

Cohu Protocols

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¹\$Header: d:/TXB-Cohu/RCS/Cohu.tex,v 1.16 2006-08-30 12:31:56-07 Hamilton Exp Hamilton \$

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1 Introduction to the Cohu Protocols

Cohu has many different systems deployed among their various customers. This results in several different versions of their control protocol. Most of it is similar but there are many differences.

A result of the variations in the various active Cohu protocols, is that it is difficult to determine exactly what commands are valid and will need to be translated. This publication has been extracted from various Cohu protocol sources to put in one place some indication of the breadth of the variations in Cohu's protocol suite. An "annotated" index has been provided to give a quick reference as to which sub-protocol is documented to generate each command.

1.1 The Cohu Web Site

Cohu has a helpful web site at www.cohu-cameras.com. This web site has much useful data about the Cohu product line and includes a downloadable GUI, instructions on how to use the GUI, information about their protocols and information about their product line.

When the web site is accessed, select the "Tech Center" option to get to the most interesting page which has pointers to most of their technical documents. The web site does not require "registration" prior to being allowed to access/download information.

A typical abridged version of the Cohu Web Site is in Appendix A, page A-1.

1.2 Basic Types of Cohu Systems

Cohu utilizes several similar protocols to control their line of PTZ units. There are two basic groups of these protocols:

1. The older types of units have fixed speed control in pan/tilt. These include at least the following types:
 - 1.1. MPC-D Mode,
 - 1.2. ER2221B,
 - 1.3. ER2222 and
 - 1.4. 27XX

These type names were obtained by reading the choices of camera types in WinMPC rev 4.703.

2. The newer set of units all have variable speed operation in pan/tilt. These include at least the following types:
 - 2.1. iDome,
 - 2.2. Dome,
 - 2.3. Positioner,
 - 2.4. LCU,
 - 2.5. iView2,
 - 2.6. 36XX and
 - 2.7. 4200

These type names were obtained by reading the choices of camera types in WinMPC rev 4.703.

²\$Header: d:/TXB-Cohu/RCS/Intro.inc,v 1.2 2006-08-25 11:06:21-07 Hamilton Exp Hamilton \$

1.3 Differences Between Various Cohu Systems

In addition to having, or not, variable speed operation other changes include:

1. Number of presets, 10 or 64.
2. Presence of a digitally controlled camera type.

1.4 Cohu Protocol Documents

The net result of this is that Cohu has many variations of their basic protocol. So far the following protocol documents have been downloaded from the Cohu web site.

1. 3500PRO.PDF A modified version of this document is in Section 7, page 87.
2. 3600PRO.PDF This subversion of the protocol did not seem different enough to warrant extracting its information.
3. 3810PRO.PDF This subversion of the protocol did not seem different enough to warrant extracting its information.
4. 3830PRO.PDF This subversion of the protocol did not seem different enough to warrant extracting its information.
5. 3850PRO.PDF A modified version of this document is in Section 5, page 49.
6. IDOMEIVIEWLCUCommPROTOCOL.PDF A modified version of this document is in Section 6, page 61.
7. MPC2221PRO.PDF A modified version of this document is in Section 8, page 107.
8. MPC232PRO.PDF A modified version of this document is in Section 4, page 39.
9. MPC422PRO.PDF A modified version of this document is in Section 3, page 31.

Due to the quantity of differing protocol documents, some customers of Cohu extract a subset of what they expect a Cohu compliant PTZ unit to do and produce their own document. A typical one is this one from Georgia's Department of Transportation: CCTV (REV 8.0) 936 04-18-05 (1).PDF

Cohu provides, on their web site, a GUI (WINMPC) which is configurable to control many of their PTZ systems. On their web site there is an out of date, downloadable manual on how to use it (1032V42.PDF)

1.5 Other Cohu Originated Documentation

Other items on the Cohu web site that are useful in determining how a Cohu system ties together and works are: (More is available, but these seem to be the most relevant.)

1. 1027_R0 (IVIEW).PDF
2. 1032V42.PDF
3. 1037.PDF
4. 1050A.PDF

- 5. 5030.PDF
- 6. 5035.PDF
- 7. 829A.PDF
- 8. 836A.PDF

1.6 Unexpected and Undocumented Commands

Using WinMPC has revealed some unexpected features of the Cohu Protocol. This section also discusses some important design decisions and other general information about the TXB-C project. As far as known/decided these are:

1. Commands may be stacked. I.e. it OK to say stop pan and stop tilt in the same command such as:
`<auto-baud> <address> P S T S <checksum>. (F8 01 PSTS 85)`
 There have been no observed cases where more than two commands have been stacked in the same command unit.
2. To send an “Iris Close” (which is useful in Spectra menu mode) the camera must report that it is in manual iris mode. Since Pelco does not differentiate between auto and manual mode, the status response says that the camera is always in manual mode.
3. It is unclear what the format of pan/tilt/iris/focus responses should be. In the Georgia DOT procurement document it specifies:

Encoding an azimuth position value of decimal 2748_{10} or $0xABC$, we break it up into three nibbles and add $0x30$ to each so:

$$\begin{aligned} A_2 &= 0x3A, \\ A_1 &= 0x3B, \text{ and} \\ A_0 &= 0x3C. \end{aligned}$$

Azimuth data is sent in this order: $A_2A_1A_0$.

When this example is used for pan information, WinMPC displays on the screen: “CBA” which wasn’t as expected. Reversing the order of the bytes as they are sent ($A_0A_1A_2$) results in a display of “ABC”, which is isn’t too much better. (274.8 should have shown up in at least one of the attempts.)

I haven’t seen any indication of where Pan 90° is. Is it East or West of 0° ? There is a short description of how the TXB-C treats this problem here: Section 1.6.1, page 14.

Additionally:

- 3.1. Where is 0° Tilt? Up, Down, horizontal?
- 3.2. How about 90° in tilt? Up, Down, etc.
- 3.3. Same for 180° , 270° .
- 3.4. Does 360° result in an error?

³\$Header: d:/TXB-Cohu/RCS/UnDoc.inc,v 1.11 2006-08-29 12:47:37-07 Hamilton Exp Hamilton \$

Does anything display on the camera screen? And if so how is it numbered? Does it match the readout? (Pelco's does not match for tilt values.)

4. Several undocumented commands have been generated with WinMPC rev 4.703. A table of these commands is in Table 1, page 12.
5. Preset numbering is some what unusual. For starters, on WinMPC presets are numbered from $1 \rightarrow n$, but the actual protocol values start at ASCII 0 (which is really 0x30) (MPC-D mode) or 0x10 (iDome mode).

5.1. With the following: **iDome** Mode, Dome, Positioner, LCU, iView2, 36XX and 4200 choices, the numbering is as follows: (these values were obtained by running WinMPC rev 4.703.) A table of these values is located here: Table 2, page 13.

5.1.1. Presets $1 \rightarrow 47$ it is $0x10 = 1$. $0x11 = 2$, etc., and $0x3E = 47_{10}$. (**Note the gap.**)

5.1.2. Presets $48 \rightarrow 63$ it is $0x60 = 48_{10}$. $0x61 = 49_{10}$, etc., and $0x70 = 64_{10}$.

5.2. With the following: **MPC-D** Mode, ER2221B, ER2222 and 27XX choices, the numbering is as follows: (these values were obtained by running WinMPC rev 4.703.)

5.2.1. Presets $1 \rightarrow 64$ it is $0x30$ ("0", Zero) = 1. $0x31$ ("1", One) = 2, etc., and $0x6F$ ("o", lower case OH) = 64_{10} . (**With no "gaps".**)

If WinMPC has previously run in iDome mode these values are obtained. However if a "fresh" run is being made, then the highest preset # is 10. This probably is indicative of a bug in WinMPC and is not a capability.

6. The results of the above preset logic is that there may be confusion if presets are sent in both modes.

As can be seen from the above the two modes of preset ranges have some conflicts. This is because the MPC-D preset IDs are in the middle of the iDome preset IDs.

Take '0' (0x30), for MPC-D systems this is preset 1 however for iDome systems it is preset 33.

The overall results of this is that it is not possible to uniquely identify some preset IDs. The TXB-C's internal logic makes the following assumptions:

6.1. Communications will be with a MPC-D type of unit that has a total of ten presets, numbered from ASCII 0 through ASCII 9 (0x30 through 0x39).

6.2. If a preset in the iDome range, that does not include the MPC-D range, is detected then the preset mode changes to support only the iDome preset numbering sequence.

6.3. The only way to return to MPC-D mode is to power cycle the TXB-C.

Thus what is preset 5 for an MPC-D user will be preset 38 for a iDome user. And there is no way to notify the user of this problem.

7. So far there is nothing uniquely identified as being sent out by WinMPC to indicate which type of unit it is talking to.

8. For putting a label on a preset the following command string is sent:

The label is blank padded and for camera 1 preset 1 has a default label of:

"Preset_1" (24 characters total)

```
f8 01 64 50 10 50 72 65 73 65 74 20 31 20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 81
```

9. When a command is received and ACKed, WinMPC assumes that the function works. I.e. when commands for “Manual Color”, and “Manual Integration”, are sent, then WinMPC enables those sections of the GUI. This happens even if a query is sent that indicates those functions are not there.
10. There are some indications that the checksum is not checked by WinMPC.
11. When using WinMPC rev 4.703, there are two modes of operation that may be selected with the “**Camera Setup**” option on the main menu. They are:
 - 11.1. **PC to MPC Master:** This is the method of communication to a Master Control Unit. In this mode messages are framed with an STX/ETX character pair (0x02/0x03). Inside the two delimiters the only difference in the command is that there is no “auto baud” character used. In this mode WinMPC ignores the replies and reports a “**Com Error**”. The commands are decoded transparently by the TXB-C, however it appears that a problem is occurring because of the internal bug of WinMPC.
 - 11.2. **PC to MPC Receiver:** This is the method of communication to the dome. In this mode an “auto baud” character (0xF8) is sent as the first byte of a message and the last byte of the message is a checksum. In this mode everything seems to work correctly. It is the default mode of operation of WinMPC.

Command	Description/use
dpE	In the Set ID Display/Azimuth Elevation menu, selects Enable
dpD	In the Set ID Display/Azimuth Elevation menu, selects Disable
dpt	In the Set ID Display/Azimuth Elevation menu, selects Permanent
dpT	In the Set ID Display/Azimuth Elevation menu, selects TimeOut
dNE	In the Set ID Display/Direct Display menu, selects Enable
dND	In the Set ID Display/Direct Display menu, selects Disable
dNt	In the Set ID Display/Direct Display menu, selects Permanent
dNT	In the Set ID Display/Direct Display menu, selects TimeOut
dNI	In the Set ID Display selects Grouped with IDs
dNi	In the Set ID Display selects Separated from IDs
mNs	In the North Direction selects Set
mNc	In the North Direction selects Clear
mNO	In the North Direction selects Set 8 Zones
mN1	In the North Direction selects Set 16 Zones
mNE	On the main display in the NTCIP Features, selects Enable NTCIP Mode
mND	On the main display in the NTCIP Features, selects Disable NTCIP Mode . An NTCIP Protocol message is sent which followed by the Cohu protocol command. 54 byte message sent in NTCIP Protocol: 7e 05 13 c1 30 2d 02 01 00 04 06 70 75 62 6c 69 63 a3 20 02 01 00 02 01 00 02 01 00 30 15 30 13 06 0e 2b 06 01 04 01 89 36 03 1d 01 06 01 02 0a 02 01 03 d3 ee 7e Followed by this command sent in Cohu Protocol: f8 01 6d 4e 44 86 (mND)
L?H	On the main display in Camera, is used to determine what the camera's address is.

Table 1. Known undocumented commands

Protocol	Preset #	Protocol	Preset #	Protocol	Preset #	Protocol	Preset #
0x10	1 ₁₀	0x20	17 ₁₀	0x30	33 ₁₀	0x61	49 ₁₀
0x11	2 ₁₀	0x21	18 ₁₀	0x31	34 ₁₀	0x62	50 ₁₀
0x12	3 ₁₀	0x22	19 ₁₀	0x32	35 ₁₀	0x63	51 ₁₀
0x13	4 ₁₀	0x23	20 ₁₀	0x33	36 ₁₀	0x64	52 ₁₀
0x14	5 ₁₀	0x24	21 ₁₀	0x34	37 ₁₀	0x65	53 ₁₀
0x15	6 ₁₀	0x25	22 ₁₀	0x35	38 ₁₀	0x66	54 ₁₀
0x16	7 ₁₀	0x26	23 ₁₀	0x36	39 ₁₀	0x67	55 ₁₀
0x17	8 ₁₀	0x27	24 ₁₀	0x37	40 ₁₀	0x68	56 ₁₀
0x18	9 ₁₀	0x28	25 ₁₀	0x38	41 ₁₀	0x69	57 ₁₀
0x19	10 ₁₀	0x29	26 ₁₀	0x39	42 ₁₀	0x6A	58 ₁₀
0x1A	11 ₁₀	0x2A	27 ₁₀	0x3A	43 ₁₀	0x6B	59 ₁₀
0x1B	12 ₁₀	0x2B	28 ₁₀	0x3B	44 ₁₀	0x6C	60 ₁₀
0x1C	13 ₁₀	0x2C	29 ₁₀	0x3C	45 ₁₀	0x6D	61 ₁₀
0x1D	14 ₁₀	0x2D	30 ₁₀	0x3D	46 ₁₀	0x6E	62 ₁₀
0x1E	15 ₁₀	0x2E	31 ₁₀	0x3E	47 ₁₀	0x6F	63 ₁₀
0x1F	16 ₁₀	0x2F	32 ₁₀	0x60	48 ₁₀	0x70	64 ₁₀

Table 2. Extended Preset Values

Command	Data	Response
Pan/Tilt Position Request	“P?”	ACK + Pan/Tilt Response (Table 14, page 28)
Pan/Tilt Goto Command	“pA ₂ A ₁ A ₀ E ₂ E ₁ E ₀ ”	ACK
Zoom/Focus Position Request	“V?”	ACK + Zoom/Focus Response
Zoom/Focus Goto Command	“vZ ₂ Z ₁ Z ₀ F ₂ F ₁ F ₀ ”	ACK (Table 15, page 28)

Table 3. Position Commands

1.6.1 Position Encoding

The message data for the “Pan/Tilt Goto Command” above begins with an ASCII ‘p’ followed by the azimuth ($A_2A_1A_0$) and elevation ($E_2E_1E_0$) positions. The positions are 12-bit values encoded four-bits each in the least significant nibbles of the three bytes whose most significant nibbles are always 0x30. The subscript-2 indicates the byte containing the most significant bytes of the position and subscript-0 indicates the least significant.

1.6.1.1 Position Encoding Example:

(This information comes from the GA DOT document.)

Encoding an azimuth position value of decimal 2748_{10} or 0xABC, we break it up into three nibbles and add 0x30 to each so:

$$\begin{aligned} A_2 &= 0x3A, \\ A_1 &= 0x3B, \text{ and} \\ A_0 &= 0x3C. \end{aligned}$$

The same encoding scheme is used for the zoom and focus positions in the “Zoom/Focus Goto Command”.

1.6.2 Pan/Tilt Positions

Pan readouts are based on the CAL_0 (North or 0°) value of the PTZ. Angular readouts then increment to 90° (East), 180° (South) and to 270° (West) when looking down on the PTZ unit from above.

Tilt readouts are based on the horizon, with 0° meaning that the PTZ is looking at the horizon. As the PTZ points down the protocol readout changes to 45° and then 90° when the PTZ is pointing straight down. The PTZ on-screen display will indicate - 45° and then -90°. The discrepancy in the two types of readouts is that the protocol value is unsigned and the on-screen is signed. As tilt passes through straight down (not physically possible, but conceptually convenient, the protocol values increment until a straight up readout is 270° and the on-screen display shows 90°. At 45° above the horizon the protocol readout will be 315° and the on-screen display will be 45°. Here is a short table (Table 4, page 14) and a figure (Figure 1, page 15) to attempt and explain these values.

Position	D readouts	Displays as
90° up	270	90
45° up	315	45
Horizontal - 1°	359	1
Horizontal	0	0
45° down	45	-45
90° down	90	-90

Table 4. Protocol readouts *vs.* On-screen tilt readouts

Note

1. **Position:** Pointing direction of the enclosure/camera.
2. **D readouts:** D protocol returned value for this angle.
3. **Displays as:** What is displayed on the Spectra screen.

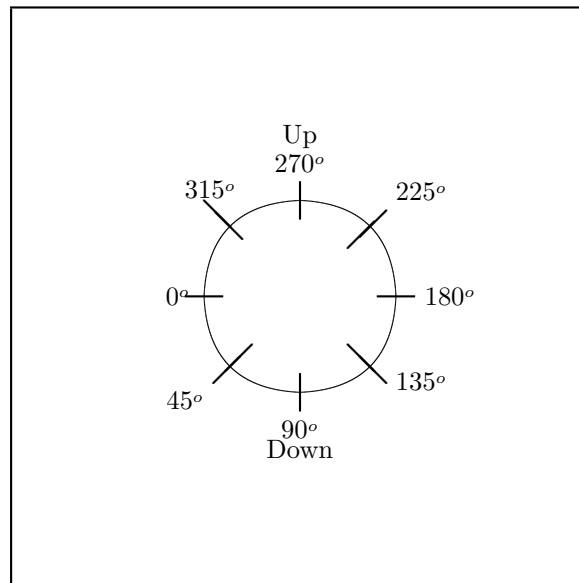


Figure 1. D Protocol Tilt Readout Positions

1.7 Notes on using WinMPC

WinMPC is a Windows based GUI (Glass Keyboard) from Cohu. The version used during development of the TXB-Cohu was rev 4.703 and was obtained from the Cohu web site. It consists of a single executable (.EXE) module which self installs on a PC. It has been used on Windows 98 SE and Windows XP and gives about the same level of performance.

Cohu provides a manual, which is slightly out of date, (1032V42.PDF) on how to use it.

Through use of the WinMPC program, several unexpected problems have been discovered. Some of these are:

1. Whenever “**Camera Setup**” is accessed from the main menu, the program sends a “**reset camera**” (RS) command to the camera.
2. Often times the program seems to get “locked up” sending “queries” to the camera. Usually by “clicking” on the “**status**” button on the main display it will stop doing that, in some cases the “**status**” button must be clicked twice. In a few cases clicking does no good at all.
3. Near the bottom of the main menu, there is a display of what the GUI is sending out (Tx) and receiving back in (Rx). The format is very convenient, but unexpected.

A typical transmit command would display as: **F8_01_cDS_85**⁴

- **F8**: This is the “auto baud” character that is the first byte of all commands except for single byte ACKs. It is displayed in hex.
- **01**: This is the camera address that this command is being sent to. It is displayed in hex.
- **cDS**: This is the actual command being sent to the camera. It is displayed in ASCII. In this example if it was being displayed in hex, the display would be **63 44 53**.
- **85**: This is the checksum. It is displayed in hex.

An ACK is displayed as “**Ack**”.

4. When first started, the GUI, send nothing out to the camera until the program user tells it to.
5. When the GUI “locks up” sending a command, the only way out is to get out of the program and restart.
6. The GUI does “remember” the last camera, etc., set up data that was selected.
7. The “log” function does work, however it stops logging the first time that an error is detected. Errors are indicated on the screen by having the red “LED” marked **Comm Error** turn on.
8. The only way of getting the **Comm Error** LED to turn off, is to receive a good message or an ACK from the camera. (Or restarting the GUI.)
9. **Lens Function Control** items do not become activated until a reply is received from the camera that indicates that function is present. The only exception for this is that **Zoom** is always turned on.

⁴The response from the TXB-C, as of 25AUG06, is

F8 01 63 57 30 53 30 59 30 4D 31 44 30 4C 37 41 30 58 30 48 49 50 30 76 30 70 30 46 6F 73 6F 86 or
<auto baud> <Camera Address> c W O S O Y O M 1 D O L 7 A O X O H I P O v O p O F o s o <CKSM>.

10. Since different cameras have different capabilities, options in **Latch Commands** are sometimes enabled and sometimes “grayed out”. If a specific latch function is desired, fool around with the choices in **Camera Setup** to find a camera type that uses that latch function.

The TXB-C always returns a status command to the L? command (L7A0) that says:

- The Iris is in Manual mode,
 - The Lens is in Fast mode,
 - That the Camera is Powered on and
 - That all three Auxes are turned off.
11. After looking a long time, there is no specific command string that is sent from the GUI to indicate which type of camera it thinks that it is talking to. The most that happens is that if an iDome type is being addressed, then variable speed commands are sent and if a MPC type dome is being accessed then the commands are fixed speed types.
 12. Sometimes the GUI will change the camera address from whatever it used to be to 0xFF. The way to get out of this is to click the **Reset** and then the **Find** buttons and let the GUI reacquire the correct address.

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2 GA DOT, CCTV Standard Protocol

2.1 General

Use⁶ the NaviGator Standard CCTV Control Protocol (hereinafter called the “CCTV standard protocol” or “standard protocol”) for CCTV system control communications between the user control interface unit and the NaviGator central system. Implement the standard protocol as specified in this subsection for all CCTV equipment installed on this project. The CCTV standard protocol governs all control communications between the NaviGator central system (hereinafter called the “host”) and the CCTV system.

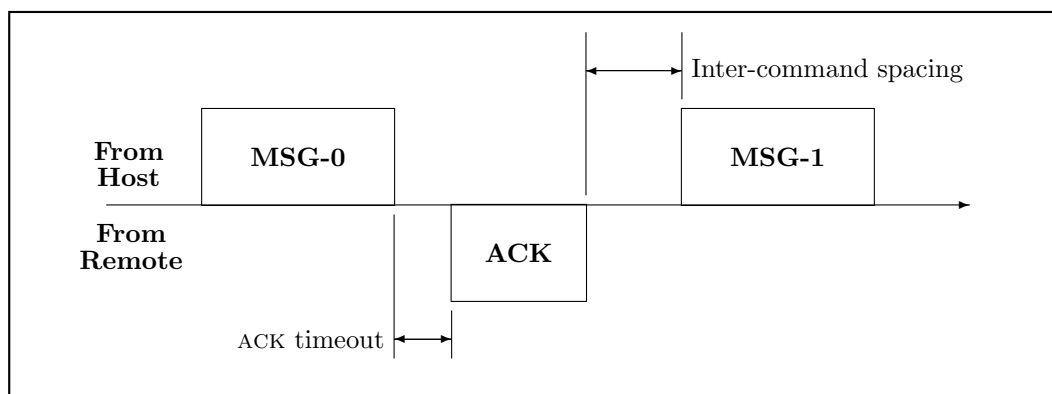
2.2 Interface

The remote shall communicate using the CCTV standard protocol over an RS-232 serial interface. Data is transmitted using 1 start bit, 8 data bits, and 1 stop bit (no parity) at a baud rate of 9600.

Each remote shall be identified by a unique integer address between 1 and 233₁₀ (*This is probably an error, it should probably read 223₁₀.*). This address is set during installation and shall not be altered using the standard protocol. The address is included in messages to identify the intended recipient of commands from the host and responses from the remote.

2.3 Message Sequence

All communication between the host and the remote is initiated by the host. The remote shall not transmit except in response to a properly formatted message from the host addressed to the remote’s assigned address. The remote shall respond to such messages with an ACK (a single ASCII character 0x06) within 500 milliseconds (“ACK timeout”). The remote shall be ready to receive and process another command in as little as 150 milliseconds after the ACK is transmitted (“Inter-command spacing”). Figure 2, page 19 depicts this sequence.



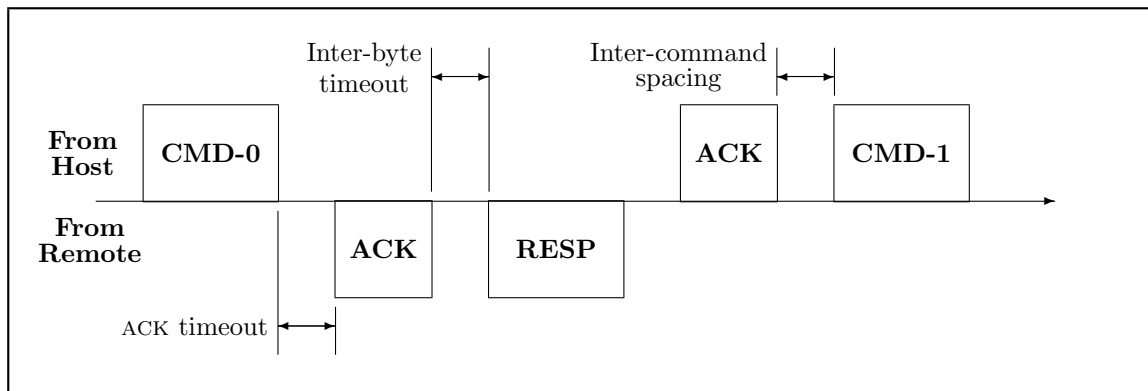
\$RCSfile: BMS.inc,v \$

Figure 2. Basic Message Sequence

⁵\$Header: d:/TXB-Cohu/RCS/GaCohu.inc,v 1.14 2006-08-29 10:15:17-07 Hamilton Exp Hamilton \$

⁶This document was derived from the Georgia Department of Transportation solicitation: “CCTV (Rev 8.0) 936 04-18-05 (1).pdf”

Some messages from the host require a subsequent response message from the remote. In this case, the remote's ACK shall be followed immediately by a response message. When the host receives the properly formatted response, it will transmit an ACK back to the remote⁷. This sequence is depicted in Figure 3, page 20. The timing constraints presented above apply. Additionally, the host will wait a maximum of 500 milliseconds for each byte in the response message ("Inter-byte timeout").



\$RCSfile: RMS.inc,v \$

Figure 3. Response Message Sequence

2.4 Message Format

Command and response messages shall be formatted as shown in Table 5, page 20.

Size	Data	Description
1 byte	0xF8	Message header
1 byte	Address	Controller address (0x01 to 0xDF)
2+ bytes	Message	Data (see Command and Response Message sections (Section 2.5, page 21 and Section 2.7, page 28))
1 byte	Checksum	0x80 to 0x8F (Section 2.4.1, page 20)

Table 5. Message Format

Messages start with a single-byte header followed by a single-byte address. Two or more message data bytes follow the address. The message is terminated with a single-byte checksum.

2.4.1 Checksum Calculations

The message checksum byte is defined as the least significant nibble of the exclusive-or of all previous bytes in the message (excluding the 0xF8 header) added to 0x80. The resulting byte will be between 0x80 and 0x8F inclusive.

⁷ There is no requirement to resend a message that does not get an ACK, but these ACK's must be ignored.

2.4.1.1 Checksum Example

- The bytes of a “Pan Left” command addressed to controller 1 would be:
0xF8 0x01 0x50 0x4C 0x??
- The bitwise exclusive-or of the bytes between the 0xF8 header and the checksum comes out to 0x1D:
 $0x01 \oplus 0x50 \oplus 0x4C = 0x1D$
- Adding the least significant nibble to 0x80, we get 0x8D for the checksum byte:
 $0x80 \mid (0x0F \& 0x1D) = 0x8D$
- The resulting 5-byte command would be:
0xF8 0x01 0x50 0x4C 0x8D

2.5 Command Messages

The tables included present the message data contained within command messages sent by the host to the remote. In most cases (exceptions will be noted), the “Data” column contains the ASCII characters of the message data to be sent. For example, the Pan Left command data is “PL”, an ASCII ‘P’ (0x50) followed by an ASCII ‘L’ (0x4C).

An “ACK”⁸ in the “Response” column indicates no response message is expected from the remote beyond the ACK itself as shown above in Figure 2, page 19. An “ACK + * Response” indicates the ACK from the remote is to be followed by the specified response message as shown above in Figure 3, page 20.

Command	Length	Data	Response
Pan Left	5	“PL”	ACK
Pan Right	5	“PR”	ACK
Pan Stop	5	“PS”	ACK
Tilt Up	5	“TU”	ACK
Tilt Down	5	“TD”	ACK
Tilt Stop	5	“TS”	ACK
Zoom In	5	“ZI”	ACK
Zoom Out	5	“ZO”	ACK
Zoom Stop	5	“ZS”	ACK
Focus Near	5	“FN”	ACK
Focus Far	5	“FF”	ACK
Focus Stop	5	“FS”	ACK
Iris Open	5	“IO”	ACK
Iris Close	5	“IC”	ACK
Iris Stop	5	“IS”	ACK

Table 6. Momentary Commands

⁸ This ACK (0x06) is a standard ASCII control byte. There is also another ASCII control byte of NAK (0x15) which is not to be used. It is defined in other Cohu Documents.

Command	Length	Data	Response
Manual Iris Toggle	5	“LM”	ACK
Camera Power Toggle	5	“LP”	ACK
Lens Speed Toggle	5	“LL”	ACK
Latch Status Request	5	“L?”	ACK + Latch Response (Table 16, page 29)

Table 7. Latch Commands

Command	Length	Data	Response
Goto Preset 0 $\rightarrow$ 9	5	“H0” $\rightarrow$ “H9”	ACK (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9)
Store Preset 0 $\rightarrow$ 9	5	“P0” $\rightarrow$ “P9”	ACK (P0, P1, P2, P3, P4, P5, P6, P7, P8, P9)
Preset Status Request	5	“H?”	ACK + Preset Response (Table 17, page 29)

Table 8. Preset Commands

2.6 Queries and their Responses

All of this data is repeated where it logically appears (according to the original document).

2.6.1 Latch Query and its Response

Command	Length	Data	Response
Latch Status Request	5	“L?”	ACK + Latch Response (Table 16, page 29)
Latch Response	7	“LD ₁ AD ₀ ”	
	1	“L”	Data ID
	1	$D_1 = 0x30 \text{ to } 0x38$	The bits of D_1 , the second byte in the data, indicate: (L0, L1, L2, L3, L4, L5, L6, L7, L8) 0: Iris Auto(0) or Manual(1) 1: Camera Power Off(0) or On(1) 2: Lens Speed Slow(0) or Fast(1) 3: Comm. Error No(0) or Yes(1) 4: (always 1) 5: (always 1) 6: (always 0) 7: (always 0)
	1	“A”	Data ID
	1	$D_0 = 0x30 \text{ to } 0x37$	The bits of D_0 , the fourth byte in the data, indicate: (A0, A1, A2, A3, A4, A5, A6, A7) 0: Aux-1 Off(0) or On(1) 1: Aux-2 Off(0) or On(1) 2: Aux-3 Off(0) or On(1) 3: (always 0) 4: (always 1) 5: (always 1) 6: (always 0) 7: (always 0)

Table 9. Command “Latch Query” and its Response

2.6.2 Preset Status Query and its Response

Command	Length	Data	Response
Preset Status Request	5	“H?”	ACK + Preset Response (Table 17, page 29)
Preset Response	5	“HD ₀ ”	D ₀ is a single ASCII character indicating:
	1	“H”	Data ID ‘0’ → ‘9’: at the indicated preset H0, H1, H2, H3, H4, H5, H6, H7, H8, H9) ‘A’: (HA) Active, going to a preset ‘I’: (HI) Inactive, not at a preset ‘E’: (HE) Error, unable to get to preset

Table 10. Command “Preset Status Query” and its Response

2.6.3 Pan/Tilt Query and its Response

Command	Length	Data	Response
Pan/Tilt Position Request	5	“P?”	ACK + Pan/Tilt Response (Table 14, page 28)
Pan/Tilt Position Response	10	“PA ₂ A ₁ A ₀ E ₂ E ₁ E ₀ ”	Using the same data encoding as Pan/Tilt Goto Command described earlier. Note: (see Position Encoding above) while the command uses a lower-case ‘p’, the response uses an upper-case ‘P’)
	1	“P”	Data ID
	3	A ₂ A ₁ A ₀	Azimuth data
	3	E ₂ E ₁ E ₀	Elevation data

Table 11. Command “Pan/Tilt Query” and its Response

2.6.4 Zoom/Focus Query and its Response

Command		Length	Data	Response
Zoom/Focus Request	Position	5	“V?”	ACK + Zoom/Focus Response
Zoom/Focus Response	Position	10	“VZ ₂ Z ₁ Z ₀ F ₂ F ₁ F ₀ ”	Using the same data encoding as Zoom/Focus Goto Command described (see Position Encoding above) earlier. Note: while the command uses a lower-case ‘v’, the response uses an upper-case ‘V’)
		1	“V”	Data ID
		3	Z ₂ Z ₁ Z ₀	Zoom position
		3	F ₂ F ₁ F ₀	Focus position

Table 12. Command “Zoom/Focus Query” and its Response

2.6.5 Position Encoding

The message data for the “Pan/Tilt Goto Command” above begins with an ASCII ‘p’ followed by the azimuth ($A_2A_1A_0$) and elevation ($E_2E_1E_0$) positions. The positions are 12-bit values encoded four-bits each in the least significant nibbles of the three bytes whose most significant nibbles are always 0x30. The subscript-2 indicates the byte containing the most significant bytes of the position and subscript-0 indicates the least significant.

2.6.5.1 Position Encoding Example:

Encoding an azimuth position value of decimal 2748₁₀ or 0xABC, we break it up into three nibbles and add 0x30 to each so:

$$\begin{aligned} A_2 &= 0x3A, \\ A_1 &= 0x3B, \text{ and} \\ A_0 &= 0x3C. \end{aligned}$$

The same encoding scheme is used for the zoom and focus positions in the “Zoom/Focus Goto Command”.

Command	Data	Response
Pan/Tilt Position Request	“P?”	ACK + Pan/Tilt Response (Table 14, page 28)
Pan/Tilt Goto Command	“pA ₂ A ₁ A ₀ E ₂ E ₁ E ₀ ”	ACK
Zoom/Focus Position Request	“V?”	ACK + Zoom/Focus Response
Zoom/Focus Goto Command	“vZ ₂ Z ₁ Z ₀ F ₂ F ₁ F ₀ ”	ACK (Table 15, page 28)

Table 13. Position Commands

2.6.6 Pan/Tilt Positions

Pan readouts are based on the CAL_0 (North or 0°) value of the PTZ. Angular readouts then increment to 90° (East), 180° (South) and to 270° (West) when looking down on the PTZ unit from above.

Tilt readouts are based on the horizon, with 0° meaning that the PTZ is looking at the horizon. As the PTZ points down the protocol readout changes to 45° and then 90° when the PTZ is pointing straight down. The PTZ on-screen display will indicate - 45° and then -90°. The discrepancy in the two types of readouts is that the protocol value is unsigned and the on-screen is signed. As tilt passes through straight down (not physically possible, but conceptually convenient, the protocol values increment until a straight up readout is 270° and the on-screen display shows 90°. At 45° above the horizon the protocol readout will be 315° and the on-screen display will be 45°. Here is a short table to attempt and explain these values.

Position	D readouts	Displays as
90° up	270	90
45° up	315	45
Horizontal - 1°	359	1
Horizontal	0	0
45° down	45	-45
90° down	90	-90

Note

1. **Position:** Pointing direction of the enclosure/camera.
2. **D readouts:** D protocol returned value for this angle.
3. **Displays as:** What is displayed on the Spectra screen.

2.7 Response Messages

In Table 14, page 28 through Table 17, page 29, presents the message data contained within response messages sent by the remote to the host.

Message	Data	Comment
Pan/Tilt Position Response	"PA ₂ A ₁ A ₀ E ₂ E ₁ E ₀ "	Using the same data encoding as Pan/Tilt Goto Command described earlier. Note: (see Position Encoding above) while the command uses a lower-case 'p', the response uses an upper-case 'P')

Table 14. Pan/Tilt Response Messages

Message	Data	Comment
Zoom/Focus Position Response	"VZ ₂ Z ₁ Z ₀ F ₂ F ₁ F ₀ "	Using the same data encoding as Zoom/Focus Goto Command described Note: see Position Encoding above) earlier. (note: while the command uses a lower-case 'v', the response uses an upper-case 'V')

Table 15. Zoom/Focus Response Messages

While the remote is going to a position as a result of a "Pan/Tilt Goto", "Zoom/Focus Goto", or "Preset Goto" command, "Preset Responses" will return 'A' in the D_0 byte (HA). If the remote is unable to get to the position in the "Goto command" (i.e. the pan/tilt assembly reaches the mechanical stops), the "Latch Response" will return 'E' in the D_0 byte (HE).

Message	Data	Comment
Latch Response	$\text{"LD}_1\text{AD}_0\text{"}$ $D_1 = 0\text{x}30 \text{ to } 0\text{x}38$	The bits of D_1 , the second byte in the data, indicate: (L0, L1, L2, L3, L4, L5, L6, L7, L8) 0: Iris Auto(0) or Manual(1) 1: Camera Power Off(0) or On(1) 2: Lens Speed Slow(0) or Fast(1) 3: Comm. Error No(0) or Yes(1) 4: (always 1) 5: (always 1) 6: (always 0) 7: (always 0)
	$D_0 = 0\text{x}30 \text{ to } 0\text{x}37$	The bits of D_0 , the fourth byte in the data, indicate: (A0, A1, A2, A3, A4, A5, A6, A7) 0: Aux-1 Off(0) or On(1) 1: Aux-2 Off(0) or On(1) 2: Aux-3 Off(0) or On(1) 3: (always 0) 4: (always 1) 5: (always 1) 6: (always 0) 7: (always 0)

Table 16. Latch Response Messages

Message	Data	Comment
Preset Response	$\text{"HD}_0\text{"}$	D_0 is a single ASCII character indicating: ‘0’ $\rightarrow$ ‘9’:at the indicated preset (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9) ‘A’: (HA) Active, going to a preset ‘I’: (HI) Inactive, not at a preset ‘E’: (HE) Error, unable to get to preset

Table 17. Preset Response Messages

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3 MPC System RS-422 Interface

3.1 General Description

The MPC¹⁰ Master Control Panel contains an 8031 microcomputer with on-board UART for RS-422 communications with MPC Remote Control Panels and MPC Control Receivers and RS-232 for communications with a Host Computer. (The RS-232 interface is described in publication **6X-5030**.)

This section supplies the details necessary to understand RS-422 communications between the MPC Master and Control Receivers as used in the camera control system (Figure 4, page 32).

3.2 Message Format

Any time a command message is sent from the MPC Master Control Panel to a Control Receiver, the Receiver will respond with an ACK or an NAK (Figure 4, page 32). Data is transmitted using 1 start bit, 8 data bits, and 1 stop bit (no parity). The baud rate is set using the monitor 97 function as an entry code. It is typically set to 9600 baud. This process is described in the installation instructions of the Control Panel manual.

The commands are sent using the command message format show in Section 3.6.1, page 32. The various commands that may be transmitted are listed in Section 3.6.2, page 33.

1. If the command message contains a latch function command, then the latch status response (Section 3.6.3, page 34, Format of Latch Status Response) will be sent back to the Master Control Panel.
2. If the command message contains a home function command, then the home status response (Section 3.6.3, page 34, Format of Home Status Response from MPC) will be sent back to the Master Control Panel.
3. If the command is a position message, the response will be as shown in Section 3.6.4, page 35.
4. If the command message contains only a momentary function, no further response beyond the ACK or NAK will occur.
5. If the command message contains a communications error (e.g., an address to a non-existent control receiver or a failure in the communications system), then the command error message response (in Section 3.6.3, page 34, with B3 of byte 3 equal to 1) will be sent back.
6. Section 3.6.5, page 36 gives the ID message format for communications from the master control panel to a control receiver. An ACK or NAK is returned.

3.3 Maintenance

No maintenance adjustments are required for the RS-422 circuits on the processor board.

3.4 Parts List

Refer to the processor board for parts identifications.

⁹\$Header: d:/TXB-Cohu/RCS/422Pro.inc,v 1.13 2006-08-24 14:43:13-07 Hamilton Exp Hamilton \$

¹⁰This document was derived from Cohu's document: "mpc422pro.pdf"

3.5 Schematic Diagrams

Refer to the processor board for the schematic diagram.

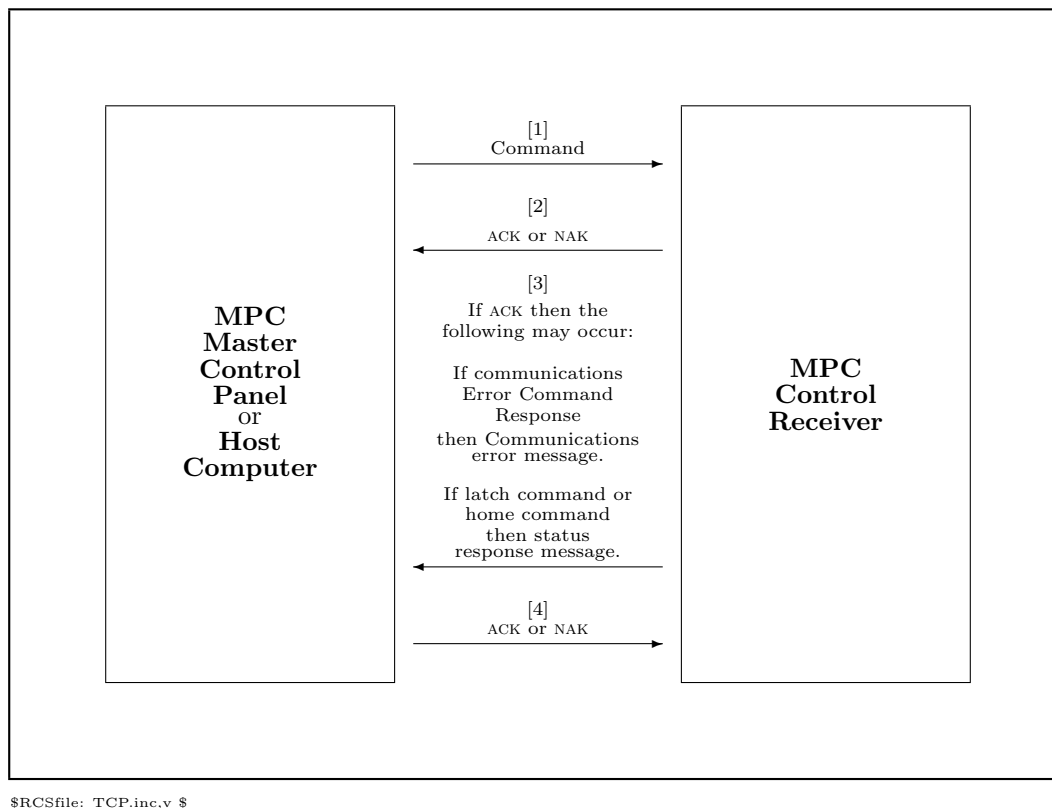


Figure 4. Typical Communications Protocol (Similar to the one in Cohu Document 6X-5035)

3.6 Commands and Responses

3.6.1 RS-422 Command Message Format

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in hex	Camera address (0x01 to 0xDF)
2 to $2n + 1$	Command Data	See Section 3.6.2, page 33
$2n + 2$	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

Note

n is the number of commands in the message.

3.6.2 RS-422 Command Data

Momentary		
Reset Control Receiver	“rs”	
Pan Left	“PL”	
Pan Right	“PR”	
Pan Stop	“PS”	
Tilt Up	“TU”	
Tilt Down	“TD”	
Tilt Stop	“TS”	
Zoom In	“ZI”	
Zoom Out	“ZO”	
Zoom Stop	“ZS”	
Focus Near	“FN”	
Focus Far	“FF”	
Focus Stop	“FS”	
Iris Open	“IO”	
Iris Close	“IC”	
Iris Stop	“IS”	
P/T Position Request	“P?”	
P/T Goto Command	“pA ₂ A ₁ A ₀ E ₂ E ₁ E ₀ ”	See Section 3.6.4, page 35 for position format
Lens Position Request	“V?”	
Lens Goto Command	“vA ₂ A ₁ A ₀ E ₂ E ₁ E ₀ ”	
Latch		
Manual Iris Toggle	“LM”	
Camera Power Toggle	“LP”	See Section 3.6.3, page 34 for response format
Lens Speed Toggle	“LL”	
Latch Status Request	“L?”	
Aux Functions (Option 1)	“L1” → “L3”	Toggles Aux 1, Aux 2, or Aux 3
Color Balance (Option 2)	“L1”	Select auto/Manual Mode
Increase Blue	“B1”	
Increase Red	“B2”	
Balance Stop	“B0”	
Home		
Home Position Goto Pre-set 0 → 9	“H0” → “H9”	A home active HA will be immediate response. Later a home position H0 to H9 or home error HE will be generated. (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9)
<i>Continued on the next page.</i>		

<i>Continued from the previous page.</i>		
Home Position Store Program 0 → 9	“P0” → “P9”	(P0, P1, P2, P3, P4, P5, P6, P7, P8, P9)
Home Position Status Request	“H?”	Will generate a home status response See Section 3.6.3, page 34

Note

Commands consist of the ASCII codes for the two letters shown:

- “rs” = ASCII codes for “r” and “s”
- “PL” = ASCII codes for “P” and “L”, etc.

3.6.3 RS-422 Response Message

3.6.3.1 Format of Latch Status Response from MPC Control Receiver

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	L	Latch Status
3	0x30 to 0x37 or 0x38	LS nibble is four bits of status (Comm error) Bit Value 0/1 B_0 = Iris Auto/Manual B_1 = Camera power Off/On B_2 = Lens Speed Slow/Fast B_3 = Communications Error No/Yes (L0, L1, L2, L3, L4, L5, L6, L7, L8)
4	A	Aux Status
5	0x30 to 0x37	LS nibble is four bits of status Bit Value 0/1 B_0 = Aux 1 B_1 = Aux 2 B_2 = Aux 3 (A0, A1, A2, A3, A4, A5, A6, A7)
6	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

3.6.3.2 Format of Home Status Response from MPC Control Receiver

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	H	Home Status
3	0 → 9	ie, 2 = Home position 2 (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9)
	A I E	(HA) Home active (HI) Not-at-Home position, or active (HE) Home error — could not get to home position
4	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

3.6.4 MPC Position Message**3.6.4.1 Format of Pan/Tilt Position Message**

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	P p	Upper case P is response Lower case p is Goto command
3	A ₂	(MS nibble)
4	A ₁	Azimuth position (See Notes)
5	A ₀	(LS nibble)
6	E ₂	(MS nibble)
7	E ₁	Elevation position (See Notes)
8	E ₀	(LS nibble)
9	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

3.6.4.2 Format of Zoom/Focus Position Message

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	V v	Upper case V is response Lower case v is Goto command
3	A ₂	(MS nibble)
4	A ₁	Zoom position (See Notes)
5	A ₀	(LS nibble)
6	E ₂	(MS nibble)
7	E ₁	Focus position (See Notes)
8	E ₀	(LS nibble)
9	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

Note

The 12-bit position data is contained in nibbles 0 $\rightarrow$ 2, with nibble 0 = $b_0 \rightarrow b_3$, nibble 1 = $b_4 \rightarrow b_7$, and nibble 2 = $b_8 \rightarrow b_{11}$. The nibble is then added to 0x30 to produce a value from 0x30 to 0x3F.

Example: Azimuth data $b_0 \rightarrow b_3$ is expressed as A_0 (azimuth nibble 0)

3.6.5 ID Message Format

3.6.5.1 Format of Select Mode Message

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	d	Display message
3	M	(dM) Mode select
4	M I	(dMM) Menu mode (dMI) ID mode
5	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

3.6.5.2 Format of ID Enable/Disable Message

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	d	Display message
3	I	(dI) ID display
4	D E	(dID) Disable ID display (dIE) Enable ID display
5	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

3.6.5.3 Format of ID Clear Screen Message

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	d	Display message
3	C	(dC) Clear screen
4	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

3.6.5.4 Format of Select ID Top Message

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	d	Display message
3	I	(dI) ID display
4	T	(dIT) ID at top
5	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

3.6.5.5 Format of Select ID Bottom Message

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	d	Display message
3	I	(dI) ID display
4	B	(dIB) ID at bottom
5	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

3.6.5.6 Format of Update Line Message

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	d	Display message
3	L	(dL) Line of text
4	1 → <	(0x31 → 0x3C) Line number (1 → 12) + 0x30 (dL1, dL2, dL3, dL4, dL5, dL6, dL7, dL8, dL9, dL:, dL;, dL<)
5	(ID text)	ASCII characters (up to 24) for the line starting with the left most character
N	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

3.6.5.7 Format of Alarm Display Message

Byte	Data	Description
0	0xF8	Autobaud character
1	Address in Hex	Camera address (0x01 to 0xDF)
2	d	Display message
3	A	(dA) Alarm message
4	1 → 3	(0x31 → 0x33) Display line number (1 → 3) + 0x30 (dA1, dA2, dA3)
5	B	Blink alarm message (dA1B, dA2B, dA3B)
	E	Enable alarm message (dA1E, dA2E, dA3E)
	D	Disable alarm message (dA1D, dA2D, dA3D)
6	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS nibble only) except 0xF8

Note

For all messages from master control panel to control receiver, ACK or NAK is returned¹¹.

¹¹ACK (0x06) is a standard ASCII control byte as is NAK (0x15).

4 MPC System RS-232 Interface

Document: 6X-5030

January 10, 1994

Rev 1. 7-26-94

Rev 2. 2-13-95

4.1 General Description

The MPC¹³ Master Control Panel contains an 8031 microcomputer with on-board UART and RS-232 interface circuitry for communications with other MPC control panels, control receivers, and a Host Computer.

This section supplies the details necessary to understand RS-232 communications between the Host Computer and the MPC Master Control Panel as used in the Camera control system (Figure 5, page 40).

4.2 Message Format

Anytime a command message is sent from the Host Computer to the MPC Master Control Panel, the MPC Master will respond with an ACK or an NAK¹⁴ (Figure 5, page 40). Data is transmitted using 1 start bit, 8 data bits, and 1 stop bit (no parity). The baud rate is set by a DIP switch located on the RS-232 board. It is typically set to 9600 baud.

The commands are sent using the command message format show in Section 4.5.1, page 40.

The various commands that may be transmitted are listed in Section 4.6, page 41.

If the command message contains a latch function command, then the latch status response (Section 4.7.1, page 43, Format of Latch Status Response) will be sent back to the Host Computer. If the command message contains a home function command, then the home status response (Section 4.7.2, page 43, Format of Home Status Response from MPC) will be sent back to the Host Computer.

If the command is a position message, the response will be as shown in Section 4.8, page 44.

If the command message contains only a momentary function, no further response beyond the ACK or NAK will occur. If the command message contains a communications error (e.g., an address to a non-existent control receiver or a failure in the communications system), then the command error message response (in Section 4.7.1, page 43, with B_3 ¹⁵ of byte 3 equal to 1) will be sent back.

Section 4.9, page 45 gives the RS-232 switch message format.

Section 4.10, page 45 gives the ID message format for communications from a host computer to the master control panel. An ACK or NAK is returned.

4.3 Maintenance

No maintenance adjustments are required for the RS-232 circuits on the processor board.

4.4 Parts List

Refer to the processor board for parts identifications.

¹²\$Header: d:/TXB-Cohu/RCS/232Pro.inc,v 1.9 2006-08-24 14:43:12-07 Hamilton Exp Hamilton \$

¹³This document was derived from Cohu's document: "mpc232pro.pdf"

¹⁴ACK = 0x06, NAK = 0x15.

¹⁵The phrase " B_3 " means bit 3 with numbering starting at 0 in the least significant position of a byte.

4.5 Schematic Diagrams

Refer to the proces or board for the schematic diagram.

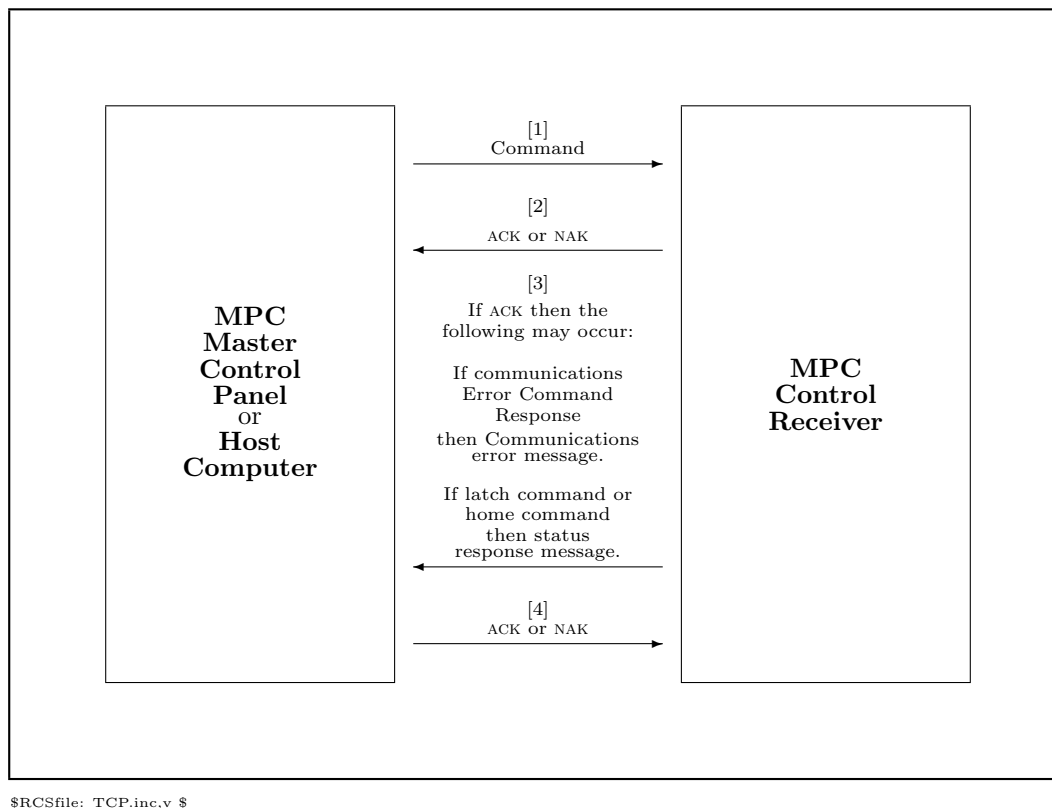


Figure 5. Typical Communications Protocol (From Cohu Document 6X-5046(A))

4.5.1 RS-232 Command Message Format

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address in hex	Camera address (0x01 → 0xDF)
2 to $2n + 1$	Command Data	See Section 4.6, page 41
$2n + 2$	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
$2n + 3$	ETX	End of Message (0x03)

NOTE: n is the number of commands in the message

4.6 RS-232 Command Data

DATA consists of the ASCII codes for the two letters shown:

“rs” = ASCII codes for “r” and

“s”, “PL” = ASCII codes for “P” and “L”, etc.

4.6.1 RS-232 Command Data, Momentary

Function	Data	Description
Reset Control Receiver	“rs”	
Pan Left	“PL”	
Pan Right	“PR”	
Pan Stop	“PS”	
Tilt Up	“TU”	
Tilt Down	“TD”	
Tilt Stop	“TS”	
Zoom In	“ZI”	
Zoom Out	“ZO”	
Zoom Stop	“ZS”	
Focus Near	“FN”	
Focus Far	“FF”	
Focus Stop	“FS”	
Iris Open	“IO”	
Iris Close	“IC”	
Iris Stop	“IS”	
Auto Scan On	“AS”	
Auto Scan Off	“AO”	
P/T Position Request	“P?”	See Section 4.8.1, page 44 for position format.
P/T Goto Command	“pA ₂ A ₁ A ₀ E ₂ E ₁ E ₀ ”	
Lens Position Request	“V?”	
Lens Goto Command	“vA ₂ A ₁ A ₀ E ₂ E ₁ E ₀ ”	See Section 4.8.2, page 44 for position format.

4.6.2 RS-232 Command Data, Latch

Function	Data	Description
Manual Iris Toggle	"LM"	
Camera Power Toggle	"LP"	See Section 4.7.1, page 43 for response format
Lens Speed Toggle	"LL"	
Latch Status Request	"L?"	
Aux Functions (Option 1)	"L1" → "L3" (L1, L2, L3)	Toggles Aux 1, Aux 2, or Aux 3
Color Balance (Option 2)	"L1"	Select auto/manual mode
	"B1"	Increase blue
	"B2"	Increase red
	"B0"	Balance stop

4.6.3 RS-232 Command Data, Home

Function	Data	Description
Home Position Goto	Preset 1 → 9 "H0" → "H9"	A home active "HA" will be immediate response. Later a home position "H0" to "H9" or home error "HE" will be generated (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9)
Home Position Store	"P0" → "P9" Program 0 → 9	(P0, P1, P2, P3, P4, P5, P6, P7, P8, P9)
Home Position Status Request	"H?"	Will generate a home status response See Section 4.7.2, page 43

4.7 RS-232 Response Messages

4.7.1 Format of Latch Status Response from MPC

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address in hex	Camera address 0x01 to 0xDF
2	“L” Latch Status	
3	0x30 to 0x37 (Comm error)	LS Nibble is four bits of status (L0, L1, L2, L3, L4, L5, L6, L7, L8) Bit Value 0/1 B_0 = Iris Auto/Manual B_1 = Camera power Off/On B_2 = Lens Speed Slow/Fast B_3 = Communications Error No/Yes
4	“A” Aux Status	
5	0x30 to 0x37	LS Nibble is four bits of status (A0, A1, A2, A3, A4, A5, A6, A7) Bit Value 0/1 B_0 = Aux 1 B_1 = Aux 2 B_2 = Aux 3
6	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
7	ETX	End of message (0x03)

4.7.2 Format of Home Status Response from MPC

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address in hex	Camera address 0x01 0xDF
2	“H” Home Status	
3	“O” → “9” or “A”, or “I”, or “E”	ie, “2” = Home position 2 “A” = (HA) Home active “I” = (HI) Not-at-Home position, or active “E” = (HE) Home error could not get to home position
4	Checksum	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
5	ETX	End of message (0x03)

4.8 MPC Position Messages

4.8.1 Format of Pan/Tilt Position Message

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address in hex	Camera address (0x01 to 0xDF)
2	“P” or “p”	Upper case “P” is response; Lower case “p” is GOTO command
3	A_2 (MS nibble)	
4	A_1	Azimuth position (See Notes)
5	A_0 (LS nibble)	
6	E_2 (MS nibble)	
7	E_1	Elevation position (See Notes)
8	E_0 (LS nibble)	
9	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
10	ETX	End of message (0x03)

4.8.2 Format of Zoom/Focus Position Message

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address in hex	Camera address (0x01 to 0xDF)
2	“V” or “v”	Upper case “V” is response; Lower case “v” is GOTO command
3	A_2	(MS nibble)
4	A_1 Zoom position	(See Notes)
5	A_0	(LS nibble)
6	E_2	(MS nibble)
7	E_1 Focus position	(See Notes)
8	E_0	(LS nibble)
9	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
10	ETX	End of message (0x03)

Encoding position data

The 12-bit position data is contained in nibbles 0 $\longrightarrow$ 2, with:

nibble 0 = $b_0 \longrightarrow b_3$,
 nibble 1 = $b_4 \longrightarrow b_7$, and
 nibble 2 = $b_8 \longrightarrow b_{11}$.

The nibble is then added to 0x30 to produce a value from 0x30 to 0x3F.

Example: Encoding an azimuth position value of decimal 2748₁₀ or 0xABC, is broken up into three nibbles and added 0x30 to each so:

$A_2 = 0x3A$,
 $A_1 = 0x3B$, and
 $A_0 = 0x3C$.

The same encoding scheme is used for the zoom and focus positions in the “Zoom/Focus Goto Command”.

4.9 RS-232 Switch Message Format

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address in hex	The remote control panel address in hex that the switch message will be displayed on. This remote will also be given control of the control receiver for the camera number in the switch message (if applicable). Binary 0 to 30 valid for remote control panels. Binary 31 refers to the master control panel. Data greater than 31 will provide for video switching only; no control panel is associated.
2	“S”	ASCII character for letter S
3	C100	ASCII character for the camera number. C100 is the hundred’s digit,
4	C10	C10 is the ten’s digit,
5	C1	and C1 is the unit’s digit
6	M100	ASCII character for monitor number. M100 is the hundred’s digit,
7	M10	M10 is the ten’s digit,
8	M1	and M1 is the unit’s digit
9	CHECKSUM	CHECKSUM is a hexadecimal number 0x80 to 0x8F. The least significant (nibble) is the XOR of all previous bytes (LS Nibble only) except STX
10	ETX	End of Message (0x03)

4.10 ID Message Formats

4.10.1 Format of Select Mode Message

Byte	Data	Description
0	STX	Start of Message (0x02)
1	Address in hex	Camera address (0x01 to 0xDF)
2	“d”	Display message
3	“M”	(dM) Mode select
4	“M” “I”	(dMM) Menu mode (dMI) ID mode
5	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
6	ETX	End of Message (0x03)

4.10.2 Format of ID Enable/Disable Message

Byte	Data	Description
0	STX	Start of Message (0x02)
1	Address in hex	Camera address (0x01 to 0xDF)
2	“d”	Display message
3	“I”	(dI) ID display
4	“D” “E”	(dID) Disable ID display (dIE) Enable ID display
5	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
6	ETX	End of Message (0x03)

4.10.3 Format of ID Clear Screen Message

Byte	Data	Description
0	STX	Start of Message (0x02)
1	Address in hex	Camera address (0x01 to 0xDF)
2	“d”	Display message
3	“C”	(dC) Clear screen
4	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
5	ETX	End of Message (0x03)

4.10.4 Format of Select ID Top Message

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address in hex	Camera address (0x01 to 0xDF)
2	“d”	Display message
3	“I”	(dI) ID display
4	“T”	(dIT) ID at top
5	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
6	ETX	End of Message (0x03)

4.10.5 Format of Select ID Bottom Message

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address in hex	Camera address (0x01 to 0xDF)
2	“d”	Display message
3	“I”	(dI) ID display
4	“B”	(dIB) ID at bottom
5	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
6	ETX	End of Message (0x03)

4.10.6 Format of Update Line Message

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address in hex	Camera address (0x01 to 0xDF)
2	“d”	Display message
3	“L”	(dL) Line of text
4	“1” → “<” (0x31 → 0x3C)	Line number (dL1, dL2, dL3, dL4, dL5, dL6, dL7, dL8, dL9, dL:, dL; dL>) (1 → 12) + 0x30
5	(ID text)	ASCII characters (up to 24) for the line starting with the left most character
<i>n</i>	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
<i>n</i> + 1	ETX	End of Message (0x03)

4.10.7 Format of Alarm Display Message

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address in hex	Camera address (0x01 to 0xDF)
2	“d”	Display message
3	“A”	(dA) Alarm message
4	“1” → “3” (0x31 → 0x33)	Display line number (dA1, dA2, dA3) (1 → 3) + 0x30
5	“B” “E” “D”	(dA1B, dA2B, dA3B) Blink alarm message (dA1E, dA2E, dA3E) Enable alarm message (dA1D, dA2D, dA3D) Disable alarm message
6	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except STX
7	ETX	End of Message (0x03)

NOTE: For all messages from a host computer to the master control panel, ACK or NAK is returned.

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5 3850 Variable Speed Pan/Tilt Communication Interface Protocol

5.1 General

This document¹⁷ defines the Asynchronous communication protocol between the MPC Master Control Panel/Host Computer and a Positioner/Dome camera. Figure 1. illustrates the handshake protocol. The communication is a full duplex. Typical or default communication parameters will be 9600 baud, 8 data bits, 1 stop bit and no parity.

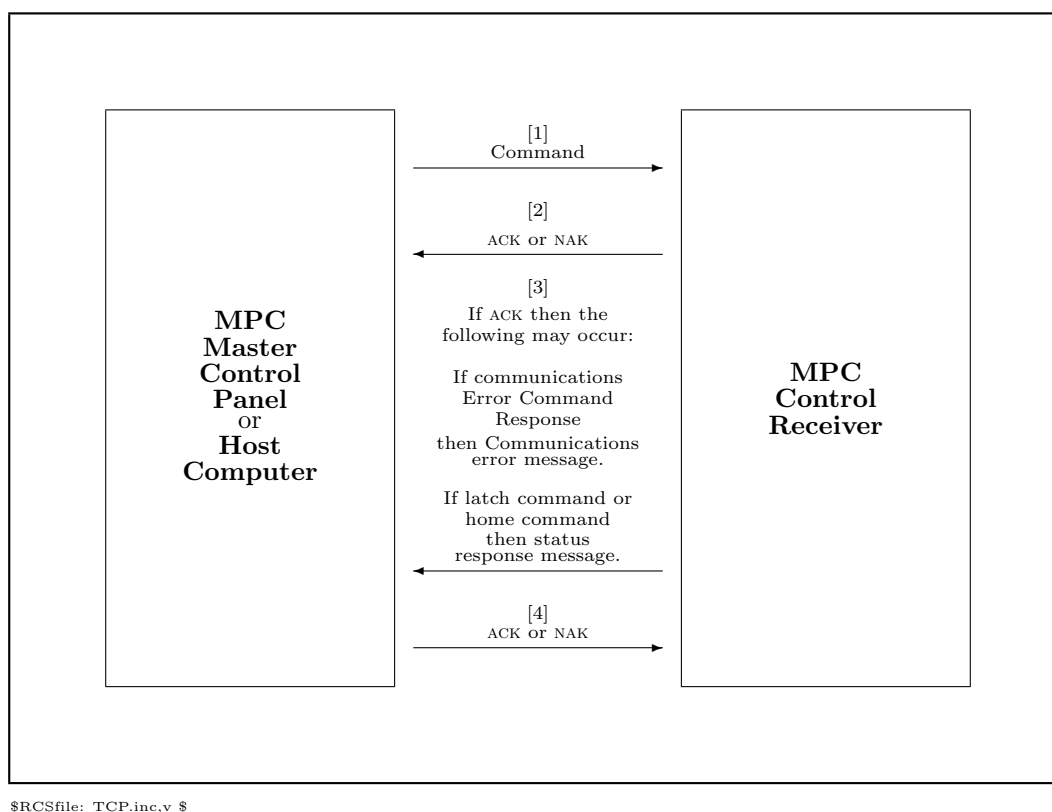


Figure 6. Typical Communications Protocol (Similar to the one in 3850pro.pdf)

Notes: The time between two consecutive commands to the camera is 250 milliseconds. For example, Zoom In and follow right after that is Zoom Stop.

5.2 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 Section 5.2.1, page 50. The response message

¹⁶\$Header: d:/TXB-Cohu/RCS/3850pro.inc,v 1.17 2006-08-30 12:31:56-07 Hamilton Exp Hamilton \$

¹⁷This document was derived from Cohu's document: "3850pro.pdf"

from the camera is shown in Section 5.2.6, page 58.

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:

- 0xF8 Start Character
- ACK Acknowledge proper receipt of transmission
- NAK Bad transmission — retransmit
- CS Checksum (End of Message)
- ID Camera address
- ## One byte
- # Number in ASCII
- n is the number of command data bytes in the message.

All transmissions will be in format:

0xF8/ID/c/DATA BYTES/CHECKSUM

Note: **W**a means ASCII characters for “**W**” and “**a**”.

5.2.1 3850 Command Message Format

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF) Note: 0xFF address is used to read camera address or to assign camera address
2	c	Message type (for camera control)
3 to $n + 3$	Command Data	See Section 5.2.2, page 51 (for camera control) See Section 5.2.3, page 56 (for variable speed pan/tilt)
$n + 4$	CHECKSUM	End of message 0x80 → 0x8F Least significant nibble is XOR of all previous bytes (LS nibbles only) except 0xF8

Note

1. n is the number of command data bytes in the message.
2. Assign camera address msg. does not contain the c.
3. Set Camera/Preset ID msg. does not contain the c.
4. Preset programming and goto does not contain c.
5. All standard commands won't contains “c”. (Section 5.2.4, page 56)
6. Var. Speed pan/tilt msg. does not contain the c. r l u d (For variable speed pan/tilt).

5.2.2 3850 Command/Response Data Command

Command	Description
cAS	Read Camera Address
cA###	Return the current CamAddr in ASCII ### = $001_{10} \rightarrow 255_{10}$
As###	Assign Camera Address ### = $001_{10} \rightarrow 255_{10}$ NOTE: The above command is also valid if Camera Address 0xFF is used.
cB1	Back Light ON
cB0	Back Light OFF
cBS	Request for current Status of Back Light
cB0	Return the current Status of Back Light Off
cB1	Return the current Status of Back Light On
cD#	Digital Zoom Range cD0 OFF cD1 2X cD2 4X cD3 8X
cDS	Request for current Status of Digital Zoom Range of Digital Zoom Mode
cZ#	Response to Return the current Status of Digital Zoom Range of Digital Zoom Mode cZ0 OFF cZ1 2X cZ2 4X cZ3 8X
cS#	Shutter cS0 1/4 cS7 1/250 cS1 1/8 cS8 1/500 cS2 1/15 cS9 1/1000 cS3 1/30 cS: 1/2000 cS4 Auto cS; 1/4000 cS5 1/60 cS< 1/10000 cS6 1/100 —
Continued on the next page.	

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Command	Description
cSS	Request for current Status of Shutter
cS#	Return the current Status of Shutter cS0 1/4 cS7 1/250 cS1 1/8 cS8 1/500 cS2 1/15 cS9 1/1000 cS3 1/30 cS: 1/2000 cS4 Auto cS; 1/4000 cS5 1/60 cS< 1/10000 cS6 1/100 —
cIA	Iris Auto
cIM	Iris Manual
cIS	Request for Current Status of Iris Mode
cI#	Return the current Status of Iris Mode cI0 Auto cI1 Manual
cI0	Iris Open
cIC	Iris Close
cIs	Iris Stop
cW#	White Balance cW0 Auto cW1 Set cW2 Lock cW3 Indoor cW4 Outdoor cW5 Flourescent
cWS	Request for current Status of White Balance
cW#	Return the current Status of White Balance cW0 Auto cW1 Set cW2 Lock
<i>Continued on the next page.</i>	

<i>Continued from the previous page.</i>	
Command	Description
	cW3 Indoor cW4 Outdoor cW5 Florescent
cz#	Zoom Wide cz0 Low Speed cz1 Medium Speed cz2 Fast Speed
cZ#	Zoom Tele cz0 Low Speed cz1 Medium Speed cz2 Fast Speed
cZs	Zoom Stop
cFA	Focus Auto
cFM	Focus Manual
cFS	Request for current Status of Focus Mode
cF#	Return the current Status of Focus Mode cF0 Auto cF1 Manual
cF#	Focus Far cF0 Low Speed cF1 Medium Speed cF2 Fast Speed
cN#	Focus Near cN0 Low Speed cN1 Medium Speed cN2 Fast Speed
cFs	Focus Stop
P##	Program Preset Position See Table 18, page 55. P## = 0x10 to 0x3E (first 47 positions) P## = 0x60 to 0x6F (last 16 positions)
H##	Goto a Preset Position See Table 18, page 55 H## = 0x10 to 0x3E (first 47 positions) H## = 0x60 to 0x6F (last 16 positions)
cRS	Firmware Revision Query
	Return Firware Revision (Maximum 24 Characters and blank padded to 24 total characters) Model# Firmware Ver. 1.0
<i>Continued on the next page.</i>	

<i>Continued from the previous page.</i>	
Command	Description
	For example: 3855_Firmware_Ver._2.2.
dIE	Enable ID display
dID	Disable ID display
dIT	Display ID on top of screen
dIB	Display ID on bottom of screen
dL#<DATA>	Set content of ID messages dL1<DATA>: line 1 (ID line 1) dL2<DATA>: line 2 (ID line 2) dL3<DATA>: line 3 (Alarm ID line 1) dL4<DATA>: line 4 (Alarm ID line 2) dL5<DATA>: line 5 (Alarm ID line 3) DATA = 24 ASCII characters
dP##<DATA>	Store Preset ID display in the receiver Preset ID will be displayed when a preset is executed, and disappears when a P/T/Z/F command is executed. ## = 0x10 to 0x3F (first 48 positions) See Table 18, page 55 ## = 0x60 to 0x6F (last 16 positions) DATA = 24 ASCII characters
cd##S	Get Preset ID display stored in receiver to the GUI
	## = 0x10 to 0x3F (first 48 positions) See Table 18, page 55 ## = 0x60 to 0x6F (last 16 positions)
dP	##<DATA>
dAE	Enable Alarm display
dAD	Disable Alarm # display
dAB	Enable Alarm Blinking
dAb	Disable Alarm Blinking

Protocol	Preset #	Protocol	Preset #	Protocol	Preset #	Protocol	Preset #
0x10	1 ₁₀	0x20	17 ₁₀	0x30	33 ₁₀	0x61	49 ₁₀
0x11	2 ₁₀	0x21	18 ₁₀	0x31	34 ₁₀	0x62	50 ₁₀
0x12	3 ₁₀	0x22	19 ₁₀	0x32	35 ₁₀	0x63	51 ₁₀
0x13	4 ₁₀	0x23	20 ₁₀	0x33	36 ₁₀	0x64	52 ₁₀
0x14	5 ₁₀	0x24	21 ₁₀	0x34	37 ₁₀	0x65	53 ₁₀
0x15	6 ₁₀	0x25	22 ₁₀	0x35	38 ₁₀	0x66	54 ₁₀
0x16	7 ₁₀	0x26	23 ₁₀	0x36	39 ₁₀	0x67	55 ₁₀
0x17	8 ₁₀	0x27	24 ₁₀	0x37	40 ₁₀	0x68	56 ₁₀
0x18	9 ₁₀	0x28	25 ₁₀	0x38	41 ₁₀	0x69	57 ₁₀
0x19	10 ₁₀	0x29	26 ₁₀	0x39	42 ₁₀	0x6A	58 ₁₀
0x1A	11 ₁₀	0x2A	27 ₁₀	0x3A	43 ₁₀	0x6B	59 ₁₀
0x1B	12 ₁₀	0x2B	28 ₁₀	0x3B	44 ₁₀	0x6C	60 ₁₀
0x1C	13 ₁₀	0x2C	29 ₁₀	0x3C	45 ₁₀	0x6D	61 ₁₀
0x1D	14 ₁₀	0x2D	30 ₁₀	0x3D	46 ₁₀	0x6E	62 ₁₀
0x1E	15 ₁₀	0x2E	31 ₁₀	0x3E	47 ₁₀	0x6F	63 ₁₀
0x1F	16 ₁₀	0x2F	32 ₁₀	0x60	48 ₁₀	0x70	64 ₁₀

Table 18. Extended Preset Values

5.2.3 Variable Pan/Tilt Command Data

Command	Description
r##	Pan Right ##: 16 variable speed controls (from 0x30 to 0x3F) (r0, r1, r2, r3, r4, r5, r6, r7, r8, r9, r:, r;, r<, r=, r>, r@, rA)
l##	Pan Left ##: 16 variable speed controls (from 0x30 to 0x3F) (l0, l1, l2, l3, l4, l5, l6, l7, l8, l9, l:, l;, l<, l=, l>, l@, lA)
PS	Pan Stop
u##	Tilt Up ##: 16 variable speed controls (from 0x30 to 0x3F) (u0, u1, u2, u3, u4, u5, u6, u7, u8, u9, u:, u;, u<, u=, u>, u@, uA)
d##	Tilt Down ##: 16 variable speed controls (from 0x30 to 0x3F) (d0, d1, d2, d3, d4, d5, d6, d7, d8, d9, d:, d;, d<, d=, d>, d@, dA)
TS	Tilt Stop

5.2.4 Standard Momentary Commands

Note: All standard command don't contain "c" as DSP commands.

Command	Description
PR	Pan Right
PL	Pan Left
PS	Pan Stop
TU	Tilt Up
TD	Tilt Down
TS	Tilt Stop
rn	Pan Right — Nudge Notes: Nudge commands are optional
ln	Pan Left — Nudge
un	Tilt Up — Nudge
dn	Tilt Down — Nudge

Note: All above command will generate variable speed pan/tilt based on the Camera Zoom position.

Command	Description
ZI	Zoom In
ZO	Zoom Out
ZS	Zoom Stop
FN	Focus Near
FF	Focus Far
FS	Focus Stop
IO	Iris Open
IC	Iris Close
<i>Continued on the next page.</i>	

<i>Continued from the previous page.</i>	
Command	Description
IS	Iris Stop
rs	Software Reset

5.2.5 Latch Commands

Command	Description
LM	Manual Iris toggle
LL	Lens Speed toggle
L?	Latch Status Request. See Section 5.2.7, page 58 for response status
L1	Aux 1 Function (Auto/Manual Focus)
B1	Integration Up
B2	Integration Down. Continue to do this to go back to 1/60th Shutter

5.2.6 Variable Pan/Tilt Command Data

Home Commands

Command	Description
H0 to H9	Goto Presets 1 to 10 (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9)
P0 to P9	Program Presets 1 to 10 (P0, P1, P2, P3, P4, P5, P6, P7, P8, P9)
H?	Home Position Request. See Section 5.2.7, page 58 for response status

5.2.7 Standard Latch/Home Response Message Format

Latch Status Response

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF)
2	L	Latch status
3	0x30 → 0x37	LS nibble is four bits of status Bit Value 0/1 B_0 = Auto Iris/Manual Iris B_1 = Camera Power Off/On B_2 = Lens Speed Slow/Fast B_3 = Not Used (L0, L1, L2, L3, L4, L5, L6, L7)
4 5	A 0x30 → 0x37	Aux status LS nibble is four bits of status Bit Value 0/1 B_0 = Auto Integration/Manual Integration B_1 = Not Used B_2 = Not used B_3 = Not Used (A0, A1)
6	CHECKSUM	End of message 0x80 → 0x8F Least significant nibble is XOR of all previous bytes (LS nibbles only) except 0xF8

5.2.8 Home Status Response

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF)
2	H	Latch status
3	0x30 → 0x39	Home Position (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9)
4	CHECKSUM	End of message 0x80 → 0x8F Least significant nibble is XOR of all previous bytes (LS nibbles only) except 0xF8

5.2.9 DSP Response Message Format

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF) Note: 0xFF address is used to read camera address or to assign camera address
2	c	Message type (camera)
3 to $n + 3$	Response Data	Refer to Response Data of those commands above
$n + 4$	CHECKSUM	End of message 0x80 → 0x8F Least significant nibble is XOR of all previous bytes (LS nibbles only) except 0xF8

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6 iDome/iView/LCU Communication Protocol

Rev 3.0
3/29/2004
COHU, INC¹⁹

6.1 General

This document²⁰ defines the Asynchronous communication protocol between the MPC Master Control Panel/Host Computer and an iDome/iView/LCU. Figure 7, page 61, Illustrates the handshake protocol. The communication is full duplex. Typical or default communication parameters will be 9600 baud, 8 data bits, 1 stop bit and no parity.

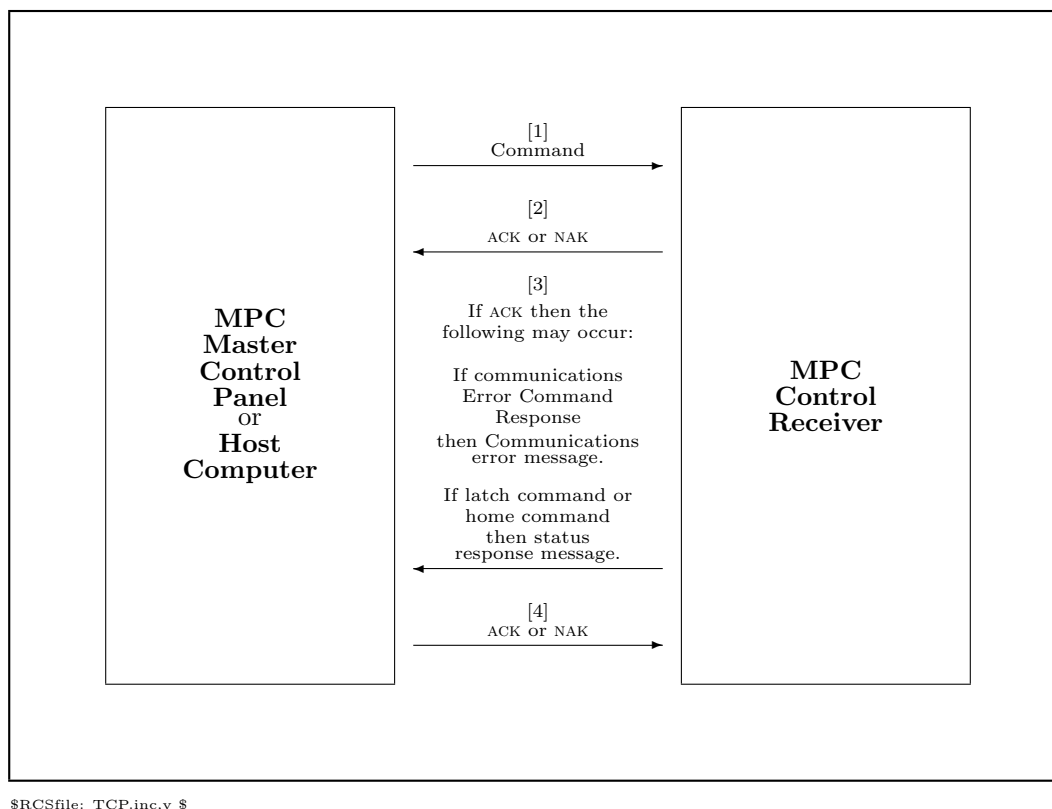


Figure 7. Typical Communications Protocol (From Cohu Document 6X-5046(A))

¹⁸\$Header: d:/TXB-Cohu/RCS/iDome.inc,v 1.14 2006-08-29 10:32:13-07 Hamilton Exp Hamilton \$

¹⁹Electronics Division, P.O. Box 85623, San Diego, CA 92186-5626 — Telephone: (619) 277-6700 Fax: (619) 277-0221 Web: www.cohu.com/cctv

²⁰This document was derived from the Cohu document: "iDomeiViewLCUCommProtocol.pdf"

6.2 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 Section 6.2.1, page 62 to Section 6.2.4, page 63. The response message from the camera is shown in Section 6.4, page 72 and Section 6.5.1, page 76.

If the command message contains only a momentary function, no further response beyond the ACK or NAK will occur. If the command requires a status message response, then a message will be returned following the ACK.

The control characters to be used are:

- 0xF8 Start Character
- ACK Acknowledge proper receipt of transmission
- NAK Bad transmission — retransmit
- CS Checksum (End of Message)
- ID Camera address
- ## One byte in Hex
- “#” Number in ASCII
- “*” ASCII Asterisk
- “c” ASCII c
- “d” ASCII d

All transmissions will be in formats:

1. <0xF8> <CamID> <DATA> <CS> (Section 6.2.1, page 62).
or:
2. <0xF8> <CamID> <c> <DATA> <CS> (Section 6.2.2, page 63).
or:
3. <0xF8> <CamID> <*> <DATA> <CS> (Section 6.2.3, page 63).
or:
4. <0xF8> <CamID> <d> <DATA> <CS> (Section 6.2.4, page 63).

6.2.1 Standard Command Message Format

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF) Note: 0xFF address is used to read camera address or to assign camera address
2 to $n + 2$	Command Data	
$n + 3$	CHECKSUM	End of message 0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except 0xF8

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

6.2.2 DSP Camera Command Message Format

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF) Note: 0xFF address is used to read camera address or to assign camera address
2	“c”	Message type (for camera control)
3 to $n + 3$	DSP	Command Data
$n + 4$	CHECKSUM	End of message 0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except 0xF8

6.2.3 Sector/Touring Command Message Format

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF) Note: 0xFF address is used to read camera address or to assign camera address
2	“*”	Message type (for sector/touring)
3 to $n + 3$	Touring/Position	Command Data
$n + 4$	CHECKSUM	End of message 0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except 0xF8

6.2.4 Id command Message Format

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF) Note: 0xFF address is used to read camera address or to assign camera address
2	“d”	Message type (for ID)
3	Command 1	See Section 6.3.4, page 66 for command types
4	Command 2	and reponse
5 to 29 ID Data	24 ID	ASCII characters, or Enable/Disable, or Blinking, etc.
$n + 30$	CHECKSUM	End of message 0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except 0xF8

6.3 Standard Commands

Command	Description
PR	Pan Right
PL	Pan Left
PS	Pan Stop
TU	Tilt Up
TD	Tilt Down
TS	Tilt Stop
ZI	Zoom In
ZO	Zoom Out
ZS	Zoom Stop
FN	Focus Near
FF	Focus Far
FS	Focus Stop
IO	Iris Open
IC	Iris Close
IS	Iris Stop
P##	Program Preset Position
	## = 0x10 to 0x3E (first 47 positions) See Table 19, page 68
	## = 0x60 to 0x70 (last 16 positions)
H##	Goto a Preset Position
	## = 0x10 to 0x3E (first 47 positions) See Table 19, page 68
	## = 0x60 to 0x70 (last 16 positions)
B1	Integration Up — Continue up to 1/8th shutter speed
B2	Integration Down — Continue back to 1/60th shutter speed

6.3.1 Latch Commands

Command	Description
LP	Camera Power ON/OFF
LM	Manual Iris toggle
LL	Lens Speed toggle
L1	Manual Focus toggle

Notes: All latch commands will return the status as the L? command described below.

6.3.2 Status request

Command	Description
L?	Latch Status Request — See Section 6.4, page 72 for response status
H?	Home Position Request — See Section 6.4, page 72 for response status

6.3.3 Variable Speed P/T/Z Commands

Command	Description
r##	Pan Right — Var. Speed ##: 16 variable speed controls (from 0x30 to 0x3F) (r0, r1, r2, r3, r4, r5, r6, r7, r8, r9, r:, r;, r<, r=, r>, r@, rA)
l##	Pan Left — Var. Speed ##: 16 variable speed controls (from 0x30 to 0x3F) (l0, l1, l2, l3, l4, l5, l6, l7, l8, l9, l:, l;, l<, l=, l>, l@, lA)
PS	Pan Stop
u##	Tilt Up — Var. Speed ##: 16 variable speed controls (from 0x30 to 0x3F) (u0, u1, u2, u3, u4, u5, u6, u7, u8, u9, u:, u;, u<, u=, u>, u@, uA)
d##	Tilt Down — Var. Speed ##: 16 variable speed controls (from 0x30 to 0x3F) (d0, d1, d2, d3, d4, d5, d6, d7, d8, d9, d:, d;, d<, d=, d>, d@, dA)
TS	Tilt Stop
rn	Pan Right — Nudge
ln	Pan Left — Nudge
un	Tilt Up — Nudge
dn	Tilt Down — Nudge
i#	Zoom In — Var. Speed “i0” Low Speed “i1” Medium Speed “i2” Fast Speed
o#	Zoom Out — Var. Speed “o0” Low Speed “o1” Medium Speed “o2” Fast Speed
f#	Focus Far — Var. Speed “f0” Low Speed “f1” Medium Speed “f2” Fast Speed
n#	Focus Near — Var. Speed “n0” Low Speed “n1” Medium Speed “n2” Fast Speed

6.3.4 ID Commands

Command	Description
dIE	Enable ID Display
dID	Disable ID Display
dIT	Display ID on top of screen
dIB	Display ID on bottom of screen
dAE	Enable Alarm Display
dAD	Disable Alarm # Display
dAB	Enable Alarm Blinking
dAb	Disable Alarm Blinking
dME	Maintenance Display Enable
dMD	Maintenance Display Disable
dIC	Clear All ID Data, include Presets, Sectors, Privacy Zones
dL#<DATA>	Set content of ID messages “dL1” : line 1 (ID line 1) “dL2” : line 2 (ID line 2) “dL3” : line 3 (Alarm ID line 1) “dL4” : line 4 (Alarm ID line 2) “dL5” : line 5 (Alarm ID line 3) DATA = 24 ASCII characters
dP##<DATA>	Store Preset ID display in the receiver Preset ID will be displayed when a preset is executed, and disappears when a P/T/Z/F command is executed. P## = 0x10 to 0x3E (first 48 positions) See Table 19, page 68 P## = 0x60 to 0x70 (last 16 positions) DATA = 24 ASCII characters
dST#<DATA>	Set Sector ID Text dST# = Sector Number (0x31 to 0x40) (dST1<DATA>, dST2<DATA>, dST3<DATA>, dST4<DATA>, dST5<DATA>, dST6<DATA>, dST7<DATA>, dST8<DATA>, dST9<DATA>, dST:<DATA>, dST;<DATA>, dST<<DATA>, dST=<DATA>, dST><DATA>, dST@<DATA>, dSTA<DATA>) DATA = 24 ASCII characters
dSS#s	Set Sector ID State # = Sector Number (0x31 to 0x40) s = State “0”=Off: (dSS10, dSS20, dSS30, dSS40, dSS50, dSS60, dSS70, dSS80, dSS90, dSS:0, dSS;0, dSS<0, dSS=0, dSS>0, dSS@0, dSSA0)
Continued on the next page.	

<i>Continued from the previous page.</i>	
Command	Description
	s = State “1”=On: (dSS20, dSS21, dSS31, dSS41, dSS51, dSS61, dSS71, dSS81, dSS91, dSS:1, dSS;1, dSS<1, dSS=1, dSS>1, dSS@1, dSSA1)
cdSc	Get ID Control Data, i.e Enable, Top, Alarm Blink ... Reply is: dC# # = Control Byte (xxx11111)
cdSl#	Get ID Messages “cdSl1”, “cdSl2”, “cdSl3”, “cdSl4”, “cdSl5” Reply is: dL#<DATA>
cdS##	Get Preset ## ID stored in camera ## = 0x10 to 0x3E (first 48 positions) See Table 19, page 68 ## = 0x60 to 0x70 (last 16 positions) Reply is: dP##<DATA>
cdSS##	Get Sector ## ID stored in camera ## = 0x31 to 0x40 (16 sectors) (cdSS1, cdSS2, cdSS3, cdSS4, cdSS5, cdSS6, cdSS7, cdSS8, cdSS9, cdSS:, cdSS;, cdSS<, cdSS=, cdSS>, cdSS@, cdSSA) Reply is: dST##<DATA> (dST1<DATA>, dST2<DATA>, dST3<DATA>, dST4<DATA>, dST5<DATA>, dST6<DATA>, dST7<DATA>, dST8<DATA>, dST9<DATA>, dST:<DATA>, dST;<DATA>, dST<<DATA>, dST=<DATA>, dST><DATA>, dST@<DATA>, dSTA<DATA>)
cdSs##	Get Sector ID State ## = Sector Number (0x31 to 0x40) (cdSs1, cdSs2, cdSs3, cdSs4, cdSs5, cdSs6, cdSs7, cdSs8, cdSs9, cdSs:, cdSs;, cdSs<, cdSs=, cdSs>, cdSs@, cdSsA) Reply is: dSS#s s = State (“1”=On; “0”=Off)
	(dSS10, dSS20, dSS30, dSS40, dSS50, dSS60, dSS70, dSS80, dSS90, dSS:0, dSS;0, dSS<0, dSS=0, dSS>0, dSS@0, dSSA0) (dSS11, dSS21, dSS31, dSS41, dSS51, dSS61, dSS71, dSS81, dSS91, dSS:1, dSS;1, dSS<1, dSS=1, dSS>1, dSS@1, dSSA1)

6.3.5 Misc. Commands

Command	Description	Response
A?	Read Camera Address	“A###” Return the current CamAddr in ASCII
<i>Continued on the next page.</i>		

Protocol	Preset #	Protocol	Preset #	Protocol	Preset #	Protocol	Preset #
0x10	1 ₁₀	0x20	17 ₁₀	0x30	33 ₁₀	0x61	49 ₁₀
0x11	2 ₁₀	0x21	18 ₁₀	0x31	34 ₁₀	0x62	50 ₁₀
0x12	3 ₁₀	0x22	19 ₁₀	0x32	35 ₁₀	0x63	51 ₁₀
0x13	4 ₁₀	0x23	20 ₁₀	0x33	36 ₁₀	0x64	52 ₁₀
0x14	5 ₁₀	0x24	21 ₁₀	0x34	37 ₁₀	0x65	53 ₁₀
0x15	6 ₁₀	0x25	22 ₁₀	0x35	38 ₁₀	0x66	54 ₁₀
0x16	7 ₁₀	0x26	23 ₁₀	0x36	39 ₁₀	0x67	55 ₁₀
0x17	8 ₁₀	0x27	24 ₁₀	0x37	40 ₁₀	0x68	56 ₁₀
0x18	9 ₁₀	0x28	25 ₁₀	0x38	41 ₁₀	0x69	57 ₁₀
0x19	10 ₁₀	0x29	26 ₁₀	0x39	42 ₁₀	0x6A	58 ₁₀
0x1A	11 ₁₀	0x2A	27 ₁₀	0x3A	43 ₁₀	0x6B	59 ₁₀
0x1B	12 ₁₀	0x2B	28 ₁₀	0x3B	44 ₁₀	0x6C	60 ₁₀
0x1C	13 ₁₀	0x2C	29 ₁₀	0x3C	45 ₁₀	0x6D	61 ₁₀
0x1D	14 ₁₀	0x2D	30 ₁₀	0x3D	46 ₁₀	0x6E	62 ₁₀
0x1E	15 ₁₀	0x2E	31 ₁₀	0x3E	47 ₁₀	0x6F	63 ₁₀
0x1F	16 ₁₀	0x2F	32 ₁₀	0x60	48 ₁₀	0x70	64 ₁₀

Table 19. Extended Preset Values

<i>Continued from the previous page.</i>		
Command	Description	Response
		### = "001" — "223"
AS###	Assign Camera Address	### = "001" — "223"
	NOTE: The above command is also valid if Camera Address 0xFF is used.	
E#####	Elevation Level where the camera is mounted. This is used to calibrate the Low Pressure indicator in the camera. ##### = 0 to 10000 in ASCII (in feet)	
RS	iDome/iView Firmware Revision Query	Return Firmware Revision (Maximum 24 Characters blank padded) "Model#_Firmware_Ver._1.0" For example: RModel#_Firmware_V1.0_
Rs	LCU Firmware Revision Query	Return Firmware Revision (Maximum 24 Characters blank padded) "Model#_Firmware_Ver._1.0" For example: rLCU_Firmware_V1.0_
Lp#	Line Lock Phase Adjust Lp0 (Camera is in Crystal mode) Lp1 (Line Lock — Phase 0 mode — 0 degree) Lp2 (Line Lock — Phase 1 mode — 30 degree) Lp3 (Line Lock — Phase 2 mode — 60 degree) Lp4 (Line Lock — Phase 3 mode — 90 degree) Lp5 (Line Lock — Phase 4 mode — 120 degree) Lp6 (Line Lock — Phase 5 mode — 150 degree)	
Bs####	Set Camera Baud Rate #### = 0300, 0600, 1200, 2400, 4800, 9600	
<i>Continued on the next page.</i>		

<i>Continued from the previous page.</i>		
Command	Description	Response
	(Bs0300, Bs0300, Bs0600, Bs1200, Bs2400, Bs4800, Bs9600)	
bs####	Set LCU Host Baud Rate #### = 0300, 0600, 1200, 2400, 4800, 9600 (bs0300, bs0300, bs0600, bs1200, bs2400, bs4800, bs9600)	
b?####	Query LCU Host Baud Rate (b0300, b0300, b0600, b1200, b2400, b4800, b9600)	b#### = 0300, 0600, 1200, 2400, 4800, 9600
fE	Tilt Flip Enabled	
fD	Tilt Flip Disabled	
fS	iDome/iView Flip Enable Query	Return Tilt Flip Enable Status “fSE” (Tilt Flip Enabled) “fSD” (Tilt Flip Disabled)
h1	RS-232 Flow Control (RTS/CTS) Enabled	
h0	RS-232 Flow Control (RTS/CTS) Disabled	
hS	RS-232 Flow Control Query	Return RS-232 Handshake Status “h1” (Enabled) “h0” (Disabled)
Jc0	Set Javelin Continuous Motor Mode for Camera OFF	
Jc1	Set Javelin Continuous Motor Mode for Camera ON	
JcS	Query Camera for Javelin Continuous Motor Mode status in Camera	“Jc0” (OFF) “Jc1” (ON)
Jb0	Set Javelin 2 Bytes Addr for camera OFF	
Jb1	Set Javelin 2 Bytes Addr for camera ON	
JbS	Query Camera for Javelin 2 Bytes Addr status in camera	“Jb0” (OFF) “Jb1” (ON)
<i>Continued on the next page.</i>		

<i>Continued from the previous page.</i>		
Command	Description	Response
jc0	Set Javelin Continous Motor Mode for LCU OFF	
jc1	Set Javelin Continous Motor Mode for LCU ON	
jcS	Query LCU for Javelin Continous Motor Mode status in LCU	"jc0" (OFF) "jc1" (ON)
jb0	Set Javelin 2 Bytes Addr for LCU OFF	
jb1	Set Javelin 2 Bytes Addr for LCU ON	
jbS	Query LCU for Javelin 2 Bytes Addr status in LCU	"jb0" (OFF) "jb1" (ON)
mPS	Query the internal pressure data	"mPxx.x" xx: 2 digits — ASCII data and 1 digit decimal For example: 10.5
mTS	Query the internal temperature data	"mPxx" xx: 2 digits — ASCII data in degree C For example: 30 degree C
mSN	Set True North Offset	

6.4 Standard Latch/Home Response Message Format

6.4.1 Format Latch Status Response

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF)
2	“L”	Latch status
3	0x30 — 0x37	LS nibble is four bits of status Bit Value 0/1 B_0 = Manual Iris/Auto Iris (1/0) B_1 = Camera Power On/Off (1/0) B_2 = Lens Speed Fast/Slow (1/0) B_3 = Not Used (L0, L1, L2, L3, L4, L5, L6, L7, L8)
4	“A”	Aux status
5	0x30 — 0x37	LS nibble is four bits of status Bit Value 0/1 B_0 = Auto/Manual Focus (1/0) B_1 = Auto Integration/Manual Integration (1/0) B_2 = Not used B_3 = Not Used (A0, A1, A2, A3, A4, A5, A6, A7)
6	“X”	Misc. status
7	0x30 — 0x37	LS nibble is four bits of status Bit Value 0/1 B_0 = Not Used B_1 = Low Pressure (1) B_2 = Video Loss (1) B_3 = Not Used (X0, X1, X2, X3, X4, X5, X6, X7)
8	CHECKSUM	End of message 0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except 0xF8

6.4.2 Format Home Status Response

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF)
2	“H”	Home status
3	0x10 — 0x3E 0x60 — 0x70 “HI”	Home Position See Table 19, page 68 (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9) Home is inactive (camera is not at a preset position)
4	CHECKSUM	End of message 0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except 0xF8

6.5 DSP Commands

Command	Description	Response
cD#	Digital Zoom Range cD0 (OFF) cD1 (2X) cD2 (5X) cD3 (10X)	
cS#	Shutter cS0 (Auto) cS8 (1/180) cS1 (1/2) cS9 (1/250) cS2 (1/4) cS: (1/500) cS3 (1/8) cS; (1/1000) cS4 (1/15) cS< (1/2000) cS5 (1/30) cS= (1/4000) cS6 (1/60) cS> (1/10000) cS7 (1/120) cS@ (1/30000)	
cW#	White Balance cW0 (Auto) cW1 (Manual)	
cWR	Increase RED (in Manual mode only)	
cWr	Decrease RED	
cWB	Increase BLUE	
cWb	Decrease BLUE	
cWQ	Stop Increase/Decrease color	
cY1	Wide Dynamic Range ON	
cY0	Wide Dynamic Range OFF	
cM0	Camera in Day/Night Auto Mode	
<i>Continued on the next page.</i>		

<i>Continued from the previous page.</i>		
Command	Description	Response
cM1	Camera in Day Mode (Color)	
cM2	Camera in Night Mode (Monochrome)	
cIA	Iris Auto	
cIM	Iris Manual	
cz#	Zoom Wide — Var. Speed cz0 (Low Speed) cz1 (Medium Speed) cz2 (Fast Speed)	
cZ#	Zoom Tele — Var. Speed cZ0 (Low Speed) cZ1 (Medium Speed) cZ2 (Fast Speed)	
cZs	Zoom Stop	
cFA	Focus Auto	
cFM	Focus Manual	
cFs	Focus Stop	
cP#	Camera Communication Protocol Selection cP0 (Cohu) cP1 (American Dynamics) cP2 (Pelco D) cP3 (Javelin) cP4 (Philips) cP5 (Vicon) cP6 (Kalatel) cP7 (Ultrak)	
cPs	Query LCU Communication Protocol	P# LCU Protocol # = 0x30 (Cohu) P1 (American Dynamics) P2 (Pelco D) P3 (Javelin) P4 (Philips) P5 (Vicon) P6 (Kalatel)
cs0	Set Progressive Scan On	
cso	Set Progressive Scan Off	
cFF	Video Freeze ON/OFF toggle	
<i>Continued on the next page.</i>		

<i>Continued from the previous page.</i>		
Command	Description	Response
cF#	Set Video Freeze ON/OFF cF0 (ON) cFo (OFF)	
cb	Enable Boot Loader to update new firmware in the iDome/iView	
cB	Enable Boot Loader to update new firmware in the LCU	
cLN	Set Normal Light mode (ER8439E — special Camera module)	
cLn	Set Sodium Vapor Light mode (ER8439E — special Camera module)	
cLS	Status request of Light mode setting (ER8439E — special Camera module)	cLN: Normal mode cLn: Sodium Vapor mode
cC#	Set Camera Head Comm. Baud Rate (ER-8682 only) cC0 for 4800 cC1 for 9600 cC2 for 19.2K cC3 for 38.4K	
cn#	Set Poll Camera (ER-8682 only) cn0 for OFF cn1 for ON	
cDS	DSP Status Request, See Section 6.5.1, page 76 for response formats	

6.5.1 DSP Response Message Format

Byte	Data	Description
0	0xF8	Start of message
1	Camera Address	(0x01 to 0xDF)
2	c	DSP status
3	W	White Balance Status
4	W0 = Auto	
<i>Continued on the next page.</i>		

<i>Continued from the previous page.</i>		
Byte	Data	Description
	W1 = Manual	
5	S	Shutter Status
6	0x30 — 0x3F	S0 = Auto cS0 (Auto) cS8 (1/180) cS1 (1/2) cS9 (1/250) cS2 (1/4) cS: (1/500) cS3 (1/8) cS; (1/1000) cS4 (1/15) cS< (1/2000) cS5 (1/30) cS= (1/4000) cS6 (1/60) cS> (1/10000) cS7 (1/120) cS@ (1/30000)
7	Y	Wide Dynamic Range Status
8		Y0 = Off Y1 = On
9	M	Day Night Mode
10		M0 = Day/Night in Auto mode M1 = in Day mode M2 = in Night mode
11	D	Digital Zoom Mode
12		D0 = Off D1 = 2X D2 = 5X D3 = 10X
13	L	Latch status
14	0x30 — 0x37	LS nibble is four bits of status Bit Value 0/1 B ₀ = Manual Iris/Auto Iris (1/0) B ₁ = Camera Power On/Off (1/0) B ₂ = Lens Speed Fast/Slow (1/0)
<i>Continued on the next page.</i>		

<i>Continued from the previous page.</i>		
Byte	Data	Description
		B_3 = Not Used (L0, L1, L2, L3, L4, L5, L6, L7, L8)
15	A	Aux status
16	0x30 — 0x37	LS nibble is four bits of status Bit Value 0/1 B_0 = Auto/Manual Focus (1/0) B_1 = Auto Integration/Manual Integration (1/0) B_2 = Not used B_3 = Not Used (A0, A1, A2, A3, A4, A5, A6, A7)
17	X	Misc. status
18	0x30 — 0x37	LS nibble is four bits of status Bit Value 0/1 B_0 = Not Used B_1 = Low Pressure (1) B_2 = Video Loss (1) B_3 = Not Used (X0, X1, X2, X3, X4, X5, X6, X7)
19	H Home status	
20	0x10 — 0x3E 0x60 — 0x70 HI	Home Position See Table 19, page 68 (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9) Preset is inactive (camera is not at a preset position)
21	P	Camera Communication Protocol
22		P0 (Cohu) P1 (American Dynamics) P2 (Pelco D) P3 (Javelin) P4 (Philips) P5 (Vicon)
23	v	Video Type
24		v0 (NTSC) v1 (PAL)
25	p	Line Lock Phase Status
26		p0 (Camera is in Crystal mode) p1 (Line Lock — Phase 0 mode — 0 degree) p2 (Line Lock — Phase 1 mode — 30 degree) p3 (Line Lock — Phase 2 mode — 60 degree)
<i>Continued on the next page.</i>		

<i>Continued from the previous page.</i>		
Byte	Data	Description
		p4 (Line Lock — Phase 3 mode — 90 degree) p5 (Line Lock — Phase 4 mode — 120 degree) p6 (Line Lock — Phase 5 mode — 150 degree)
27	F	Video Status
28		Fo (Video Live mode) F0 (Video Freeze mode)
29	C	Camera Head Comm. Baud Rate (ER-8682)
30		C0 4800 C1 9600 C2 19.2K C3 38.4K
31	n	Poll Camera ON/OFF Status (ER-8682)
32		n0 No Poll n1 Poll
33	s	Progressive Scan
34		so Off s0 On
35	CHECKSUM End of message	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except 0xF8

6.6 Sector/Zone/Touring Message Format

6.6.1 Sector Commands

Command	Description	Response
*SC#	Clear Sector Limits # = Sector Number (0x30 to 0x40) If 0x30 clear all, otherwise clear sector only	
*SX	Set Calibration Position (optional)	
*Sx	Get Calibration Position (optional)	*SXpppp pppp = ASCII 0000 to 3599
*SL#s	Set Sector Limit # = Sector Number (0x31 to 0x40) s = “L” — Left Limit or “R” — Right Limit	
*S1#	Get Sector Limits # = Sector Number (0x31 to 0x40)	*SS#1111rrrr 1111 and rrrr = ASCII 0000 to 3599

6.6.2 Privacy Zone Commands

Command	Description	Response
*PC#	Clear Privacy Zone Limits # = Zone Number (0x30 to 0x38) If 0x30 clear all, otherwise clear zone only	
*PL#s	Set Privacy Zone Limit # = Zone Number (0x31 to 0x38) s = “L” — Left Limit or “R” — Right Limit	
*Pl#	Get Privacy Zone Limits # = Sector Number (0x31 to 0x38)	*Pp#1111rrrr 1111 and rrrr = ASCII 0000 to 3599
*PS#s	Set Privacy Zone State # = Zone Number (0x31 to 0x38) s = State (“1”=On; “0”=Off)	
*Ps#	Get Privacy Zone State # = Sector Number (0x31 to 0x38)	*PS#s s = State (“1”=On; “0”=Off)

6.6.3 Tour Commands

Command	Description	Response
*TC#	Clear all preset/dwell data for Tour # # = Tour Number (0x31 to 0x38)	
*TP#<data>	Set Tour Presets # = Tour Number (0x31 to 0x38) <data> = 32 preset values in the range 0x10 to 0x50 (i.e. 0 to 64) Note: 0x10 indicates No Preset	
*Tp#	Get Tour Presets # = Tour Number (0x31 to 0x38) <data> = 32 preset values in the range of 0x10 to 0x50 (0 to 64)	*TP#<data>
*TD#<data>	Set Tour Dwell Times # = Tour Number (0x31 to 0x38) <data> = 32 dwell times in the range 0x10 to 0x4D (0 to 60 sec)	
*Td#	Get Tour Dwell Times	*TD#<data> # = Tour Number (0x31 to 0x38) <data> = 32 dwell times in the range of 0x10 to 0x4D (0 to 60 sec)
*TS#s	Set Tour State # = Tour Number (0x31 to 0x38) s = State ("0"=Stop; "1"=Start)	
*Ts#	Get Tour State # = Sector Number (0x31 to 0x38) s = State ("0"=Stop; "1"=Start)	*TS#s

6.7 Position

This section describes how to GET the position/presets data and GOTO a position of the camera.

6.7.1 Standard Position Response Data

Command	Description	Response
P?	Pan/Tilt Position Request	Ppppttt ppp = 12 bit data of Pan (0x000 to 0xFFF) Format: 0x303030 — 0x3F3F3F
		ttt = 12 bit data of Tilt (0x000 — 0xFFF) Format: 0x303030 — 0x3F3F3F
V?	Zoom/Focus Position Request	Pzzzfff zzz = 12 bit data of Zoom (0x000 to 0xFFF) Format: 0x303030 to 0x3F3F3F
		fff = 12 bit data of Focus (always 0x000) Format: 0x303030

6.7.2 Standard Goto A Position

Command	Description	Response
paaabbb	Goto a Pan/Tilt Position aaa = 12 bit data of Pan (0x000 to 0xFFF) Format: 0x303030 — 0x3F3F3F	
	bbb = 12 bit data of Tilt (0x000 — 0xFFF) Format: 0x303030 — 0x3F3F3F	
vccddd	Goto Zoom/Focus Position ccc = 12 bit data of Zoom (0x000 to 0xFFF) Format: 0x303030 to 0x3F3F3F	
	ddd = 12 bit data of Focus (always 0x000) Format: 0x303030	

6.7.3 Actual Position Response Data

Command	Description	Response
cPS	Pan/Tilt Position Request	cPppptttt pppp = Pan data (0000 to 3599 in ASCII) tttt = Tilt data (0000 to 1220 in ASCII)

6.7.4 Actual Goto A Position

Command	Description	Response
cpaaaabbbb	Goto a Pan/Tilt Position aaaa = Pan data (0000 to 3599 in ASCII) bbbb = Tilt data (0000 to 1220 in ASCII)	

6.7.5 Get Actual Presets Position Data

Command	Description	Response
*pp##	Get Preset data stored in camera ## = 0x10 to 0x3E (first 48 positions) ## = 0x60 to 0x70 (last 16 positions)	pP##ppppttttzzzzffff See Table 19, page 68 pppp = Pan Preset Position data tttt = Tilt Preset Position data zzzz = Zoom Preset Position data ffff = Focus Preset Position data

6.7.6 Position Encoding

The message data for the “Pan/Tilt Goto Command” above begins with an ASCII ‘p’ followed by the azimuth ($A_2A_1A_0$) and elevation ($E_2E_1E_0$) positions. The positions are 12-bit values encoded four-bits each in the least significant nibbles of the three bytes whose most significant nibbles are always 0x30. The subscript-2 indicates the byte containing the most significant bytes of the position and subscript-0 indicates the least significant.

6.7.6.1 Position Encoding Example:

(From the GA DOT document.)

Encoding an azimuth position value of decimal 2748_{10} or 0xABC, we break it up into three nibbles and add 0x30 to each so:

$$\begin{aligned} A_2 &= 0x3A, \\ A_1 &= 0x3B, \text{ and} \\ A_0 &= 0x3C. \end{aligned}$$

The same encoding scheme is used for the zoom and focus positions in the “Zoom/Focus Goto Command”.

6.7.7 Pan/Tilt Positions

Pan readouts are based on the CAL_0 (North or 0°) value of the PTZ. Angular readouts then increment to 90° (East), 180° (South) and to 270° (West) when looking down on the PTZ unit from above.

Tilt readouts are based on the horizon, with 0° meaning that the PTZ is looking at the horizon. As the PTZ points down the protocol readout changes to 45° and then 90° when the PTZ is pointing straight down. The PTZ on-screen display will indicate - 45° and then -90°. The discrepancy in the two types of readouts is that the protocol value is unsigned and the on-screen is signed. As tilt passes through straight down (not physically possible, but conceptually convenient, the protocol values increment until a straight up readout is 270° and the on-screen display shows 90°. At 45° above the horizon the protocol readout will be 315° and the on-screen display will be 45°. Here is a short table to attempt and explain these values.

Position	D readouts	Displays as
90° up	270	90
45° up	315	45
Horizontal - 1°	359	1
Horizontal	0	0
45° down	45	-45
90° down	90	-90

Note

1. **Position:** Pointing direction of the enclosure/camera.
2. **D readouts:** D protocol returned value for this angle.
3. **Displays as:** What is displayed on the Spectra screen.

6.8 Upload Camera Configuration to Camera

This section describes how to upload camera configuration data to the camera. For example, camera IDs, Presets position, Tour/Sector position, etc.

Command	Description
dC#	Upload ID Control Data, i.e Enable, Top, Alarm Blink ... to camera # = Control Byte(0xx11111)
dL#<DATA>	Upload ID Messages # = "1", "2", "3", "4", "5" DATA = 24 ASCII characters
dP##<DATA>	Upload Preset ## ID to camera See Table 19, page 68 ## = 0x10 to 0x3E (first 48 positions) ## = 0x60 to 0x70 (last 16 positions)
dST##<DATA>	Upload Sector ## ID to camera ## = 0x31 to 0x40 (16 sectors)
dSS##s	Upload Sector ID State to camera ## = Sector Number (0x31 to 0x40) s = State ("1"=On; "0"=Off)
*SS#1111rrrr	Upload Sector Limits to camera # = Sector Number (0x31 to 0x40) 1111 and rrrr = ASCII 0000 to 3599
*Pp#1111rrrr	Upload Privacy Zone Limits to camera # = Sector Number (0x31 to 0x38) 1111 and rrrr = ASCII 0000 to 3599
*PS#s	Upload Privacy Zone State to camera # = Sector Number (0x31 to 0x38) s = State ("1"=On; "0"=Off)
*TP#<data>	Upload Tour Presets to camera # = Tour Number (0x31 to 0x38) <data> = 32 preset values in the
*TD#<data>	Upload Tour Dwell Times to camera # = Tour Number (0x31 to 0x38) <data> = 32 dwell times in the range of 0x10 to 0x4D (0 to 60 sec)
*TS#s	Upload Tour State to camera # = Sector Number (0x31 to 0x38) s = State ("0"=Stop; "1"=Start)
*pP##pppppttttzzzzffff	Upload Presets Data to camera

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Command	Description
	## = 0x10 to 0x3E (first 48 positions) ## = 0x60 to 0x70 (last 16 positions) pppp = Pan Preset Position data tttt = Tilt Preset Position data zzzz = Zoom Preset Position data ffff = Focus Preset Position data

7 Cohu 3500 DSP Camera, RS-232 Interface

rev 1.15. June 01 1998

7.1 General

This document²² 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.

7.2 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 20, page 88. The various commands that may be transmitted are listed in Table 21, page 89 → Table 32, page 93. The response message from the camera is shown in Table 33, page 94 → Table 43, page 104.

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 (0xF8 if RS-422/RS-485)
- ACK Acknowledge proper receipt of transmission
- NAK Bad transmission — retransmit
- ETX End of Message (not used for RS-422)
- CS Checksum
- ID Camera address

All transmissions will be in this format:

STX	ID	"c"	DATA BYTES	CHECKSUM	ETX
-----	----	-----	------------	----------	-----

Note

1. "Wa" means ASCII characters for W and a.
2. **Since all commands are to have a "c" in byte position 2 (after the Camera Address and before the Command Data), a c has been added into each command ID.**

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

²¹\$Header: d:/TXB-Cohu/RCS/3500pro.inc,v 1.9 2006-08-30 12:31:56-07 Hamilton Exp Hamilton \$

²²This document was derived from the Cohu document: "3500pro.pdf".

Byte	Data	Description
0	STX	Start of message (0x02)
1	Address	Camera address (0x01 — 0xDF)
2	“c”	Message type (camera)
3 to $n + 3$	Command Data	See Table 21, page 89 through Table 32, page 93
$n + 4$	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
$n + 5$	ETX	End of message (0x03)

Table 20. RS-232 Command Message Format

7.2.1 RS-232 Command Data

Message	Data	Description	Response
WB Status Request	"cWS"		See Table 33, page 94
WB Sample/Hold	"cWa"		ACK/NAK
WB auto tracking	"cWt"		ACK/NAK
WB manual	"cWm"		ACK/NAK
WB red gain	"cWr###"	"000" → "895"	ACK/NAK
WB green gain	"cWg###"	"000" → "895"	ACK/NAK
WB blue gain	"cWb###"	"000" → "895"	ACK/NAK
Hue	"cWh###"	"000" → "063"	ACK/NAK
Saturation	"cWs###"	"000" → "255"	ACK/NAK
Indoor Lighting	"cWi"		ACK/NAK
Outdoor Lighting	"cWo"		ACK/NAK

Table 21. White Balance Commands

Message	Data	Description	Response
Sync Status Request	"cSS"		See Table 34, page 95
Horizontal Phase	"cSc#"	0x30 → 0x3F 16 steps	ACK/NAK (cSc0, cSc1, cSc2, cSc3, cSc4, cSc5, cSc6, cSc7, cSc8, cSc9, cSc:, cSc;, cSc<, cSc=, cSc>, cSc@)
Sub-Carrier phase	"cSp###"	"000" → "127"	ACK/NAK
Sync line lock	"cSl#"	"0" → "5" 6 steps	ACK/NAK (cSl0, cSl1, cSl2, cSl3, cSl4, cSl5)
Sync mode	"cSm#"	"0" → "4"	ACK/NAK (cSm0, cSm1, cSm2, cSm3, cSm4)

Table 22. Synchronize Modes Commands

Note: These commands depend on the sync board specified

Sync mode

- "0" = GenLock,
- "1" = H/V,
- "2" = vert reset,
- "3" = LineLock and
- "4" = Crystal.

Message	Data	Description	Response
Sht/Int Status Request	"cVS"		See Table 35, page 96
Shutter Automatic	"cVa"		ACK/NAK
Shutter Manual	"cVm"		ACK/NAK
Shutter speed	"cVs#"	"0" → "7" 8 steps	ACK/NAK (cVs0, cVs1, cVs2, cVs3, cVs4, cVs5, cVs6, cVs7, cVs8)
Integration Auto	"cVA"		ACK/NAK
Integration manual	"cVM"		ACK/NAK
Integration external	"cVE"		ACK/NAK
Integration time	"cVi##"	"01" → "99" frames	ACK/NAK

Table 23. Shutter/Integration Commands

Message	Data	Description	Response
Gain Status request	"cGS"		See Table 36, page 97
Automatic gain	"cGa"		ACK/NAK
Manual gain	"cGm"		ACK/NAK
Manual gain level	"cGg###"	"000" → "126"	ACK/NAK

Table 24. Gain Commands

Message	Data	Description	Response
ID Status Request	“cTS”		See Table 37, page 98
Enable ID text	“cTE”		ACK/NAK
Disable ID text	“cTD”		ACK/NAK
Top of screen	“cTT”		ACK/NAK
Bottom of screen	“cTB”		ACK/NAK
Text up to 24 chars	“cTL”		ACK/NAK

Table 25. Operator’s ID Commands

Message	Data	Description	Response
Iris status request	“cIS”		See Table 38, page 99
Automatic Iris	“cIa”		ACK/NAK
Iris Manual	“cIm”		ACK/NAK
DC Iris Auto	“cIA”		ACK/NAK
DC Iris manual	“cIM”		ACK/NAK
Iris open	“cIo”		ACK/NAK
Iris close	“cIc”		ACK/NAK
Iris stop	“cIs”		ACK/NAK

Table 26. Iris Commands

Message	Data	Description	Response
Zoom Status request	“cZS”		See Table 39, page 100
Zoom magnification factor	“cZm#” #	cZm1 = x1, cZm2 = x2, cZm4 = x4, cZm8 = x8	ACK/NAK
Zoom in	“cZi”		ACK/NAK
Zoom out	“cZo”		ACK/NAK
Zoom stop	“cZs”		ACK/NAK
Scroll up	“cZu”		ACK/NAK
Scroll down	“cZd”		ACK/NAK
Scroll right	“cZr”		ACK/NAK
Scroll left	“cZl”		ACK/NAK
Scroll stop	“cZq”		ACK/NAK
Scroll center	“cZc”		ACK/NAK
Zoom ctrl Boundary	“cZB”		ACK/NAK

Table 27. Zoom/Scroll Commands

Message	Data	Description	Response
Upload Configurations	"cCG#"	0x30 → 0x39	See Table 42, page 103 (cCG0, cCG1, cCG2, cCG3, cCG4, cCG5, cCG6, cCG7, cCG8, cCG9)
DownLoad Configurations	"cCP#",parameters	0x30 → 0x39	ACK/NAK (cCP0, cCP1, cCP2, cCP3, cCP4, cCP5, cCP6, cCP7, cCP8, cCP9)

Table 28. Configuration of Camera

Note: **parameters** — see definition in Table 30, page 93.

Message	Data	Description	Response
Camera Format status request	"cFS"		See Table 40, page 101
Camera Format	"cFC##"	statusF1 , statusF2A	ACK/NAK

Table 29. Format of Camera

Note: **statusF1**, **statusF2** — see definition in Table 40, page 101

Message	Data	Description	Response
Misc. Status Request	"MS"		See Table 41, page 102
Backlight comp OFF	"Bf"		ACK/NAK
Backlight comp ON	"Bn"		ACK/NAK
Pedestal ON	"On"		ACK/NAK
Pedestal OFF	"Off"		ACK/NAK
Y Gamma	"Yy#"	"0" $\longrightarrow$ "7" 8 steps	ACK/NAK (Yy0, Yy1, Yy2, Yy3, Yy4, Yy5, Yy6, Yy7)
Aperture Correction	"A##"	"00" $\longrightarrow$ "31"	ACK/NAK
Av. Picture Lv (APL)	"L##"	"00" $\longrightarrow$ "99"	ACK/NAK
Contrast	"c##"	"00" $\longrightarrow$ "63"	ACK/NAK
Black Level	"D###"	"000" $\longrightarrow$ "255"	ACK/NAK
Date & Revision num	"RS"		See Table 44, page 105

Table 30. Miscellaneous Commands

Message	Data	Description	Response
Store Presets	"cPs#"	"0" $\longrightarrow$ "9"	ACK/NAK (cPs0, cPs1, cPs2, cPs3, cPs4, cPs5, cPs6, cPs7, cPs8, cPs9)
Recall Presets	"cPr#"	"0" $\longrightarrow$ "9"	ACK/NAK (cPr0, cPr1, cPr2, cPr3, cPr4, cPr5, cPr6, cPr7, cPr8, cPr9)
Factory Defaults	"cPd"		ACK/NAK

Table 31. Preset Commands

Message	Data	Description	Response
Window frontlight Status	"cwFS"		See Table 43, page 104
Window defaults Status	"cwFD"		See Table 43, page 104
Window HV weights	"cwX", 0x01 $\longrightarrow$ 0x05, v1 $\longrightarrow$ v5, w1 $\longrightarrow$ w6	X = "F" for front light and "B" for backlight coefficient	ACK/NAK

Table 32. Windows Areas Weights Commands

7.3 Response Message Format

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	"c"	Message type
3	"W"	(cW) WB
4	StatusWB	WB status
5-7	Rgain	Red gain "000" → "895"
8-10	Ggain	Green gain "000" → "895"
11-13	Bgain	Blue gain "000" → "895"
14-16	Hue	Hue "000" → "063" (RGain & BGain)
17-19	Saturation	Saturation "000" → "255" (BYGain)
20	CHECKSUM	0x80 — 0x8F LS nibble is XOR of all previous bytes (LS Nibbles only) except STX
21	ETX	End of message (0x03)

Table 33. White Balance Status

StatusWB byte

- statusWB 0x30 - 0x38
 - bit0 0 = Tracking 1 = manual
 - bit1 0 = indoor 1 = outdoor
 - bit2 not defined always 0
 - bit3 0 = no error 1 = WB error
- cW##### One 1 byte field and five 3 byte fields (cW#,###,###,###,###,###).

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	“c”	Message type
3	“S”	(cS)
4	StatusSM	Sync Board status
5	0x30 → 0x3F	Horizontal delay 16 steps
6	0x30 → 0x35	Line Lock AC Phase.
7-9	“000” → “127”	Sub carrier phase (0 → 353 degree)
10	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
11	ETX	End of message (0x03)

Table 34. Sync Status

StatusSM Byte

- statusSM 0x30 - 0x34
 - 0x30 = GenLock (Auto 1)
 - 0x31 = H and V (Auto 2)
 - 0x32 = Vertical Reset
 - 0x33 = LineLock
 - 0x34 = Crystal
- Line lock phase @60 degree interval
 - 0x30 = 300 degree
 - 0x31 = 240
 - 0x32 = 180
 - 0x33 = 120
 - 0x34 = 60
 - 0x35 = 0 degree
- cS##### Two 1 byte fields and one 3 byte field (cS#, #, ###).

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	“c”	Message type
3	“v”	(cS)
4	StatusSI	Shutter/Integration mode
5	“0” → “8”	Shutter speed
6-7	“01” → “99”	Integration time in # of frames
8	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
9	ETX	End of message (0x03)

Table 35. Shutter/Integration Status

Shutter/Integration Byte **statusSI**

- **statusSI** 0x30 - 0x37
 - 0x30 = Auto shutter
 - 0x31 = Manual Shutter
 - 0x32 = Manual Integration
 - 0x33 = Auto Integration
 - 0x34 = 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	1/8000
PAL	1/50	1/120	1/250	1/500	1/1000	1/2000	1/4000	1/8000

- **cV####** Two 1 byte fields and one 2 byte field (cV#, #, ##).

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	“c”	Message type (Camera)
3	“G”	(cG)
4	StatusGM	Gain Status
5-7	“000” → “126”	Gain value
8	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
9	ETX	End of message (0x03)

Table 36. Gain Status

statusGM

- statusGM 0x30 - 0x31
 - bit0 0 = AGC 1 = manual
- cF#### One 1 byte field and one 3 byte field (cF#,###).

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	"c"	Message type (camera)
3	"T"	(cT)
4	statusID	Status of ID message
5-29	[1-24]	text
30	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
31	ETX	End of message (0x03)

Table 37. Operator's ID Status

Operator ID Status Byte (statusID)

- statusID 0x30 - 0x33
 - 0x30 ID disable and dpy @ bottom of screen
 - 0x31 ID enable and dpy @ bottom of screen
 - 0x32 ID disable and dpy @ top of screen
 - 0x33 ID enable and dpy @ top of screen
- cT#<24 ASCII> One 1 byte field and 24 ASCII characters.

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	“c”	Message type (camera)
3	“I”	(cI)
4	StatusIR	Status of Iris (cI0, cI1, cI2, cI3, cI4, cI5)
5	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
6	ETX	End of message (0x03)

Table 38. Iris Status

Lens Iris Status Byte **statusIR**

- **statusIR** 0x30 - 0x35
 - 0x30 Manual Iris
 - 0x31 Auto Iris
 - 0x32 DC Iris Manual
 - 0x33 DC Iris Auto
 - 0x34 Motorize Iris manual
 - 0x35 Motorize Iris auto

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	"c"	Message type (camera)
3	"Z"	(cZ)
4	0x30 $\rightarrow$ 0x68	Zoom magnification factor
5	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
6	ETX	End of message (0x03)

Table 39. Zoom Status

cZ<ASCII> <ASCII> is a single ASCII character which ranges from 0 through h to give a range of 57₁₀ zoom values.

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	“c”	Message type
3	“F”	(cF)
4	StatusF1	Camera statusF1
5	StatusF2	Camera statusF2
6	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
7	ETX	End of message (0x03)

Table 40. Status

Format Status Byte (**statusF1**)

- **statusF1** 0x30 - 0x34
 - 0x30 NTSC color
 - 0x31 PAL color
 - 0x32 NTSC Black and White
 - 0x33 PAL black and white
- Format Status Byte (**statusF2**)
 - **statusF2** undefined (0x30)
- **cF##** Two 1 byte fields (cF#, # or cF00, cF10, cF20, cF30, the second field is undefined and is always 0.)

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	"c"	Message type
3	"M"	(cM)
4	statusM1	Misc status 1
5	statusM2	Misc status 2 Gamma "0" → "7"
6-7	statusM3	Misc status 3 Aperture "00" → "31"
8-9	statusM4	Misc status 4 Av. Picture Lv "00" → "99"
10-11	statusM5	Misc status 5 Contrast "00" → "63"
12-14	statusM6	Misc status 6 Black level "000" → "255"
15	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
16	ETX	End of message (0x03)

Table 41. Miscellaneous Status

- Misc Status Byte (statusM1)
 - statusM1 0x30 - 0x33
 - * 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" → "7"
- Misc Status Word (statusM3) Aperture correction value "00" → "31"
- Misc Status word (statusM4) Av. Picture Level "00" → "99"
- Misc status (statusM5) Contrast value "00" → "63" (YFADE)
- Misc status (statusM6) Black level value "000" → "255"
- cM##### Two 1 byte fields, three 2 byte fields and one 3 byte field (cM#,#,##,##,##,###)

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	“c”	Message type (Camera)
3	“C”	(cC)
4	“G” (cCG) or “P” (cCP)	“G” = get configs (upload) or “P” = put config (download)
5	0x30 → 0x37	0x30 = default 0x31 → 0x37 configuration group number
6-80	Parameters	configuration parameters of camera
81	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
82	ETX	End of message (0x03)

Table 42. Upload/DownLoad Configuration

Parameters:

Item	Bytes	Description
statusWB	1	WB status byte
param1	15	R,G,B gains, Hue and Saturation
param2	12	Window weights (6 bytes) and sizes (6 bytes)
statusSI	1	Shutter/Integration status byte
param3	3	Shutter Mode (1 byte) and Integration time (frcnt = 2 bytes)
statusGM	1	Gain status byte
param4	3	Gain level
statusID	1	Operator”s ID status byte
OperID	24	24 bytes Operator”s ID
param5	1	Zoom magnification factor
param6	2	Format statusF1 and statusF2
statusM1	1	Miscellaneous status 1
param7	10	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)

cDG<75 bytes of numeric and ASCII data> See above descriptions.

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	"c"	Message type (Camera)
3	"w"	(cw)
4	"F" (cwF) or "D" (cwD)	"F" = frontlight data or "D" = default weights/sizes data
5-9	horizParam	horizontal count values h1 → h5
10-14	vertiParam	vertical count values v1 → v5
15-20	weights	weights count values w1 → w6
21	CHECKSUM	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
22	ETX	End of message (0x03)

Table 43. Window Status

Parameters

- **horizParam** 5 bytes Horizontal count values
- **vertParam** 5 bytes Vertical count values
- **weights** 6 bytes weights for 6 areas
- **cwD#####** Two 5 byte fields and one 6 byte field (cwD#####,#####,#####)
- **cwF#####** Two 5 byte fields and one 6 byte field (cwF#####,#####,#####)

Byte	Data	Description
0	STX	Start of message
1	ID	Camera address
2	“c”	Message type (Camera)
3	“R”	(cR) 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	0x80 — 0x8F Least significant nibble is XOR of all previous bytes (LS Nibbles only) except STX
17	ETX	End of message (0x03)

Table 44. Date and Revision of Camera Software Status

Parameters

cR##/##/####.# One 6 byte field, slant delimited, one four byte field with included period “(.)”
(cR##/##/##,###)

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8 MPC System ER-2221B Receiver Communications Protocol

This interface²⁴ also applies to ER-2221AK and other ER versions.

8.1 General Description

The²⁵ MPC Master Control Panel contains an 8031 micro computer with on-board UART for communications with MPC Control Receivers.

This section supplies the details necessary to understand communications between the MPC Master Control Panel (or Host Computer) and Control Receivers as used in the camera control system (Figure 8, page 108).

8.2 Message Format

Any time a command message is sent from the MPC Master Control Panel (or Host Computer) to a Control Receiver, the Receiver will respond with an ACK or an NAK (Figure 8, page 108). Data is transmitted using 1 start bit, 8 data bits, and 1 stop bit (no parity). The baud rate is set using the monitor 97 function as an entry code. It is typically set to 9600 baud. This process is described in the installation instructions of the Control Panel manual.

The commands are sent using the command message format shown in Table 45, page 109. The various commands that may be transmitted are listed in Table 46, page 110 through Table 48, page 111.

If the command message contains a latch function command, then the latch status response (Table 49, page 112, Format of Latch Status Response) will be sent back to the Master Control Panel. If the command message contains a home function command, then the home status response (Table 50, page 113, Format of Home Status Response from MPC) will be sent back to the Master Control Panel.

If the command is a position message, the response will be as shown in Table 51, page 114 and Table 51, page 114.

If the command message contains only a momentary function, no further response beyond the ACK or NAK will occur. If the command message contains a communications error (e.g., an address to a non-existent control receiver or a failure in the communications system), then the command error message response (in Table 50, page 113, with B_3 of byte 3 equal to 1) will be sent back.

Table 54, page 116 through Table 59, page 118 gives the ID message formats for communications from the master control panel to a control receiver. An ACK or NAK is returned.

8.3 Maintenance

No maintenance adjustments are required for the circuits on the processor board.

8.4 Parts List

Refer to the processor board for parts identifications.

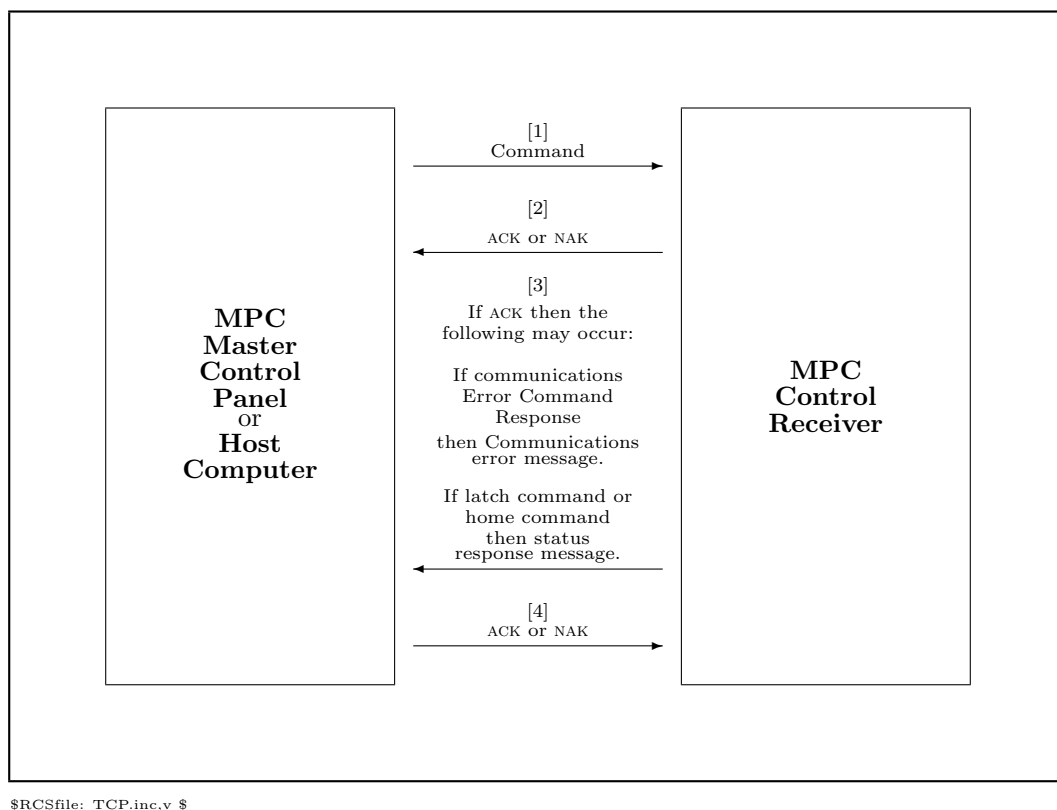
8.5 Schematic Diagrams

Refer to the processor board for the schematic diagram.

²³\$Header: d:/TXB-Cohu/RCS/2221pro.inc,v 1.10 2006-08-29 10:15:17-07 Hamilton Exp Hamilton \$

²⁴Cohu's data: Phone (619) 277- 6700, FAX (619) 277-0221, December 7, 1998, E-mail info@cohu.com

²⁵This is derived from the Cohu document: "mpc2221pro.pdf", Cohu document number 6X-5046(A).



\$RCSfile: TCP.inc,v \$

Figure 8. Typical Communications Protocol

8.6 Receiver Command Message Format

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address (0x01 0xDF)
2 TO $2n + 1$	Command Data	See Table 46, page 110 through Table 48, page 111
$2n + 2$	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 45. Receiver Command Message Format

NOTE: n is the number of commands in the message

Byte	Data	Description
Reset Control Receiver	“rs”	DATA consists of the ASCII codes for the two
Pan Left	“PL”	letters shown: rs = ASCII codes for r and s
Pan Right	“PR”	PL = ASCII codes for P and L, etc.
Pan Stop	“PS”	
Tilt Up	“TU”	
Tilt Down	“TD”	
Tilt Stop	“TS”	
Zoom In	“ZI”	
Zoom Out	“ZO”	
Zoom Stop	“ZS”	
Focus Near	“FN”	
Focus Far	“FF”	
Focus Stop	“FS”	
Iris Open	“IO”	
Iris Close	“IC”	
Iris Stop	“IS”	
P/T Position Request	“P?”	See Table 51, page 114 and Table 52, page 114 for position format
P/T GoTo Command	“pA ₂ A ₁ A ₀ E ₂ E ₁ E ₀ ”	
Lens Position Request	“V?”	
Lens GoTo Command	“vA ₂ A ₁ A ₀ E ₂ E ₁ E ₀ ”	

Table 46. Momentary, Receiver Command Data

Byte	Data	Description
Manual Iris Toggle	“LM”	See Table 49, page 112 and Table 50, page 113 for response format
Camera Power Toggle	“LP”	
Lens Speed Toggle	“LL”	
Latch Status Request	“L?”	
Aux Functions (Option 1)	“L1” → “L3”	Toggles Aux 1, Aux 2, or Aux 3 (L1, L2, L3)
Color Balance (Option 2)	“L1”	Select auto/manual mode
	“B1”	Increase blue
	“B2”	Increase red
	“B0”	Balance stop

Table 47. Latch, Receiver Command Data

Byte	Data	Description
Home Position GoTo	“H0” → “H9”	Preset 0 → 9 A home active “HA” will be immediate response. Later a home position “H0” to “H9” or home error “HE” will be generated. (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9)
Home Position Store	“P0” → “P9”	Program 0 → 9 (P0, P1, P2, P3, P4, P5, P6, P7, P8, P9)
Home Position	“H?”	Will generate a home status response
Status Request		See Table 49, page 112 and Table 50, page 113

Table 48. Home, Receiver Command Data

8.7 Responses from MPC Control Receiver

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address 0x01 0xDF
2	"L"	Latch Status
3	0x30 → 0x37 0x38	LS Nibble is four bits of status (L0, L1, L2, L3, L4, L5, L6, L8) Bit Value 0/1 (Comm error) B_0 =Iris Auto Manual B_1 =Camera power Off/On B_2 =Lens Speed Slow/Fast B_3 =Communications Error No/Yes
4	"A"	Aux Status
5	0x30 — 0x37	LS Nibble is four bits of status (A0, A1, A2, A3, A4, A5, A6, A7) Bit Value 0/1 B_0 =Aux 1 B_1 =Aux 2 B_2 =Aux 3
6 7	"X" 0x30 — 0x37	Extra Status LS Nibble is four bits of status (X0, X1, X2, X3, X4, X5, X6) Bit Value 0/1 B_0 =Local Mode B_1 =Pressure Loss B_2 =Video Loss B_3 =Not Used
8	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 49. Format of Latch Status Response

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address 0x01 → 0xDF
2	“H”	Home Status
3	“0” — “9” or “A” “I” “E”	ie, 2 = Home position 2 (H0, H1, H2, H3, H4, H5, H6, H7, H8, H9) (HA) Home active (HI) Home Not — at — Home position, or active (HE) Home error could not get to home position
4	CHECKSUM	0x80 to 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 50. Format of Home Status

8.8 Receiver Position Message

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address (0x01 to 0xDF)
2	“P” or “p”	Upper case “P” is response; Lower case “p” is GOTO command
3	A_2 (MS nibble)	Azimuth position (See Notes)
4	A_1	
5	A_0 (LS nibble)	
6	E_2 (MS nibble)	Elevation position (See Notes)
7	E_1	
8	E_0 (LS nibble)	
9	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 51. Format of Pan/Tilt Position Message

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address (0x01 to 0xDF)
2	“V” or “v”	Upper case “V” is response; Lower case “v” is GOTO command
3	A_2 (MS nibble)	Zoom position (See Notes)
4	A_1	
5	A_0 (LS nibble)	
6	E_2 (MS nibble)	Focus position (See Notes)
7	E_1	
8	E_0 (LS nibble)	
9	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 52. Format of Zoom/Focus Position Message

8.8.1 Position Encoding

The message data for the “Pan/Tilt Goto Command” above begins with an ASCII ‘p’ followed by the azimuth ($A_2A_1A_0$) and elevation ($E_2E_1E_0$) positions. The positions are 12-bit values encoded four-bits each in the least significant nibbles of the three bytes whose most significant nibbles are always 0x30. The subscript-2 indicates the byte containing the most significant bytes of the position and subscript-0 indicates the least significant.

The 12-bit position data is contained in nibbles $0 \rightarrow 2$, with:

nibble 0 = $b_0 \rightarrow b_3$,
 nibble 1 = $b_4 \rightarrow b_7$, and
 nibble 2 = $b_8 \rightarrow b_{11}$.

The nibble is then added to 0x30 to produce a value from 0x30 to 0x3F.

8.8.1.1 Position Encoding Example:

Example: Encoding an azimuth position value of decimal 2748₁₀ or 0xABC, is broken up into three nibbles and added 0x30 to each so:

$A_2 = 0x3A$,
 $A_1 = 0x3B$, and
 $A_0 = 0x3C$.

The same encoding scheme is used for the zoom and focus positions in the “Zoom/Focus Goto Command”.

8.8.2 Pan/Tilt Positions

Pan readouts are based on the CAL_0 (North or 0°) value of the PTZ. Angular readouts then increment to 90° (East), 180° (South) and to 270° (West) when looking down on the PTZ unit from above.

Tilt readouts are based on the horizon, with 0° meaning that the PTZ is looking at the horizon. As the PTZ points down the protocol readout changes to 45° and then 90° when the PTZ is pointing straight down. The PTZ on-screen display will indicate - 45° and then -90°. The discrepancy in the two types of readouts is that the protocol value is unsigned and the on-screen is signed. As tilt passes through straight down (not physically possible, but conceptually convenient, the protocol values increment until a straight up readout is 270° and the on-screen display shows 90°. At 45° above the horizon the protocol readout will be 315° and the on-screen display will be 45°. Here is a short table to attempt and explain these values.

Position	D readouts	Displays as
90° up	270	90
45° up	315	45
Horizontal - 1°	359	1
Horizontal	0	0
45° down	45	-45
90° down	90	-90

Table 53. Screen *vs.* Protocol Tilt Readouts

Note

These are for Table 53, page 115:

1. **Position:** Pointing direction of the enclosure/camera.
2. **D readouts:** D protocol returned value for this angle.
3. **Displays as:** What is displayed on the Spectra screen.

8.9 Receiver ID Message Format

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address (0x01 to 0xDF)
2	"d"	Display message
3	"M"	Mode select
4	"M" "I"	(MM) Menu mode (MI) ID mode
5	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 54. Format of Select Mode Message

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address (0x01 to 0xDF)
2	"d"	Display message
3	"I"	ID display
4	"D" "E"	(ID) Disable ID display (IE) Enable ID display
5	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 55. Format of ID Enable/Disable Message

NOTE: For all messages from master control panel to control receiver, ACK or NAK is returned.

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address (0x01 to 0xDF)
2	"d"	Display message
3	"C"	(dC) Clear screen
4	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 56. Format of ID Clear Screen Message

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address (0x01 to 0xDF)
2	"d"	Display message
3	"I"	ID display
4	"I"	(dIT) ID at top
5	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 57. Format of Select ID Top Message

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address (0x01 to 0xDF)
2	"d"	Display message
3	"I"	ID display
4	"B"	(dIB) ID at bottom
5	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 58. Format of Select ID Bottom Message

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address (0x01 to 0xDF)
2	"d"	Display message
3	"L"	Line of text
4	"1" — "<" (0x31 — 0x3C)	Line number (1–12) + 0x30 (dL1, dL2, dL3, dL4, dL5, dL6, dL7, dL8, dL9, dL:, dL;, dL<)
5	(ID text)	ASCII characters (up to 24) for the line starting with the left most character
n	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 59. Format of Update Line Message

Byte	Data	Description
0	0xF8	Auto baud character
1	Address	Camera address (0x01 to 0xDF)
2	"d"	Display message
3	"A"	Alarm message
4	"1" — "3" (0x31 — 0x33)	Display line number (1–3) + 0x30
5	"B"	Blink alarm message (dA1B, dA2B, dA3B)
	"E"	Enable alarm message (dA1E, dA2E, dA3E)
	"D"	Disable alarm message (dA1D, dA2D, dA3D)
6	CHECKSUM	0x80 0x8F Least significant nibble is XOR of all previous bytes (LS Nibble only) except 0xF8

Table 60. Format of Alarm Display Message

APPENDIX A

A Cohu's Web Page

Note

This is an extract from Cohu's technical support web page. (www.cohu-cameras.com) It was obtained on 25AUG06. Cohu has an active policy of updating this page quite often.

A.1 Operations Manuals

This is a list of current Manual Numbers *vs.* camera model numbers.

Camera Model	Manual #	Camera Model	Manual #	Camera Model	Manual #
1100	970b.pdf	3950 (i-View)	1027.pdf	7500	1018.pdf
1300	971a.pdf	3960 (i-View II)	1050.pdf	7800	1030.pdf
2100	979.pdf	4710	862c.pdf	7700	1029.pdf
2200	972a.pdf	4810	845e.pdf	8210	917a.pdf
2600	1009.pdf	4910	924e.pdf	8240	937a.pdf
2700	1040.pdf	4920	1001.pdf	9200 i-commander	1033.pdf
2740	1048.pdf	4990	947.pdf	9300 i-control	1034.pdf
2750 (serial ctl)	1064.pdf	6310	931a.pdf	DSPX/DSPE	957a.pdf
2900	1016.pdf	6400	882b.pdf	MPC-D	836a.pdf
3600	1042.pdf	6600-1000	987.pdf	MPC-M & MPC-R	829a.pdf
3810	1003.pdf	6600-3000	997.pdf	MPC RS422 I'face	5035.pdf
3820	1010.pdf	6600 Timing	1024.pdf	MPC RS232 I'face	5030.pdf
3830	1005.pdf	6710	890a.pdf	Win MPC GUI	1032.pdf
3920 (i-Dome)	1026.pdf	7100 Operations	1043.pdf	—	—
3930 (housing only)	1037.pdf	7100 Reference	1044.pdf	—	—

A.2 Software & Protocol Downloads

WinMPC v4703 download here (22 August 06) Note: this is an .exe file. Software and descriptive files for setup of Cohu 3800 Series and 3900 Series.

A.3 Camera/System Protocol

1. Camera Protocol: Model 3500
2. System Protocol: MPC RS-232
3. System Protocol: MPC RS-422

²⁶\$Header: d:/TXB-Cohu/RCS/CohuWeb.inc,v 1.2 2006-08-25 11:06:23-07 Hamilton Exp Hamilton \$

4. System Protocol: Positioners and domes
5. System Protocol: ER2221B CCR
6. Camera Protocol: idome/iview/LCU

A.4 Camera GUIs

1. GUI for 3600 Series cameras (122 KB zip)
2. GUI for 3900 (i-Series) Use WinMPC from "Software System Control", above. Select manual 1032 from list.

A.5 Cohu Data

Cohu, Inc., Electronics Division

Correspondence:
P.O. Box 85623
San Diego, CA 92186, USA

Factory:
3912 Calle Fortunada
San Diego, CA 92123-1827
Tel. +1 (858) 277-6700
Fax: +1 (858) 277-0221

APPENDIX B

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