

WAT-1000 RS-232 Communication Specification

Rev. 1.02

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Watec Co., Ltd

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0. Change History

Rev. No.	Date	Changes	Remarks
1.00	2008.08.27	-	first edition
1.01	2008.09.08	Grammar change	
1.02	2008.09.11	Description correct (p.7)	

1. General disclaimer

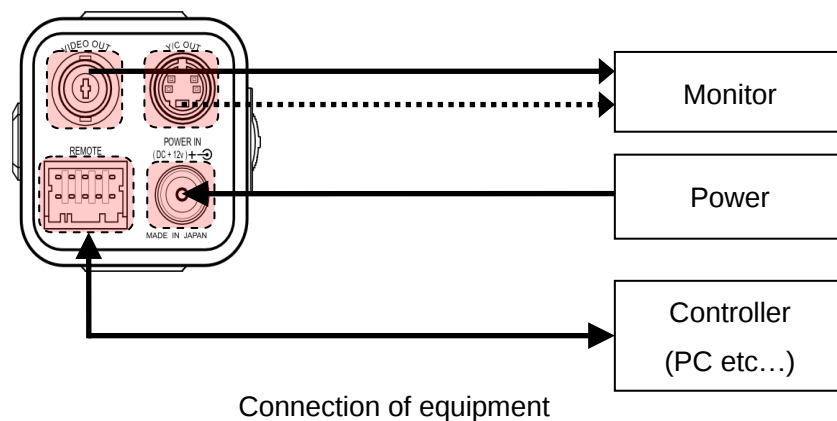
Please acknowledge Watec Co., Ltd. is not responsible for any trouble and any attendant damages to the camera or peripheral equipment caused by this software that uses the command described in this document.

2. Overview

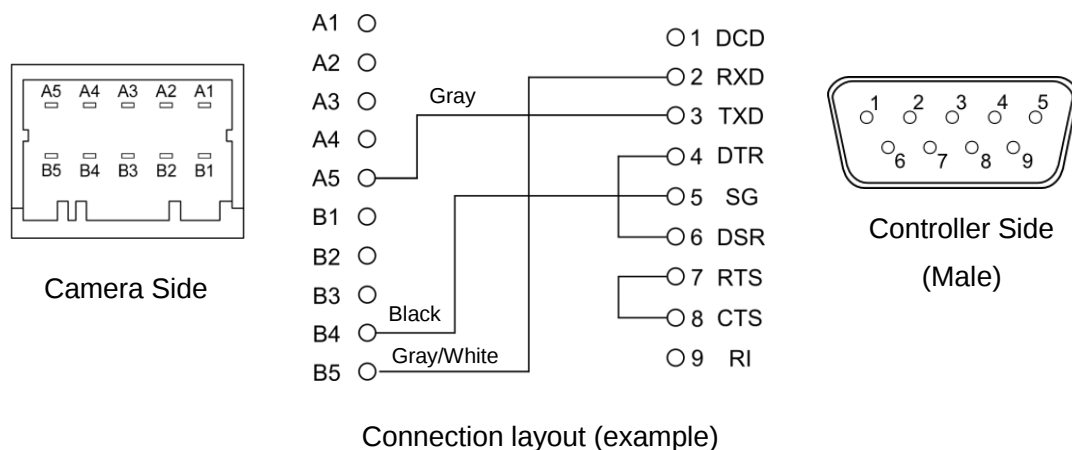
The WAT-1000 can be remotely controlled using the remote terminal on the back panel and connecting with control equipment such as a PC. The RS-232 communication of the WAT-1000 is used to operate the OSD menu, Save/Load/Restore Camera parameters, and change the Camera parameters.

3. Connection

Please connect the equipment as follows when you want to control the camera remotely.



Please connect each pin on the I/O connector and the RS-232 terminal as follows. (The figure in the below is for a D-Sub 9pin)



4. Specifications

4-1. Communication method

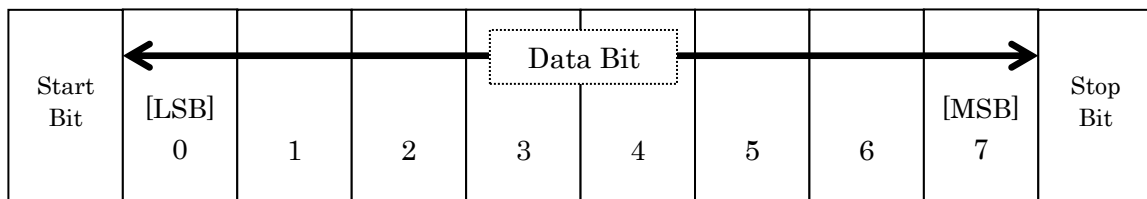
Serial Communication of WAT-1000 is RS-232 compatible.

Parameter of communication port is as follows.

Parameter	Specification
Baud rate	2400/4800/9600/19200/*38400/57600/115200 [baud] (*default)
Data type	8[bit] - binary
Parity	None
Start bit	1bit
Stop bit	1bit
Flow Control	None

Order of transmission is LSB first.

Bit sequence is as follows.



Bit sequence of 1-byte transmission

4-2. Operation Command

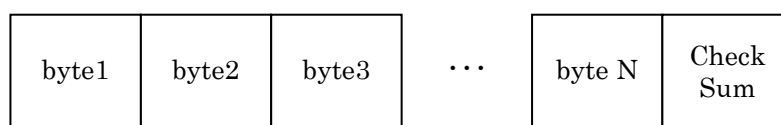
4-2-1. Data structure

The Operation Command of the WAT-1000 is composed of byte sequence of unspecified length and checksum.

A checksum is calculated by one's complement of sum of all bytes (excluding the checksum itself), and it is located at the end of a command.

In a few commands, a parameter of the camera is determined by the byte value of a specific part of the operation command. Therefore, calculation of the checksum is needed in this case. Please see "4-2-2. Classification" in detail.

The basic structure of the operation command is shown below.



Basic structure of the Operation Command

Depending on control content, two or more command transmissions might become necessary. Please refer to "4-3-1. Command Sequence" and "5. Details of the Operation Command".

4-2-2. Classification

The operation command of the WAT-1000 is comprised of "OSD Menu Control Command" and "Save / Load / Restore Command" and "parameter set command". Please see "5.Details of the Operation Command" about details of each command.

In parameter set command, it is necessary to convert a parameter value into hexadecimal value, and to apply it to the parameter set command. In this case, the value of the checksum depends on the value of the parameter. So, calculating the corresponding checksum is also needed. An example of the calculation procedure for the "Operation Command" is shown on the next page.

Example : Set manual white balance parameter value to 6000 [Kelvin]

1: Convert a parameter value “6000” into hexadecimal value, and separate into 1-byte values.

Parameter = 6000 = 0x1770  0x17 0x70

2: Apply each byte into a part of a command, and sum up all the bytes.

A part of a command to set manual white balance ('XX XX' is parameter part): 0x02 0x04 0x00 0x25 XX XX



0x02 0x04 0x00 0x25 0x17 0x70

Total byte value = 0x02+0x04+0x00+0x25+0x17+0x70 = *0xB2

* If necessary, do an 8bit bitmask. Because checksum is 1byte.

3: Calculate one's complement of the total byte value, this result is checksum.

Checksum = 0xFF - 0xB2 = 0x4D

Therefore, an operation command that sets the white balance to 6000K is as follows.

operation command : 0x02 0x04 0x00 0x25 0x17 0x70 0x4D

4-3. Communications

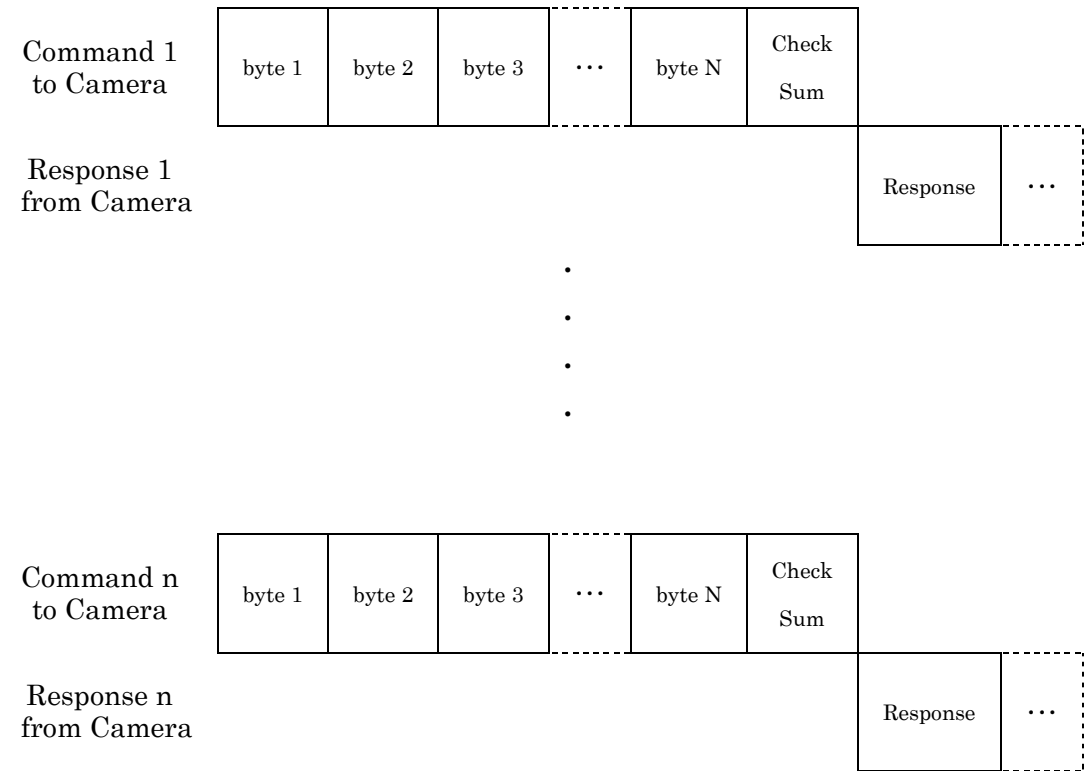
4-3-1. Command sequence

When one-command is transmitted from a controller such as a PC, the “Response” is returned from the WAT-1000. The response includes information of whether the communication has succeeded or failed, and error code as byte-value. Length of response is up to three-bytes.

A flow of send commands and return responses is shown below.

*Depending on the control content, two or more command transmissions might become necessary. In this case, the response is returned to the number of transmitted commands, so please check whether the transmission is successful or not in each command.

Please refer to “5. Details of the Operation Command” for the number of commands that should be transmitted.



Command sequence

4-3-2. Response

There are three types of the responses that the WAT-1000 returns after the transmission of the operation command. It is 'ACK' (0x01), 'NAK' (0x03) and 'ACK ERR' (0x04).

Data length of 'ACK' and 'NAK' is 1-byte, 'ACK ERR' is 3-byte.

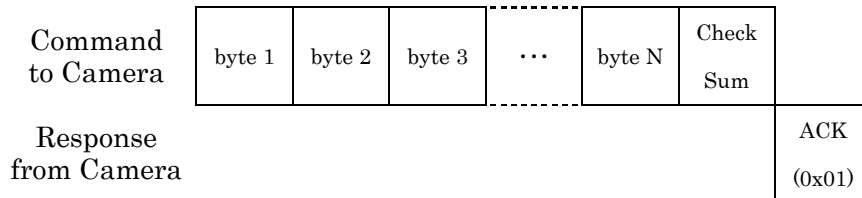
Description of each response is shown below.

Response Table

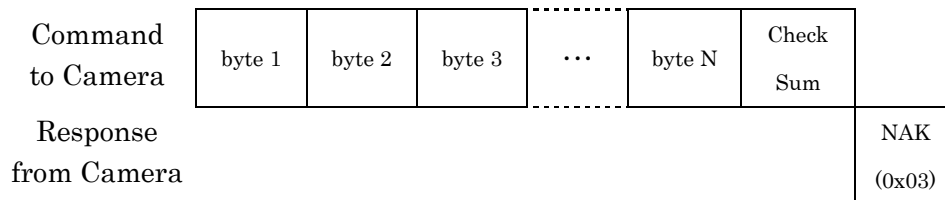
Response	Byte Value	Description
ACK	0x01	Communication was successful.
NAK	0x03	Communication failed. Checksum value is not correct or length of the command is not correct.
ACK ERR	0x04	The error occurred in the camera. The error code and checksum are returned to continuing 2-bytes.

A flow of the each response that returns after transmitted commands is as follows.

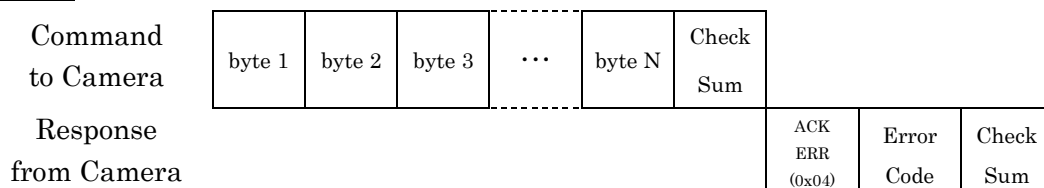
ACK



NAK



ACK ERR



The 'error code' (with checksum of each error code) that returned continuing 'ACK ERR' is as follows.

'error code' and checksums

Error Code	Description	Check sum
0x00	There was no error that was able to be identified inside the camera.	0xFB
0x02	An internal error occurred.	0xF9
0x04	The requested command doesn't exist.	0xF7
0x06	The requested command cannot be accessed.	0xF5
0x07	The parameter value is invalid.	0xF4
0x09	The parameter value is outside of the range that can be set.	0xF2

4-3-4. Time Out

When transmitting one command, if the transmission is broken off for two seconds due to deterioration in the communication state, communication will time-out. When communication becomes a timed-out, the state of the camera is waiting for a command input, so please transmit the command again.

4-4. Limitations

The "parameter set command" is used to set almost all parameter of the WAT-1000. But a few parameters are not settable directly. Therefore, you may want to change the parameter, to combine several "OSD Menu Control Command" and send them one-by-one.

Please see p.13 "Transmission Sequence of the OSD Menu Control Command for set specified parameters." in detail.

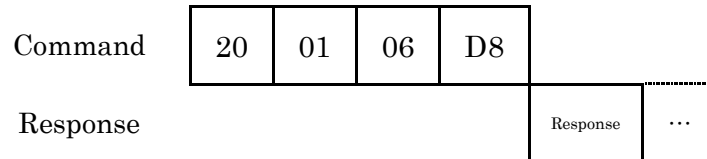
5. Details of the Operation Command

5-1. OSD Menu Control Command

The OSD Menu Control Command is used to operate the On-Screen-Display Menu.

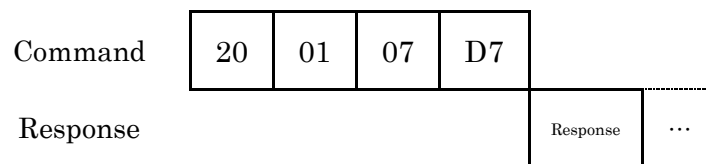
MENU OPERATION – SHOW MENU

Display of the OSD menu.



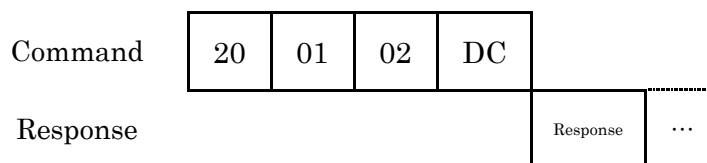
MENU OPERATION – CLOSE MENU

Hide of the OSD menu.



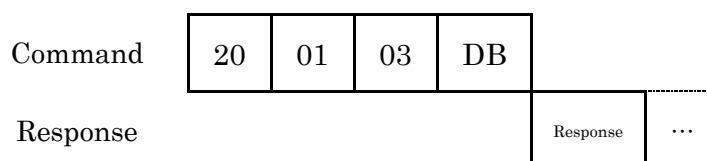
MENU OPERATION – UP

Move the selection up.



MENU OPERATION – DOWN

Move the selection down.



MENU OPERATION – LEFT

Change setting of selection.

Command	20	01	04	DA		
Response					Response	...

MENU OPERATION – RIGHT

Change setting of selection.

Command	20	01	05	D9		
Response					Response	...

MENU OPERATION – ENTER

Open next page of the OSD menu, or activate a selected item.

Command	20	01	00	DE		
Response					Response	...

MENU OPERATION – EXIT

Back to the previous page of the OSD menu, or deactivate the selected item.

Command	20	01	01	DD		
Response					Response	...

§ Transmission Sequence of the OSD Menu Control Command for set specified parameters.

A parameter that is not settable directly and the transmission sequence of the “OSD Menu Control Command” to set each parameter as shown below.

SHUTTER MODE – E.I / ESS

Transmission Sequence:

SHOW MENU→DOWN→ENTER→ENTER→ENTER
→LEFT or RIGHT (Change parameter)
→CLOSE MENU

D/N THRESHOLD

Transmission Sequence:

SHOW MENU→DOWN→ENTER→DOWN→DOWN→ENTER→ENTER
→LEFT or RIGHT (Select ‘AUTO’ or ‘EXT’)
→ENTER
→ENTER
→UP or DOWN (Select ‘INTO NIGHT’ or ‘HYSTERESIS’)
→ENTER
→LEFT or RIGHT (Change parameter)
→CLOSE MENU

ACTIVITY DETECTION – OFF / ON

Transmission Sequence:

SHOW MENU→DOWN→ENTER→UP→UP→ENTER→DOWN→DOWN→DOWN→ENTER→ENTER
→LEFT or RIGHT (Change parameter)
→ENTER
→CLOSE MENU

ACTIVITY DETECTION – DETECTION ZONE

Transmission Sequence:

SHOW MENU→DOWN→ENTER→UP→UP→ENTER→DOWN→DOWN→DOWN→ENTER→DOWN→ENTER

→LEFT or RIGHT (Change parameter)

→ENTER

(If 'CUSTOM' is selected, send 'ENTER' or 'LEFT' or 'RIGHT' to change the parameter.)

→CLOSE MENU

ACTIVITY DETECTION – RESPONSE ZOOM

Transmission Sequence:

SHOW MENU→DOWN→ENTER→UP→UP→ENTER→DOWN→DOWN→DOWN→ENTER→DOWN→DOWN→ENTER

→UP or DOWN (Select 'DIG. ZOOM' or 'DIG. PAN' or 'DIG. TILT')

→ENTER

→LEFT or RIGHT (Change parameter)

→ENTER

→CLOSE MENU

ACTIVITY DETECTION – THRESHOLD & DURATION

Transmission Sequence:

SHOW MENU→DOWN→ENTER→UP→UP→ENTER→DOWN→DOWN→DOWN→ENTER→DOWN→DOWN→DOWN→ENTER

→UP or DOWN (Select 'ACTIVITY THR.' or 'DURATION')

→ENTER

→LEFT or RIGHT (Change parameter)

→ENTER

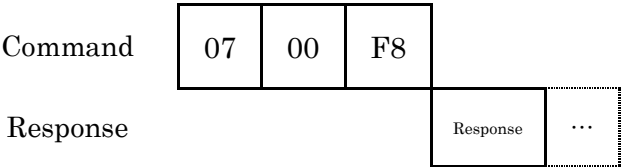
→CLOSE MENU

5-2. Save / Load / Restore Command

Save / Load / the restore command is used to save, load and restore (to factory settings) parameter values.

SAVE USER SETTINGS

Save current camera parameters to the memory of the camera.

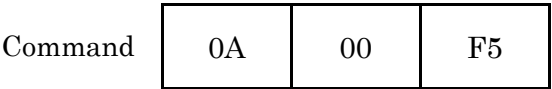


LOAD USER SETTINGS

Load camera parameters from the memory of the camera.

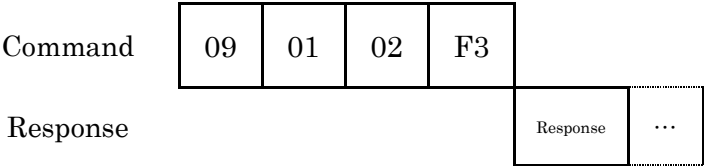
Caution: Do not send additional commands for 5 seconds following this command.

*This Command is not a return 'Response'.



RESTORE FACTORY SETTINGS

Restore camera parameters to the factory default settings.

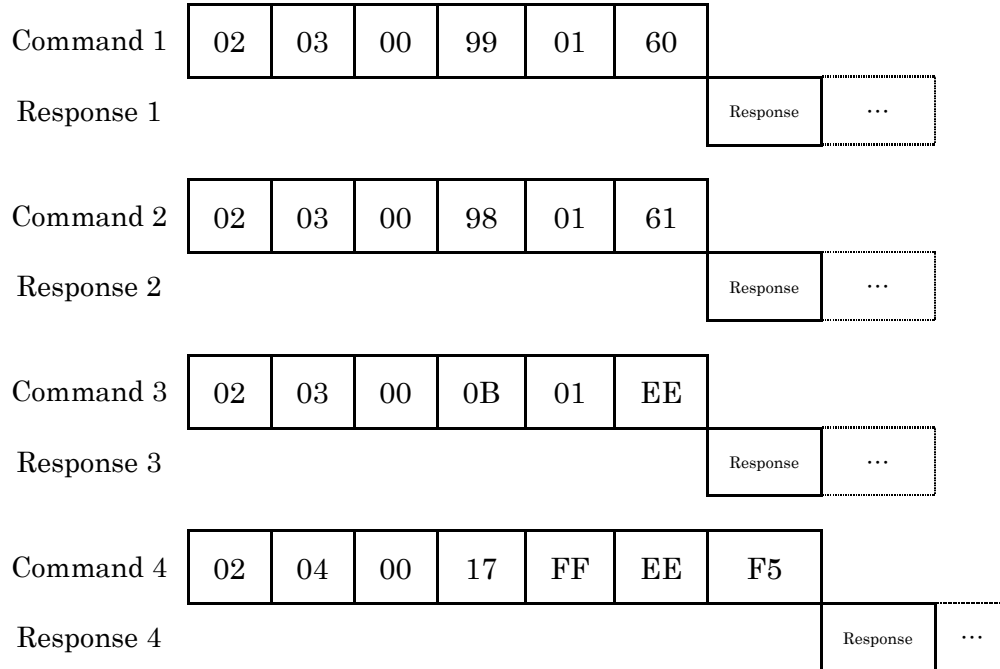


5-3. Parameter set command

parameter set command is used to set each camera parameters.

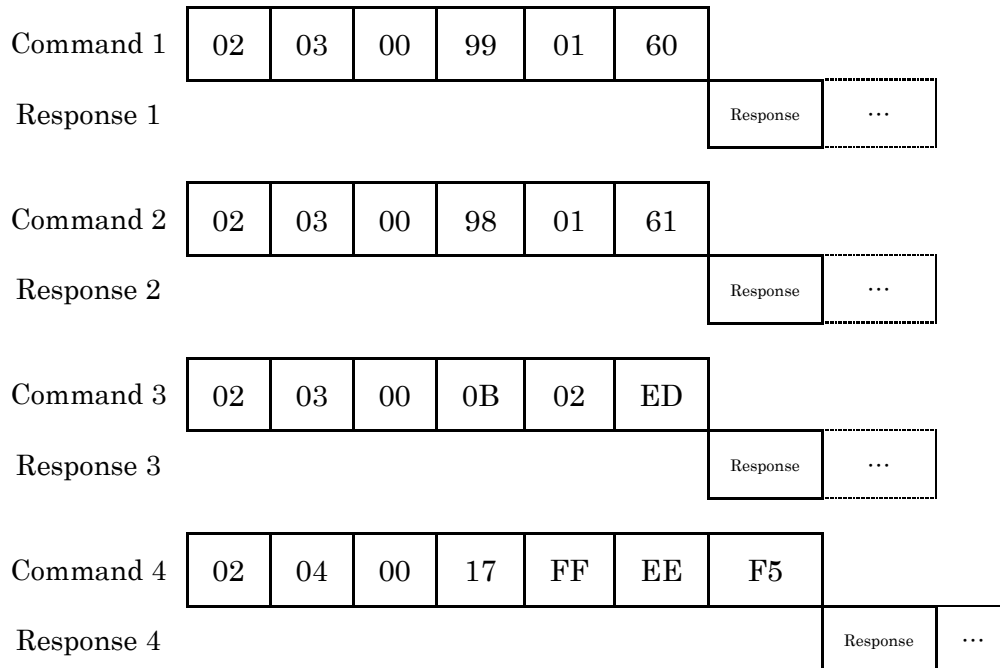
E.I - SHUTTER LIMIT - OFF

Set the "E.I – SHUTTER LIMIT" to "OFF".



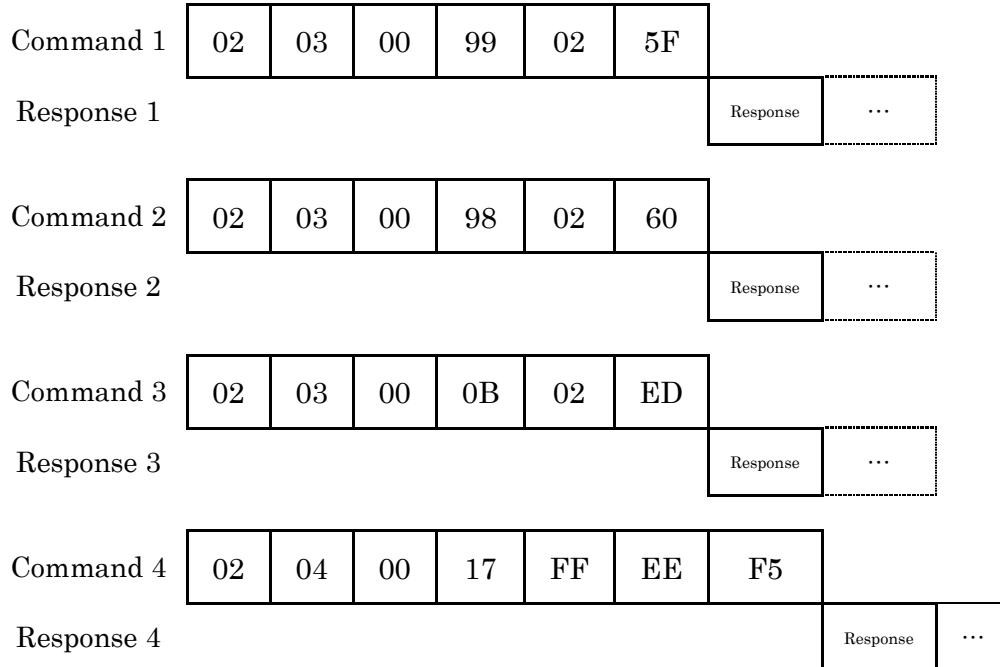
E.I - SHUTTER LIMIT – X2

Set the "E.I – SHUTTER LIMIT" to "X2".



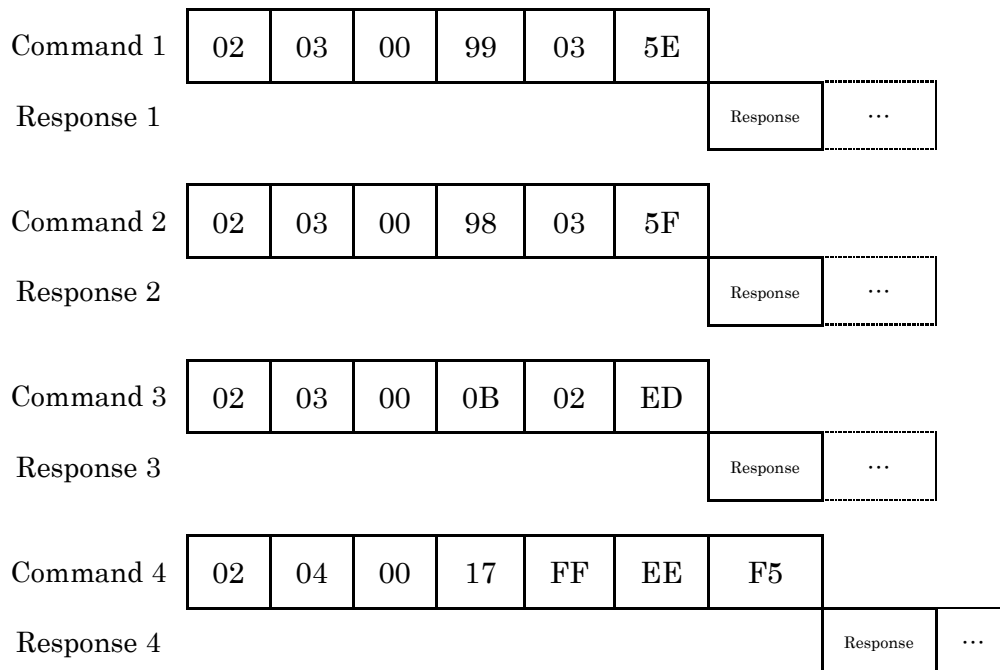
E.I - SHUTTER LIMIT – X4

Set the "E.I – SHUTTER LIMIT" to "X4".



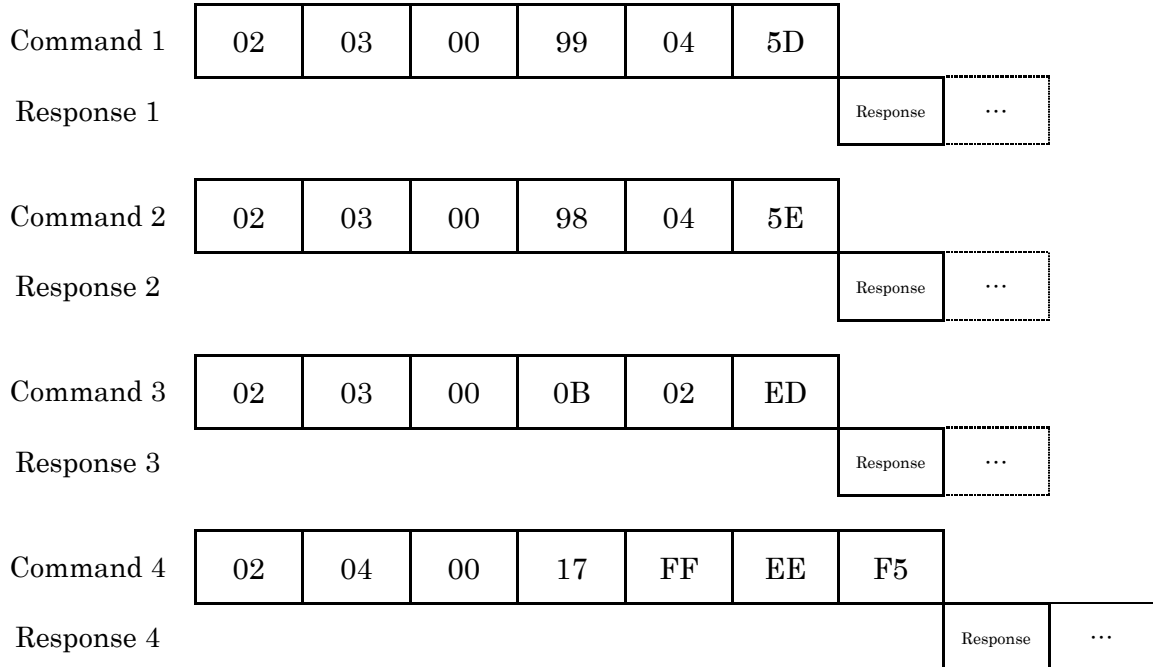
E.I - SHUTTER LIMIT – X8

Set the "E.I – SHUTTER LIMIT" to "X8".



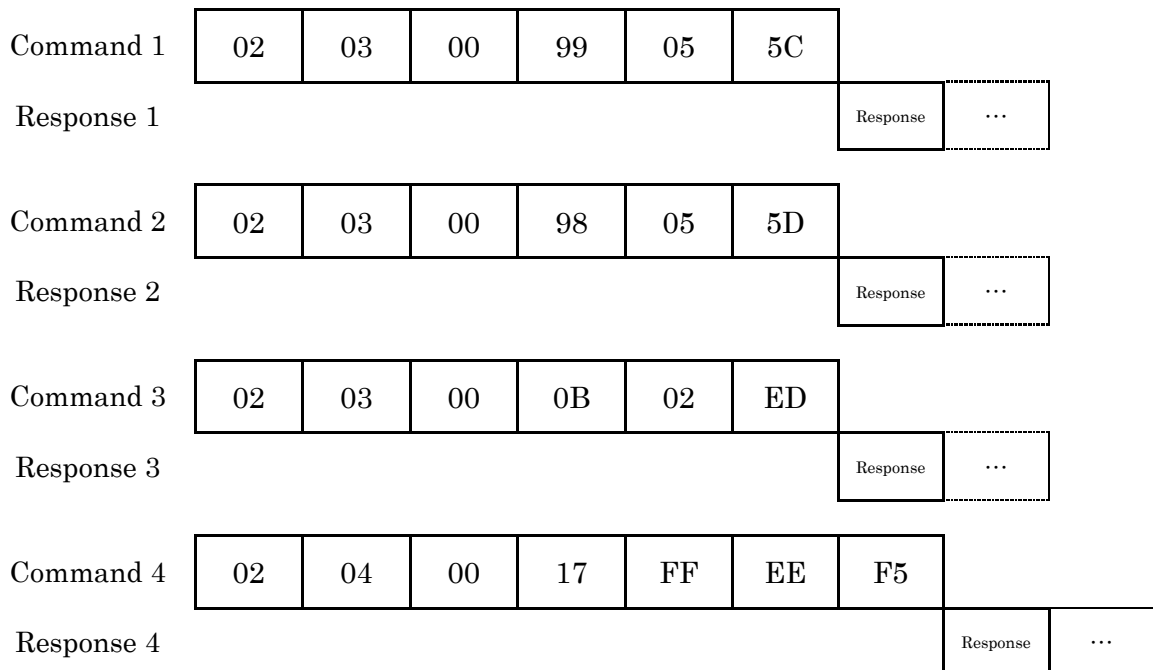
E.I - SHUTTER LIMIT – X16

Set the "E.I – SHUTTER LIMIT" to "X16".



E.I - SHUTTER LIMIT – X32

Set the "E.I – SHUTTER LIMIT" to "X32".



E.I – LOWLIGHT SCENE – GAIN PRI

Set the "LOWLIGHT SCENE" to "GAIN PRI".

Command 1	02	03	00	97	04	5F					
Response 1							Response	...			
Command 2	02	06	00	AF	00	00	00	16	32		
Response 2									Response	...	
Command 3	02	06	00	B0	00	00	00	0A	3D		
Response 3									Response	...	

E.I – LOWLIGHT SCENE – SHUT PRI

Set the "LOWLIGHT SCENE" to "SHUT PRI".

Command 1	02	03	00	97	04	5F					
Response 1							Response	...			
Command 2	02	06	00	AF	00	00	00	0E	3A		
Response 2										Response	...
Command 3	02	06	00	B0	00	00	00	08	3F		
Response 3										Response	...

E.I – FLICKERLESS MODE - OFF

Set the "E.I – FLICKERLESS MODE" to "OFF".

Command	02	06	00	3C	00	00	00	00	BB		
Response										Response	...

E.I – FLICKERLESS MODE - ON

Set the "E.I - FLICKERLESS MODE" to "ON".

Note: This parameter is only available with NTSC.

Command	02	06	00	3C	00	00	00	03	B8		
Response										Response	...

ESS – SHUTTER SPEED X2

Set the "ESS – SHUTTER SPEED" to "X2".

Command 1	02	03	00	98	01	61		
Response 1							Response	...
Command 2	02	03	00	15	00	E5		
Response 2							Response	...
Command 3	02	03	00	16	00	E4		
Response 3							Response	...
Command 4	02	03	00	14	00	E6		
Response 4							Response	...

ESS – SHUTTER SPEED X4

Set the "ESS – SHUTTER SPEED" to "X4".

Command 1	02	03	00	98	02	60		
Response 1							Response	...
Command 2	02	03	00	15	00	E5		
Response 2							Response	...
Command 3	02	03	00	16	00	E4		
Response 3							Response	...
Command 4	02	03	00	14	00	E6		
Response 4							Response	...

ESS – SHUTTER SPEED X8

Set the "ESS – SHUTTER SPEED" to "X8".

Command 1	02	03	00	98	03	5F		
Response 1							Response	...
Command 2	02	03	00	15	00	E5		
Response 2							Response	...
Command 3	02	03	00	16	00	E4		
Response 3							Response	...
Command 4	02	03	00	14	00	E6		
Response 4							Response	...

ESS – SHUTTER SPEED X16

Set the "ESS – SHUTTER SPEED" to "X16".

Command 1	02	03	00	98	04	5E		
Response 1							Response	...
Command 2	02	03	00	15	00	E5		
Response 2							Response	...
Command 3	02	03	00	16	00	E4		
Response 3							Response	...
Command 4	02	03	00	14	00	E6		
Response 4							Response	...

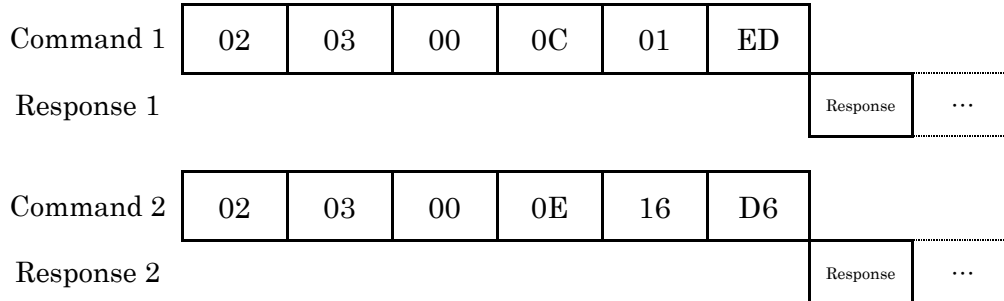
ESS – SHUTTER SPEED X32

Set the "ESS – SHUTTER SPEED" to "X32".

Command 1	02	03	00	98	05	5D		
Response 1							Response	...
Command 2	02	03	00	15	00	E5		
Response 2							Response	...
Command 3	02	03	00	16	00	E4		
Response 3							Response	...
Command 4	02	03	00	14	00	E6		
Response 4							Response	...

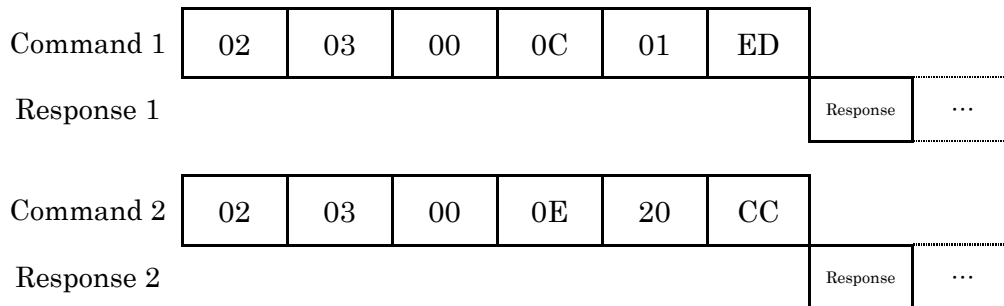
AGC – LOW

Set the AGC to LOW.



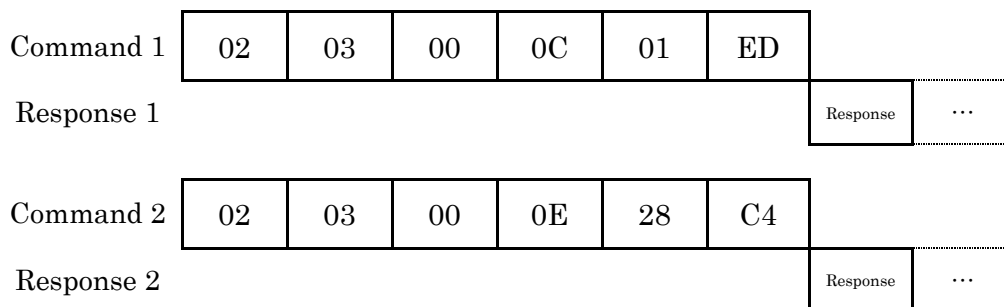
AGC – MEDIUM

Set the AGC to MEDIUM.



AGC - HIGH

Set the AGC to HIGH.



AGC – MANUAL

Set the AGC to MANUAL.

Command	02	03	00	0C	02	EC	
Response							Response ...

MANUAL GAIN

Set the Manual Gain value.

Command	02	04	00	0F	00	XX	Check Sum	
Response								Response ...

The parameter value of the manual gain applies to "XX" part of the command.
The parameter range is 0~40dB (0x00 ~ 0x28).

As an example, the parameter values and commands are shown below.

Parameter values and Commands	
Parameter	Command
0 dB	02 04 00 0F 00 00 EA
10 dB	02 04 00 0F 00 0A E0
20 dB	02 04 00 0F 00 14 D6
30 dB	02 04 00 0F 00 1E CC
40 dB	02 04 00 0F 00 28 C2

DYNAMIC RANGE - LOW

Set the DYNAMIC RANGE to LOW.

Command	02	03	00	1C	00	DE		
Response							Response	...

DYNAMIC RANGE - MEDIUM

Set the DYNAMIC RANGE to MEDIUM.

Command	02	03	00	1C	14	CA		
Response							Response	...

DYNAMIC RANGE - HIGH

Set the DYNAMIC RANGE to HIGH.

Command	02	03	00	1C	24	BA		
Response							Response	...

AE PREFs - HIGHLIGHTS

Set the AE PREFs to HIGHLIGHTS.

Command	02	03	00	8F	00	6B		
Response							Response	...

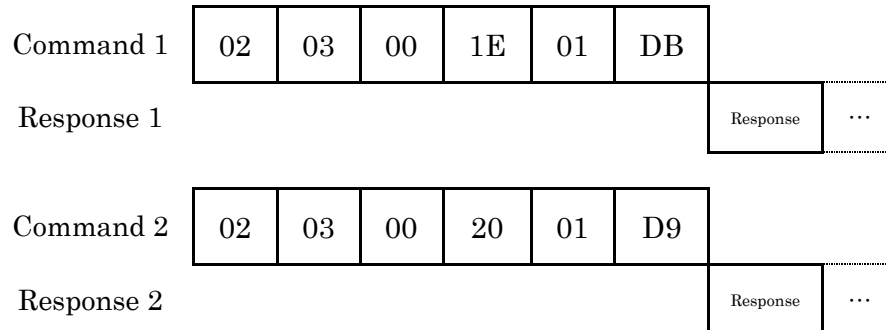
AE PREFs - SHADOWS

Set the AE PREFs to SHADOWS.

Command	02	03	00	8F	01	6A		
Response							Response	...

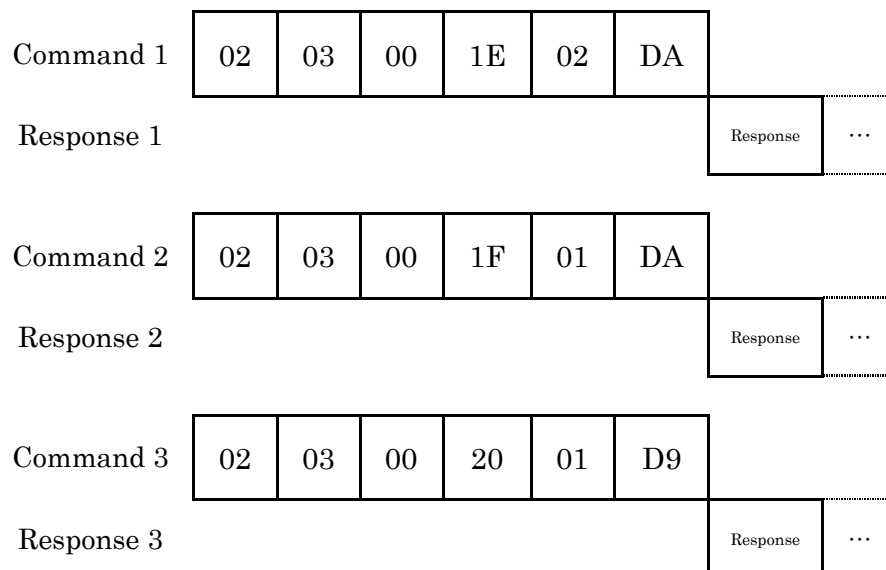
BACK LIGHT – OFF

Set the BACK LIGHT to OFF.



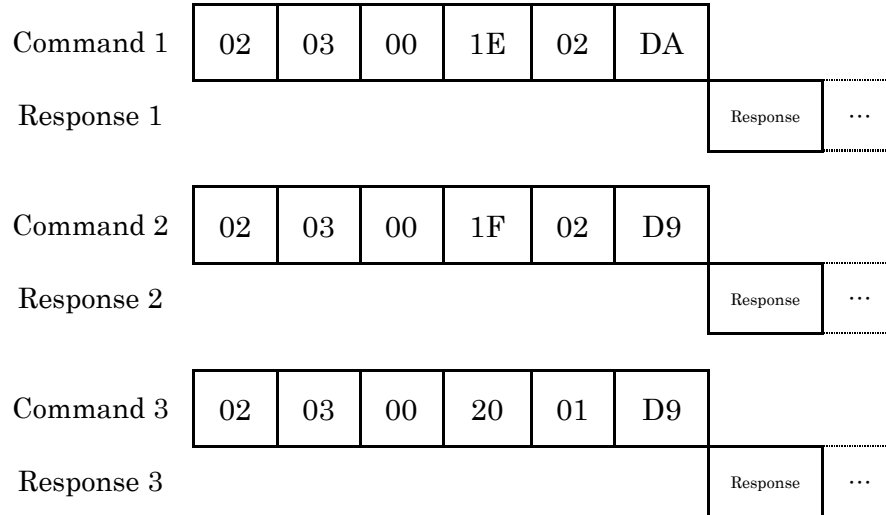
BACK LIGHT – CENTER

Set the BACK LIGHT to CENTER.



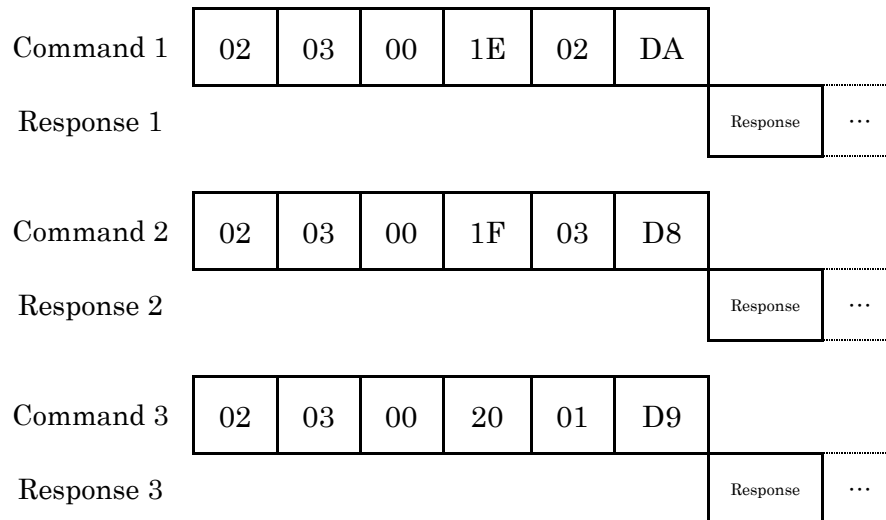
BACK LIGHT – UNDER

Set the BACK LIGHT to UNDER.



BACK LIGHT – CENTER+UNDER

Set the BACK LIGHT to CENTER+UNDER.



CONTROL SPEED – AE - FAST

Set the CONTROL SPEED (AE) to FAST.

This command sets the control speed of the AE (automatic exposure) only.

Note: The CONTROL SPEED in the OSD MENU (EASY) sets the control speed of the “automatic exposure”, “dynamic range” and “white balance” at the same time.

Command 1	02	06	00	77	00	00	0F	A0	D1		
Response 1										Response	...
Command 2	02	06	00	78	00	00	00	32	4D		
Response 2										Response	...
Command 3	02	06	00	79	00	00	03	E8	93		
Response 3										Response	...

CONTROL SPEED – AE - NORMAL

Set the CONTROL SPEED (AE) to NORMAL.

This command sets the control speed of the AE (automatic exposure) only.

Note: The CONTROL SPEED in the OSD MENU (EASY) sets the control speed of the “automatic exposure”, “dynamic range” and “white balance” at the same time.

Command 1	02	06	00	77	00	00	07	D0	A9		
Response 1										Response	...
Command 2	02	06	00	78	00	00	00	64	1B		
Response 2										Response	...
Command 3	02	06	00	79	00	00	01	2C	51		
Response 3										Response	...

CONTROL SPEED – AE - SLOW

Set the CONTROL SPEED (AE) to SLOW.

This command sets the control speed of the AE (automatic exposure) only.

Note: The CONTROL SPEED in the OSD MENU (EASY) sets the control speed of the “automatic exposure”, “dynamic range” and “white balance” at the same time.

Command 1	02	06	00	77	00	00	03	33	4A		
Response 1										Response	...
Command 2	02	06	00	78	00	00	03	33	49		
Response 2										Response	...
Command 3	02	06	00	79	00	00	01	48	35		
Response 3										Response	...

CONTROL SPEED – DYNAMIC RANGE - FAST

Set the CONTROL SPEED (DYNAMIC RANGE) to FAST.

This command sets the control speed of the dynamic range only.

Note: The CONTROL SPEED in the OSD MENU (EASY) sets the control speed of the “automatic exposure”, “dynamic range” and “white balance” at the same time.

Command 1	02	06	00	7A	00	00	0F	A0	CE		
Response 1										Response	...
Command 2	02	06	00	7B	00	00	00	32	4A		
Response 2										Response	...
Command 3	02	06	00	7C	00	00	03	E8	90		
Response 3										Response	...

CONTROL SPEED – DYNAMIC RANGE - NORMAL

Set the CONTROL SPEED (DYNAMIC RANGE) to NORMAL.

This command sets the control speed of the dynamic range only.

Note: The CONTROL SPEED in the OSD MENU (EASY) sets the control speed of the “automatic exposure”, “dynamic range” and “white balance” at the same time.

Command 1	02	06	00	7A	00	00	07	D0	A6		
Response 1										Response	...
Command 2	02	06	00	7B	00	00	00	64	18		
Response 2										Response	...
Command 3	02	06	00	7C	00	00	01	2C	4E		
Response 3										Response	...

CONTROL SPEED – DYNAMIC RANGE - SLOW

Set the CONTROL SPEED (DYNAMIC RANGE) to SLOW.

This command sets the control speed of the dynamic range only.

Note: The CONTROL SPEED in the OSD MENU (EASY) sets the control speed of the “automatic exposure”, “dynamic range” and “white balance” at the same time.

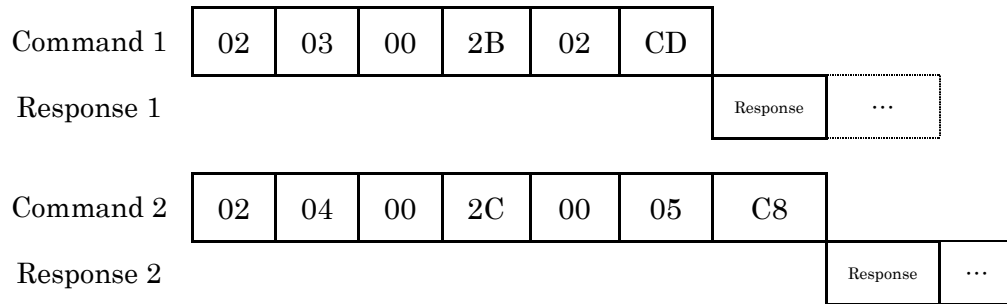
Command 1	02	06	00	7A	00	00	03	33	47		
Response 1										Response	...
Command 2	02	06	00	7B	00	00	03	33	46		
Response 2										Response	...
Command 3	02	06	00	7C	00	00	01	48	32		
Response 3										Response	...

CONTROL SPEED – WHITE BALANCE - FAST

Set the CONTROL SPEED (WHITE BALANCE) to FAST.

This command sets the control speed of the white balance only.

Note: The CONTROL SPEED in the OSD MENU (EASY) sets the control speed of the “automatic exposure”, “dynamic range” and “white balance” at the same time.

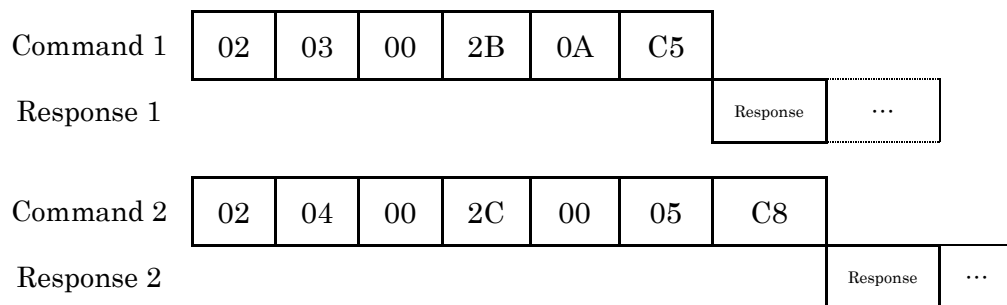


CONTROL SPEED – WHITE BALANCE - NORMAL

Set the CONTROL SPEED (WHITE BALANCE) to NORMAL.

This command sets the control speed of the white balance only.

Note: The CONTROL SPEED in the OSD MENU (EASY) sets the control speed of the “automatic exposure”, “dynamic range” and “white balance” at the same time.



CONTROL SPEED – WHITE BALANCE - SLOW

Set the CONTROL SPEED (WHITE BALANCE) to SLOW.

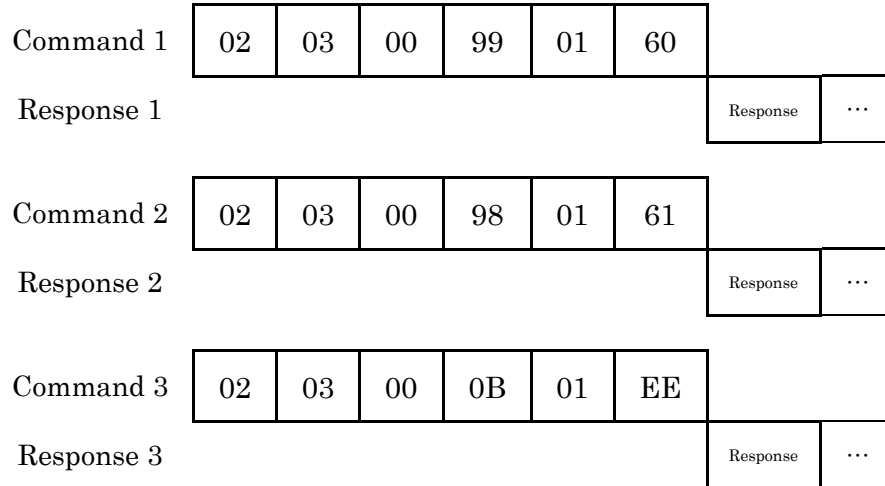
This command sets the control speed of the white balance only.

Note: The CONTROL SPEED in the OSD MENU (EASY) sets the control speed of the “automatic exposure”, “dynamic range” and “white balance” at the same time.

Command 1	02	03	00	2B	0A	C5		
Response 1							Response	...
Command 2	02	04	00	2C	00	1E	AF	
Response 2								Response ...

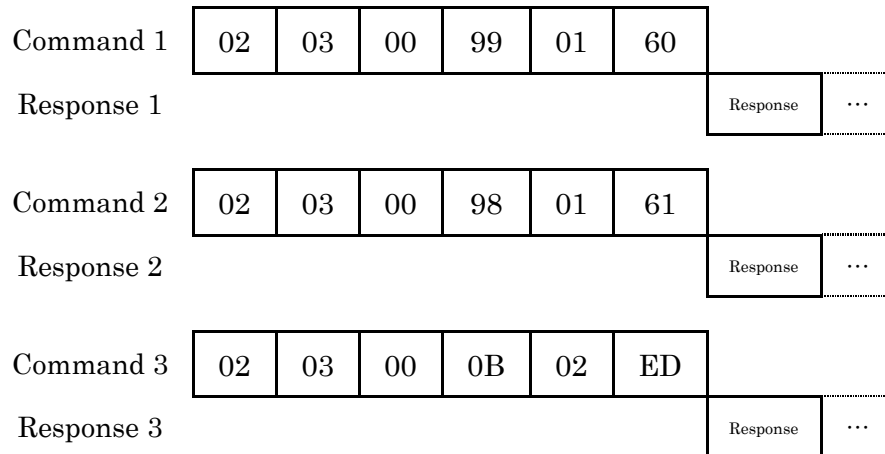
SLOW SHUTTER – OFF

Set the SLOW SHUTTER to OFF.



SLOW SHUTTER - ON

Set the SLOW SHUTTER to ON.



WHITE BALANCE MODE - ATW

Set the WHITE BALANCE MODE to ATW.

Command	02	03	00	22	05	D3		
Response							Response	...

WHITE BALANCE MODE - ATW - LOWLIMIT

Set the ATW-LOWLIMIT value.

Command	02	04	00	34	XX	XX	Check Sum	
Response								Response ...

The parameter value of the ATW-LOWLIMIT applies to the “XX XX” part of the command.
The parameter range is 2000~5500K (0x07 0x0D ~ 0x15 0x7C).

WHITE BALANCE MODE - ATW - HIGHLIMIT

Set the ATW-HIGHLIMIT value.

Command	02	04	00	18	XX	XX	Check Sum	
Response								Response ...

The parameter value of the ATW-HIGHLIMIT applies to the “XX XX” part of the command.
The parameter range is 5500~11000K (0x15 0x7C ~ 0x2A 0xF8).

WHITE BALANCE MODE - PWB

Set the WHITE BALANCE MODE to PWB.

Command	02	03	00	22	02	D6		
Response							Response	...

WHITE BALANCE MODE – PWB – EXECUTE PWB

Execute WHITE BALANCE adjustment in PWB mode.

Command	18	00	E7		
Response				Response	...

WHITE BALANCE MODE – MANUAL

Set the WHITE BALANCE MODE to MANUAL.

Command 1	02	03	00	22	03	D5		
Response 1							Response	...
Command 2	02	03	00	23	01	D6		
Response 2							Response	...

WHITE BALANCE MODE – MANUAL - KELVIN

Set the manual white balance value (KELVIN).

Command	02	04	00	25	XX	XX	Check Sum	
Response								Response ...

The parameter value of the manual white balance value applies to the “XX XX” part of the command.

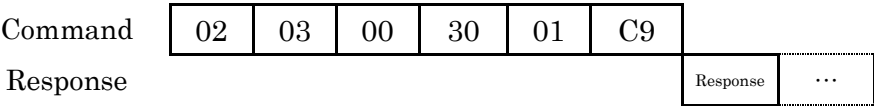
The parameter range is 2000K~11000K(0x07 0xD0 ~ 0x2A 0xF8)

As an example, commands to set the presets value are shown below.

Parameter values and Commands	
Parameter	Command
3200K	02 04 00 25 0C 80 48
4300K	02 04 00 25 10 CC F8
6500K	02 04 00 25 19 64 57
9300K	02 04 00 25 22 60 52

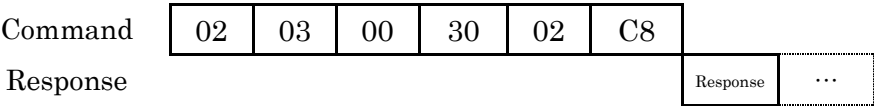
DAY/NIGHT CONTROL – AUTO

Set the DAY/NIGHT CONTROL to AUTO.



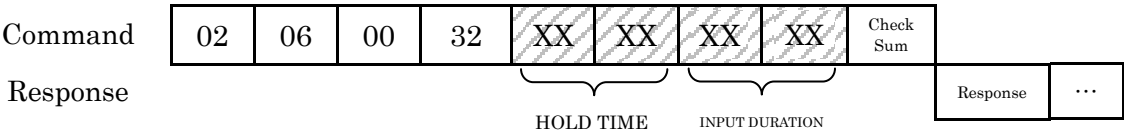
DAY/NIGHT CONTROL – EXT

Set the DAY/NIGHT CONTROL to EXT.



DAY/NIGHT CONTROL – AUTO (EXT) – INPUT DURATION / HOLD TIME

Set the INPUT DURATION and HOLD TIME of the DAY/NIGHT CONTROL.
The parameter value applied to the AUTO and the EXT on the DAY/NIGHT CONTROL.



The parameter value of the HOLD TIME and the INPUT DURATION applies to the “XX XX XX XX” part of the command. The upper 4 digits are assigned to HOLD TIME, and the lower 4 digits are assigned to INPUT DURATION.

The parameter range of the INPUT DURATION is 1~255 sec (0x00 0x01 ~ 0x00 0xFF).

The parameter range of the HOLD TIME is 0~65535 msec (0x00 0x00 ~ 0xFF 0xFF).

DAY/NIGHT CONTROL – DAY

Set the DAY/NIGHT CONTROL to DAY.

Command	02	03	00	30	04	C6		
Response							Response	...

DAY/NIGHT CONTROL – NIGHT

Set the DAY/NIGHT CONTROL to NIGHT.

Command	02	03	00	30	03	C7		
Response							Response	...

ZOOM - ON

Set the digital zoom to ON.

This command enables ZOOM/PAN/TILT.

Command	02	03	00	5B	01	9E		
Response							Response	...

ZOOM – ZOOM

Set the digital zoom value.

Command	02	03	00	5C	ZZ	Check Sum		
Response							Response	...

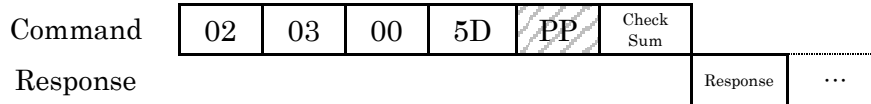
The parameter value of the ZOOM applies to the “ZZ” part of the command.

The parameter range is 1~12(0x01 ~ 0x0C).

Note: The ZOOM/PAN/TILT is enabled by setting the digital zoom to ON.

ZOOM – PAN

Set the pan value.



The parameter value of the PAN applies to the “PP” part of the command.

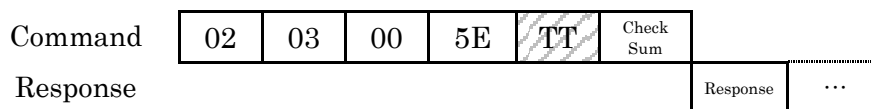
The parameter range is +100~-100(0x64 ~ 0x00 , 0xFF ~ 0x9C).

Note 1: The ZOOM/PAN/TILT is enabled by setting the digital zoom to ON.

Note 2: The PAN/TILT becomes effective when the ZOOM value is set to a number greater than 1.

ZOOM – TILT

Set the tilt value.



The parameter value of the TILT applies to the “TT” part of the command.

The parameter range is +100~-100(0x64 ~ 0x00 , 0xFF ~ 0x9C).

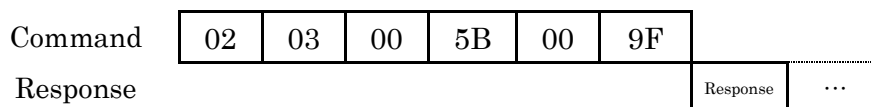
Note 1: The ZOOM/PAN/TILT is enabled by setting the digital zoom to ON.

Note 2: The PAN/TILT becomes effective when the ZOOM value is set to a number greater than 1.

ZOOM - OFF

Set the digital zoom to OFF.

This command disables ZOOM/PAN/TILT.



FLIP - OFF

Set the FLIP to OFF.

Command	02	03	00	3B	00	BF		
Response							Response	...

FLIP - HORIZ

Set the FLIP to HORIZ.

Command	02	03	00	3B	01	BE		
Response							Response	...

FLIP - VERT

Set the FLIP to VERT.

Command	02	03	00	3B	02	BD		
Response							Response	...

FLIP - BOTH

Set the FLIP to BOTH.

Command	02	03	00	3B	03	BC		
Response							Response	...

BW MODE - OFF

Set the BW MODE to OFF.

Command	02	03	00	33	00	C7		
Response							Response	...

BW MODE – B/W

Set the BW MODE to B/W.

Command	02	03	00	33	02	C5		
Response							Response	...

BW MODE – B/W w/Burst

Set the BW MODE to B/W w/Burst (with Burst).

Command	02	03	00	33	01	C6		
Response							Response	...

GAMMA MODE – AUTO

Set the GAMMA MODE to AUTO.

Command	02	03	00	2E	01	CB		
Response							Response	...

GAMMA MODE – MANUAL

Set the GAMMA MODE to MANUAL.

Command	02	03	00	2E	02	CA		
Response							Response	...

GAMMA MODE – MANUAL – 0.36

Set the manual gamma value to 0.36.

Command	02	03	00	2F	24	A7		
Response							Response	...

GAMMA MODE – MANUAL – 0.45

Set the manual gamma value to 0.45.

Command	02	03	00	2F	2D	9E		
Response							Response	...

GAMMA MODE – MANUAL – 0.6

Set the manual gamma value to 0.6.

Command	02	03	00	2F	3C	8F		
Response							Response	...

GAMMA MODE – OFF

Set the GAMMA MODE to OFF.

Command	02	03	00	2E	00	CC		
Response							Response	...

SHARPNESS SETTING – DETAIL BOOST - ON

Set the SHARPNESS SETTING - DETAIL BOOST to ON.

Command	02	03	00	7F	01	7A		
Response							Response	...

SHARPNESS SETTING – DETAIL BOOST - OFF

Set the SHARPNESS SETTING – DETAIL BOOST to OFF.

Command	02	03	00	7F	00	7B		
Response							Response	...

SHARPNESS SETTING – NOISE REDUCTION - ON

Set the SHARPNESS SETTING – NOISE REDUCTION to ON.

Command	02	03	00	48	02	B0		
Response							Response	...

SHARPNESS SETTING – NOISE REDUCTION - OFF

Set the SHARPNESS SETTING – NOISE REDUCTION to OFF.

Command	02	03	00	48	01	B1		
Response							Response	...

SHARPNESS SETTING – SHARPNESS

Set the SHARPNESS SETTING – SHARPNESS value.

Command	02	06	00	38	XX	XX	XX	XX	Check Sum	
Response										Response ...

The parameter value of the SHARPNESS applies to the “XX XX XX XX” part of the command.

The parameter range is +8~-8(0x00 0x00 0x00 0x08 ~ 0x00 0x00 0x00 0x00 , 0xFF 0xFF 0xFF 0xFF ~ 0xFF 0xFF 0xFF 0xF8).

The table of the parameter values and commands are shown below.

Parameter values and Commands

Parameter	Command								
+8	02	06	00	38	00	00	00	08	B7
+7	02	06	00	38	00	00	00	07	B8
+6	02	06	00	38	00	00	00	06	B9
+5	02	06	00	38	00	00	00	05	BA
+4	02	06	00	38	00	00	00	04	BB
+3	02	06	00	38	00	00	00	03	BC
+2	02	06	00	38	00	00	00	02	BD
+1	02	06	00	38	00	00	00	01	BE
0	02	06	00	38	00	00	00	00	BF
-1	02	06	00	38	FF	FF	FF	FF	C3
-2	02	06	00	38	FF	FF	FF	FE	C4
-3	02	06	00	38	FF	FF	FF	FD	C5
-4	02	06	00	38	FF	FF	FF	FC	C6
-5	02	06	00	38	FF	FF	FF	FB	C7
-6	02	06	00	38	FF	FF	FF	FA	C8
-7	02	06	00	38	FF	FF	FF	F9	C9
-8	02	06	00	38	FF	FF	FF	F8	CA

SHARPNESS SETTING – APERTURE

Set the SHARPNESS SETTING – APERTURE value.

Command	02	06	00	39	XX	XX	XX	XX	Check Sum	
Response										Response ...

The parameter value of the APERTURE applies to the “XX XX XX XX” part of the command.

The parameter range is +8~-8(0x00 0x00 0x00 0x08 ~ 0x00 0x00 0x00 0x00 ,
0xFF 0xFF 0xFF 0xFF ~ 0xFF 0xFF 0xFF 0xF8).

The table of parameter values and commands are shown below.

Parameter values and Commands

Parameter	Command								
+8	02	06	00	39	00	00	00	08	B6
+7	02	06	00	39	00	00	00	07	B7
+6	02	06	00	39	00	00	00	06	B8
+5	02	06	00	39	00	00	00	05	B9
+4	02	06	00	39	00	00	00	04	BA
+3	02	06	00	39	00	00	00	03	BB
+2	02	06	00	39	00	00	00	02	BC
+1	02	06	00	39	00	00	00	01	BD
0	02	06	00	39	00	00	00	00	BE
-1	02	06	00	39	FF	FF	FF	FF	C2
-2	02	06	00	39	FF	FF	FF	FE	C3
-3	02	06	00	39	FF	FF	FF	FD	C4
-4	02	06	00	39	FF	FF	FF	FC	C5
-5	02	06	00	39	FF	FF	FF	FB	C6
-6	02	06	00	39	FF	FF	FF	FA	C7
-7	02	06	00	39	FF	FF	FF	F9	C8
-8	02	06	00	39	FF	FF	FF	F8	C9

CHROMA SETTING – CHROMA LEVEL

Set the CHROMA SETTING – CHROMA LEVEL value.

Command	02	06	00	75	XX	XX	XX	XX	Check Sum	
Response										Response ...

The parameter value of the CHROMA LEVEL applies to the “XX XX XX XX” part of the command.

The parameter range is +7~-7(0x00 0x00 0x00 0x07 ~ 0x00 0x00 0x00 0x00 ,
0xFF 0xFF 0xFF 0xFF ~ 0xFF 0xFF 0xFF 0xF9).

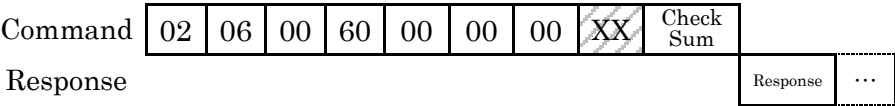
The table of parameter values and commands are shown below.

Parameter values and Commands

Parameter	Command								
+7	02	06	00	75	00	00	00	07	7B
+6	02	06	00	75	00	00	00	06	7C
+5	02	06	00	75	00	00	00	05	7D
+4	02	06	00	75	00	00	00	04	7E
+3	02	06	00	75	00	00	00	03	7F
+2	02	06	00	75	00	00	00	02	80
+1	02	06	00	75	00	00	00	01	81
0	02	06	00	75	00	00	00	00	82
-1	02	06	00	75	FF	FF	FF	FF	86
-2	02	06	00	75	FF	FF	FF	FE	87
-3	02	06	00	75	FF	FF	FF	FD	88
-4	02	06	00	75	FF	FF	FF	FC	89
-5	02	06	00	75	FF	FF	FF	FB	8A
-6	02	06	00	75	FF	FF	FF	FA	8B
-7	02	06	00	75	FF	FF	FF	F9	8C

CHROMA SETTING – CHROMA LIMIT

Set the CHROMA SETTING – CHROMA LIMIT value.



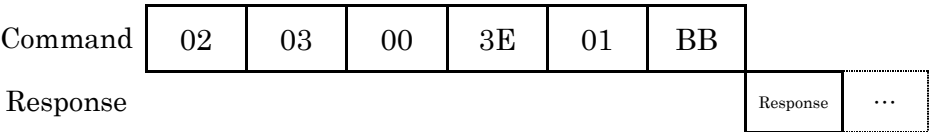
The parameter value of the CHROMALIMIT applies to the “XX” part of the command.
The parameter range is 100~130(0x64 ~ 0x82).

As an example, the parameter values and Commands are shown below.

Parameter values and Commands									
Parameter	Command								
100	02	06	00	60	00	00	00	64	33
110	02	06	00	60	00	00	00	6E	29
120	02	06	00	60	00	00	00	78	1F
130	02	06	00	60	00	00	00	82	15

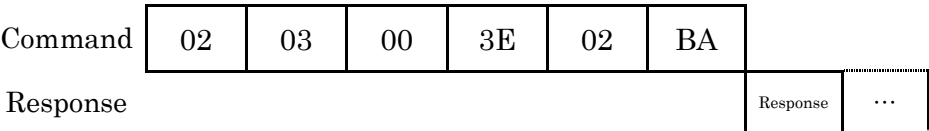
VIDEO OUTPUT – NTSC

Set the output video standard to NTSC.



VIDEO OUTPUT – PAL

Set the output video standard to PAL.



SETUP LEVEL / COLOR BAR

Set the SETUP LEVEL 0/7.5IRE and COLOR BAR on/off.

Command	02	04	00	46	00	XX	Check Sum	
Response								Response ...

The setup level 0/7.5IRE and color bar on/off depends on the value of the “XX” part of the command.

Note: The setup level is only available with NTSC.

The setup level, color bar and commands are shown below.

Settings of the Setup/Color bar and Command	
Settings	Command
SETUP LEVEL : 0 IRE COLOR BAR : OFF	02 04 00 46 00 00 B3
SETUP LEVEL : 7.5 IRE COLOR BAR : OFF	02 04 00 46 00 03 B0
SETUP LEVEL : 0 IRE COLOR BAR : ON	02 04 00 46 00 05 AE
SETUP LEVEL : 7.5 IRE COLOR BAR : ON	02 04 00 46 00 07 AC

VIDEO LEVEL – 100 IRE

Set the video level to 100 IRE.

Command	02	03	00	37	64	5F		
Response							Response	...

VIDEO LEVEL – 75 IRE

Set the video level to 75 IRE.

Command	02	03	00	37	4B	78		
Response							Response	...

FRAME STRUCTURE – NORMAL

Set the FRAME STRUCTURE to NORMAL.

Command	02	03	00	49	01	B0		
Response							Response	...

FRAME STRUCTURE – PROGRESSIVE

Set the FRAME STRUCTURE to PROGRESSIVE.

Command	02	03	00	49	02	AF		
Response							Response	...

FRAME STRUCTURE – FREEZE

Set the FRAME STRUCTURE to FREEZE.

Command	02	03	00	49	00	B1		
Response							Response	...

CAMERA ID DISPLAY – ON

To display a CAMERA ID.

Command	02	03	00	4A	01	AF		
Response							Response	...

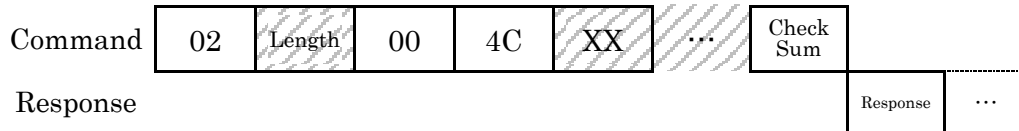
CAMERA ID - DISPLAY – OFF

To hide a CAMERA ID.

Command	02	03	00	4A	00	B0		
Response							Response	...

CAMERA ID CHARACTER

Set the CAMERA ID CHARACTER.



The value of "Length" depends on the number of characters (**it doesn't contain the terminal character**). The relationship with the number of characters and the "Length" is shown below.

$$\text{Length} = 0x04 + ([\text{hexadecimal}] \text{ double number of characters})$$

The character-code of Unicode (two bytes per character) applies to the "XX.."part (Add the terminal character (0x00 0x00) to the end of the "XX.." part.) .

The number of characters that can be set a max of 26 characters (**The terminal character is included**).

The characters that can be set with the WAT-1000 and character code are shown below.

Character and Character Code

Character	Character Code
Upper-Case Alphabets ["A" ~ "Z"]	0x00 0x41 ~ 0x00 0x5A
Digits ["0" ~ "9"]	0x00 0x30 ~ 0x00 0x39
Space [" "]	0x00 0x20
Plus Sign ["+"]	0x00 0x2B
Hyphen-Minus ["-"]	0x00 0x2D
Low Line ["_"]	0x00 0x5F
Ampersand ["&"]	0x00 0x26
Number Sign ["#"]	0x00 0x23
Commercial AT ["@"]	0x00 0x40

As an example, the calculating procedure of command that sets "CAMERA1" for CAMERA ID is shown below.

1: Calculate the "Length" part from the number of characters.

The Number of characters (excluding terminal character) = 7

Double, and convert to hexadecimal.

$$7 * 2 = 14 = 0x0E$$

$$\text{Length} = 0x04 + 0x0E = 0x12$$

2: Dispose the character code(Unicode) corresponding to "CAMERA1".

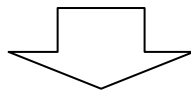
"CAMERA1" = 0x00 0x43 0x00 0x41 0x00 0x4D 0x00 0x45 0x00 0x52 0x00 0x41 0x00 0x31

Add the terminal character (0x00 0x00) to the end of the character codes.

XX... = 0x00 0x43 0x00 0x41 0x00 0x4D 0x00 0x45 0x00 0x52 0x00 0x41 0x00 0x31 0x00 0x00

3: Apply each byte into part of a command, and calculate the checksum.

The part of command to set CAMERA ID CHARACTER is: 0x02 Length 0x00 0x4C XX ...



0x02 0x12 0x00 0x4C 0x00 0x43 0x00 0x41 0x00 0x4D 0x00 0x45 0x00 0x52 0x00 0x41 0x00 0x31 0x00 0x00

Add up each byte, and do an 8bit-bitmask.

$$\text{Total byte value (8bit masked)} = 0x3A$$

Calculate One's complement of "0x3A".

$$\text{Checksum} = 0xFF - 0x3A = 0xC5$$

Therefore, the Command that sets "CAMERA1" for CAMERA ID is as follows.

Command : 02 12 00 4C 00 43 00 41 00 4D 00 45 00 52 00 41 00 31 00 00 C5

CAMERA ID – POSITION – UP-LEFT

Set the position of the CAMERA ID to UP-LEFT.

Command	02	06	00	4F	00	14	00	20	74		
Response										Response	...

CAMERA ID – POSITION – UP-CENTER

Set the position of the CAMERA ID to UP-CENTER.

Command	02	06	00	4F	00	14	00	73	21		
Response										Response	...

CAMERA ID – POSITION – UP-RIGHT

Set the position of the CAMERA ID to UP-RIGHT.

Command	02	06	00	4F	00	14	00	C8	CC		
Response										Response	...

CAMERA ID – POSITION – DOWN-LEFT

Set the position of the CAMERA ID to DOWN-LEFT.

Command	02	06	00	4F	00	D0	00	20	B8		
Response										Response	...

CAMERA ID – POSITION – DOWN-RIGHT

Set the position of the CAMERA ID to DOWN-RIGHT.

Command	02	06	00	4F	00	D0	00	C8	10		
Response										Response	...

BAUD RATE – 115200

Set the BAUD RATE to 115200 baud.

Command	02	03	00	0A	07	E9		
Response							Response	...

BAUD RATE – 57600

Set the BAUD RATE to 57600 baud.

Command	02	03	00	0A	06	EA		
Response							Response	...

BAUD RATE – 38400

Set the BAUD RATE to 38400 baud.

Command	02	03	00	0A	05	EB		
Response							Response	...

BAUD RATE – 19200

Set the BAUD RATE to 19200 baud.

Command	02	03	00	0A	04	EC		
Response							Response	...

BAUD RATE – 9600

Set the BAUD RATE to 9600 baud.

Command	02	03	00	0A	03	ED		
Response							Response	...

BAUD RATE – 4800

Set the BAUD RATE to 4800 baud.

Command	02	03	00	0A	02	EE		
Response							Response	...

BAUD RATE – 2400

Set the BAUD RATE to 2400 baud.

Command	02	03	00	0A	01	EF		
Response							Response	...

WAT-1000 Operation Command List (1/2)

Operation				Command				Comments				
OSD Menu Control	SHOW MENU			20 01 06 D8								
	CLOSE MENU			20 01 07 D7								
	UP			20 01 02 DC								
	DOWN			20 01 03 DB								
	LEFT			20 01 04 DA								
	RIGHT			20 01 05 D9								
	ENTER			20 01 00 DE								
	EXIT			20 01 01 DD								
SAVE / LOAD / RESTORE	SAVE USER SETTINGS			07 00 F8								
	LOAD USER SETTINGS			0A 00 F5				Do not send additional commands for five seconds following this command.				
	RESTORE FACTORY SETTINGS			09 01 02 F3								
Parameter set	AUTOMATIC EXPOSURE	SHUTTER MODE	E.I			02 03 00 97 04 5F	02 06 00 9C 00 27 DC 8D CB	02 03 00 0B 02 ED	02 04 00 17 FF EE F5	02 06 00 2A FF FF FF EE E2	A setting display of the advanced menu doesn't change even if the command is sent.	
						02 03 00 15 64 81	02 03 00 16 55 8F	02 03 00 14 1E C8				
			SHUTTER LIMIT	OFF	02 03 00 99 01 60	02 03 00 98 01 61	02 03 00 0B 01 EE	02 04 00 17 FF EE F5				
				X2	02 03 00 99 01 60	02 03 00 98 01 61	02 03 00 0B 02 ED	02 04 00 17 FF EE F5				
				X4	02 03 00 99 02 5F	02 03 00 98 02 60	02 03 00 0B 02 ED	02 04 00 17 FF EE F5				
				X8	02 03 00 99 03 5E	02 03 00 98 03 5F	02 03 00 0B 02 ED	02 04 00 17 FF EE F5				
				X16	02 03 00 99 04 5D	02 03 00 98 04 5E	02 03 00 0B 02 ED	02 04 00 17 FF EE F5				
				X32	02 03 00 99 05 5C	02 03 00 98 05 5D	02 03 00 0B 02 ED	02 04 00 17 FF EE F5				
			LOWLIGHT SCENE	GAIN PRI	02 03 00 97 04 5F	02 06 00 AF 00 00 00 16 32	02 06 00 B0 00 00 00 0A 3D					
				SHUT PRI	02 03 00 97 04 5F	02 06 00 AF 00 00 00 0E 3A	02 06 00 B0 00 00 00 08 3F					
			FLICKERLESS MODE	OFF	02 06 00 3C 00 00 00 00 BB							
				ON	02 06 00 3C 00 00 00 03 B8				NTSC only.			
			ESS				02 03 00 97 03 60	02 03 00 98 01 61	02 06 00 9C 00 27 DC 8D CB	02 03 00 0B 02 ED	02 04 00 17 FF D6 0D	A setting display of the advanced menu doesn't change even if the command is sent.
							02 06 00 2A FF FF FF EE E2	02 03 00 15 00 E5	02 03 00 16 00 E4	02 03 00 14 00 E6		
					SHUTTER SPEED	X2	02 03 00 98 01 61	02 03 00 15 00 E5	02 03 00 16 00 E4	02 03 00 14 00 E6		
						X4	02 03 00 98 02 60	02 03 00 15 00 E5	02 03 00 16 00 E4	02 03 00 14 00 E6		
						X8	02 03 00 98 03 5F	02 03 00 15 00 E5	02 03 00 16 00 E4	02 03 00 14 00 E6		
						X16	02 03 00 98 04 5E	02 03 00 15 00 E5	02 03 00 16 00 E4	02 03 00 14 00 E6		
			X32	02 03 00 98 05 5D		02 03 00 15 00 E5	02 03 00 16 00 E4	02 03 00 14 00 E6				
			AGC	LOW		02 03 00 0C 01 ED	02 03 00 0E 16 D6					
		MEDIUM		02 03 00 0C 01 ED	02 03 00 0E 20 CC							
		HIGH		02 03 00 0C 01 ED	02 03 00 0E 28 C4							
		MANUAL		02 03 00 0C 02 EC								
		MANUAL GAIN (XX) [0~40db]		02 04 00 0F 00 *XX *ChkSum			*The value changes depending on the MANUALGAIN value. Please see additional explanation.					
		DYNAMIC RANGE	LOW		02 03 00 1C 00 DE							
			MEDIUM		02 03 00 1C 14 CA							
			HIGH		02 03 00 1C 24 BA							
		AE PREFs	HIGHLIGHTS		02 03 00 8F 00 6B							
			SHADOWS		02 03 00 8F 01 6A							
		BACKLIGHT	OFF		02 03 00 1E 01 DB	02 03 00 20 01 D9						
			CENTER		02 03 00 1E 02 DA	02 03 00 1F 01 DA	02 03 00 20 01 D9					
			UNDER		02 03 00 1E 02 DA	02 03 00 1F 02 D9	02 03 00 20 01 D9					
			CENTER+UNDER		02 03 00 1E 02 DA	02 03 00 1F 03 D8	02 03 00 20 01 D9					
		CONTROL SPEED	AE	FAST	02 06 00 77 00 00 0F A0 D1	02 06 00 78 00 00 00 32 4D	02 06 00 79 00 00 03 E8 93					
				NORMAL	02 06 00 77 00 00 07 D0 A9	02 06 00 78 00 00 00 64 1B	02 06 00 79 00 00 01 2C 51					
				SLOW	02 06 00 77 00 00 03 33 4A	02 06 00 78 00 00 03 33 49	02 06 00 79 00 00 01 48 35					
			DYNAMIC RANGE	FAST	02 06 00 7A 00 00 0F A0 CE	02 06 00 7B 00 00 00 32 4A	02 06 00 7C 00 00 03 E8 90					
				NORMAL	02 06 00 7A 00 00 07 D0 A6	02 06 00 7B 00 00 00 64 18	02 06 00 7C 00 00 01 2C 4E					
				SLOW	02 06 00 7A 00 00 03 33 47	02 06 00 7B 00 00 03 33 46	02 06 00 7C 00 00 01 48 32					
			WHITE BALANCE	FAST	02 03 00 2B 02 CD	02 04 00 2C 00 05 C8						
				NORMAL	02 03 00 2B 0A C5	02 04 00 2C 00 05 C8						
				SLOW	02 03 00 2B 0A C5	02 04 00 2C 00 1E AF						
		SLOW SHUTTER	OFF		02 03 00 99 01 60	02 03 00 98 01 61	02 03 00 0B 01 EE					
			ON		02 03 00 99 01 60	02 03 00 98 01 61	02 03 00 0B 02 ED					
		WHITE BALANCE	MODE	ATW			02 03 00 22 05 D3					
					LOWLIMIT(XX) [2000K~5500K]		02 04 00 34 *XX *XX *ChkSum			*The value changes depending on the LOWLIMIT value. Please see additional explanation.		
					HIGHLIMIT(XX) [5500K~11000K]		02 04 00 18 *XX *XX *ChkSum			*The value changes depending on the HIGHLIMIT value. Please see additional explanation.		
				PWB		02 03 00 22 02 D6						
				EXECUTE PWB		18 00 E7						
				MANUAL			02 03 00 22 03 D5	02 03 00 23 01 D6				
					KELVIN(XX) [2000K~11000K]		02 04 00 25 *XX *XX *ChkSum			*The value changes depending on the KELVIN value. Please see additional explanation.		
				PRESET			N/A			Not available.		
					3200K		02 04 00 25 0C 80 48					
					4300K		02 04 00 25 10 CC F8					
					6500K		02 04 00 25 19 64 57					
					9300K		02 04 00 25 22 60 52					

WAT-1000 Operation Command List (2/2)

Operation				Command					Comments
Parameter set	DAY / NIGHT SETTING	D/N CONTROL	AUTO		02 03 00 30 01 C9				
				INPUT DURATION HOLD TIME (XX)	02 06 00 32 *XX *XX *XX *XX *ChkSum				*Please see additional explanation.
			EXT		02 03 00 30 02 C8				
				INPUT DURATION HOLD TIME (XX)	02 06 00 32 *XX *XX *XX *XX *ChkSum				*Please see additional explanation.
			DAY		02 03 00 30 04 C6				
			NIGHT		02 03 00 30 03 C7				
	IMAGE SETTING	ZOOM	ON		02 03 00 5B 01 9E				
				ZOOM(ZZ) [1 ~ 12]	02 03 00 5C *ZZ *ChkSum				*The value changes depending on the ZOOM value. Please see additional explanation.
				PAN(PP) [-100 ~ 100]	02 03 00 5D *PP *ChkSum				*The value changes depending on the PAN value. Please see additional explanation.
				TILT(TT) [-100 ~ 100]	02 03 00 5E *TT *ChkSum				*The value changes depending on the TILT value. Please see additional explanation.
			OFF		02 03 00 5B 00 9F				
		FLIP	OFF		02 03 00 3B 00 BF				
			HORIZ		02 03 00 3B 01 BE				
			VERT		02 03 00 3B 02 BD				
			BOTH		02 03 00 3B 03 BC				
		BW MODE	OFF		02 03 00 33 00 C7				
			B/W		02 03 00 33 02 C5				
			B/W w/Burst		02 03 00 33 01 C6				
		GAMMA MODE	AUTO		02 03 00 2E 01 CB				
			MANUAL		02 03 00 2E 02 CA				
				0.36	02 03 00 2F 24 A7				
				0.45	02 03 00 2F 2D 9E				
				0.6	02 03 00 2F 3C 8F				
			OFF		02 03 00 2E 00 CC				
		SHARPNESS SETTING	DETAIL BOOST	ON	02 03 00 7F 01 7A				
				OFF	02 03 00 7F 00 7B				
			NOISE REDUCTION	ON	02 03 00 48 02 B0				
				OFF	02 03 00 48 01 B1				
			SHARPNESS(XX) [-8 ~ +8]		02 06 00 38 *XX *XX *XX *XX *ChkSum				*The value changes depending on the SHARPNESS value. Please see additional explanation.
			APERTURE(XX) [-8 ~ +8]		02 06 00 39 *XX *XX *XX *XX *ChkSum				*The value changes depending on the APERTURE value. Please see additional explanation.
		CHROMA SETTING	CHROMA LEVEL(XX) [-7 ~ +7]		02 06 00 75 *XX *XX *XX *XX *ChkSum				*The value changes depending on the CHROMA LEVEL value. Please see additional explanation.
			CHROMA LIMIT(XX) [100 ~ 130]		02 06 00 60 00 00 00 *XX *ChkSum				*The value changes depending on the CHROMA LIMIT value. Please see additional explanation.
	FUNCTIONS	VIDEO OUTPUT	NTSC		02 03 00 3E 01 BB				
				SETUP LEVEL	7.5IRE	0IRE (XX)	02 04 00 46 00 *XX *ChkSum		
				COLOR BAR	OFF				
					ON				
			PAL		02 03 00 3E 02 BA				
				COLOR BAR	OFF	ON (XX)	02 04 00 46 00 *XX *ChkSum		
					ON				
			VIDEO LEVEL	100IRE	02 03 00 37 64 5F				
				75IRE	02 03 00 37 4B 78				
			FRAME STRUCTURE	NORMAL	02 03 00 49 01 B0				
				PROGRESSIVE	02 03 00 49 02 AF				
				FREEZE	02 03 00 49 00 B1				
		CAMERA ID	DISPLAY	ON	02 03 00 4A 01 AF				
				OFF	02 03 00 4A 00 B0				
			CAMERA ID CHARACTER (XX..)		02 *Length 00 4C *XX.. *ChkSum				The maximum number of CAMERA ID character is 26 Unicode characters. (including the string termination character) *The value changes depending on the CAMERA ID CHARACTER. Please see additional explanation.
			ID POSITION	UP-LEFT	02 06 00 4F 00 14 00 20 74				
				UP-CENTER	02 06 00 4F 00 14 00 73 21				
				UP-RIGHT	02 06 00 4F 00 14 00 C8 CC				
				DOWN-LEFT	02 06 00 4F 00 D0 00 20 B8				
				DOWN-RIGHT	02 06 00 4F 00 D0 00 C8 10				
			BAUD RATE	115200	02 03 00 0A 07 E9				
				57600	02 03 00 0A 06 EA				
				38400	02 03 00 0A 05 EB				
				19200	02 03 00 0A 04 EC				
				9600	02 03 00 0A 03 ED				
				4800	02 03 00 0A 02 EE				
				2400	02 03 00 0A 01 EF				

Additional explanation

MANUAL GAIN

Command	02	04	00	0F	00	XX	ChkSum
Example	Manual Gain[dB]		XX : (Hexadecimal of Manual Gain value)			ChkSum	
	20		0x14			0xFF - (0x02+0x04+0x00+0x0F+0x00+0x14) = 0x06	
The parameter range is 0~40db(0x00 ~ 0x28).							

WHITE BALANCE - ATW - LOWLIMIT

Command	02	04	00	34	XX	XX	ChkSum
Example	LOWLIMIT[K]			XX XX : (Hexadecimal of LOWLIMIT value)			ChkSum
	3200			0x0C 0x80			0xFF - (0x02+0x04+0x00+0x34+0x0C+0x80) = 0x39
	The parameter range is 2000K~5500K(0x07 0xD0 ~ 0x15 0x7C).						

WHITE BALANCE - ATW - HIGHLIMIT

Command	02	04	00	18	XX	XX	ChkSum
Example	HIGHLIMIT[K]			XX XX : (Hexadecimal of HIGHLIMIT value)			ChkSum
	6000			0x17 0x70			0xFF -(0x02+0x04+0x00+0x18+0x17+0x70) = 0x5A
	The parameter range is 5500K~11000K(0x15 0x7C ~ 0x2A 0xF8).						

WHITE BALANCE - MANUAL - KELVIN

Command	02	04	00	25	XX	XX	ChkSum
Example	MANUAL[K]		XX XX : (Hexadecimal of MANUAL value)				ChkSum
	7500		0x1D 0x4C				0xFF - (0x02+0x04+0x00+0x25+0x1D+0x4C) = 0x68
	The parameter range is 2000K~11000K(0x07 0xD0 ~ 0x2A 0xF8).						

SHARPNESS

Command	02	06	00	38	XX	XX	XX	XX	ChkSum
Example	SHARPNESS		XX : (Hexadecimal of SHARPNESS value)		ChkSum				
	5		0x00 0x00 0x00 0x05		0xFF - (0x02+0x06+0x00+0x38+0x00+0x00+0x00+0x05) = 0x8A				
The parameter range is +8 ~ -8(0x00 0x00 0x00 0x08 ~ 0x00 0x00 0x00 0x00 , 0xFF 0xFF 0xFF 0xFF ~ 0xFF 0xFF 0xFF 0xFF).									

APERTURE

Command	<table><tr><td>02</td><td>06</td><td>00</td><td>39</td><td>XX</td><td>XX</td><td>XX</td><td>XX</td><td>ChkSum</td></tr></table>								02	06	00	39	XX	XX	XX	XX	ChkSum
02	06	00	39	XX	XX	XX	XX	ChkSum									
Example	APERTURE		XX : (Hexadecimal of APERTURE value)				ChkSum										
	.5		0xFF 0xFF 0xFF 0xFB				0xFF - (0x02+0x06+0x00+0x39+0xFF+0xFF+0xFF+0xFB) = 0xC6										
	The parameter range is +8 ~ -8(0x00 0x00 0x00 0x08 ~ 0x00 0x00 0x00 0x00 , 0xFF 0xFF 0xFF 0xFF ~ 0xFF 0xFF 0xFF 0xFF).																

CHROMA LEVEL

Command	<table><tr><td>02</td><td>06</td><td>00</td><td>75</td><td>XX</td><td>XX</td><td>XX</td><td>XX</td><td>ChkSum</td></tr></table>								02	06	00	75	XX	XX	XX	XX	ChkSum							
02	06	00	75	XX	XX	XX	XX	ChkSum																
Example	<table><tr><td colspan="3">CHROMA LEVEL</td><td colspan="3">XX : (Hexadecimal of CHROMA LEVEL value)</td><td colspan="2">ChkSum</td></tr><tr><td colspan="3">7</td><td colspan="3">0x00 0x00 0x00 0x07</td><td colspan="2">0xFF - (0x02+0x06+0x00+0x75+0x00+0x00+0x00+0x07) = 0x78</td></tr></table> The parameter range is +7 ~ -7(0x00 0x00 0x00 0x07 ~ 0x00 0x00 0x00 0x00 , 0xFF 0xFF 0xFF 0xFF ~ 0xFF 0xFF 0xFF 0xFF)								CHROMA LEVEL			XX : (Hexadecimal of CHROMA LEVEL value)			ChkSum		7			0x00 0x00 0x00 0x07			0xFF - (0x02+0x06+0x00+0x75+0x00+0x00+0x00+0x07) = 0x78	
CHROMA LEVEL			XX : (Hexadecimal of CHROMA LEVEL value)			ChkSum																		
7			0x00 0x00 0x00 0x07			0xFF - (0x02+0x06+0x00+0x75+0x00+0x00+0x00+0x07) = 0x78																		

CHROMA LIMIT

Command	02	06	00	60	00	00	00	XX	ChkSum
Example	CHROMA LIMIT		XX : (Hexadecimal of CHROMA LIMIT value)					ChkSum	
	130		0x82					0xFF - (0x02+0x06+0x00+0x60+0x00+0x00+0x00+0x00+0x82) = 0x15	
	The parameter range is 100 ~ 130 (0x64~0x82).								

DAY/NIGHT INPUT DURATION / HOLD TIME

Command	02	06	00	32	XX	XX	XX	XX	ChkSum
					HOLD TIME		INPUT DURATION		
The parameter value of the HOLD TIME and the INPUT DURATION applies to the "XX XX XX XX" part.									
The upper 4 digits are assigned to HOLD TIME, and the lower 4 digits are assigned to the INPUT DURATION.									
The parameter value applied to AUTO and EXT on the DAY/NIGHT CONTROL.									
Example	Settings				XX : (Hexadecimal)			ChkSum	
	INPUT DURATION : 10[s] HOLD TIME : 3200[ms]				INPUT DURATION : 0x000A HOLD TIME : 0x0C80			0xFF - (0x02+0x06+0x00+0x32+0x0C+0x80+0x00+0x0A) = 0x2F	
	The parameter range of the INPUT DURATION is 1~255 sec (0x00 0x01 ~ 0x00 0xFF). The parameter range of the HOLD TIME is 0~65535 msec (0x00 0x00 ~ 0xFF 0xFF).								

ZOOM

Command	02	03	00	5C	ZZ	ChkSum
Example	Zoom		ZZ : (Hexadecimal of Zoom value)			ChkSum
	10		0x0A			0xFF - (0x02+0x03+0x00+0x5C+0x0A) = 0x92
	The parameter range is 1 ~ 12(0x01 ~ 0x0C).					

PAN

Command	02	03	00	5D	PP	ChkSum
Example	Pan		PP : (Hexadecimal of Pan value)			ChkSum
	-50		0xCE			0xFF - (0x02+0x03+0x00+0x5D+0xCE) = 0xCF
The parameter range is +100 ~ -100(0x64 ~ 0x00, 0xFF ~ 0x9C).						

TILT

Command	02	03	00	5E	TT	ChkSum
Example	Tilt		TT : (Hexadecimal of Tilt value)			ChkSum
	-50		0xCE			0xFF -(0x02+0x03+0x00+0x5E+0xCE) = 0xCE
	The parameter range is +100 ~ -100(0x64 ~ 0x00, 0xFF ~ 0x9C).					

SETUP LEVEL / COLOR BAR

Command	02	04	00	46	00	XX	ChkSum
The setup level of 0/7.5IRE and color bar on/off depends on a value of the "XX" part of the command. The setup level is only available with NTSC.							
Each setting and value of the "XX" part are as follows.							
Settings		XX : (Hexadecimal)					
SETUP LEVEL : 0[IRE] , COLOR BAR : OFF		0x00					
SETUP LEVEL : 7.5[IRE] , COLOR BAR : OFF		0x03					
SETUP LEVEL : 0[IRE] , COLOR BAR : ON		0x05					
SETUP LEVEL : 7.5[IRE] , COLOR BAR : ON		0x07					
Example	Settings		XX : (Hexadecimal)		ChkSum		
	SETUP LEVEL 7.5[IRE] COLOR BAR : ON		0x07		0xFF - (0x02+0x04+0x00+0x46+0x00+0x07) = 0xAC		

CAMERA ID CHARACTER

Command	02	Length	00	4C	XX	...	ChkSum
The value of the "Length" part depends on the number of characters(it doesn't contain the terminal character) Length = 0x04 + { (hexadecimal) double number of characters }							
The character- code of Unicode (two bytes per character) applies the "XX-" part. Add the terminal character (0x00 0x00) to the end of the "XX-" part. The number of characters that can be set is a max of 26 characters (the terminal character is included).							
The character that can be set with WAT-1000 including the character code are shown below.							
Character		Character Code					
UpperCase Alphabets ["A" ~ "Z"]		0x00 0x41 ~ 0x00 0x5A					
Digits ["0" ~ "9"]		0x00 0x30 ~ 0x00 0x39					
Space [" "]		0x00 0x20					
Plus Sign ["+"]		0x00 0x2B					
Hyphen-Minus ["-"]		0x00 0x2D					
Low Line ["_"]		0x00 0x5F					
Ampersand ["&"]		0x00 0x26					
Number Sign ["#"]		0x00 0x23					
Commercial AT ["@"]		0x00 0x40					

Settings	Length : (Hexadecimal)	XX : (Hexadecimal)	ChkSum
"CAMERA1"	num of characters : 7 7*2 = 14 = 0x0E Length = 0x04+0x0E = 0x12	0x00 0x43 0x00 0x41 0x00 0x4D 0x00 0x45 0x00 0x52 0x00 0x41 0x00 0x31 0x00 0x00	0xFF - (0x02+0x12+ 0x00+0x43+0x00+0x41+0x00+0x4D+0x00+0 x45+0x00+0x52+0x00+0x41+0x00+0x31+0x00+0x00) = 0xC5