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**Nighthawk DE2 Interface   
Software Specification**

14312 Franklin Avenue  
 Building 100  
Tustin CA 92780  
[www.pvpaeo.com](http://www.pvpaeo.com)  
714-508-2742



19360 Business Center Drive  
Northridge, CA 91234  
[www.ITSamerica.com](http://www.ITSamerica.com)  
(818)883-2034

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# Change History

## DRAFT 2 Notes

New Functions and Changes for the 2110 controller (vs. the 6125DE2-Embedded) are in italic blue and/or blue.

### No-Change Release; 9/18/09

1. Adds new commands to support a zoomable laser illuminator and on-off command for a Range Finder.
2. Changed Active Camera references to Active Device; Select Active Device (Type 02 Controller only)
3. Active Device Query is changed to add illuminator
4. Home Status changed note added for status with NH P/T with absolute encoders
5. Revised description of MECHANCIAL HOME (formerly RETURN TO HOME) function
6. Revises GALIL software upload to type 01 controller
7. Added Illuminator Busy Status query
8. Added Turn Range Finder ON/OFF
9. Added System Manifest notes
10. Changed AZ and EL set and reporting resolution for Type 02 controller.

### Rev A 9/25/09

1. Add “77” byte to Illuminator status, Power on/off and Range Finder on/off commands

### Rev B 10/1/09

1. Adds 02 Controller ITS proprietary command preamble and new code upload, change IP commands.
2. Revises description of Home functions and reordered paragraphs
3. Added Query Offsets and Lens Autofocus commands
4. Changed action of mechanical home command in 02 controllers to reset offsets
5. Preassigned command/query values to Door Open Cue Lenses, Scale Max Rate commands

### Rev C 10/2/09

1. Adds step zoom and focus commands
2. Adds status information so a GUI can learn what devices are loaded into the Nighthawk (embedded in camera type query and illuminator busy)

### Rev D 10/19/09

1. Separates Zoom control from Camera lenses for what is now termed accessories, e.g. laser illuminator or other non-imaging zoomable device. Affects lens zoom go to, queries and joystick control, active camera select and status and creates new active accessory select and query.

### Rev E 11/25/09

1. Adds Visible lens autofocus command, expands pan/tilt rate scaling to include 50% to 150% user override, expands Cue Lens command to add Sensor range driven auto zoom to target FOV
2. Revises upload and IP address change commands and procedures for 02 controller
3. Adds Control Mode capability

### Rev F 6/5/2010

1. Adds Ezoom, Rate compensation features to specifications.
2. Adds UDP discovery functional description

### Rev G 6/9/10

1. Corrects errors in Rate Bias commands as specified and restructures control mode for rate compensation from a master mode 04 to a joystick subcommand (03).

### Rev H 11/16/10

1. Add new specifications for the Range Finder Controls; reassign Range Finder on/off.
2. Changes Illuminator status to be both FF 00 0F 77 27 … and FF 00 40 77 01 …
3. Adds specifications for logarithmic pan/tilt control.
4. Added that IP discovery is sent to requesting client and to the IP broadcast address.

### Rev I 8/31/11

1. Eliminates references to earlier “DE2” controllers (type 0 and type 1)
2. Adds detail and reorganizes to align with full implementation of the system manifest
3. Adds commands to report lens FOV as an angle or relative
4. Adds descriptions to support:
   1. FLIR HRCx IR camera
   2. Night Sun

### Rev J 12/20/2011

1. Added control to control the night filter of the daylight camera
2. Revised the laser pointer command to add continuous and pulse modes as well as a new status reporting feature.

### Rev K 3/20/2012

1. Added support for an Axsys XXX IR Camera
2. Revised Lens Focus Go to, Query Lens Values etc. to support command and return values of 12 bits for focus.
3. Added tracker commands.

### Rev L 5/15/2012

1. Added Aggregate Data Request
2. Added commands to the visible camera suite to control/query brightness, set AGC gain and turn AGC on/off.

### Rev M 9/21/2012

1. Corrected laser pointer command FF 00 0F 77 25 18 and added FF 00 0F 77 25 19
2. Added adjustable GO TO rate command/Query
3. Added Move at Rate command/query
4. Added HD-IR , Thermal Mitigation Filter, Blur and Warp Commands/Queries
5. Revised SD-IR Thermal Mitigation Filter from Threshold Averaging/Filter commands to Blur/Warp
6. Added commands/status for the Zeiss Range Finder
7. Added queries for AGC and ALGC controls, restated AGC/ALGC mode setting commands.
8. Revises Laser Pointer to report full internal status
9. Revises Manifest to consolidate Annotators, Laser Range Finders, Trackers, and Pointer/Illuminators to one accessory list. This is not yet implement in code, but in the next release will be. Once released, the individual manifest lists will no longer apply and product numbers will be incorrect.

### Rev N 11/14/2012

1. Revised WALRSS, WALRSS A and L3-HD IR Image Stabilize command/query to expand usage to all strengths available.
2. Added more explanation of PIP/Main HD IR Ezoom and ADR value control in the section on the ADR and Ezoom for the IR camera.
3. Added Filter on/off command variation to control the PIP window separately from the main window for HD IR cameras.

### Rev P 5/31/2013 (Rev O omitted)

1. Added commands and descriptions as noted in Release Notes for Version 3.30 of the 2110 firmware.

### Rev Q 10/31/2014

1. Updated and added commands that were added through version 364 of firmware.

# Controller Versions:

00 and 01 controller versions are used in legacy products not covered in this document.

02 = ITS model 2110-DE2 embedded controller within Nighthawk (June 09)

10 = ITS model 2110-ROTC embedded controller within a Nighthawk. This controller is identical to the 2110-DE2 except that in the J1 expansion port, 4 FUARTs have been implemented to controller other devices.

In the 02 and 10 controllers, there is a direct upload capability built into the system facilitating update of the motor controller firmware at user discretion. This facility exists in 2110 code version 1.46 and later.

Type 02 or 10 is reported back to a GUI when the controller type query (see Controller Type Query, FF 00 0F 77 1C 00) is sent.

The System Manifest is an important feature of the 2110 type 02 controller. This function is supported in firmware versions 2.00 and up.

# General Notes

## PELCO commands

All Pelco Structured commands start with “FF”

All commands shown are followed by a 1 byte checksum

All ITS controller unique commands are FF 00 xx 77 xx xx plus checksum

All ITS commands either respond (acknowledge receipt) to a commend by echo of the command sent, or echo the basic command with status values as described in detail below

## ITS Proprietary Commands

There are a certain range of commands that offer capability not achievable using the PECLO command structure. All such commands are identified to the controller by a specific byte sequence we refer to as PA (preamble). The PA code sequence is B2 A5 E6 93.

Those PA commands necessary for others to interface and control the 2110 are included herein. Care must be taken to use only those PA commands described. Attempts to search for others can result in corruption of the firmware on board, or issue of harmful commands to cameras, lenses or the motor controls which may result in damage to the equipment, or injury to the persons in the vicinity of the Nighthawk.

## System Manifest

System Manifest functions are supported in 2110 firmware versions 2.00 and up.

An important benefit of the 2110 ITS embedded controller imbedded within the Nighthawk is that a common set of commands (e.g. zoom, focus, pan, tilt, NUC, onscreen menus, annotation, IR imaging polarity, and many other functions) are accessed through a common set of commands and tailored by the 2110 to correctly and appropriately operate the actual camera, lens or other device connected to the 2110. In this way, a single graphical user interface (GUI) or hand controller interface can be designed that will operate a wide variation of Nighthawk systems seamlessly even on the same network.

A key element in achieving this commonality of command and flexibility of sensor suite is the ITS 2110 System Manifest.

The commands that are active depend on the manifest of peripherals integrated onto the Nighthawk. This manifest is set at the factory. Commands that are not active are simply ignored by the 2110 or responses to them return initialization values. Whether a command is active or not is determined by the manifest input to the system using the

1. IR camera unique commands are only active if an IR camera was included in the system manifest. If not on the manifest, IR unique command will be ignored by the controller and responses will simply be factory default initialization values. The 2110-DE2 supports a range if IR cameras (see relevant appendices). Through the manifest system, a specific IR camera can be declared which will make use of commands in a camera specific manner. Similarly query values may/are adjusted as appropriate to provide unified responses back to the controlling software.
2. The Visible lens controls (e.g. zoom, focus, 2x multiplier, autofocus, stabilization, filters, refocus) are used tailored to the lens specified by the manifest (e.g. Fujinon, Pentax PAIR, PAIR 2, etc.) Some functions will not be available depending on the lens specified in the manifest.
3. Illuminator unique commands on only active if an illuminator was included in the system manifest. If not on the manifest, illuminator unique command will be ignored by the controller.
4. Rangefinder unique commands on only active if a rangefinder was included in the system manifest. If not on the manifest, illuminator unique command will be ignored by the controller.
5. Tracker commands are unique commands only active if the EOI video tracker was included in the system manifest. If not on the manifest, the tracker unique commands will be ignored by the controller. Responses to such commands will be nothing, an echo of the commands sent, or a default return value (see Tracker Status Responses, page 73 for more information). When using/adding the tracker, the manifest format is changed slightly. 2110 Code versions 3.00 and higher include the tracker task. When a manifest is queried with this version of code the new format is returned (Manifest Type 00A, see Change HistoryManifest Block, below). Likewise to set a tracker in place, one should be using the modified manifest format (00A) and ensure that ITS 2110 firmware level 3.00 or higher is previously installed.

Pan/Tilt (AZ, EL) commands are always active in the controller.

The manifest permits the reassignment of serial ports (firmware version 2.08 and up) used by each peripheral (cameras, annotators, etc.). The only port that may not reassigned is the serial port used to control the Nighthawk position (AZ and El).

### Reading the System Manifest

The system manifest may be queried by issuing the following command:

PA 01 00 00 00 00

The response from the 2110 is

PA 01 00 + manifest block

#### Manifest Block

The Manifest Block is comprised:

1. Type 00 or 63 (99 decimal) manifest: a type byte, a byte count, 19 data bytes and 2 checksum bytes.
2. Type 01 or 62 (98 decimal) manifest: a type byte, a byte count, 21 data bytes and 2 checksum bytes. The

The manifest block check sum is organized high byte, low byte. The check sum is an 8 bit sum of 19 bytes.

The byte count passed does not include the manifest type, byte count or checksum bytes.

All type numbers as shown in Appendix A are represented in the manifest block as 1 byte hexadecimal numbers.

| **Element** | **Format** | **Manifest Type** | **Notes** |
| --- | --- | --- | --- |
| Manifest Type | 1 byte |  | 00 & 63 (19 bytes) or 01 & 62 (21 bytes) |
| Byte Count | 1 Byte |  | Value = 19 type 00 or 99, value = 21 type 01 or 98 |
| Camera A Type (e.g. visible) | 1 Byte | All | See Appendix A, Cameras, page 80 |
| Lens A Type (e.g. visible) | 1 Byte | All | If a separately controllable camera lens, See Appendix A, External Lenses, page 80 |
| Lens A descriptor | 1 Byte | All | See Appendix A, External Lenses. 80 |
| Enclosure Type Camera A | 1 Byte | All | See Camera/Lens Enclosures, page 83 |
| Enclosure Descriptor | 1 Byte | All | See Appendix A, Manifest Types page 80 |
| Camera A port | 1 Byte | All | See Appendix A, Assignable Serial Ports, page 83 |
| Lens A port | 1 Byte | All | See Appendix A, Assignable Serial Ports, page 83 |
| Camera B Type (e.g. IR) | 1 Byte | All | See Appendix A, Cameras, page 80 |
| Lens B Type | 1 Byte | All | Currently all supported IR cameras have internal lenses and require no additional serial ports. Therefore, this value is usually 0x00. |
| Enclosure B Type | 1 Byte | All | All supported cameras have a camera specific case with no externally controllable features. Therefore this value is usually 0x63 (dec 99). |
| Camera B Port | 1 Byte | All | See Appendix A, Assignable Serial Ports, page 83 |
| Illuminator Type  Becomes Accessory 1 Type | 1 Byte | All | See Appendix A, Lasers & Illuminator Pods, page 82  (becomes) See Appendix A, Accessory List, page 81 |
| Illuminator Port  Becomes Accessory 1 Port | 1 Byte | All | See Appendix A, Assignable Serial Ports, page 83 |
| Range Finder Type  Becomes Accessory 2 Type | 1 Byte | All | See Appendix A, Ranger Finders, page 82  (becomes) See Appendix A, Accessory List, page 81 |
| Range Finder Port  Becomes Accessory 2 Port | 1 Byte | All | See Appendix A, Assignable Serial Ports, page 83 |
| Annotator Type  Becomes Accessory 3 Type | 1 Byte | All | See Appendix A, ITS Annotators, page 82  (becomes) See Appendix A, Accessory List, page 81 |
| Annotator Port  Becomes Accessory 3 Port | 1 Byte | All | See Appendix A, Assignable Serial Ports, page 83 |
| Pan/Tilt Type | 1 Byte | All | Nighthawks. Serial port assignment is not configurable. (see Appendix A, Nighthawk Types, page 83) |
| Tracker Type  Becomes Spare | 1 Byte | 00  00A | Reserved; NS 2110 firmware versions less than 3.xxx  For 2110 Version 3.xxx and higher firmware, this byte is comprised of two nibbles. The most significant nibble specifies the tracker type (see Video Tracker Types page 82 for the current list). The second nibble specifies the serial port to which it is connected in the 2110 (See Assignable Serial Ports page 83) |
| Spare Type  Becomes Accessory 4 Type | 1 Byte | 01 | See Appendix A, Accessory List, page 81 |
| Spare Port  Becomes Accessory 4 Port | 1 Byte | 01 | See Appendix A, Assignable Serial Ports, page 83 |

## Angular Scale Factor

There are 16 binary bits used to determine current position in AZ or EL and received for command to positions from control software.

The true scale factor of 1 binary bit in both axes is 0.0054932 degrees. For the purposes of this specification, a value of 0.005 degrees is used. In designing control software where absolute position is critical, one must use the true scale factor when calculating go to and current positions.

## Constants saved within the controller (state of the machine values)

1. Soft stops relative to home in degrees for AZ (CCW [-] and CW [+]) and for EL (up [+] and down [-]) (2110 only)
2. Last AZ position relative to home in degrees (CCW is minus, CW is plus)
3. Last EL position relative to home in degrees up [+] or down [-]
4. Version value (includes Galil version coordinated with this firmware; 01 controller only)
5. For each preset
   1. AZ, El (relative to home as above) in degrees,
   2. Zoom, Focus (unless autofocus invoked) *of both cameras per the manifest and which camera is active at the time of preset capture.*
6. Each camera parameter setting (as last set by the user, but for only those directly set by the controller)
7. ETHERNET address
8. Max AZ move rate in degrees/second. If the user commands a faster rate, the controller will command the max rate.
9. Max EL move rate in degrees/second. If the user commands a faster rate, the controller will command the max rate.
10. AZ calibration points (two) in degrees from home, CCW [-] and CW [+] with corresponding heading positions. When set, the heading positions will be used as offset references when reporting position back to the GUI. Likewise, when heading positions are set, the user can command to a heading position (verses a position
11. Camera status (on, active, IR white/black hot, AGC, ALGC, Manual)
12. 2x lens status if present per the manifest
13. Autopan parameters
14. State of an illuminator (if present), e.g. on/off, zoom value
15. State of range finder
16. State of the PAIR lens filters, bypass and status

## Constants Saved in NV Memory and restored at power up

Any time a value is set that is to survive a power down; the system must write this value to internal FLASH memory.

The user must wait not less than 10 seconds after any SET or value SAVE before issuing a system reset or power cycling the system to ensure all FLASH values are written and are valid. Cycling power or generating a general reset sooner may result in loss of the last value setting. In the worst case, the FLASH memory data may be corrupted. In such an event, the 2110 will restore all values to the factory default. This ensures the Nighthawk will start up and operate normally, but all user modified data (except IP and MAC address) may be lost.

1. ETHERNET address
2. System Manifest
3. Time Zone Offset (used to correct GPS reported time from UTC).
4. AZ offset[[1]](#footnote-2), if any, relative to mechanical home in degrees (CCW is minus, CW is plus)
5. EL offset1, if any, relative to mechanical home in degrees up [+] or down [-]
6. Soft stops relative to mechanical home in degrees for AZ (CCW [-] and CW [+]) and for EL (up [+] and down [-])
7. Reference Home set values (azimuth, elevation)
8. Version value (includes Galil version coordinated with this firmware; 01 controller only)
9. For each preset
   1. AZ, El (relative to mechanical home as above) in degrees,
   2. Zoom, Focus (unless autofocus invoked) of all cameras and accessories and active camera
   3. Illuminator setting (on/off, zoom)
   4. Which camera was active (this is restored when the preset is selected)
10. The settings of any annotation (if present) saved by the user (02 controller only).
    1. Show status, e.g. on/off, where [row, col], data labels:
       1. IP addr
       2. System mnemonic
       3. AZ and El, resolution, labels, etc.
       4. Zoom & focus values of current camera
       5. Illuminator status (on/off, zoom)
       6. Time
       7. Coordinates (GPS location)
    2. Show status and content of up to 5 free text fields of up to 32 ASCII characters each

For details regarding content and options for show values and free text see Appendix B, Annotator Commands page 84.

At power up, the controller will reset the camera(s) if connected and such command exists. Zoom will be set to the widest FOV and focus will be set correspondingly.

The controller queries each camera present (if any) for determinable states of the cameras so that status can be properly reported to controlling software.

Invocation of a mechanical home will be required for the controller to respond to command to position and presets; however rate moves will be functional. Likewise physical values of soft stops, if any have been set, will have no meaning and will be incorrect until a mechanical home is complete.

Until mechanical home is complete, position queries will be meaningless except for zoom and focus of the active camera.

# Mechanical HOME FUNCTION

The controller and GUI have a function, “MECHANICAL HOME”.

### Nighthawks with Relative Encoders (NightHawkHT, manifest type 00)

This button (on the GUI) will cause PVP NH pan/tilt return the AZ axis to its factory set home position and the EL axis to what we can call “CAMERA LEVEL” position.

The CAMERA LEVEL position is one mechanically defined within the pan/tilt and means level (or orthogonal) to the AZ axis of rotation. This function relies on a constant PVP will furnish that will be determined at the factory. This constant will be the number of counts from the EL up limit flag to camera level. The GUI Controller from a password protected form will accept a value for the counts or angle from EL at up limit stop to Camera Level. This value will be passed to the controller. The value will be used by the homing routine in the controller to set encoder home to = camera level.

RETURN TO HOME (MH) will NOT automatically occur with any power on. We have decided not to invoke MH automatically as a safety concern. A field technician will be able to invoice MH when desired by accessing the controller through the ETHERNET port, running the GUI and clicking the function. This ensure that a power on does not inadvertently cause camera damage or strike a technician on a tower.

On power up, the controller will set a flag that no MH has been invoked. When MH is false (no MH issued yet), the GUI will advise the user that an MH is needed. During this condition, presets and soft stops will not be.

The controller will store in NV memory (somewhere) the last AZ and EL position relative to home in each axis at the completion of each move. In the event of a pan scenario, the controller will store the AZ position relative to home dynamically. By keeping the last AZ and EL position in near real time, an unexpected power down and restore will permit the controller to estimate where home is in each axis. In the event that soft stops have been set to prevent equipment damage or other harm, the stops will still be reasonably valid. Enabling the ability to have a reasonable estimate of home in both axes through a disorderly shut down, reasonable functionality and safety can be maintained while waiting for an opportune time to accomplish an MH.

If there is no saved values for the last AZ or EL positions relative to home, the controller will not execute ANY moves until an MH command is completed. The GUI will receive this condition from the 2110 controller during a status query or any move command. On receipt of this status from the 2110, a special message will be presented to the user that an MH is required before any movement operations can be accomplished.

At start up, the controller will send commands to each camera and lens to restore them to the last settings commanded by the user and saved by the controller.

### Nighthawks with Absolute Encoders (manifest type 01 and 02)

Mechanical home has no meaning in this version of Nighthawk as the location of the pan and tilt position is known at power up. AZ offsets (calibration) remain valid after being set. If not set, encoder zero (mechanically fixed in the Nighthawk) will be AZ zero at power up. If an AZ calibration point is set, then AZ will be encoder zero plus the AZ calibration offset. This value is set to 0.005 degree resolution.

EL operates similarly.

A Mechanical Home (MH) operation is not required in this version of Nighthawk. Home status will be reported as complete at power up.

# System Reset Commands

## Reset the Pan/Tilt Motor Controller

This command is intended for troubleshooting or to stop errant positoner motions immediately.

FF 00 32 77 01 00  
 FF 00 32 77 01 00 Acknowledge

A caution with this command. If stops, max rates and other user settings are necessary to get the desired operation, these values will not be sent to the motion controller unless a General System Reset is sent (see page 20)

## System General Reset

When this reset is issued any TCP/IP connection to the controller will be lost. Any client socket opened must be closed by the client and a new socket must be opened to reestablish communications.

When received the 2110 will close all communications ports to the Nighthawk peripherals and reboot. This could take 5 to 20 seconds.

|  |  |
| --- | --- |
| FF 00 32 77 01 11 |  |
| FF 00 32 77 01 11 | Acknowledge is prior to reboot. |

After reboot, the 2110 will send any user saved (refer to Constants Saved in NV Memory and restored at power up page 18) values to the motion controller (e.g. calibration values), annotation values (if any). The 2110 does issue a reset to the motion controller and any connected annotators (except the type 01 (see page 82 for annotator types) and the IR camera (if connected and supported). Most other devices do not support remote reset. If such a device requires a remote reset, it will be necessary to cycle Nighthawk system power.

# Obstruction Check

The controller will monitor the loop error in both AZ and EL. When a position error that reaches a max value (set at the factory) the movement of the positioner will be terminated, the motor(s) turned off and the error will be available for query (controller status). A move of the affected axis will be allowed in a direction opposite from the direction in which the error was detected. If a max error is detected moving in this direction as well, the pan/tilt will be deactivated. At PT reset can clear this condition. After a PT reset, an MH will be required to restore normal operation of the system.

# Motion Controller Firmware Load Function

Properly prepared motion controller (DMC) code may be uploaded through the 2110 using the same protocol and procedure for any code upload to the controller.

# Door Open Function (Not yet in Nighthawk)

A discrete (number TBD) shall be used to inform the controller that the Nighthawk access door is open. This state can be interpreted in two ways

1. The door is open for servicing
2. Someone is attempting to tamper with the equipment.

When the door is open, the controller will limit pan/tilt rates to TBD degrees/second as a safety feature to protect the equipment and local technician from damage or injury should the pan/tilt be told to move to a new position. The controller shall also maintain this status and report this as “DOOR OPEN” when queried by the GUI or other control software*.*

### The Door Open Query

At this revision, this command is query is ignored by the 2110; there will be no return

FF 00 0F 77 28 00

FF 00 0F 77 28 0x x = a 4 bit value where

0 = “Closed”  
1 = “Open”  
3, 4 = “Not defined”

In order to be fail-safe, the door closed will be the active condition such that a broken wire, failed sensor or other fault will indicate door open and protect the user and alert remote operators. In the factory, ITS will use a jumper or other suitable device to satisfy the Door Closed conditions.

# UDP Discovery Capability

If UDP broadcast message, “ITS CLIENT REQUEST", sent to UDP port 1757 is sent over a network that the controller is connected to, the controller will respond with its current TCP/IP address, gateway address, subnet mask and MAC address. This message is sent to the requesting IP address and the IP broadcast address of 255.255.255.255. This insures that discovery of all ITS controllers is achieved across a network.  The response is returned on UDP port 1758 is:

MAC address (6 bytes)  
IP address (4 bytes)  
gateway address (4 bytes)  
network address mask (4 bytes)  
port number (2 bytes)

# Command Set

Start-up queries “State of Machine” when first addressing a controller so that GUI settings match the condition the controller was set to by the last user.

## General System Commands

### Queries

#### Active Camera Query

An active device is the imaging source to which all commands and status queries are directed. Any information such as zoom position, focus and other similar status are those of the active device only when common commands are used.

FF 00 0F 77 16 00 Checks Active Camera;   
 FF 00 0F 77 16 xx where00 = Visible, 01 = IR

If no camera is present or no IR camera is present, this always returns 00.

#### Active Accessory Query

An active accessory is the device to which all commands and status queries are directed. An accessory includes but is not limited to laser illuminators and range finders. Any information such as zoom position or other similar status is those of the active accessory only when common commands are used.

FF 00 40 77 00 00  
FF 00 40 77 00 xx xx = accessory, 00 = none, 01 = Illuminator, 02=Range Finder

This will always return 00 if the System Manifest does contain a type value for an accessory.

#### Controller Type Query

|  |  |
| --- | --- |
| FF 00 0F 77 1C 00 | Checks Controller type stored in manifest |
| FF 00 0F 77 1C xx | Type 00= reserved  01=reserved  02= 2110-DE2 controller  10=2110-ROTC controller |

#### Controller Status Query

FF 00 0F 77 1D 00 Checks Controller Status  
FF 00 0F 77 1D xx Always 00 in controller types 01 and 02, other values to be defined

#### Controller Firmware Version Query

FF 00 0F 77 1E 00 Checks Controller firmware Most significant value  
FF 00 0F 77 1E xx xx values will reflect version

FF 00 0F 77 1F 00 Checks Controller firmware Least significant value  
FF 00 0F 77 1F xx xx values will reflect version

#### Video Switch/Splitter Query (No longer used, referenced for legacy purposes only)

FF 00 0F 77 20 00 Checks video splitter or switch type and status  
FF 00 0F 77 20 xx 00 = “none”, 01 = “splitter, 02 = “switch only”

#### Video Inserter Query

|  |  |
| --- | --- |
| FF 00 0F 77 21 00 | Reads value of annotator manifest. 99 return = none. |
| FF 00 0F 77 21 xx | Values (binary) are determined by the type loaded into the System Manifest (see ITS Annotators page 82) |

#### Home Status

FF 00 32 77 00 00 Checks HOME status  
FF 00 32 77 00 xx 00 =Home Required[[2]](#footnote-3), 01=Mech Home in progress, 02=Home Operation Complete

This status will always be reported as “Home Operation Complete” (02,) for Nighthawks with absolute controllers (type 02 and up).

#### Current AZ value

FF 00 09 77 00 00  
FF 00 09 77 xx xx xx xx = position is binary; 2 HEX digits from 0 to FFFF; from 0 to 359.995)

#### Current EL value

FF 00 0A 77 00 00  
FF 00 0A 77 xx xx xx xx = position is binary; 2 HEX digits

Binary 0000 = 0.000 degrees. +95 degrees (up max) = 438D;   
-95 degrees (down max) is 265.000 degrees = BC71

#### Query Current Zoom value (active camera)

The controller will report the zoom position of the active camera based on the active camera selection

FF 00 0B 77 00 00  
FF 00 0B 77 xx xx xx xx = packed BCD from 0-255, 1000 to 1255 if the IR camera is active and the value reported by the camera does not equal the last value commanded by the controller

Queries of the IR lens zoom position requires testing controller IR busy status before issuing a lens position query. Any such query returned value is the last value received from the camera. If the last value does not equal the value commanded by the controller internally, the 1000 is added to the returned value. This out of range value can be used by interfacing software to detect an error has occurred and signal such to a user for remedial action.

#### Query Current Focus value (active camera)

FF 00 0C 77 00 00  
FF 00 0C 77 xx xx xx xx = 0-255 packed BCD, 1000 to 1255 if the IR camera is active and the value reported by the camera does not equal the last value commanded by the controller

Queries of the IR lens focus position requires testing controller IR busy status before issuing a lens position query. Any such query returned value is the last value received from the camera. If the last value does not equal the value commanded by the controller internally, the 1000 is added to the returned value. This out of range value can be used by interfacing software to detect an error has occurred and signal such to a user for remedial action.

#### AZ offset value

This command returns a binary value representative of the offset from mechanical zero. Mechanical zero is “found” in the Nighthawk HT or any model with relative encoders by first completing a mechanical home. This sets the encoders to 0.

Mechanical zero is fixed and known at power up in Nighthawks (such as the direct drive) with fixed encoders.

FF 00 33 77 00 00  
FF 00 33 77 xx xx

Where xx xx = a binary value of the offset from mechanical zero from 0 to FFFF (0 to 359.995)

#### El offset value

This command returns a binary value representative of the offset from mechanical zero. Mechanical zero is “found” in the Nighthawk HT or any model with relative encoders by first completing a mechanical home. This sets the encoders to 0.

Mechanical zero is fixed and known at power up in Nighthawks (such as the direct drive) with fixed encoders.

FF 00 34 77 00 00  
FF 00 34 77 xx xx  
Where xx xx = a binary value of the offset from mechanical zero from; 0000 = 0.000 degrees. +95 degrees (up max) = 438D or from 0 to -95 degrees (down max) is 265.000 degrees = BC71

#### Current Max GO TO Rate

|  |  |  |
| --- | --- | --- |
| PA 42 00 “?” +CR | Response as PA 42 00 value (ACII)+CR | data = CR (\r) = restore default  = ?CR (ASCII string)= report current max rate setting Values returned will be a floating point number from 0 to 100 and up to 3 decimal places. |

#### Current Move Rate

|  |  |  |
| --- | --- | --- |
| PA 42 1x “?”+CR | Response is PA 42 1x **Rvalue** +CR | = x = 0 or 1, the response provided is for both Az and El rates, but x will echo commanded value. = **Rvalue** is the response to the “?” command and is formatted as “±aaa.aaa,±eee.eee”cr where  “a” values are Azimuth and  “e” values elevation.  The meaning of the sign is the same as the input definition (see Move at Rate page 28). Aaa.aaa is a variable width and represent a floating point number response.  E values are similarly formatted. |

#### Aggregate Data Request

The Aggregate Data Request (ADR) has been created as an alternative to the issue of individual query command for many parameters.

Multibyte values are ordered high-byte/low-byte unless otherwise noted.

There shall be at least 150 msec between ADR commands. This will ensure that data furnished is current for each element of the list.

PA 40 00 00 00 00.   
PA 40 00 + 48 byte block

The 48 byte block of data is defined below.

| **Group** | **Byte No.** | **Status Item** | **Byte Count** | **Type** | **Notes** |
| --- | --- | --- | --- | --- | --- |
| Nighthawk | 0-2 | Current AZ | 3 | binary | 2^19 bit values |
| 3-5 | Current EL | 3 | binary | 2^19 bit values |
| 6 | Active Device | 1 | bit 0 | Vis |
| bit 1 | IR |
| bit 2 | TBD=0 |
| bit 3 | TBD=0 |
| bit 4 | TBD=0 |
| bit 5 | TBD=0 |
| bit 6 | TBD=0 |
| bit 7 | TBD=0 |
| 7 | Other devices | 1 | bit 0 | Pointer Status (ON/Off) |
| bit 1 | Illuminator Status (ON/Off) |
| bit 2 | Nightsun on/off |
| bit 3 | NH Rate Comp on/off |
| bit 4 | JS (0) or remote (e.g. tracker) control (1) |
| bit 5 | TBD=0 |
| bit 6 | TBD=0 |
| bit 7 | TBD=0 |
| Vis Camera | 8-9 | Zoom | 2 | Upper Nibble | 0 if present F if no camera or table to converter from FOV to relative |
| lower 12 bits | 0-254 in general |
| 10-11 | Focus | 2 | Upper Nibble | 0 if present F if no camera |
| lower 12 bits | 0-4095 depending on the camera |
| 12-13 | FOV | 2 | Upper Nibble | 0 if present F if no camera or table to convert from relative to FOV |
| BCD\*10 | BCD value \*10; 0-99.9 degrees |
| 14 | Cam/Lens Status | 1 | bit 0 | 2x in(1) out(0) |
| bit 1 | Stab on (1) off (0) |
| bit 2 | Filter in (1) out (0) |
| bit 3 | BW Mode (1) Color Mode (0) |
| bit 4 | TBD=0 |
| bit 5 | TBD=0 |
| bit 6 | TBD=0 |
| bit 7 | TBD=0 |
| IR Camera | 15-16 | Zoom | 2 | Upper Nibble | 0 if present F if no camera or table to converter from FOV to relative |
| lower 12 bits | 0-254 in general |
| 17-18 | Focus | 2 | Upper Nibble | 0 if present F if no camera |
| lower 12 bits | 0-4095 depending on the camera |
| 19-20 | FOV | 2 | Upper Nibble | 0 if present F if no camera or table to convert from relative to FOV |
| BCD\*10 | BCD value \*10; 0-99.9 degrees |
| 21 | Ezoom | 1 | binary | 0-10; The multiplier varies with the camera in use.   * L3 Walrus 0-10 is scaled from 100% to 400% * L3 HDIR reports Ezoom value for Main and PIP video. Switching requires a query command (see **Error! Reference source not found.**, page **Error! Bookmark not defined.**) to be sent to 2110 for the Ezoom desired. Thereafter, Ezoom reported reflects the values of the last query source * FLIR Ranger HRC 0=100%, 3=200% 10=400% |
| 22 | Camera/Lens Status | 1 | bit 0 | Stab on (1) off (0) |
| bit 1 | Ezoom on (1) off (0) (see Ezoom cautionary note below) |
| bit 2 | White (0)/Black (1) Hot |
| bit 3 | PIP White (0)/Black (1) Hot |
| bit 4 | TBD=0 |
| bit 5 | TBD=0 |
| bit 6 | TBD=0 |
| bit 7 | TBD=0 |
| SWIR | 23-24 | Zoom | 2 | Upper Nibble | 0 if present F if no camera |
| lower 12 bits | 0-4095 depending on the camera |
| 25 | Spare | 1 |  | TBD=00 |
| Tracker | 26-27 | Tracker Error x | 2 | signed | Values relative to screen center |
| 28-29 | Tracker Error y | 2 | signed | Values relative to screen center |
| 30 | Track Status | 1 | binary | 01, 03 or 08 representing, acquiring, on track, autotrack respectively. FF is returned when a tracker is not present |
| 31-32 | Spare | 2 | binary |  |
| Illuminator | 33-34 | Illuminator zoom position | 2 | Upper Nibble | 0 if present F if no illuminator |
| lower 12 bits | 0-254 in general |
| Time  NOT YET AVAILABLE  All 7bytes=00 | 35 | Time Status | 1 | bit 0 | 0= no time source; 1 = time source available |
| bit 1 | GPS (0) or IRIG (1) time source |
| bit 2 | Locked (1) or not locked (0) |
| bit 3 | TBD=0 |
| bit 4 | TBD=0 |
| bit 5 | TBD=0 |
| bit 6 | TBD=0 |
| bit 7 | TBD=0 |
| 36-41 | Time Value | 6 | Binary  When no time source, all values are 0 | Byte 1; Year, 0-99 |
| Byte 2-3; Days, 1-366 |
| Byte 4-6; Time, 0-8639999 where each increment is 10 ms. |
| TBD | 42 | Reserved | 1 | binary |  |
| TBD | 43-47 | Spare Bytes for future use | 5 | binary | Each byte value = 00 |

**CAUTION**

Since internal variables are updated by independent tasks scheduled by the 2110‑DE2 operating system, it is possible that parameter value returned with the use of an individual query command and the data found within the ADR differ. This phenomenon is possible with dynamic data such as azimuth and elevation values since data sampling may be taken at different times.

Ezoom value reported for the L3 HD IR camera may either be the main or PIP video. In order to change/set the source, send a query (see **Error! Reference source not found.** page **Error! Bookmark not defined.** for details )the of the desired value source to the system. This action switches the Ezoom source reported in the Ezoom field of the ADR. At power on, the source is defaulted to the main video.

#### System BIT

The system BIT command provides a pass fail response. The system checks communication with all devices selected in the manifest and will provide a fail if any of the devices is non-responsive.

PA 45 01 FF

45 01 xx Where xx:

0 = Fail

1 = Pass

### Controls

#### Go To Position

In Nighthawks with relative encoders, this command does not work until a MECHANICAL HOME is completed. This command is always available in nighthawks with absolute encoders (type 1 and 2, see Nighthawk Types page 83).

To command to a position to one or all of the following as it applies

FF 00 05 77 xx xx xx xx is the binary value of AZ from 0 to FFFF (0.000 to 359.995 degrees)

FF 00 06 77 xx xx xx xx is the binary value of EL from

Binary 0000 = 0.000 degrees. +95 degrees (up max) = 438D; -95 degrees (down max) is 265.000 degrees = BC71

#### Go To Max Rate

The GO TO Max Rate command set the speed in both azimuth and elevation that any Go To Position executes. The value may be set from 0. to 100.000 to three decimal places. If a value of zero is set, there will be no motion with GO TO commands When programming, set this max rate first then the go to position. Once motion has started, a new Max Rate can be sent. This new Max Rate will be effective on the NEXT Go To command. This command contains an integrated query. The system default is a rate set by the factory that is restored as described below.

|  |  |
| --- | --- |
| PA 42 00 data+CR | data = CR (\r) = restore default  = ?CR (ASCII string)= report current max rate setting, (see Current Max GO TO Rate page 24)  =any floating point number in ASCII. Values MUST include a decimal point and can range from 0. to 100.  values can be entered to a decimal resolution of 3 places (e.g. 0.001). Values below zero or above 100 will be ignored.  Setting values are in degrees/sec and determine both the AZ and EL max and goto rates. |

#### Move at Rate

The intent of this command is to permit a user to directly control the rate and direction of motion of the Nighthawk. This command permits rates to from ±0.001 degrees/sec to ±100 degrees/sec on either axis independently. Please be advised that the lowest practical rate is limited to the payload on the system, temperature conditions and internal friction in the azimuth and elevation axes. It is likely that the lowest rate can be achieved on the elevation axis.

As noted there are two ways to stop motion, entering a zero rate or sending an “S” for the particular axis. These are two types of stops. When entering a zero rate the position counter in the motion controller ceases to advance/decrement. Depending on the velocity at the time the command is received, the P/T may overshoot the position counter and return. If an “S” command is sent, the motion controller’s profiler plots a stop. The terminal position will be determined by the profiler, but the stop should be critically damped.

When a query of rate is sent to the system, the current actual motion rate is returned, not the commanded rate.

|  |  |
| --- | --- |
| PA 42 1x data+CR | x = 0 for Azimuth moves, 1 for Elevation moves.  data  ="**?**"cr (ASCII string)= report current max rate setting (see Current Move Rate, page 24 for details).  = "**S**"cr (ASCII string) = stop motion in respective channel (this is a controlled stop by the profiler rather than an uncontrolled stop from a zero rate)  = **Data** is any signed floating point number in ASCII.  Values of data ***MUST*** include a decimal point and can range from -100. to 100. Values can be entered to a decimal resolution of 3 places (e.g. 0.001). Values outside the range will be ignored.  Setting values are in degrees/sec and determine rate at which AZ moves right (+ values) or left (-values) or EL moves up (+ values) or down (-) values |

#### Vector Pan/Tilt Commands

These commands permit the programmer to move pan and tilt simultaneously with a single command. The command is organized in quadrants.

FF 00 00 yy pp tt

Where the yy is the quadrant (see the table below), pp is the pan rate and tt is the tilt rate.

Pp = 0 (stop) to 63; tt is 0 (stop) to 63 in the same manner as the individual pan and tilt commands

Quadrant motion is determined as shown below where the values in the corresponding boxes are hex and are the yy values to be used.

|  |  |  |
| --- | --- | --- |
| Pan Left (CCW) | Pan Right (CW) |  |
| 14 | 12 | Tilt up |
| 0C | 0A | Tilt Down |

#### Pan (AZ) (values of XX set rate)

FF 00 00 04 xx 00 pan left  
 FF 00 32 77 00 00 done status from controller if HOME REQUIRED, else NO response to this command

FF 00 00 02 xx 00 pan right  
 FF 00 32 77 00 00 done status from controller if HOME REQUIRED, else NO response to this command

xx = 0 (Stop) to 63 (Max rate).

Max rate is adjusted by the controller with zoom position and active camera.

#### Tilt (EL) (values of XX set rate)

FF 00 00 10 00 xx tilt down  
 FF 00 32 77 00 00 done status from controller if HOME REQUIRED, else NO response to this command

FF 00 00 08 00 xx tilt up  
 FF 00 32 77 00 00 done status from controller if HOME REQUIRED, else NO response to this command

xx = 0 (Stop) to 63 (Max rate).

Max rate is adjusted by the controller with zoom position and active camera.

#### Scale Max Rate

The true maximum pan rate is scaled by the zoom position based on the selected camera lens zoom position (not applicable to a zoomable illuminator). This user adjustment to max rate is a multiplier on this internally derived maximum pan rate. Therefore, when the active lens is zoomed out to the minimum field of view, the maximum pan rate may be internally set to 30% of the maximum pan capability (e.g. 50º/sec) of the positioner. When invoked this scaling command may further reduce this rate. For example, as previously described the internally derived max rate may be 30% of 50º/second or 15º/second. The user invokes “Scale Max Rate” of 02 (60%). The resulting max rate at this zoom position for the active lens would then be 9º/second. As the lens was later zoomed back to a wide field of view, the max rate would increase but to 60% of 50º/second; 30º/second. This limit would remain until changed by the user with this command. This value is NOT retained during power cycles.

Rate is not limited by zoom position of the active lens when commanding “go to” positions and presets. In these moves, the Nighthawk will change pointing positions at its fastest possible angular velocity.

An example of how this works is depicted in the graphic (right) for a long range lens having a field of view (FOV) range of 1 to 18 degrees.

|  |  |
| --- | --- |
| FF 00 31 77 05 | Type 01,02 Controller:  xx where xx 50% to 150% in 10% steps. 00 = no change or off 10 = 100%;  values are 5,6,7,8,9,10,11,12,13,14,15 for 50% to 150%.  99 = request for current value coded as specified" |
|  | Type 10 Controller:  xx values are 8,9,10,11,12,13,14,15 for 80% to 150%, then 5=1/1000, 6 - 1/100 and 7 = 1/10 |
| FF 00 31 77 05 xx |  |

#### Logarithmic Pan/Tilt Joystick/Mouse Control

Joystick rates (virtual mouse rates) are logarithmic following the profile shown below. This profile provides for fine control of pan and tilt with small joystick moves while maintaining the ability to move the nighthawk quickly to a new position.

The logarithmic profile can be turned off by setting 2110 switch S1-3 to ON and rebooting the controller. After this, joystick input control will be linear.

Logarithmic control is scaled with Max Rate as described earlier in that at full joystick displacement (63) the maximum rate that the Nighthawk will travel is set by the max rate determined by the lens zoom position.

#### ALL Stop

FF 00 00 00 00 00 Stops all current AZ, EL, Zoom and Focus motion

#### Select Visible as/Toggle Active Camera

If there is no IR camera specified in the System Manifest, this command is ignored.

|  |  |
| --- | --- |
| FF 00 0F 77 14 0x | x=0 sets visible as active device; x=7 toggles the active device IF another camera is present (determined by manifest) AND the other camera is ON, else it will set the Visible Camera as active device. |
| FF 00 0F 77 14 0y | Y = 0 if x=0 at command, y=active device where Visible Camera y=1 and IR Camera y=2 if x=7 at command time. |

#### Select IR as /Toggle Active Camera

If there is no IR camera specified in the System Manifest, this command is ignored.

|  |  |
| --- | --- |
| FF 00 0F 77 15 0x | x=0 sets IR as active device if it is ON; x=7 toggles the active device IF another camera is present (determined by manifest) AND the other camera is ON, else it will set the IR Camera as active device. |
| FF 00 0F 77 15 0y | Y = 0 if x=0 at command, y=active device where Visible Camera y=1 and IR Camera y=2 if x=7 at command time |

FF 00 0F 77 15 00  
FF 00 0F 77 15 00

#### Select Active Camera

FF 00 0F 77 24 xx 00 =Visible; 01 = IR camera

Note this command supersedes the previous Visible Camera selector command (FF 00 0F 77 14 00) and the previous IR Camera selector command (FF 00 0F 77 15 00) on the type 02 (2110-DE2) controller only. The 2110-DE2 controller will accept the legacy command for backward compatibility. However, this new command must be used to select the illuminator.

This command is ignored by the 2110 if no camera type is specified in the system manifest (see Cameras page 80). If only one camera exists in the system manifest, the active camera will always be set to the camera available.

#### Go to mechanical home

FF 00 32 77 01 01

FF 00 32 77 01 01

#### For Nighthawks with relative encoders (type 0, see , page 83)

This command will cause the positioner to execute a homing sequence. In AZ it will rotate to an internal home position set at the factory. In EL is will move the positioner in elevation CW first up to 180 degrees. Then return the EL position to where it started or 90 degrees from the CW mechanical stop flag set at the factory. It will delay then proceed CCW up to 180 degrees or until the lower mechanical flag is found. The EL sequence completes by placing the EL position geometrically between the two stop positions. At this point a home status query will yield a response of FF 00 32 77 00 02 (home complete. In the event that one or the other of the EL stop flags is not found (an internal positioner fault), home status will be reported as FF 00 32 77 00 00 (Home required). This of course is an error.

#### For Nighthawks with **absolute** encoders (type 1 & 2, see , page 83)

The positioner is not moved, but any user offsets set in AZ (FF 00 02 77 xx xx) will be reset to zero and EL (FF 00 04 77 xx xx). This may be confirmed by issuing offset value queries for AZ (FF 00 32 77 01 04) or EL (FF 00 32 77 01 05).

The ITS GUI displays HOME REQUIRED any time the ITS controller status is set to 32 77 00 00 informing the user that this operation is required. Any time power is cycled on the system, a mechanical home is required. At power up, the ITS controller sets its status of FF 00 32 77 00 00 (home required).

#### Go to Reference Home

This will go to a reference home as set by the user.

FF 00 32 77 01 03

When home status is “Home Required” (FF 00 32 77 00 00)

A mechanical home must be completed before home is valid. Mechanical home is always complete in Nighthawks with absolute encoders. If a home command (see below) is issued with home required status, the ITS controller will ignore it. Since this command and the controller response is status sensitive, home status should be queried prior to issue.

#### Set Reference Home

This is a special preset and acts like a preset in every way. However, this preset is command as a go to position by the “GO TO REFERENCE HOME” command rather than a go to preset command.

FF 00 32 77 01 02

When invoked, this command saves AZ and EL positions relative to mechanical home in Nighthawks with relative encoders. Reference home set is the encoder offset in Nighthawks with absolute encoders.

These values can be give “true heading” values from 0 to 359.995 (AZ) and 0 to 95 (tilt up) or 359.995 to 265 (tilt down) pointing angles. These values are used as reference when commanding to position.

#### Calibrate Home (enter offsets)

Calibrating home changes the reference home setting from 0 AZ and 0 EL (default) to any value 0 to 359.995 (may be limited by physical stops in the pan/tilt) to 0 to 90 (tilt up but may actually limited by physical stops within the pan/tilt) or 359.995 to 270 (tilt down and may also be limited by physical stops in the pan/tilt unit.) Resolution is 0.01 degree for both movements. These user entered values are offsets

Values sent to are reported from the controller are binary values from 0 to 65535 where the 0 =0.000 degrees and 65535 = 359.995 degrees.

These values can be set to zero with these commands

#### Calibrate (set a value for reference home Pan (AZ)

FF 00 02 77 xx xx where xx xx = two hex digits from 00 to FFFF (0.000 to 359.995 degrees)

#### Calibrate (set a value for reference home Tilt (EL)

FF 00 04 77 xx xx where xx xx = two hex digits;   
 Binary 0000 = 0.000 degrees. +95 degrees (up max) = 438D;   
 -95 degrees (down max) is 265.000 degrees = BC71

When appropriately set, an AZ of 0.0 should point the cameras on the pan/tilt to true north (or magnetic north depending on the heading reference used). A tilt (EL) value of 0.0 should indicate a camera position perpendicular to a radial line projected from the center of earth

#### Control Mode

This mode selection is not available unless the host Nighthawk has a cuing and/or slaving control sources such as a message stream input having dynamic EFG (or equivalent) target location information that can be used to establish pointing angles for the Nighthawk sensors or has a video tracker installed.

Joystick is default control source at power up.

The command sequence is FF 00 44 77 aa bb the response is of the same format, however aa bb values are dictated by the responding control source.

If in Sensor control and Sensor data is not valid or becomes not valid, control reverts to Joystick in rate mode where the rate used is the last valid rate and direction computed from a valid Sensor data stream.

If control is Video Tracker and tracker is not ready or becomes invalid control will revert to Sensor if ready and available and lastly joystick.

If there is no Sensor cueing source, 02 mode select is ignored and the system remains the last mode set.

If there is no Video Tracker installed 03 mode select is ignored and the system remains in the last mode set.

When the system is instructed to exit cue mode (any mode other than 02), any position offsets are reset to 0 and are not saved. Reentering cue modes will not restore any previously set offsets

aa = select source

00 all modes disabled (all stop)

01 joystick input

bb = 00 disable

01 = rate mode (normal & default)

02 = rate hold (displacements add to current rate)

99 = joystick mode status only

response = bb, 00 (not selected), 01 and 02 as above

02 cue to remote sensor (***Controller type 10 only)***

bb = 00 cue not

01 = cue

03 = cue-predictive

10 = increment AZ (x-axis) position cue offset

11 = decrement AZ (x-axis) position cue offset

13 = clear AZ (x-axis) position cue offset

20 = increment EL (y-axis) position cue offset

21 = decrement EL (y-axis) position cue offset

23 = clear EL (y-axis) position cue offset

30 = clear all position cue offsets

99 = current mode status only

responses 02 9b

b=0 not selected, 1=not ready, 2 ready-not cued,

3= cued, 4=cued-predictive, 8=data errors, 9=fault

03 slave to video tracker ***(controller type 10 only)***

bb = 00 unlock

01 slave to tracker

99 current mode status only

Response 03 9b

b = 0 =not selected, 1= not ready, 2 =ready-not slaved

b= 3= ready-slaved, 8=data errors, 9=fault

When in Rate Compensation Mode, an inertial sensor detects external mechanical motion of the Nighthawk mounting and automatically commands counter motion to hold the image steady. When in this mode, it may be necessary to adjust and save the rate compensation bias (see that command without adjustment, either axis (AZ or EL) may drift. The default is control mode 0101. Any GUI must query the control mode to properly set the display and enable the correct functions before enabling joystick control.

If the controller is in control mode 0103 and receives a GO TO value (AZ or EL only), GO TO PRESET or HOME command, the 2110 will temporarily return to control mode 0101 until the corresponding move is completed. Once completed, the 2110 will return to control mode 0103 automatically. The status of the control mode is be reported in its actual state (transitory as necessary) when queried by the interface.

## Set Autopan Profile

These commands do not work until a MECHANICAL HOME is completed. Mechanical home is always completed for Nighthawk type 1 and 2 systems (see Nighthawk Types page 83).

Left Limit

FF 00 31 77 00 00  
FF 00 31 77 00 30 Controller stored current AZ position

Right Limit

FF 00 31 77 01 00  
FF 00 31 77 01 31 Controller stored current AZ position

#### Start Auto Pan

FF 00 31 77 02 00  
FF 00 31 77 02 32

Controller moves positioner to left limit at max rate, then starts pan left to right at pan rate setting.  
At right limit controller starts pan right to left at pan rate setting. Set the speed first.

#### Stop Pan

FF 00 31 77 03 00  
FF 00 31 77 03 33  
Controller stops position in place.

#### Pan Speed Setting

FF 00 31 77 04 xx   
FF 00 31 77 04 xx xx = hex value equivalents of (0 to 127) 0 to 7Fh

May be adjusted to any value on the fly. The rate used is a percent of full value. Max rate is adjusted with zoom position by the controller for this command. Therefore, the max pan rate is slower at a narrow FOV for the active camera and fastest when the FOV is wide for the active camera.

## Preset Functions

Although preset values are stored in the controller, the have no meaning until a mechanical home is completed in Nighthawks with relative encoders. Nighthawk types 1 and 2 (see Nighthawk Types page 83) do not require establishing home and always respond to these controls.

#### Set (store) a preset value group

FF 00 00 03 00 xx xx = 1h to 40h (1 to 64 dec)  
FF 00 00 00 Controller acknowledge

With this command, controller stores current AZ, EL, IR Zoom, IR focus, Vis Zoom and Vis focus, Vis 2X status values to controller preset x. X is determined by user (preset 1 to 64).

#### Go to Preset

FF 00 00 07 00 xx xx = 1h to 40h (1 to 64) .. the stored preset value  
FF 00 00 00 Controller acknowledge

With this command, controller sets cameras to stored value of the preset number (1-64)   
Default values are zoom =; focus =; AZ = home, EL = Home

#### Clear Preset

FF 00 00 05 00 xx xx = 1h to 40h (1 to 64) .. the stored preset value  
FF 00 00 00 Controller acknowledge

This command clears the preset value group for preset xx to default values (makes unavailable until set).

## Soft Stop Functions

Although soft stop values are stored in the controller, the have no meaning until a mechanical home is completed in Nighthawks with relative encoders. As such, moves commanding the controller through a soft stop position will be honored by the controller which may cause damage to the equipment, nearby obstructing structures or personnel in the vicinity.

In Nighthawks with absolute encoders, soft stops are valid at power up, however, when the positioner is off, there is no guarantee that the AZ or EL physical position could be outside of the soft stop range.

#### Set Pan Left Stop

FF 00 30 77 00 04 Controller captures the positoner current AZ value and uses it to limit counter-clockwise pan

#### Clear Pan Left Stop

FF 00 30 77 00 00 Clears this stop (unlimited counter-clockwise pan)

#### Set Pan Right Stop

FF 00 30 77 00 05 Controller captures the positoner current AZ value to the resolution available and uses it to limit clockwise pan

FF 00 30 77 00 01 Clear Pan Right Stop - Controller clears this stop (unlimited clockwise pan)

#### Set Tilt Up Stop

FF 00 30 77 00 06  (EL values from 0 to 95) Controller captures the current positioner EL value to the resolution available and uses it to limit up tilt motion. Refer to go to for proper values of EL when using the type 02 controller.

#### Clear Tilt Up Stop

FF 00 30 77 00 02 Controller clears this stop (unlimited up tilt to mechanical stop)

#### Set Tilt Down Stop

FF 00 30 77 00 07  (EL positions from 359.9 to 265) Controller captures the current positioner EL value to the resolution available and uses it to limit tilt down motion. Refer to go to for proper values of EL when using the type 02 controller.

#### Clear Tilt Down Stop

FF 00 30 77 00 03 - Controller clears this stop (unlimited down tilt to mechanical stop)

FF 00 30 77 00 08 Clear All Stops - Controller clears all pan & tilt stops.

#### Clear All Soft Stops

|  |  |
| --- | --- |
| FF 00 30 77 00 08 | Controller clears all pan & tilt stops and removes values from NV storage |
|  |  |

## Rate Compensation Nighthawk type 2 only (see page 83)

Upon receiving this command the 2110 turns on rate mode. In rate mode mechanically induced motion imposed on the Nighthawk through its mounting or wind loads will be sensed by the internal rate sensor and compensated. The result is a steady image that remains on the target to which it is pointed. When selected, this mode must be temporarily turned off when GO TO commands, HOME or PRESET commands are to be sent. This mode (RATE) may be restored after the move is completed. When joystick inputs are received (rate mode commands) rate compensation remains in effect and active.

When in rate compensation mode, any query of azimuth or elevation Nighthawk position will reflect the actual position relative to the mounting of the Nighthawk itself as modified by offsets entered by the user. Therefore, one will be able to observe the effects of compensation in AZ and EL values in real time if monitored. Likewise, any GO TO position will be variable after the move is complete by any angle necessary to maintain FOV on the intended target. When Rate Compensation is turned off, the Nighthawk will move to the last commanded position prior to assertion of rate compensation.

Rate mode is entered by changing the system to control mode 04 (see CONTROL MODE).

### Queries

#### Query PT AZ Bias Value

FF 00 49 77 00 00   
FF 00 49 77 xx xx

xxxx= the bias value ranging from -32768 to +32767 on receiving this command, the 2110 will respond with the current value Any GUI should wait 150 mS or more before requesting this value after the value has been set or incremented"

#### Query PT El Bias Value

FF 00 4A 77 00 00   
FF 00 4A 77 xx xx

xxxx= the bias value ranging from -32768 to +32767

On receiving this command, the 2110 will respond with the current value.

Any GUI should wait 150 mS or more before requesting this value after the value has been set or incremented

### Controls

#### PT AZ Rate Bias Value

FF 00 46 77 xx xx  
FF 00 46 77 xx xx (actual state)

xxxx= the drift value ranging from -32678 to +32767

#### PT El Rate Bias Value

FF 00 47 77 xx xx  
FF 00 47 77 xx xx (actual state)

xxxx= the drift value ranging from -32768 to +32767

#### PT Save Rate Bias Compensation

FF 00 48 77 xx yy  
FF 00 48 77 xx yy

xx = 99 the last commanded AZ bias value is to be saved to survive a power cycle and used as a new default

yy = 99 the last commanded EL bias value is to be saved to survive a power cycle and used as a new default

Any GUI should wait 150 ms before querying the value after a save.

## General Lens Commands

These controls are intended to provide the functions indicated for either the visible (camera a) or IR (camera b) lens and are directed to the ACTIVE camera.

### Queries

#### Query Current Zoom value

|  |  |
| --- | --- |
| FF 00 0B 77 a0 00 | If a=0 reports value of selected device; xxx = packed BCD from 0-255,  If a=1, it reports xxx=000 to 999 (packed BCD) where 999=99.9 degrees. |
| FF 00 0B 77 yx xx | In either case, y=1 if the IR camera is active and the value reported by the camera does not equal the last value commanded by the controller. (V1.28) If communication with or an error is detected by the controller for the active camera lens y=1 for that query.  y=9 if no table exists (or the camera does not support) to report degrees. In this case the xxx value will be as though y=0 |

#### Query Current Focus value

|  |  |
| --- | --- |
| FF 00 0C 77 a0 00 | When a=0 the value return will be that of the active camera  When a=1 the query is for the focus value of the Visible Camera  When a = 2 the query is for the focus value of the IR camera |
| FF 00 0C 77 yx xx | If y=0 or 1, the response is for the active camera. Y=1 indicates the value returned by the camera is in error (equivalent to report the value plus 1000)  If y=2 or 3 the value returned is for the Visible camera. If y=3 the returned value is in error and is equivalent to adding 1000 to the focus value returned by the visible camera.  When y=4 or 5, the value returned is for the IR camera. If y=5 then the returned value is in error and is equivalent to adding 1000 to the focus value returned by the IR camera. |

### Controls

#### Lens Zoom/Focus Go To

This command permits directing the active camera lens to go to a relative position (0-254 binary) or to a field of view (FOV) value in degrees (0 to 999). When commanding the lens to FOV values the xxx argument is in one tenth degree increments. That is 999 is 99.9 degrees.

Some lenses can only commanded in relative values and some only in FOV values. In general the 2110 will contain a 4th order polynomial function that crates a cross reference table between FOV and relative values for a lens supported in this manner. When supported, one may command the lens either way as specified for this command.

If the subject lens does not have a cross reference table, an error will be returned as shown in this command.

**Zoom Go To**

|  |  |
| --- | --- |
| FF 00 07 77 ax xx | The upper nibble, a, is defined as:  Bits 3 2 1 0 where 3=MSB  bit 3-2= 00 is Active camera command  = 01 is Vis Cam command  = 10 is IR Cam command command  bit 1 = 0 is Relative, bit 1=1 is FOV degrees  bit 0 = reserved  Xx x = 0-999. When using FOV in degrees 999=99.9 degrees |
| FF 00 07 77 y0 00 | y response nibble iis defined as:  Bits 3 2 1 0 where 3=MSB  bit 3-2= 00 is Active camera command  = 01 is Vis Cam command  = 10 is IR Cam command  bit 1 = 0 is relative, 1= FOV in degrees  bit 0 = 0 is OK, 1=Error  y=1111 if there is no table. |

In either case, the 2110 will take care of limiting commanded values to the range of the specific camera (active) and defined by the manifest (type).

**Focus Go To**

|  |  |
| --- | --- |
| FF 00 08 77 ax xx | The upper nibble, a, is defined as:  Bits 3 2 1 0 where 3=MSB  bit 3 = 0 xxx is BCD format, bit 3 = 1 xxx is binary format  bit 2 = (reserved)  bit 1-0 = 00 values are directed at the ACTIVE camera  = 01 values are directed at the VISIBLE camera  = 10 values are directed at the IR camera  xxx = 0-255 BCD format or 0-4095 12-bit binary format |
| FF 00 08 77 y0 00 | y=a |

#### Cue Lenses (02 controller only); NOT YET IMPLEMENTED

FF 00 32 77 03 xx where

00 = No Cue; 99 = return current cue status  
01=cue lenses to each other if two lenses present  
2a = cue lenses to FOV with sensor range input a is the FOV goal as 1=100 ft, 2=200 ft, 3= 300 ft, 4= 400 ft, 5=500 ft, 6=750 ft, 7= 1,000 ft, 8= 1,500 ft, 9= 2,000 ft  
 FF 00 32 77 03 xx

The controller uses the “Active Camera” as the master and the other camera lens is cued to it. On switching active cameras, the controller will not change either lens zoom positions until the then (newly selected) active camera lens position is changed. When changing from cued to not cued, neither lens zoom position shall be changed. When changing from not cued to slaved, the “cued” lens will be moved to match (as closely as practical) the lens FOV of the master (active) camera. During movement of the “master lens” the cued lens is not moved until the “master” lens has stopped and its final position is determined. The cued lens will then be commanded to the nearest equivalent field of view.

When this command is 2a, the active lens is cued to an FOV that when target range is valid approximates the desired FOV setting in feet within the zoom range of the lens. If no source of range information is available to the system, this command is ignored

#### Step Zoom

This function will increment or decrement the position count of the zoom for the active camera provided that the active camera has a zoom capability. This increment or decrement does not roll over. When the end of range is reached, the controller will not continue to increment or decrement and will respond with a 00 argument as shown in the commands below. Decrement/Increment values vary depending on the lens in use and the manner in which the lens responds. Observed values may change from 1-3 counts for any increment/decrement command.

FF 00 32 77 05 xx: where values of xx are 00 do nothing, 01 = increment, 02 = decrement

FF 00 32 77 05 xx where xx values are a repeat of the command ( 01 or 02) or 00 if at end of range

Step count = 3 counts for Type 02 controllers and 5 counts for type 10 controllers

#### Step Focus

This function will increment or decrement the position count of the zoom for the active camera provided that the active camera has a zoom capability. This increment or decrement does not roll over. When the end of range is reached, the controller will not continue to increment or decrement and will respond with a 00 argument as shown in the commands below. Decrement/Increment values vary depending on the lens in use and the manner in which the lens responds. Observed values may change from 1-4 counts for any increment/decrement command.

FF 00 32 77 06 xx: where values of xx are 00 do nothing, 01 = increment, 02 = decrement

FF 00 32 77 06 xx where xx values are a repeat of the command ( 01 or 02) or 00 if at end of range

Step count = 3 counts for Type 02 controllers and 5 counts for type 10 controllers

## Visible Lens Specific Commands

Unless the lens specified in the system manifest (see External Lenses page 80) supports a 2x function, this command will always return a 99.

### Queries

#### 2X Visible Camera Lens Status

FF 00 32 77 02 02 Checks 2X zoom (visible camera)  
FF 00 32 77 02 xx 00=out, 01= in, 99 = NONE

#### Visible Lens zoom Status

FF 00 32 77 04 01

FF 00 32 77 04 xx where xx = 00 complete; 01 in process; 02 timed out

If there is no autofocus capability, this command is ignored. To learn if the lens specified by the System Manifest supports autofocus see External Lenses, page 80.

#### Query Vis Lens Values

|  |  |
| --- | --- |
| FF 00 50 77a0 00 | The upper nibble, a, is defined as:  Bits 3 2 1 0 where 3=MSB  bit 3 = 0 requests BCD data, 1 requests binary (12 bit) data  bit 2 = 0 requests a Zoom value, or 1 requests a Focus value  bit 1 = 0 req Relative, bit 1= 1 req FOV degrees  bit 0 = reserved  Xx x = 0-999. When using FOV in degrees, 999=99.9 degrees. Focus may be BCD or binary relative.  In either case, The 2110 will take care of limiting commanded values to the range of the specific camera (active) and defined by the manifest (type). |
| FF 00 50 77 yx xx | y response nibble iis defined as:  Bits 3 2 1 0 where 3=MSB  bit 3 = 0 indicates BCD value, 1 indicates binary value (0-4095) returned  bit 2 = 0 response is a Zoom Value  = 1 response is a Focus Value  bit 1 = 0 is relative, 1= FOV in degrees  bit 0 = 0 is OK, 1=Error  y=1111 if there is no table for degrees |

The query reports the last value obtained in the internal 2110 loop. In general unless a command has changed the zoom position, the last value should be the last commanded value.

### Controls

#### Zoom Visible Camera

FF 00 0E 77 xx 00 Zoom (standard Pelco D)  
 xx= FE (254) To 80 (128) =zoom to wide FOV  
 xx= 01 (1) to 7F (127) = zoom to narrow FOV

xx = 00 = stop

Zoom commands are directed to the visible camera.

#### Focus Visible

FF 00 0E 77 00 xx Focus (standard Pelco D)  
 xx= 01 (1) to 7F (127) focus FAR  
 xx = FE (254) to 80 (128) focus NEAR  
 xx = 00 stop

#### Visible Lens Autofocus

FF 00 32 77 04 00 If capable, initiates an autofocus sequence of the camera/lens system of the selected device

FF 00 32 77 04 xx where xx = 00 if capable, = 99 if not capable

#### 2X Lens In/Out

If present in the lens system, this command controls the insertion of a 2x multiplier on the zoom optics. If not present this command is ignored, except that the 2110 will return a xx=99 to indicate that no 2x multiplier is available for the lens specified in the manifest (see External Lenses page 80 for types that support the 2x function).

|  |  |
| --- | --- |
| FF 00 32 77 02 xx | 00= out; 01 = In, |
| FF 00 32 77 02 xx | Responses are as above and 99= no 2X lens |

## PENTAX PAIR Lens Specific Commands

#### Lens PAIR Fog Filter

This control either turns off the filter or sets strength. This command is accepted by the 2110 but the filter is NOT effective unless the Lens is not in LENS PAIR FUNCTION BYPASS and the FILTERS are set to ON.

|  |  |
| --- | --- |
| FF 00 32 77 08 xx | xx where  0x00=none 0x01=light 0x02=medium 0x03=strong 0x63=query, |
| FF 00 32 77 08 xx | When 99 is received from this command, the 2110 tests the status of Pair filter where response is y values above. |

#### Lens PAIR Functions (PAIR 2 Only)

This control either invokes or bypasses all image processing of the PAIR lens. All image processing functions including image stabilization are bypassed when this function is in bypass mode. However, the settings made (filter strength and whether stabilization is on or off remain set in bypass.

|  |  |
| --- | --- |
| FF 00 32 77 07 xy | xy where  x = bypass state; 0=bypassed, 1=modified, 9=query  y = filters state; 0=filters off, 1=filters on, 9=query  9 (in either x or y) reports the state kept by the 2110 |
| FF 00 32 77 07 xy | Responses reflect the state using the same codes as above. |

#### Lens PAIR Heat Haze Reduction (PAIR 2 only)

This control either turns off the filter or sets strength. This command is accepted by the 2110 but the filter is NOT effective unless the Lens is not in LENS PAIR FUNCTION BYPASS and the FILTERS are set to ON.

|  |  |
| --- | --- |
| FF 00 32 77 09 xx | xx where  0x00=none 0x01=light 0x02=medium 0x03=strong 0x63=query, |
| FF 00 32 77 09 xx | When 99 is received from this command, the 2110 tests the status of Pair filter where response is y values above. |

#### Lens PAIR Backlight Filter (PAIR 2 only)

This control either turns off the filter or sets strength. This command is accepted by the 2110 but the filter is NOT effective unless the Lens is not in LENS PAIR FUNCTION BYPASS and the FILTERS are set to ON.

|  |  |
| --- | --- |
| FF 00 32 77 0A xx | xx where  0x00=none 0x01=light 0x02=medium 0x03=strong 0x63=query, |
| FF 00 32 77 0A xx | When 99 is received from this command, the 2110 tests the status of Pair filter where response is y values above. |

#### Lens PAIR Night View Mode (PAIR 2 only)

This control either turns off the filter or sets strength. This command is accepted by the 2110 but the filter is NOT effective unless the Lens is not in LENS PAIR FUNCTION BYPASS and the FILTERS are set to ON.

|  |  |
| --- | --- |
| FF 00 32 77 0B xx | xx where  0x00=none 0x01=light 0x02=medium 0x03=strong 0x63=query, |
| FF 00 32 77 0B xx | When 99 is received from this command, the 2110 tests the status of Pair filter where response is y values above. |

#### Lens PAIR Stabilization (PAIR 2 only)

This control either turns on or off the stabilization (shake filter). This command is accepted by the 2110 but the filter is NOT effective unless the Lens is not in LENS PAIR FUNCTION BYPASS.

|  |  |
| --- | --- |
| FF 00 32 77 0C xx | xx where  xx=1 is PAIR stab on xx = 0 PAIR stab off xx = 0x63 send status of Pair filter where response xx is  01 = PAIR stab on  00 - PAIR stab off |
| FF 00 32 77 0C xx | Response xx  01 = PAIR stab on  00 - PAIR stab off |

## Visible Camera Commands

### Queries

If no camera is specified in the system manifest (see System Manifest, page 14), default values are turned

#### Visible Camera Type Query

|  |  |
| --- | --- |
| FF 00 0F 77 18 00 | Checks Visible Camera Type and will return the manifest value (see page 80 for type numbers) |
| FF 00 0F 77 18 xx | 99 = No Visible Camera |

#### Visible Camera Busy Status

|  |  |
| --- | --- |
| FF 00 0F 77 19 00 | Checks Visible Camera Status |
| FF 00 0F 77 19 xx | 00=Ready, 01 = busy, 02= com format error, 03= com timeout, 99=No Camera |

*After issuing this command, wait at least 100 milliseconds before requesting status again.*

#### Visible Enclosure Pressure Query

|  |  |
| --- | --- |
| FF 00 0F 77 24 00 |  |
| FF 00 0F 77 24 xx | xx = 0-255 translates to pressure as:  (xx/255+0.07739) \*18.535 psi, e.g. xx = 100 p = 8.703 psi |

*Conversion from a sensor value (0-255) to PSI shall be done in a GUI and not the controller.*

#### Brightness Query

|  |  |
| --- | --- |
| FF 00 11 77 25 00 |  |
| FF 00 11 77 25 xx | Returns current visible camera brightness where xx = 00 to FF. Default with no such camera feature is 00 |

#### AGC Gain Query

|  |  |
| --- | --- |
| FF 00 11 77 26 00 |  |
| FF 00 11 77 26 xx | Returns visible camera AGC gain where xx = 00 to FF. Default with no such camera feature is 00 |

### Controls

#### Turn on Visible Camera Menu

FF 00 11 77 07 02   
 FF 00 11 77 07 02

#### Turn off Visible Camera Menu

FF 00 11 77 07 00  
 FF 00 11 77 07 00

#### Menu Cursor Up

FF 00 11 77 17 08  
 FF 00 11 77 17 08

#### Menu Cursor Down

FF 00 11 77 17 04  
 FF 00 11 77 17 04

#### Menu Item Select

FF 00 11 77 17 10  
 FF 00 11 77 17 10

#### Black & White Mode (*If equiped*)

|  |  |
| --- | --- |
| FF 00 11 77 21 xx | xx = Where xx = 00 (off), 01 (on), 10 requests mode status. In B/W mode, the “near IR” filter is also removed to enhance this mode. |
| FF 00 11 77 21 xx | Echoes the command except when status is requested, the return value is 1x where x=1 is B/W, and x=0 of color. If no camera present or this feature is not available, x = 0 |

#### Brightness

|  |  |
| --- | --- |
| FF 00 11 77 22 xx | Sets Viscam brightness where xx = 00 to FF. At startup the 2110 queries the camera and determines current setting.  For the Hitachi KP-DE500, this control equates to the pedestal adjustment |
| FF 00 11 77 22 xx | The return value of xx is the last value of brightness as reported by the camera (00 to FF). If no camera present xx = 00 |

#### AGC Gain

|  |  |
| --- | --- |
| FF 00 11 77 23 xx | Sets Viscam AGC gain where xx = 00 to FF. At startup 2110 queries the camera to determine current setting. |
| FF 00 11 77 23 xx | The return value of xx is the last value of AGC gain as reported by the camera (00 to FF). If no camera present xx =00 |

#### AGC On/OFF

|  |  |
| --- | --- |
| FF 00 11 77 24 xx | Where xx = 00 is OFF and xx 01 is ON. Xx= FF to query status |
| FF 00 11 77 24 xx | The response is an echo or when command xx = FF (status) the xx value represents the status of the AGC (xx=01; on or x=00; off), default is off. |

#### SensUp

|  |  |
| --- | --- |
| FF 00 11 77 27 xx | Where xx = 00 is OFF and xx sets values. See the SensUp Table, below. |
| FF 00 11 77 27 xx | The response is an echo or when command xx = FF (status) the xx value represents the status of the AGC (xx=01; on or x=00; off), default is off. |

##### SensUp Table

| **Values of xx** | **KPDE 500 Camera** | **KPDE 5000 Camera** |
| --- | --- | --- |
| 10 | A2 | A2 |
| 11 | A4 | A4 |
| 12 | A6 | A6 |
| 13 | A8 | A8 |
| 14 | A10 | A10 |
| 15 | A12 | A12 |
| 16 | A16 | A16 |
| 17 | A32 | A32 |
| 18 | A64 | A64 |
| 19 | NA | A128 |
| 20 | M2 | M2 |
| 21 | M4 | M4 |
| 22 | M6 | M6 |
| 23 | M8 | M8 |
| 24 | M10 | M10 |
| 25 | M12 | M12 |
| 26 | M16 | M16 |
| 27 | M32 | M32 |
| 28 | M64 | M64 |
| 29 | M88 | NA |
| 30 | M128 | M128 |
| 31 | NA | M192 |
| 32 | NA | M256 |
| 33 | NA | M320 |
| 34 | NA | M384 |
| 35 | NA | M448 |
| 36 | NA | M512 |
| FF | Query | Query |

#### Detail Control

|  |  |
| --- | --- |
| FF 00 11 77 28 xx | Where xx =sets a value from 01-254 |
| FF 00 11 77 29 00 | Queries for the current value of Detail.  The response is FF 00 11 77 28 xx |

#### Gamma Control

|  |  |
| --- | --- |
| FF 00 11 77 30 xx | Where xx =  For KPDE 500 Camera; 00=OFF,01=LOW  For KPDE 5000 Camera; 00=OFF, 01=LOW, 02=HIGH  xx=FF is a query command.  Query response = FF 00 11 77 30 xx |

#### DNR Control

This control only applies when AGC is set to OFF

|  |  |
| --- | --- |
| FF 00 11 77 31 xx | Where xx values are defined in the DNR Table below.  The query (xx=FF) response is FF 00 11 77 30 xx |

##### DNR Table

| **Values of xx** | **KPDE 500 Camera** | **KPDE 5000 Camera** |
| --- | --- | --- |
| 0 | Off | Off |
| 1 | Low | Low |
| 2 | Mid | High |
| 3 | High |  |
| 4 | On1 |  |
| 5 | On2 |  |
| 6 | On3 |  |
| 7 | On4 |  |
| 8 | On5 |  |
| 9 | On6 |  |
| 10 | On7 |  |
| FF | Query | Query |

## Fog Filter Commands(Hitachi 50x0 Cameras only)

#### Fog Filter Mode (Hitachi 50x0 Cameras only)

|  |  |
| --- | --- |
| FF 00 11 77 32 xx  FF 00 11 77 32 xx | Where xx =  00 = Off  01 = Auto  02 = Manual  FF = Query |

#### Fog Filter Manual Level (Hitachi 50x0 Cameras only)

There are 16 individual manual levels.

|  |  |
| --- | --- |
| FF 00 11 77 33 xx  FF 00 11 77 33 xx | Where xx = (0x00 to 0x0F) |

#### Fog Filter Manual Level Query (Hitachi 50x0 Cameras only)

|  |  |
| --- | --- |
| FF 00 11 77 34 00  FF 00 11 77 34 xx | Returns xx = (0x00 to 0x0F) |

## Lens Heater Controls

The following commands only apply if a lens heater is installed and configured properly in the manifest.

#### Heater Control

PA 4401ww xx yy zz zz   
PA44 01 ww xx yy zz zz

|  |  |  |
| --- | --- | --- |
| ww | Mode | 0 = Off 1 = Auto 2 = Manual 0x63 = Query 0xFF = Default |
| xx | Upper Thermal Boundary | 0x00 - 0x3c = 0-60 degrees F 0x63 = Query 0xFF = Default |
| yy | Lower Thermal Boundary | 0x00 - 0x3c = 0-60 degrees F 0x63 = Query 0xFF = Default |
| zz | Reserved for future use | 0x00 |
| zz | Reserved for future use | 0x00 |

## IR Camera (Camera B Commands)

An IR camera type must be set in the manifest (see Cameras page 80 for camera types) or these commands to be effective, else the 2110 will report response values as factory default initialization values (generally 00) or will ignore the command.

In all of these commands, a GUI must test that status of the camera is ON-Ready then check IR Camera PROCESS busy status before sending a new command. This prevents overrunning the camera with commands. The best practices sequence for all IR camera commands is

Test for busy status:

if busy wait 100 ms and test again

if ready, issue new command or query

On power up, the IR camera will not report valid status until it is READY.

### Queries

#### IR Camera Type Query

FF 00 0F 77 1A 00 Checks and reports the IR Type specified by the system manifest (see Cameras, page 80 for type numbers and their meaning).   
FF 00 0F 77 1A xx xx=binary value determined by the manifest. 99 = No IR Camera

#### IR Camera Power Status

FF 00 0F 77 12 00 Checks IR Camera Status  
 FF 00 0F 77 12 3F Extension response telling GUI to look elsewhere

FF 00 0F 77 1B 00 Checks IR Camera Status

FF 00 0F 77 1B xx 00= On and Ready, 01= com not ready, 02= buffer overflow, 03=time out error, 04= Off (FPA & Cooler) Not Ready, 05=On Not ready (most likely not at temperature), 99 = No Camera

After issuing this command, wait at least 100 milliseconds before requesting status again

#### IR Camera Process Busy Status

FF 00 0F 77 17 00 IR camera status  
FF 00 0F 77 17 xx 00= IR camera ready, 01 = busy, 03 = time out, 02 = com error

*After issuing this command, wait at least 100 milliseconds before requesting status again.*

#### Cooler Time (minutes)

FF 00 24 77 08 00  
FF 00 24 77 08 00  
FF 00 0F 77 17 00  
FF 00 0F 77 17 01 (BUSY) INTERATE UNTIL “DONE”  
FF 00 0F 77 17 00 (DONE)   
FF 00 24 77 08 01 (LSD)   
FF 00 24 77 08 1F (Hex)   
FF 00 24 77 08 02  
FF 00 24 77 08 7F   
FF 00 24 77 08 03 (MSD)   
FF 00 24 77 08 01 three HEX digits e.g. 01 7F 1F (98079 minutes)

#### Cooler Cycles

FF 00 24 77 09 00  
FF 00 24 77 09 00  
FF 00 0F 77 17 00  
FF 00 0F 77 17 01 (BUSY) INTERATE UNTIL “DONE”  
FF 00 0F 77 17 00 (DONE)  
FF 00 24 77 09 01  
FF 00 24 77 09 92   
FF 00 24 77 09 02  
FF 00 24 77 09 00 2 HEX digits e.g. 00 92 (146 cycles)

#### FPA Temp (DEG K)

FF 00 24 77 11 00  
FF 00 24 77 11 00  
FF 00 0F 77 17 00  
FF 00 0F 77 17 01 (BUSY) INTERATES UNTIL “DONE”  
FF 00 0F 77 17 00 (DONE)  
FF 00 24 77 11 01  
FF 00 24 77 11 4E   
FF 00 24 77 11 02  
FF 00 24 77 11 00 two HEX digits e.g. 00 4E (78 dec)

#### Query IR AGC Mode

|  |  |
| --- | --- |
| FF 00 24 77 80 00 |  |
| FF 00 24 77 80 xx | xx=00 (manual), 01 (AGLC mode) or 02 (ALC mode) |

#### Query IR Brightness/ALC Value

|  |  |
| --- | --- |
| FF 00 24 77 81 00 |  |
| FF 00 24 77 81 xx | xx = 00-FF Value represents brightness (Manual mode) or ALC value (AGLC or ALC modes) |

#### Query IR Contrast/AGC Value

|  |  |
| --- | --- |
| FF 00 24 77 82 00 |  |
| FF 00 24 77 82 xx | xx = 00-FF Value represents contrast (Manual mode or ALC modes) or AGC value (AGLC mode) |

#### Query Video Polarity

FF 00 24 77 83 00

FF 00 24 77 83 0x

Where x = 0 = White Hot ; x=1 = Black Hot

#### Query Image Stabilize

When using the L3\_HD IR camera, the status applies to both the main and PIP video.

|  |  |
| --- | --- |
| FF 00 24 77 8C ab | For definition of ab values, see below  Response is current value |
| FF 00 24 77 8C ab |

Interpretation of ab values are derived from the following structure.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| Not Used and set to 0 | Strength of Vertical Stab | | | Strength of Horizontal Stab | | | On/Off |
| Value range 0-5 | | | Value range 0-5 | | | On=1 |

Example; An ab value of 24 indicates that the values of V and H are both 2 and Stab is off. An ab value of 25 would indicate that the V and H values are 2 but that the stability filter is on.

The value meanings are

* + 1. Off
    2. Light
    3. Normal
    4. Strong
    5. Stronger
    6. Strongest

#### Query Edge Enhance

FF 00 24 77 90 00  
FF 00 24 77 90 xx

Xx is a value from 00h (off) to 64h (max). This is a sensitive control. The recommended “ON” value is 09h. The xx value is the current setting as known by the 2110.

This function adjusts both the PIP and Main Video windows when using the HD IR camera.

#### Query Local Area Contrast

FF 00 24 77 8F 00  
FF 00 24 77 8F xx 00h (OFF) to 0Fh (High) (0-15 dec)

This function adjusts both the PIP and Main Video windows when using the HD IR camera.

### HD IR PIP Window Queries

These commands only apply to the Picture-In-Picture video parameters of an HD IR camera.

#### IR Query PIP AGC Mode

|  |  |
| --- | --- |
| FF 00 24 77 C0 00 |  |
| FF 00 24 77 C0 xx | xx=00 (manual), 01 (AGLC mode) or 02 (ALC mode) |

#### IR Query PIP Brightness/ALC Value

|  |  |
| --- | --- |
| FF 00 24 77 C1 00 |  |
| FF 00 24 77 C1 xx | xx = 00-FF Value represents brightness (Manual mode) or ALC value (AGLC or ALC modes) |

#### IR Query PIP Contrast/AGC Value

|  |  |
| --- | --- |
| FF 00 24 77 C2 00 |  |
| FF 00 24 77 C2 xx | xx = 00-FF Value represents contrast (Manual mode or ALC modes) or AGC value (AGLC mode) |

#### IR Query PIP Video Polarity

|  |  |
| --- | --- |
| FF 00 24 77 C3 00 |  |
| FF 00 24 77 C3 0x | X=0=White Hot; x=1 = Black Hot |

### Controls

#### Turn IR off (with IR as active camera)

This command is ignored if no IR camera is specified in the System Manifest (see page 14). The effects on the camera vary with the camera. In general the camera is reset, but not powered down. In some cases the cooler (if there is on) is shut down and the focal plan array (FPA) is disabled resulting in no video output. What is done is limited by the capabilities of the cameras themselves and the best operating practices for the individual camera.

FF 00 0F 77 10 00 (turn off camera)   
FF 00 0F 77 10 00  
IR camera power is not actually controlled. The Cooler (if possible) and Camera are RESET only

#### Turn IR camera on (IR camera is never active unless on)

This command is ignored if no IR camera is specified in the System Manifest (see page 14). Turn on varies with the individual camera in a manner similar to the Turn IR off command.

FF 00 0F 77 11 00  
FF 00 0F 77 11 00

#### Set Polarity White/Black Hot

Sets polarity for the Standard Definition Analog cameras.

Sets polarity for the Picture in Picture (PIP) window for the L3 WALRSS HD IR camera

FF 00 24 77 03 0x  
FF 00 24 77 03 0x

X= 0 to set to white hot

X= 1 to set to black hot

Execute 3 Point NUC

In any GUI, this command should inhibit the ability to use this command again until NUC is complete. Complete can be determined by testing the controller IR status.

FF 00 24 77 0E 00 (Save)  
FF 00 24 77 0E 00

FF 00 24 77 0E 01 (Don’t Save)  
FF 00 24 77 0E 01

At this point inhibit sending this command again.

Test controller IR busy status at no more frequent intervals of 100 ms until IR status reports not busy before enabling the ability to send this command again.

For the L3 HD IR camera this command performs a full NUC only with a without SAVE.

#### Execute 5 Point NUC

In any GUI, this command should inhibit the ability to use this command again until NUC is complete. Complete can be determined by testing the controller IR status.

FF 00 24 77 0E 02 (Save)  
FF 00 24 77 0E 02

FF 00 24 77 0E 03 (Don’t Save)  
FF 00 24 77 0E 03

At this point inhibit sending this command again.

Test controller IR busy status at no more frequent intervals of 100 ms until IR status reports not busy before enabling the ability to send this command again.

For the L3 HD IR camera this command performs a full NUC only with a without SAVE.

#### Execute Level NUC (L3 HD IR camera only)

In any GUI, this command should inhibit the ability to use this command again until NUC is complete. Complete can be determined by testing the controller IR status.

FF 00 24 77 0E 04 (Save)\* ***NOT RECOMMENDED***  
FF 00 24 77 0E 04

FF 00 24 77 0E 05 (Don’t Save)   
FF 00 24 77 0E 05

At this point inhibit sending this command again.

Test controller IR busy status at no more frequent intervals of 100 ms until IR status reports not busy before enabling the ability to send this command again.

#### Execute Offset NUC (L3 HD IR camera only)

In any GUI, this command should inhibit the ability to use this command again until NUC is complete. Complete can be determined by testing the controller IR status.

FF 00 24 77 0E 06 (Save)  
FF 00 24 77 0E 06

FF 00 24 77 0E 07 (Don’t Save)  
FF 00 24 77 0E 07

At this point inhibit sending this command again.

Test controller IR busy status at no more frequent intervals of 100 ms until IR status reports not busy before enabling the ability to send this command again.

#### Execute 1 Point NUC (L3 HD IR camera only)

In any GUI, this command should inhibit the ability to use this command again until NUC is complete. Complete can be determined by testing the controller IR status.

FF 00 24 77 0E 08 (Save)  
FF 00 24 77 0E 08

FF 00 24 77 0E 09 (Don’t Save)  
FF 00 24 77 0E 09

At this point inhibit sending this command again.

Test controller IR busy status at no more frequent intervals of 100 ms until IR status reports not busy before enabling the ability to send this command again.

#### IR AGC/Manual Mode

|  |  |
| --- | --- |
| FF 00 24 77 00 0x | Manual Mode (ALC and ALGC modes are OFF) |
| FF 00 24 77 00 0x | acknowledge |
|  | x= 0; Manual Mode  x= 1; AGLC Mode  x = 2; ALC mode  ***Each mode is mutually exclusive***. |

#### IR Brightness/ALC control

|  |  |
| --- | --- |
| FF 00 24 77 01 xx | xx 00h (lowest) to FFh (highest) **When mode=Manual** (FF 00 24 77 00 00) values control brightness **When mode = AGLC** (FF 00 24 77 00 01) **or ALC** (FF 00 24 77 00 02) values control ALC level |
| FF 00 24 77 01 xx | acknowledge |

#### IR Contrast/AGC control

|  |  |
| --- | --- |
| FF 00 24 77 02 xx | xx 00h (lowest) to FFh (highest)  **When mode=Manual** (FF 00 24 77 00 00) **or ALC** (FF 00 24 77 00 02) values control Contrast  **When mode = AGLC** (FF 00 24 77 00 01) values control AGC gain |
| FF 00 24 77 02 xx | acknowledge |

### WALRSS, WALRSS A and L3-HD IR Main Commands

#### Set Image Stabilize

When using the L3\_HD IR camera, this function applies the image stabilize filter to both the main and PIP video.

|  |  |
| --- | --- |
| FF 00 24 77 0C ab | For definition of ab values, see below  Response is current value |
| FF 00 24 77 0C ab |

Values of ab are derived from the following structure.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| Not Used and set to 0 | Strength of Vertical Stab | | | Strength of Horizontal Stab | | | On/Off |
| Value range 0-5 | | | Value range 0-5 | | | On=1 |

Example; Setting H and V to a strength of 2 while leaving Stab off, yields

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |

HEX value =24; When turning STAB on with the same H and V strength, bit 0=1, thus HEX =25

|  |  |
| --- | --- |
| **Value Meaning of a or b** | **Fully formed command**  **H & V (a & b) are equal** |
| 1. Off | FF 00 24 77 0C 00 |
| 1. Light | FF 00 24 77 0C 13 |
| 1. Normal | FF 00 24 77 0C 25 |
| 1. Strong | FF 00 24 77 0C 37 |
| 1. Stronger | FF 00 24 77 0C 49 |
| 1. Strongest | FF 00 24 77 0C 5B |

#### Edge Enhance

FF 00 24 77 10 xx  
FF 00 24 77 10 yy

Xx is a value from 00h (off) to 64h (max). This is a sensitive control. The recommended “ON” value is 09h. The yy value is the current setting as known by the 2110.

This function adjusts both the PIP and Main Video windows when using the HD IR camera.

#### Local Area Contrast

FF 00 24 77 0F xx  
FF 00 24 77 0F xx 00h (OFF) to 0Fh (High) (0-15 dec)

This function adjusts both the PIP and Main Video windows when using the HD IR camera.

#### ~~IR Turbulence Mitigation (TM) (WALRSS, WALRSS A Cameras Only)~~

|  |  |
| --- | --- |
| ~~FF 00 24 77 13 xy~~ | ~~xx sets function:~~  ~~x= 0 = OFF x=1=ON~~  ~~y= 1=Low; 2=Mild; 3=moderate; 4=high; 5=extreme~~  ~~x=F?h report current where setting; (?=don’t care)~~ |
| ~~FF 00 24 77 13 ab~~ | ~~ab=current setting where a = "x" status (on/off) and b="y" level.~~  ~~When setting the filter off, xy = 00. In this instance, the level previously set does not change. A query in this case (x=F, y=don't care) returns 0b (e.g. a=0 for OFF, and b= the level setting)~~ |

#### ~~IR TM: Threshold Averaging (WALRSS & WALRSS A Cameras Only)~~

|  |  |
| --- | --- |
| ~~FF 00 24 77 14 xx~~ | ~~xx =0 = off xx =1 = 8DU xx = 2 = 16 DU xx= 3 = 32 DU xx= 63h = report current value back; yy return is 00 unless xx=63h then yy = 0>3 reflecting the setting reported by the camera.~~ |
| ~~FF 00 24 77 14 yy~~ | ~~yy return is 00 unless xx=63h then yy = 0>3 reflecting the setting reported by the camera.~~ |

#### ~~IR TM: Filter (WALRSS & WALRSS A Cameras Only)~~

|  |  |
| --- | --- |
| ~~FF 00 24 77 15 xx~~ | ~~xx is a number from 0 - 64h (0-100 dec). FF requests the current value;~~  ~~The 2110 receives xx values and sends hex values representing decimal numbers from 0.0 to 1.0 in 0.01 steps to set the averaging threshold.~~ |
| ~~FF 00 24 77 15 yy~~ | ~~yy values are returned as 00 for a set (xx<>FF) and the current setting for xx=FFh~~  ~~The 2110 responds with yy=00 in all circumstances except if xx value is FF (request for current state). In this case the 2110 responds with yy equaling the equivalent of 0.0 to 1.0 in 0.01 increments of the scale by querying the camera~~ |

#### Turbulence Filter

|  |  |  |
| --- | --- | --- |
| FF 00 24 77 13 xy | x sets filter function:  x= 0 = OFF x=1=ON ; | y sets LAC function:  y= 0 = OFF y=1=ON |
|  |
| FF 00 27 77 13 xy | xy=FF is query of current xy settings |  |

Do not issue this control faster than once every seven seconds. The camera rejects this command if issued more frequently.

#### Turbulence Mitigation-Super Resolution (TMSR)

|  |  |  |
| --- | --- | --- |
| FF 00 24 77 13 xy | x sets filter function:  x= 0 = OFF x=2=ON | y sets LAC function:  y= 0 = OFF x=1=ON |
| FF 00 27 77 13 xy |

This function may not be available in all WALRSS/L3 HD IR Cameras

#### Turbulence Filter; Blur

|  |  |
| --- | --- |
| FF 00 24 77 14 xx | xx =0-FEh (0-254) representing the Blur level..  xx=FFh is a query for the current value. |
| FF 00 24 77 14 yy | The system always responds to this command.  yy is the actual setting read back from the camera in each response; 00-FE |

#### Turbulence Filter; Warp

|  |  |
| --- | --- |
| FF 00 24 77 15 xx | xx is a number from 0-FEh  FF requests the current value which is returned in yy of the response. |
| FF 00 24 77 15 yy | The system always responds to this command.  yy is the actual setting read back from the camera in each response; 00-FE |

When using the Main Turbulence Filter control (FF 00 24 77 13 xy) the 2110 turns off the RS170 SD NTSC video channel. The result is that Blur and Warp controls affect the HD video stream.

#### IR Camera Temperature Range

This value changes the expected temperature range that the imager is attempting no render. The actual ranges as temperature are set by the camera manufacturer. Three such ranges are offered. The default is 1 which is usually a “normal” range.

|  |  |
| --- | --- |
| FF 00 24 77 16 xx | xx = 1h, 2h, 3h, or FFh. When xx=FFh the 2110 returns the current camera setting. |
| FF 00 24 77 16 xx |

### HD IR PIP Window Controls

#### Set Polarity HD IR PIP Video

FF 00 24 77 43 0x  
FF 00 24 77 43 0x

x=0=set to white hot

x=1-set to black hot

#### HD IR PIP AGC/Manual Mode

|  |  |
| --- | --- |
| FF 00 24 77 40 xx | Manual Mode (ALC and ALGC modes are OFF) |
| FF 00 24 77 40 0x | acknowledge |
|  | x= 0; Manual Mode  x= 1; AGLC Mode  x = 2; ALC mode  ***Each mode is mutually exclusive***. |

#### HD IR PIP Brightness/ALC control

|  |  |
| --- | --- |
| FF 00 24 77 41 xx | xx 00h (lowest) to FFh (highest) **When mode=Manual** (FF 00 24 77 00 00) values control brightness **When mode = AGLC** (FF 00 24 77 00 01) **or ALC** (FF 00 24 77 00 02) values control ALC level |
| FF 00 24 77 41 xx | Acknowledge |

#### HD IR PIP Contrast/AGC control

|  |  |
| --- | --- |
| FF 00 24 77 42 xx | xx 00h (lowest) to FFh (highest  **When mode=Manual** (FF 00 24 77 00 00) **or ALC** (FF 00 24 77 00 02) values control Contrast  **When mode = AGLC** (FF 00 24 77 00 01) values control AGC gain |
| FF 00 24 77 42 xx | acknowledge |

#### PIP Turbulence Filter

|  |  |  |
| --- | --- | --- |
| FF 00 24 77 53 xy | x sets filter function:  x= 0 = OFF x=1=ON ; | y sets LAC function:  y= 0 = OFF y=1=ON |
| FF 00 27 77 53 xy |

#### PIP Turbulence Mitigation-Super Resolution (TMSR)

|  |  |  |
| --- | --- | --- |
| FF 00 24 77 53 xy | x sets filter function:  x= 0 = OFF x=2=ON | y sets LAC function:  y= 0 = OFF x=1=ON |
| FF 00 27 77 53 xy |

This function may not be available in all WALRSS/L3 HD IR Cameras

Do not issue this control faster than once every seven seconds. The camera rejects this command if issued more frequently.

When using the PIP Turbulence Filter control (FF 00 24 77 53 xy) the 2110 ensures that the RS170 SD NTSC video channel is turned on The result is that Blur and Warp controls affect the SD video stream.

### Set IR Palette (FLIR HRC only)

***This command either inverts or restores the current palette. There is no command yet implemented to change the palette.***

See Cameras page 80 for the type number.

|  |  |
| --- | --- |
| FF 00 24 77 03 xx | Xx=00 sets current palette to normal (similar to white hot)  Xx=01 inverts the current palette (similar to black hot) |
| FF 00 24 77 03 yy | yy= 8y to report max palette number or 9y for current setting  2110 will always respond with 9y on any setting of xx except 88 (report capability). |

Values of xx and yy are decimal

## IR Lens Specific Commands

All currently supported IR cameras employ camera specific optics and lens controllers that are remotely controlled through the same serial port as the camera functions. The 2110 controls for these functions are common, but the values sent with the command and return values differ depending

### Queries

#### IR Lens Autofocus Status

This command will report the status of the autofocus sequence for any selected device having an autofocus lens. For the IR camera you may use the IR Camera Status Command, FF 00 0F 77 17 00, for this purpose. Be aware if the IR Status Command is used, it ONLY reports the status of the IR camera

FF 00 32 77 04 01  
FF 00 32 77 04 xx  
where xx = 00 complete; 01 in process; 02 timed out

#### Query IR Lens Values

|  |  |
| --- | --- |
| FF 00 51 77 a0 00 | The upper nibble, a, is defined as:  Bits 3 2 1 0 where 3=MSB  bit 3 = 0 return BCD (0-999) or 1 return binary 12 bits (0-4095)  bit 2 = 0 requests a Zoom value  = 1 requests a Focus value  bit 1 = 0 req Relative, bit 1 = 1 req FOV degrees  bit 0 = (reserved)  xxx = 0-999 BCD format or 0-4095 binary format . When using FOV in degrees, 999=99.9 degrees. |
| FF 00 51 77 yx xx | y response nibble is defined as:  Bits 3 2 1 0 where 3=MSB  bit 3 = 0 when BCD or 1 with binary response  bit 2 = 0 response is a Zoom Value  = 1 response is a Focus Value  bit 1 = 0 xxx is Relative, bit 1 = 1 xxx is FOV degrees  bit 0 = 0 is OK, 1=Error  y=1111 if there is no table for degrees. |

In either case, the 2110 will take care of limiting commanded values to the range of the specific camera (active) and defined by the manifest (type).

### Controls

#### Zoom IR

FF 00 00 20 00 xx Zoom to narrow FOV

FF 00 00 40 00 xx Zoom to wide FOV

xx = 01 to 3F = rate of zoom  
if rate = 0, command is FF 00 00 00 00 00

Time to complete lens moves is a variable and determined by the camera. Queries of lens position require testing controller IR busy status before issuing a lens position query. Any such query returned value is the last value received from the camera. If the last value does not equal the value commanded by the controller internally, the 1000 is added to the returned value. This out of range value can be used by interfacing software to detect an error has occurred and signal such to a user for remedial action.

#### IR Focus Near

|  |  |
| --- | --- |
| FF 00 01 00 xx 00 | 01 (1) to 7F (127) focus rate ; 00 stop  Moves focus to near at specified rate until stopped |
|  |  |

#### IR Focus Far

|  |  |
| --- | --- |
| FF 00 00 80 xx 00 | 01 (1) to 7F (127) focus rate ; 00 stop  Moves focus to far at specified rate until stopped |
|  |  |

#### IR Lens Autofocus

This command is only supported in the WALRSS, WALRSSA and FLIR HRC camera as of this writing. Issue of this command with any other camera type will be ignored.

If capable, imitates an autofocus sequence of the camera/lens system of the selected device. In all cases this is a onetime sequence and does not start a continuous autofocus function. For the IR camera, this command will also initiate an autofocus. The command used in the 00 and 01 controllers to autofocus the IR camera, FF 00 24 77 0D 00, will also work, but for the IR camera (if on the manifest) ONLY.

Since autofocus is an indefinite length command (e.g. the time to complete is unknown), any GUI must query lens autofocus status before initiating another autofocus sequence. Similarly, ALL lens operations (zoom and focus) should be inhibited until autofocus is complete.

If the active lens does not support autofocus the response to the command will be FF 00 32 77 04 99.

In any GUI, this command should inhibit the ability to use this command again until Autofocus is complete. Complete can be determined by testing the controller IR status.

FF 00 24 77 0D 00 Autofocus command  
FF 00 24 77 0D 00

At this point, inhibit this command as well as refocus (below) until the status query, FF 00 0F 77 17 00 IR camera status *(at least 100 ms between requests), reports* FF 00 0F 77 17 00 (IR camera busy is FF 00 0F 77 17 01)

At the end of this function, the current position is updated within the controller and is available for query.

#### IR Lens Ezoom (Electronic Zoom)

When 2110 receives this command it increments or decrements the amount of electronic zoom. The range of electronic zoom is 100% (FOV equals the optical FOV) to 400% (one fourth of the current optical FOV). This capability enhances the zoom range of the optical FOV range of the camera lens. The command sends an increment/decrement signal. When ten (10) increment commands have been send to the controller further increment commands are ignored. At ten, the full 400% Ezoom is reached. Decrement commands received after the count has reached zero are also ignored. A zero count is equivalent to no Ezoom enhancement.

FF 00 24 77 xx yy

xx = 12 controls the main video channel

xx=52 controls the PIP video channel

##### Values of yy (HEX)

|  |  |
| --- | --- |
| 00 | Ezoom Off |
| 10 | Ezoom On |
| 11 | Step in |
| 12 | Step out |
| 14 | 100% |
| 15 | 130% |
| 16 | 160% |
| 17 | 190% |
| 18 | 220% |
| 19 | 250% |
| 1A | 280% |
| 1B | 310% |
| 1C | 340% |
| 1E | 370% |
| 1F | 400% |
| 99 | Status Query |

#### Command Refocus (WALRSS & WALRSS A Cameras Only)

This command is only supported with the WALRSS and WALRSS A camera types. Issue of this command with any other camera will be ignored.

Check that the camera is not busy first (FF 00 0F 17 00 as shown above)

At the end of this function, the current position is updated within the controller and is available for query.

In any GUI, this command should inhibit the ability to use this command again until Refocus is complete. Complete can be determined by testing the controller IR status.

FF 00 24 77 0D 01  
FF 00 24 77 0D 01

At this point, inhibit this command as well as Autofocus (above) until the status query, FF 00 0F 77 17 00 IR camera status *(at least 100 ms between requests), reports* FF 00 0F 77 17 00 (IR camera busy is FF 00 0F 77 17 01)

## Illuminator & Laser Pointer Commands

These controls are only active if an illuminator, laser pointer or both types (see Lasers & Illuminator Pods page 82) is set in the System Manifest (see page 14).

The illuminator is a zoomable device and, therefore, the Illuminator Busy Status should be used prior to commanding new go to or zoom rates. Query Illuminator Zoom Position will return a 00 unless the manifest is set to a type that includes the zoomable illuminator. Zoom Illuminator and Illuminator Zoom Goto are ignored unless the manifest is set to a type that includes the zoomable illuminator.

The pointer is an eye safe laser offering two modes of operation, pulsed and continuous light.

However, the 2110 will report initialization values as follows:

Illuminator Busy Status = 63h (none)

Zoom Illuminator = value will ignored

Illuminator Zoom Go To = will be ignored

Query Illuminator Zoom Position = will always return 00

Turn Illuminator ON/OFF = will be ignored and return 00 (off status).

### Queries

#### Illuminator Busy Status

FF 00 0F 77 27 00 or FF 00 40 77 01 00 xx is 00=Ready, 01 = busy, 02= com format error,   
FF 00 0F 77 27 xx orFF 00 40 77 01 xx 03= com timeout, 04 = OFF, 99= No Illuminator  
   
Either command will work, but FF 00 0F 77 27 00 will render a FF 00 0F 77 27 xx response and FF 00 40 77 01 00 will render a FF 00 40 77 01 xx response.

When the illuminator is powered up, there may be an extended busy status until the Illuminator is reported. *After issuing this command, wait at least 100 milliseconds before requesting status again.*

This query will always return a 63h if the system manifest (see page 14) has no illuminator type specified.

#### Query Illuminator Zoom Position

FF 00 43 77 00 00

FF 00 43 77 xx xx xx is 00 01 to 02 54(1-254) controller returns illuminator zoom position

*After issuing this command, wait at least 100 milliseconds before requesting status again.*

This query always returns 00 00 if the system manifest (see page 14) has no illuminator type specified.

#### Query Laser Pointer Status

There are two status queries for this device, a standard and extended. When the extended status is requested (FF 00 0F 77 25 18), a non-PELCO D structured status is returned where additional bytes are sent as described below. When the standard status is requested (FF 00 0F 77 25 19), a standard PELCO D structured response is retuned also as described

FF 00 0F 77 25 18 (Extended Status)

FF 00 0F 77 25 1z aa W

z is a status nibble where:

1=BUSY, 2=FORMAT ERROR, 3=COM TIME OUT, 4=MESSAGE READY, 9=NOT PRESENT

When 9 is returned, it means that a Laser Pointer is not specified in the manifest.

The aa byte is the message length of W to follow: and is either 00 (none) or 1E

W is the status message. When returned (aa=1E) W is a 30 byte binary message comprised of 15 words as defined below.

| **Word** | **Meaning** | **Byte 1** | **Byte 2** | **Example** |
| --- | --- | --- | --- | --- |
| 1 | SW version (Major / minor), minor is the LS byte | 02 | 32 | Values shown indicate a software version of 2.50 |
| 2 | Laser command status | 0A | 8C | Values shown indicate OFF/PULSE MODE |
| 0A | 8D | Values shown indicate ON/PULSE MODE |
| 13 | 88 | Values shown indicate OFF/CONTINUOUS MODE |
| 13 | 89 | Values shown indicate ON/ CONTINUOUS MODE |
| 3 | Laser safety discrete | 00 | 0x |  |
| 4 | Laser current (instant) | xxxxx | | where xxxxx = binary value of current in mA at the time status was requested |
| 5 | Laser Power (instant) | xxxxx | | where xxxxx = binary value of current in mA  NOTE: This is actual measured power, which is typically not available without external components |
| 6 | Laser Status | 00 | 00 | Laser OFF |
| 00 | 01 | Laser ON |
| 7 | Laser Current Limit | xxxxx. | | where xxxxx = the current limit (mA) that the board is set to |
| 8 | Laser Current peak (1 second) | xxxxx | | where xxxxx = binary value of the current limit (mA) that the board is set to |
| 9 | Laser Current Average (10 seconds) | xxxxx | | where xxxxx = binary value of the peak current (mA) measured in the past 1 second |
| 10 | Temperature (CPU) | xxxxx | | where xxxxx = binary value of the average current (mA) measured over the past 10 second  Temperature returned in degrees as xxxxx. This sensor is NOT measuring ambient, but does reflect general temperature conditions. Typically, it reports approximately 12 to 15 deg F above ambient. |
| 11 | Pressure | xxxxx | | Where xxxxx = voltage (0 to 4095 = 0 to 3.3V) for internal pressure sensor. Default conversion can be found from kPa = (counts/4096 + .07739)/.007826 |
| 12 | Humidity | xxxxx | | Where xxxxx = voltage representing relative humidity within housing (Optional) |
| 13 | Spare ADC | xxxxx | | Where xxxxx= voltage (0 to 4095 = 0 to 3.3V) for spare channel.  Typical use would be for an external temperature sensor.  Example setup: MAX6605 powered via 3.3V (X1-13) to Ground (X1-9), with signal return on X1-11. Note that signal conditioning on board comes into play for scaling. |
| 14 | RPM | xxxxx | | Where xxxxx = RPM of dynamic mode scrambler |
| 15 | UNUSED – reserved for future use |  | |  |

FF 00 0F 77 25 19 (Standard Status)

FF 00 0F 77 25 1z

z is a status nibble where:

0=BUSY, 1=ON PULSE, 2=FORMAT ERROR, 3=COM TIME OUT, 4=On Continuous, 9=NOT PRESENT

When 9 is returned, it means that a Laser Pointer is not specified in the manifest.

### Controls

#### Zoom Illuminator

|  |  |
| --- | --- |
| FF 00 41 77 xx 00 | where: FE (254) To 80 (128) =zoom to wide FOV; 01 (1) to 7F ( 127) = zoom to narrow FOV; 00 stop |
|  |  |

There is no response to this input as it is intended for dynamic control by a joystick or virtual joystick just as with a standard joystick zoom Pelco input.

This command is ignored if the system manifest (see page 14) has no illuminator type specified.

#### Illuminator Zoom Go To

FF 0042 77 xx xx xx is 00 01 to 02 54(1-254) and commands the illuminator to zoom to this value

There is no direct response to this command as it is indeterminate when the zoom will reach the desired value. Use the Query Illuminator Zoom Position command to evaluate system response.

This command is ignored if the system manifest (see page 14) has no illuminator type specified.

#### Turn Illuminator ON/OFF

|  |  |
| --- | --- |
| FF 00 0F 77 25 0y | Values of y are: 0=off, 1=on,9=status request |
| FF 00 0F 77 25 0z | Response values of y> 0=OFF; 1=ON, 2=com format error, 3 = com timeout, 4-8 not used, 9=Not present |

Check status after setting illuminator on before attempting to select it or zoom it.

This command is ignored if the system manifest (see page 14) has no illuminator type specified.

#### Turn Pointer ON/OFF-Pulse/Continuous Modes

|  |  |
| --- | --- |
| FF 00 0F 77 25 1y | Values of y are: 0=off, 1=on in pulse mode, 2= on in continuous mode. |
| **FF 00 0F 77 25 10** | Is an acknowledge. To learn actual state of the pointer, issues the command |

This command is ignored if the system manifest (see page 14) has no illuminator type specified.

## Range Finder Commands

These controls are only active if a range finder type is set in the System Manifest (see page 14). However, the 2110 will report initialization values as follows:

Range Finder Status = 63h (none)

Start Range Measure Cycle = ignored

Start Range Finder BIT = ignored

Range Finder BIT Status = always returns 63h

Query Range Finder for Range Data = ignored

Query Range Finder Shots = always returns 0

Query Range Finder for Serial Number= always returns 0

### Queries

#### Range Finder Status

FF 00 40 77 02 00  
FF 00 40 77 02 xx 00 = Ready, 01 = HV charging, 02 = laser measuring, 03 = com timeout, 04 = fail,   
 05 = Range Gate error, 06 = out of range, 07 = multi-target, 99 = NONE

The "HV Charging" state turns on ITS GUI "ON".

The "Laser Measuring" state turns on ITS GUI "measuring".

After "Ready" status is received, automatically query 2110 to send back data. 2110 will reset error status (03..07) to "Ready" after status is read. NOTE: status must be "Ready" before sending "Start Range Measure Cycle" or "Start Range Finder BIT" command. *After issuing this command, wait at least 100 milliseconds before requesting status again.*

#### Range Finder BIT Status (L3 Laser Range Finder Only)

FF 00 40 77 03 00

FF 0040 77 03 xx 00=Passed; 01=in process; 02 = HV Fail, 63h = NONE

Command FF 00 0F 77 29 00 initiates a BIT cycle it can take up to 4 seconds

#### Range Finder BIT Status (Zeis Range Finder Only)

FF 00 40 77 03 00

FF 0040 77 03 xx 00=LED OFF; 01=LED ON 63h = NONE (no range finder present)

#### Query Range Finder for Range Data

FF 00 4B 77 00 00

FF 00 4B 77 xx xx xxxx= MSB LSB =range (binary) from 0 to 32768 meters

#### Query Range Finder Shots

FF 00 4C 77 00 00

FF 00 4C 77 xx xx xxxx= MSB LSB =range (binary) from 0 to 32768

#### Query Range Finder for Serial Number

FF 00 4D 77 00 00

FF 00 4D 77 xx xx xxxx= MSB LSB =range (binary) from 0 to 256

### Controls

#### Start Range Measure Cycle (formerly Turn Range Finder ON/OFF)

FF 00 0F 77 26 00

FF 00 0F 77 26 00 Command initiates a 2110 process to start the RF, shoot the laser and qualify return data. These controls are embedded in the COMMAND MESSAGE; Min range is always 0 meters and Max range is always 20,000 (byte1 bit 7 = true); First Target bit is always true.

The 2110 will make up three (3) measurement attempts spaced 1 second apart before returning a failed measurement status.

#### Start Range Finder BIT (L3 Laser Range Finder only)

FF 00 0F 77 29 00

FF 00 0F 77 29 00 2110 initiates a BIT laser firing; Range is 0 to 20kM, set first target   
(2045 meters is correct answer). After HV ready, fire with fire inhibit bit (byte 1, bit 4 =0)

#### Set Range Finder Test LED (Zeiss Laser Range Finder only)

|  |  |
| --- | --- |
| FF 00 0F 77 29 0x | When x=0 LED OFF; x=1 LED ON. The response is always the actual setting. |
| FF 00 0F 77 29 0x |

## GPS Commands

These controls are only active if a GPS Board is installed and the type is set in the System Manifest (see page 14).

To ensure the most accurate measurement for Yaw (Equivalent to Compass Heading) the system must first be calibrated. To calibrate the system do the following:

1. Enable calibration mode
2. Pan the gimbal in azimuth for several continuous 360 rotations
3. Switch back into normal mode.

#### GPS Mode

PA 43 03 Calibration Mode

PA 43 04 Normal Mode

PA 43 05 Query

Returns 3 = Normal Operation

4 = Calibration Mode

#### GPS Query

PA 43 01 Returns an ASCII string containing:

Signed Latitude to 6 decimal places, followed by a semi-colon

Signed Longitude to 6 decimal places, followed by a semi-colon

Signed Altitude (meters) to 2 decimal places, followed by newline

#### Attitude Query

PA 43 02 Returns an ASCII string containing:

Signed Pitch value to 3 decimal places, followed by a semi-colon

Signed Roll value to 3 decimal places, followed by a semi-colon

Signed Yaw value to 3 decimal places, followed by a newline

## 

## Wiper Commands

These controls are only active if a Wiper is installed. It may also require custom settings in the System Manifest (see page 14).

#### Wiper Control

|  |  |
| --- | --- |
| FF 00 40 77 05 xx | X = 0 Wiper Off  X = 1 Wiper On  X = 9 Query  Returns: 0 = Off 1= On |
| FF 00 40 77 05 xx |

## Night Sun Control

These commands are ignored or responses return a TIME OUT unless the manifest is set to a type that includes the Night Sun Nighthawk peripheral (see Lasers & Illuminator Pods page 82).

|  |  |
| --- | --- |
| FF 00 0F 77 23 xy | x & y values are binary  x = 0001 (1) > Control Power  y= 0000 (0)>command off;  y=0001 (1) command on  x= 0011 (0x3)> control Lamp  y=0000 (0) kill lamp;  y= vvvv (values 1-9)) lamp start  x=0100 (0x4)> Control focus  y= 00 > stop  y= 01 > focus left y=10 focus right  x=8 >  X=9 > Power Status (1001) y= 00 going out,  y responses  0= off 1= blowers on  2=Lamp start (transient condition)  3= Lamp on  4=Lamp off 5 = power off (blowers are still on in this state)  6= Busy  7=Time Out |
| FF 00 0F 77 23 xy |

## SWIR Lens Zoom Control

These commands are ignored or responses return a TIME OUT unless the manifest is set to a type that includes the SWIR Nighthawk peripheral. See ITS Annotators, page 82.

|  |  |
| --- | --- |
| FF 00 52 77 xx yy | When yy value = 00; the command is a RATE input command. The value xx= is the commanded rate and is a 2's complement 8-bit value where FF (255) To 80 (128) zooms to wide and values from 01 (1) to 7F ( 127) zooms to narrow FOV; 00 stops motion.  When yy = 63 (99 decimal) the command is a request for current position only and the value of xx is ignored.  The return echoes the command and adds the zzzz value. The zzzz value is the current position 0-255 in packed BCD format.  Caution, values returned while the lens is in motion will lag behind the actual present position. The current position may be queried at up to a 100 mS rate. |
| FF 00 52 77 zz zz |

## Video Tracker

### Commands

The video tracker is controlled and status is queried using one basic command PA command (see ITS Proprietary Commands, page 14 for the PA definition) root, PA 30 02 pp qq. Valid pp and qq values are defined in the table below.

| **pp** | **Meaning** | **qq** | **Meaning/Notes** |
| --- | --- | --- | --- |
| 01 | Gate Size[[3]](#footnote-4) | 11 | Increment width |
| 12 | Decrement width |
| 21 | Increment height |
| 22 | Decrement height |
| 02 | Mode | 04 | Centroid (default set by 2110) |
| 05 | Intensity |
| 07 | Correlation |
| 01-03, 06, 08-254 | Not used and reserved |
| FF | Report current mode request |
| 03 | Threshold | 00 | Manual mode (default set by 2110) |
| 01 | Increment (manual only) |
| 02 | Decrement (manual only) |
| 10 | Auto threshold |
| FF | Current mode |
| 04 | Gate Position | 00 | Manual (default set by 2110) |
| 01 | Auto |
| 05 | Gate Size | 00 | Manual |
| 01 | Automatic |
| FF | Query (Returns 0 or 1) |
| 06 | Return to Boresite | 00 | Sets Gate Position to image center (boresite) ONLY effective when Gate position is set to MANUAL |
| 07 | Display Annotation On/Off | 00 | Display annotation Off |
| 01 | Display annotation On |
| FF | Query (Returns 0 or 1) |
| 08 | Video Polarity | 01 | White (default set by 2110) |
| 02 | Black |
| FF | Current setting query |
| 09 | Target Enhancement On/Off | 00 | Target Enhancement Off |
| 01 | Target Enhancement On |
| FF | Query (Returns 0 or 1) |
| 50 | Quit | xx | Disengages the Nighthawk from the tracker. That is, even if the tracker is locked on to a target, the 2110 ignores any error input from the tracker and stops all Az and El motion. |
| 54 | Acquire | xx | Sets tracker in acquire mode. No track error data is available from the tracker in this mode, therefore the Nighthawk does not attempt to follow any target in the gate.  **DO NOT SEND IF THERE IS NO TRACKER IN THE MANIFEST** |
| 55 | Track | xx | Sets the tracker to follow the target acquired (if any) inside the gate. In this mode, if the target is lost, the tracker will return to acquire mode. When tracking, the Nighthawk will control AZ and EL such that it attempts to maintain the acquired/tracked target in the center of the image area.  **DO NOT SEND IF THERE IS NO TRACKER IN THE MANIFEST** |
| 56 | Autotrack | 00 | Sets the tracker to follow a target as in 55 above. In this mode however, if the current target is lost by the tracker it will automatically hunt for a new target within the video scene. In this mode, when the tracker reports that lock is lost, the Nighthawk continues to move in AZ and EL at the last rates applied just before track lock was lost.  **DO NOT SEND IF THERE IS NO TRACKER IN THE MANIFEST** |
| 59 | Tracker Status | 00 | See Tracker Status Responses, below |
| 0A | Video Source Selection | 00 | Visible Light Camera |
| 01 | IR Camera |
| FF | Query (Returns 0 or 1) |
| 0B | Coast Mode Enable On/Off | 00 | Coast Mode Off |
| 01 | Coast Mode On |
| FF | Query (Returns 0 or 1) |
| 0C | Correlation Match % Setting | 00 | Automatic Mode |
| 01-0x64 | Manual Mode 1 to 100% |
| FF | Query (Returns 0 or 1) |
| FF | Reset Tracker | 00 | Reboots the tracker system itself. This function is provided as an emergency command and is not required for normal system operation. |

### Tracker Status Responses

All responses echo the PA command sent unless the command is a status request (generally a qq value of FF).

If the tracker is not set in the manifest, there will be no response from the 2110 at all.

**Caution**

If a tracker command is sent when the manifest does not specify a tracker is present, a COMPLETE 8-byte command must be sent to the 2110. Incomplete commands may cause an interpreter error and stall the interface.

If any PA response from the 2110 contains a qq value of FF, this response is “BUSY”. It is recommended that any control software wait 50 to 100 ms before requesting status again when an FF is returned.

Responses to queries (pp are query values, qq are response values) are as defined in the table below.

| **PA 30 01 pp** | **Meaning** | **qq Response Value** | **Meaning/Notes** |
| --- | --- | --- | --- |
| 02 | Mode[[4]](#footnote-5) | 04 | Centroid (default) |
| 07 | Correlation |
| 03 | Threshold[[5]](#footnote-6) | 00 | Manual mode (default) |
| 01 | Increment (manual only) |
| 02 | Decrement (manual only) |
| 10 | Auto threshold |
| 04 | Gate Position | 00 | Manual (default) |
| 01 | Auto |
| 08 | Video Polarity[[6]](#footnote-7) | 01 | White (default) |
| 02 | Black |
| 59 | Tracker Status[[7]](#footnote-8) | 01 | Acquire Mode |
| 03 | On Track (Nighthawk will only follow targeting data when this status is true) |
| 08 | Autotrack. When in this mode, the Nighthawk will follow or during intervals between which the tracker is hunting for a new target in the scene, the Nighthawk will continue to travel in the direction and last rate applied to track the last target found by the tracker. |

## Imagize Video Processor

When integrated and set in the system manifest, these controls are active and will provide overlay markers indicating items that may be of interest.

One or two processors may be present, one processing visible camera video and one to process IR camera video.

At system boot up, the 2110 always attempts to set any Imagize channel present to Visualization OFF.

### Queries

#### Visible Channel Visualization State

|  |  |
| --- | --- |
| FF 00 53 77 80 00 | xx = 00 = OFF; xx=01 = ON FF = Not present, FE = Timeout, FD=Error  Error could be checksum, format, invalid |
| FF 00 53 77 80 xx |

#### IR Channel Visualization State

|  |  |
| --- | --- |
| FF 00 53 77 C0 00 | xx = 00 OFF; xx=01 ON FF = Not present, FE = Timeout, FD=Error  Error could be checksum, format, invalid |
| FF 00 53 77 C0 xx |

#### Visible Channel Motion Measurement

This command must be issued once until a response or timeout is returned. Do not issue an IR Channel Motion Measurement until this command is complete.

|  |  |
| --- | --- |
| FF 00 53 77 81 00 | xx = 04 followed by a 32 bit result, [z z z z], (4-bytes) MSB to LSB  xx = FF device not present, FE timeout error, FD=Error  Error could be checksum, format, invalid |
| FF 00 53 77 81 xx [z z z z] |

#### IR Channel Motion Measurement

This command must be issued once until a response or timeout is returned. Do not issue an IR Channel Motion Measurement until this command is complete.

|  |  |
| --- | --- |
| FF 00 53 77 C1 00 | xx = 04 followed by a 32 bit result, [z z z z], (4-bytes) MSB to LSB  xx = FF device not present, FE timeout error, FD=Error  Error could be checksum, format, invalid |
| FF 00 53 77 C1 xx [z z z z] |

### Controls

#### Set Visualization

|  |  |
| --- | --- |
| FF 00 53 77 x0 0y | X=0 = visible camera channel; x=4 = IR camera channel  y = 00 OFF; y=01 ON  Response is actual values. yy=FF = Not present, yy = FE = Timeout |
| FF 00 53 77 x0 yy |

# Load New Firmware

To upload new firmware, a procedure must be followed. In order to protect the integrity of the design and firmware, one must first unlock the controller to accept new code. Unlock requires a password supplied by the factory. Once unlocked, the first block of new code must arrive for processing no longer than 3 seconds after affirmation that unlock has been accomplished. If this timing is not met, the upload function will be relocked and any data uploaded will be discarded. The process must then be restarted. This is true whether the timing is not met during upload between blocks as well.

During upload NO OTHER COMMAND MUST BE SENT TO THE CONTROLLER. IF anything other than a resend of the last block or the send of the next block of data is sent to the controller, upload will be aborted, all uploaded data will be discarded and the upload port will be relocked.

The procedure used in the controller is to accept the entire upload as prescribed above, validate this code with checksum and other means. Once this is accomplished, the controller proceeds to write this new code to the internal flash memory. This will take up to sixty (60) seconds or less depending on the code size. Once flash write is complete, the controller outputs to the ETHERNET port a PA FF 01 0007 yy yy response. This response indicates that flash programming has been completed. After this message is sent by the controller, it self-generates a restart. Communication will be lost with the controller at restart. The system will come up in the user set IP address in listen mode. The client must close its socket and reopen a new socket with the controller after restart.

A code upload does not overwrite user data such as IP address, presets, home and calibration settings. Therefore, generally these need not be reestablished after a code upload unless the new functionality of the new code requires changes or reestablishment of this data.

## Unlock/Relock command

PA FF 00 xx xx xx where xx xx xx is an unlock password factory supplied for this upload  
  
Lock = PA FF 00 FF FF FF; any time this code is sent, upload will be terminated, all data discarded and the upload function will be relocked.

PA FF 00 00 00 00 this response is returned if and only if a valid unlock or lock command is received. Any other PA FF 00 xx xx xx sequence will result in no response. In designing software to manage code upload, if no response is received from the controller in 3 seconds or less, it can be certain that the unlock code was not accepted and the system upload function is locked.

## Upload Command

B2 A5 E6 93 FF 01 + blocks

Blocks = block = xx xx cc cc data checksum

xx xx = total block count (00 01 to FF FE)   
cc cc = current block number  
data = 1024 bytes, MSB first, LSB last  
checksum = 16 bit value

Response for each block transferred:   
 PA FF 01 rrrr yy yy  
 rrrr = response code

0000 = OK  
0001=format error; can resend within 3 seconds  
0002=checksum error; can resend with 3 seconds  
0003 =timeout error (3 sec since last block); system locked; upload lost  
0004=another command received; system locked; upload lost  
0005=code mismatch, i.e. wrong application; system locked; upload lost  
0006=upload requires unlock; system locked, no data accepted  
0007=flash programming complete (could take up to 60 seconds to see this)

yy yy = current block count

As each block is received the controller validates the block. If in error a non-zero value of rrrr is returned, the sourcing computer may resend or terminate transmission. If the block is validated, an rrrr=00 is returned by the controller.

Blocks must be sent in consecutive order (except that a resend can occur. A resend must be a block for which a non-zero rr was returned). Once all blocks are received, the controller reboots and begins to operate under the new code.

A terminate command (PA FF 00 FF FF FF) causes the controller to discard the entire upload and resume operation under the previous code.

**Unlock is reset (Locked) when**:

The total number of blocks are received and accepted

A terminate command is sent (PA FF 00 FF FF FF)

A time out (3 seconds) has occurred. The time starts from when the last block was accepted to when the next block is received.

# Change IP Address

**Caution**. While we try to prevent some errors, this command not carefully managed can cause the loss of communications with the controller from the network. Once lost, communications may not be recoverable remotely and will require a trip to the field to reset the IP address.

The source computer sends the following string to the ITS Controller  
PA 00 02 + IP Address + Null where:

IP address is III.III.III.III [, GGG.GGG.GGG.GGG, and MMM.MMM.MMM.MMM]-PPPPP where:

All characters are ASCII string characters  
III is an IP address value from 000 to 255  
GGG is a Gateway address value from 000 to 255  
MMM is a subnet mask value from 000 to 255  
PPPPP is a port address from 00000 to 65536

[ ] denotes an optional parameter

Null terminator (string terminator)

Any element or any part of the format not precisely correct will be ignored by the controller and the previous IP address, gateway, mask and port will be used.

The response is PA 00 02 “III.III.III.III.[GGG.GGG.GGG.GGG,MMM.MMM.MMM.MMM]-PPPPP”.

The response will always be returned before the current socket is closed. The socket will NOT be closed if the new IP is rejected. This response is always the IP address parameters that the controller will connect with even if it is unchanged. The user should capture the IP address, gateway, mac and port to validate the controller is being set to the intended address parameters. If captured as recommended, the user will then know with what address the controller may be connected to once more change the address or confirm that the address has been set correctly before attempting to reestablish communications.

## Recovery Procedure

In the event that the IP address becomes corrupted or otherwise unknown, the controller can be restored to one of 16 factory default IP values.

One must go to the physical location of the controller and change the setting of the default IP address switch (S7) on the controller board and hold S8 and depress and release the CPU reset switch (S2) on the board. This will force the controller back to a range of 16 IP addresses starting with 192.168.150.90. The exact address is determined by adding the value of the switch (0-9, A-F hex) to the starting IP address. When successful a blue LED (A) will illuminate when using this address for communications.

# TCP/IP Server Behavior

The controller is designed as a server in a networking environment.

## Loss of link behavior

The Ethernet interface on the controller will initialize to TCP/IP listen mode at power up. In this mode, the interface is available to make a connection to a client.

When a connection is established, establishment of additional connections to the interface is blocked.

In the event that the Ethernet cable that would be directly attached to the J45 connector or any such cable directly connected in the path between either the client or a switch/router between the controller and the client is disconnected, the interface immediately reverts back to TCP/IP listen mode, thereby facilitating reconnection to a client when the direct physical path is restored.

## IP Keep Alive

In the event that the client suffers a disorderly shutdown, or the physical path between the client and any router/switch between the controller and client fails, the controller will detect this event. The controller employs the TCP/IP keep-alive function to do so. This function sends an empty packet from the server to the client periodically. When the path is between the client and controller is complete and the connection is still open at the client side, the client responds (in the background) with an acknowledge packet. This tells the controller that the connection to the client is still valid. The controller issues a TCP/IP keep alive packet after 60 seconds of connection inactivity. If not acknowledge from the client is received, the controller will wait 60 more seconds and try again. This will repeat three more times. If no acknowledge is received after these five (5) attempts, the controller closes its server side connection and returns to TCP/IP listen mode.

## Multi-client Capability

Up to 4 client sockets can be opened with the same server IP address, port and gateway.

The number of sockets that can be opened at power up is determined by the settings of switches 1 and 2 of S1 on the controller board. S1/2 when both off permit 1 socket, S1-1 on, S1-2 off permits 2 sockets, S1-1 off S1-2 on permits 3 sockets and S1-1 on and S1-2 on permits 4 sockets. Data activity on an open socket (not network activity, but data transfer between a client and a system server socket) is indicated on LEDs A through D.

When data is being transferred either in or out of this server to the client/server socket, the corresponding LED will be illuminated. Each socket has its own keep alive. If a connection is broken the socket will close itself at the server end up to 10 minutes after the last socket was opened. All other active sockets will remain open or available.

When a code down load is initiated on any socket, all remaining sockets will immediately be closed by the server and will be unavailable for reconnect until the code upload sequence is complete and the system reboots.

After reboot wit will automatically reconnect to the socket that initiated the code upload.

This protocol protects the integrity of an upload and prevents other operators form intervening during the sequence.

# Other commands in the ITS standard GUI not used by the controller

The following commands permit the user to set control values that our GUI uses to manage values sent to the controller.

For example, in the SETUP menu one finds the STEP RATES group. These values can be set by a user, but only tell the GUI what values to send to the controller with the – and + increment buttons for zoom and focus (remember this has no meaning for the IR camera).

Also in the SETUP menu there is a set site config file location. This procedure is only used by the GUI to set the path and file name of the external text file that permits the user to select a site. Coordinated with site names (user definable) this is where the GUI picks up the IP and port address for the system at the site selected.

In the SETUP menu the “Video” group of controls is used by the NTSC video splitter which is an option in the system. This option is present in the CBP Nighthawk HT system and therefore is not implemented at this time.

# Appendix A

## Manifest Types

The definitions in this appendix are subject to change without notice. Please contact the factory for the latest manifest content.

NS=not supported in current 2110 code as of this date

Types are stated in decimal

#### Cameras

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model | Type | Mfg | LENS | Notes |
| KP-D581 | 01 | Hitachi | External | Reserved; NS |
| KP-D591 | 02 | Hitachi | External | Reserved; NS |
| Generic | 03 | Standard Visible | External | Reserved; NS |
| KPDE 500 | 08 | Hitachi | External |  |
| KPDE 5000 | 09 | Hitachi | External |  |
| None | 99 |  |  |  |
| LTC550 | 101 | Bae | Internal | Reserved; NS |
| MILCAM | 102 | FLIR | Internal | Reserved; NS |
| C-POD | 103 | Axsys | Internal | Reserved; NS |
| Fieldpro 5X | 104 | Axsys | Internal | Reserved; NS |
| PMC300 | 105 | Bae | Internal | Reserved; NS |
| Ranger HRC | 106 | FLIR | Internal |  |
| WALRSS | 108 | L3-CE | Internal |  |
| WALRSS-A | 109 | L3-CE | Internal |  |
| Axsys XXX | 110 | Axsys | Internal | Reserved; NS |
| L3-HD IR | 111 | L3-CE | Internal |  |

#### External Lenses

| **Name** | **Descriptor Byte** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Type** | **Zoom** | **AF** | **2x** | **FOG Filter** | **Haze** | **Stab** | **Filter A** | **Filter B** |  |
| Internal | 00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| Generic 01 | 01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Reserved; NS |
| Generic 02 | 02 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Reserved; NS |
| Generic 04 | 04 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | Reserved; NS |
| Generic 05 | 05 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | Reserved; NS |
| Generic 06 | 06 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Reserved; NS |
| Generic 07 | 07 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | Reserved; NS |
| Fujinon | 20 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |  |
| Pentax PAIR | 30 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |  |
| Pentax PAIR02 | 31 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |
| Multi-FOV | 80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Reserved; NS |
| Multi-FOV | 81 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | Reserved; NS |

#### Accessory List

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Model** | **Type**  **(dec)** | **Video Channels In** | **Video Channels Out** | **GPS** | **Model** | **Notes** |
| None | 255 | 0 | 0 | N |  |  |
| 6325PVP | 01 | 1 | 1 | Y |  |  |
| Reserved | 02 |  |  |  |  | Reserved |
| 2150 | 03 | 3 | 2 | Y |  |  |
| 6980G-HD | 04 | 1 | 1 | Y |  | For use with SD/HD-SDI Cameras only |
| SWIR Lens | 15 |  |  |  |  | Special Lens Control only |
| Imagize Vis | 20 | 1 | 1 | N |  |  |
| Imagize IR | 21 | 1 | 1 | N |  |  |
| Imagize Both | 22 | 2 | 2 | N |  | Uses common serial port |
| Illuminator | 31 | 0 | 0 | N | PVP |  |
| Laser Pointer | 32 | 0 | 0 | N | PVP |  |
| Pointer - Illuminator (two Laser) | 33 | 0 | 0 | N | PVP |  |
| Night Sun | 34 | 0 | 0 | N | PVP |  |
| NS & Pointer | 36 | 0 | 0 | N | PVP | Night Sun w/ Laser Pointer |
| ELRF-2MC | 41 | 0 | 0 | N | L3 Laser Range Finder |  |
| Zeiss LRF | 42 | 0 | 0 | N | Zeiss Laser Range Finder |  |
| EIO Video Tracker | 51 | 1 | 1 | N | EIO 8000 | Only available in 2110 firmware version 3.00 and up |
|  |  |  |  |  |  |  |

#### Lasers & Illuminator Pods (to be merged at next release to Accessory list)

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **Type** | **Model** | **Notes** |
| None | 99 | None |  |
| Illuminator | 01 | PVP |  |
| Laser Pointer | 02 | PVP |  |
| Pointer - Illuminator (two Laser) | 03 | PVP |  |
| Night Sun | 04 | PVP |  |
| NS & Pointer | 06 | PVP | Night Sun w/ Laser Pointer |

#### Ranger Finders (to be merged at next release to Accessory list)

|  |  |  |  |
| --- | --- | --- | --- |
| **Model** | **Type** | **Description** | **Notes** |
| None | 99 | None |  |
| ELRF-2MC | 01 | L3 Laser Range Finder |  |
| Zeiss | 02 | Zeiss Laser Range Finder |  |

#### ITS Annotators (to be merged at next release to Accessory list)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model** | **Type** | **Video Channels In** | **Video Channels Out** | **GPS** | **Notes** |
| None | 99 | 0 | 0 | N |  |
| 6325PVP | 01 | 1 | 1 | Y |  |
| Reserved | 02 |  |  |  | Reserved |
| 2150 | 03 | 3 | 2 | Y |  |
| 6980G-HD | 04 | 1 | 1 | Y | For use with SD/HD-SDI Cameras only |
| SWIR Lens | 15 | 0 | 0 | N | Special Lens Control only |
| Imagize Vis | 20 | 1 | 1 | N |  |
| Imagize IR | 21 | 1 | 1 | N |  |
| Imagize Both | 22 | 2 | 2 | N |  |

#### Video Tracker Types (to be merged at next release to Accessory list)

|  |  |  |
| --- | --- | --- |
| **Description** | **Type** | **Notes** |
| None | 99 |  |
| EIO 8000 Video Tracker | 01 | Only available in 2110 firmware version 3.00 and up |

#### Camera/Lens Enclosures

| **Name** | **Descriptor Byte** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Type** | **pressure Sensor** | **Wiper** | **Heater** | **TBD** | **TBD** | **TBD** | **TBD** | **TBD** |
| None | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| P Sensor | 01 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| P Sensor - Heater | 02 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | Reserved; NS |
| P Sensor- Heater- Wiper | 03 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Reserved; NS |

#### Nighthawk Types

|  |  |  |
| --- | --- | --- |
| **Description** | **Type** | **Notes** |
| Nighthawk DD | 01 |  |
| Nighthawk DD w Stabilizer | 02 |  |

#### Assignable Serial Ports

In the table below, J# refers to the nomenclatures that appears on the 2110 PWA and Nomenclature is the label that is silkscreened on the 2110 PWA. These designations are the defaults for each element.

All serial ports are RS232 compatible except as noted below.

|  |  |  |  |
| --- | --- | --- | --- |
| **J #** | **Nomenclature** | **Type** | **Notes** |
| J12 | Visible Camera | 01 |  |
| J15 | Visible Lens | 02 |  |
| J11 | IR Camera | 03 |  |
| J8 | Range Finder | 04 |  |
| J9 | Illuminator | 05 |  |
| J7 | Spare | 06 | Can be configured for RS422 |
| J4 | Splitter | 07 |  |
| J1-a | FUART 1 | 08 | Reserved for annotators and special functions. These UARTS are TTL I/O only and are not compatible with RS232 signals or RS422 Signals |
| J1-b | FUART 2 | 09 |
| J1-c | FUART 3 | 10 |
| J1-d | FUART 4 | 11 |

# Appendix B

## Annotator Commands

All annotator query and display control commands are ITS proprietary commands and are preceded by the preamble, PA (see ITS Proprietary Commands page 14).

All responses return the PA with the command and response values as shown herein.

### Annotator Type

This command identifies the font used for annotation. In order to determine which annotator is configured in this system, query the System Manifest (see page 15).

|  |  |
| --- | --- |
| PA 10 01 pp qq 00 | pp=channel 1 value; qq = channel 2 command/status  pp/qq= 0 is relative white, 01 = black, 02 = black surround  pp/qq=99 = status request for specified channel; |
| 10 01 pp qq 00 = acknowledge | response is as above |

### Annotator On/OFF

Turns on/off all enabled annotation. Default is both channels off. When off, controller ignores all other annotator commands. Turns on/off all enabled annotation. Default is both channels off.

|  |  |
| --- | --- |
| PA 10 00 pp qq 00 | pp=channel 1 value; qq = channel 2 command/status  pp/qq is 00 = all annotation OFF  pp/qq = 1, annotation on  if pp/qq=99, command is request for status |
| 10 00 pp qq 00 | Status codes = 00=on/ready, 01 = busy, 02=fault, 09= not present |

### Graphic

Controller response ack response = 10 02 ab as sent. Request for status is 10 02 a9, response is 10 02 ab, e.g. 10 02 19 (status of channel 1) response = 10 02 11 (chan 1 crosshair on). 10 02 09 is in valid status request. Default = off

|  |  |
| --- | --- |
| PA 10 02 pp qq 00 | pp=channel 1 value; qq = channel 2 command/status  pp/qq = 0 no graphic, 1=crosshair on, 2 = bore site on  pp/qq =99 is status request for specified channel; |
| PA 10 02 pp qq 00 | response is as above |

### Intensity Control

Intensity changes the annotation from transparent (not visible) to a bright white overlay. Default is highest intensity (64)

|  |  |
| --- | --- |
| PA 10 03 pp qq 00 | pp/qq = 00 to 64 is intensity setting (1 to 100 decimal)  pp = channel 1; qq = channel 2 |
| 10 03 pp qq 00 |  |

### Save/Clear Basic Setup

Saves, restores commands PA 10 00 through PA 10 03 only. A save writes setup to FLASH to survive a power down

|  |  |
| --- | --- |
| PA 10 04 pp qq 00 | pp/qq = 11 is save command. SEE FLASH NOTES  pp/qq = 33 is clear command  pp/qq = 55 is restore last saved setup (clear current)  pp/qq = 99 is status; |
| 10 04 pp qq 00 | 11 is saved set up, 33 is no set up saved |

### Clear Screen

|  |  |
| --- | --- |
| PA 10 05 pp 00 00 | pp selects video channel, clears all text (free and preformatted) from the screen. At next annotator write cycle, all current text and locations are restored. |
| echo or status |  |

In a GUI, if the user desires to change the content of any preformatted or free text or location thereof, send this command first, then follow up with the new commands to place data on the video area as specified.

#### Display Active Camera Zoom/Focus

This command is only active with the ITS 2150 2-channel video inserter.

|  |  |
| --- | --- |
| PA 10 06 xx 00 00 | xx = 0 to enable ‘Display Active Camera Zoom/Focus’  xx = 1 to disable  When enabled (default), the values of zoom, focus and the related scales are representative of the current lens values for the active camera for both output video streams of the 2150 Video Inserter.  When disabled each video stream will display the current lens zoom, focus and scales separately. The camera/lens values connected to left ear (generally an IR) will be reported in 2150 video out C and the camera connected to the right ear (generally a visible light camera) will be reported in the video out A. |
| B2 A5 E6 93 10 06 xx 00 00 | XX = the current state response |

### Variable Control Group

|  |  |
| --- | --- |
| PA 11 v-v 0p wx yy zz .. .. | p= 0 is both, p=1 is channel 1, p=2 is channel 2  v-v is the sub-command  wx = annotation format parameter  yy= 00 = not displayed, 99 = status  yy = line number (1-30),  zz = start column (1-31) |
| 11 0a v-v wx yy zz = acknowledge | response is acknowledge unless xx = 99, then yy and zz are current settings |

All of the subsequent commands under this heading are compliant with this format.

#### Time Format

|  |  |
| --- | --- |
| PA 11 01 0p wx yy zz | p = don't care; whatever format is selected applies to all channels  w = 0 do not display time  1; Julian, DDD HH:MM: SS  2; reserved  3; Julian, DDD HH:MM: SS.sss  4; mm/dd/yy HH:MM:SS (requires GPS)  5; reserved  6; mm/dd/yy HH:MM:SS.sss (requires GPS)  7:reserved |
| echo or status | x = 0; Not USED  1; if lock status on precedes time,  2 = lock status on and is suffix to time show lock status as  if IRIG selected (and available) not locked = "i", locked = "I"  if GPS selected (and available) not locked = "g", locked = "G" |

Not all annotators have IRIG inputs; see ITS Annotators page 82.

#### Time Label

If time is not displayed, ignore this command

|  |  |
| --- | --- |
| PA 11 02 0p wx yy zz | x = 0 is before time  1 is after time  yy & ZZ are 00 00 for this command |
| echo |  |

#### IP Address

Displays IP address where directed (only IP and port, gateway and subnet omitted); Currently defaulted to display in the video on line 1 at the center

|  |  |
| --- | --- |
| PA 11 03 0p 00 yy zz | yy zz as defined above |
| echo |  |

#### Azimuth

Displays pointing azimuth as read from pan/tilt where directed to the decimal places specified “AZ: ###.###" is format

|  |  |
| --- | --- |
| PA 11 04 0p wx yy zz | w > 1,2 or 3 denoting decimal places  x > 0= no label, 1= "AZ: " |
| echo |  |

#### Elevation

Displays pointing azimuth as read from pan/tilt where directed to the decimal places specified “EL: ###.###" is format

When V=0, the default, is “About 360” which means the values below zero elevation start at 359.995 and descend toward 290.

When V=1, “+/- Zero”, means displayed values of elevation below 0 degrees are displayed as negative numbers (e.g. 350 degrees “About 360” is =10 degrees as “+/- Zero”)

|  |  |
| --- | --- |
| PA 11 05 Vp wx yy zz | V = 0 ,"About 360" (default  V= 1, "+/- Zero"  w > 1,2 or 3 denoting decimal places  x > 0= no label, 1= "EL: " |
| echo |  |

#### Zoom Value

Displays zoom value of the active camera where specified; Format "Zoom: ###" or "Zoom: ##%"

The controller will display the zoom AND zoom scale data on a temporary basis if EITHER command has V=1. If the user wishes to display these values on a full time basis, the GUI must send both zoom and zoom scale command out with each V=0. The default is full time on the GUI and the system unless a default is saved by the user.

|  |  |
| --- | --- |
| PA 11 07 Vp wx yy zz | V = 0, show full time, 1 - 9 show for 1 to 9 seconds (sets value for zoom scale as well)  w > 0 = no label, 1 = "Z:", 2 = "Zoom:"  x = 00 specifies a relative number (0-254)  01= % from wide to narrow  02 = Degrees (taken from a table if available) |
| PA 11 07 vp wx yy zz | Variables reflect the current settings. |

#### Focus Value

Displays focus value of the active camera where specified; Format "Focus: ###" or "Focus: ##%"

The controller will display the focus AND focus scale data on a temporary basis if EITHER command has V=1. If the user wishes to display these values on a full time basis, the GUI must send both focus and focus scale command out with each V=0. The default is full time on the GUI and the system unless a default is saved by the user.

|  |  |
| --- | --- |
| PA 11 08 Vp wx yy zz | V = 0, show full time, 1 - show for 10 seconds (sets value for focus scale as well)  w > 0 = no label, 1 = "F:", 2 = "Focus:"  x> 0 = number (1-254), 1= % from Near to Far |
|  |  |

#### Zoom Scale

10 character scale as VZ ZOOM W ▓▓▓▓▓\_\_\_\_\_ N 2X as modified by code;

if no scale (w=1), 2X at row, col location

IR or VZ selected to match active camera.

Number of block characters in 10 character range based on zoom values

The controller will display the zoom AND zoom scale data on a temporary basis if EITHER command has V=1. If the user wishes to display these values on a full time basis, the GUI must send both zoom and zoom scale command out with each V=0. The default is full time on the GUI and the system unless a default is saved by the user.

|  |  |
| --- | --- |
| PA 11 09 Vp wx yy zz | V = 0, show full time, 1 - show for 10 seconds (sets value for zoom value as well)  yy = line number, 00 = off; 99=report status  zz = starting column 1-30, 00=off  w = 0 no lens status, 1 show status of "2X" lens only, w=2 add "2X" to scale  x = 0 > no labels  x = 1 > show Zoom W(ide) and N(arrow) labels  x = 2 > show VZ or IR  x = 3 > show VZ or IR and ZOOM W/N labels |
|  |  |

#### Illuminator Status

set to show Status show ¤ or equivalent when command to show status and illuminator is on. When illuminator is off show nothing.

|  |  |
| --- | --- |
| PA 11 10 0p wx yy zz | yy = line number, 00 = off; 99=report status  zz = starting column 1-30, 00=off  w = 0 no status, 1 show On/Off status (see notes)  x = 0 only for now; not used |
|  |  |

#### Focus Scale

10 character scale as VZ FOCUS N ▓▓▓▓▓\_\_\_\_\_ F as modified by code;

VZ or IR selected to match active camera

Number of block characters in 10 character range based on focus values

The controller will display the focus AND focus scale data on a temporary basis if EITHER command has V=1. If the user wishes to display these values on a full time basis, the GUI must send both focus and focus scale command out with each V=0. The default is full time on the GUI and the system unless a default is saved by the user.

|  |  |
| --- | --- |
| PA 11 11 Vp 0w yy zz | V = 0, show full time, 1 - show for 10 seconds (sets value for focus value as well)  yy = line number, 00 = off; 99 report status  ZZ = starting column 1-30, 00=off,  w = 0 > no labels  w = 1 > show Focus N(ear) and F(ar) labels  w = 2 > show VZ or IR  w = 3 > show VZ or IR and FOCUS W/N labels |
|  |  |

#### Coordinates

Displays GPS coordinate data in the format and location specified. If no GPS is available this command is ignored except as shown in the response

|  |  |
| --- | --- |
| PA 11 12 0p wx yy zz | yy zz as defined above  wx as 1x= Lat/Long, 2x = MGRS;  x as 1 = DD:MM:SS.ss or 10 meters (MGRS) |
|  |  |

#### Display Pneumonic

If no pneumonic is set (blank or null), this command is ignored.

|  |  |
| --- | --- |
| PA 11 16 0p 00 yy zz | as defined in general format |
|  |  |

#### Set pneumonic

Value is limited to 12 ASCII characters. If value is not accepted, prior value is retained. This value is kept in NV RAM and survives a power cycle

|  |  |
| --- | --- |
| PA 11 17 pp xx value | pp = 00 is set pneumonic; 22 is clear pneumonic; 99 is report status. SEE FLASH NOTES  xx = byte count to follow, max is 12 bytes (12 ASCII characters)  abcde are any printable ASCII characters  Response xx = 00 if accepted or set, 01 if error, 02 is cleared/none |
|  |  |

#### Illuminator Zoom Value

Displays zoom value of the Laser Illuminator (if attached) where specified; Format "Zoom: ###" or "Zoom: ##%"

The controller will display the illuminator zoom data on a temporary basis if V=1. If the user wishes to display this values on a full time basis, the GUI must send both zoom command with V=0. The default is full time on the GUI and the system unless a default is saved by the user

|  |  |
| --- | --- |
| PA 11 18 Vp wx yy zz | V = 0, show full time, 1 - 9 show for 1 to 9 seconds  w > 0 = no label, 1 = "IZ:", 2 = "IZoom:"  x> 00 = number (1-254), 01= % from wide to narrow |
|  |  |

#### Control Mode

Causes 2110-ROTC (type 10, see Controller Versions: page 14) only to send to the appropriate 2110-GVI video channel the current control mode label at the line and column specified.

Labels are: 0101 = "JSR ", 0102 = "JSRH",0201="TATS", 0301="VDTK"

|  |  |
| --- | --- |
| PA 11 18 0p xx yy zz | p = channel 1 or 2  yy zz is line and column as normally specified  xx = 19 for channel 1 status (line, column) and 29 is channel 2 status |
|  |  |

#### Free Text

Permits annotation (and save to flash) of up to 5 lines of text located as specified by the yy and zz parameters. Care must be taken to avoid overwriting other items in the annotation. Time labels will always overwrite this text.

|  |  |
| --- | --- |
| PA 11 20 ab xx yy zz "tttttt…"" | a=channel number (0 for both, 1 or 2) and b = line number of the GUI text (1-5)  yy and zz are line and starting character  xx is number of characters (1-32)  ttttttt is any printable ASCII text character including space and punctuation. No CR or LF |
|  |  |

If character count does not exactly = xx value, whole command is ignored.

1. Offsets relative to mechanical home are the difference between the position calibrated in AZ and EL by the user and the angular value of these calibrated positions relative to mechanical home. These offsets are used to adjust query (AZ and EL) values to calibrated positions and also used with command to position (AZ and EL) to move the P/T to calibrated headings and elevations. Please refer **to CALIBRATE HOME** for specific commands. [↑](#footnote-ref-2)
2. When home is required, it means a mechanical home is required. Prior to mechanical home, the Nighthawk HT does not know where it is, therefore, reference home, any presets and any command to position values (AZ and EL) will have no meaning. Consequently, the controller will ignore these commands until a mechanical home is completed. Rate AZ and EL command will be honored. [↑](#footnote-ref-3)
3. The tracker does not report gate size to the 2110, therefore at start up, the 2110 sets the gate size to a default value of 50 height and 50 width. The 2110 firmware then increments and decrements as commanded from this starting point. [↑](#footnote-ref-4)
4. There are other modes of the tracker that are not implemented in the 2110. If by some chance the tracker entered a mode not specifically commanded via the 2110, the actual mode number would be read by the 2110 and inserted into the qq value. Possible values range from 0 to 7 which include the two implemented. [↑](#footnote-ref-5)
5. The actual threshold value is not reported back to the 2110. At startup the 2110 sets the threshold to MANUAL mode (qq=00) and sets a value of 511. The 2110 then keeps track of the threshold value to facilitate increment decrement function. [↑](#footnote-ref-6)
6. The tracker offers “polarities” of ***GRAY(0)***, ***WHITE(1)***, ***BLACK(2)***, ***MIX(3)*** and ***AUTO(4)***. Commands available through the 2110 only select white or black polarities. If by chance the tracker entered a mode not specifically commanded by the 2110, the 2110 will read values (range 0 to 4) and insert the actual value read into the qq response. [↑](#footnote-ref-7)
7. The there are 7 possible states that tracker can report. The 2110 will only command the ***acquire***, and ***auto acquire*** states. The 2110 looks for the ***on track*** state (3) and when the tracker is in this state, the 2110 will calculate rates to apply to the Nighthawk motion control to follow the tracked target. No other state is used by the 2110 for control or status. However, the 2110 reads whatever state is reported by the tracker and inserts the value in the qq response. [↑](#footnote-ref-8)