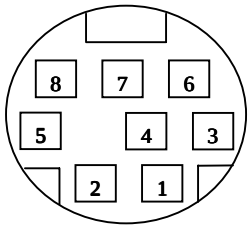
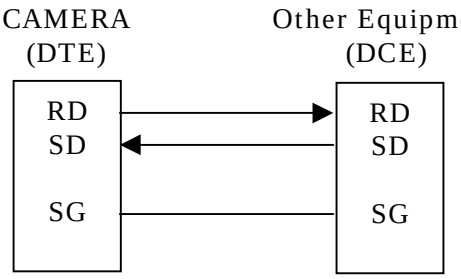
CAMERA UNIT (KX-DP60X)

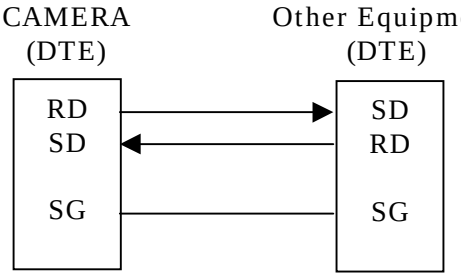
SERIAL INTERFACE SPECIFICATION

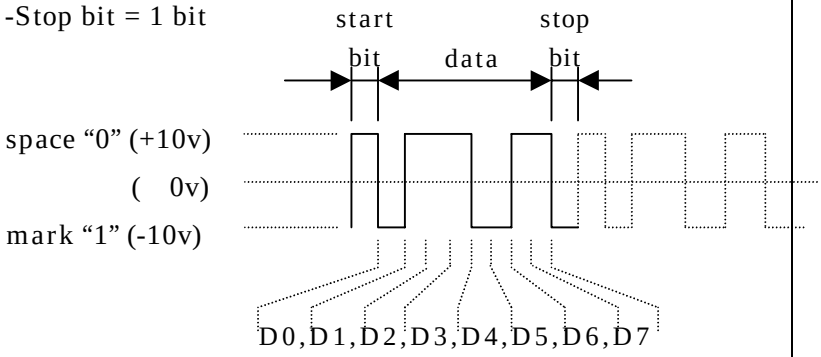
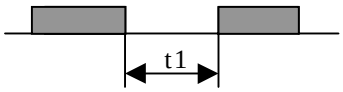
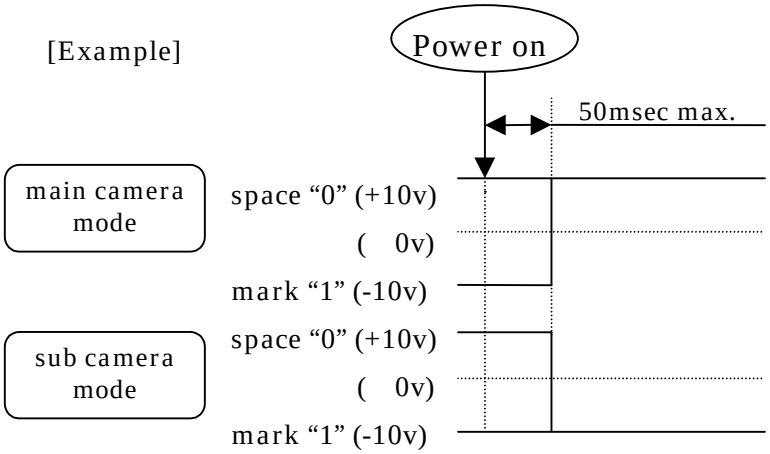
Nov. 1st. 1999

Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design ,purchase or use.

1. Serial Interface Specification

<table>
<tr><th>No</th><th>ITEM</th><th>CONTENTS</th><th>NOTES</th></tr>
<tr><td>1</td><td>Communication Type</td><td>RS-232C (asynchronous) full duplex</td><td></td></tr>
<tr><td>2</td><td>Terminal</td><td>Camera = DTE (Data Terminal Equipment)</td><td></td></tr>
<tr><td>3</td><td>Connection Signal</td><td></td><td></td></tr>
<tr><td>3-1</td><td>Connector Type</td><td>Circle type miniature Connector (8pin)
 
</td><td></td></tr>
<tr><td>3-2</td><td>Pin Circle</td><td>
<table>
<tr><th>Pin No.</th><th>Signal</th><th>JIS sign</th><th>Signal direction</th></tr>
<tr><td>1</td><td>Reserved</td><td></td><td>Output</td></tr>
<tr><td>2</td><td>Camera Mode</td><td></td><td>Input</td></tr>
<tr><td>3</td><td>Send Data(TXD)</td><td>SD</td><td>Output</td></tr>
<tr><td>4</td><td>Signal GND for RS-232C</td><td>SG</td><td>-</td></tr>
<tr><td>5</td><td>Receive Data (RXD)</td><td>RD</td><td>Input</td></tr>
<tr><td>6</td><td>Signal GND for RS-232C</td><td>SG</td><td>-</td></tr>
<tr><td>7</td><td>Power GND</td><td></td><td>-</td></tr>
<tr><td>8</td><td>Power Input (+12V)</td><td></td><td>Input</td></tr>
</table>
</td><td></td></tr>
<tr><td>3-3</td><td>Connection Example</td><td>1. Connect to DCE
 

2. Connect to DTE
 
</td><td></td></tr>
</table>

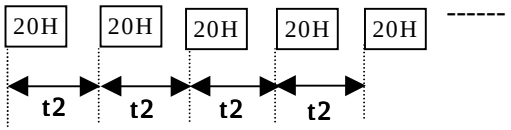
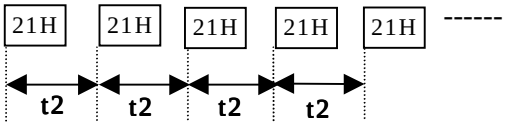
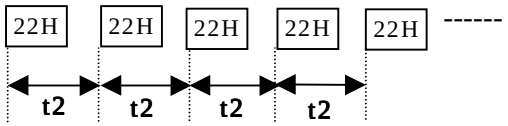
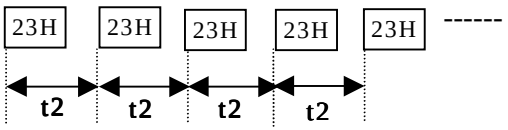
No	ITEM	CONTENTS	NOTES
4	Flow Control	Camera is not apply to flow control	
5	Communication Speed	9600 bps	
6	Data Construction	-Data = 8 bit -Parity = None -Stop bit = 1 bit 	
7	Application Command & Timing Condition	Interval between each command : t1 t1 >= 97.2 msec 	Refer to “Command outline”
8	Signal “Camera Mode”	Camera mode is selected depending upon signal “Camera Mode” (the 2’nd pin of interface connector) during Initialization. (refer to below about detail timing) -Camera Mode = space “0” → main camera mode -Camera Mode = mark “1” → sub camera mode -Camera Mode = open → sub camera mode [Example]  [NOTE] -main camera mode All key code data received from I.R. remote controller are transferred to Host Device. Camera does not interpret and execute any key code from I.R. remote controller. -sub camera mode Camera unit interpret and executes key code from I.R. Remote Controller.	After initialization, camera mode is selectable by camera control command.

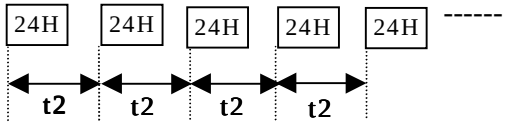
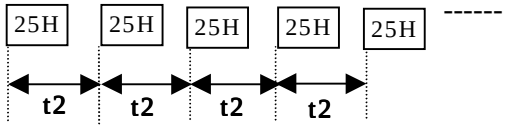
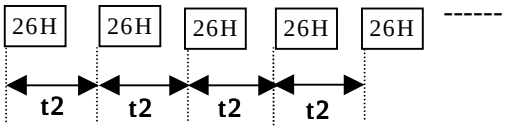
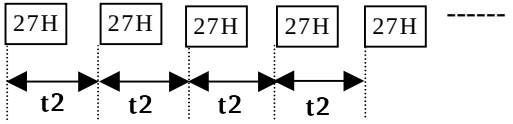
3.Camera Control Command

Command	Application Contents		Command Format (Received Command)	Response Data Format
04H	Video On	Video on (Fade in condition)	04H	B1H --- ACK B4H --- NAK
05H	Video Off	Video off (Fade out condition)	05H	B1H --- ACK B4H --- NAK
07H	Auto Focus		07H	B1H --- ACK B4H --- NAK
08H	Manual Focus		08H	B1H --- ACK B4H --- NAK
0AH	Shutter Speed	Switch Shutter Speed Setting by this command is held after turning off power. factory setting : data = 00H	0AH data 00H NTSC:1/60 sec PAL :1/50 sec 01H NTSC:1/100 sec PAL :1/60 sec	B1H --- ACK B4H --- NAK
0CH	Manual White Balance		0CH No. 80H - 9CH (29points)	B1H --- ACK B4H --- NAK
0DH	Auto White Balance		0DH	B1H --- ACK B4H --- NAK

<table>
<tr><th>Command</th><th colspan="2">Application Contents</th><th>Command Format (Received Command)</th><th>Response Data Format</th></tr>
<tr>
<td>0FH</td>
<td>Parameters Initialization</td>
<td>Initialization of following Parameters
<table>
<tr><th>Parameter</th><th>status</th></tr>
<tr><td>Pan direction</td><td>Normal</td></tr>
<tr><td>Focus</td><td>Auto</td></tr>
<tr><td>White Balance</td><td>Auto</td></tr>
<tr><td>Back Light Compensation Level</td><td>Standard</td></tr>
<tr><td>Video</td><td>ON</td></tr>
<tr><td>Pan Speed</td><td>Auto</td></tr>
<tr><td>Tilt Speed</td><td>Auto</td></tr>
</table>
</td>
<td>0FH</td>
<td>B1H --- ACK
B4H --- NAK</td>
</tr>
</table>

Command	Application Contents		Command Format (Received Command)	Response Data Format
10H	Preset Store	Store the current camera position as the Preset Position data. data to be stored : -pan coordination -tilt coordination -zoom coordination -back light compensation condition	10H No. 00H - 09H (10 Points)	B1H --- ACK B4H --- NAK
1AH	Document Position Store	Store the current Document position as Document Position data data to be stored : -pan coordination -tilt coordination -zoom coordination -back light compensation condition	1AH	B1H --- ACK B4H --- NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
20H	Pan (left)	Move to Pan Direction -Direction is selectable by "Pan Direction " command. -Speed is selectable by "Pan Speed" command.	 97<=t2<=118msec	B1H --- ACK B4H --- NAK (NOTES) Even if the camera can not pan because panning limit exceeded, camera replies ACK(B1H)for this command.
21H	Pan (right)	Move to Pan Direction -Direction is selectable by "Pan Direction " command. -Speed is selectable by "Pan Speed" command.	 97<=t2<=118msec	B1H --- ACK B4H --- NAK (NOTES) Even if the camera can not pan because panning limit exceeded, camera replies ACK(B1H)for this command.
22H	Tilt (up)	Move to Tilt Direction(up) -Speed is selectable by "Tilt Speed" command.	 97<=t2<=118msec	B1H --- ACK B4H --- NAK (NOTES) Even if the camera can not tilt because tilting limit exceeded, camera replies ACK(B1H)for this command.
23H	Tilt (down)	Move to Tilt Direction(down) -Speed is selectable by "Tilt Speed" command.	 97<=t2<=118msec	B1H --- ACK B4H --- NAK (NOTES) Even if the camera can not tilt because tilting limit exceeded, camera replies ACK(B1H)for this command.

Command	Application Contents		Command Format (Received Command)	Response Data Format
24H	Zoom Wide	Move zooming lens to “Wide”	 97<=t2<=118msec	B1H --- ACK B4H --- NAK
25H	Zoom Tele	Move zooming lens to “Tele”	 97<=t2<=118msec	B1H --- ACK B4H --- NAK
26H	Focus Far	Move focusing lens to “Far” -Focus mode is switched to manual focus mode by execution of this command in auto focus mode.	 97<=t2<=118msec	B1H --- ACK B4H --- NAK
27H	Focus Near	Move focusing lens to “Near” -Focus mode is switched to manual focus mode by execution of this command in auto focus mode.	 97<=t2<=118msec	B1H --- ACK B4H --- NAK

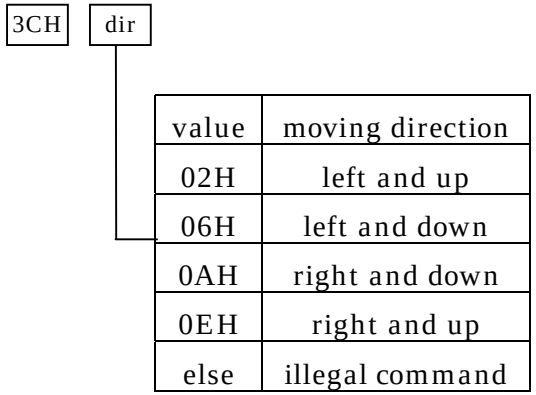
Command	Application Contents		Command Format (Received Command)	Response Data Format
30H	Preset Move	Move to Preset Position Position move Data : Pan, Tilt, Zoom, Back Light Pan and Tilt motion is at same time .	30H No. 00H - 09H (10 Points)	ACK : B1H A2H 01H No. 00H - 7FH Back Light Compensation level No. NAK : B4H

Command	Application Contents		Command Format (Received Command)	Response Data Format
38H	Home Position Detect	Move to home position detecting home position sensor. Position move data: Pan (0 point) Tilt (0 point) Refer to command “Home Position Move” (39H). Pan and Tilt motion is concurrent.	38H	B1H : ACK B4H : NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
39H	Home Position Move	Move to home position Position move data : Pan(0 Point), Tilt(0 Point), Zoom(Wide-end), Back Light (standard) Camera does not use home position sensor in this motion . Refer to command “Home Position Detect” (38H). Pan and Tilt motion is concurrent.	39H	ACK : B1H A2H 01H No. 00H - 7FH Back Light Compensation level No. NAK : B4H

Command	Application Contents		Command Format (Received Command)	Response Data Format
3AH	Document Position Move	Move to Document Position Position move Data : : Pan, Tilt, Zoom, Back Light Pan and Tilt motion is concurrent.	3AH	ACK : B1H A2H 01H No. 00H - 7FH Back Light Compensation level No. NAK : B4H

Command	Application Contents		Command Format (Received Command)	Response Data Format
3BH	Detect I.R. Remote Controller	Move to I.R. Remote Controller direction Position move Data : : Pan, Tilt(0 Point), Zoom(Wide-end), Back Light (standard) -Pan and Tilt motion is concurrent.	3BH	ACK : B1H A2H 01H No. 00H - 7FH Back Light Compensation level No. NAK : B4H

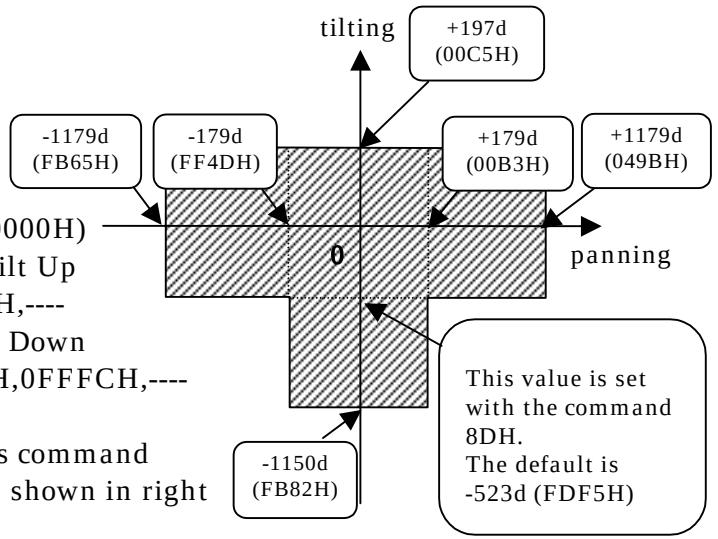
<table>
<tr><th>Command</th><th colspan="2">Application Contents</th><th>Command Format (Received Command)</th><th>Response Data Format</th></tr>
<tr><td>3CH</td><td>Slant pan/tilt motion start</td><td>Start to slant pan/tilt motion</td><td>


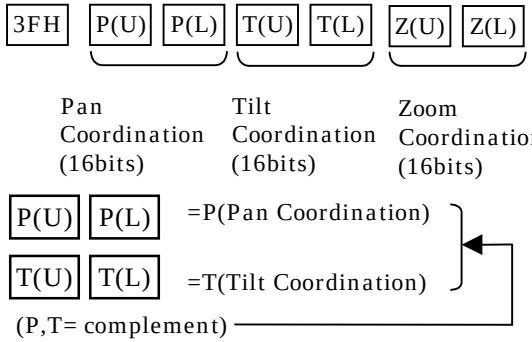
<table>
<tr><th>value</th><th>moving direction</th></tr>
<tr><td>02H</td><td>left and up</td></tr>
<tr><td>06H</td><td>left and down</td></tr>
<tr><td>0AH</td><td>right and down</td></tr>
<tr><td>0EH</td><td>right and up</td></tr>
<tr><td>else</td><td>illegal command</td></tr>
</table>
[NOTE]
This slant pan/tilt motion is stopped by the pan/tilt stop command (4AH).
</td><td>


---ACK


---NAK
</td></tr>
</table>

Command	Application Contents		Command Format (Received Command)	Response Data Format
3EH	Absolute Coordination Move	Move to the direction specified with this command Execute Tilt motion and Pan motion at the same time	3EH P(U) P(L) T(U) T(L) D Z Pan Coordination (16bits) Tilt Coordination (16bits) P(U) P(L) =P(Pan Coordination) T(U) T(L) =T(Tilt Coordination) (P,T = complement) -Home Position : (P,T)=(0000H,0000H) -when move Pan (Right Area), Tilt Up 0000H,0001H,0002H,0003H,---- -when move Pan(Left Area), Tilt Down 0FFFFH,0FFFEH,0FFFDH,0FFFCH,---- The pan/tilt coordination in this command should be contained in the area shown in right figure. D =staying direction (The value of "D" should be 14H.) Z =Zoom Coordination (8 bits : 00H<=Z<=0FFH)	B1H ---ACK B4H ---NAK



Command	Application Contents		Command Format (Received Command)	Response Data Format
3FH	Relative Coordination Move	Move to the direction specified with this command Execute Tilt motion and Pan motion at the same time	 -Present Position : (P,T)=(0000H,0000H) -when move Right Pan, Tilt Up 0000H,0001H,0002H,0003H,---- -when move Left Pan, Tilt Down 0FFFFH,0FFFEH,0FFFDH,0FFFCH,— -2358d(=F6CAH)<=P<=+2358d(=0936H) -1346d(=FABEH)<=T<=+1346d(=0542H) Z(U) Z(L) =Zoom Coordination (Z= complement) -Present Zoom Position : Z=(0000H) -when move to “Tele” 0000H,0001H,0002H,0003H, ---- -when move to “Wide” 0FFFFH,0FFFEH,0FFFDH,0FFFCH,— 0FF01H<=Z<=00FFH End of Wide End of Tele	B1H ---ACK B4H ---NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
40H	Pan (left) Start	Start panning -Direction is selectable by "Pan Direction" command. -Speed is selectable by "Pan Speed" command.	40H	B1H ---ACK B4H ---NAK [NOTES] Even if the camera can not pan because panning limit exceeded, camera replies ACK(B1H) for this command.
45H	Tilt (up) Start	Start tilting -Speed is selectable by "Tilt Speed" command.	45H	B1H ---ACK B4H ---NAK [NOTES] Even if the camera can not tilt because tilting limit exceeded, camera replies ACK(B1H) for this command.
4AH	Pan/Tilt Stop	Stop panning or tilting.	4AH	B1H ---ACK B4H ---NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
4BH	Zoom Wide Start	start to move zooming lens to “WIDE”	4BH	B1H ---ACK B4H ---NAK
4CH	Zoom Tele Start	start to move zooming lens to “TELE”	4CH	B1H ---ACK B4H ---NAK
4DH	Zoom Stop	Stop zooming lens motion	4DH	B1H ---ACK B4H ---NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
50H	Pan (right) Start	Start panning -Direction is selectable by "Pan Direction" command. -Speed is selectable by "Pan Speed" command.	50H	B1H ---ACK B4H ---NAK [NOTES] Even if the camera can not pan because panning limit exceeded, camera replies ACK(B1H) for this command.
55H	Tilt (down) Start	Start tilting -Speed is selectable by "Pan Speed" command.	55H	B1H ---ACK B4H ---NAK [NOTES] Even if the camera can not tilt because tilting limit exceeded, camera replies ACK(B1H) for this command.

Command	Application Contents		Command Format (Received Command)	Response Data Format
5AH	CPU Software RESET	Execute the software Reset to CPU	5AH AAH 55H	-No reply same as Power ON ADH ---initialization and Home position move completed E0H ---Home position error happened
5BH	Focus Far Start	Start to Far Focus of Lens	5BH	B1H ---ACK B4H ---NAK
5CH	Focus Near Start	Start to Near Focus of Lens	5CH	B1H ---ACK B4H ---NAK
5DH	Focus Stop	Stop focusing of Lens	5DH	B1H ---ACK B4H ---NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
60H	Back Light Setting	Back Light compensation condition setting	60H No. 00H - 7FH (back light compensation level No.) (128 Steps)	B1H ---ACK B4H ---NAK
67H	White Balance Hold	Holding the white balance condition	67H	B1H ---ACK B4H ---NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
80H	Zoom speed setting	Set zooming speed	80H 00H data 00H :standard speed 01H - 0AH :zoom speed choices (10 steps)	B1H ---ACK B4H ---NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
85H	Remote Controller Receiving ON/OFF	Enable and disable of remote controller receiving	85H data 00H enable receiving 01H disable receiving	B1H ---ACK B4H ---NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
86H	Pan Direction Setting (Reverse)	Setting the Pan Move direction Received 20H Move direction : CCW Received 21H Move direction : CW This command is valid in Sub Camera Mode only.	86H Setting by this command is held after turning off power.	B1H ---ACK B4H ---NAK
87H	Pan Direction Setting (Normal)	Setting the Pan Move direction Received 20H Move direction : CW Received 21H Move direction : CCW This command is valid in Sub Camera Mode only.	87H Setting by this command is held after turning off power.	B1H ---ACK B4H ---NAK
88H	Camera Mode Change	Setting the Camera Mode <Camera Mode> -Main Camera -Sub Camera	88H Mode 00H Sub Camera Mode 01H Main Camera Mode	B1H ---ACK B4H ---NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
8CH	Pan Speed Setting	Set Panning speed This command is invalid during manual pan motion. Camera increase and decrease speed gradually during manual pan motion.	8CH SPD 00H (auto speed change) 01H - 08H (fixed speed : 8 speeds)	B1H ---ACK B4H ---NAK
8DH	Tilt Speed Setting	Set Tilting speed This command is invalid during manual tilt motion. Camera increase and decrease speed gradually during manual tilt motion.	8DH SPD 00H (auto speed change) 01H - 08H (fixed speed : 8 speeds)	B1H ---ACK B4H ---NAK

Command	Application Contents		Command Format (Received Command)	Response Data Format
90H	Read status of motion	Camera responds status of following motion -pan -tilt -zoom -manual focusing motion -manual white balance continuous change -back light continuous change -execution of a command belonging to group “MOVE” (Command group “MOVE” contains following commands) -Preset Move (30H) -Document Position Move -Home Position Move -Absolute Coordination Move -Relative Coordination Move -Detect Remote Controller and Move	90H	A4H 01H data

bit	bit data	status
7	0	(reserved)
	1	(reserved)
6	0	stopped continuous manual white balance changing
	1	continuous manual white balance changing in progress
5	0	stopped continuous back light level changing
	1	continuous back light level changing in progress
4	0	stopped executing command group “MOVE”
	1	executing command group “MOVE” at present
3	0	stopped moving manual focus
	1	moving manual focus at present
2	0	stopped zooming
	1	zooming in progress
1	0	stopped tilting
	1	tilting in progress
0	0	stopped panning
	1	panning in progress

Command	Application Contents		Command Format (Received Command)	Response Data Format
91H	Read Camera Status	Camera responds camera status condition: -Pan Direction -Camera Mode -Focus Mode -Video Output Mode (ON/OFF) -Receiving of I.R. remote controller (enabled/disabled) -Shutter Speed -remote controller obedience mode	91H	A5H 01H data

bit	bit data	s t a t u s	
7	0	Receiving of I.R. remote controller is enabled.	
	1	Receiving of I.R. remote controller is disabled.	
6	0	obedient to “AUX.” remote controller	remote controller obedience mode
	1	obedient to “MAIN” remote controller	
5	0	Shutter Speed (NTSC: 1/60 sec, PAL:1/50 sec.)	
	1	Shutter Speed (NTSC:1/100 sec, PAL:1/60 sec.)	
4	0	Bits 5 is valid	
	1	Bits 5 is not valid	
3	0	Video output condition is Normal. (Fade in)	
	1	Video output condition is Fade out.	
2	0	Focus control condition is Auto.	
	1	Focus control condition is Manual.	
1	0	Camera mode is Sub Camera mode.	
	1	Camera mode is Main Camera mode.	
0	0	Pan direction condition is Normal. Received 20H : Move direction : CW	
	1	Pan direction condition is Reverse. Received 20H : Move direction : CCW	

Command	Application Contents		Command Format (Received Command)	Response Data Format
94H	Read Absolute Coordination	When this command is received Camera responds current absolute coordination of Pan/Tilt/Zoom and staying direction	94H	A0H 06H P(U) P(L) T(U) T(L) D Z Pan Coordination (16bits) Tilt Coordination (16bits) P(U) P(L) =P(Pan Coordination) T(U) T(L) =T(Tilt Coordination) (P,T= complement) -Home Position : (P,T)=(0000H,0000H) -when move Pan (Right Area), Tilt Up 0000H,0001H,0002H,0003H,---- -when move Pan(Left Area), Tilt Down 0FFFFH,0FFFEH,0FFFDH,0FFFCH,— -1179d(=FB65H)<=P<=+1179d(=049BH) -1150d(=FB82H)<=T<=+197d(=00C5H) D = staying direction Bit3 = Pan staying direction (“0”=CCW, “1”=CW) Bit4 = Tilt staying direction (“0”=UP, “1”=DOWN) Z = Zoom Coordination (8 bits : 00H<=Z<=0FFH)

Command	Application Contents		Command Format (Received Command)	Response Data Format
96H	Read Back Light Condition	Respond the Back Light Compensation Condition	96H	A2H 01H No. 00H - 7FH
97H	Read White Balance Condition	Respond the White balance Condition	97H	A3H 01H No. 00H (Auto W/B Mode) 01H (W/B Hold Mode) 80H - 9CH (Manual W/B Mode) (29 points)

Command	Application Contents		Command Format (Received Command)	Response Data Format
99H	Read Pan/Tilt Speed	Camera responds setting of pan and tilt speed. Refer to specification of command “8CH” ,”8DH”	99H	A8H 02H SPD(P) SPD(T) Tilt speed No. Pan speed No. SPD(P),SPD(T)=”00H” :auto speed change SPD(P),SPD(T)=”01H “ - ”08H” : fixed speed
9AH	Read zoom Speed	Camera responds zoom speed. Refer to specification of command “80H”	9AH 00H	AAH 01H data 00H :standard speed 01H - 0AH :zoom speed choices (10steps)

Command	Application Contents		Command Format (Received Command)	Response Data Format
9BH	Read Error Status	Camera responds status of following Error -Home position move and detect Error	9BH	A4H 01H data

bit	bit data	status
7	0	reserved
	1	reserved
6	0	reserved
	1	reserved
5	0	reserved
	1	reserved
4	0	reserved
	1	reserved
3	0	reserved
	1	reserved
2	0	reserved
	1	reserved
1	0	reserved
	1	reserved
0	0	Noting the home position Error when home position move with detector
	1	Home position Error happened (Could not complete the home position move with detector)

Command	Application Contents		Command Format (Received Command)	Response Data Format
9CH	Model name inquiring	Camera responses the fundamental model name	9CH	ABH 0AH STR --- STR character strings (10bytes) [Example] ABH 0AH 44H 50H 36H 30H 58H 20H -- 20H character strings “DP60X” =model name 20H(space): meaningless