and two (2) years for “Factory Refurbished” units, from the date of purchase.
Buyer must obtain a Return Material Authorization ("RMA") number from SVS prior to returning a product for repair. If, in SVS' sole discretion, the product is found to be defective during the term of this warranty, SVS will at its option: (a) provide free replacement parts, and/or (b) repair the unit at an SVS facility. During the warranty period, SVS will make every reasonable effort to support critical emergencies by supplying no-cost loan equipment while the defective unit is being repaired. SVS will provide replacement parts and/or factory service at no charge. Buyer bears the cost of shipping products returned to SVS under this warranty. SVS will bear the cost of shipping repaired products or replacement parts to the Buyer.

This limited warranty shall not apply to any of SVS's goods which have been altered or which have been subjected to misuse, mishandling, improper storage or negligence. The aforementioned provisions do not extend the original warranty period of any goods which have been replaced by SVS. This limited warranty shall not apply to any goods not of SVS's manufacture, Buyer to be entitled only to the warranty set forth in the original manufacturer's limited warranty.

THIS LIMITED WARRANTY IS EXPRESSED IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE, AND ALL OTHER OBLIGATIONS OR LIABILITIES ON SVS'S PART.

SVS neither assumes nor authorizes any other person to assume for SVS any other liabilities in connection with the sale of products of its own manufacture.

2. SVS's liability hereunder on any claim of any kind, except as set forth herein for any loss, injury to person or property or damage, shall in no case exceed the price allocable to the goods which give rise to such claim.

3. In no event shall SVS be liable for any damages or injuries to person or property if any goods do not meet the above limited warranty, including, without limitation, incidental expenses or consequential or special damages, except as set forth in such limited warranty. The foregoing states the exclusive remedy of Buyer and the exclusive liability of SVS for any breach of the foregoing limited warranty.

C. Cancellation

Except as provided in paragraph B immediately above, all sales are final, and Buyer may cancel this order or return products only upon written consent of SVS.

D. General

In the event of a breach of any of the terms hereof, the non-breaching party shall be entitled to recover all of its costs, fees, and expenses, including, without limitation, reasonable attorney's fees, from the breach party incurred as a result of such breach, regardless of whether or not a suit is actually filed to enforce the terms hereof.

The provision hereof shall be governed by the laws of the State of California (excluding its choice of law provisions).

The headings are for convenience only and do not limit or amplify the terms and provisions hereof.

In case any one or more of the provisions set forth herein shall be held to be invalid, illegal, or unenforceable in any respect, the validity, legality, and enforceability of the remaining provisions contained herein shall not in any way be affected or impaired thereby.

No waiver, alteration, or modification of any of the provisions hereof shall be binding unless in writing and signed by an authorized Officer of SVS.

NOTE:

All products returned to SVS for service must have prior approval. Return authorization requests may be obtained from your SVS dealer.