Date: July 1997 **File No. TB97-01**

Technical Bulletin

re: RS-232 Command Enhancements for *Marquee* Projectors

This bulletin documents the RS-232 new functions and protocol available in Marquee main software version 4.0 and higher.

● *Brief History of Marquee RS-232 Communications*

Connecting an external control device such as an AMX or Crestron controller to the RS-232 port on a Marquee projector enables automated control of individual or multiple projectors according to custom requirements. The original RS-232 commands described in *Technical Bulletin TB96-05* (June 1996) enable the controller to be programmed to emulate a projector keypad. The protocol (message structure) used for issuing these commands remains valid and usable for any Marquee projector with software version 2.0 or higher. In addition, with software version 4.0 and higher, you can use a simpler RS-232 protocol to issue these original commands as well as several other new commands.

● *The RS-232 Enhancements — CHIEF FEATURES IN SOFTWARE VERSION 4.0+*

IMPROVED SOURCE SWITCHING

Switch sources by sending one message rather than six.

DIRECT SETTING OF PARAMETERS

Use a numerical value to set each projector function at the level desired.

DIRECT SELECTION OF AN INTERNAL FREQUENCY

Use a numerical value to select or read a specific internal frequency.

DIRECT SELECTION OF AN INTERNAL TEST PATTERN

Use a numerical value to select or read a specific test pattern.

SET OR READ PROJECTOR ADDRESS / NUMBER

Specify the numerical address (name) of a projector.

OPTIONAL CHECKSUM CALCULATIONS

Substitute “zero” for the checksum value if you do not wish to actually calculate and use a checksum.

SIMPLE SIGNAL STATUS FEEDBACK

Determine basic status of projector and any input connected.

COMPATIBLE WITH ECP or VISTAPRO BINARY PROTOCOL

Transport software originally written for the Marquee can be utilized in mixed networks without disrupting normal projector function. For some messages, all projectors — the Marquee, ECP and *VistaPro* — will respond.

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NOTE: This bulletin is intended for technicians familiar with controller applications and programming. For highly specialized applications beyond simple projector control, please contact Electrohome for additional technical assistance.

● *System Requirements and Setup*

The RS-232 commands in main software V4.0 can be used with any Marquee projector that has the Control Board #02-2x0336-0xP installed. The software is backwards compatible with existing Marquee 8110 Plus, 8500 and 9500 projectors.

As shown below, connect the controller only to the "IN" port of the Marquee projector, never directly to a switcher. Use a quality cable of up to 100 feet in length.

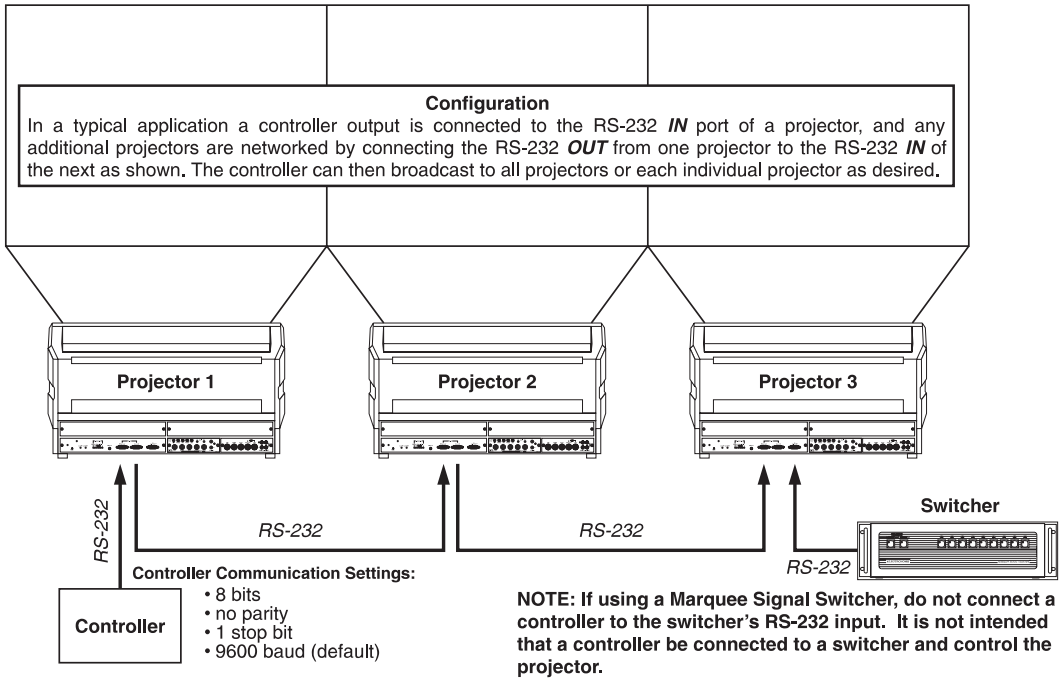

Figure 1. Typical RS-232 Control Application

● *Choosing Which Protocol to Use*

Refer to Table 1 on the following page to determine how an RS-232 message for any command you wish to use can be structured (i.e., which protocol will be recognized). Most commands can be structured according to the protocol in either software version while some commands require the protocol in V4.0 software as shown.

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The functions below are supported by this software ➡	Either Version	V4.0 or higher only
Power ON/OFF	4	
Standby ON/OFF Key (keys disabled)	4	
Audio Mute Key ON/OFF (toggle)	4	
Select Channel via number keys	4	
"#" key	4	
Number keys 0,1,2,3,4,5,6,7,8,9	4	
Volume (Adjust)	4	
Contrast (Adjust)	4	
Brightness (Adjust)	4	
Color (Adjust)	4	
Tint (Adjust)	4	
Detail (Adjust)	4	
Source (key)	4	
Pic (key)	4	
Geom (key)	4	
Conv (key)	4	
Help (key)	4	
Util (key)	4	
Up Arrow (key)	4	
Down Arrow (key)	4	
Left Arrow (key)	4	
Right Arrow (key)	4	
Proj (key)	4	
Exit (key)	4	
Enter (key)	4	
✻ Key (key)	4	
Ping (Note: replies differ between versions)	4	
Picture Mute ON/OFF (Set and Read)		4
Audio Mute ON/OFF (Set and Read)		4
Standby ON/OFF, no lockouts (Set and Read)		4
Volume (Set and Read)		4
Contrast (Set and Read)		4
Brightness (Set and Read)		4
Color (Set and Read)		4
Tint (Set and Read)		4
Detail (Set and Read)		4
Channel (Select and Read)		4
Input switcher or slot (Select and Read)		4
Recall Memory (Select and Read)		4
Internal Frequency (Select and Read)		4
Signal Status (Read)		4
Projector Address		4
Diagnostics: Internal Test Pattern		4

TABLE 1. Commands and Protocol Required

NOTES: 1) The RS-232 communications as described in the remainder of this document apply only to projector software version 4.0 and higher. Please refer to ELECTROHOME Technical Bulletin TB06-05 (June 1996) if you are using an earlier version of software (V2.0 — V3.x) or if you wish to execute a command using the earlier commands or protocol. 2) Method of communication directly to the IOP has changed. Contact Electrohome for assistance if previous commands other than Power or Key were being used in the past.

● *Data Transmission Structure*

A basic understanding of RS-232 data transmission structure enables you to begin programming automated controls for the Marquee projector. Once you have become familiar with this structure, refer to the two tables later in this document. These tables list the specific binary codes required for all available commands and provide examples of commands most commonly used in typical applications. Use these tables to quickly begin programming the controller without having to determine each complete data stream yourself.

Every Marquee serial communication consists of two parts: the transport layer and the message. In general, information in the transport layer determines how information is passed to and from the projector and the message contains the specific information being passed. Both parts are shown in Figure 2 and are further described below.

NOTE:) Throughout this document a number preceded by a "$" is a hexadecimal value.

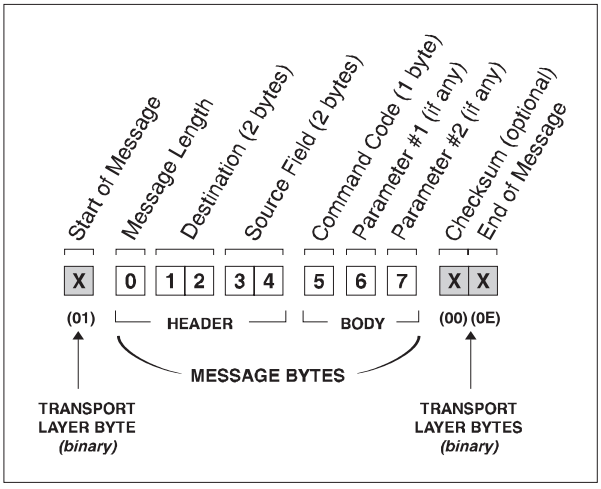

Figure 2. A Complete RS-232 Data Transmission

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● *Transport Layer*

Every message must include a transport layer in order to be recognized as a complete RS-232 data transmission. As shown in Figure 2, transport code appears at the beginning and end of every RS-232 communication. A transport layer has three main functions:

1) To mark the start and finish of each message.
2) To prevent data overflow.
3) To separate transport layer codes from message data.

Special control codes reserved only for the transport layer are shown in Table 2.

BINARY (HEX) VALUE	MNEMONIC	DESCRIPTION	FUNCTION
$01	SOH	start of header	start of message
$0E	SO	shift out	end of message
$13	XOFF	transmit off	stop transmission
$11	XON	transmit on	resume transmission
$1B	ESC	escape	next byte has been shifted

TABLE 2 *Transport Layer Special Control Codes*

$01 AND $0E (MESSAGE START AND END)

Use the ***$01*** control code to preface each and every transmission. This byte indicates to a network receiver that the next byte is the first byte of a new message. Any message which (for some reason) is partially received prior to the ***$01*** will be discarded.

The ***$0E*** control code signifies the end of each and every transmitted message. It signals to the receiving network software that the message has been completely transmitted.

$13 AND $11 (STOP AND RESUME)

Normally messages can be sent to the projector before processing of earlier messages has been completed — the projector will just store messages in a buffer until ready to process. However, if a series of messages is sent it is possible that the projector will not be able to process them as fast as they are being transmitted and the buffer will become full. If this happens, the projector will immediately send the ***$13*** (XOFF) code to halt further transmission. This instructs the controller (and any devices preparing to transmit) to cease transmission within three characters transmission time. At 9600 baud (the default baud rate), this gives the controller about three milliseconds to respond. The projector is able to accommodate the receipt of at least three more bytes after it sends ***$13*** (XOFF) — additional bytes may be lost. When the buffer is once again available, the projector will send a ***$11*** (XON) command to resume transmission.

NOTE: XON and XOFF controls apply to both directions of communication.

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$1B (ESCAPE)

Occasionally a byte within a message may have the same value as one of the special control codes reserved for the transport layer. If this occurs, ***$1B*** must be used to "escape" the byte so that it is not mistaken for a transport layer control code. “Escape” a byte by inserting an ESC character (***$1B***) into the data stream just ahead of the message byte in question and then adding 128 (***$80***) to the value of the message byte. This effectively sets the MSB (most significant bit) high, moving the value of the byte out of the range of values reserved for transport control codes.

On the receiving end, the transport layer software recognizes the escape sequence and strips the ***$1B*** (ESC) from the stream. The next data byte will have its MSB reset which restores it back to its original value.

● *Message Format*

The other portion of an RS-232 communication is the message itself (see Figure 2 again). A message portion is a sequence of up to 64 bytes — always a five-byte ***header*** followed by a variable length ***body***. The header supplies the information needed for routing the messages within the projector network, and the body contains the specific projector control data. These two message components are further described below.

HEADER (NETWORK/PROJECTOR ADDRESSING)

The message header consists of three main parts:

1) Message Length: This byte contains a value which declares the length of the message as a specific number of bytes. Note that message length does *not* include bytes from the transport layer.
2) Destination and **3) Return Address (Source) Fields:** These fields contain two sixteen-bit addresses — one for the message destination and one for the source. A breakdown of each address field is shown in Figure 3. Note that Near and Far Port Address bits are now ignored — while it is strongly recommended that these bits be set to “0” to ensure compatibility with future releases of software, it is not yet mandatory to do so. Bit #14, however, *must* be set to 0.

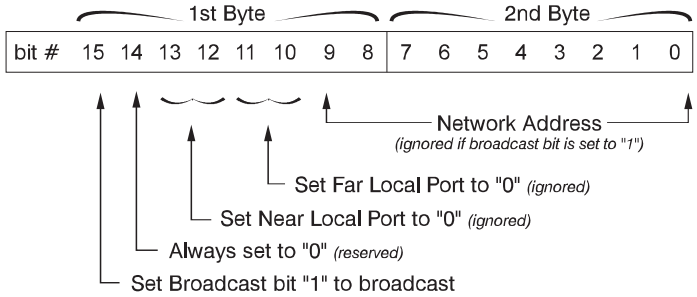

Figure 3 *Format of Address Fields*

Set the Broadcast flag to "0" if a specific projector is to respond, set to "1" if all projectors are to respond. Always set Bit 14 to "0" and, if at all possible, set Bits 10, 11, 12 and 13 to “0” as well.

Bits 0 through 9 contain the Network Address. Possible Network Addresses are shown in Table 3 (decimal values shown). For the Destination Address field, you should use a projector number. For the Source field, use the network controller address (note that the value for a projector number may require an ESC — see Transport Layer codes, above).

START	FINISH	DEVICE TYPE
0	999	projector
1000	1009	switcher
1010	1019	ACON
1020	1022	not assigned
1023	1023	network controller

TABLE 3 *Network Address Assignments*

BODY

The body of a message can consist of one or more bytes, depending on the number of details required to complete the specific command at hand.

The first byte of the message body represents the type of message being issued. There are three types of messages: a ***Set*** message, a ***Request*** message, or a ***Reply*** message. For example, the first byte may be “***Set*** Power” (turn the projector on or off) or “***Request*** Channel” (find out what the channel is) or “***Reply*** with Signal Status” (relay the current channel number). The binary message codes for each possible command are listed in Table 4.

The next byte(s) is the actual hex value for the parameter in question. For example, to set the volume to “0” this second byte must be “00”. To set it to 64, this byte must be “$40”. Each parameter (there may be more than one, depending on the command) requires at least one byte in the message. Refer to Table 4 for a list of message codes and parameter codes. Examples of entire specific commands using these codes appear in Table 5.

NOTES: 1) Most “Request” messages have no parameter data. 2) Do not broadcast a Request to more than one projector. 3) “Set” and “Reply” messages usually have the same data in the same format.

● *Optional Checksum*

It is no longer necessary to calculate and include an eight-bit additive sum as the next-to-last byte in every data transmission. Note that you must still include the checksum *field* in each message stream, but if the value assigned is “$00” the checksum will be ignored. If you still wish to use an accurate checksum for maximum message security, calculate the checksum value as follows:

1. Take the message before the transport layer bytes have been added.
2. Add the bytes together.
3. Divide the sum by 256 and take the remainder. The remainder value is the checksum.

The receiving projector software collects all of the message bytes as defined in the first byte of the message, then creates its own checksum value for comparison with the received checksum. If the values match, the message is considered to have been correctly received—otherwise the message is discarded.

NOTE: Transport layer bytes including ESC (and the resultant top bit set) are NOT included in the checksum. See ***Transport Layer****.*

● *Command Codes*

Table 4 lists all 1-byte hex command codes now available on the `Marquee`. The first column identifies each projector control, with the applicable set/request/reply command codes listed in the next two columns — one of these codes appears as the first byte *after* the header in any message. The fourth column lists any parameters that may apply to the function at hand, with P1 representing the first parameter of the data sent (such as switcher number), P2 representing the second parameter of the data sent (such as slot number) and P3 representing the third parameter (such as vertical frequency). These bytes follow the command code byte. The last column briefly describes what each "set" command does.

NOTES: 1) Each parameter allows a limited range of values — these values are shown in Table 4 in ***decimal format****. 2) The projector will convert any out-of-range value to the nearest maximum value allowed. For example, "set color to 100" will set the color to its maximum value of 63. 3) Values are treated as unsigned. So -1 in a byte is treated as 255.*

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Table 4. Command Codes and Descriptions

Function	Command Code		Parameter(s) *"Set" and "Reply" msg."*	Description *("set" function)*
	Set	**Request or Reply**		
Power ON/OFF	$08	$88	P1: 0 = Off 1 = On 2 = Between	Turn projector off or on. NOTE: If "2", the projector is currently in the process of powering up. In this state, any RS-232 commands (other than "Power Off") will be ignored and discarded.
Standby ON/OFF	$3D	$BD	P1: 0 = Off 1 = On	"On" blanks the picture and mutes the audio (and is same as sending separate commands to blank picture and mute audio). The projector remains operational while in standby. "Off" turns picture and audio back on. See page 15.
Picture Mute ON/OFF	$0E	$8E	P1: 0 = Off 1 = On	"On" blanks the picture only — the rest of the projector remains operational. You can go into this mode, then switch sources or change a setting, and then leave ("Off) to regain the picture. See page 15.
Audio Mute ON/OFF	$0D	$8D	P1: 0 = Off 1 = On	Turn the audio off or on. The rest of the projector remains operational.
Volume Level	$34	$B4	P1: 0-127	Set the volume level of the current slot.
Contrast Level	$56	$D6	P1: 0-127	Set the contrast level of the current slot.
Brightness Level	$55	$D5	P1: 0-255	Set the brightness level of the current slot.
Color Level	$57	$D7	P1: 0-63	Set the color level of the current slot.
Tint Level	$58	$D8	P1: 0-63	Set the tint level of the current slot.
Detail Level	$59	$D9	P1: 0-63	Set the detail level of the current slot.
Channel ##	$0B	$8B	P1: 1-99	Select channel ##. 0 = no channel
Input (Switcher, Slot)	$09	$89	P1 (switcher#): 0-9 P2 (slot#): 1-9	Select input. If P1 = 0 (projector) then: Slot 1 = standard RGB, VIM Slot 2 = optional interface card, into VIM Slot 3 = Composite (on decoder) Slot 4 = Composite (on decoder) Slot 5 = S-Video (on decoder) Slot 6 = S-Video (on decoder)
Recall Memory	$0C	$8C	P1: 0-99	Select recall memory. 0 = none
Internal Frequency	$35	$B5	P1: 0-6	Select internal frequency. 0 = current external signal. 1-6 = one of the internal frequencies from the Marquee "Select Internal Frequency" menu.
Key Code	$63	n/a	P1 = Code	Emulate the function of a key on the keypad. Any additional parameters sent are ignored. See *Technical Bulletin TB96-05 (June 1996).*

Note: Parameter values are shown in decimal format

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Table 4, continued

Function	Command Code		Parameter(s) *"Set" and "Reply" msg."*	Description *("set" function)*
	Set	**Request or Reply**		
Projector Address	$02	$82	P1: 0-999	Set projector to a new address. NOTE: The next message sent must either contain the new address or it must be a broadcast message.
Signal Status	n/a	$91	P1: 3 options: 0 = frequency P2: Horizontal P3: Vertical 1 = state P2 = 0: Good P2 = 1: Changing P2 = 2: Error 2 = sync P2 = see right ➡	Request frequency, state, or sync of current input signal. Reply with frequency of current input signal. Reply with state of current input signal. Good = locked signal Changing = signal is currently changing, as in a source switch Error = signal is unstable or missing NOTE: sync errors cannot be detected if a signal has one of the following **vertical** frequencies (all ± 2.00 Hz) as well as one of the following **horizontal** frequencies (± .120 kHz): **vertical:** **horizontal:** 50.0 Hz 15.62*2 kHz 59.95 Hz 15.73*2 kHz 100 Hz 119.9 Hz Reply with sync type of current input signal. P2: 0 = no sync 1 = sync-on-green 2 = composite sync 3 = separate H sync 6 = sync from decoder 7 = sync on internal
Ping	n/a	$81	P1 = 2 (Marquee 68k) P2 = 0-99 P3 = 0-99 P4 = a-z P5 = 0-999 P6 = 0	Request/read general projector information (type and software version) Software version, major Software version, minor Software version, maintenance Software version, beta number Software version, type (always 0 for now). *See page 18 for additional information.*

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Table 4, continued

Function	Command Code		Parameter(s) *"Set" and "Reply" msg."*	Description *("set" function)*
	Set	**Request or Reply**		
Diagnostic: Internal Test Pattern	$7F	$FF	P1: 7 (test ptn.) P2: Various: 0 = external video 7 = black 19 = dots in xhatch 20 = dots only 21 = gray scale 17 = white field 22 = dbl. xhatch 23 = xhatch	Run a diagnostic, such as "Test Pattern". P1 = $07 (runs the "Test Pattern" diagnostic). In Replies to "set" command: 7 0 = OK 7 1 = pattern not available

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● *Creating Simple Messages*

Figure 4 below illustrates a complete RS-232 data transmission using the hex command codes from Table 4. In this example, the projector is “0” and the message is coming from the controller (always 1023). Note that in this example contrast ***level*** is the only parameter involved.

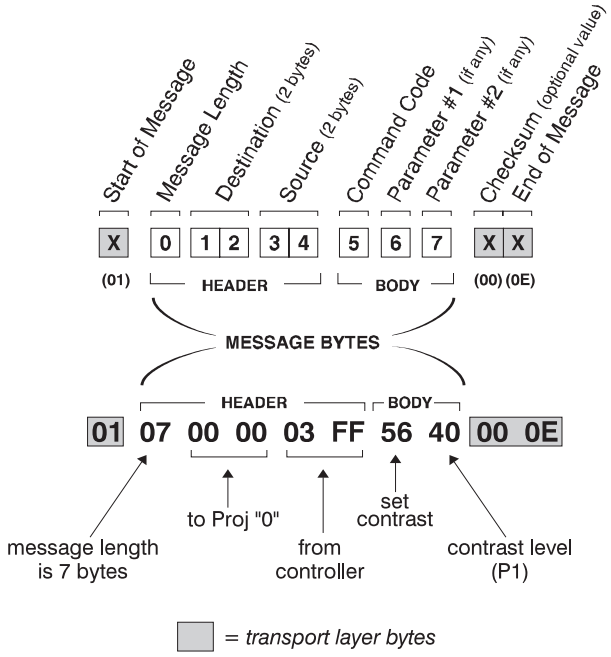

Figure 4. The “set contrast to 64” command

The above data transmission is one of the sample messages in Table 5. A comparison with code in the other three “contrast” commands reveals how identically structured transmissions differ in content and function. For example, note that the request message has no data (P1), thus it is only 6 bytes in length. In the resulting reply message from the projector, the controller (03 FF) is now the destination and the projector (00 00) is the source, thus the codes for these two fields are likewise reversed. The “D6” byte signifying request or reply is drawn from the list of codes in Table 4.

Note that several of the sample messages in Table 5 include escape ($1B) codes to prevent message bytes from being interpreted as transport layer bytes. For example, in the first four controls shown (power, standby, picture mute and audio mute), the normal “on” code of $01 must be escaped with the insertion of $1B and the addition of $80 to $01. Thus “$01” is replaced with “$1B $81”.

Commands that are more complex (standby, picture mute, projector address, signal status, ping, and the test pattern diagnostic) are described in detail on the pages following Table 5.

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● *Sample Data Transmissions*

Table 5 shows complete examples of common binary commands for projector control. All are for projector "0".

Table 5. RS-232 Commands in v.4.0

Set Power Off	01 07 00 00 03 FF 08 00 00 0E	Set Brightness to 0	01 07 00 00 03 FF 55 00 00 0E
Set Power On	01 07 00 00 03 FF 08 1B 81 00 0E	Set Brightness to 128	01 07 00 00 03 FF 55 80 00 0E
Request Power Status	01 06 00 00 03 FF 88 00 0E	Request Brightness Value	01 06 00 00 03 FF D5 00 0E
Reply with Power Status	01 07 03 FF 00 00 88 1B 81 00 0E (On)	Reply with Brightness Value	01 07 03 FF 00 00 D5 80 00 0E (128, 50%)
Set Standby Off	01 07 00 00 03 FF 3D 00 00 0E	Set Color to 0	01 07 00 00 03 FF 57 00 00 0E
Set Standby On	01 07 00 00 03 FF 3D 1B 81 00 0E	Set Color to 32	01 07 00 00 03 FF 57 20 00 0E
Request Standby Status	01 06 00 00 03 FF BD 00 0E	Request Color Value	01 06 00 00 03 FF D7 00 0E
Reply with Standby Status	01 07 03 FF 00 00 BD 1B 81 00 0E (On)	Reply with Color Value	01 07 03 FF 00 00 D7 20 00 0E (32, 50%)
Set Pic Mute Off	01 07 00 00 03 FF 1B 8E 00 00 0E	Set Tint to 0	01 07 00 00 03 FF 58 00 00 0E
Set Pic Mute On	01 07 00 00 03 FF 1B 8E 1B 81 00 0E	Set Tint to 32	01 07 00 00 03 FF 58 20 00 0E
Request Pic Mute Status	01 06 00 00 03 FF 8E 00 0E	Request Tint Value	01 06 00 00 03 FF D8 00 0E
Reply with Pic Mute Status	01 07 03 FF 00 00 8E 1B 81 00 0E (On)	Reply with Tint Value	01 07 03 FF 00 00 D8 20 00 0E (32, 50%)
Set Audio Mute Off	01 07 00 00 03 FF 0D 00 00 0E	Set Detail to 0	01 07 00 00 03 FF 59 00 00 0E
Set Audio Mute On	01 07 00 00 03 FF 0D 1B 81 00 0E	Set Detail to 32	01 07 00 00 03 FF 59 20 00 0E
Request Audio Mute Status	01 06 00 00 03 FF 8D 00 0E	Request Detail Value	01 06 00 00 03 FF D9 00 0E
Reply with Audio Mute Status	01 07 03 FF 00 00 8D 1B 81 00 0E (On)	Reply with Detail Value	01 07 03 FF 00 00 D9 20 00 0E (32, 50%)
Set Contrast to 0	01 07 00 00 03 FF 56 00 00 0E	Select Channel 1	01 07 00 00 03 FF 0B 1B 81 00 0E
Set Contrast to 64	01 07 00 00 03 FF 56 40 00 0E	Select Channel 3	01 07 00 00 03 FF 0B 03 00 0E
Request Contrast Value	01 06 00 00 03 FF D6 00 0E	Request Current Channel	01 06 00 00 03 FF 8B 00 0E
Reply with Contrast Value	01 07 03 FF 00 00 D6 40 00 0E (64, 50%)	Reply with Channel	01 07 03 FF 00 00 8B 03 00 0E (channel 3)
Set Volume to 0	01 07 00 00 03 FF 34 00 00 0E	Select Input (0,1)	01 08 00 00 03 FF 09 00 1B 81 00 0E
Set Volume to 64	01 07 00 00 03 FF 34 40 00 0E	Select Input (1,5)	01 08 00 00 03 FF 09 1B 81 05 00 0E
Request Volume Value	01 06 00 00 03 FF B4 00 0E	Request Current Input	01 06 00 00 03 FF 89 00 0E
Reply Volume Value	01 07 03 FF 00 00 B4 40 00 0E	Reply with Input	01 08 03 FF 00 00 89 1B 81 05 00 0E (switcher 1, slot 5)

continued…

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Table 5, continued

Select Recall (00)	01 07 00 00 03 FF 0C 00 00 0E
Select Recall (15)	01 07 00 00 03 FF 0C 0F 00 0E
Request Current Recall	01 06 00 00 03 FF 8C 00 0E
Reply with Recall	01 07 03 FF 00 00 8C 0F 00 0E (recall 15)
Reply with Recall	01 07 03 FF 00 00 8C 00 00 0E (recall 0, i.e. using input memory)

Request Signal Status, Freq	01 07 00 00 03 FF 91 00 00 0E
Reply w/ Sig.Status,Freq	01 0B 03 FF 00 00 91 00 0C 4E 17 70 00 0E (31.5Khz,60.0Hz)
Request Sig. Status, State	01 07 00 00 03 FF 91 1B 81 00 0E
Reply w/ Sig. Status, State	01 08 03 FF 00 00 91 1B 81 00 00 0E (Good,SignalLocked)
Reply with Signal Status, State	01 08 03 FF 00 00 91 1B 81 1B 81 00 0E (Changing src)
Reply with Signal Status, State	01 08 03 FF 00 00 91 1B 81 02 00 0E (Error,sync err)
Request Signal Status, Sync On?	01 07 00 00 03 FF 91 02 00 0E
Reply with Signal Status, Sync	01 08 03 FF 00 00 91 02 00 00 0E (No sync)
Reply with Signal Status, Sync	01 08 03 FF 00 00 91 02 1B 81 00 0E (Sync On Green)
Reply with Signal Status, Sync	01 08 03 FF 00 00 91 02 02 00 0E (Composite Sync)
Reply with Signal Status, Sync	01 08 03 FF 00 00 91 02 03 00 0E (Sep.HSync on H.)
Reply with Signal Status, Sync	01 08 03 FF 00 00 91 02 06 00 0E (SyncfromDecoder)

Request Ping	01 06 00 00 03 FF 81 00 0E
Reply w/ Data	01 0D 03 FF 00 00 81 02 03 04 61 00 48 00 00 0E

See page 18 for additional information

Select Internal Test Pattern	01 08 00 00 03 FF 7F 07 17 00 0E (crosshatch)
Select Internal Test Pattern (ext.)	01 08 00 00 03 FF 7F 07 00 00 0E
Request Current Test Pattern	01 07 00 00 03 FF FF 07 00 0E
Reply with Current Test Pattern	01 08 03 FF 00 00 FF 07 1B 93 00 0E (dots in crosshatch)
Reply with Current Test Pattern	01 08 03 FF 00 00 FF 07 00 00 0E (ext.)

Select Internal Frequency (1)	01 07 00 00 03 FF 35 1B 81 00 0E
Select External Freq (signal)	01 07 00 00 03 FF 35 00 00 0E
Request Current Internal Freq	01 06 00 00 03 FF B5 00 0E
Reply with Internal Freq	01 07 03 FF 00 00 B5 1B 81 00 0E (Int Freq 1, menu)

Set Proj Address to 0	01 08 00 00 03 FF 02 00 00 00 0E
Set Proj Address to 14	01 08 00 00 03 FF 02 00 1B 8E 00 0E
Request Proj Address (broadcast)	01 06 80 00 03 FF 82 00 0E
Reply with Proj Address	01 08 03 FF 80 00 82 00 1B 8E 00 0E (proj address 14)

If broadcasting: Same as above examples, except use "**8**0 00" for destination

Example:

Set Tint to 0	01 07 **8**0 00 03 FF 58 00 00 0E
Set Tint to 32	01 07 **8**0 00 03 FF 58 20 00 0E
Request Tint Value **(max. 1 proj.)***	01 06 **8**0 00 03 FF D8 00 0E
Reply w/ Tint Value **(max. 1 proj.)***	01 07 03 FF **8**0 00 D8 20 00 0E (32, 50%)

* Do not broadcast a request to more than one projector, as it may generate multiple attempts at replies that could collide on the network.

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This section includes additional notes about some of the more complex RS-232 messages.

● *"Standby" Command*

During standby entered via normal keypad-projector operation, the picture is blanked, the audio is muted and you can perform no operation from the keypad except to "get out of standby". This type of standby occurs when you use the Standby key on either the keypad or Marquee switcher (available only from Presentation level), when you use the Picture Mute key on the Extron switcher, or when you send RS-232 standby keycodes from a controller.

The RS-232 "set standby" command triggers a significantly different type of standby. This standby command blanks the picture and mutes the audio as usual, but you can still execute most other projector commands as well — you are not locked out. In addition, note that it is not necessary to be in presentation mode in order to enter standby via the RS-232 command.

WHILE IN STANDBY…

- the picture and audio are both off.
- you can issue other projector commands as desired.
- a request of Contrast, Brightness or Audio Mute reports the value that will be restored after coming out of standby.
- any Picture Mute command is ignored.
- switcher slot buttons do not function.
- commands causing an unblanked picture take effect only after leaving standby mode (exit via a keypress or RS-232 methods).
- the amber LED status light is lit on the projector and connected switcher.

LEAVING STANDBY…

Exit standby via a keypress or RS-232 method. The amber LED status light will go out.

● *"Picture Mute" Command*

The RS-232 "set pic mute" command blanks only the picture — the audio is not affected. Otherwise, this command is similar to the RS-232 "set standby" command. You can use most other projector commands while in "pic mute" mode. Note that it is not necessary to be in presentation mode in order to enter Picture Mute via the RS-232 command. Note also that a Picture Mute command is ignored if you are already in any form of standby.

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WHILE IN PICTURE MUTE…

- the picture is off but the audio is on
- you can issue other projector commands as desired.
- commands causing an unblanked picture take effect only after leaving picture mute mode (exit via a keypress or RS-232 methods).
- a request of Contrast or Brightness reports the value that will be restored after coming out of Picture Mute.
- the amber LED status light is lit on the projector and connected switcher.

LEAVING PICTURE MUTE …

Exit Picture Mute via a keypress or RS-232 method.

NOTE: You have no way of knowing that a projector has only the picture muted rather than being in standby except if you hear audio from the current source. If you mistake Picture Mute for Standby and try to leave by pressing the standby key, you will ***enter*** *standby rather than leave it. Press the standby key once again to leave standby and restore the picture.*

● *"Projector Address" Command*

Make sure that if you change a projector's address, either change the address in all future messages as well or issue a command that is broadcast (set broadcast bit to "1").

● *"Signal Status" Command*

The signal status command enables you to request and obtain specific information about the current signal, namely its ***frequency***, ***state*** or type of ***sync***. Note that one (only) of these descriptors must be included as P1 in every signal status request message. Resulting signal status replies will then include one or two additional parameters as necessary to fully describe the status of P1. Frequency, state and sync signal status messages are further described below.

NOTE: There is no "set" command for signal status information — you can issue requests and receive replies only.

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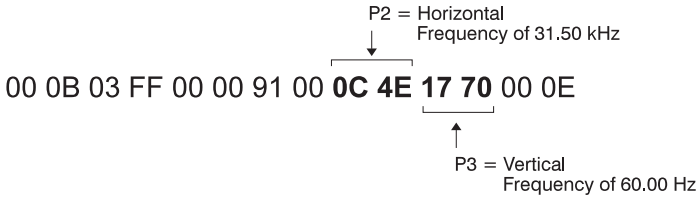
P1 = FREQUENCY ($00)

If you want to determine the horizontal and vertical frequencies of the current signal, you can send a "request signal status/**frequency**" to the projector. Note that this message must include both the signal status code ($91) as well as the P1 frequency code ($00) as shown in the example from Table 5:

01 07 00 00 03 FF **91 00** 00 0E

FREQUENCY REPLIES:

A reply to the "request signal status/**frequency**" message supplies the horizontal and vertical frequencies of the current signal. In the example from Table 5, P2 is the horizontal frequency and P3 is the vertical frequency as shown in the following illustration. Convert to decimal format and assume two decimal places.



P1 = STATE ($01)

If you want to determine the state of the current signal, you can send a "request signal status/**state**" to the projector. Note that this message must include both the signal status code ($91) as well as the P1 state code ($01) as shown in the example from Table 5. Note also the "escaped" $01 byte.

01 07 00 00 03 FF **91 1B 81** 00 0E

STATE REPLIES:

A reply to the "request signal status/**state**" message includes another parameter (P2) whose value describes the state of the current signal as a good locked signal ($00), a changing signal ($01), or an error characterized by an unstable or missing signal ($02). See Table 5 for an example of each.

NOTE: Errors are not detected or reported for NTSC and PAL frequencies or certain computer-generated sources having these frequencies. See Table

P1 = SYNC ON? ($02)

If you want to determine the sync of the current signal, you can send a "request signal status/**sync**" to the projector. Note that this message must include both the signal status code ($91) as well as the P1 sync code ($02) as shown in the example from Table 5.

01 07 00 00 03 FF **91 02** 00 0E

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SYNC REPLIES:

A reply to the "request signal status/**sync**" message includes a second parameter (P2) to describe the sync. Possible values are defined in Table 6:

0	None, no sync present
1	Sync-on-green
2	Composite sync
3	Separate H sync on H
6	Sync from decoder
7	Sync on internal

Table 6. Sync Replies (P2)

● *"Ping" Command*

Use ping to request and obtain basic projector information, such as projector type and current software version. Like most RS-232 requests, a ping request contains no data (parameters):

01 06 00 00 03 FF **81** 00 0E

NOTE: There is no "set" command for ping — you can issue requests and receive replies only.

PING REPLIES

The Ping reply contains data for the six parameters necessary to fully answer the ping request, as shown in the example from Table 5:

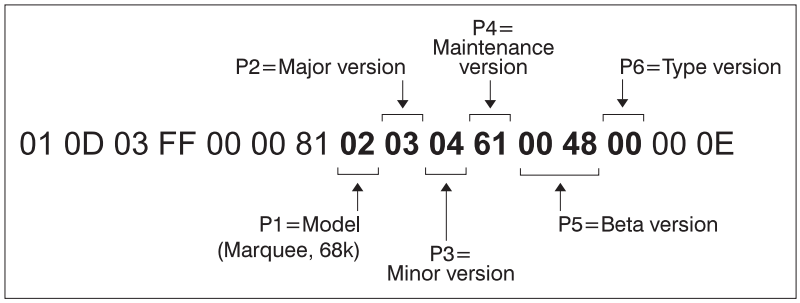

Figure 5. Information in a Ping Reply

This reply represents V3.4.a.072 Beta of the main (68K) software.

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● *"Test Pattern" Diagnostic Command*

The "Diagnostic:Test Pattern" command enables you to select, request or obtain the number of a specific test pattern. Note that such commands must include both the "diagnostic" command code as well as the "test pattern" parameter (P1). This parameter represents the diagnostic to be run and ensures that the proper diagnostic is run (in this case "test pattern"). Shown below is the "request" example from Table 5.

01 07 00 00 03 FF **FF 07** 00 0E

DIAGNOSTIC/TEST PATTERN REPLIES

Resulting replies will then include an additional parameter (P2) representing the number (name) of the test pattern. The example below shows that a "dots in crosshatch" pattern is present.

01 08 03 FF 00 00 **FF 07 1B 93** 00 0E

EXITING FROM A TEST PATTERN

Exit a test pattern by pressing the Exit key or by selecting test pattern "0".

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