

COHU 3500 DSP CAMERA
RS-232 INTERFACE
rev 1.15. June 01 1998
PRELIMINARY

1.1 GENERAL

This documents defines the Asynchronous communication protocol between the PC and a 3500 DSP Camera. The communication is a full duplex. Typical or default communication parameters will be 9600 baud, 8 data bits, 1 stop bit and no parity.

1.2 MESSAGE FORMAT

Anytime a command message is sent to the Camera the camera will respond with an ACK or NAK. The commands are sent using the command message format show in table 1. The various commands that may be transmitted are listed in table 2. The response message from the camera is shown in tables 3a to 3k

If the command message contains only a momentary function, no further response beyond the ACK OR NAK will occur .

-The control characters to be used are:-

STX	start of text or (F8 if RS422/RS485)
ACK	Acknowledge proper receipt of transmission
NAK	Bad transmission - re transmit
ETX	End of Message (not used for rs422)
CS	Checksum
ID	Camera address in HEX

All transmissions will be in formats:-

STX/ID/'c'/DATA BYTES/CHECKSUM/ETX

Note: 'Wa' means ASCII characters for W and a

TABLE 1 RS- 232 COMMAND MESSAGE FORMAT

BYTE	DATA	DESCRIPTION
0	STX	Start of message (02h)
1	Address in hex	Camera address (01h - DFh)
2	'c'	Message type (camera)
3 to n+3	Command Data	See Table 2
n+4	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX

n+5 ETX End of message (03h)

NOTE: n is the number of command data bytes in the message

TABLE 2. RS- 232 COMMAND DATA

MESSAGE	DATA	DESCRIPTION	RESPONSE
WHITE BALANCE COMMANDS			
WB Status Request	'WS'		see table 3a
WB Sample/Hold	'Wa'		ACK/NAK
WB auto tracking	'Wt'		ACK/NAK
WB manual	'Wm'		ACK/NAK
WB red gain	'Wr' #,#,#	'000' to '895'	ACK/NAK
WB green gain	'Wg' #,#,#	'000' to '895'	ACK/NAK
WB blue gain	'Wb' #,#,#	'000' to '895'	ACK/NAK
Hue	'Wh' #,#,#	'000' to '063'	ACK/NAK
Saturation	'Ws' #,#,#	'000' to '255'	ACK/NAK
Indoor Lighting 'Wi'			ACK/NAK
Outdoor Lighting	'Wo'		ACK/NAK
* SYNCHRONIZE MODES COMMANDS			
*Sync Status Request	'SS'		see table 3b
*Horizontal Phase	'Sc' #	30 to 3f hex 16 steps	ACK/NAK
*Sub_Carrier phase	'Sp' #,#,#	'000' to '127'	ACK/NAK
*Sync line lock 'Sl' #		'0' to '5' 6 steps	ACK/NAK
**Sync mode	'Sm' #	'0' to '4'	ACK/NAK
Note * these commands depends on the sync board specified			
** Sync mode '0'=GenLock, '1'=H/V, '2'=vert reset, '3'=LineLock and '4'=Crystal			
SHUTTER /INTEGRATION COMMANDS			
Sht/Int Status Request	'VS'		see table 3c
Shutter Automatic	'Va'		ACK/NAK
Shutter Manual 'Vm'			ACK/NAK
Shutter speed	'Vs' #	'0' to '7' 8 steps	
			ACK/NAK
Integration Auto	'VA'		ACK/NAK
Integration manual	'VM'		ACK/NAK
Integration external	'VE'		ACK/NAK
Integration time 'Vi' #,#		'01' to '99' frames	ACK/NAK
GAIN COMMANDS			
Gain Status request	'GS'		see table 3d
Automatic gain 'Ga'			ACK/NAK
Manual gain	'Gm'		ACK/NAK
Manual gain level	'Gg' #,#,#	'000' to '126'	ACK/NAK'

OPERATOR'S ID COMMANDS

ID Status Request	'TS'	see table 3e
Enable ID text	'TE'	ACK/NAK
Disable ID text	'TD'	ACK/NAK
Top of screen	'TT'	ACK/NAK
Bottom of screen	'TB'	ACK/NAK
Text up to 24 chars	'TL'	ACK/NAK

TABLE 2. RS- 232 COMMAND DATA CONTINUE

MESSAGE	DATA	DESCRIPTION	RESPONSE
IRIS COMMANDS			
Iris status request	'IS'		see table 3f
Automatic Iris	'Ia'		ACK/NAK
Iris Manual	'Im'		ACK/NAK
DC Iris Auto	'IA'		ACK/NAK
DC Iris manual	'IM'		ACK/NAK
Iris open	'Io'		ACK/NAK
Iris close	'Ic'		ACK/NAK
Iris stop	'Is'		ACK/NAK
ZOOM/SCROLL COMMANDS			
Zoom Status request	'ZS'		see table 3g
Zoom magnification factor	'Zm' #	31,32,34,38 hex(x1,x2,x4,x8)	ACK/NAK
Zoom in	'Zi'		ACK/NAK
Zoom out	'Zo'		ACK/NAK
Zoom stop	'Zs'		ACK/NAK
Scroll up	'Zu'		ACK/NAK
Scroll down	'Zd'		ACK/NAK
Scroll right	'Zr'		ACK/NAK
Scroll left	'Zl'		ACK/NAK
Scroll stop	'Zq'		ACK/NAK
Scroll center	'Zc'		ACK/NAK
Zoom ctrl Boundary			'Z','B',cs, ETX
CONFIGURATION OF CAMERA			
Upload Configurations	'CG',#	30 to 39 hex	see Table 3j
DownLoad Configurations	'CP',#,parameters	30 to 39 hex	ACK/NAK
Note parameters -- see defination in table 3j			
FORMAT OF CAMERA			
Camera Format status request	'FS'		see table 3h
Camera Format	'FC' #,#	statusF1, statusF2	ACK/NAK
Note statusF1,statusF2 ---> see defination in table 3h			
MISCELLANEOUS COMMANDS			
Misc. Status Request	'MS'		see table 3i

Backlight comp OFF	'Bf'		ACK/NAK
Backlight comp ON	'Bn'		ACK/NAK
Pedestal ON	'On'		ACK/NAK
Pedestal OFF	'Of'		ACK/NAK
Y Gamma	'Yy' #	'0' to '7' 8 steps	
	ACK/NAK		
Aperture Correction	'A' #,#	'00' to '31'	ACK/NAK
Av. Picture Lv (APL)	'L' #,#	'00' to '99'	ACK/NAK
Contrast	'c' #,#	'00' to '63'	ACK/NAK
Black Level	'D' #,#,#	'000' to '255'	ACK/NAK
Date & Revision num	'RS'		see table 3L

TABLE 2. RS- 232 COMMAND DATA CONTINUE

MESSAGE	DATA	DESCRIPTION	RESPONSE
PRESET COMMANDS			
Store Presets	'Ps' #	'0' to '9'	ACK/NAK
Recall Presets	'Pr' #	'0' to '9'	ACK/NAK
Factory Defaults	'Pd'		ACK/NAK

WINDOWS AREAS WIEGHTS COMMANDS

Window frontlight Status 'wFS'		see table 3k
Window defaults Status 'wFD'		see table 3k
Window HV weights "wX, h1->h5,v1-v5,w1-w6		ACK/NAK
X = F for front light and B for backlight coefficient		

TABLE 3a. WHITE BALANCE STATUS RESPONSE MESSAGE FORMAT

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type
3	'W'	WB
4	StatusWB	WB status
5-7	Rgain	Red gain '000' to '895'
8-10	Ggain	Green gain '000' to '895'
11-13	Bgain	Blue gain '000' to '895'
14-16	Hue	Hue '000' to '063' (RGain & BGain)

17-19	Saturation	Saturation '000' to '255' (BYGain)'
20	CHECKSUM	80H-8FH LS nibble is XOR of all previous bytes (LS NIBBLES only) except STX
21	ETX	End of message (03h)

StatusWB byte

	Hex
statusWB	30 - 38
	bit0 0=Tracking 1=manual
	bit1 0=indoor 1=outdoor
	bit2 not defined always 0
	bit3 0=no error 1=WB error

TABLE 3b. SYNC STATUS RESPONSE MESSAGE FORMAT

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type
3	'S'	
4	StatusSM	Sync Board status
5	30 to 3F hex	Horizontal delay 16 steps
6	30 to 35 hex	Line Lock AC Phase.
7-9	'000' to '127'	Sub carrier phase (0 to 353 degree)
10	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
11	ETX	End of message (03h)

StatusSM Byte

	Hex
statusSM	30 - 34
	30 = GenLock (Auto 1)
	31 = H and V (Auto 2)
	32 = Vertical Reset
	33 = LineLock
	34 = Crystal

Line lock phase @60 degree interval

30 = 300 degree

31 = 240

32 = 180

33 = 120
34 = 60
35 = 0 degree

TABLE 3c. SHUTTER/INTEGRATION STATUS RESPONSE MESSAGE FMT

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type
3	'V'	
4	StatusSI	Shutter/Integration mode
5	'0' to '8'	Shutter speed
6-7	'01' to '99'	Integration time in # of frames
8	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
9	ETX	End of message (03h)
Shutter/Integration Byte statusSI		
	Hex	
statusSI	30-37	
	30 = Auto shutter	
	31 = Manual Shutter	
	32 = Manual Integration	
	33 = Auto Integration	
	34 = External Integration	
Shutter Speed byte		
	'0' '1' '2' '3' '4' '5' '6' '7'	
(NTSC)	1/60, 1/100, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/8,000	
(PAL)	1/50, 1/120, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/8,000	

TABLE 3d. GAIN STATUS RESPONSE MESSAGE FORMAT

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type (Camera)
3	'G'	
4	StatusGM	Gain Status
5-7	'000' to '126'	Gain value
8	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
9	ETX	End of message (03h)
statusGM		
	Hex	
	statusGM	30 - 31
		bit0 0=AGC 1>manual

TABLE 3e. OPERATOR'S ID STATUS RESPONSE MESSAGE FORMAT

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type (camera)
3	'T'	
4	statusID	Status of ID message
5-29	[1-24]	text
30	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
31	ETX	End of message (03h)

Operator ID Status Byte (statusID)

	Hex
statusID	30-33
	30 ID disable and dpy @ bottom of screen
	31 ID enable and dpy @ bottom of screen
	32 ID disable and dpy @ top of screen
	33 ID enable and dpy @ top of screen

TABLE 3f. IRIS STATUS RESPONSE MESSAGE FORMAT

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type (camera)
3	'I'	
4	StatusIR	Status of Iris
5	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
6	ETX	End of message (03h)

Lens Iris Status Byte statusIR

	Hex
statusIR	30-35
	30 Manual Iris
	31 Auto Iris
	32 DC Iris Manual
	33 DC Iris Auto
	34 Motorize Iris manual
	35 Motorize Iris auto

TABLE 3g ZOOM STATUS RESPONSE MESSAGE FORMAT

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type (camera)
3	'Z'	
4	30 to 68 hex	Zoom magnification factor
5	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
6	ETX	End of message (03h)

TABLE 3h FORMAT STATUS RESPONSE MESSAGE FORMAT

BYTE	DATA	DESCRIPTION
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0	STX	Start of message
1	ID	Camera address
2	'c'	Message type
3	'F'	
4	StatusF1	Camera statusF1
5	StatusF2	Camera statusF2
6	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
7	ETX	End of message (03h)

Format Status Byte (statusF1)

	Hex
statusF1	30-34
	30 NTSC color
	31 PAL color
	32 NTSC Black and White
	33 PAL black and white

Format Status Byte (statusF2)

	Hex
statusF2	undefined (30)

TABLE 3i MISCELLANEOUS STATUS RESPONSE MESSAGE FORMAT

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type
3	'M'	
4	statusM1	Misc status 1
5	statusM2	Misc status 2 gamma '0' to '7'
6-7	statusM3	Misc status 3 Aperture '00' to '31'
8-9	statusM4	Misc status 4 Av.Picture Lv '00' to '99'
10-11	statusM5	Misc status 5 Contrast '00' to '63'
12-14	statusM6	Misc status 6 Black level '000' to '255'
15	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
16	ETX	End of message (03h)

Misc Status Byte (statusM1)

Hex
 statusM1 30-33
 bit0 0=backlight OFF 1=backlight compensation ON
 bit1 0=pedestal OFF 1=pedestal ON(7.5 IRE) only for NTSC

Misc Status Byte (statusM2) gamma '0' to '7'

Misc Status Word (statusM3) Aperture correction value '00' to '31'

Misc Status word (statusM4) Av.Picture Level '00' to '99'

Misc status (statusM5) Contrast value '00' to '63' (YFADE)

Misc status (statusM6) Black level value '000' to '255'

**TABLE 3j UPLOAD/DownLoad CONFIGURATION RESPONSE MESSAGE
FORMAT**

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type (Camera)
3	'C'	
4	'G' or 'P'	G=get configs(upload) or P= put config (download)
5	30 to 37 hex	30=default 31 to 37 configuration group number
6-80	Parameters	configuration parameters of camera
81	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
82	ETX	End of message (03h)

Parameters

statusWB	01 byte	WB status byte
param1	15 bytes	R,G,B gains, Hue and Saturation
param2	12 bytes	Window weights(6 bytes) and sizes(6 bytes)
statusSI	01 byte	Shutter/Integration status byte
param3	03 bytes	Shutter Mode(1) and Integration time(frcnt=2bytes)
statusGM	01 byte	Gain status byte
param4	03 bytes	gain level
statusID	01 byte	Operator's ID status byte
OperID	24 bytes	24 bytes Operator's ID
param5	01 byte	Zoom magnification factor
param6	02 bytes	Format statusF1 and statusf2
statusM1	01 byte	Miscellaneous status 1
param7	10 bytes	gamma,Aperture, APL, contrast and black level
Total	75 bytes	

Note: See status response message formats for White balance, Sync, Shutter/Integration, Gain, Operator's ID, Iris, Format and Misc. for details of data.

param2 = 6 bytes weights

6 bytes sizes (horizontal h2,h3,h4,h5 and vertical dimensions V3 & V4)

TABLE 3k Window Status RESPONSE MESSAGE FORMAT

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type (Camera)
3	'w'	
4	'F' or 'D'	F=frontlight data or D= default weights/sizes data
5-9	horizParam	horizontal count values h1 to h5
10-14	vertiParam	vertical count values v1 to v5
15-20	weights	weights count values w1 to w6
21	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
22	ETX	End of message (03h)

Parameters

horizParam	5 bytes	Horizontal count values
vertParam	5 bytes	Vertical count values
weights	6 bytes	weights for 6 areas

**TABLE 3L Date and Revision of Camera software status RESPONSE MESSAGE
FORMAT**

BYTE	DATA	DESCRIPTION
0	STX	Start of message
1	ID	Camera address
2	'c'	Message type (Camera)
3	'R'	Date and Revision number status
4-5	month	month of the year
6	'/'	slash
7-8	day	day of the month
9	'/'	slash
10-11	year	year-- 98
12-15	revision	revision number e.g. 02.0
16	CHECKSUM	80H-8FH Least significant nibble is XOR of all previous bytes (LS NIBBLES only) except STX
17	ETX	End of message (03h)

Parameters