D-Protocol Command Reference

VIS-1000 Series Illuminators
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VIS-1000 Series Illuminators, D-Protocol Command Reference

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Introduction

D-Protocol is a defacto security industry standard protocol used to control camera systems over a serial cable. This document describes the portions of D-Protocol that are implemented by the VIS-1000 Series Illuminators (hereafter referred to as VIS). Much thought has been given to adapting this protocol to an illuminator such that existing controlling devices (keyboard, encoder, PC application, etc.) can access most of VIS's features without little or no modifications.

Note that throughout this document, all numbers preceded by `0x` are hexadecimal numbers.

Serial Communication Configuration

The communication interface of VIS is composed of 2 serial wires, a digital input/output, and a common return. All serial communication is configured to be 8-bit data, no parity, and 1 stop bit (8-N-1). The baud rate and base address can be configured and stored in persistent memory via the NuOptic Control Protocol (using the NuOptic Demo Application). Additionally, a 4 position DIP switch controls other aspects of the serial communication.

Configuration Switches

The first, or top, switch position (labeled MODE) selects between RS-485 and RS-232 modes. The next one down (labeled TERM) enables RS-485 bus termination if required. Finally, the last 2 switch positions (labeled ADDR) configure the device address in RS-485 mode, or select different protocol options in RS-232 mode. Note: Bus termination violates RS-232 specifications, therefore it should not be enabled when VIS is in RS-232 mode.

Base Address and Offsets

D-Protocol requires that devices being controlled have an associated device address. If more than one device is on a serial bus, each device must have a unique address. VIS contains an internal, configurable base address that is used in conjunction with the configuration switches to form a device address. In RS-485 mode, the 2 ADDR switches provide a numeric offset (0, 1, 2, or 3) that is added to the base address to form the device address. In RS-232 mode, the device address is simply the base address. The default value for the base address is 32 (0x20).

RS-485 Mode

When the MODE switch is ON ("up" or set away from the text), VIS's serial interface is configured for D-protocol using 2-wire RS-485 with a default baud rate of 2400. The two ADDR switches provide 4 unique offsets to the base address. Assuming the default base address of 32, if both ADDR switches are OFF ("down" or set toward the text), VIS's device address is 32. Similarly, when both ADDR switches are ON, VIS's device address is 35. Table 1 below shows all possible ADDR switch positions and the associated VIS device addresses.

Table 1 Device Address in RS-485 Mode

Upper ADDR Switch	Lower ADDR Switch	Device Address
OFF	OFF	32
OFF	ON	33
ON	OFF	34
ON	ON	35

RS-232 Mode

When the MODE switch is OFF ("down" or set toward the text), VIS's serial interface is configured for full-duplex RS-232. The ADDR switches are used to select a serial protocol and baud rate combination. Table 2 below shows all possible ADDR switch positions and the associated protocols and baud rates. When configured for D-Protocol, the device address is the base address.

Table 2 Serial Protocol Selection

Upper ADDR Switch	Lower ADDR Switch	Serial Protocol	Default Baud Rate
OFF	OFF	D-Protocol	2400
OFF	OFF	NuOptic Control Protocol	57600
ON	OFF	NuOptic Control Protocol	57600
ON	ON	NuOptic Control Protocol	57600

VIS-1000 Series Features

VIS provides a number of features many of which are accessible through D-protocol. The main three items that can be controlled are: Field of Illumination, Brightness level, and Ambient Threshold level. These controls are set by a percentage value, i.e., 0% through 100% in 1% increments. Additionally, each of these three controls has a physical knob that can be adjusted to set the respective feature. Since these controls can be adjusted via either the serial communications or a physical knob, VIS will adjust itself base on the last interface that was adjusted. The other key feature accessible through D-Protocol is Presets.

Field of Illumination (Zoom) Control

One of VIS's unique features is the ability to vary its field of illumination (FOI) in the field. This affects the area illuminated by VIS and the effective distance that a camera can see. When the FOI control is set to 0%, the area illuminated is the widest and when set to 100% the area is the narrowest. In between these two extremes the FOI can be continuously varied between wide and narrow in 1% increments.

Since FOI is in many ways analogous to the field of view of a camera, and since camera field of view is often referred to as its zoom level, VIS's FOI can be thought of as a kind of zoom. In keeping with this analogy, supported D-Protocol commands related to zoom are mapped to VIS's FOI control. Therefore, sending a zoom wide command (or reducing the zoom position) will increase the area illuminated by VIS, and sending a zoom narrow command (or increasing the zoom position) will narrow the area illuminated and increase the effective illumination distance.

Brightness Control

VIS provides the ability to vary the illumination power level or Brightness. This can be set anywhere between full power and completely off, with full power output occurring when the Brightness level is set to 100% and no power output when the Brightness level is set to 0%. As with the other two controls, Brightness can be set anywhere between these extremes in 1% increments.

Since illuminator brightness is in many ways analogous to camera exposure, and since camera exposure can be controlled by adjusting its iris, VIS's Brightness can be thought of as an iris control. In keeping with this analogy, supported D-Protocol commands related to iris adjustment are mapped to VIS's Brightness control. As a result, sending an iris open command (which would increase exposure or lighten an image) will increase VIS's Brightness level and sending an iris close command (which would decrease exposure or darken an image) will reduce VIS's Brightness level.

Ambient Threshold Control

VIS contains an ambient light sensor that is used to automatically turn the illumination ON or OFF. Since different installations and situations warrant unique light levels for turn-on, VIS provides an Ambient Threshold control that can set the light level threshold that turns VIS ON or OFF. This threshold can be adjusted from 0% to 100%. Setting this control to a smaller number will make VIS turn ON when the ambient light level is darker and setting it to a larger number will make it turn ON when the ambient light level is brighter.

In addition to controlling the turn-on and turn-off light levels, the Ambient Threshold control affects VIS in another important way. When this control is set to exactly 0%, VIS's illumination is no longer controlled by the ambient light level, but rather by the digital I/O line, which becomes an input signal (DI). Assuming the Brightness level is greater than 0% and the Ambient Threshold is set to 0%, VIS will turn ON when DI is shorted to Common and will turn OFF when DI is open-circuited. When the Ambient Threshold control is set to exactly 100%, VIS's illumination is forced to be always ON, assuming the Brightness level is > 0%. When the Ambient Threshold is > 0%, the digital I/O line becomes an output (DO) and its open collector output will be driven low whenever VIS's illumination is ON; otherwise, the collector will be open.

Since there is no logical analogy between this threshold control and camera controls, a convenient and available control in D-Protocol was commandeered, namely focus control. As with VIS's other two controls, supported D-Protocol commands related to focus adjustment are mapped to VIS's Ambient Threshold control.

Presets

VIS is capable of storing and accessing up to 64 unique triplets of zoom percentage, brightness percentage, and ambient threshold percentage. These stored triplets are called presets and reside in persistent memory within the illuminator. They can be accessed using an ID from 1 through 64. The ID that is used to store a preset can subsequently be used to "go" to this preset, thus causing the illuminator to move the previously stored configuration of zoom, brightness, and ambient threshold. Also, a previously stored configuration can be cleared, which removes it from persistent memory. Additional presets that access other features of VIS are described in the **Predefined Presets** section.

Protocol Overview

D-Protocol is a serial command-response protocol that utilizes a fixed length command message. The response messages can be one of 3 different length messages. This protocol is master-slave, with only 1 master and 1 or more slaves. The master initiates all communication by issuing a command to a target device (there are no "broadcast" messages). The targeted device will then generate a return response to the master, and this must be transmitted within 300 milliseconds of receiving the command. The D-Protocol specification recommends delaying 300 milliseconds between transmissions of commands to devices on the bus.

At the physical level, D-protocol can be implemented on various serial physical interfaces. The VIS Series supports this protocol on either RS-232 or two-wire (i.e., half-duplex) RS-485. When configured for RS-232 mode, VIS supports all commands outlined in this manual with the exception of the shadowing functionality, which relies on a bus-connected architecture, which RS-232 does not support. VIS will only respond to commands that match the device address determined by the configuration switches. See section for details on setting VIS's device address.

Command Message Format

The format for all Command messages is shown below in Table 3. Commands are transmitted a byte at a time, from left to right beginning with the Sync byte, which is always 0xFF. The second byte in the message is the Address of the device the controller wishes to affect, and must be in the range of 1 – 255. Bytes 3 through 6 are the command and data bytes, or the payload of the message. Finally, the seventh byte is the Checksum byte, which is the 8-bit sum of bytes 2 through 6.

Table 3 Command Message Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Command Message	0xFF	--	--	--	--	--	--

There are two types of commands that can be sent to a device: Standard Commands and Extended Commands. Standard Commands always utilize Cmd1 and Cmd2 (Bytes 3 & 4) as a 16-bit command. Data1 and Data2 (Bytes 5 & 6) are utilized as 8-bit parameters if the Standard Command is a pan or tilt command. Cmd2 of Standard Commands is always even. Extended Commands are almost exclusively composed of Cmd1 set to 0x00 and Cmd2 set to an odd byte value; a few commands have Cmd1 set to a non-zero number to provide some variations to a given base command in Cmd2. Extended Commands often use Data2 as an 8-bit parameter and sometimes use Data1 and Data2 as a 16-bit parameter (with Data1 as the MSB and Data2 as the LSB).

Response Message Formats

A device is expected to (but not required to) return a response message for every command issued to it. There are 3 types of responses: General Response, Extended Response, and Query Response. All responses begin with a Sync Byte (always 0xFF), followed by the device Address Byte, followed by a payload, and terminated by a Checksum Byte. Following are the formats of the responses, which are transmitted a byte at a time, from left to right beginning with the Sync Byte.

VIS will always return a response for each command sent to it, unless responses are disabled (see **Response Suppression** section below). Disabling responses using a *predefined preset* is useful in the case where VIS is connected as a two-wire RS-485 device on a four-wire RS-485 bus. In this situation, VIS should be connected to the controller's transmit wires and it should act as a "listen only" device, otherwise the responses could

collide with other commands being sent by the controller (and VIS's output would fight with the controller's output bus drivers). Responses are suppressed for Standard Commands in RS-485 mode because some controllers output many repeated commands in rapid succession without sufficiently delaying for a response to be sent between commands. D-Protocol does not adequately specify bus timing in general, so various controllers have implemented different behaviors with respect to command and response timing. Suppressing responses to Standard Commands in half-duplex mode is VIS's attempt to achieve the broadest compatibility with existing controllers.

General Response

This is the dominant response type in D-protocol and contains a single byte payload, which in D-protocol is used to return the state of a device's alarms. Each bit position represents a different alarm and a '1' in a bit position signifies that alarm has been tripped, while a '0' signifies that alarm has been cleared. Each bit can be independently set or cleared, as each bit represents a different alarm number. In VIS, there are no alarms as such, however this alarm byte is used to represent the state of various hardware fault conditions. Similar to D-protocol alarms, each bit position can be independently set or cleared to represent a specific fault condition that is present or absent, and more than one fault condition can be active at any time. Table 4 below lists the fault condition associated with each bit position of the alarm byte.

Table 4 Hardware Fault Condition Bit Definitions

Error Bit	Error Condition
0x01	Lens motion error
0x02	LED Overvoltage
0x04	Input Power Undervoltage
0x08	Reserved
0x10	Reserved
0x20	Reserved
0x40	Reserved
0x80	Reserved

The Checksum byte is the 8-bit sum of the Checksum from the command plus the Fault byte. There are a couple exceptions in which the Fault byte does not signify hardware fault conditions – these exceptions are outlined in the Predefined Presets section. Table 5 below shows the General Response message format.

Table 5 General Response Message Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	--	--	--

Extended Response

This response message is used to return 8-bit or 16-bit data from the device to the controller. The payload consists of 4 bytes and resembles a command message. Resp1 (Byte 3) is always 0x00, Resp2 (Byte 4) is a unique response code, and Data1 and Data 2 are used as 1 or 2 8-bit parameters or as a single 16-bit parameter (with Data1 as the MSB and Data2 as the LSB). The Checksum byte is the 8-bit sum bytes 2 through 6. Table 5 below shows the Extended Response message format.

Table 6 Extended Response Message Format

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	--	0x00	--	--	--	--

Query Response

This response message is used to return a number of bytes of data from the device to the controller. The payload consists of 15 bytes and the Checksum byte is the 8-bit sum the Checksum from the command plus the sum of all the Data bytes (bytes 3 through 17). Table 6 below shows the Query Response message format.

Table 7 Query Response Message Format

	Byte Number	1	2	3	4	5	6
	Meaning	Sync	Addr	Data1	Data2	Data3	Data4
Query Response		0xFF	--	--	--	--	--
		7	8	9	10	11	12
		Data5	Data6	Data7	Data8	Data9	Data10
		--	--	--	--	--	--
		13	14	15	16	17	18
		Data11	Data12	Data13	Data14	Data15	ChkSum
		--	--	--	--	--	--

Standard Commands

All devices that support D-Protocol must support Standard Commands. The Cmd bytes are composed of a number of independent bit-fields that can be set or cleared in order to control some action in the device. Table 7 below shows each bit-field's bit position, its numeric value (always 0, always 1, either 0 or 1 – shown as 1/0, and doesn't matter – shown as x), and the function it controls in VIS. It is useful to think of Cmd1 and Cmd2 as a single 16-bit virtual register within a device and that the Standard Commands sent to that device are meant to set or clear individual bits of this virtual register. Another way to say this is that a device will store and act on a received Standard Command until a subsequent one is received, and that newly received one will replace the former one.

Table 8 Standard Command Bit Definitions

Bit	15	14	13	12	11	10	9	8
Value	x	0	0	0	0	1/0	1/0	1/0
Cmd1 Byte	Standard Command	Reserved	Reserved	N/A	N/A	**Brightness Decrease**	**Brightness Increase**	**Ambient Thresh Increase**

Bit	7	6	5	4	3	2	1	0
Value	1/0	1/0	1/0	x	x	x	x	0
Cmd2 Byte	**Ambient Thresh Decrease**	**Zoom Wide (Decrease)**	**Zoom Narrow (Increase)**	Tilt Down	Tilt Up	Pan Left	Pan Right	Must Be Set To 0

From this table, it can be seen that there are three 2-bit bit-fields (in bold) that control VIS's major adjustments, namely output brightness level, ambient threshold level, and field of illumination or zoom. Within these 2-bit bit-fields, one of the bits will increase a control level and the other one will decrease it. Setting one of these bits to 1 will cause that action to happen; setting it to 0 will stop the action (or do nothing). Setting both bits to 1 within a command is illegal and VIS will ignore that control. These three bit-fields are independent of one another, meaning that one, two, or all three adjustments can be controlled within a single command.

The Brightness and Ambient Threshold level bit-fields operate identically, in that each Standard Command that causes a transition from 0 to 1 in the Increase bit (with respect to the last received Standard Command) will increase the control level by 10%. For example, if a command is sent with both brightness bits set to 0, and then a command is sent with the Brightness Increase bit set (position 9), VIS's brightness will increase by 10%. An intervening command setting this bit back to 0 must be sent before another increase command is sent, as this will enable another 0 → 1 transition to be detected by VIS. If an Increase command is received when VIS's control level is greater than 90%, that control level will limit at 100%; any subsequent Increase commands will have no effect once the control level is at 100%. The Decrease bit operates identically, except that the control level is reduced by 10% for each 0 → 1 transition. Also, if a Decrease command is receive when VIS's control level is less than 10%, that control level will limit at 0% and any subsequent Decrease commands will have no effect.

The Zoom level bit-field operates in a slightly different manner than the Brightness and Ambient Threshold bit-fields do. In this case, the 0 → 1 bit transition does not simply increase or decrease the zoom level by some fixed amount, but rather it starts the zoom movement and then a subsequent 1 → 0 bit transition stops the movement. The Zoom control operates this way to allow a more servo-like interface to this electro-mechanical system. Typically, a controlling keyboard or PC app will have Zoom Wide and Zoom Narrow buttons. When either of these buttons is depressed, a Standard Command with

the appropriate Zoom bit set to 1 is sent, and when the button is released another Standard Command with that Zoom bit set to 0 is sent. This provided a convenient method for interactively controlling VIS's zoom functionality.

The bit values for bit-fields in positions 15 thru 11 and 0 should be set as shown in Table 7. Bit-fields in positions 4 through 1 normally control pan and tilt, however since VIS supports neither of these motions, these 4 bits can be set to 0 or 1. Table 8 below shows the Standard Command message format. Normally, Data1 would contain the pan speed and Data2 would contain the tilt speed. VIS ignores the values in these two bytes.

Table 9 Standard Command Message Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Standard Command	0xFF	--	--	--	0x00	0x00	--

Extended Commands

These commands provide functionality above and beyond that available by Standard Commands. Table 9 below is a summary of the Extended Commands supported by VIS.

Table 10 Supported Extended Commands

Command Name	Cmd2 Value	Data2 Value	Response	Notes
Set Preset	0x03	Preset ID (1-64)	General	
Clear Preset	0x05	Preset ID	General	
GoTo Preset	0x07	Preset ID	General	
Remote Reset	0x0F	0x00	General	
Set Zoom Speed	0x27	Speed	General	
Reset System Defaults	0x29	0x00	General	
Query Command	0x45	0x00	Query	Uses non-zero Cmd1 codes
Set Zoom Position	0x4F	Zoom %	General	Data1 & Data2 form 16-bit scaled value
Get Zoom Position	0x55	Varies	Extended	Data1 & Data2 form 16-bit scaled value
Set Baud Rate	0x67	Baud Rate Code	General	
Query Device Type	0x6B	0x00	Extended	
Query Diagnostic Information	0x6F	Varies	Extended	Uses non-zero Cmd1 code; response uses all 4 payload bytes to return model number
Query Version Info	0x73	Varies	Extended	Uses non-zero Cmd1 codes
Macro Command	0x75	Varies	Extended	Uses non-zero Cmd1 codes
Set Brightness Level	0x7D	Brightness %	General	
Set Ambient Threshold	0x7F	Threshold %	General	
Get Brightness Level	0x81	Brightness %	Extended	
Get Ambient Threshold	0x83	Threshold %	Extended	

Note that commands and responses shown below arbitrarily contain VIS address of 34 (0x22). The actual address of the VIS being controlled must be used. Also, checksum bytes shown as numbers below have been computed using 34 (0x22) as the address.

Any Extended Commands issued to VIS that are not listed above in Table 9 will generate the NACK Extended Response in the following format:

Response Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
NACK Extended Response	0xFF	0x22	0x00	0x01	0x00	0x00	0x23

Set Preset (0x03)

This command will cause VIS to save the current zoom, brightness and ambient threshold percentages into a persistent memory location identified by a numeric ID in the range of 1 – 64. The preset IDs in this numeric range are *storable presets*, meaning they can be set and cleared in VIS's internal, persistent memory. There are other presets with IDs in the range of 70 – 108 that are *predefined presets*, meaning they are not storable and they cannot be cleared. These presets provide a means for accessing other functionality. See the **Predefined Presets** section below for more details.

Byte 6 should contain the desired preset number to set and should be in the range of 1 – 108. If the supplied ID is a *storable preset*, then the current zoom, brightness, ambient, and LED color quad will be stored at that ID, overwriting any previously stored quad. If the ID is an existing *predefined preset*, then the feature associated with that ID will be executed. A General Response will be returned with the checksum that was received in the command, plus the Errors byte. The General Response does not contain any success/fail feedback for this command.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Set Preset	0xFF	0x22	0x00	0x03	0x00	Preset ID	--

Response Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	0x22	--	--

Clear Preset (0x05)

This command will clear a previously set *storable preset* identified by the supplied preset ID. Byte 6 should contain the desired preset number to clear and should be in the range of 1 – 64. It is not necessary to clear a preset before setting it. *Predefined presets* cannot be cleared. A General Response will be returned with the checksum that was received in the command, plus the Errors byte. The General Response does not contain any success/fail feedback for this command.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Clear Preset	0xFF	0x22	0x00	0x05	0x00	Preset ID	--

Response Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	0x22	--	--

GoTo Preset (0x07)

If the supplied preset ID is in the range of 1 – 64, this command will cause VIS to change its zoom, brightness and ambient threshold percentages to the values that were saved in the specified ID. If no values were saved in that ID, no changes will occur to VIS's state. If the ID is one of the *predefined presets*, then the specified functionality is executed. See the **Predefined Presets** section below for more details.

A General Response will be returned with the checksum that was received in the command, plus the Errors byte. Some *predefined presets* will return a specific value in the Errors field.The General Response does not contain any success/fail feedback for this command.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Go To Preset	0xFF	0x22	0x00	0x07	0x00	Preset ID	--

Response Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	0x22	--	--

Remote Reset (0x0F)

This command causes VIS to perform a soft reset. A General Response will be returned with the checksum that was received in the command, plus the Errors byte. The response will be completely transmitted before the soft reset actually occurs.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Remote Reset	0xFF	0x22	0x00	0x0F	0x00	0x00	0x31

Response Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	0x22	--	--

Set Zoom Speed (0x25)

This command causes VIS to change its zoom speed for all subsequent zoom motions. The list of possible zoom speeds is shown below in Table 10. The desired Speed Value should be sent in Data2. VIS's default speed is Highest, or 400 steps per second. A General Response will be returned with the checksum that was

received in the command, plus the Errors byte. The General Response does not contain any success/fail feedback for this command.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Set Zoom Speed	0xFF	0x22	0x00	0x25	0x00	Speed	--

Table 11 Zoom Speed Definitions

Name	Speed Value	Steps Per Second
Slowest	0x00	125
Low Medium	0x01	250
High Medium	0x02	325
Highest	0x03	400

Response Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	0x22	--	--

Reset System Defaults (0x29)

This command will return all settings to their factory defaults. A General Response will be returned with the checksum that was received in the command, plus the Errors byte. The General Response does not contain any success/fail feedback for this command.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Reset System Defaults	0xFF	0x22	0x00	0x29	0x00	0x00	0x4B

Response Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	0x22	--	--

Query Command (0x45)

This command is not yet implemented in revision 2.x firmware.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Query	0xFF	0x22	--	0x45	0x00	0x00	--

Response Format

Byte Number	1	2	3	4	5	6
Meaning	Sync	Addr	Data1	Data2	Data3	Data4
Query Response	0xFF	0x22	0x00	0x00	0x00	0x00
	7	8	9	10	11	12
	Data5	Data6	Data7	Data8	Data9	Data10
	0x00	0x00	0x00	0x00	0x00	0x00
	13	14	15	16	17	18
	Data11	Data12	Data13	Data14	Data15	ChkSum
	0x00	0x00	0x00	0X00	0x00	--

Set Zoom Position (0x4F)

This command sets VIS's zoom position to an absolute value from 0 – 100%. The position is sent as a 16-bit value in Data1 and Data2, scaled by 65,535 (0xFFFF). So the valued encoded in Data1 and Data2 should be the desired zoom percentage time 65,535. A General Response will be returned with the checksum that was received in the command, plus the Errors byte. The General Response does not contain any success/fail feedback for this command.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Set Zoom Position	0xFF	0x22	0x00	0x4F	Zoom % MSB	Zoom % LSB	--

Response Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	0x22	--	--

Get Zoom Position (0x55)

This command returns VIS's current zoom position. The position is returned in Data1 and Data2 as a 16-bit valued in the Extended Response. This 16-bit is scaled by 65,535 (0xFFFF), so in order to convert it back to a percentage, it should be divided by 65,535. The Extended Response will contain the Cmd2 code in Resp2 and the checksum will be the 8-bit sum of bytes 2 – 6.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Get Zoom Position	0xFF	0x22	0x00	0x55	0x00	0x00	0x77

Response Format

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	0x22	0x00	0x5D	Zoom % MSB	Zoom % LSB	--

Set Baud Rate (0x67)

This command is not yet implemented in revision 2.x firmware.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Set Baud Rate	0xFF	0x22	0x00	0x67	0x00	Baud Code	--

Table 12 Baud Code Definitions

Value	Baud Rate
0x00	2400
0x01	4800
0x02	9600
0x03	19200
0x04	38400
0x05	57600
0x06	115200

Response Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	0x22	--	--

Query Device Type (0x6B)

This command returns VIS's model number. This command utilizes a non-zero value in Cmd1 to differentiate it from the Pelco-defined Query Device Type command. This is done so that the entire VIS model number can

be returned in a single, non-standard Extended Response. The 4-byte model number is contained in Resp1, Resp2, Data1, and Data2, and the checksum will be the 8-bit sum of bytes 2 – 6.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Query Device Type	0xFF	0x22	0x02	0x6B	0x00	0x00	0x8F

Response Format

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	0x22	Model # MSB	Model #	Model #	Model # LSB	--

Query Diagnostic Information (0x6F)

This command is not yet implemented in revision 2.x firmware.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Query Diagnostic Info	0xFF	0x22	0x00	0x6F	0x00	0x00	0x91

Response Format

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	0x22	0x00	0x6F			--

Query Version Information (0x73)

This command returns VIS's firmware revision number, firmware datestamp, bootloader revision number, and hardware revision number. This command utilizes non-zero values in Cmd1 to select among the four possible return values. It does vary a bit from the Pelco-defined Query Version Info command, in that it utilizes all 4 payload bytes so that the entire revision numbers can be returned in a single, non-standard Extended Response. In all cases, the checksum will be the 8-bit sum of bytes 2 – 6.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Query Version Info	0xFF	0x22	0x02	0x73	0x00	0x00	--

Response Format

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	0x22	FW Major Number	FW Minor Number	FW Build MSB	FW Build LSB	--

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Query Version Info	0xFF	0x22	0x04	0x73	0x00	0x00	--

Response Format

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	0x22	BL Major Number	BL Minor Number	BL Build MSB	BL Build LSB	--

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Query Version Info	0xFF	0x22	0x06	0x73	0x00	0x00	--

Response Format

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	0x22	0x07	0x00	HW Rev Major	HW Rev Minor	--

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Query Version Info	0xFF	0x22	0x08	0x73	0x00	0x00	--

Response Format

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	0x22	Serial # MSB	Serial #	Serial #	Serial # LSB	--

Macro Command (0x75)

This command is not yet implemented in revision 2.x firmware.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Macro Command	0xFF	0x22	--	0x75	--	--	--

Response Format

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	0x22	0x00	0x73			--

Set Brightness Level (0x7D)

This command sets VIS's brightness level to the desired percentage. The percent value should be sent in Byte 6 (Data2) and should be between 0 and 100 (values above 100 will be limited to 100 internally by VIS). A General Response will be returned with the checksum that was received in the command, plus the Errors byte. The General Response does not contain any success/fail feedback for this command.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Set Brightness Level	0xFF	0x22	0x00	0x7D	0x00	Bright %	--

Response Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	0x22	--	--

Set Ambient Threshold Level (0x7F)

This command sets VIS's ambient threshold level to the desired percentage. The percent value should be sent in Byte 6 (Data2) and should be between 0 and 100 (values above 100 will be limited to 100 internally by VIS). A General Response will be returned with the checksum that was received in the command, plus the Errors byte. The General Response does not contain any success/fail feedback for this command.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Set Ambient Threshold	0xFF	0x22	0x00	0x7F	0x00	Thresh %	--

Response Format

Byte Number	1	2	3	4
Byte Definition	Sync	Addr	Faults	ChkSum
General Response	0xFF	0x22	--	--

Get Brightness Level (0x81)

This command will return the current brightness level percentage in Byte 6 (Data2) of the returned Extended Response. This command will always succeed.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Get Brightness Level	0xFF	0x22	0x00	0x81	0x00	0x00	0xA3

Response Format

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	0x22	0x00	0x85	0x00	Bright %	--

Get Ambient Threshold Level (0x83)

This command will return the current ambient threshold level percentage in Byte 6 (Data2) of the returned Extended Response. This command will always succeed.

Command Format

Byte Number	1	2	3	4	5	6	7
Byte Definition	Sync	Addr	Cmd1	Cmd2	Data1	Data2	ChkSum
Get Ambient Threshold	0xFF	0x22	0x00	0x83	0x00	0x00	0xA5

Command Response

Byte Number	1	2	3	4	5	6	7
Meaning	Sync	Addr	Resp1	Resp2	Data1	Data2	ChkSum
Extended Response	0xFF	0x22	0x00	0x87	0x00	Thresh %	–

Predefined Presets

In D-protocol, *predefined presets* were added as a means for accessing addition device functionality. This functionality is accessed by "Setting" or "Going To" the preset ID associated with the desired functionality. It is not possible to "Clear" a *predefined preset*. VIS's predefined presets lie in the ID range of 84 – 100. Table 12 below lists the functionality associated with each preset.

Table 13 Supported Predefined Presets

Preset Name	Preset #	Set/Go Preset	Notes
Ambient Thresh 0%	0x46 (70)	Set	
Ambient Thresh 25%	0x47 (71)	Set	
Ambient Thresh 50%	0x48 (72)	Set	
Ambient Thresh 75%	0x49 (73)	Set	
Ambient Thresh 100%	0x4A (74)	Set	
Brightness Level 0%	0x4B (75)	Set	
Brightness Level 50%	0x4C (76)	Set	
Brightness Level 75%	0x4D (77)	Set	
Brightness Level 100%	0x4E (78)	Set	
Zoom Position 0%	0x4F (79)	Set	
Zoom Position 50%	0x50 (80)	Set	
Zoom Position 75%	0x51 (81)	Set	
Zoom Position 100%	0x52 (82)	Set	
Reserved	0x53 (83)	Set/Go	
Capture PTZ Address	0x54 (84)	Set	Command immediately following sets shadow address. In this shadowing mode, only non-predefined presets are executed.
Return PTZ Address	0x54 (84)	Go	Shadowed address is in Faults byte of General Response.
Capture Master Address	0x55 (85)	Set	Command immediately following sets shadow address. In this shadowing mode, all supported commands are executed (except predefined presets).
Return Master Address	0x55 (85)	Go	Shadowed address is in Faults byte of General Response.
Disable Responses	0x56 (86)	Set	Disables command responses.
Enable Responses	0x56 (86)	Go	Enables command responses.
Lock Digital Input	0x57 (87)	Set	Forces digital I/O to be in input mode.
Release Digital Input	0x57 (87)	Go	Digital I/O can be either input or output.
White reserved	0x58 (88)	Set	
White (color)	0x58 (88)	Go	
IR reserved	0x59 (89)	Set	
IR (black & white)	0x59 (89)	Go	
Initiate Autobaud	0x5A (90)	Set	Send twice; 2nd command used to calibrate baud rate.
Autobaud reserved	0x5A (90)	Go	
Use Physical Controls	0x5B (91)	Set	Causes all physical control settings to take effect.
Use Physical Reserved	0x5B (91)	Go	
Reserved	0x5C (92)	Set/Go	
Reserved	0x5D (93)	Set/Go	
Reserved	0x5E (94)	Set/Go	
Reserved	0x5F (95)	Set	Will not be used – typically brings up camera's menu.
Ambient Thresh 0%	0x60 (96)	Set	
Ambient Thresh 25%	0x61 (97)	Set	
Ambient Thresh 50%	0x62 (98)	Set	
Ambient Thresh 75%	0x63 (99)	Set	

Ambient Thresh 100%	0x64 (100)	Set
Brightness Level 0%	0x65 (101)	Set
Brightness Level 50%	0x66 (102)	Set
Brightness Level 75%	0x67 (103)	Set
Brightness Level 100%	0x68 (104)	Set
Zoom Position 0%	0x69 (105)	Set
Zoom Position 50%	0x6A (106)	Set
Zoom Position 75%	0x6B (107)	Set
Zoom Position 100%	0x6C (108)	Set

Response Suppression

In certain configurations (most notably when connecting VIS's half-duplexed RS-485 interface to a full-duplexed system bus), it may be required to suppress VIS's responses. Sending a Set Preset 86 command will cause VIS to stop sending responses to commands sent to it, starting with said Set Preset command. Sending the GoTo Preset 86 will cause VIS to send responses to all commands, begin with said GoTo Preset. The state of VIS's response generation (on or off) is stored in persistent memory, so once it is set it will remain in that state until it is specifically changed with a Set or GoTo Preset 86 command.

Digital Input Locking

Since VIS's Ambient Threshold setting also controls the direction of the digital I/O (DI/O) pin, it may be desire to force this pin to always be an input. One typical case is when multiple VIS illuminators are ganged together and it is desired to have all units turn ON and OFF at the same ambient light level. This can be easily accomplished by designating one unit as the "master" and the remaining units in the gang as "slaves." The master's Ambient Threshold should be adjusted to the desired ON/OFF light level, and the slaves should have their Ambient Threshold set to 0%, and the DI/O signals should be tied together (and tying the Commons together as well). This hardware and settings configuration will cause the master to assert its DO line low whenever its illumination is ON, and consequently the slave units will turn ON their illumination in response to DI input being driven low.

In the case outlined above, it is useful to ensure that a slave unit maintains its DI/O line as an input, so it can respond to the master's changing DO line. The Digital Input Locking preset provides a means for ensuring this. Sending a Set Preset 87 to a slave unit will force its DI/O to be a DI, regardless of the current or future Ambient Threshold level. Likewise, sending a GoTo Preset 87 will "release" the DI/O line and it will become a DI or DO based solely on the current Ambient Threshold level. VIS's Digital Input Locking state (locked or released) is stored in persistent memory, so once it is set it will remain in that state across power cycles until it is specifically changed with a Set or GoTo Preset 87 command.

Command Shadowing

Command Shadowing is a unique feature of VIS wherein it can be configured to execute all commands sent to a specific device (other than itself) on the RS-485 bus. In this way, the VIS "shadows" this other device. One key use for this feature is when controlling ganged VISs such that they appear from a controller perspective as one illuminator. In this situation, the slaves VISs are configured to shadow the master VIS and all control commands are sent to the master's device address. The gang of VISs all respond to each single command sent to the master's device address.

To enable Command Shadowing, VIS must be programmed with the desired device address to shadow. This is done by issuing a Set Preset 85 to VIS and then issuing any command to the device that VIS

should shadow. VIS will memorize the device address sent in the command issued immediately following a Set Preset 85 command. From that point forward, Command Shadowing will be enabled and VIS will execute all commands sent to the device being shadowed, as well as any commands sent to VIS's device address. The only commands that VIS will not shadow are *predefined presets*, which are typically meant for configuring some aspect of VIS and shadowing these would be confusing. To disable Command Shadowing, simply send VIS a Set Preset 85 then issue any other command to VIS, effectively telling VIS to shadow itself. VIS's Command Shadowing state (shadow or normal) is stored in persistent memory, so once set it will remain in that state across power cycles until it is specifically changed with a Set Preset 85 command.

To provide some diagnostic information on Command Shadowing, GoTo Preset 85 will return the device address being shadowed in the Alarms byte of the returned General Response. This provides a quick way to determine if Command Shadowing is turned on and which device is being shadowed. If the Alarms byte is 0x00, then Command Shadowing is turned off; if it is not 0x00, then it is turned on and VIS is shadowing the device addressed in the Alarms byte.

Preset Shadowing

Preset Shadowing operates almost identical to Command Shadowing except that instead causing all commands to be shadowed, only *storable preset* commands are. It is basically a subset of Command Shadowing and is intended for use in conjunction with a PTZ where it would be difficult to match the zooming of VIS and that of the PTZ's camera. In this configuration, it is possible to manually set a number of VIS presets, each of which provides a field of illumination matching the field of view of the PTZ camera at that preset. Once a manual "pairing" is done between a PTZ and the VIS associated with it id performed, Preset Shadowing provides a means for automatically controlling VIS such that the optimum illumination is provided to the PTZ camera at each preset location.

Enabling Preset Shadowing is done in the same way that Command Shadowing is, except that a different preset ID is used. Issuing a Set Preset 84 to VIS followed by a command to the device to be Preset Shadowed will enable this feature. Once in this mode, VIS will respond to any *storable preset* commands sent to the device being shadowed, as well as any command sent to VIS's device address. To disable Preset Shadowing, simply send VIS a Set Preset 84 then issue any other command to VIS, effectively telling VIS to shadow itself. VIS's Preset Shadowing state (shadowing or normal operation) is stored in persistent memory, so once set it will remain in that state across power cycles until it is specifically changed with a Set Preset 84 command.

To provide some diagnostic information on Preset Shadowing, GoTo Preset 84 will return the device address being shadowed in the Alarms byte of the returned General Response. This provides a quick way to determine if Preset Shadowing is turned on and which device is being shadowed. If the Alarms byte is 0x00, then Preset Shadowing is turned off; if it is not 0x00, then it is turned on and VIS is shadowing the device addressed in the Alarms byte.

Revision History

Revision 0.1 March 5, 2012
All commands currently supported have been defined. Additional descriptions and explanations required in some areas.

Revision 0.2 March 16, 2012
Most sections completed. Additional descriptions and explanations required in VIS features and Pre-defined presets areas.

Revision 0.3 March 20, 2012
Just needs additional work in Pre-defined presets areas.

Revision 0.4 March 21, 2012
Review before 1.0 release.

Revision 0.5 June 13, 2012
Standard Command bit 7 is “don't care.” Added 5 Pre-defined presets for setting ambient threshold level. Changed default bus address to 32.

Revision 1.0 October 22, 2012
Added 5 Pre-defined presets for setting brightness level and 5 Pre-defined presets for setting zoom position. General release, for firmware revisions 1.1.1138 or 2.0.1318.

Revision 1.1 January 16, 2013
Added Pre-defined preset to use physical controls to set illuminator state. General release, for firmware revision 2.1.xxxx.

Revision 1.2 April 22, 2013
Added Query Device Info and Query Version Info commands. General release, for firmware revision 2.1.1447 or greater.

Revision 1.3 June 25, 2013
Added Reset System Defaults commands. General release, for firmware revision 2.1.1452 or greater.

Revision 1.4 November 5, 2013
Fixed 2 checksum errors. Duplicated Pre-defined presets numbered 96 – 108 at 70 – 83 so that keyboards that only have 2 digits of presets can access these useful presets. General release, for firmware revision 2.1.1513 or greater.

Revision 1.5 January 28, 2014
Change to GetVersionInfo. General release, for firmware revision 2.1.1549 or greater

Revision 1.6 February 25, 2014
Fault codes are passed back in General Responses. General release, for firmware revision 2.2.1590 or greater.