Application Note

Receiver/Driver and AutoDome® Control Code Protocol

TC8560 Series
TC700 Series

Philips
Communication &
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PHILIPS

The following paragraphs document the control code data format used by Philips CSS control systems to communicate with On-Site Receiver/Drivers and AutoDome® cameras. This document does not cover other forms of status type data which is also generated by certain control systems.

Control code data is sent in message packets. For certain functions, commands must be sent repetitively at a rate of 20 Hz to maintain a smooth operational response of the device being driven by the receiver/driver.

Default RS-232 parameters for receiver/drivers are:

2400 or 9600 baud, 1 stop bit, 8 data bits, no parity, and no handshake.

The format for the Receiver/Driver control code message packet is as follows:

Length Byte
Receiver/Driver High Order Address Byte
Receiver/Driver Low Order Address Byte
Opcode Byte
Data Byte 1
Data Byte 2
Data Byte 3 (used with Opcodes 5 and 8 only)
Checksum Byte

Each packet begins with a **Length byte** that specifies the number of bytes in the remainder of the packet (the length byte itself is not included in this number). The most significant bit (MSB) of the length byte is always set to 1. The MSB must be zero for ALL other bytes of the message packet. For the functions below, only control commands with lengths of 6 and 7 bytes are used, therefore, the length byte (with the MSB set) will be either 86 hex or 87 hex.

The message packet contains a **Receiver/Driver** address number encoded using a 14 bit binary value. (Including an address value permits the data to be broadcast to all receiver/driver sites but only the site set to a matching address will respond.) This address number is sent using 2 bytes of the message packet. The binary value corresponds to the logical camera number of the camera site being controlled minus 1. For example, camera number 1 would be encoded with all 14 data bits reset to zero. Camera number 2 has its Least Significant Bit (LSB) set to 1 and all other bits set to zero. The High Order Address byte consists of the upper 7 bits of the 14 bit binary camera number. The Low Order Address byte consists of the lower 7 bits of the 14 bit binary camera number. In all cases, the MSB of each byte is not counted as part of the address number and must always be reset to zero so it will not be confused with a Length byte. Since the use of a 14 bit binary number provides a camera number range from 1 to 16384, the corresponding Receiver/Driver Address data bytes would take the form of 0000 hex to 7F7F hex.

Address Bytes examples are shown below:

Camera Number	Value to Be Encoded	14-Bit Binary Value	High Order Byte (Hex)	Low Order Byte (Hex)
1	0	0000000 0000000	00	00
2	1	0000000 0000001	00	01
256	255	0000001 1111111	01	7F
257	256	0000010 0000000	02	00
500	499	0000011 1110011	03	73
512	511	0000011 1111111	03	7F
513	512	0000100 0000000	04	00
1024	1023	0000111 1111111	07	7F
5000	4999	0100111 0000111	27	07
9999	9998	1001110 0001110	4E	0E
16384	16383	1111111 1111111	7F	7F

The **Opcode** byte along with the 2 or 3 data bytes determine the actual function to be executed by the receiver/driver. Currently, 7 different opcodes are supported. Opcodes 2, 3, 4, 6, and 7 are associated with 2 data bytes while opcodes 5 and 8 are associated with 3 data bytes.

The format of three **Data Bytes** depend on the opcode. The opcode functions and their corresponding data formats are shown in Table 1. In all cases, a 1 written into a bit position initiates the specified action. If conflicting bits are set (e.g., Pan Left and Pan Right), the action is undefined, but the receiver/ driver will resolve the conflict with no damage. If the receiver/driver receives a command while still processing a previous command, the old command will be aborted, and the new one executed.

The **Checksum** is computed as the sum of all previous bytes (including the length byte) in the message, modulo 128 (logical AND sum with 7F hex).

Opcode Descriptions:

Opcode 2 is used activate fixed speed pan/tilt/zoom functions for an indefinite period. A logic one will activate the indicated function, which will remain active until explicitly turned off. The functions can be turned off by a command with a different opcode, or by opcode 2 with a zero in the associated data bit position.

Opcode 3 is referred to as a "poor man's preposition" because it can be used to operate any pan/tilt/zoom (even those without preposition capability) to approximate positions by moving for a specified time in the desired direction. The duration of the function is specified using a 6-bit data value where the time is specified in units of half-seconds. This provides a time range of 1/2 second duration (all bits reset to zero) to 32 seconds (all bits set to 1). Note that the actual duration of the function may only approximate the specified time due to conditions at the receiver/driver site.

Opcode 4 activates pan/tilt/zoom functions at a fixed speed determined by the Receiver/Driver or AutoDome. This opcode causes the specified function to be activated for at least 50 ms, so the command must be issued at a frequency of not less than 20 Hz for smooth operation.

Opcode 5 is used activate variable speed functions for an indefinite period. A logic one will activate the indicated function, which will remain active until explicitly turned off. The functions can be turned off by a command with a different opcode, or by opcode 5 with a zero in the associated data bit position.

Opcode 6 activates iris/focus/zoom functions at a fixed speed determined by the Receiver/Driver or AutoDome. This opcode causes the specified function to be activated for at least 50 ms, so the command must be issued at a frequency of not less than 20 Hz for smooth operation.

Opcode 7 activates preposition or auxiliary functions, as shown in Table 2. The numeric data consists of a 10 bit binary number. The upper 3 bits of this 10 bit number along with the desired function is sent as Data Byte 1. The lower 7 bits of the 10 bit number is sent as Data Byte 2. The Auxiliary On and Off commands are sometimes issued repetitively to control level adjustment type functions. For those functions that use repetitive issuance of the command, the repetition rate is 20 Hz.

Opcode 8 activates pan, tilt, zoom, focus, and iris functions. It provides for variable speed control over pan/tilt/zoom functions. The pan and tilt functions require a speed value of 0 to 15 (0 to F hex); 0 is the slowest speed and 15 is the fastest speed. The zoom function requires a speed value of 0 to 7; 0 is the slowest speed and 7 is the fastest speed. This opcode causes the specified function to be activated for at least 50 ms, so the command must be issued at a frequency of not less than 20 Hz for smooth operation.

TABLE 1. Coding of Data Bytes

OPCODE	DATA BYTE	BIT 7	6	5	4	3	2	1	0
2 (Indefinate Activation)	1	0	0	0	Pan L	Tilt U	Zoom O	Foc N	Iris O
	2	0	0	0	Pan R	Tilt D	Zoom I	Foc F	Iris C
3 (PoorMan's Prepos)	1	0	-- Time (Value-1 = Number of Half Seconds) --						Foc F
	2	0	Foc N	Zoom I	Zoom O	Tilt U	Tilt D	Pan L	Pan R
4 (Pan/Tilt/Zoom)	1	0	0	0	0	0	0	0	Foc F
	2	0	Foc N	Zoom I	Zoom O	Tilt U	Tilt D	Pan L	Pan R
5 (Indef Act Var Speed Pan/Tilt/Lens)	1	0	Zoom Speed			Tilt Speed			
	2	0	Pan Speed				Iris O	Iris C	Foc F
	3	0	Foc N	Zoom I	Zoom O	Tilt U	Tilt D	Pan L	Pan R
6 (Lens Control)	1	0	0	0	0	0	0	0	0
	2	0	0	Iris O	Iris C	Foc F	Foc N	Zoom I	Zoom O
7 (Aux/Prepos)	1	0	Numeric Data MSB's			Function Code (See Table 2)			
	2	0	Numeric Data LSB's						
8 (Variable Speed Pan/Tilt/Lens)	1	0	Zoom Speed			Tilt Speed			
	2	0	Pan Speed				Iris B	Iris D	Foc F
	3	0	Foc N	Zoom I	Zoom O	Tilt U	Tilt D	Pan L	Pan R

Abbreviations used in Table 1:

Foc N = Focus Near Zoom I = Zoom In Pan R = Pan Right Tilt U = Tilt Up Iris C = Iris Close (Iris Darker)
Foc F = Focus Far Zoom O = Zoom Out Pan L = Pan Left Tilt D = Tilt Down Iris O = Iris Open (Iris Brighter)

Opcode 4 note: Although bits 1, 2, and 3 for Data Byte 1 are shown as zeros in Table 1 above, certain existing Philips CSS controllers generate commands where these bits are set to 1. Either format will be accepted by the receiver/driver device and it has no affect on the desired function.

TABLE 2. Opcode 7 Functions

Function Code	Function	Numeric Data
0000	Reserved	Undefined
0001	Auxiliary ON	Auxiliary #
0010	Auxiliary OFF	Auxiliary #
0011	Auxiliary TOGGLE	Auxiliary #
0100	Pre-position SET	Pre-position #
0101	Pre-position SHOW	Pre-position #
0111	Reserved	Undefined
1000*	Cancel Latching Aux	Don't Care
1001*	Latching Aux ON	Auxiliary #
1010*	Latching Aux OFF	Auxiliary #
1011	Reserved	Undefined
1100	Reserved	Undefined
1101	Reserved	Undefined
1110	Reserved	Undefined
1111	Reserved	Undefined

* Latching auxiliary ON and OFF functions are used to activate the auxiliary function until explicitly deactivated using the Cancel Latching Aux command.

Sample Message Packets:

1. Camera Address 1, Pan Left.

	Bit Contents 7 6 5 4 3 2 1 0	Binary	Decimal	Hex
Length Byte	1 0 0 0 0 1 1 0	10000110	134	86
High Order Address Byte	0 0 0 0 0 0 0 0	00000000	0	00
Low Order Address Byte	0 0 0 0 0 0 0 0	00000000	0	00
Opcode Byte	0 0 0 0 0 1 0 0	00000100	4	04
Data Byte 1	0 0 0 0 0 0 0 0	00000000	0	00
Data Byte 2	0 0 0 0 0 0 1 0	00000010	2	02
Checksum Byte	0 0 0 0 1 1 0 0	00001100	12	0C

2. Camera Address 62, Pan Right and Tilt Down at Medium Speed.

	Bit Contents 7 6 5 4 3 2 1 0	Binary	Decimal	Hex
Length Byte	1 0 0 0 0 1 1 1	10000111	135	87
High Order Address Byte	0 0 0 0 0 0 0 0	00000000	0	00
Low Order Address Byte	0 0 1 1 1 1 0 1	00111101	61	3D
Opcode Byte	0 0 0 0 1 0 0 0	00001000	8	08
Data Byte 1	0 0 0 0 1 0 0 0	00001000	8	08
Data Byte 2	0 1 0 0 0 0 0 0	01000000	64	40
Data Byte 3	0 0 0 0 0 1 0 1	00000101	5	05
Checksum Byte	0 0 0 1 1 0 0 1	00011001	25	19

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