RS-422/RS-485 Communications Protocol

User's Guide

For SpeedDome® Ultra VII, SpeedDome Optima®, and later versions

Contents

If you need assistance...

Call Customer Support at:

800-507-6268, Option 2

561-912-6259, Option 2

e-mail: adtechservices@tycoint.com.

About this Guide

This guide explains the RS-422/RS-485 asynchronous communications protocols and how to develop a controlling protocol interface for SpeedDome Ultra VII, SpeedDome Optima, and later versions.

This guide will help you understand and use the RS-422/RS-485 communication protocols. There is no assurance of accuracy or correctness of the document or verification of compliance by all versions of products. Only currently required commands are presented; legacy implementations are not included. The protocols are subject to and are expected to change and be revised due to continuing product improvements.

Protocol Characteristics

Table 1. Protocol characteristics

Data rate	4.8 kbits/sec.
Data format	Asynchronous Start bits: 1 Data bits: 8 Parity bits: 0 Stop bits: 1
Format	3 bytes: Address Command Checksum
Topologies	Daisy Chain or Star
Physical Layer	RS-485, 4-Wire, Full duplex
Max. Devices per line	10 (Depends on device loading.)
Cable type	2 shielded, twisted pair*
Wire gauge	22 AWG
Max. Length	1km (3,000 ft.)
Connection	Polarized Euro-style plug
Data and Power Connections Color-Code Conventions	Color — Designation Black — 24Vac Red — Ground White — 24Vac Orange — RS-422 Data In High (+) Green — RS-422 Data In Low (–) Yellow — RS-422 Data Out High (+) Brown — RS-422 Data Out Low (–)

* American Dynamics composite cable is recommended. This cable also contains wires for power and video. If another cable is substituted, cable wire colors may be different.

RS-422/RS-485 Commands

The majority of dome control communications is by 3-byte data packets consisting of Dome Address, Command, and Checksum. The Dome Address range is from hex 1 to 99 (1h to 63h), depending on the type of control system used. To Calculate the Checksum, subtract the sum of the bytes from zero and use the least significant byte of the results. The dome acknowledges a command by sending its 1-byte address within 25 milliseconds.

The dome also recognizes multiple-byte data commands. These commands consist of Dome Address, Command, 1-N Data, and Checksum bytes.

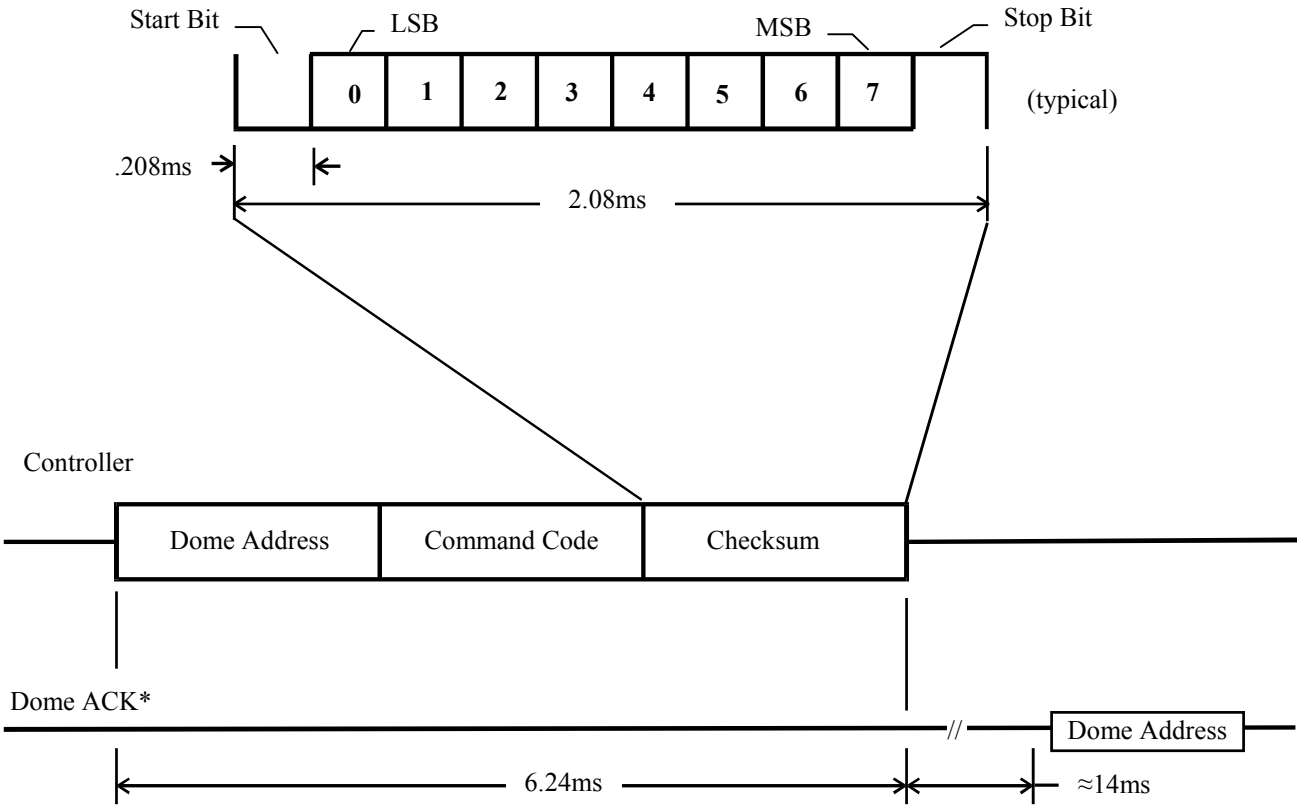
The proportional speed pan and tilt commands that are specified in the multi-byte format table are recommended for control except for recording of patterns.

When changing direction of movement, always send a STOP command before you send the new direction change.

Pan and Tilt speeds, shown in °/sec in the tables, are the nominal speeds with a wide-angle zoom setting. The Zoom Adjusted Program™ (ZAP) feature automatically adjusts pan and tilt speeds scaled in proportion to zoom positions.

The dome will timeout in 30 seconds and stop panning if all communications is lost.

Figure 1. 3-Byte Format



* The dome echoes its address to acknowledge the controller command.

Controller to Dome Commands

Standard 3-Byte Format

For standard 3-Byte Format see (Figure 1)

Table 2. Standard 3-byte Commands

Command Name	Description	Command Code (Hex)	Dome Response
Pan Left	Pan left (24°/sec) until Pan Stop	81	ACK
Pan Right	Pan right (24°/sec) until Pan Stop	82	ACK
Pan Stop	Stop panning	83	ACK
Tilt Up	Tilt up until Tilt Stop	84	ACK
Tilt Down	Tilt down until Tilt Stop	85	ACK
Tilt Stop	Stop tilting	86	ACK
Focus Near	Focus Near until Focus Far or Focus Stop	87	ACK
Focus Far	Focus Far until Focus Near or Focus Stop	88	ACK
Focus Stop	Stop focus	89	ACK
Zoom In	Zoom in (telephoto) until Zoom Out or Zoom Stop	8A	ACK
Zoom Out	Zoom out (wide angle) until Zoom In or Zoom Stop	8B	ACK
Zoom Stop	Stop zoom	8C	ACK
Fast	Increase pan and tilt speeds (48°/sec) until Fast Stop	8D	ACK
Fastest	Increase pan and tilt speeds (96°/sec) until Fast Stop	8E	ACK
Fast Stop	Stop fast/fastest speeds (back to normal 24°/sec)	8F	ACK
Iris Open	Opens iris (manual iris mode)/lightens Iris Preference™ offset (auto iris mode) until Iris Close or Iris Stop	90	ACK
Iris Close	Closes iris (manual mode)/darkens Iris Preference™ offset (auto iris mode) until Iris Open or Iris Stop	91	ACK
Iris Stop	Stop iris offset adjustment (also stops V-Phase Adjust)	92	ACK
All Stop	Stop all movement	93	ACK
Dome Type	Request dome type	94	Note 1
Alarm Status	Request status of alarm inputs	95	Note 1
Send ACK	ACKnowledge response to dome asynchronous commands	97	ACK
Suspend all Transmis-sion	Disable transmission of asynchronous messages	98	Note 2
Normal transmis-sion	Enable transmission of asynchronous messages	99	ACK Note 3
Faster	Increase pan and tilt speeds (72°/sec) until Faster Stop	9A	ACK
Faster Stop	Stop faster (back to normal 24°/sec speed)	9B	ACK
Define Boundary	Start boundary definition. This command is followed by dome movement commands and four Mark Boundary commands.	9C	ACK
Mark Boundary	Marks the current position as a boundary	9D	ACK
On Air	Set On Air status to tell the dome to send the boundary crossing command (see Table 5. Asynchronous Messages	9E	ACK
On Air Reset	Reset On Air status	9F	ACK
Define Pattern 1	Start defining Pattern 1	A0	ACK
Define Pattern 2	Start defining Pattern 2	A1	ACK
Define Pattern 3	Start defining Pattern 3	A2	ACK
Save New Pattern	Accept the new pattern as the current pattern and delete the old pattern	A3	ACK
Request Position	Request dome position coordinates. (Dome ACKs command followed by a momentary pause & data)	A5	ACK pause Data Note 1
Mark Target 1	Store the current position as Target 1	A8	ACK
Mark Target 2	Store the current position as Target 2	A9	ACK
Mark Target 3	Store the current position as Target 3	AA	ACK
Mark Target 4	Store the current position as Target 4	AB	ACK
Run Pattern 1	Run Pattern 1	B0	ACK
Run Pattern 2	Run Pattern 2	B1	ACK
Run Pattern 3	Run Pattern 3	B2	ACK
Run New Pattern	Run a newly defined pattern to review before accepting it to replace previous pattern	B3	ACK
Go to Target 1	Go to preset position called Target 1	B4	ACK

Command Name	Description	Command Code (Hex)	Dome Response
Go to Target 2	Go to preset position called Target 2	B5	ACK
Go to Target 3	Go to preset position called Target 3	B6	ACK
Go to Target 4	Go to preset position called Target 4	B7	ACK
Pattern End	Tells the dome to stop recording (defining) a pattern	B8	ACK
Mark Target 5	Store the current position as Target 5	B9	ACK
Mark Target 6	Store the current position as Target 6	BA	ACK
Mark Target 7	Store the current position as Target 7	BB	ACK
Go to Target 5	Go to preset position called Target 5	BC	ACK
Go to Target 6	Go to preset position called Target 6	BD	ACK
Go to Target 7	Go to preset position called Target 7	BE	ACK
Peel	Run default "Apple Peel" pattern for a spiral view of everything (only supported in SpeedDome Ultra V and DeltaDome II or late)	C6	ACK
Software Version	Get software version number from dome	C9	Note 1
Output	Set output drivers x = low nibble bit 0 = output 1 bit 1 = output 2 bit 2 = output 3 bit 3 = output 4 0 = Off/Open 1 = On/Closed	Ex	ACK

Notes:

1. See Table 6 for response message definitions.
2. This command is used to stop any asynchronous messages from corrupting data being sent to the controller because of a data request. This message is usually sent to all domes using the Broadcast address of 40(Hex). Since the domes have been commanded to suspend messages, no ACK will be generated.
3. When this command is issued, any pending asynchronous messages will be sent.

Multiple-Byte Format

Dome Address	Command Code	Data	Checksum

Table 3. Multiple-Byte Commands

Command Name	Description	Command Code (Hex)	Dome Response
Goto Position	Go to absolute position Byte 1 = dome address Byte 2 = command A6 Byte 3 & 4 = pan position Byte 5 & 6 = tilt position Byte 7 & 8 = zoom position Byte 9 & 10 = digital zoom Byte 11 = iris offset Byte 12 = digital zoom limit Byte 13 = checksum Note: The fields are in different positions in the Request Dome Position command.	A6	ACK
Proportional speed	Proportional speed pan or tilt movement commands Byte 1 = dome address Byte 2 = command C0 Byte 3 = 81 Pan Left Byte 3 = 82 Pan Right Byte 3 = 84 Tilt Up Byte 3 = 85 Tilt Down Byte 4 = Speed 1 - 64 Hex = 1 - 100°/sec Byte 5 = checksum	C0	ACK
Get Configura-tion Buffer	Allows access to the data stored in the dome configuration buffer Byte 1 = dome address Byte 2 = command C4 Byte 3 = 02 Byte 4 = offset Byte 5 = byte count Byte 6 = checksum	C4	Note 1
Set Preset	Store the current position as the specified preset. Byte 1 = dome address Byte 2 = command C7 Byte 3 = 01 Byte 4 = preset number (0 – 95 (decimal)) Byte 5 = checksum	C7 01	ACK
Go To Preset	Positions to preset specified by preset number. Byte 1 = dome address Byte 2 = C7 Byte 3 = 02 Byte 4 = preset number (0 – 95 (decimal)) Byte 5 = checksum	C7 02	ACK
Flip	Pan 180° from the current position.	CC 00	ACK

Command Name	Description	Command Code (Hex)	Dome Response
Enter Dome Menu	Display dome menu and enters menu mode	CC 01	ACK
Exit Dome Menu	Exits dome menu and returns to normal dome operation	CC 02	ACK
Repeat Pattern 1	Run pattern 1 continuously	CC 03	ACK
Repeat Pattern 2	Run pattern 2 continuously	CC 04	ACK
Repeat Pattern 3	Run pattern 3 continuously	CC 05	ACK
Get Pattern Size	Get total number of pattern steps used in each of the 3 patterns	CC 06	Note 1
Clear Pattern	Resets pattern to apple peel (default spiral). Only send this command if “Define Pattern X” command sent before it.	CC 07	ACK
Reset Auto Focus & Iris	Put focus in auto focus mode and restores the iris set-point to the factory setting	CC 08	ACK
Reset Dome	Dome Soft Reset	CC 09	ACK
Increase V-Phase Delay	Increase the vertical phase delay	CC 0A	ACK
Decrease V-Phase Delay	Decrease the vertical phase delay	CC 0B	ACK
Stop Adjusting V-Phase	Stop the V-Phase adjustment	CC 0C	ACK
QuickSet®	If byte 4 is zero the dome will display or clear (if already displayed) the QuickSet function menu. If byte 4 is not zero the dome will perform the QuickSet command of such number. Byte 1 = dome address Byte 2 = command CD Byte 3 = Access Level 0 = Admin 1 = Operator Byte 4 = entered number Byte 5 = checksum	CD	ACK
Display Text	Display text on dome video Byte 1 = dome address Byte 2 = command DE Byte 3 = row (4,5, or 10) Byte 4 = Column (0-27) Byte 5 = length Byte 6…= ASCII text to display Last Byte = checksum	DE	ACK

Command Name	Description	Command Code (Hex)	Dome Response
Network Position Command (NP)	Allows the control system to get position information in degrees or motor counts. Byte 1 = dome address Byte 2 = command FA Byte 3 = length & control bit 0 - 4 = length of command bit 5 = absolute / relative 0 = Absolution Position Move 1 = Relative Position Move bit 6 = 0 (reserved) bit 7= get/set position 0 = Get position 1 = Set position Byte 4 = data unit flags bit 0 - 1 = length 00 = pan & tilt in motor counts 01 = pan & tilt in degrees 10 = pan & tilt in frames bit 2 = digital & optical zoom 1 = separate 0 = combine bit 3 = Optical Units 0 = Optical Zoom in magnification factor. 1 = Optical Zoom in counts bit 4 = (reserved) bit 5 = (reserved) bit 6 = auto focus 0 = off 1 = on bit 7 = auto iris 0 = off 1 = on Bytes 5 through the next to last Byte = Data Bytes (based on Bytes 3 & 4) Last Byte = checksum (See Network Position Command Section)	FA	Note 1

Views, Presets, Targets

View coordinates can be stored inside the dome by using the Mark Target commands. This action allows seven views to be saved and recalled with the Go To Target commands. This number is increased to 96 views on SpeedDome Ultra V version 3.06 and subsequent products with the preset command (C7h).

An unlimited number of views can be achieved by using the Request Dome Position commands to get the position coordinates, and using the Goto Position commands to cause the dome to return to the view (position).

Network Position Command

In the SpeedDome Ultra VII version 1.07 and subsequent versions a new **NP** command provides improved control when using networks, which typically present relatively long latency and do not have deterministic delay times.

NP Command Standard Units

This command allows the control system to get and send the absolute position in normalized units such as degrees, frames, magnification factor, etc. It also allows movements relative to the current position normalized in degrees or frames. Positions specified in degrees allow mathematical calculation of positions. Relative movements in frames or fractions of frames allow pan and tilt movement to the adjacent or overlaying frame as referenced to the present field of view. In addition to the rest of this section see the Dome Control Examples.

Table 4. NP Command Standard Units

PAN			
Units	Max Value	Min Value	Notes
Motor Counts	07 FF FFh	00 00 00h	
Degrees	36 EE 80h 360.0000	C9 11 80h -360.0000	value X 10,000 = position in degrees
Frames	01 11 70h 700.00%	FE EE 90h -700.00%	value X 10,000 = # frames to move
TILT			
Units	Max Value	Min Value	Notes
Motor Counts	02 80 A0h ~ +21 deg	08 5B 20h ~ -90 deg	
Absolute Degrees	03 34 50h +21.000	F2 44 60h -90.000	value X 10,000 = position in degrees
Relative Degrees	10 EF F0h +111.000	EF 10 10h -111 .000	value X 10,000 = offset in degrees
Frames	01 11 70h 700.00%	FE EE 90h -700.00%	value X 10,000 = # frames to move
ZOOM			
Units	Max Value	Min Value	Notes
Combined Magnification	00 B7h +183	FF 49h - 183	relative
Combined Magnification	00 B8h 184	00 01h 1	absolute
Optical in counts (Separate)			
Optical Magnification (separate)	00 16h +23	FF EAh -22	relative
Optical Magnification (separate)	00 17h 23	00 01h 1	absolute
Digital in counts (separate)			
Digital Magnification (separate)	00 63h +9.9	FF 9Dh -9.9	Relative (value X 10)
Digital Magnification (separate)	00 64h 10.0	00 0Ah 1.0	Absolute (value X 10)

NP Command Format Outline:

- General Format:

Dome Address	NP Command = FAh	Command Type	Units	0 to 26 Data Bytes	Checksum

- All the Network Position Commands follow the same basic format. There are a variable number of bytes that are always in the same order.
    - First Byte: Dome Address
    - 2nd Byte: NP command Prefix, this lets the dome know that this will be an NP command
        - This value should always be FAh
    - 3rd Byte: Command type / length
        - Bits 0 through 4
            - 00000 (binary) = 0(decimal) = 00h
                - Request Minimum Values allowed
            - 00111 (binary) = 7(decimal) = 07h
                - Pan
            - 01010 (binary) = 10(decimal) = 0Ah
                - Pan / Tilt
            - 01100 (binary) = 12(decimal) = 0Ch
                - Pan / Tilt / Optical zoom (or Combined zoom)
            - 01101 (binary) = 13(decimal) = 0Dh
                - Pan / Tilt / Optical Zoom (or Combined zoom) / Digital Zoom (Digital portion is ignored for combined optical / digital zooms)
            - 01111 (binary) = 15(decimal) = 0Fh
                - Pan / Tilt / Optical Zoom (or Combined zoom) / Digital Zoom (Digital portion is ignored for combined optical / digital zooms) / Focus Position
            - 10000 (binary) = 16(decimal) = 10h
                - Pan / Tilt / Optical Zoom (or Combined zoom) / Digital Zoom (Digital portion is ignored for combined optical / digital zooms) / Iris Setting
            - 11110 (binary) = 30(decimal) = 1Eh
                - Pan / Tilt / Optical Zoom (or Combined zoom) / Digital Zoom (Digital portion is ignored for combined optical / digital zooms) / Iris Setting / Fine Tuning Values
            - 11111 (binary) = 31(decimal) = 1Fh
                - Max Values Display
        - Bit 5
            - 0 means this is an absolute position command
            - 1 means this is a relative position command
        - Bit 6 (not used yet)
        - Bit 7
            - 0 means get position information from the dome
            - 1 means set the positioning using the data that was sent

- 4th Byte: Unit Types
  - Bits 0 & 1 (pan/tilt units)
    - AND with 03h(hex) to get the value to look at
      - 00 : pan/tilt in motor counts (an arbitrary number)
      - 01 : pan/tilt in degrees
      - 10 : pan/tilt in displayed video frames (only used for relative movement)
  - Bit 2 Zoom Combined / Separate
    - tells weather the zoom values are separated into optical and digital or combined into one value.
    - AND with 04h(hex) to see this bit
      - 0 means that the digital and optical zoom values are combined. It also means that zoom data is in magnification factor (x2, x23,x240, etc.)
      - 1 means that the optical and digital zoom portions are separate. Zoom data may be in either counts or magnification factor
  - Bit 3 Optical Zoom Units
    - And with 08h(hex) to see the value
      - 0 mean that the optical zoom is in magnification factor
      - 1 means that the optical zoom is in counts
    - Note: The digital zoom portion is always given in magnification factor.
  - Bit 4 & 5: Not used
  - Bit 6 Auto Focus Setting:
    - AND with 40h(hex) to see value
      - 0 means that Auto Focus is turned OFF
      - 1 means that Auto Focus is turned ON
  - Bit 7 Auto Iris Setting:
    - AND with 80h(hex) to see value
      - 0 means that Auto Iris is turned OFF
      - 1 means that Auto Iris is turned ON
- 5th through the next-to-last Byte (Data Bytes): Data to send to the dome for setting the various values for the command used in Byte 3, in the format specified in Byte 4.
- Last byte: Checksum.

Patterns

You can define up to three patterns for each dome that can be stored into the dome's memory. Patterns are established by first sending the Define Pattern command (A0h, A1h, and A2h) to the dome. This puts the dome into a mode where it will record the movement commands.

Note: To maintain reproducible pattern accuracy, only the fixed speed (24°/sec) commands should be used. SpeedDome Ultra VII with flash version 1.05 and later will accept proportional speed command and convert them to fixed while programming pattern.

A dome can store up to a total of 99 movement commands in its memory for the three patterns. When defining a pattern, the on-screen display of the dome shows the remaining available memory.

Initially, all patterns default to the “Apple Peel” or spiral pattern. This pattern provides a view of the entire viewable area of the dome. This default pattern does not use dome memory space.

To indicate that pattern recording is finished, the Pattern End command (B8h) is sent to the dome. To review the new pattern, the Run New Pattern command (B3h) is sent to the dome. To replace the previous pattern with the new pattern, the New Pattern command (A3h) is sent to the dome.

To play patterns, the Run Pattern commands (B0h through B2h) are sent to the dome.

To clear a pattern and return to the default "Apple Peel" command, send the Clear Pattern command (CCh,07h) or the Clear Pattern combination command (A0h, A1h, or A2h) (8Eh) (B8h) (A3h) (8Fh).

QuickSet®

QuickSet provides a simple method to add control and online help for future camera functions without updating the system controllers. The video system controller interface needs a special QuickSet button and a numeric keypad. Selecting the QuickSet without a previous numeric entry will cause the QuickSet command to be sent to the camera, triggering the camera to display a numbered menu list of current available special camera control functions (such as flip, peel, select day/night/auto IR mode, reset auto focus/iris, enter camera set up mode, toggle wide dynamic range mode, and etc.). The numbers on the displayed list are the currently assigned special function numbers. Entering a numeric value (1-255), followed by the QuickSet button, triggers the controller to send the special function command and the entered number to the camera. When the camera receives the special QuickSet command with a valid number, it will clear the menu from the screen, if it is being displayed, and will perform the function, weather the menu was previously displayed or not. When the function is complete the camera will resume normal operation.

Pressing the QuickSet button while the menu is being displayed, without a numeric entry, will clear the menu from the screen and continue normal operation. When in this QuickSet menu display mode, multiple screens of the menu can be viewed with page next/previous by using the focus far/near commands. See the following table:

QuickSet Key Definitions

BUTTONS	ACTION
Quick Set (with #)	Execute command #
Quick Set (with no # or zero)	Toggle Menu between displayed and not displayed (no operation is performed)
Pan & Tilt	Moves Camera
Focus (Far/Near)	Pages next/previous
Iris (Open/Close)	Iris (Open/Close)
Zoom (Tele/Wide)	Zoom (Tele/Wide)

This allows new functions to be implemented without needing to use cryptic function keys or multiple key combinations to obtain new and needed control codes. Since functions can be selected without the menu of functions being displayed first it will allow users to more quickly

select functions once they know the appropriate number. When the QuickSet menu is displayed normal camera control operation is maintained so that the ability to view this menu does not interfere with normal operation such as tracking suspects.

The QuickSet button can be an onscreen button in a graphical user interface or a hard key on a conventional keyboard controller. This will allow operation with any type of user interface as long as it has this QuickSet button.

There are two QuickSet commands implemented. One allows camera configuration functions to be listed on the QuickSet menu and performed. Another command provides for cases where the operator is not intended to have administrative permission to configure the camera, and it does not list or allow camera configuration. Camera configuration is the setting and saving of any parameters that can be password protected in the camera menus.

This command is new and is only available in SpeedDome Ultra VII flash version 1.06 and later.

Dome Control Examples

In the following examples, all numerical values are in hexadecimal notation unless specified. To calculate the packet checksum, add together each packet byte and subtract the results it from 00.

- **Pan**

To make a dome at address 07 **PAN RIGHT** at 10°/sec(Dec), send the following packet:

07 C0 82 0A AD

To make a dome at address 07 **STOP**, send the following packet:

07 83 76

When changing direction of movement, always send a **STOP** packet before you send the new direction change.

To make a dome at address 04 **PAN LEFT** while in pattern programming mode, send the following packet:

04 81 7B

- **Tilt**

To make a dome at address 05 **TILT DOWN** at 30°/sec(Dec), send the following packet:

05 C0 85 1E 98

To make a dome at address 10(Dec) **STOP**, send the following packet:

0A 86 70

When changing direction of movement, always send a **STOP** packet before you send the new direction change.

To make a dome at address 01 **TILT UP** while in pattern programming mode, send the following packet:

01 84 7B

- **Set Outputs**

To set dome address 03 outputs 2 and 3 **ON** and outputs 1 and 4 **OFF**, send the following packet:

03 E6 17

- **Get Dome Position**

When requesting a dome's position data, you must first tell all domes to suspend transmission. This is accomplished by sending the **Suspend Transmission (98)** command to broadcast address 40(Hex).

40 98 28

To get the position data from dome address 08, send the following packet:

08 A5 53

The position data response follows the syntax described in Table 6. Response Messages.

Once the controller has received the requested data, the controller should send a **Normal Transmission (99)** command to the broadcast address.

40 99 27

- **Get Configuration Buffer**

When requesting data from the dome's configuration buffer, you must first tell all domes to suspend transmission. This is accomplished by sending the **Suspend Transmission (98)** command to broadcast address 40(Hex).

40 98 28

To get the flash version number and the Mnemonic data from the configuration buffer for dome address 03, send the following packet:

03 C4 02 06 0C 25

The data response follows the syntax described in Table 6. Response Messages.

Once the controller has received requested data, it should send a **Normal Transmission (99)** command to the broadcast address.

40 99 27

NP Relative Position Move in Degrees

To make the dome at address 01 **PAN RIGHT 90°, TILT DOWN 10°,** and **ZOOM IN 2X**. Send:

01 FA AC C1 0D BB A0 FE 79 60 00 02 57

Where:

01 = Address of dome

FA = NP Command

AC = Length, description, and control flags

Bits 0-4 = Number of bytes (12 = 01100 in binary), this means we are sending the pan/tilt/ and a combined zoom position move command.

Bits 5 = 1 for a relative command

Bit 6 = not used

Bit 7 = 1 for move to position

C1 = Data unit flags

Bits 0-1 = 01 pan/tilt in degrees

Bits 2 = 0 for combine zoom info

Bit 3-5 = not used for pan/tilt/zoom

Bit 6 = 1 Auto Focus Turned (left) ON

Bit 7 = 1 Auto Iris Turned (left) ON

0D BB A0 = Pan (+90°) * 10000 (900,000 decimal)

FE 79 60 = -10° Tilt (0 - (10 * 10000) = -100,000 decimal)

00 02 = 2x combined zoom increase

57 = checksum

The dome response will be the absolute position information in the same format to confirm the command has been accepted.

- **NP Relative Position Move in Frames**

To make the dome at address 01 **PAN LEFT ½ FRAME,** and **TILT UP ONE FRAME** Send:

01 FA AA C2 FF EC 78 00 27 10 C7

Where:

01 = Address of dome

FA = NP Command

AA = Length, description, and control flags

Bits 0-4 = Number of bytes (10)

Bits 5 = 1 for a relative command

Bit 6 = not used

Bit 7 = 1 for move to position

C2 = Data unit flags

Bits 0-1 = 10 pan/tilt in % of frames

Bits 2-5 = not used for pan/tilt

Bit 6 = 1 Auto Focus ON

Bit 7 = 1 Auto Iris ON

FF EC 78 = Pan - 50%= 0 - (0.5 * 10000) = (-5,000 decimal)

00 27 10 = Tilt + 100% Tilt = 1.0 * 10000 = (+10,000 decimal)

C7 = checksum

The dome response will be the absolute position information in the same format to confirm the command has been accepted.

NP Get the Current Position in Degrees

To get the current position for pan and tilt in degrees from the dome at address 01 send:

01 FA 0A 01 FA

Where:

01 = Address of dome

FA = NP Command

0A= Length, description, and control flags

Bits 0-4 = Number of bytes (10)

Bits 5 = 0 for absolute position

Bit 6 = not used

Bit 7 = 0 for get position

01 = Data unit flags

Bits 0-1 = 01 pan/tilt in degrees

Bits 2 = 0 for combine zoom info

Bit 3-7 = not used for pan/tilt/zoom

FA = checksum

The dome response will be similar to:

01 FA 0A 01 08 CC FF FC A4 47 40 Where:

01 = Address of dome

FA = NP Command

0A = Length, description, and control flags

Bits 0-4 = Number of bytes (10)

Bits 5 = 0 for absolute position

Bit 6 = not used

Bit 7 = 0 for get position

01 = Data unit flags

Bits 0-1 = 01 pan/tilt in degrees

Bits 2-5 = not used for pan/tilt

Bit 6 = 0 Auto Focus is ON

Bit 7 = 0 Auto Iris is ON

08 CC FF = Pan Position = 576767 decimal / 10000 = 57.6767 degrees

FC A4 47 = Tilt Position (0-FC A4 47)/ 10000 = (0x03 45 61(in hex)) / 10000 = 214369 in decimal = 21.4369 degrees down

40 = checksum

To have the dome return to the same position at a latter time the data can be sent to the dome as a go to position command by changing bit 7 of byte 3 and recalculating the checksum to obtain:

01 FA 8A C1 08 CC FF FC A4 47 00

Combination Commands

On older control systems, the combination of commands allows the operator to access new functions without requiring a system change to add new commands. Sending the combination of control commands, in the order indicated, accesses the functions listed here. SpeedDome Ultra V and subsequent products can access these functions with a single (CCh) command as shown in Table 3. Multiple-Byte Commands. These single commands are simpler, and they eliminate the possibility of missing data or errors causing incorrect operations to be performed.

- **Reset Auto Iris and Resume Auto Focus:** Simultaneously press and hold IRIS OPEN and IRIS CLOSE keys. This restores the iris set-point to the factory setting, and returns to Auto Focus after a manual focus operation.

1) Iris Open	addr	90	sum
2) Iris Close	addr	91	sum
3) Iris Stop	addr	92	sum

- **Pan 180° from Current Position "FLIP":** Press and hold the FAST key and press the FASTEST key.

1) Fast	addr	8D	sum
2) Fastest	addr	8E	sum
3) Fast Stop	addr	8F	sum

- **Repeat Pattern:** Press and hold the FASTER key and initiate a pattern. The pattern repeats until cancelled by any movement command.

1) Faster	addr	9A	sum
2) Run Pattern	addr	Bx	sum

x = 0-2 (Ex: 0 = Pattern 1)

3) Faster Stop	addr	9B	sum

- **Clear pattern and reset to default "Apple Peel" pattern:**

1) Define Pattern	addr	A0 or A1 or A2	sum
2) Fastest	addr	8E	sum
3) Pattern End	addr	B8	sum
4) New Pattern	addr	A3	sum
5) Fast Stop	addr	8F	sum

- **Manually activating or deactivating the IR mode:** This allows the user to change between color (day) and B&W (night) modes with the day/night cameras.

1) Iris Open	addr	90	sum
2) Focus Far	addr	88	sum
3) Focus Near	addr	87	sum

- **Enter Dome Menu Mode:** Start on-screen configuration mode and display the menu on the video display.

1) Iris Open	addr	90	sum
2) Focus	addr	87 or 88	sum
3) Zoom Out	addr	8B	sum

- **Exit the Dome Menu Mode:** Quick exit the on-screen configuration menu mode and save the changes.

1) Iris Close	addr	91	sum
2) Focus	addr	87 or 88	sum

- **Reset the Dome:** Press and hold the FASTER key and, in sequence, press and hold the ZOOM OUT, FOCUS FAR, and IRIS OPEN keys.

1) Faster	addr	9A	sum
2) Zoom Out	addr	8B	sum
3) Focus Far	addr	88	sum
4) Iris Open	addr	90	sum

- **Increase V-Phase Delay:** Press and hold the FASTER key and press the IRIS OPEN key. The IRIS STOP command Table 2. Standard 3-byte Commands stops the Phase increase/decrease.

1) Faster	addr	9A	sum
2) Iris Open	addr	90	sum

3) V-Phase will slowly increase delay until…

4) Iris Stop	addr	92	sum
5) Faster Stop	addr	9B	sum

- **Decrease V-Phase Delay:** Press and hold the FASTER key and press the IRIS CLOSE key. The IRIS STOP command stops the Phase increase/decrease.

1) Faster	addr	9A	sum
2) Iris Close	addr	91	sum

3) V-Phase will slowly decrease delay until…

4) Iris Stop	addr	92	sum
5) Faster Stop	addr	9B	sum

Dome Configuration Menu

The dome configuration utility provides a text overlay menu for setting the camera dome features. The utility provides settings relating to camera functions, alarms, text display, privacy zones, directional indicators, and password protection. Some items supplement similar features that may be available through the controller.

Access the menu with a single Enter Dome Menu (CCh 01h) command as shown in Table 3. Multiple-Byte Commands, or with a keystroke combination command.

The following type of menu appears on the monitor (example of SpeedDome Ultra V menu):

Dome Configuration Menu

Pan / Tilt / Zoom / Shutter Opts
Camera / Lens Functions
Alarms / Areas / Home / PZ
On-screen Text Display
Language / Password

Reset to Factory Settings
Quit without Saving
Exit and Save Changes

Once the Dome Configuration Menu is displayed, you can select a menu item, then modify the settings you want to change. The controls used with the utility are Pan/Tilt (Tracker Ball or Joystick), Focus Near, Focus Far, Zoom In (Zoom Tele), Zoom Out (Zoom Wide), Iris Open, and Iris Close. For combination keystrokes, press and hold each button in sequence, then release it.

The following table summarizes the controller commands used with the configuration utility.

These functions are performed by the appropriate commands shown in Table 2. Standard 3-byte Commands.

Menu Control Commands

If you want to…	Use…
Move the highlight bar	**Pan/Tilt**
Select the highlighted item on the screen	**Focus Far**
Increase the value of the selected setting or displays the next choice for the setting	**Zoom In**
Decrease the value of the selected field, or display the previous choice for the field.	**Zoom Out**
During naming, move the cursor to the right of the current character in the name	**Zoom In**
During naming, move the cursor to the left of the current character in the name.	**Zoom Out**

Note: Where no specific ***Focus*** button is listed, either **Focus Near** or **Focus Far** may be used. Where no specific ***Zoom*** button is listed, either **Zoom In** or **Zoom Out** may be used.

Dome to Controller Communications

When a dome sends either an asynchronous message or requested dome position data in response to (A5), it expects the controller to acknowledge that transmission by sending a CONSOLE ACK (97) back to the sending dome. The following is the format for the CONSOLE ACK message:

Dome Address	ACK = 97h (151d)	Checksum

If this CONSOLE ACK is not received by the sending dome within 50 milliseconds the dome will retry twice and then give up.

Asynchronous Messages

When appropriate, the dome will send messages listed in Table 5. Asynchronous Messages.

Upon power-up or reset, the dome On Air status is reset. It can be set or reset by the On Air or On Air Reset command. This status is used for the Boundary Crossing messages.

Table 5. Asynchronous Messages

Response Code (Hex)	Description of Dome Asynchronous Messages
Dx	Dome alarm (sent by dome if its input switches change state) Dx…x is low nibble bit 0 = alarm input 0 bit 1 = alarm input 1 bit 2 = alarm input 2 bit 3 = alarm input 3 1 = normal (open) 0 = alarm (closed) 1 is the normal state upon power-up or reset. A menu option of the dome allows inputs to be setup as normal closed (0 = open, 1 = closed)
Bx	Boundary crossing (sent by dome if pan boundary was crossed and "on-the-air" status is true (being watched)) Bx…x is low nibble x=0: boundary crossing 1 occurred x=1: boundary crossing 2 occurred x=2: boundary crossing 3 occurred x=3: boundary crossing 4 occurred.
B4	Boundary confusion (sent by dome if problem defining boundaries)
B5	Pattern done (sent by dome when it completes a pattern)
C1	Dome powered up (sent by dome to indicate it has powered up and is on-line)

The format for the asynchronous messages is the standard 3-byte format:

Dome Address	Message Code	Checksum

A CONSOLE ACK from the controller is expected as described at the start of this section.

Dome Response Messages

As shown in Figure 1. 3-Byte Format most dome commands are for control and are acknowledged with a single address byte response. Commands that request information from the dome are acknowledged by the requested data. The only exception is the **REQUEST DOME POSITION (A5)** command. This command is first acknowledged with the standard ACK and then the dome sends the response indicated in Table 6. Response Messages. This table defines the syntax of the response for the commands that do request information. The format for these response packets is:

Dome Address	1 – N Data Bytes	Checksum

As shown in Table 2. Standard 3-byte Commands, some controller commands are responded to with a data packet. Table 6. Response Messages, lists these data responses and provides examples. They are in similar format to the other commands.

Table 6. Response Messages

Controller Command Description	Controller Command Code (Hex)	Response Data	Example Response Message for Dome 1
Request Dome Type	94	F5	01, f5, 0A
Request status of alarm inputs	95	0x x = low nibble bit 0 = alarm input 0 bit 1 = alarm input 1 bit 1 = alarm input 2 bit 2 = alarm input 3 1 = normal (open) 0 = alarm (closed) 1 is the normal state upon power-up or reset. A menu option of the dome allows inputs to be setup as normal closed (0 = open, 1 = closed).	01,00, FF
Request dome position	A5	ACK (dome address) followed by a momentary pause to retrieve the data before the following message: byte 1 = dome address byte 2 = iris offset byte 3 = digital zoom limit byte 4 & 5 = Tilt position byte 6 & 7 = zoom position byte 8 & 9 = digital zoom byte 10 & 11 = pan Position byte 12 = checksum Note: The fields are in different positions in the Goto Position command. Dome expects ACK from controller or dome tries twice more.	01 pause 01, 80, 15, 41, 33, 10, DC, 00, 00, 6C, B4, EA
Get configu-ration buffer	C4	byte 1 = dome address byte 2 = command C4 byte 3 = byte count byte 4 thru (3+BC) = Data last byte = checksum.	01, C4, 06, 07, 10, 01, 47, 01, 03, D2
Response to Software Version Request	C9	byte 1 = dome address byte 2 = command C9 byte 3 = byte count 06 Byte 4 = firmware prefix typically 07 01 or 07 10 Byte 5 = identifies the firmware series Byte 6 = firmware version #, 01 00 is version 1.00 Byte 7 = checksum The example shown is for firmware part number of 0710-0147-0100	01,C9, 06,07, 10,01, 47,01, 00,D0 see example
Response to Get Pattern Size	CC 06	Byte 1 = dome address Byte 2 = command CC Byte 3 = 06 Byte 4 =pattern 1 size (0-99) Byte 5 =pattern 2 size (0-99) Byte 6 =pattern 3 size (0-99) Byte 7 = checksum	01,CC, 06,22, 00,00, 0B
Response To Network Go To Position	FA >7F	The dome response will be the absolute position information in the same format to confirm the command has been accepted.	01,FA, 8C,01, 0D,BB, A0,FE, 79,60 ,00,08, 31 see example

Controller Command Description	Controller Command Code (Hex)	Response Data	Example Response Message for Dome 1
Response To Network Get Position	FA <7F	Byte 1 = dome address Byte 2 = command FA Byte 3 = length & control bit 0 - 4 = length 00000 = minimum size 01100 = pan, tilt, zoom 01110 = p, t, z, focus 10000 = p, t, z, focus, iris 10011 = p, t, z, f, I, speed 11111 = maximum size bit 5 = 0 (absolute) bit 6 = 0 (reserved) bit 7 = 0 get position Byte 4 = data unit flags bit 0 - 1 = length 00 = pan & tilt in motor counts 01 = pan & tilt in degrees 10 = pan & tilt in frames 11 = reserved bit 2 = digital & optical zoom 1 = separate 0 = combine bit 3 = 0 (reserved) bit 4 = focus data 1 = focal distance 0 = counts bit 5 = iris data 1 = f-stops 0 = counts bit 6 = auto focus 1 = on 0 = off bit 7 = auto iris 1 = on 0 = off Byte 5,6,7 = pan position Byte 8,9,10 = tilt position Byte 11 = optical zoom Byte 12 = digital zoom Byte 13,14 = focus high Byte 15,16 = iris high Byte 17,18 = pan speed to position Byte 19,20 = tilt speed to position Byte 21,22 = zoom speed to position Last Byte = checksum	01,FA, 0C,01, 0D,BB, A0,FE 79,60, 00,08, B1 see example

Configuration Buffer

The dome maintains a buffer that provides manufacturing data for reference. This data can be accessed by the **Get Configuration Buffer (C4)** command. Table 7. Configuration Buffer Definitions, lists the data that can be accessed in this buffer.

The following is the format for getting data from the configuration buffer:

Dome Address	C4 02 XX BC XX = buffer offset BC = Byte count	Checksum

The response from the dome takes the following format:

Dome Address	C4 BC 1-BC bytes BC = Byte count	Checksum

An example:

If the dome is an SpeedDome Ultra VII with firmware version 1.03 and the controller sends the command 01 C4 02 06 0E 25, dome 1 will send back:

01 C4 06 07 10 01 47 01 03

53 44 55 20 37 20 00 41 2E

Where:

01 = Address of responding dome

C4 = Command that was sent

06 = Byte count to follow

07 10 01 47 01 03 = Flash version data

53 44 55 20 37 20 = Mnemonic in ASCII

00 41 = Device type code

2E = checksum

Table 8. Product Information provides a list of mnemonics, device type codes, and flash version numbers for the many different products.

Table 7. Configuration Buffer Definitions

Offset	Name	Length	Description
0	Boot loader number	6	Packed BCD digits of the boot loader program code. The last four digits represent the software version number (i.e. 0102 represents version 1.02)
6 6h	Flash version number	6	Packed BCD digits of the programmed FLASH IC part number. The last four digits represent the software version number (i.e. 0102 represents version 1.02)
12 0Ch	Mnemonic	6	A six ASCII character abbreviation of the dome product for use in identifying the type of dome on system configuration screens and other display purposes.
18 12h	Device type code	2	Packed BCD digits of a device type code that identifies the hardware PCB. It is used to assure only correct software is loaded and for other software configuration management tasks.
20 14h	Device type code extension	2	Packed BCD digits of a device type code extension for factory configuration info.
22 16h	Device serial number	10	Packed BCD digits of the 20 digit manufacturing serial number.
32 20h	Date of manufacture	3	Packed BCD digits of the manufacturing date MM/DD/YY

Table 8. Product Information

Device	Mnemonic	Device Type Code	Flash Version Number
Viewer	VW1	0037	0710-0156-0102
SpeedDome Optima	SDO 1	2233	0701-2843-0109
SpeedDome Ultra VII	SDU 7	0041	0710-0147-0107
SpeedDome Ultra VI	SDU 6	2477	0701-4008-0103*
SpeedDome Ultra LT	SLT	2283	0701-4009-0100
SpeedDome Ultra V	SDU 5	2283	0701-2507-0307
SpeedDome Ultra IV	SDU 4	2283	0701-2507-0307
SpeedDome Ultra III	SDU 3	2283	0701-2507-0307
SpeedDome Ultra II	None	2287	0701-2315-0307
SpeedDome Ultra	None	1036	0701-2315-0209
SensorTrac	None	3333	0701-4003-2512
SpeedDome LT	None	1326	0701-2489-0102
SpeedDome 2000 ES	None	0430	0701-0082-0200
SpeedDome Unicard Snet	None	0760	0701-0081-0316
SpeedDome	None	0428	0701-0006-0630

* SpeedDome Ultra VI can accept the SpeedDome Ultra VII larger memory integrated circuit and code.

Definitions

Area	Programmed start and end points of the dome's field of view around its pan axis. Each area is a part of a circular viewing area that extends around the dome. The areas can be different sizes.
Boundary	A separation between areas.
Flip	To instantaneously rotate the SpeedDome 180° in the opposite direction of where it is currently pointing. This is achieved by pressing a button on the controller (i.e., Touch Tracker).
Focus	The process of adjusting the clarity of a scene or an object, as seen through a camera.
Input	A connection point on a system component that enables the system to monitor input devices.
Input device	A hardware component that provides an electrical signal to indicate the state of a device. Typical input devices include door contacts, motion detectors and smoke detectors.
Iris	The camera component that determines how much light enters the camera. By adjusting the iris, you can adjust the brightness and darkness of the video on the monitor.
Line lock	Allows you to phase lock the video with the AC power line. When line lock is enabled, it prevents vertical video rolling when switching multiple cameras to a single monitor. If text appears slightly tinted on color monitors, disabling the line lock may prevent this problem.
Output	A connection point on a hardware component that enables the system to control output devices.
Pan	Side-to-side camera movement.
Pattern	A sequential series of pan, tilt, zoom, and focus movements from a single programmable dome. You “teach” the dome a combination of these movements that can be replayed automatically.
View	A programmed video scene, based on a specific pan, tilt, zoom, and focus setting that can be recalled automatically. Also called a *preset* or *target*.
Tilt	Up and down camera movement.
Zoom	To adjust the magnification of the camera lens to make an object appear closer (larger) or farther away (smaller).

Boundaries

The Define Boundary, Mark Boundary, On Air, and On Air Reset commands (9Ch through 9Fh) support the Boundary feature of the SpeedDome Ultra series of domes. They are not necessary if this feature is not used, or if the internal boundary feature supported by the dome configuration Utility Menu is used instead of the external controller text overlay boundary feature.

Upon power-up or reset, the dome ON AIR status is reset. This prevents the dome from sending boundary crossing information to the controller when it is not the controlled dome. When a controller selects a dome it sends ON AIR (9E). This allows the dome to send boundary crossing information to the controller. When the controller switches to another dome, it sends an ON AIR RESET (9F) to the selected dome. This prevents the deselected dome from sending boundary data and interfering with the selected dome.

To establish the boundaries, the Define Boundary command (9Ch) is sent to the dome, followed by PAN RIGHT movement commands to position the dome at the boundaries. The Mark Boundary command (9Dh) is sent when the dome is pointing at each of the four boundaries. To change boundary positions the process is started over with the Define Boundary command. If a boundary is not to the right of the previous boundary, or the fourth boundary overlaps the first boundary, the dome will issue a boundary confusion (B4) message. The dome will issue the boundary crossed message (B0 – B3) if the dome has been set on the air (9E).

When the dome's On Air status (9Eh) is set, it will asynchronously transmit the Boundary Crossing response (see Table 5. Asynchronous Messages) when a boundary is crossed.

Declarations

Thank you for using American Dynamics products. We support our products through an extensive and worldwide network of dealers. The dealer, through whom you originally purchased this product, is your point of contact if you have a need for service or support. Our dealers are fully empowered to provide the very best in customer service and support. Dealers should contact American Dynamics at 8005076268 or 5619126259 or on the web at http://www.americandynamics.net/.

WARRANTY DISCLAIMER: Sensormatic Electronics Corporation makes no representation or warranty with respect to the contents hereof and specifically disclaims any implied warranties of merchantability or fitness for any particular purpose.

NOTICE: The information in this manual was current when published. The manufacturer reserves the right to revise and improve its products. All specifications are therefore subject to change without notice.

LIMITED RIGHTS NOTICE: For units of the Department of Defense, all documentation and manuals were developed at private expense and no part of it was developed using Government Funds. The restrictions governing the use and disclosure of technical data marked with this legend are set forth in the definition of "limited rights" in paragraph (a) (15) of the clause of DFARS 252.227.7013. Unpublished - rights reserved under the Copyright Laws of the United States.

TRADEMARK NOTICE: *SpeedDome, SpeedDome Optima, American Dynamics* and *Sensormatic* are trademarks or registered trademarks of Sensormatic Electronics Corporation. Other product names mentioned herein may be trademarks or registered trademarks of Sensormatic or other companies.

SS/CSD 10/2003