

# **SPECTRON HMD**

## **CONTROL LANGUAGE COMMANDS**

**1430 DASH HMD TEST SYSTEM**

03/20/01

## Spectron Control Language Commands:

### *List of HMD SCL Commands and Reference.*

Command	Action	Section
ADAta	Read binary image data.	Measurement
ALIgn	Align coordinate system to external reference.	Setup
AREa	Take area Luminance measurement.	Measurement
ATIndex	Read or Change the transform coefficients – Alpha, Beta, & DAZ	Setup
BDAta	Read binary line data.	Measurement
DARk	Take a new Dark current reading at preset gain.	Measurement
DDAta	Read double precision line data.	Measurement
DLUminance	Restore default luminance calibration.	Setup
FILter	Change the Neutral Density or Color Filter.	Setup
FOCus	Read or Move the focus position.	Positioning
GAIn	Change camera integration timing & take Dark.	Setup
GRAphics	Display the DASH camera image.	Measurement
GUPdate	Refresh graphics thresholds & Display graphics.	Measurement
HLRead	Read altitude home reference position.	Measurement
HZRead	Read azimuth home reference position.	Measurement
IHLimit	Read or Change X Y Z high limits.	Setup
ILLimit	Read or Change X Y Z low limits.	Setup
IPOsition	Read or Move Eye Position (X Y X) transports.	Positioning
IREsume	Resume after Emergency Transport stop.	Positioning
ISTest	Perform Internal Self Test.	Setup
ITRanslate	Read or Change X Y Z offsets.	Setup
LDAta	Read single precision line data.	Measurement
LINE	Take a line measurement.	Measurement
MTF	Take a Modulation Factor measurement.	Measurement
PARallax	Take a parallax measurement.	Measurement

*List of HMD SCL Commands and Reference. (continued)*

Command	Action	Section
PCAlibration	Change the luminance calibration.	Setup
POSition	Read or Move angular (Altitude & Azimuth) transports.	Positioning
SCAn	Takes one scan (frame grab) at preset gain.	Measurement
SERial	Read camera and transport serial numbers and software version number.	Setup
SET	Read or Change the current measurement settings.	Setup
STatus	Read the status after an Internal Self Test (IST).	Setup
SVCamera	Save luminance calibration to EEPROM.	Setup
SYNc	Change the image capture synchronizing source.	Setup
VFinder	Read or Set viewfinder mode on or off.	Setup

# Spectron Control Language Commands:

## Summary of HMD SCL Commands and Results

### Section 1, HMD Positioning Commands

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
FOCUS	Z position range: $\pm 0.45$ inches	Repositions the camera focus transport to the specified z-axis position. Note that this is an absolute position relative to the center of the focus transport.	<i>FOCUS 0.124</i> returns: X ' 0.121  Where X indicates the status of the focus transport axis, 0 = OK and 1 = Emergency stop
FOCUS	AUTOMATIC  VERTICAL (optional – this is the default)	Automatically focuses the camera on a vertical line. Requires that a vertical line be in the camera's field of view. Moves the X-Axis to measure the parallax and then moves the focus transport into the position necessary to correctly focus on this vertical line image.	<i>FOCUS AUTOMATIC VERTICAL</i>  **or** <i>FOCUS AUTOMATIC</i> returns: X ' 0.354  Where X indicates the status of the focus transport axis, 0 = OK and 1 = Emergency stop
FOCUS	AUTOMATIC  HORIZONTAL	Automatically focuses the camera on a horizontal line. Requires that a horizontal line be in the camera's field of view. Moves the Y-Axis to measure the parallax and then moves the focus transport into the position necessary to correctly focus on this horizontal line image.	<i>FOCUS AUTOMATIC HORIZONTAL</i> returns: X ' 0.354  Where X indicates the status of the focus transport axis, 0 = OK and 1 = Emergency stop
FOCUS	DISTANCE	Computes the distance in feet to an image that would be in focus at the current focus transport position. This command can be used after an autofocus command is performed to give an indication of the distance to that image.	<i>FOCUS DISTANCE</i> returns: 8.8 ' FT

**Section 1, HMD Positioning Commands (continued)**

IPOsition	none	<p>Returns 3 status codes and the present X, Y, and Z axis positions of the eye transports (Status codes are defined below).</p> <p>All position reports are signed relative to the pilots perspective. X (the interpupillary axis) is positive toward the right eye. Y (the other exit pupil plane axis) is positive toward the top of the head. Z (the eye relief axis) is positive away from the image.</p> <p>Notes: The position returned is in inches relative to the PRESENT coordinate system (see ITRANS command below).</p>	<p><i>IPOsition</i></p> <p>return: ABC'-0.1122'0.1253'0.0178</p> <p>Where A, B, &amp; C represent the status code for the X, Y, &amp; Z axes respectively (see IPOS status codes at end of Section 1)</p>
IPOsition	<p>X position –Parm 1 &lt;space&gt; Y position –Parm 2 &lt;space&gt; Z position –Parm 3 &lt;space&gt;</p> <p>Range: ± 1.7 inches</p> <p>see ITRans, ILLimit, IHLimit in Section 2, Setup Commands</p>	<p>Repositions the eye transports to the specified X, Y, and Z positions. Any one, two, or all three parameters can be changed with a single command.</p> <p>Notes: Input parameters that exceed a low or high limit will be changed to that limit before moving that axis.</p> <p>Quotes (“) may be used to avoid movement of a specific axis. Trailing blanks on the command line will avoid movement of the remaining axes.</p>	<p><i>IPOsition 1 1 1</i></p> <p>return:ABC'1.0002'0.9995'1.0006</p> <p><i>IPOsition “ “ -.5</i></p> <p>return: ABC'1.0002'0.9995'-0.4993</p> <p><i>IPOsition “.1</i></p> <p>return: ABC'1.0002'0.0997-0.4993</p> <p>Where A, B, &amp; C represent the status code for the X, Y, &amp; Z axes respectively (see IPOS status codes at end of Section 1)</p>
IREsume	none	<p>Enables eye position transports to move again after kill switch has been used. This is to insure that joystick, command strings, or other movement inputs are taken care of properly before restarting.</p>	<p><i>IREsume</i></p> <p>returns: nothing</p>

**Section 1, HMD Positioning Commands (continued)**

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
POSition	none	Returns the actual azimuth and altitude angular positions of the camera transport in degrees. Note that these are absolute positions relative to the present coordinate system 0,0 position and may be positive or negative.	<i>POSition</i> returns: XY'1.022' -1.125  Where X & Y indicate the status codes for the azimuth axis and the altitude axis respectively, 0 = OK and 1 = Emergency stop
POSition	Parm 1: Az (or X) position  Parm 2: Alt (or Y) position  HUD/CRT: ± 15° Alt & Az  HMD: ± 35° Alt +105°, -195° Az	Repositions the camera to the specified azimuth and altitude positions. Note that these are absolute positions relative to the present coordinate system 0,0 position and may be positive or negative. The actual transport position values are returned.	<i>POSition 1.023 -1.125</i> returns: XY'1.022 ' -1.125  Where X & Y indicate the status codes for the azimuth axis and the altitude axis respectively, 0 = OK and 1 = Emergency stop
POSition	ORG	Redefines the coordinate system so that PRESENT position will be offset and become the new position (0, 0). This user defined offset is only held in temporary memory and will be lost on power down.	<i>POSition ORG</i> returns: nothing
POSition	ZERo	Removes the user defined offset generated from a POSition ORG command.	<i>POSition ZERo</i> returns: nothing

### Eye Transport (IPOS) Status Codes one number for each axis - X, Y, & Z respectively

- 0 = no error
- 1 = kill switch active (IREsume needed to resume all transport operations except focus)
- 2 = open
- 3 = open
- 4 = timed out before position reached (partial jog is reported on a prejog move time out)
- 5 = high limit set equal to low limit (transport will not move, limits must be modified)
- 6 = IPOsition input position parameter truncated to the exceeded limit
- 7 = no jog/partial jog (can occur with a close to limit move and a prejog move timeout)
- 8 = open

# Spectron Control Language Commands:

## Summary of HMD SCL Commands and Results

### Section 2, HMD Setup Commands

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
ALIgn	none	Performs an alignment measurement then calculates the transform constants. Daz, Alpha, Beta. For use with Spectron Direct View Alignment Tool only.	<p><i>ALIgn</i></p> <p>returns: Two digit status code, a single quote delimiter, and a text string (see ALIGN status codes &amp; text strings at end of Section 2)</p> <p>Return Examples: 00' ALIGN OK 16' ALIGN FAIL - LOW LIGHT, NO LINE IN FOV</p>
ALIgn	<p>3 Parameters:</p> <p>#1 Align input one, Azimuth offset (Daz) in thousandths of a degree.</p> <p>#2 Align input two, Elevation offset (Alpha) in thousandths of a degree.</p> <p>#3 Align input three, Roll offset (Beta) in thousandths of a degree.</p>	<p>Performs an alignment measurement then calculates the transform constants Daz, Alpha, and Beta.</p> <p>The alignment inputs, parameters #1, #2 and #3 are integers representing the number of thousandths of degrees of offset. The leading digit represents the sign of the offset where 1 equals minus and 0 equals plus. These inputs represent the offset of a theoretical boresight from the center of the alignment tool. Used for HUD Alignment Tools.</p>	<p><i>ALIgn 0 0 0</i> or <i>ALIgn 043 189 0112</i></p> <p>returns: Two digit status code, a single quote delimiter, and a text string (see ALIGN status codes &amp; text strings at end of Section 2)</p> <p>Return Examples: 00' ALIGN OK 16' ALIGN FAIL - LOW LIGHT, NO LINE IN FOV</p>

## Section 2, HMD Setup Commands (continued)

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
ALIgn	<p>7 Parameters:</p> <p>#1 Align input one, Azimuth offset (Daz) in thousandths of a degree.</p> <p>#2 Align input two, Elevation offset (Alpha) in thousandths of a degree.</p> <p>#3 Align input three, Roll offset (Beta) in thousandths of a degree.</p> <p>Optional for non standard alignments:</p> <p>#4 Left cross Elevation in SEI coordinates.</p> <p>#5 Left cross Azimuth in SEI coordinates.</p> <p>#6 Right cross Elevation in SEI coordinates.</p> <p>#7 Right cross Azimuth in SEI coordinates.</p>	<p>Performs a HUD Simulator tool Calibration. May be used for Direct display tools or HUD tools. Makes an alignment measurement then calculates and returns the transform constants. Daz, Alpha, Beta.</p> <p>The alignment inputs, parameters #1, #2 and #3 are integers representing the number of thousandths of degrees of offset. The leading digit represents the sign of the offset where 1 equals minus and 0 equals plus.</p> <p>The 7 parameter version of this command can be used with either direct or infinite sources. The gain and focus should be set before running the command as these are not programmed in this mode.</p>	<p><i>ALIgn 0 0 0 0.015 -4.430 - .022 4.441</i></p> <p>returns: Two digit status code, a single quote delimiter, and a text string (see ALIGN status codes &amp; text strings at end of Section 2)</p> <p>Return Examples:  00' ALIGN OK  16' ALIGN FAIL - LOW LIGHT,  NO LINE IN FOV</p>



## Section 2, HMD Setup Commands (continued)

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
ATIndex	none	Reads out the Alpha, Beta and Daz translation constants currently set.	<i>ATIndex</i> returns: 0.105' -0.078' 1.114
ATIndex	Parameters:  #1 Alpha- Y translation in signed degrees.  #2 Beta- Roll translation in signed degrees.  #3 Daz- X translation in signed degrees.	Input Alpha Beta and Daz to simulate running an Alignment procedure (which alternately generates these same variables).	<i>ATIndex 0.105 -0.078 1.114</i> returns: 0.105' -0.078' 1.114
ATIndex	0 0 0	Forces the translation constants to zero. This is the same state as on power on.	<i>ATIndex 0 0 0</i> returns: nothing
DLUminance	none	Restores the default factory calibration to the Luminance calibration factors. Can be used to overcome an inappropriate use of the PCAI command.	<i>DLUminance</i> returns: nothing
FILter	ND filter  0, 1 or 2 ( Neutral Density )	Sets the Neutral Density Filter wheel.	<i>FILter 1</i> returns: nothing
FILter	Color Filter  WHItE, BLUe, RED, or GREen	Sets the Color Filter wheel.	<i>FILter GREen</i> returns: nothing
GAIIn	Integration Time  1 to 2048	Sets the integration time and takes a new dark reference reading.	<i>GAIIn 16</i> returns: nothing

## Section 2, HMD Setup Commands (continued)

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
IHLimit	none	Returns high limit in PRESENT coordinate system for all three axes.	<i>IHLimit</i> returns: 1.5' 1.25' 1.3
IHLimit	ZERo	Redefines the high limit to equal the maximum allowable high limit.  This transport calibration is held in temporary memory and will be lost on power down.	<i>IHLimit ZERo</i> returns: nothing
IHLimit	X position –Parm 1 <space> Y position –Parm 2 <space> Z position –Parm 3 <space>	Redefines high limit per the parameters input in the PRESENT coordinate system.  Notes: Transport does NOT have to be in a particular position to set a high limit.  If parameter input exceeds maximum allowable high limit, this max value is set as the new high limit.  Quotes (“) may be used to avoid high limit modification to a specific axis. Trailing blanks on the command line will avoid high limit modification to the remaining axes.  This transport calibration is held in temporary memory and will be lost on power down.	<i>IHLimit -1.5 -1.5 -1.5</i> returns: nothing  <i>IHLimit -.9 “ -.5</i> returns: nothing  <i>IHLimit .1</i> returns: nothing

**Section 2, HMD Setup Commands (continued)**

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
ILLimit	none	Returns low limit in PRESENT coordinate system for all three axes.	<i>ILLimit</i> returns: -1.5'-1.25'-1.3
ILLimit	ZERo	Redefines the low limit to equal the minimum allowable low limit.  This transport calibration is held in temporary memory and will be lost on power down.	<i>ILLimit ZERo</i> returns: nothing
ILLimit	X position –Parm 1 <space> Y position –Parm 2 <space> Z position –Parm 3 <space>	Redefines low limit per the parameters input in the PRESENT coordinate system.  Notes: Transport does NOT have to be in a particular position to set a low limit.  If parameter input exceeds the minimum allowable low limit, this min value is set as the new low limit.  Quotes (“) may be used to avoid low limit modification to a specific axis. Trailing blanks on the command line will avoid low limit modification to the remaining axes.  This transport calibration is held in temporary memory and will be lost on power down.	<i>ILLimit -1.5 -1.5 -1.5</i> returns: nothing <i>ILLimit -.9 “ -.5</i> returns: nothing <i>ILLimit .1</i> returns: nothing
ISTest	none	Initiates Internal Self Test. This command is generally followed by a STAtus command	<i>ISTest</i> returns: nothing

**Section 2, HMD Setup Commands (continued)**

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
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ITRanslate	none	Returns the offsets of the PRESENT coordinate system from the "as built" origin for all three axes.	<i>ITRanslate</i> returns: 0.2000'-0.3456'0.0000
ITRanslate	ZERo	Zeroes all offsets so that a (0,0,0) returned position also represents the "as built" origin.  This transport calibration is held in temporary memory and will be lost on power.	<i>ITRanslate ZERo</i> returns: nothing
ITRanslate	X offset -Parm 1 <space> Y offset -Parm 2 <space> Z offset -Parm 3 <space>  Note: Can be used on start up to insure a known coordinate system.	Redefines coordinate system by substituting input parameters as offsets to the "as-built" origin.  Notes: High and low limits will be modified to accommodate to new coordinate system, but will remain in same place relative to "as-built" origin.  Quotes (") may be used to avoid coordinate modification to a specific axis. Trailing blanks on the command line will avoid coordinate modification to the remaining axes.  This transport calibration is held in temporary memory and will be lost on power.	<i>ITRanslate 1.25 1 -.1</i> returns: nothing  <i>ITRanslate " " .25</i> returns: nothing  <i>ITRanslate -1.25</i> returns: nothing

## Section 2, HMD Setup Commands (continued)

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
ITRanslate	RELabel	Redefines coordinate system so that PRESENT position will be relabeled per parameters that are input.	<i>ITRanslate RELabel 1.25 1 -.1</i>
	X position –Parm 1 <space>		returns: nothing
	Y position –Parm 2 <space>	Notes: High and low limits will be modified to accommodate to new coordinate system, but will remain in same place relative to “as-built” origin.	<i>ITRanslate RELabel “ “.25</i>
	Z position –Parm 3 <space>		returns: nothing
	Note: Can be used to adjust hardcoded positions in existing programs to shifts in helmet positions.	<p>Parenthesis (“”) may be used to avoid coordinate modification to a specific axis. Trailing blanks on the command line will avoid coordinate modification to the remaining axes.</p> <p>This transport calibration is held in temporary memory and will be lost on power down.</p>	<i>ITRanslate RELabel –1.25</i>
PCAlibration	desired luminance value	Calibrates luminance of AREa and peak brightness (fourth parameter in LINE command output) to desired luminance value (decimal number) input. NOTE: Care should be taken changing this calibration. A calibrated photometer of the correct spectroradiometric or photometric response must be <u>carefully</u> used on a well controlled/stable light source as a transfer standard. Also, an AREa command must be carefully executed on the exact part of the source measured with the photometer BEFORE the PCAlibrate command is initiated. This luminance calibration is held in temporary memory and will be lost on power down unless it is saved using the SVCamera command.	<i>PCAlibration 121.3</i>
	decimal number		returns: nothing

## Section 2, HMD Setup Commands (continued)

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
SERial	none	Returns the serial numbers of the Camera and Transport as saved in the EEPROM pages in each module and the software Version number.	<p><i>SERial</i></p> <p>returns:</p> <p>CCCCC'XXXXX'VVVVVV</p> <p>where CCCCC= the camera serial number, XXXXX = the transport serial number, and VVVVVV = the software version number.</p>
SET	none	<p>Returns setup parameters for the camera:</p> <ol style="list-style-type: none"> <li>1) Camera integration time (gain) = 1 to 2048</li> <li>2) ND filter wheel position = 0 or 1 or 2</li> <li>3) COLOR filter wheel position = W(hite) or R(ed) or G(reen) or B(lue)</li> <li>4) Synchronization (VSYNC) type = X(ternal) or P(rovided)</li> <li>5) Actual lens position = F(inite) or I(nfinite)</li> <li>6) Setup required lens position = F(inite) or I(nfinite)</li> <li>7) Setup of color analysis = C(olor) for shadow mask analysis or M(onochrome) for NO shadow mask analysis</li> <li>8) Setup Number</li> </ol>	<p><i>SET</i></p> <p>returns: 1'0'W'X'F'F'M'3</p>

**Section 2, HMD Setup Commands (continued)**

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
SET	Setup Parameter 3,5,7,9 13,15,17,19	Setup configuration 3 - 3mm Aperture 5 - 5mm Aperture 7 - 7mm Aperture 9 - 9mm Aperture 13- 3mm Aperture and uses a digital filter for use with pixilated displays. 15- 5mm Aperture and uses a digital filter for use with pixilated displays. 17- 7mm Aperture and uses a digital filter for use with pixilated displays. 19- 9mm Aperture and uses a digital filter for use with pixilated displays.	<i>SET 3</i> returns: nothing
STAtus	none	Verifies the operating condition of the machine. This command is generally preceded by an IST command.	<i>STAtus</i> returns: A status message, or an "OK" if there are no pending errors or messages

## Section 2, HMD Setup Commands (continued)

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
SVCamera	none	Saves the newest PCALibration, to be used on power-up. NOTE: 'LED ON' appears in the lower right hand corner of the DASH Controller when the SVCamera command is properly sent and received as an indication that the EEPROM is written	<i>SVCamera</i> returns: nothing
SYNc	INTernal	Uses vertical sync pulses from controller (~60 Hz) to supply timing source. Can be used for non-pulsed image luminance measurement when the camera to image synchronization is not important for consistent luminance measurements.	<i>SYNc INTernal</i> returns: nothing
SYNx	EXTernal	Uses vertical sync pulses from external display source being measured to maintain camera to image synchronization and timing	<i>SYNx EXTernal</i> returns: nothing
VFInDer	ON	Activates the viewfinder mode.	<i>VFInDer ON</i> returns: nothing
VFInDer	OFF	Inactivates the viewfinder mode.	<i>VFInDer OFF</i> returns: nothing
VFInDer	none	When the Viewfinder mode is active, the Y-Axis will automatically move between the WFOV (Wide Field Of View) camera position and the mirror position when the appropriate camera button is selected. An emergency stop will set the viewfinder mode to inactive.	<i>VFInDer</i> returns: XC'Viewfinder Mode Is Active (Inactive).  Where X indicates the mode, 0 = inactive and 1 = active and where C indicates the Camera selected: 0 = DASH display or Auxillary camera, 1 = Flip-up camera, 2 = WFOV camera.



**Section 2, HMD Setup Commands (continued)****Alignment (ALIGN) Status Codes and Text Strings**

Status code	text string
00	ALIGN OK
11	ALIGN FAIL - INPUT ERROR
12	ALIGN FAIL - LENS POSITION ERROR
13	ALIGN FAIL - SET NUMBER ERROR
14	ALIGN FAIL - NO EOF
15	ALIGN FAIL - NO VSYNC
16	ALIGN FAIL - LOW LIGHT, NO LINE IN FOV
17	ALIGN FAIL - HALF LINE IN FOV
18	ALIGN FAIL - SHUTTER MALFUNCTION

# Spectron Control Language Commands:

## Summary of HMD SCL Commands and Results

### Section 3, HMD Measurement Commands

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
ADAta	WARNING! Improper use of this command will lock up the system. USE CAREFULLY!	This command causes the latest image to be transmitted in BINARY form over the GPIB Interface.	<i>ADAta</i> returns: 12544 Binary Bytes
AREa	none	Default. Takes a photometer reading of a 64 X 64 pixel area.	<i>AREa</i> returns: XX '102.3 (where "XX" represents a Camera Status Codes defined at end of Section 3)
AREa	Pixel Area 16, 32, or 64	Takes a photometer reading. The parameter specifies the size of the area in pixels, such as 32 pixels by 32 pixels.	<i>AREa 32</i> returns: same as above
BDAta	WARNING! Improper use of this command will lock up the system. USE CAREFULLY!	This command causes the latest Line scan to be transmitted in BINARY form over the GPIB Interface.	<i>BDAta</i> returns: 112 Binary Bytes
DARk	none	Takes a dark reference reading.	<i>DARk</i> returns: nothing
DDAta	none	Returns a double precision decimal ASCII string of the latest line data. (Range is 0.xx to 255.xx)	<i>DDAta</i> returns: pixel brightness values of last line analysis, single quote ( ' ) delimited. (5.34' 14.78' 127.89...)
GRAphics	none	Causes the video monitor to display the camera's view as a four-gray scale graphic.	<i>GRAphics</i> returns: nothing
GUPdate	none	Recalculates the threshold amplitudes for the 4 gray scale display discussed above.	<i>GUPdate</i> returns: nothing

## Section 3, HMD Measurement Commands (continued)

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
HLRead	none	Finds and measures the position of the Altitude knife edge. If the edge is found the position is returned. If not found HI or LOW is returned.	<i>HLRead</i> returns: ALT 0.1234 Or ALT HI
HZRead	none	Finds and measures the position of the Azimuth knife edge. If the edge is found the position is returned. If not found HI or LO is returned.	<i>HZRead</i> returns: AZ -.0345 Or AZ LO
LDAta	none	Returns a single precision decimal ASCII string of the latest line data. (Range is 0 to 255)	<i>LDAta</i> returns: pixel brightness values of last line analysis, single quote ( ' ) delimited. ( 5'14'127 ... )
LINE	none	Default. Does a 64 line wide analysis of a vertical line which includes the line center, line width, and line peak brightness.	<i>LINE</i> returns: XX 'LC' 1.0201 'LW' 0.0100 'PB' 52.0 ( where "XX" represents a camera status code defined below )
LINE	Line Orientation (Parm 1)  VERTical or HORizontal	Analyzes a vertical or horizontal line with default Parm 2 of 64 line wide analysis including the line center, line width, and line peak brightness.	<i>LINE VERTical</i> returns: same as above
LINE	Width of Analysis (Parm 2)  1, 16, or 64	Specifies the width of the analysis including the line center, line width, and line peak brightness.. Parm 1 (VERTical or HORizontal) must be present in the command string before this Parameter.	<i>LINE HORizontal 16</i> returns: same as above

**Section 3, HMD Measurement Commands (continued)**

<i>SCL Command</i>	<i>Parameters / Range</i>	<i>Description</i>	<i>Example / Reply</i>
MTF	Line Orientation (Parm 1)  VERTical or HORizontal	Defaults to a 64 line wide analysis of a vertical or horizontal line pattern and calculates the modulation factor.	<i>MTF VERTical</i>  returns: XX '90.3 ( where "XX" represents a camera status code defined below )
MTF	Width of Analysis (Parm 2)  1, 16, or 64	Specifies the width of the analysis including the vertical or horizontal Modulation Factor. VERTical or HORizontal must be present in Parm 1 of the command string before this Parameter is appended and used.	<i>MTF HORizontal 16</i>  returns: same as above
PARallax	VERTical	Calculates the Parallax of an infinite display by shifting the X-Axis and measuring a vertical line. The return value is in Diopters or 1/(focal distance in meters) <u>NOTE</u> : The camera must not be parallel to the X Axis. (Az = 90 or -90 degrees)	<i>PARallax VERTical</i>  returns: VLP'0.0152
PARallax	HORizontal	Calculates the Parallax of an infinite display by shifting the Y-Axis and measuring a horizontal line. The return value is in Diopters or 1/(focal distance in meters)	<i>PARallax HORizontal</i>  returns: HLP'0.0152
SCAN	none	Causes the Camera to take one scan. Does not perform any measurements.	<i>SCAN</i>  returns: nothing

**Section 3, HMD Measurement Commands (continued)****Camera Status Codes**

- 00 = no error, OK - no GPIB msg, data output
- 01 = no EOF \*MSG\* = "CAMERA NOT PRESENT, CHECK CABLE"
- 02 = no vsync \*MSG\* = "NO SYNC! CHECK INPUT IF EXTERNAL"
- 03 = vsync frequency out-of-range =  $47.5 \text{ Hz} > \text{VSYNC} < 63 \text{ Hz}$  -  
no GPIB msg, data output
- 04 = vsync unstable  $> 1.17\%$  delta - no GPIB msg, data output
- 05 = no line \*MSG\* = "NO LINE IN FIELD OF VIEW"
- 06 = saturation - at least 1 pixel in average is \$FF raw data -  
no GPIB msg, data output
- 07 = luminance level (inside window for line) is  $< 10\%$  of the  
dynamic range - no GPIB msg, data output
- 08 = luminance level (inside window for line) is  $< 30\%$  of the  
dynamic range - no GPIB msg, data output
- 09 = actual lens position differs from setup configuration wanted for lens  
\*MSG\* = "LENS POSITION & SETUP DIFFER"

## LabView Drivers for Spectron Commands

Command	LabView Menu Location
ADAta	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Data</b>
ALIgn	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Configure</b>
AREa	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Data</b>
ATIndex	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Configure</b>
BDAta	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Data</b>
DARk	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Action Status</b>
FILter	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Action Status</b>
FOCus	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Action Status</b>
GAIIn	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Action Status</b>
GRAphics	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Action Status</b>
IHLimit	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Configure</b>
ILLimit	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Configure</b>
IPOsition	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Action Status</b>

## LabView Drivers for Spectron Commands (continued)

Command	LabView Menu Location
IREsume	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Utility</b>
ISTest	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Utility</b>
ITRanslate	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Configure</b>
LDAta	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Data</b>
LINE	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Data</b>
MTF	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Data</b>
PARallax	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Data</b>
PCAlibration	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Configure</b>
POSition	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Action Status</b>
SCAN	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Action Status</b>
SET	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Configure</b>
STatus	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Utility</b>
SYNc	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Configure</b>
VFinder	Instrument I-O/Instrument Drivers/SEI 1430 Robotic Theodolite/ <b>Utility</b>