hp
xp8010 series
digital projector

hp invent

rs232 protocol reference

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RS-232 connections

This guide describes how to configure the projector for RS-232 communication with an external controller, and describes the RS-232 command keywords used to send requests to the projector.

Cable connections

Use an RS-232 cable to connect a controller to the projector's D-sub 9-pin connector. The table below lists the connector's pin outputs.

✎ When connecting a computer to the projector, use a null-modem cable.

D-Sub 9-Pin Connection

Pin	Signal	Direction
3	TxD	data from projector to controller
2	RxD	data from controller to projector
5	GND	—

Communication settings

Make sure the controller device uses the following settings for RS-232 communication with the projector.

- ❏ 9600 baud
- ❏ 1 start bit + 8 data bits (D0 = LSB, D7 = MSB) + 1 stop bit
- ❏ no parity
- ❏ full duplex communication channels (no flow control)
- ❏ no handshaking

RS-232 protocol syntax

The following describes the general elements of RS-232 protocol syntax. For details about a specific keyword, refer to the "RS-232 keyword listing" on page 10.

✎ This manual uses the symbols "<CR>" and "<LF>" to represent a carriage return and line feed, respectively.

Requests

Commands are sent to the projector as "requests," which consist of an asterisk (*) prefix, a command keyword, any needed parameter, and a carriage return <CR> as a terminator:

keyword = *parameter* <CR>

Requests can contain only ASCII alphanumeric characters. Blanks (spaces) are allowed, except within keywords and numbers. Line feeds <LF> are ignored.

The following table shows the specific syntax to use for various requested tasks.

To perform this task...	Use this request syntax
Change a setting to a specified value	*keyword=value*<CR>
Query a setting	*keyword=?*<CR>
Increment a setting	*keyword=+*<CR>
Decrement a setting	*keyword=–*<CR>
Invoke an action *(no parameter needed)*	*keyword*<CR>

Some requests to modify a particular setting also modify other related settings. For example, a request to modify the active input source might also modify settings such as brightness or white intensity to suit the new source. This and other requests can produce delayed (asynchronous) notifications — see page 9 for examples.

Notifications

In general, every request sent to the projector generates one or more notification messages, which are sent to the controller. (The exception is unrecognized requests, which are ignored.) Actions initiated by the projector can also generate notifications.

The projector is always in verbose mode, and sends notifications whenever a setting changes, whether as the result of a request from a controller, or as the result of an action such as a button press or menu change. Some requested setting changes take time to accomplish, or are carried out in stages: because of this, these requests may produce asynchronous notifications.

A given request may produce more than one notification. An example of this is a request to change the active input source: the initial request produces a notification acknowledging the request, and also produces delayed notifications indicating that related settings were changed.

The following table lists the types of notifications generated in various situations.

This type of request...	Generates this type of notification
Modify a setting	Echoes the request keyword and shows the resulting value: **Request:** `*BRT=65<CR>` **Notification:** `*BRT=65<CR><LF>`
Query a setting	Echoes the request keyword and shows the resulting value: **Request:** `*CON=?<CR>` **Notification:** `*CON=40<CR><LF>`
Execute an action	Echoes the request keyword: **Request:** `*NXT<CR>` **Notification:** `*NXT<CR><LF>`

The following table illustrates the types of notifications that can result if a request uses incorrect syntax.

This incorrect syntax...	Generates this type of notification
No asterisk at start of request	None: **Request:** `PMOD=1<CR>` **Notification:**
Unrecognized keyword	None: **Request:** `*BTR=65<CR>` **Notification:**
Invalid parameter	Echoes the request keyword with the current value: **Request:** `*BRT=-65<CR>` **Notification:** `*BRT=10<CR><LF>`
Specifies an action with an unnecessary parameter	Ignores the parameter, executes the request keyword, and echoes the keyword: **Request:** `*SYNC=65<CR>` **Notification:** `*SYNC<CR><LF>`
Requests a valid setting that is unavailable (for example, due to lack of an input source, or to the setting not being supported for the input source)	Echoes the request keyword, with a question mark instead of a value: **Request:** `*CSPC=0<CR>` **Notification:** `*CSPC=?<CR><LF>`
Attempts to increment/decrement a setting past its defined limits.	Ignores the request, and echoes the keyword with the current value for the setting. For example, if BRT is set to 100 (its maximum): **Request:** `*BRT=+<CR>` **Notification:** `*BRT=100<CR><LF>`
Attempts to modify a read-only setting.	Ignores the request, and echoes the keyword with the current value for the setting: **Request:** `*STAT=3<CR>` **Notification:** `*STAT=1<CR><LF>`

Example — changing input source

The following simplified example shows how the projector typically responds to a request to change the active input source. Note that the three latter notifications are delayed.

Request:	`*RSRC=2<CR>`	
Notifications:	`*RSRC=2<CR><LF>`	*(acknowledges request)*
	`*SRC=0<CR><LF>`	*(projector is attempting to acquire source 2, and in the interim has no valid source)*
	`*SRC=2<CR><LF>`	*(source 2 has been acquired and is now active)*
	`*BRT=50<CR><LF>`	*(brightness has been modified for source 2)*
	`*CSPC=?<CR><LF>`	*(color space is not supported for this input)*

Example — changing the picture mode

A request to change the picture mode can take a moment to complete, and so produces a delayed notification. In this example, the picture mode is initially set to 0.

Request:	`*PMOD=1<CR>`	
Notifications:	`*PMOD=0<CR><LF>`	*(current setting)*
	`*PMOD=1<CR><LF>`	*(new mode is active)*

Example — turning on the projector

Request:	`*STAT=?<CR>`	
Notification:	`*STAT=0<CR><LF>`	*(current setting)*
Request:	`*W<CR>`	
Notifications:	`*W<CR><LF>`	*(echoes request)*
	`*STAT=2<CR><LF>`	*(projector enters its warm-up state)*
	`*STAT=1<CR><LF>`	*(projector enters its on state)*

RS-232 keyword listing

The following table shows the RS-232 keywords supported by the projector.

If the parameter listing for a particular keyword is "None," that keyword requires no parameter.

✎ Except as noted in the keyword listing, each keyword is valid only when the projector is in its on state, STAT=1 (and *not* warm-up, cool-down, or standby state).

RS-232 keyword listing

Keyword	Parameters	Description
Source functions		
SRC	?	Queries the current active input source: • 0 = no active source • 1 = VGA1 • 2 = VGA2 • 3 = composite video • 4 = S-video • 5 = component video YPbPr • 6 = RGBHV • 7 = M1 graphics
RSRC	1 to 7, ?	Attempts to use the specified source as the active input source, or queries the last source requested: • 1 = VGA1 • 2 = VGA2 • 3 = composite video • 4 = S-video • 5 = component video YPbPr • 6 = RGBHV • 7 = M1 graphics If the requested source is not available and AUTO is enabled, the projector scans for the next valid source; if AUTO is disabled, the projector returns the notification *SRC=0.
NXT	None	Searches for the next input source.
AUTO	0 to 1, ?	Queries or sets input source auto-search: 0 = disabled, 1 = enabled

RS-232 keyword listing *(continued)*

Keyword	Parameters	Description
Video functions		
CSPC	0 to 2, ?	Sets or queries the active color space: 0 = RGB, 1 = YPbPr, 2 = YCbCr **Note:** The active input source must be analog RGBHV interlaced, analog RGBHV progressive, or component progressive.
PMOD	0 to 2, ?	Sets or queries the picture mode: • 0 = business graphics mode • 1 = theatre video mode • 2 = super-bright mode **Note:** The notification sent in response to a request using PMOD indicates the current picture mode, *not* the requested picture mode. It can take up to 15 seconds for the requested mode to take effect. Once it does, a second notification is sent indicating that the requested picture mode is active.
WHIT	0 to 10, +, −, ?	Sets or queries the white intensity. **Note:** PMOD must be set to 0 or 1.
BRT	0 to 100, +, −, ?	Sets or queries the brightness.
CON	0 to 100, +, −, ?	Sets or queries the contrast.
SAT	0 to 100, +, −, ?	Sets or queries the color saturation.
TNT	0 to 100, +, −, ?	Sets or queries the tint.
CTMP	0 to 2, ?	Sets or queries the color temperature: 0 = warm, 1 = neutral, 2 = cool
SHRP	0 to 12, +, −, ?	Sets or queries the sharpness.
KEYV	−50 to 50, +, −, ?	Sets or queries the vertical keystone: • 0 = no keystone adjustment. • 1 to 50: shrinks the top of the display. • −1 to −50: shrinks the bottom of the display.

RS-232 keyword listing *(continued)*

Keyword	Parameters	Description
KEYH	–50 to 50, +, –, ?	Sets or queries the horizontal keystone: • 0 = no keystone adjustment. • 1 to 50: shrinks the right side of the display. • –1 to –50: shrinks the left side of the display.
ASPT	0 to 3, ?	Sets or queries the aspect ratio: • 0 = 1-to-1 • 2 = Fill • 1 = Best Fit • 3 = 16:9 **Note:** All options may not be available for all input sources.
ZOOM	0 to 9, +, –, ?	Sets or queries the zoom level: • 0 = no zoom. • 1 to 9: progressively higher magnification.
PANH	0 to 100, +, –, ?	Sets or queries horizontal panning of zoomed images: • 0 (lower limit) = the left edge of the window aligns with the left edge of the screen. • 100 (upper limit) = the right edge of the window aligns with the right edge of the screen.
PANV	0 to 100, +, –, ?	Sets or queries vertical panning of zoomed images: • 0 (lower limit) = the top edge of the window aligns with the top edge of the screen. • 100 (upper limit) = the bottom edge of the window aligns with the bottom edge of the screen.
SYNC	None	Automatically resynchronizes (auto-sync) the projector to the active input source. **Note:** The active input source must be VGA1, VGA2, analog M1, or analog RGBHV.
FREQ	–50 to 50, +, –, ?	Sets or queries the projector's timing relative to the active input source. **Note:** The active input source must be VGA1, VGA2, analog M1, or analog RGBHV.

Keyword	Parameters	Description
TRK	*value*, +, −, ?	Sets or queries the synchronization of the projector to the active input source. **Note:** The active input source must be VGA1, VGA2, analog M1, or analog RGBHV.
VPOS	*value*, +, −, ?	Sets or queries the vertical positioning of the projected image: usable range is the maximum and minimum allowed by the active input source. **Note:** The active input source must be VGA1, VGA2, analog M1, or analog RGBHV.
HIDE	0 to 1, ?	Sets or queries picture blanking: 0 = disabled, 1 = enabled. **Note:** If the active input source is changed while picture blanking is active (HIDE=1), the picture remains blanked.
Audio functions		
MUTE	0 to 1, ?	Sets or queries audio muting: 0 = not muted, 1 = muted.
VOL	0 to 31, +, −, ?	Sets or queries audio volume: 0 = off, 31 = maximum.
TRB	−6 to 6, +, −, ?	Sets or queries audio treble: −6 = minimum, 6 = maximum.
BASS	−6 to 6, +, −, ?	Sets or queries audio bass: −6 = minimum, 6 = maximum.
BAL	−50 to 50, +, −, ?	Sets or queries audio balance: • −50 to −1: fade left • 0 = centered • 1 to 50: fade right
AIN	0 to 7, ?	Sets or queries the audio input source: • 0 = Auto • 1 = VGA1 • 2 = VGA2 • 3 = Composite Video • 4 = S-Video • 5 = Component Video YPbPr • 6 = RGBHV • 7 = M1
INTSP	0 to 1, ?	Sets or queries usage of the internal speakers: 0 = disabled, 1 = enabled.

Keyword	Parameters	Description
Setup functions		
LANG	0 to 9, ?	Sets or queries the language used by the projector: • 0 = English • 5 = Spanish • 1 = French • 6 = Traditional Chinese • 2 = Italian • 7 = Simplified Chinese • 3 = German • 8 = Korean • 4 = unavailable • 9 = Japanese **Note:** Some firmware versions may not support all languages.
LSAV	0 to 1, ?	Sets or queries the lamp saver status: 0 = disabled, 1 = enabled.
LHRS	?	Queries the time (in tenths of hours) that the lamp has been in use.
THRS	?	Queries the total time (in hours) that the projector has been in use.
POS	0 to 3, ?	Sets or queries the projector's position: • 0 = front table • 2 = rear table • 1 = front ceiling • 3 = rear ceiling
VERS	?	Queries the projector model number and firmware version, and the connectivity module's model number and firmware version. The notification takes this form: *VERS="proj_model:proj_fw, mod_model:mod_fw"* where: • *proj_model* = projector model number. • *proj_fw* = projector firmware version. • *mod_model* = connectivity module model number. • *mod_fw* = connectivity module firmware version. For example: *VERS="xp8010:1.04, L1837:1.03"

Keyword	Parameters	Description
IPAD	?	Queries the IP addresses associated with the connectivity module. The notification takes this form: *IPAD=*IP_addr_1*, *IP_addr_2* where: • *IP_addr_1* = the IP address of the module's LAN connector. • *IP_addr_2* (if present) = the IP address of a wireless network card connected to the connectivity module. For example: *IPAD=15.7.123.54, 15.7.123.55
SNUM	?	Queries the projector's serial number.
Power and status functions		
SHDN	None	Puts the projector into cool-down state, and later into standby state. The projector sends a notification when it enters cool-down state (STAT=3), and another when it enters standby state (STAT=0). **Note:** This keyword requires the projector to be in its on state (STAT=1). **Note:** Do not send any requests other than STAT in the time between the cool-down and standby state notifications. Otherwise, unexpected results can occur.
W	None	Puts the projector into warm-up state, and later into on state. The projector sends a notification when it enters warm-up state (STAT=2), and another when it enters the on state (STAT=1). **Note:** This keyword requires the projector to be in standby state (STAT=0). **Note:** Do not send any requests other than STAT in the time between the warm-up and on state notifications. Otherwise, unexpected results can occur.

RS-232 keyword listing *(continued)*

Keyword	Parameters	Description
STAT	?	Queries the projector's current state: • 0 = standby state • 2 = warm-up state • 1 = on • 3 = cool-down state **Note:** STAT can be used anytime, regardless of the projector's state.
ALERT	Not a request — see note	Notifies when a system alert condition occurs: • 0 = lamp life warning • 4 = internal temperature too high • 1 = lamp life reached • 5 = fan problem • 2 = lamp faulty • 6 = ambient temperature too high • 3 = lamp problem **Note:** ALERT is sent only by the projector, and cannot be used in requests.

Changing input sources

When the input source is changed back to a source used previously, the video settings usually return to their previous values for that source. However, if too many different types of sources have been selected since this source was last used, *default* values will be used instead. The projector stores values for the last 14 sources used.

✎ A different source is defined as any input that has different signal characteristics from another input, even if connected to the same port on the projector.

If analog and digital sources are simultaneously wired to the M1 port, the projector treats them as separate inputs. However, if the M1 source is selected, the analog M1 input is activated. Use the NXT keyword to activate the digital M1 input.