INTERFACE DEFINITION DOCUMENT

FOR THE

ESI DPT 115 DIGITAL PAN & TILT HEAD

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For Use with DPT 115 Software P/N: 768794 v2.0 and above

1.0 INTRODUCTION

This document defines the hardware and software interface requirements for remote control of the ESI DPT 115 Digital Pan & Tilt Head. This document is divided into two main sections. The first defines the hardware interfaces and the second defines the software and message interface. Both interfaces must be as described in this document to get the best performance from the DPT 115. The ESI Model 180 Digital Controller fully complies with all of the interface requirements addressed in this document.

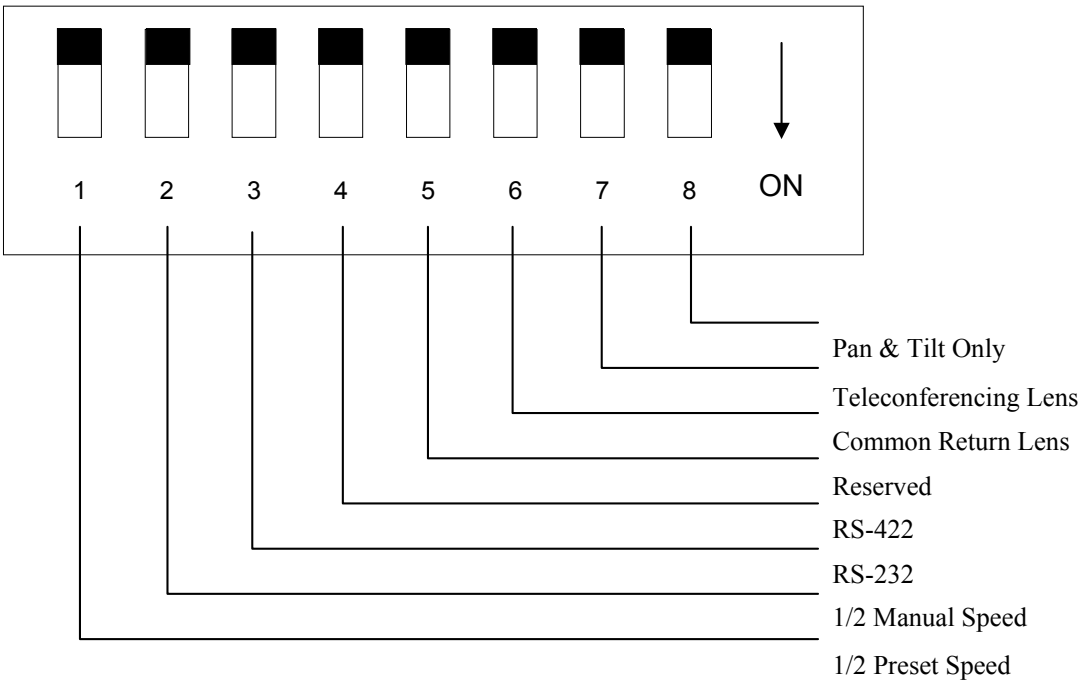
1.1 THE COMMUNICATIONS INTERFACE

Control of the pan and tilt is accomplished by sending messages to the pan & tilt head. The standard communications protocol is 9600 baud, eight data bits, one stop bit , and no parity. These commands tell the head and lens which direction and at what rate to move. Preset related commands are also passed over the communication link between the head and the controller. Depending upon the position of DIP Switches #3 and #4, the DPT 115 may communicate to the controller via RS-232, RS-422, both RS-232 and RS-422 or it may be in the CCU pass through mode. The CCU pass through mode is only applicable when using the JVC KY-F55BU or the JVC KY-F32U three chip cameras.

If the DIP Switch #3 is in the DOWN position and DIP switch #4 is in the UP, the RS-232 communications link is enabled and no response will be made to commands coming in from the RS-422 port. Conversely, if the DIP Switch #3 is in the UP position and DIP switch #4 is in the DOWN, the RS-422 communications link is enabled and no response will be made to commands coming in from the RS-232 port. If both DIP Switch #3 and DIP Switch #4 are in the UP position, the “Polling” mode is enabled and both RS-232 and RS-422 communications links are enabled. If both DIP Switch #3 and DIP Switch #4 are in the DOWN position the CCU “Pass Through” mode is enabled and communications will be via the RS-422 link. For further information on the “Pass Through” mode see Application Note AN101.

The DIP Switch diagram on the next page describes the operation of each DIP Switch location. It is important that the DIP Switches be properly positioned. The DPT has been designed to interface to virtually any lens and the DIP settings and the internal Jumper settings are essential for proper operation. For any questions about lens interfacing, contact ESI @ 321-956-0095.

DIP SWITCHES LOCATED ON THE BASE OF THE DPT 115



The Function of each of these switches is as follows: **NOTE:** Down is equivalent to ON

- *Pan & Tilt Only*
  - Up: Pan, Tilt, Zoom and Focus Presets are enabled
  - Down: Only Pan & Tilt Presets are allowed
- *Teleconferencing Lens*
  - Up: CCTV Lens
  - Down: Teleconferencing Lens
- *Common Return*
  - Up: Independent Return for Zoom & Focus (4 Wire Control)
  - Down: Common Return for Zoom & Focus (3 Wire Control)
- *Special: Keep in UP position*
  - Up: TBD
  - Down: TBD
- *RS-422*
  - Up: Polls between RS-232 & RS-422 if DIP Switch 4 is also "Up"
  - Down: RS-422 Communications only (If both RS-232 & RS-422 are "DOWN", ***CCU Pass thru Mode)***
- *RS-232*
  - Up: Polls between RS-232 & RS-422 if DIP Switch 4 is also "Up"
  - Down: RS-232 Communications only (If both RS-232 & RS-422 are "DOWN", ***CCU Pass thru Mode)***
- *1/2 Manual Speed*
  - Up: Pan & Tilt has maximum speed capability when manually controlled
  - Down: Pan & Tilt has 1/2 maximum speed capability when manually controlled
- *1/2 Preset Speed*
  - Up: Pan & Tilt has maximum speed capability when in Preset Mode
  - Down: Pan & Tilt has 1/2 maximum speed capability when in Preset Mode

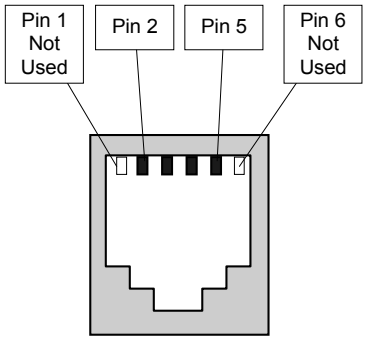
2.0 HARDWARE INTERFACE

The hardware interface to the DPT 115 is accomplished through either an RJ-11 connector for the differential RS-422 interface or a 9 pin D connector for the RS-232 interface. Both of these interfaces are described below.

2.1. DIFFERENTIAL INTERFACE, RS-422

The differential interface is the preferred interface when there are long distances between the controller and the pan & tilt head. The RS-422 receiver/drivers used by the DPT 115 are National Semiconductor DS8922 dual differential line driver and receiver pairs which meet the requirements of EIA Standard RS-422. The ESI Model 180 interfaces to the DPT 115 via the RS-422 link.

The connector labeled “RS422” on the DPT 115 connector plate is a six position, four conductor RJ-11 modular jack. This connector provides RS 422 interface voltage levels to and from the digital pan and tilt head. Shown below is the pinout for the RS-422 connector located on the DPT 115. A typical interface need only wire for the P/T Data In - and P/T Data In + signals. The wiring for the P/T Data Out - and P/T Data Out + is optional but included in all ESI cables.



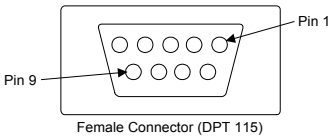
The pin assignment for this connector follows:

Pin #	Description
2	P/T Data Out -
3	P/T Data Out +
4	P/T Data In -
5	P/T Data In +

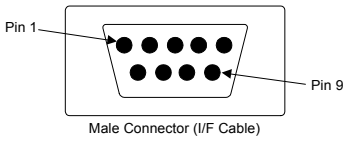
ESI Part Number 960379-XXX may be purchased from ESI to interface a Model 180 Digital Controller to the DPT 115. The XXX defines the distance between the Model 180 and the DPT 115 in feet. We recommend the use of twisted pairs and a wire size of AWG 26 to AWG 24 be used. For short distances, less than 150 feet, AWG 28 wire can be used.

2.2 SINGLE ENDED INTERFACE, RS-232

The RS-232 interface may be used in place of, or in addition to, the RS-422 interface described above. The RS-232 receiver/drivers used in the DPT 115 are Maxim MAX 242 +5VDC powered dual channel RS-232 driver/receivers which meet EIA/TIA-232E and V.28 specifications. The connector labeled "RS232" on the connector plate is a nine pin sub-miniature female (socket) "D" type. This connector provides RS-232 voltage signals to and from the digital pan and tilt head. The pin numbers for the RS-232 connector located on the DPT 115 and the Interface Cable shown below.



Female Connector (DPT 115)

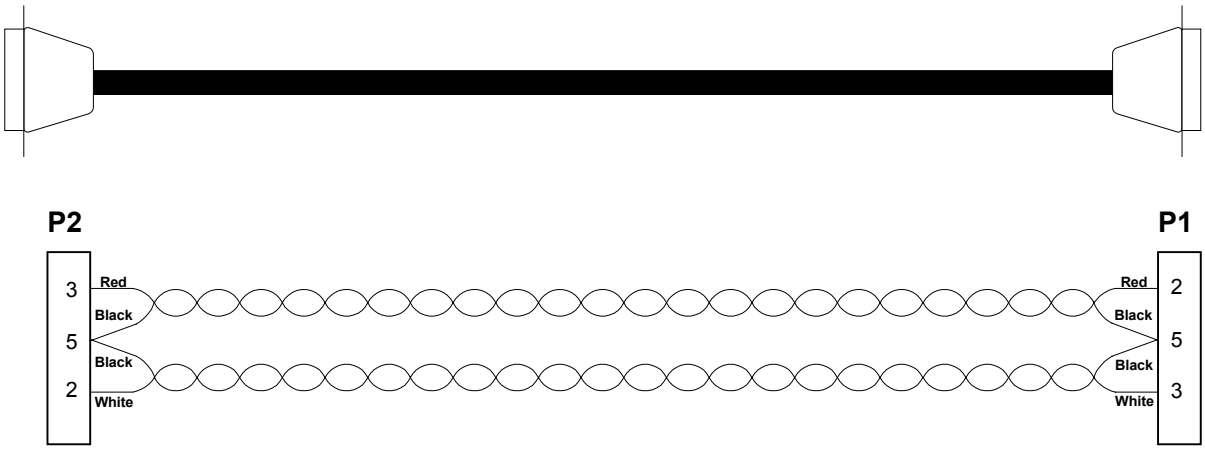


Male Connector (I/F Cable)

The pin assignments for the DPT 115 side of the interface cable are as follows:

Pin #	Description	RS-232	LDCC
1.	TTL Transmit Output: Do not wire in RS-232 Applications.		✓
2.	RS-232 Transmit Data Out of Pan & Tilt	✓	
3.	RS-232 Receive Data into Pan & Tilt	✓	
4.	Tied to Pin 6 (DSR): JP2 [● ●] ● Tied to Pullup Resistor to +5VDC: JP2 ● [● ●]	✓	 ✓
5.	Signal Ground via 10 Ohms: JP1 ● [● ●] Signal to Hard Ground: JP1 [● ●] ●	✓	 ✓
6.	See Pin 4		
7.	Tied to Pin 8	✓	
8.	Tied to pin 7	✓	
9.	TTL receive data from Camera Remote Control		✓

A typical interface cable between a controller and the DPT 115 is illustrated below:



3.0 SOFTWARE INTERFACE

The software interface is based upon the Asynchronous Serial Interface Mode of the MicroChip PIC 16C74B microcontroller used in the DPT 115. The format is NRZ with one start bit, eight data bits, one stop bit and no parity. The microcontroller sends and receives data LSB first. The BAUD rate is 9600. During normal communications, the DPT 115 will operate in a RECEIVE ONLY mode. Special protocols may be implemented which employ two way communications.

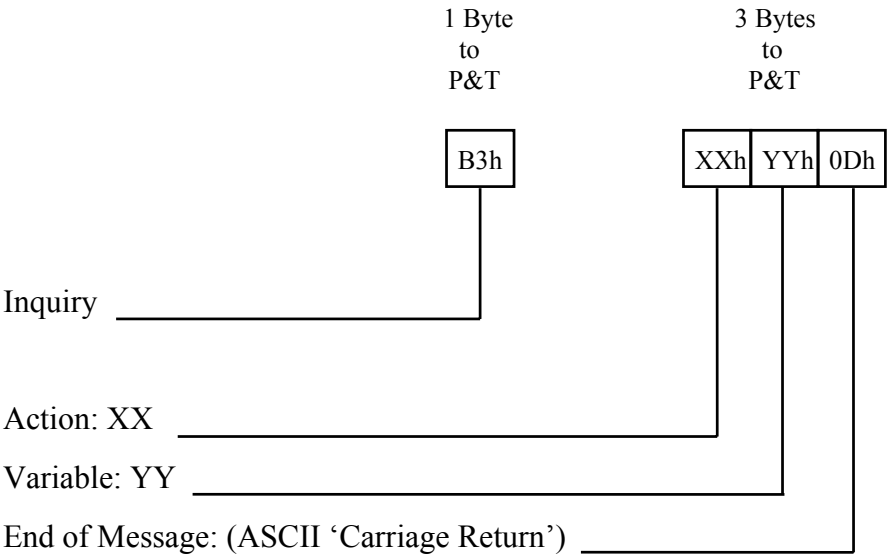
3.1 SOFTWARE PROTOCOL

A software protocol block diagram is presented on the next page and the protocol is described in the balance of this paragraph. The message interface with the DPT 115 consists of the following bytes:

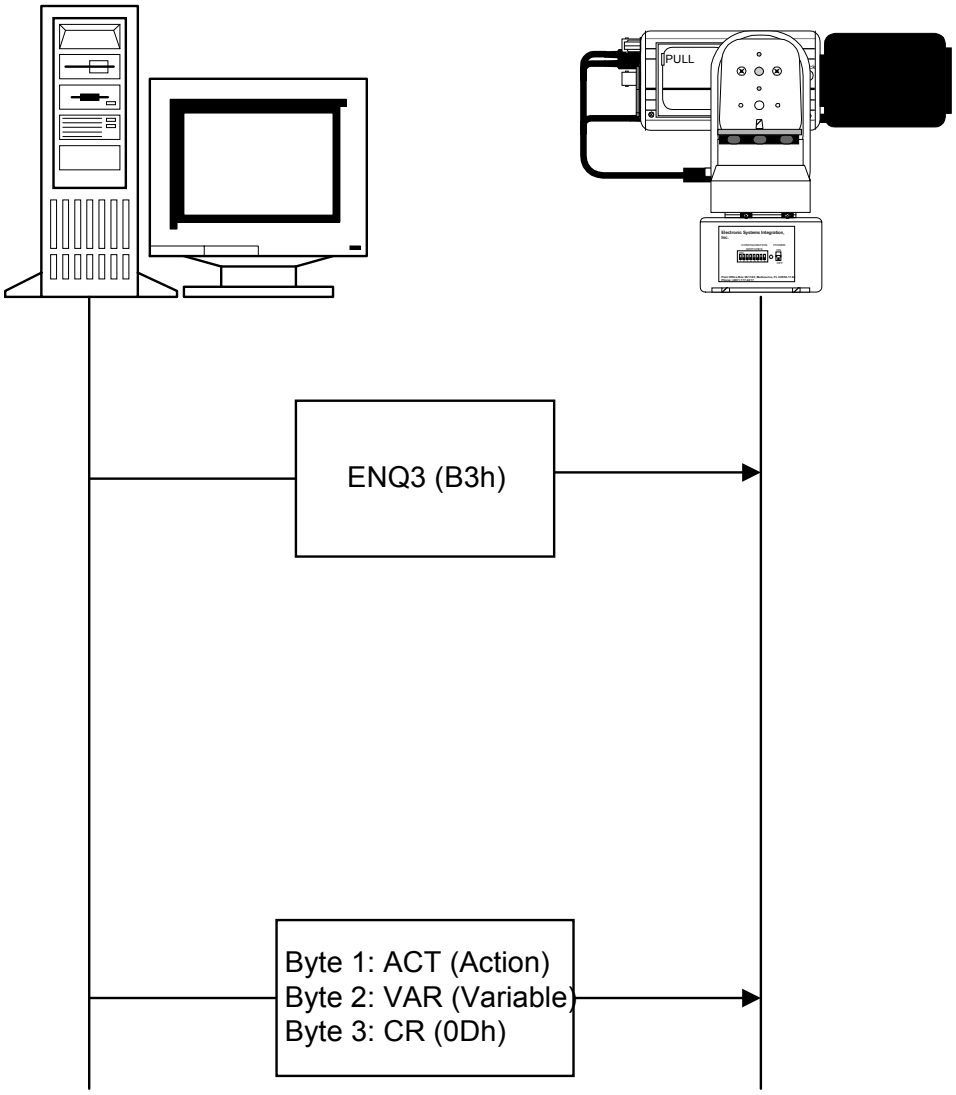
Byte Name	**# of Bytes**	**Originator**	**Hex Code**
Inquiry:	1	Controller	B3
Message Content	3	Controller	XX, YY, 0D

Where XX represents an action to be taken by the DPT 115 and YY represents a variable which modifies the action to be taken. For example XX may represent a Tilt UP action and YY is a binary (00 to FF) speed of the UP action.

The message is alternately shown below:



Protocol Block Diagram



This message format is used for all messages to the DPT 115. The two Bytes which communicate the actions of the pan & tilt are the Action and Variable bytes. The Action byte is actually an ASCII character which represents the action the pan & tilt is to take. A list of the valid actions is presented below. The Action List also portrays the commands in their proper sequence. This sequence of Action commands will be discussed later.

ACTION COMMAND LIST IN ORDERED SEQUENCE

Action	Letter	Hex
Pan & Tilt		
Up	U	55
Down	D	44
Left	L	4C
Right	R	52
Focus		
Far	F	46
Near	N	4E
Zoom		
Wide (Speed Mode)	W	57
Wide (Position Mode)	w	77
Telephoto (Speed Mode)	T	54
Telephoto (Position Mode)	t	74
Iris *		
Open	O	4F
Close	C	43
Auto	A	41
Auxiliary *		
Rotate Right	S	53
Rotate Left	K	4B
Preset		
Preset	P	50
Communication		
Carriage Return	CR	0D
Inquiry	ENQ3	B3

* Not used in normal modes of operation. Used in special requirements.

The Variable Byte is used to provide a “Speed” to all of the Action commands except Auto Iris and Preset. The range of values for Variable is 00h to FFh with 00h being no speed and FFh being the maximum speed. For example, if the controller wanted to tilt the pan & tilt head up at a slow rate (04h), the following message would be generated (see Protocol Block Diagram).

B3h	55h	30h	0Dh

The Variable byte is ignored for the Auto Iris command. For the Preset command, the following bit locations of the Variable byte are used:

Bit Location	b7	b6	b5	b4	b3	b2	b1	b0
Action Modifier	NU	NU	GTO	STR	PL3	PL2	PL1	PL0

0	0	0	0	Preset Location 1
0	0	0	1	Preset Location 2
0	0	1	0	Preset Location 3
0	0	1	1	Preset Location 4
0	1	0	0	Preset Location 5
0	1	0	1	Preset Location 6
0	1	1	0	Preset Location 7
0	1	1	1	Preset Location 8
1	0	0	0	Preset Location 9
1	0	0	1	Preset Location 10
1	0	1	0	Preset Location 11
1	0	1	1	Preset Location 12
1	1	0	0	Preset Location 13
1	1	0	1	Preset Location 14
1	1	1	0	Preset Location 15
1	1	1	0	Preset Location 16

Store the pan, tilt, zoom and focus data at the preset location defined by bits PL0 -PL3

Go to the pan, tilt, zoom and focus location stored at the preset location defined by bits PL0 -PL3

Not Used (Send as 0)

3.2 Message Sequencing and Timing

Sequencing: The Action Command in Ordered Sequence List provided in the previous section, listed the commands in the sequence they are to be sent. If an Action Command (all commands except Auto & Preset) is sent out of sequence, the motion associated with the out of sequence command is stopped. This is illustrated by example in Section 4.

Timing: The time between pan & tilt messages must not exceed 72 milliseconds. If the time does exceed 72 milliseconds, the DPT 115 will assume communications with the controller is lost and stop all motion.

4.0 EXAMPLES:

This section presents several examples of message sequences. These examples will be illustrated with the 4 byte messages described in section 3.1. These message sequences are shown as illustrative examples. An actual message sequence would contain many more messages to create a measurable move.

4.1 EXAMPLE 1: Normal operation of a Tilt Up Command

This sequence will ramp the tilt speed up from a standstill to a maximum rate of A0h and then slowly ramp back down to 30h and then to a speed of zero. It is assumed the time between messages is less than 72 milliseconds. Example 4.2 will illustrate the effect of a time delay of greater than 72 milliseconds between messages.

B3h	55h	30h	0Dh	Begin slow Tilt Up
B3h	55h	60h	0Dh	Tilt Up a little faster
B3h	55h	A0h	0Dh	Tilt Up faster yet
B3h	55h	A0h	0Dh	Continue at previous speed
B3h	55h	70h	0Dh	Slow the Tilt Up down a little
B3h	55h	50h	0Dh	Slower yet
B3h	55h	30h	0Dh	Back to real slow

EXAMPLE 4.2: Continuous Tilt Down at a rate of 80h but with a time delay of more than 72 milliseconds between messages.

B3h	44h	80h	0Dh	Constant Medium Velocity
B3h	44h	80h	0Dh	Same velocity and t<72msec; Tilt is smooth
B3h	44h	80h	0Dh	Same velocity and t>72msec; tilt stops motion after 72 msec and restarts when the command is received
B3h	44h	80h	0Dh	Same velocity and t<72msec; Tilt is smooth
B3h	44h	80h	0Dh	Same velocity and t>72msec;again the tilt stops motion after 72 msec and restarts when the command is received. this results in a “jerky” tilt response.

EXAMPLE 4.3: Normal operation of a Tilt Up Command with a Pan Left. Assume all Variables are maintained at a constant speed. and the time between messages is < 72 msec.

B3h	55h	50h	0Dh	Tilt Up at speed 50h
B3h	4Ch	60h	0Dh	Pan Left a at speed 60h & Tilt UP at speed 50h
B3h	55h	50h	0Dh	Tilt Up at speed 50h & Pan Left a at speed 60h
B3h	4Ch	60h	0Dh	Pan Left a at speed 60h & Tilt UP at speed 50h
B3h	55h	50h	0Dh	Tilt Up at speed 50h & Pan Left a at speed 60h

EXAMPLE 4.4: Same as above but with the added motion of a Zoom Wide

B3h	55h	50h	0Dh	Tilt Up at speed 50h
B3h	4Ch	60h	0Dh	Pan Left a at speed 60h. Pan Command added here & Tilt UP at speed 50h
B3h	55h	50h	0Dh	Tilt Up at speed 50h & Pan Left a at speed 60h
B3h	4Ch	60h	0Dh	Pan Left a at speed 60h & Tilt UP at speed 50h
B3h	57h	48h	0Dh	Zoom Wide at speed 48h. Zoom Command added here. & Pan Left a at speed 60h & Tilt UP at speed 50h
B3h	55h	50h	0Dh	Tilt Up at speed 50h & Zoom Wide at speed 48h. & Pan Left a at speed 60h
B3h	4Ch	60h	0Dh	Pan Left a at speed 60h & Tilt Up at speed 50h & Zoom Wide at speed 48h.
B3h	57h	48h	0Dh	Zoom Wide at speed 48h & Pan Left a at speed 60h & Tilt UP at speed 50h

Both examples 4.3 and 4.4 are normal modes of operation and show the proper sequence of commands as shown in the Action Command in Ordered Sequence List. Example 4.5 shows what will happen if a message has an out of sequence command.

EXAMPLE 4.5: Begin with tilt UP, add Pan Left and finally add Zoom Wide. Then sequence correctly and finally do an out of sequence series.

B3h	55h	50h	0Dh	Tilt Up at speed 50h
B3h	55h	50h	0Dh	Tilt Up at speed 50h
B3h	4Ch	60h	0Dh	Pan Left a at speed 60h. Pan Command added here & Tilt UP at speed 50h
B3h	55h	50h	0Dh	Tilt Up at speed 50h & Pan Left a at speed 60h
B3h	4Ch	60h	0Dh	Pan Left a at speed 60h. Pan Command added here & Tilt UP at speed 50h
B3h	57h	48h	0Dh	Zoom Wide at speed 48h. Zoom Command added here. & Pan Left a at speed 60h & Tilt UP at speed 50h
B3h	55h	50h	0Dh	Tilt Up at speed 50h & Zoom Wide at speed 48h. & Pan Left a at speed 60h
B3h	4Ch	60h	0Dh	Pan Left a at speed 60h & Tilt Up at speed 50h & Zoom Wide at speed 48h.
B3h	57h	48h	0Dh	Zoom Wide at speed 48h & Pan Left a at speed 60h & Tilt UP at speed 50h
B3h	4Ch	60h	0Dh	Pan Left at speed 60h. Pan is out of sequence & bypasses Tilt Tilt now stops motion & Zoom Wide at speed 48h.
B3h	55h	50h	0Dh	Tilt Up at speed 50h. Tilt begins again-Jerky motion Zoom now stops because it was bypassed in the sequence Pan Left a at speed 60h
B3h	57h	48h	0Dh	Zoom Wide at speed 48h. Zoom restarts with a jerk & Pan Left a at speed 60h & Tilt UP at speed 50h
B3h	4Ch	60h	0Dh	Pan Left at speed 60h. Tilt now stops motion & Zoom Wide at speed 48h. Everything is back together

5.0 PROGRAMMING AND USING PRESETS

One of the most powerful features of the DPT 115 is its preset ability. By programming a preset location (up to 16 per DPT 115), a single command can send the DPT 115 and lens to a previously stored preset position.

5.1 PROGRAMMING A PRESET

To program a preset location with a teleconferencing lens, the zoom position commands MUST BE used. These are “w” for Wide and ‘t’ for Telephoto. In fact, for a valid zoom preset position to be programmed, one must change the lens zoom position using the zoom position commands prior to storing the preset.

Position the pan, tilt, zoom and focus to the desired location and send the following command sequence to the DPT 115. Any preset location from 00h (Preset 1)to 0Fh (Preset 16) may be selected.

B3h	50h	14h	0Dh	Store in Preset Location 5

This will store the current positions of the pan, tilt, zoom and focus into preset location 5.

5.2 GOING TO A PRESET LOCATION

To command the DPT 115 to go to the previously stored preset location. Send the following command.

B3h	50h	24h	0Dh