SIGMA
MRX SERIES

ANALOG AND DIGITAL
MID-SIZE MATRIX ROUTING SYSTEM

OPERATORS MANUAL

UNPACKING

PHYSICAL INSPECTION

Inspect your packages and equipment for any damage that might have occurred during shipping. If damage has occurred, save the shipping cartons. Report the damage to the shipping company and notify Sigma Electronics, Inc.

STANDARD SHIPPING CONFIGURATION

Each MRX system will be shipped in multiple cartons. Video and Audio frames are shipped, each in their own carton, with all modules installed. Power supply frames and the required power supplies are shipped in the same carton. The accessory box (where this manual was located) containing all power interface cables, accessories, connectors and documentation is shipped inside the power frame shipping carton.

Control panels ordered with a system are shipped in separate cartons. The external power supply for the control panel is in the same carton as the control panel.

SIGMA MRX SERIES
ANALOG AND DIGITAL MID-SIZE MATRIX ROUTING SYSTEM
OPERATOR'S MANUAL

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GENERAL OPERATING REQUIREMENTS

ENVIRONMENTAL

Ambient temperature/Ventilation

The MRX Switching System is designed to operate as specified when the ambient temperature is kept within the range of 0°C to 50°C. Ventilation slots are provided on the front and sides of the frames to assist in the removal of the excess heat generated in the normal operation of the units. These ventilation slots must not be blocked. Sigma Electronics will consider blocking of these slots, to be a custom, design modification by the user. Custom design modifications void the Sigma Electronics warranty.

Humidity

Excessive humidity is harmful to electronic equipment. It is expected that the user will monitor and control the relative humidity of the operating environment to maintain levels acceptable for the operation of this equipment.

Rack-mounting

All frames and control panels are intended to be mounted in standard 19" EIA equipment racks. Prior to installing an MRX Series frame into a rack, the front panel must be removed. To remove the front panel, grasp the handles and pull firmly away from the frame. The front panel should completely detach from the ballstuds.

Audio Frame placement

Due to the susceptibility of all audio circuitry to interference from power sources, the audio frame should be located as far away from power sources as possible.

POWER

The MRX Switching System is designed to operate in all standard commercial power environments providing input voltage between 100VAC and 240VAC ± 10%. Voltages outside of this range may or may not be tolerated by the equipment for a period of time but will, in any case, be considered a violation of the warranty.

INTERCONNECT WIRING

AUDIO FRAME - ANALOG

The MRX Analog Audio Switching System is designed to accept both balanced and unbalanced audio signals having an input level of +26dBu or less in to Hi-Z (+24 dBu into 600Ω). Balanced audio signals are connected to the audio frame via a 3-wire cable attached to the 3-position, detachable, terminal block. Unbalanced signals can utilize a 2-wire conductor and connect the ground wire to both the "C" and "-" terminals on the 3-position, detachable, terminal block.

There is an individual connector assigned for each input and output. To achieve termination on the audio switch module, a load resistor may be added across the terminal block where the incoming wire is attached.

Audio frames can be configured as a full 32x32 matrix or the frame may be partitioned to accommodate multiple channels. The figure below shows an audio frame configured for a channel of 32x32. In applications utilizing stereo audio, two 1RU frames are required, one for each channel.

Outputs 1-32 Channel 1

Inputs 1-32 Channel 1
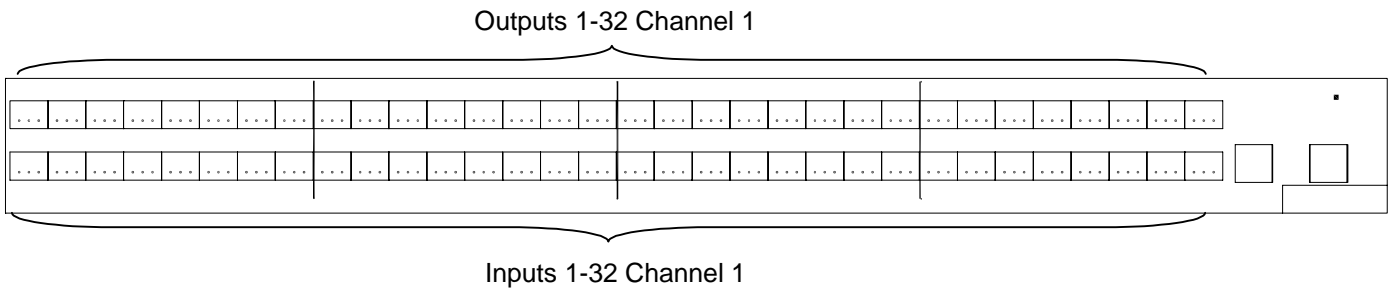
AUDIO FRAME - DIGITAL

Digital audio frames are available in two configurations - the MRX-TDAF for balanced audio signals (AES-3 1992) and the MRX-CDAF for unbalanced audio (AES-3 ID). Unlike analog audio, where the same connectors can be utilized for both types of signal, the digital audio frames have different rear panels for each model. The MRX-TDAF (balanced digital audio) rear panel contains 3-position detachable terminal blocks to accept a 3-conductor cable and each is terminated with a 110Ω resistor on the PCB. The MRX-CDAF (unbalanced digital audio) rear panel contains BNC's to be used with coaxial cable and are terminated with a 75Ω resistor on the PCB. There is a separate connector assigned for each input and output.

Audio frames can be configured as a full 32x32 matrix. The figure below shows an audio frame configured for a channel of 32x32.

Outputs 1-32 Channel 1

Inputs 1-32 Channel 1
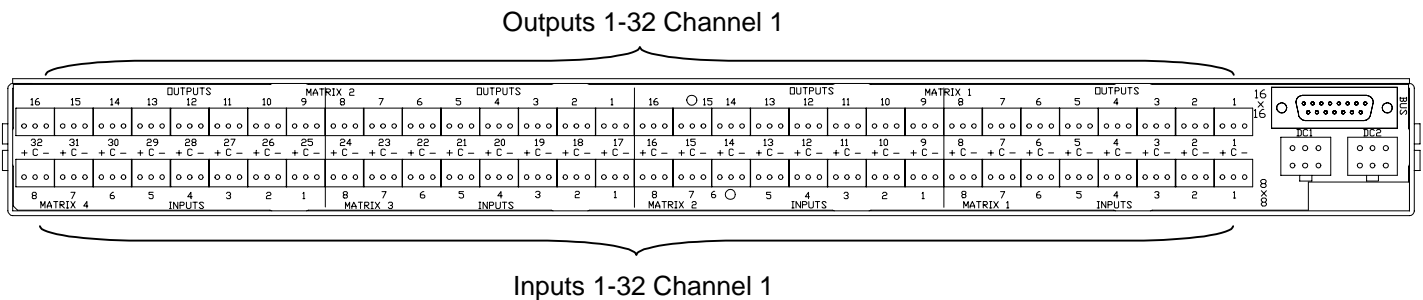
VIDEO FRAME - ANALOG

Video signals are connected to the video frame via BNC jacks on the rear panel. Connect the source video cables to the corresponding input BNCs on the rear of the frame. The MRX routing switcher must be the terminating device in the system. All video modules provide the video source with proper 75Ω termination. All active video outputs must be terminated in 75Ω. (BNC's for outputs that are beyond the configured matrix size do not need to be terminated.)

The figure below shows the rear of a system configured as a 32 X 32 switcher. In this configuration, the bottom two rows of BNC's are used as the video input connectors. The 32 BNC's that make up the top two rows are the video output connectors. All 32 output BNC's need to be terminated. Use a 75Ω load to terminate any unused output.

OUTPUTS 1 - 32   (Top 2 rows of BNCs)

INPUTS 1 - 32   (Bottom 2 rows of BNCs)
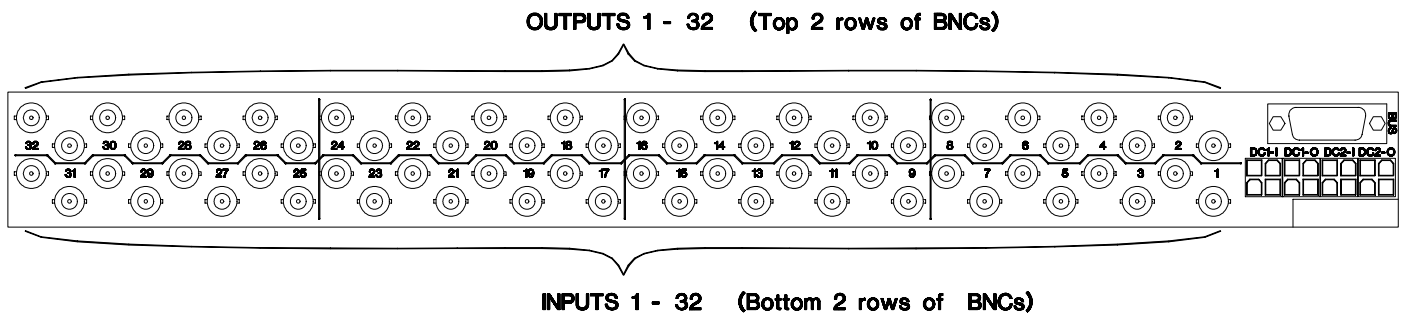
VIDEO FRAME - DIGITAL

Digital video signals are connected to the video frame via BNC jacks on the rear panel. Connect the source video cables to the corresponding input BNCs on the rear of the frame. The MRX routing switcher must be the terminating device in the system. All video modules provide the video source with proper 75Ω termination. All video outputs must be terminated in 75Ω.

The figure below shows the rear of a system configured as a 32 X 32 switcher. In this configuration, the bottom two rows of BNC's are used as the video input connectors. The 32 BNC's that make up the top two rows are the video output connectors. All 32 output BNC's need to be terminated. Use a 75Ω load to terminate any unused output.

Outputs 1-32   (Top 2 rows of BNCs)

Inputs 1-32 (Bottom 2 rows of BNCs)
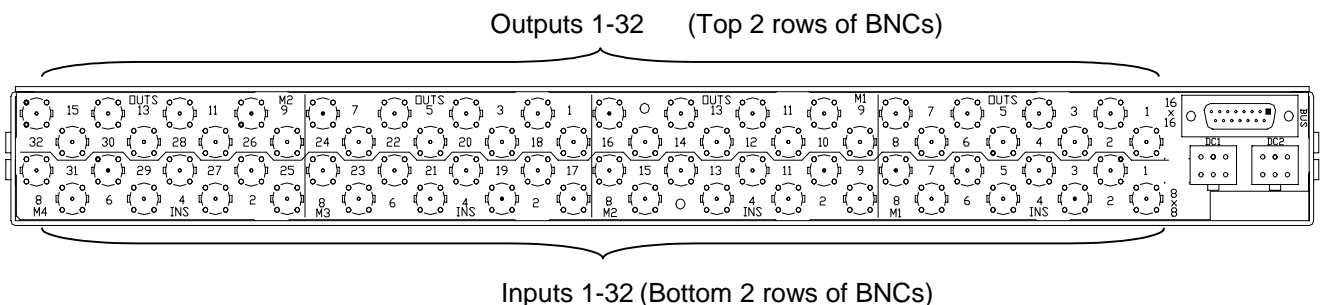
POWER FRAME

SYSTEM CONTROL INTERFACE

The system control interface module (MRX - SCI) initiates all the switching operations that occur in the MRX system. It is located on the left side of the power supply frame (when viewed from the front).

To ensure that the SCI has power at all times, the control module is connected to every power module output. This guarantees that if any functional power supply module is installed, the SCI will have power supplied to it. In addition, as long as there is more than one operating power supply in the power frame, the SCI has redundant power capability.

CONTROL BUS WIRING

The data bus connection is provided on the rear of each power frame at the SCI interface panel. Ribbon cables with 15 Pin D-type connectors are used as Bus connectors. These Bus connectors are used to transmit the control data from the SCI to all system frames. All systems will be provided with enough bus cable assemblies to meet the requirements of the system plus an expansion connector. Frame placement within the racks will determine the required length of the bus cable. If custom length cables are required for a specific application, Sigma Electronics Inc can accommodate special cable requirements.

POWER MODULE

All power is supplied to the audio and video frames from the power frame through the supplied DC power cables. Although all power modules are identical, some positions within the frame are dedicated to supply power to digital audio or video frames and other positions are to supply analog frames. For applications where redundancy is required, each power frame can hold two digital and two analog assigned supplies.

After the power supply modules are plugged into the power frame's slots, install the power cables into the rear of each supply and then connect to the rear of the appropriate frame, analog or digital. Analog power cables are terminated with 4-pin connectors and digital power cables are terminated with 6-pin connectors. Ensure that an analog power supply is used to supply an analog frame and a digital power supply is used to supply a digital frame.

Additional DC input power connectors are provided on each analog and digital frame. Redundant analog or digital power supplies may be mounted in the power frame and connected to the audio or video frames via this connector. The redundant connector on the rear of the analog frame is labeled DC2-I. The redundant connector on the rear of the digital frame is labeled DC 2.

*NOTE: If **one analog video frame** and **two analog audio frames** are used, connect the power supply cables as follows: Connect one 4-pin power supply cable from the power supply frame to the video frame connector DC1-I. Connect one 4-pin power supply cable from the power supply frame to the audio frame connector DC1-I. Connect one 4-pin power supply cable from the <u>video frame connector DC1-O</u> to the 2nd <u>audio frame connector DC1-I</u>.

POWER SUPPLY FRAME
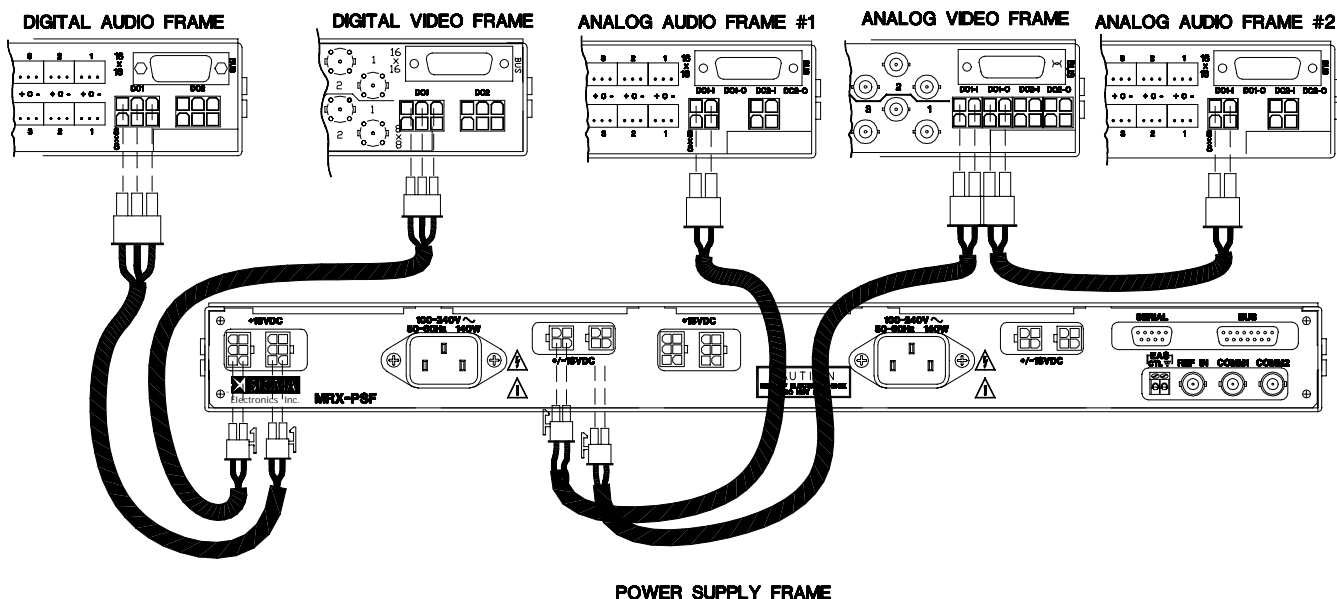
REAR SUPPORTS

Depending upon the installation, it may be necessary to install the included rear mounting frame supports. These supports are designed to allow connection to rear rails positioned between 19 and 30 inches from the front supports. To install, follow the directions below.

Rear Support Installation Instructions

       Refer to illustration below for reference letters.

1. Prior to installation of the frame into the rack, attach an extender bar (A); the flat piece with the countersunk holes at one end; to each side of the frame using the four (4) supplied #8-32 undercut, flathead screws (B) through the countersunk holes and into the threaded inserts in the side of the frame. NOTE: **Undercut**, flathead screws must be used to provide adequate clearance and proper fit.
2. Install the frame into the equipment rack, securing the front mounting brackets with the supplied #10-24 plastic-coated, rack-mounting screws. For shorter front to back rack-mounting applications, be certain both extender bars are positioned between the vertical, rear mounting rack rails.
3. Install both rear mounting brackets (C) over the end of the extender bars with the angled portion pointing toward the outside.
4. Secure the rear mounting bracket © to the rear of the rack using #10-24 plastic-coated, rack-mounting screws.
5. Install at least one of the supplied #8-32 panhead screws (D) through the extender bar and into the threaded inserts in the mounting bracket on each side. For greater security, an additional screw may be installed where possible.
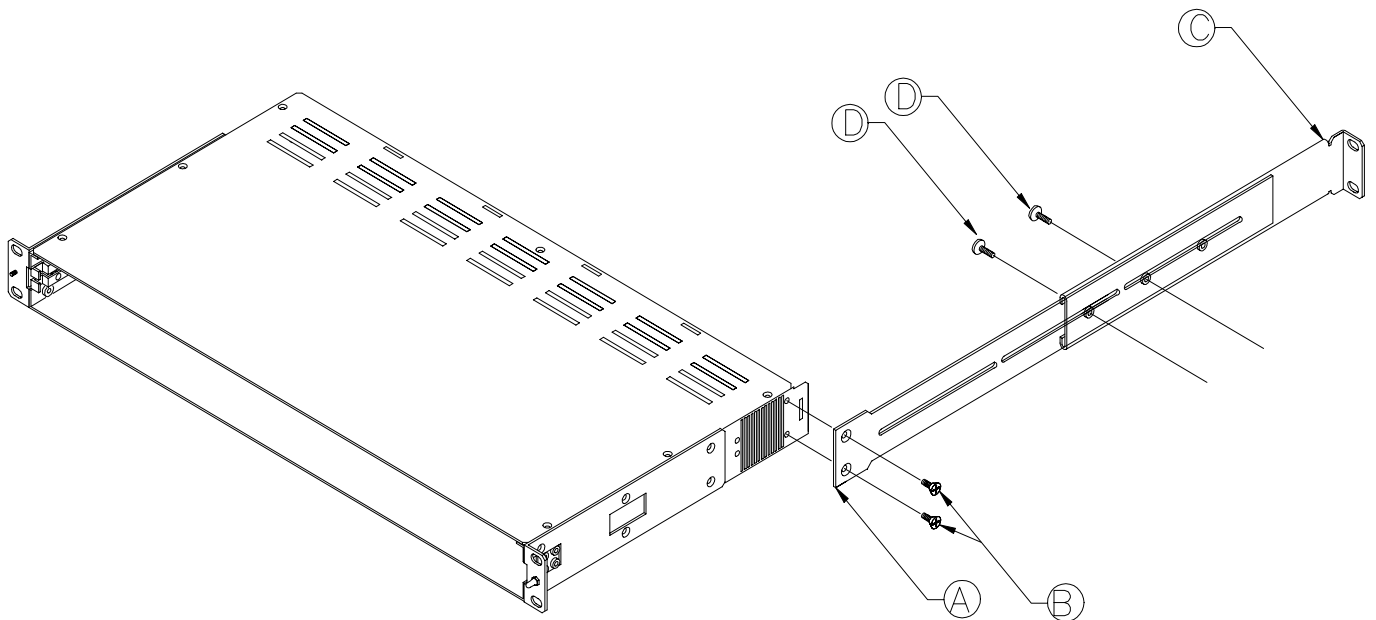
Rear Support Installation (right side only shown)

CONTROL PANEL

To initiate the switching operation, data must be input into the SCI. One way to input this data is through a control panel. The MRX system is capable of utilizing many different control panels available from Sigma Electronics, Inc.

The data from the control panels is transferred to the SCI via a communication line. References to this line are typically abbreviated to COMM line. This coaxial cable is connected between either the COMM 1 or COMM 2 BNC on the SCI interface on the rear of the power frame, and the COMM connection on the rear of the control panel. Both connectors provide an identical interface to the SCI.

Several control panels may be added to the COMM Line as system requirements dictate. Additional panels are added by installing BNC "T" connectors in the coax path. Coaxial cable paths for either COMM 1 or COMM2 are recommended to be less than 2000 total feet. This coaxial path should NOT be terminated in a 75Ω load.

TO OTHER CONTROL PANELS

SYX CONTROL PANEL (REAR)

POWER SUPPLY FRAME
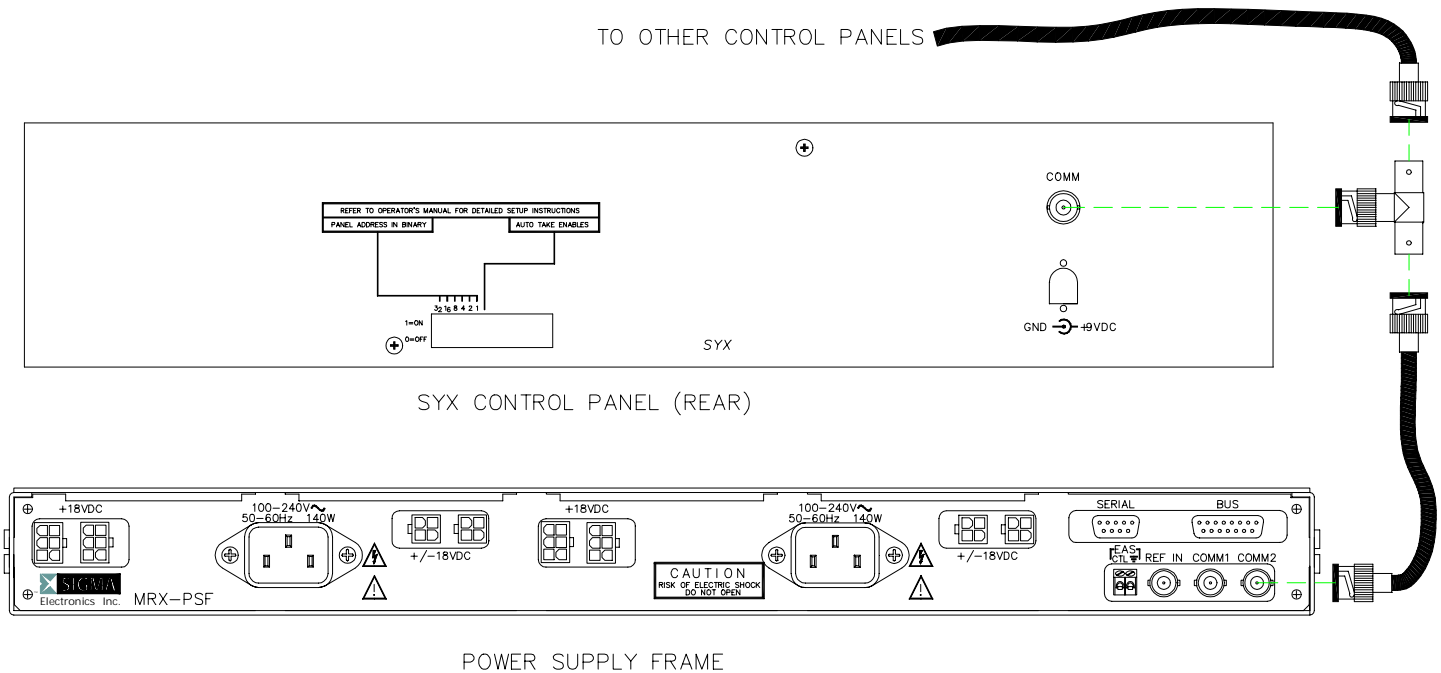
APPENDICES

APPENDIX A – SCI PROTOCOL AND INTERFACE

INTRODUCTION

The SCI serial interface card is the heart of the Sigma MRX Series mid-size matrix routing system. The SCI functions as the controller between the user and the switcher crosspoints. A switch can be generated one of two ways: by a remote control panel or by the serial port.

Control Panel Interface

On the rear of the main frame are two BNCs labeled "COMM 1" and "COMM 2". Coaxial control lines connect the COMM ports to the remote control panels. Multiple control panels may be supported by the SCI. The 64 different panel addresses allow each panel to have a unique polling address. This prevents conflicts of transaction information during a poll between the SCI and a specific address. The SCI systematically polls the control panel addresses to request transaction data. When polled, data present at the control panel is transmitted to the SCI via the coax cable. The SCI interprets and executes the instruction. After a panel is polled, the SCI transmits an update of the transaction to all the system control panels. In this way there is a positive feedback for each transaction.

Serial Control Interface

The second method of control is through the serial port. The SCI can support either RS-232 or RS-422 protocols. Selection of RS-232 is obtained by placing the dual 9 Pin jumper on JP2 (factory default). To select RS-422 the jumper must be moved to JP1. Serial communications is achieved with very simple and straightforward ASCII commands. The interrupt driven communications link will respond immediately whenever a command is issued from an external serial device. When the command is received, it is interpreted and executed. The SCI will issue a response of "OK" to the sending device upon completion of each transaction. If the command was invalid the SCI will transmit a "?". The response can be disabled if required.

Vertical Interval Switching

The SCI is capable of generating a vertical interval switch. To do this a reference signal must be present at the "REF IN" BNC. This signal can be either a composite video signal (1 Vp-p) or a composite sync pulse (-4vpp). The SCI will use this reference to determine the vertical interval switch. If no "REF IN" signal is present the SCI will execute the switch as soon as it is interpreted.

SCI Configuration Switches

There are three switches located on the front on the SCI-MRX circuit board. S1 is a momentary push button switch labeled "RESET". This switch functions as a microprocessor hardware reset that forces the processor to restart from a default setup condition. The SCI will reset all crosspoints, every output will be set to input 1. An S1 reset will clear all entries in the internal salvo tables and panel restrictions in the SCI memory. **Reset must be used with care.** Refer to the CTRL-W command before implementing a system reset with S1.

The 12-position DIP switch, S2, provides system configuration. System configuration includes serial port baud rate, switcher input range, output range, protocol logical addressing and number of control levels. Refer to the tables provided in this manual.

The four-position switch, S3 is used to select the Numeric/Alpha mode, enable/disable hardware handshaking and control panel scanning.

Control Levels

The SCI-MRX supports four or eight control levels. Rotary switches on the front of the audio and video boards control level assignments for each output group. Level 1, typically assigned to the video modules, is designated with an A in the ASCII protocol. Level 2, typically assigned to the audio modules, is designated with letter B in the protocol.

The separation of signals into levels allows the router's logic to switch one level without affecting any other level. Using level control allows the operator to switch a video signal to a given destination without changing the audio signal for that destination. This is referred to as a breakaway switch. As well, the operator may source video and audio from two different source devices. With the use of level control the video source is preset on its level and audio is preset on a different level. At the TAKE command the two different source signals switch to a common destination. This is referred to as a split mode switch.

APPENDIX A – SCI PROTOCOL AND INTERFACE

RS232 PROTOCOL COMMANDS

The following commands may be issued from a computer/terminal keyboard or other similar communication control device. This protocol is supported by various control systems provided by other control system manufacturers. Standard ASCII characters are used to create the command strings. The SCI-MRX is not case sensitive, and therefore does not care if capital or lower case letters are used. Please note that spaces are not used in any command strings.

COMMAND: Audio-Follow-Video switch

IxxxOxxx   {RETURN/ENTER}

The **'I'** represents INPUT and the **'O'** OUTPUT. The **'xxx'** represents the one to three digit number of the respective INPUT and OUTPUT. Leading zeros are optional. Valid INPUT numbers for the SCI are **1 to 128**. Valid OUTPUT numbers are **1 to 128**. To generate a TAKE command, press the RETURN/ENTER key on the keyboard. When the SCI receives the request and executes the change, it will respond with an ASCII message **'OK'** (unless disabled - see "N/Y" command explanation).

COMMAND: BREAKAWAY

AxxxOxxx   {RETURN/ENTER}

In this command only the requested input Level (A) will change causing that level to breakaway from the other levels. The **'A'** could actually be **A**,**B**,**C**,**D**,**E**,**F**,**G** or **H**. These eight letters represent the control levels 1-8 respectively. So an **"A"** would correspond to **Level 1**, a **"D"** would represent **Level 4** and so on.. The **'Oxxx'** is the OUTPUT or destination number.

COMMAND: SPLIT:

BxxxCxxxOxxx OR DxxxAxxxOxxx

In these examples, the inputs for two levels are assigned different sources, but both will go to the same OUTPUT or destination. Again, it is not necessary to supply the leading zero in assigning source or destination numbers. **B17C03O04** or **B17C3O4** will both perform the same switch.

Order and number of levels does not matter. Any combination of levels in any order is valid. For example, **D09B21A2C11O9** is a valid sequence.

COMMAND: STATUS

Any OUTPUT's status can be obtained by entering the following protocol sequence:

Sxxx   {RETURN/ENTER}

The **'S'** represents STATUS and the **'xxx'** represents the one to three digit ASCII number of the OUTPUT. Any leading zeros are optional. Press RETURN/ENTER to generate execution. The SCI will respond with the following ASCII message:

Output xxx, L1 xxx, L2 xxx, L3 xxx, L4 xxx, L5 xxx, L6 xxx, L7 xxx, L8 xxx

This will all print on one line on the terminal video screen. The **'xxx'** will indicate the one to three digit ASCII number for the OUTPUT and all the sources for LEVEL 1 to 4 or 1 to 8 in an eight level system.

COMMAND: STATUS ALL

A global status can also be generated. This will give the STATUS for all the active OUTPUTS. By default, those OUTPUTS not yet addressed will be indicated as having INPUT 01 selected.

SA   {RETURN/ENTER}

The **'S'** represents STATUS and the **'A'** represents ALL. As always, press the RETURN/ENTER key to execute the command. The SCI will respond with the following:

L1	L2	L3	L4	L5	L6	L7	L8	OUT
xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx

The current INPUT STATUS for all levels of each OUTPUT will be listed. The number of outputs to which the SCI DIP switches are set (see SCI DIP switch settings) will limit the number of outputs displayed.

Anytime an invalid or incomplete message is sent to the SCI, it will respond with an ASCII **'?'** unless this response is disabled (see "N/Y" command). This will occur for each group of invalid characters it receives. The RETURN/ENTER key is the delimiter between commands. Therefore, invalid characters will not cause a **'?'** response until the RETURN/ENTER key has been sent.

APPENDIX A – SCI PROTOCOL AND INTERFACE

COMMAND: MATRIX SETUP REQUEST

The input/output matrix setup information of the system can be displayed. To do this, send the following command:

? {RETURN/ENTER}

The SCI will respond with the following message:

AVAILABLE OUTPUTS ARE: xxx
AVAILABLE INPUTS ARE: xxx

where '**xxx**' is the number of inputs and outputs set at the SCI DIP switches.

COMMAND: DISABLE RESPONSE

Responses generated by the SCI can be disabled with the following command. The command is:

CTRL-N

This will prevent all SCI responses. No carriage return is required.

COMMAND: ENABLE RESPONSE

At any time, the responses can be resumed. The command is:

CTRL-Y

Again, no carriage return is needed. Please note this process differs from the **XON/XOFF** routine. In that case, the responses are held in a buffer and then all pending messages are sent upon receiving the **XON** command. In this case, the messages are simply discarded and no record of them is kept. In this way, it is possible to tailor a program to allow only a status response but inhibit all other SCI messages.

COMMAND: CLEAR ENTRY

Whenever a wrong key is accidentally pressed or a command needs to be changed, the current command can be cleared by pressing the SPACEBAR. This is always true as long as the RETURN/ENTER key has not yet been pressed. All keystrokes made since the last entry of the RETURN/ENTER key will be erased. The CANCEL command is automatic and does not require the RETURN/ENTER key to be pressed. The format is:

{SPACEBAR}

The SCI will respond by sending a carriage return and linefeed to move the cursor on the screen to the beginning of the next line.

The SCI always gives priority to commands over responses. All commands are executed before any responses are sent. This assures the fastest processing of a change request.

COMMAND: DISABLE CONTROL PANELS

It is possible to disable the remote control panels and give exclusive attention to the serial port for improved response time to incoming serial commands. To halt the scanning of panels press:

PD   {CARRIAGE RETURN}

The response is "**Panels Inactive**." This will cause the polling and updating of any remote panels to stop. This command is especially useful to improve SCI efficiency in systems where control panels are not used. Also, this command can be used to temporarily disable the panel scan, execute time critical serial transactions, and then re-enable the panel scan with the next command.

COMMAND: ENABLE CONTROL PANELS

To re-enable the control panel scan routines press:

PE   {CARRIAGE RETURN}

The response is "**Panels Active**." Now the SCI is fully functional again and the panels will be updated and polled as before. Careful tailoring of programming will allow maximum efficiency in executing serial commands in those applications where execution time is especially critical.

COMMAND: CONTROL PANEL STATUS

The current control panel status can be determined by pressing:

PS   {CARRIAGE RETURN}

This will yield the response of **Panels Active** or **Panels Inactive** depending on the current state.

APPENDIX A – SCI PROTOCOL AND INTERFACE

SPECIAL COMMANDS

There are several special commands available that should be used with care.

COMMAND: SYSTEM HARD REBOOT

It is possible to force a system reset from the serial port, duplicating the function of the RESET switch on the front of the SCI. All outputs are reassigned to source 1, all previously stored data is cleared, all salvo information is erased, and the system will then reboot as though a power-on condition occurred. This hard reboot command is:

CTRL - C

Note no carriage return is required.

COMMAND: SYSTEM SOFT REBOOT

This is a less destructive reset. This method will force the internal watchdog timer to restart the system as though a power-on condition had occurred. No crosspoint or salvo table information is lost. Upon this reset the DIP switch settings of the SCI are read. It is useful to use this reset command when changing the DIP switches without requiring a power down of the SCI. This soft reboot command is:

CTRL - W

Again, no carriage return is required.

COMMAND: CONDENSED STATUS

It is possible to get the status of the system in a condensed format. There are two possible methods. The first is in binary and the second is in packed BCD. The advantage here is a minimal number of bytes are issued from the port and it is a very efficient method of gaining the status from within an external control program. Since these characters may be non-printing ASCII characters it is not useful to use in a terminal package.

The command for a condensed status in binary is:

SB   {RETURN/ENTER}

The command for a condensed BCD status is:

SC   {RETURN/ENTER}

For a detailed explanation of the byte sequence please contact Sigma Electronics software department.

COMMAND: HALT DATA TRANSMIT

The SCI supports the **XON/XOFF** protocol. This is a method, through software, of halting and resuming transmission of data. The **XOFF** is activated by holding the Control key and pressing **'S' (CTRL-S)**. This will halt data transmission.. Incoming commands are still executed during an **XOFF**. It is the responses generated by the SCI that are not sent. They are held in a message buffer until an **XON** is received. Like the CANCEL command, **XOFF** is automatic and does not require the RETURN/ENTER key to be pressed.

COMMAND: RESUME DATA TRANSMIT

XON is activated by holding the Control key and pressing **'Q' (CTRL-Q)**. This will resume transmission of data from the SCI. All pending responses are sent out the serial port in the same sequence in which they were received and stored. Like the CANCEL and XOFF command, **XON** is automatic and does not require the RETURN/ENTER key to be pressed.

SALVO COMMANDS

The SCI-MRX is capable of internally storing **ten** different salvos. A salvo provides a method of switching multiple commands at one time. This "grouping" of switches eliminates delay of switching from the first step to the last step in a multi-step switch. There are commands that pertain exclusively to the creation, edit and execution of a salvo.

The ten distinct Salvo symbols are as follows-

Symbol	Keyboard	Command
!	Shift 1	Salvo 1
@	Shift 2	Salvo 2
#	Shift 3	Salvo 3
$	Shift 4	Salvo 4
%	Shift 5	Salvo 5
^	Shift 6	Salvo 6
&	Shift 7	Salvo 7
*	Shift 8	Salvo 8
(	Shift 9	Salvo 9
)	Shift 0	Salvo 10 (EAS)

SHIFT 1 through SHIFT 0 correspond to salvo 1 through salvo 10. When activating a salvo the first character in the command **must be** the salvo designator symbol; !, @, #, $, %, ^, &, *, (, or). The Salvo stored as Salvo 10 will execute upon a closure applied to the EAS screw terminals on the rear of the master frame. This provides an automatic response to an Emergency Alert System alarm.

APPENDIX A – SCI PROTOCOL AND INTERFACE

COMMAND: STORE SALVO

Creating a transaction to be stored in a salvo is done exactly as a regular transaction except the salvo symbol is the leading character. The following example will store this transaction in salvo 2 (@):

@A10C3O19 {RETURN/ENTER}

This is a split mode transaction stored in salvo number 2 (@ = SHIFT 2),change level 1 (A) to source ten (10) and level 3 (C) to source three (3) of output (O) nineteen (19).

Multiple switches may occur upon a single salvo command. This allows multiple input to output switches to be preloaded and then switch simultaneously upon the execution of the salvo. A typical multiple output salvo would be entered like the following string of commands;

! I 01 O 01 {RETURN/ENTER}
! I 02 O 02 {RETURN/ENTER}
! I 03 O 03 {RETURN/ENTER}
! I 04 O 04 {RETURN/ENTER}
! I 05 O 05 {RETURN/ENTER}
! I 06 O 06 {RETURN/ENTER}
! I 07 O 07 {RETURN/ENTER}
! I 08 O 08 {RETURN/ENTER}
! I 09 O 09 {RETURN/ENTER}
! I 10 O 10 {RETURN/ENTER}
! I 11 O 11 {RETURN/ENTER}
! I 12 O 12 {RETURN/ENTER}
! I 13 O 13 {RETURN/ENTER}
! I 14 O 14 {RETURN/ENTER}
! I 15 O 15 {RETURN/ENTER}
! A 16 B 64 O 16 {RETURN/ENTER}
(No spaces are used between any commands.)

This salvo command is set for Salvo 1 (!) and switches inputs (I) one to fifteen (1 - 15) to outputs (0) one to fifteen (1 - 15) respectively. The last step of salvo 1 performs a split switch of input level 1 (A) from source sixteen (16) and input level 2 (B) from source sixty-four (64) to output (O) sixteen (16). The salvo command is finished with Return/Enter. The number of possible transactions in a salvo is equal to the number of outputs in the system. You can only change each output once in any particular salvo. Switch commands do not need to be in numerical order. If multiple commands are entered for one output, only the last command for that output will be visualized after the execution of the salvo.

COMMAND: SALVO STATUS ALL

The status of a salvo can be examined by prefixing the status command with the salvo symbol.

!SA {RETURN/ENTER}

The example provided is for salvo 1 (!). This example provides the status (S) for all outputs (A). The difference between a normal status check and a salvo status check is anytime a level is not assigned (such as in a breakaway), the unassigned inputs will display dashes "**---**" to indicate these input levels will not be affected by the salvo. The dashed lines would appear at levels 3 (C) and 4 (D) of output 16 for the sample salvo 1 given in the previous command paragraph.

COMMAND: SALVO STATUS SINGLE OUT

Within each salvo a specific output can be checked for the status.

#S9 {RETURN/ENTER}

The example command for salvo 3 (#) would yield the current status (S) for output nine (9).

COMMAND: SALVO ERASE (clear)

There are **six** commands available to erase a salvo or portions of a salvo. To erase an entire salvo use the following command.

$Z {RETURN/ENTER}

In the example above, the command will take salvo 4 ($) erase (Z) the entire contents:

To erase only a specific output , use the command with an output limiter attached.

@Z14 {RETURN/ENTER}

This example for salvo 2 (@) erases (Z) all input assignments for output fourteen (14).

A range of outputs within a salvo can be erased as a group.

!Z11-18 {RETURN/ENTER}

This example for salvo 1 (!) erases (Z) all input assignments for outputs eleven (11) through (-) eighteen (18).

It is possible to erase only one level of a salvo. The following command erases only the level designated for all transactions listed in the command string.

APPENDIX A – SCI PROTOCOL AND INTERFACE

@ZB {RETURN/ENTER}

The example above for salvo 2 (@) will erase (Z) all level 2 (B) entries for each output specified in the salvo.

It is also possible to erase a level for a specific output within a salvo.

#ZC9 {RETURN/ENTER}

The example above for salvo 3 (#) erases (Z) the level 3 (C) input assignment for output nine (9).

A command is available to erase a level within a range of outputs for a particular level.

#ZA12-19 {RETURN/ENTER}

The example above for salvo 3# will erase (Z) all entries for level 1 (A), beginning with output twelve (12) through (-)and including output nineteen (19).

COMMAND: EXECUTE SALVO

A salvo can be executed immediately by choosing the proper salvo symbol and using the execute command.

!X {RETURN/ENTER}

The example above is the salvo 1 (!) execute (X) command.

COMMAND: PRESET SALVO

The command to PRESET a salvo, but not execute it, allows the system to queue a system for an immediate preloaded switch upon the execute command.

$P {RETURN/ENTER}

The example above for salvo 4 ($) presets (P) and holds the salvo. During a salvo preset condition, no other salvo can be accessed. Neither edits nor system transactions are permitted. There are essentially only three options: execute the salvo, cancel the salvo or request a status. This is true whether it is a command from the serial port or a control panel. All other switch commands are ignored during a salvo preset.

A salvo preset has an internal timer of approximately 30 seconds. If a preset salvo is not executed within this time, it will automatically be canceled and a salvo cancel message will be sent out the serial port.

COMMAND: EXECUTE PRESET SALVO

To execute a preset salvo, choose the salvo number/symbol of the preset salvo.

$ {RETURN/ENTER}

The example above will execute salvo 4 ($), which was in the preset mode.

COMMAND: CANCEL PRESET SALVO

A preset salvo can be canceled.

$Q {RETURN/ENTER}

The sample above takes a preset condition for salvo 4 ($) and releases (Q, quit) it. This cancellation of the preset salvo allows normal transactions to resume.

RS422/485 PROTOCOL COMMANDS

Unlike the RS232 commands, the RS422/485 protocol allows for multiple devices to be connected to a computer/terminal at the same time. In order for the computer/terminal to communicate with a device in RS422/485, it must first tell the device to listen. This is the purpose of the logic address. The SCI has four DIP switches reserved for setting the device's logic address. Valid addresses for the SCI are 01-07 (an address of 00 indicates that RS-232 is being used).

The format for RS-422/485 protocol is identical to that of RS232 with one exception. Any RS422/485 command must be have the prefix of a forward slash (/). The forward slash is required on all commands including special commands like **XON/XOFF.**

/xx

The slash (/) is the precursor, and the **'xx'** is the logic address of the device. This is **ALWAYS** a TWO DIGIT NUMBER.

For example, to generate a typical audio-follow-video switch use the sequence below.

/xxIyyyOzzz {RETURN/ENTER}

The forward slash (/) precedes the SCI's two digit logic address **'xx',** the input number is represented by one, two or three digits **'yyy'** and the output or destination is represented by the one, two or three digit **'zzz'**.

APPENDIX A – SCI PROTOCOL AND INTERFACE

SERIAL CONTROL AND MODE SWITCHES

The system configuration DIP switches S2 and S3 are located on the front edge of the SCI-MRX printed circuit board. The power supply frame holds the SCI-MRX module. Remove the front panel of the frame to access the switches. The momentary push-button reset switch S1 is positioned next to S3. See INTRODUCTION for details.

This chart sets the communications Baud Rate.

S2,1	S2,2	Baud Rate
ON	ON	9600
OFF	ON	19200
ON	OFF	38400
OFF	OFF	57600

The Dip switch settings below are configured for a 4 level 32x32 matrix using RS-232 protocol at 38,400 baud rate.

Off [down] / ON [up]

This chart sets the number of switcher inputs (sources).

S2,3	S2,4	S2,5	Input Range
ON	ON	ON	01 - 16
OFF	ON	ON	01 - 32
ON	OFF	ON	01 - 48
OFF	OFF	ON	01 - 64
ON	ON	OFF	01 - 80
OFF	ON	OFF	01 - 96
ON	OFF	OFF	01 - 112
OFF	OFF	OFF	01 - 128

This chart sets the number of switcher outputs (destinations).

S2,6	S2,7	S2,8	Output Range
ON	ON	ON	01 - 16
OFF	ON	ON	01 - 32
ON	OFF	ON	01 - 48
OFF	OFF	ON	01 - 64
ON	ON	OFF	01 - 80
OFF	ON	OFF	01 - 96
ON	OFF	OFF	01 - 112
OFF	OFF	OFF	01 - 128

This chart indicates protocol format and logical address.

S2,9	S2,10	S2,11	Logic Address
ON	ON	ON	RS-232*
OFF	ON	ON	01
ON	OFF	ON	02
OFF	OFF	ON	03
ON	ON	OFF	04
OFF	ON	OFF	05
ON	OFF	OFF	06
OFF	OFF	OFF	07

S2

S3

R
E
S
E
T

Use address 00 for RS-232. All other settings are for RS-422 operation.
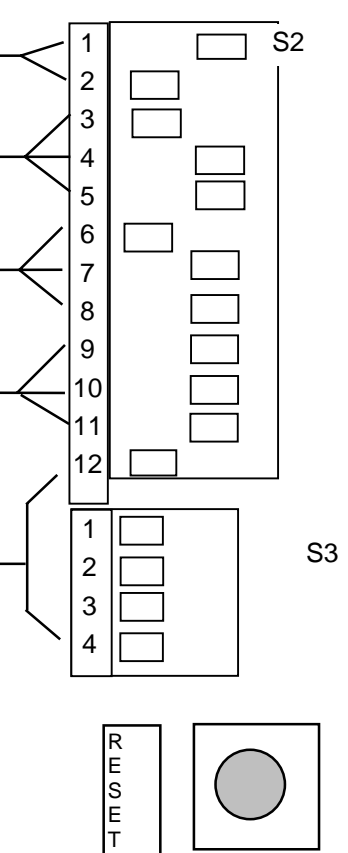
Control Level		Control Panel Type		Handshaking		Reserved	Panel Scan	
S2, 12	Levels	S3,1	Panel Type	S3.2	Handshaking	S3.3	S3.4	Panel Scan
ON	8	ON	Numeric	ON	Enabled	Reserved	ON	Scan ALL
OFF	4	OFF	Alpha	OFF	Disabled		OFF	Scan Active

NOTE 1 - Fixed serial communications parameters are: 8 Character bits   1 Stop bit   No Parity
NOTE 2 - Synchronous mode switching occurs on line 10 in NTSC and line 7 in PAL when reference is supplied.

APPENDIX A – SCI PROTOCOL AND INTERFACE

JUMPER SELECTION

SERIAL PORT COMMUNICATION FORMAT

RS-232 SELECTION   JP2, 9 position jumper with header attached, factory default.

RS-422/485 SELECTION   JP1, 9 position jumper, move header from JP2 to this position for RS-422/485.
                                 J4, RS-422/RS-485 selector, factory default is RS-422
                                 J5, Delete for RS-422 and RS-232 (factory default), Add for RS-485
                                 J6, Delete for RS-422 and RS-232 (factory default), Add for RS-485

Reserved Function   JP3, programming interface for U6 (factory reserved)

9 PIN 'D' RS-422/485 WIRING

PIN #	FUNCTION∗	DIRECTION
1	Ground	----
2	Transmit A	Output (TX Data -)
3	Receive B	Input (RCV Data +)
4	Receive Common	----
5	N/C	----
6	Transmit Common	----
7	Transmit B	Output (TX Data +)
8	Receive A	Input (RCV Data -)
9	Frame Ground	----

∗(Same as standard: ANSI/SMPTE 207M/1984)

APPENDIX A – SCI PROTOCOL AND INTERFACE

9 PIN 'D' RS-232 PIN ASSIGNMENT

PIN #	FUNCTION∗	DIRECTION
1	N/C	----
2	RECEIVE DATA	INPUT to SCI-MRX
3	TRANSMIT DATA	OUTPUT from SCI-MRX
4	DATA TERMINAL READY	OUTPUT from SCI-MRX
5	SIGNAL GROUND	N/A
6	DATA SET READY	INPUT to SCI-MRX
7	READY TO SEND	OUTPUT from SCI-MRX
8	CLEAR TO SEND	INPUT to SCI-MRX
9	N/C	----

The Pin assignments noted are per the RS-232 standard. Although the standard defines the use of twenty five (25) Pins, only nine (9) are required for PC serial communications. Of those nine pins, only seven are required for communication to the SCI when handshaking is required. If handshaking is not required only three pins will be active. There is no need to jumper the handshaking pins when unused. Consult the control device manufacturer's data sheet to determine proper wiring.

PIN OUT

5 4 3 2 1

9 8 7 6
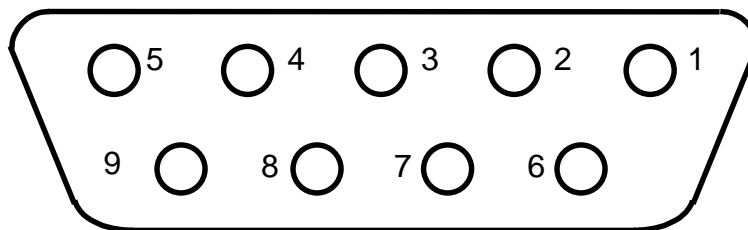
SCI-MRX Serial Port

APPENDIX A – SCI PROTOCOL AND INTERFACE

RS-232C WIRING

SCI-MRX 9 PIN 'D'

PIN	SIGNAL DESIGNATION	SERIAL PORT CONNECTIONS (COMM 1-DCE)		SERIAL PORT CONNECTIONS (COMM 2-DTE)
1-	N/C	N/C		N/C
2-	RECEIVE DATA (RXD) [INPUT]	RXD	OR	TXD
3-	TRANSMIT DATA (TXD) [OUTPUT]	TXD	OR	RXD
4-	DATA TERMINAL READY (DTR) [OUTPUT]	CTS		CTS
5-	SIGNAL GROUND	GROUND		GROUND
6-	DATA SET READY (DSR) [INPUT]	RTS		RTS
7-	READY TO SEND (RTS) [OUTPUT]	DSR		DSR
8-	CLEAR TO SEND (CTS) [INPUT]	DTR		DTR
9-	N/C	N/C		N/C

Although the RS-232C standard defines the use of 25 pins, only nine of those are needed for basic PC serial communications. Of those nine, only seven are required for serial communications with the SCI-MRX. The above wiring chart is typical for most IBM and compatible type PC's. However, it is always best to check with the manufacturer's wiring specifications to determine exact pin assignments before beginning. This is especially true if using COMM 1, since some manufacturers use a 9 pin 'D' connector instead of a 25 pin 'D'. Regardless of the connector, the signal connections are the same. RXD and TXD are reversed depending upon whether the serial port is configured as a DTE (data terminal equipment) or a DCE (data communications equipment).

If the control equipment does not require handshaking, there is no need to jumper the pins on the SCI-MRX. When handshaking is not required only 3 pins will be used: TXD, RXD and Signal Ground. All other pins will have no connection.

APPENDIX B - SPECIFICATIONS

SYSTEM CONTROL INTERFACE MODULE (MRX-SCI)

Data Transmission System ....RS-232 & RS-422
Serial Port Baud Rate ....Up to 57.6 Kb baud
Control Levels..Four or eight
Communication Line ....Coaxial, up to 2000 feet
Control Panels ....Up to 64 on 2 Comm. Lines
Number of Salvos ....Four, from Master Control Panel
Protocol ....Simple ASCII, supports Xon/Xoff
External Sync Reference ....Composite Sync or Blackburst
Connectors ....(2) BNC for Comm. Line & External Sync.
....9 Pin "D" for Serial Port

ANALOG VIDEO FRAME (MRX-24V, MRX-32V)

Input Impedance ....75Ω, terminated
Input Level ....1.4V p-p maximum
Input Coupling...DC
Input Return Loss ....35dB minimum to 5MHz
Input DC Offset...±0.3V
Tilt, field and line..<1% maximum
Output Impedance ....75Ω, source terminated
Output Level ....1.4V p-p maximum
Output Coupling..DC
Differential Phase ....<0.15° @ 4.43MHz, 10-90% APL
Differential Gain..<0.15% @ 4.43MHz %, 10-90% APL
Frequency Response...±0.1dB from DC to 25 MHz
Bandwidth..50 MHz
Input Gain Variation ....<±0.15 dB maximum
Crosstalk ....>40 dB below 1V p-p @ 5 MHz
Hum & Noise..-65 dB rms., below 1Vp-p
Connectors ....BNC

ANALOG AUDIO FRAME (MRX-24A, MRX-32A)

Input Impedance ....30 KΩ, balanced
Input Level ....+24 dBu, maximum
Output Level ....+24 dBu max. into 600Ω
....+26 dBu max. into high impedance
Output Impedance ....100Ω, balanced
Frequency Response...±0.1 dB 10 Hz to 30 KHz, any level
....±0.25 dB to 100 KHz
Hum & Noise..< -90 dBu with 22KHz low-pass filter
Total Harmonic Distortion..................................<0.05% maximum, worst case @ +24 dBu
Crosstalk...90 dB min. below referenced channel 10Hz to 20kHz,
.... all inputs driven, 600Ω loads. 110 dB typ.
Gain...Unity ±0.2 dB, 600Ω termination
Connectors..3 Pin pluggable terminals

APPENDIX B - SPECIFICATIONS

DIGITAL VIDEO FRAME (MRX-DVF)

Signal Type	SMPTE 259M
Connectors	75 Ohm BNC
Inputs	32, single-ended, terminated, 800mV p-p
Input return loss	15 dB min. from 5 MHz to 270 MHz
Equalization	Auto, 750 feet, with Belden 1694A or equiv.
Outputs	32, 800mV p-p max. (+/-10%)
Output return loss	15 dB min. from 5 MHz to 270 MHz
Output DC offset	0.0 V +/- 0.5 V
Rise and Fall time	0.4ns < tr < 1.50ns, 20% to 80% (rise time)
	0.4ns < tf < 1.50ns, 20% to 80% (fall time)
	| tr - tf | < 0.5ns (difference of tr and tf < 0.5ns)
Overshoot	maximum 10% of total amplitude
Serial Jitter	500ps p-p max.
Reclocking	Automatic
Electrical length	11ns typical
Operating temperature	0 to 50 degrees Celsius

DIGITAL AUDIO FRAME – Balanced (MRX-TDAF)

Signal Type	AES-3 1992
Connectors	3 pin removable terminal block
Inputs	32, differential, terminated, 7V p-p max. Transformer Coupled, AES-3 1992
Input impedance	110 ohms (+/-20%) from 0.1 MHz to 6.0 MHz
Input cable length	500 feet maximum
Outputs	32, differential, 7V p-p max. (4.3Vp-p typical) Transformer Coupled, AES-3 1992
Output impedance	110 ohms (+/-20%) from 0.1 MHz to 6.0 MHz
Output Rise and Fall time	5ns < tr < 30ns, 10% to 90% (rise time) 5ns < tf < 30ns, 10% to 90% (fall time)
Serial Data Rates	3.072 Mb/s max. (Fs = 48 kHz max.)
Serial Data Jitter	±20ns p-p max.
Reclocking	Automatic
Input common mode rejection	7V peak from DC to 20 kHz
Output common mode noise	30 dB min. below signal from DC to 6 MHz
Electrical length	80ns typical
Operating temperature	0 to 50 degrees Celsius

APPENDIX B - SPECIFICATIONS

DIGITAL AUDIO FRAME – Unbalanced (MRX-CDAF)

Signal Type..AES-3id 1995
Connectors ....75 Ohm BNC
Inputs..32, single-ended, terminated, 1V p-p max.
Input return loss ....15 dB min. from 0.1 MHz to 6.0 MHz
Input impedance ....75 ohms from 0.1 MHz to 6.0 MHz
Input cable length ....1000 feet maximum
Outputs ....32, single-ended, 1V p-p max.
Output return loss ....15 dB min. from 0.1 MHz to 6.0 MHz
Output impedance...75 ohms from 0.1 MHz to 6.0 MHz
Output Rise and Fall time................................30ns < tr < 44ns, 10% to 90% (rise time)
                                                                         30ns < tf < 44ns, 10% to 90% (fall time)
Serial Data Rates..3.072 Mb/s max. (Fs = 48 kHz max.)
Serial Data Jitter ....±20ns p-p max.
Reclocking ....Automatic
Electrical length ....80ns typical
Operating temperature....................................0 to 50 degrees Celsius

POWER SUPPLY FRAME (MRX-PSF)

AC Input Voltage...100-240 VAC, 50-60 Hz
AC Input Connectors.......................................3 pin IEC (2 total per frame)
Power Supply Type..AC-DC Switching, forced air cooling
Removable Supply Model Name ....MRX-PSU
Max. Removable Supplies................................2 in non-redundant configuration
                                                                         4 in redundant configuration
DC Outputs...2 per MRX-PSU (8 total per frame)
DC Output Connectors.....................................4 pin for MRX Analog
                                                                         6 pin for MRX Digital
DC Output Voltage...±18VDC for MRX Analog
                                                                         Dual +18VDC for MRX Digital
AC Input Power...85W Supplying Maximum Load for MRX Digital
                                                                             Includes MRX-DVF and MRX-TDAF (or CDAF)
                                                                         60W Supplying Maximum Load for MRX Analog
                                                                             Includes MRF-V and two frames of MRF-A
                                                                         120W Supplying Max. Load for MRX Analog & Digital
Operating temperature....................................0 to 50 degrees Celsius

MECHANICAL

Switch and Power Frame ....1 RU   1.75" H x 19" W x 10" D
Master Control Panel (SYX &SYX-3232) ....2 RU   3.5" H x 19" W x 2.5" D
Single Bus Panels (SBX-32) ....2 RU   3.5" H x 19" W x 2.5" D
Alpha-Numeric (ANX) ....1 RU   1.75" H x 19" W x 2.5" D
Rapid Take Panel (RTX-32)...............................1 RU   1.75" H x 19" W x 2.5" D