RS-422/RS-485 Communication Protocols

For SpeedDome® Ultra IV and
AD DeltaDome® Camera Domes, and
later versions

Contents

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 IV and AD DeltaDome® camera domes, and later versions.

Pro•to•col *n* An agreed-upon format for transmitting data between two devices. The protocol determines the following:

- the type of error checking to be used
- data compression method, if any
- how the sending device will indicate that it has finished sending a message
- how the receiving device will indicate that it has received a message.

Communication protocols, such as RS-422 and RS-485, allow two network-compatible devices, such as video controllers and remote camera domes, to exchange data.

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.

If you need assistance...

Call Customer Support at:
1-800-543-9740

Protocol Characteristics

Table 1 lists the RS-422/RS-485 protocol characteristics.

Table 1. Protocol characteristics

Data rate	4.8 kbits/sec.
Data format	Start bits: 1 Data bits: 8 Parity bits: 0 Stop bits: 1

Format	3 bytes:
	    Address
	    Command
	    Checksum

Max. devices per line	10 (Depends on device loading.)
Cable type	2 shielded, twisted pair*
Wire gauge	22 AWG
Max. length	1km (3,281')
Connection	Polarized
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 (–)

* Sensormatic composite cable is recommended. This cable also contains wires for power and video. If another cable is substituted, cable wire colors may be different.
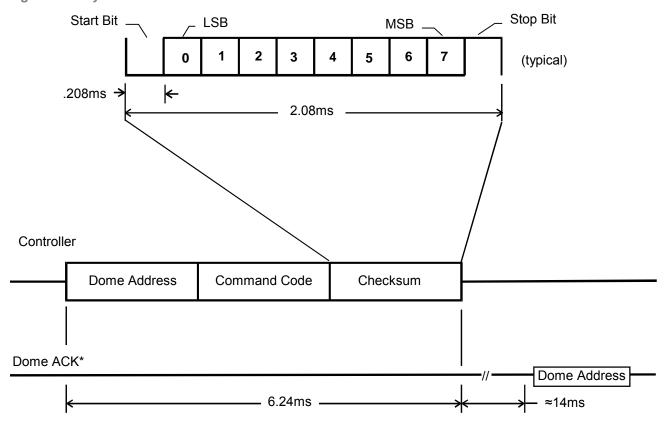
RS-422/RS-485 Commands

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. The Checksum is calculated by subtracting the sum of the bytes from 100h and using 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.

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.

Figure 1. 3-Byte Format

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

Controller to Dome Commands

Standard 3-Byte Format (Figure 1)

Table 2. Command bytes

Command Name	Description	Command Code (Hex)	Dome Response
Pan Left	Pan left (24°/sec) until Pan Right or Pan Stop	81	ACK
Pan Right	Pan right (24°/sec) until Pan Left or Pan Stop	82	ACK
Pan Stop	Stop panning	83	ACK
Tilt Up	Tilt up until Tilt Down or Tilt Stop	84	ACK
Tilt Down	Tilt down until Tilt Up or 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 sent to dome in response to asynchronous commands	97	ACK
Suspend all Transmis-sion	Disable transmission of asynchronous messages	98	Note 2

Command Name	Description	Command Code (Hex)	Dome Response
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 asynchronous boundary crossing command (see Table 4)	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
New Pattern	Accept the new pattern as the current pattern and delete the old pattern	A3	ACK
Request Position	Request dome position coordinates	A5	ACK Note 1
Mark Target 1	Mark the current position as Target 1	A8	ACK
Mark Target 2	Mark the current position as Target 2	A9	ACK
Mark Target 3	Mark the current position as Target 3	AA	ACK
Mark Target 4	Mark 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 it before accepting it to replace the previous pattern	B3	ACK
Go to Target 1	Go to preset position called Target 1	B4	ACK
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

Command Name	Description	Command Code (Hex)	Dome Response
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	Mark the current position as Target 5	B9	ACK
Mark Target 6	Mark the current position as Target 6	BA	ACK
Mark Target 7	Mark 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
Get Configura-tion Buffer	Allows access to the data stored in the configuration buffer (see Table 5)	C4	Note 1
Peel	Run default "Apple Peel" pattern for a spiral view of everything (only supported in SpeedDome Ultra V and DeltaDome II or later products)	C6	ACK
Software Version	Get software version number from dome	C9	*
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 5 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 told 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. Command bytes

Command Name	Description	Command Code (Hex)	Dome Response
Goto Position	Go to absolute position Byte 1 = dome address Byte 2 = command 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 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

Dome Control Examples

In the following examples, all numerical values are in hexadecimal notation unless specified. The packet checksum is calculated by adding together each packet byte and subtracting from 00.

- **Pan**

To make a dome at address 04 **PAN LEFT** at 24°/sec(Dec), send the following packet:

> **04 81 7A**

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

> **07 C0 82 0A AE**

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.

- **Tilt**

To make a dome at address 01 **TILT UP** at 24°/sec(Dec), send the following packet:

01 84 7B

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.

- **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 5.

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

40 99 27

Combination Commands

The following commands are generated by pressing a combination of keys on the video manager controller. In some systems, a single key or menu selection with cause the controller to send the combination commands.

addr (Dome Address)	Command Code	sum (Checksum)

- **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

- **Increase V-Phase Delay:** Press and hold the FASTER key and press the IRIS OPEN key. (The IRIS STOP command (Table 2) 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 (Table 2) 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

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

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

- **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

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 by a keystroke combination on the camera controller.

To start the dome configuration utility, do the following:

1. Select the dome that you need to configure. Refer to the controller operating instructions for specific information.

2. Press and hold IRIS OPEN, press and hold a FOCUS button (NEAR or FAR), then press ZOOM OUT (Zoom Wide).

The following type of menu appears on the monitor:

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

(Example of SpeedDome Ultra V menu.)

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

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

Working with the Dome Configuration Utility

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.

If you want to…	Use…
Start the configuration utility	**Iris Open, Focus,** then **Zoom Out**
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**
Save changes and exit the utility from any screen	**Iris Close,** then **Focus**

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.

These functions are performed by the appropriate commands shown in Table 2 and Table 3.

Dome to Controller Communications

When a dome sends either requested data or an asynchronous message, 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	97 (Hex)	Checksum

If the CONSOLE ACK is not received by the sending dome within 50Msec, the dome will retry three times and then give up.

Asynchronous Messages

When appropriate, the dome will send the asynchronous messages listed in Table 4.

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.

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

Dome Address	Message Code	Checksum

Table 4. Command bytes

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 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)
	Dome expects ACK from controller (hex 97/dec 151) or dome tries twice more.

Response Code (Hex)	Description of Dome Asynchronous Messages
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 Dome expects ACK from controller (hex 97/dec 151) or dome tries twice more.
B4	Boundary confusion (sent by dome if problem defining boundaries)
B5	Pattern done (sent by dome when it completes a pattern); dome expects ACK from controller (hex 97/dec 151) or dome tries twice more.
C1	Dome powered up (sent by dome to indicate it has powered up and is on-line)

Dome Response Messages

As shown in Table 1, 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 3. This table defines the syntax of the response for the commands that do request information. The format for these response packets are:

Dome Address	1 – N Data Bytes	Checksum

As shown in Table 2, some controller commands are responded to with a data packet. Table 5 lists these data responses and provides examples. They are in similar format to the other commands.

Table 5. Command Bytes

Controller Command Description	Controller Command Code (Hex)	Response Data	Example Response Message for Dome 1

Request alarm status	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)
		
		Dome expects ACK from controller (hex 97/dec 151) or dome tries twice more.
			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 configuration buffer	C4	byte 1 = Dome address byte 2 = Command byte 3 = Byte count byte 4 – (3+BC) = Data last byte = CHKsum Dome expects ACK from controller or dome tries twice more.	01, C4, 02, 22, 18, FF

Configuration Buffer

The dome maintains a buffer that provides manufacturing data for future reference. This data can be accessed by the **Get Configuration Buffer (C4)** command. Data can also be stored in this buffer using the **Set Configuration Buffer (C5)** command. Table 6 defines the data that can be accessed in this buffer.

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

Dome Address	C4 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 flash version number for dome number 1 is 0701-2807-0002 and the controller sends the command 01 C4 00 06 35, dome 1 will send back:

01 C4 06 07 01 28 07 00 02 FC

Where:

01 = Address of responding dome

C4 = Command that was sent

06 = Byte count to follow

07 01 28 07 00 02 = Flash version data

FC = checksum

A configuration buffer offset of 12 and a byte count of 2 will return the device type. This is useful in determining what type of device the controller is connected to. Table 7 provides a list of the type codes for the indicated devices.

The following is the format for storing data into the configuration buffer:

Dome Address	C5 BC 1-BC bytes BC = Byte count	Checksum

The dome responds with the standard ACK.

Table 6. Configuration buffer definitions

Offset	Description	Length
0	Eeprom version number	6
6	Flash version number	6
0C	Reserved	6
12	Device type	4
16	Device serial number	10
20	Date of manufacture	3

Table 7. Device type codes

Device	Codes
SpeedDome Ultra 4	2283
SpeedDome Ultra 5	2283

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*.

Zoom   To adjust the magnification of the camera lens to make an object appear closer (larger) or farther away (smaller).

The following are descriptions on how to use the commands for Boundaries, Patterns, and Views.

Boundaries

The Define Boundary, Mark Boundary, On Air, and On Air Reset commands (9Ch through 9Fh) support the Boundary feature of the SpeedDome Ultra and DeltaDome 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 no longer 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 4) when a boundary is crossed.

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.

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 combination command (A0h, A1h, or A2h) (8Eh) (B8h) (A3h) (8Fh).

Views

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.

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

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