

WAT-910BD

SPI COMMUNICATION MANUAL(Digital Out)

Ver. 1.0

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1. INTRODUCTION

This manual is a supplement manual for using the digital output of the WAT-910BD.

Therefore, it is recommended that this manual is read in conjunction with the "WAT-910BD H / W manual".

Description requiring electrical knowledge needed to properly use the camera is included in the contents of this document. Please read this document carefully, and use and/or install the camera after full understanding.

Under improper installation, it may cause serious damage to the connected equipment and the camera.

Please contact the distributor or dealer from which the WAT-910BD was purchased, if you do not understand the installation, operation or safety instructions laid out in our manuals.

In addition, how to operate and install the camera, please refer "WAT-910BD Operation Manual" together with this document.

2. LEGAL DISCLAIMER

Design and specifications are subject to change for improvement without notice.

Watec is not responsible for any inconvenience or damages to the video and monitoring recording equipment caused by misuse, mis-operation or improper wiring of our equipment.

Technical information contained herein is for reference only and does not convey any license by any implication or otherwise under any intellectual property right or other right of Watec or third parties.

Watec does not assume responsibility for any right infringements arising out of the use of this information.

3. OVERVIEW

This document describes how to set and to adjust the the digital output function by using the SPI communication function of WAT-910BD.

Please refer to Chapter 6 of "WAT-910BD H / W manual" to know that how to use the SPI communication function.

About the video format of the digital output, please refer to Chapter 5 of "WAT-910BD H / W Manual".

4. SPI COMMUNICATION

In order to operate the related parameters of the digital output function, use the following commands.

1) CAMERA PARAMETER READ

SPI Write "data set" (send to camera MCU), Address:0x082

| Symbol | C1 | C2 | ADR | DAT | CS | ST |
|--------|----|----|-----|-----|----|----|
| Value | 04 | 01 | 82 | 00 | 87 | AA |

Checksum (CS) specifies the lower 1 byte of the calculated value (C1 + C2 + ADR + DAT).

In the PARAMETER READ command (address:0x082) , it will be 0x87 fixed value.

SPI Write "data set" (send to camera MCU), Address:0x193

| Symbol | C1 | C2 | ADR | DAT | CS | ST |
|--------|----|----|-----|-----|----|----|
| Value | 04 | 02 | 93 | 00 | 99 | AA |

Checksum (CS) specifies the lower 1 byte of the calculated value (C1 + C2 + ADR + DAT).

In the PARAMETER READ command (address:0x193) , it will be 0x99 fixed value.

SPI Read "data set" (camera MCU response)

| Symbol | ADR | DAT | CS | ST |
|--------|-----|-----|----|----|
| Value | *1 | *2 | *3 | *4 |

*1: Parameter address lower byte. Same as SPI Write data.

*2: Parameter value

*3: Check sum (lower byte of "ADR + DAT")

*4: ST CODE (AA:in execution 55:EXEC. NORMALLY A5:EXEC. ERROR)

2) CAMERA PARAMETER WRITE**SPI Write "data set" (send to camera MCU), Address:0x082**

| Symbol | C1 | C2 | ADR | DAT | CS | ST |
|--------|----|----|-----|-----|----|----|
| Value | 04 | 81 | 82 | *1 | *2 | AA |

*1: Parameter Value.

*2: Checksum (CS) specifies the lower 1 byte of the calculated value (C1 + C2 + ADR + DAT).

SPI Write "data set" (send to camera MCU), Address:0x193

| Symbol | C1 | C2 | ADR | DAT | CS | ST |
|--------|----|----|-----|-----|----|----|
| Value | 04 | 82 | 93 | *1 | *2 | AA |

*1: Parameter Value.

*2: Checksum (CS) specifies the lower 1 byte of the calculated value (C1 + C2 + ADR + DAT).

SPI Read "data set" (camera MCU response)

| Symbol | ADR | DAT | CS | ST |
|--------|-----|-----|----|----|
| Value | *1 | *2 | *3 | *4 |

*1: Parameter address lower byte. Same as SPI Write data.

*2: Parameter value

*3: Check sum (lower byte of "ADR + DAT")

*4: ST CODE (AA: in execution 55:EXEC. NORMALLY A5:EXEC. ERROR)

5. DIGITAL OUTPUT FUNCTION SETTING

5.1 DIGITAL OUTPUT ON/OFF

Camera Parameter

| Address | Bit | | | | | | | |
|---------|-----|---|---|---|---|---|---|----------------------------|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0x5E2 | — | — | — | — | — | — | — | DIGIT OUT 0:OFF 1:ON |

*Factory setting value: 0x00

By using DIGIT OUT(0x5E2:Bit0), the digital output will be turned ON/OFF.

Since no other parameters are allocated in this address, digital output turning ON or OFF is possible by sending data 0x01(ON) or 0x00(OFF).

e. g. 1) turn ON the digital output function

Send following data bytes to the indirect registers for SPI control (address: 0x0036 to 0x003B).

| address | 0x36 | 0x37 | 0x38 | 0x39 | 0x3A | 0x3B |
|------------|------|------|------|------|------|------|
| symbol | C1 | C2 | ADR | DAT | CS | ST |
| value(hex) | 00 | 81 | E2 | 01 | 64 | AA |

e. g. 2) turn OFF the digital output function

Send following data bytes to the indirect registers for SPI control (address: 0x0036 to 0x003B).

| address | 0x36 | 0x37 | 0x38 | 0x39 | 0x3A | 0x3B |
|------------|------|------|------|------|------|------|
| symbol | C1 | C2 | ADR | DAT | CS | ST |
| value(hex) | 00 | 81 | E2 | 00 | 63 | AA |

5.2 DETAIL SETTINGS

5.2.1 CLOCK PHASE (CLK PHASE)

By using the bit-3, the phase of digital output clock signal DCK (connector: J6, pin number: 4) is inverted.

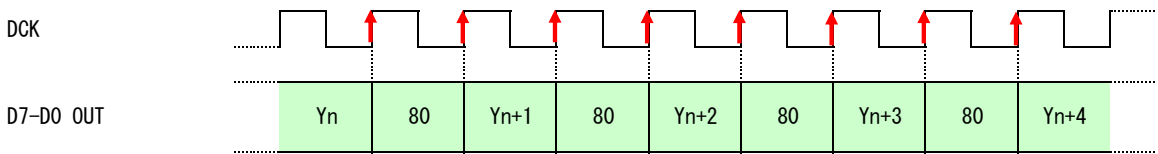
Camera Parameter

| Address | Bit | | | | | | | |
|---------|-----------------|-----------------------|------------------------------------|------------------------------------|--------------|---------|---------|---------|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0x193 | DIGIT OUT | DYC RANGE | COLOR ID | | CLK PHASE | (fixed) | (fixed) | (fixed) |
| | 0: OFF 1: ON | 0: 16-235 1: 1-254 | 0: Cb, Y, Cr, Y 2: Cr, Y, Cb, Y | 1: Y, Cb, Y, Cr 3: Y, Cr, Y, Cb | 0: ↑ 1: ↓ | 1 | 1 | 1 |

*Factory setting value: 0x47

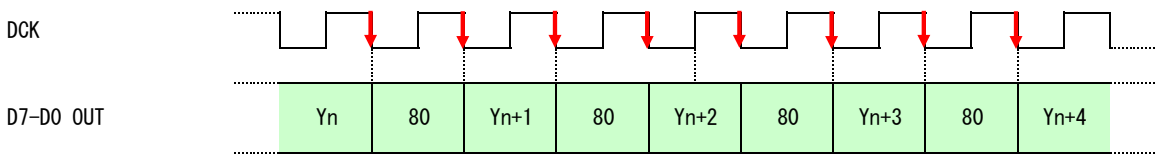
*1) CLK PHASE=0(factory setting):

In synchronization with the rising edge of the DCK, the digital video data is output.



*2) CLK PHASE=1:

In synchronization with the falling edge of the DCK, the digital video data is output.



e. g. 3) To be synchronized with the falling edge of the data output by changing the DCK phase.

(digital output ON, others are left at the default setting)

The data byte to be transmitted to the digital output setting(address: 0x193) is 0xCF.

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|-----------|-----------|-----------------|---|-----------|---------|---------|---------|
| Parameter | DIGIT OUT | DYC RANGE | COLOR ID | | CLK PHASE | (fixed) | (fixed) | (fixed) |
| | 1: ON | 1: 1-254 | 0: Cb, Y, Cr, Y | | 1: ↓ | | | |
| bit setting | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| data value | 0xCF | | | | | | | |

Send following data bytes to the indirect registers for SPI control (address: 0x0036 to 0x003B).

| | | | | | | |
|------------|------|------|------|------|------|------|
| address | 0x36 | 0x37 | 0x38 | 0x39 | 0x3A | 0x3B |
| symbol | C1 | C2 | ADR | DAT | CS | ST |
| value(hex) | 04 | 82 | 93 | CF | E8 | AA |

5.2.2 COLOR ID (COLOR ID)

By using the bit-4 and 5, the data output order of the digital output signal bit 7 to 0 (connector: J6, pin number: 6-12) are changed.

Camera Parameter

| Address | Bit | | | | | | | |
|---------|---------------|---------------------|----------------------------------|----------------------------------|------------|---------|---------|---------|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0x193 | DIGIT OUT | DYC RANGE | COLOR ID | | CLK PHASE | (fixed) | (fixed) | (fixed) |
| | 0:OFF 1:ON | 0:16-235 1:1-254 | 0:Cb, Y, Cr, Y 2:Cr, Y, Cb, Y | 1:Y, Cb, Y, Cr 3:Y, Cr, Y, Cb | 0:↑ 1:↓ | 1 | 1 | 1 |

*Factory setting value: 0x47

By using Bit-4, the output order of the chroma signal(Cb,Cr) and the luminance signal(Y) is changed.

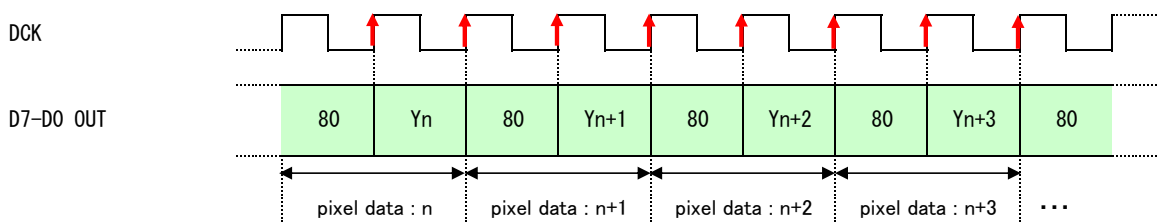
By using Bit-5, the output order of the chroma signal(Cb) and the chroma signal(Cr) is changed.

(Since WAT-910BD is a B/W camera, bit-5 is invalid for substantially, and the data values of Cb and Cr are all 0x80.)

The factory setting value is (bit-5, bit-4) = (0,0), it means that the digital data order are (Cb, Y, Cr, Y).

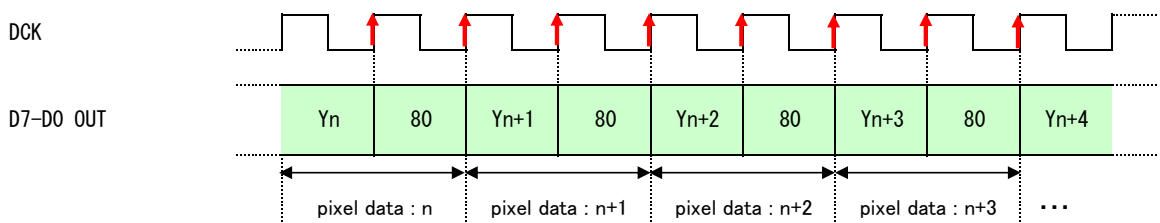
*1) COLOR ID=0 (factory setting) or 2:

The digital video data order are 0x80, Yn, 0x80, Yn+1...



*1) COLOR ID=1 or 3:

The digital video data order are Yn, 0x80, Yn+1, 0x80...



e. g. 4) To change the order of the digital data to "luminance data first output".

(digital output ON, others are left at the default setting)

The data byte to be transmitted to the digital output setting(address: 0x193) is 0xD7.

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|-----------|-----------|----------------|---|-----------|---------|---------|---------|
| Parameter | DIGIT OUT | DYC RANGE | COLOR ID | | CLK PHASE | (fixed) | (fixed) | (fixed) |
| | 1:ON | 1:1-254 | 1:Y, Cb, Y, Cr | | 0:↑ | | | |
| bit setting | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| data value | 0xD7 | | | | | | | |

Send following data bytes to the indirect registers for SPI control (address: 0x0036 to 0x003B).

| | | | | | | |
|------------|------|------|------|------|------|------|
| address | 0x36 | 0x37 | 0x38 | 0x39 | 0x3A | 0x3B |
| symbol | C1 | C2 | ADR | DAT | CS | ST |
| value(hex) | 04 | 82 | 93 | D7 | F0 | AA |

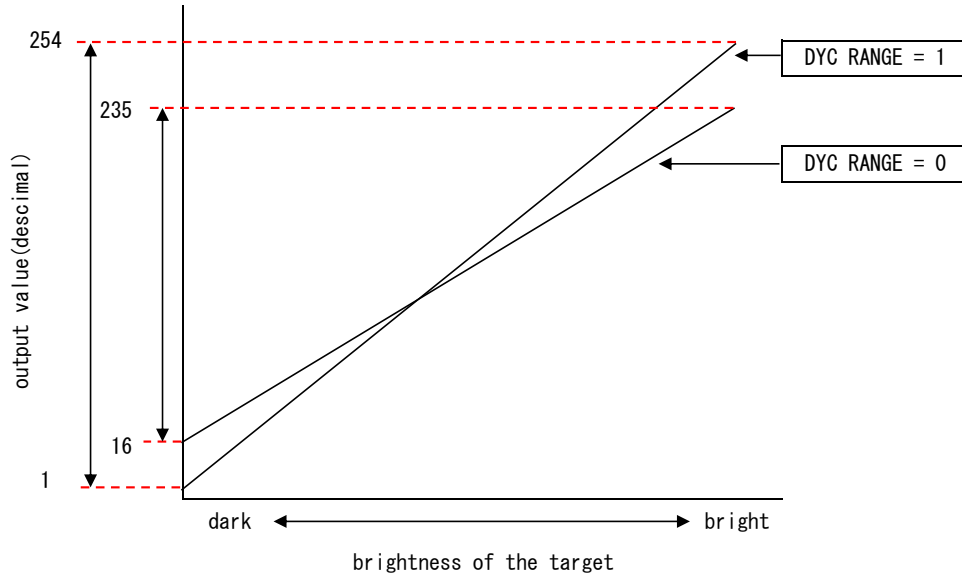
5.2.3 OUTPUT DATA RANGE (DYC RANGE)

By using the bit-6, the data output range of the digital output signal bit 7 to 0 (connector: J6, pin number: 6-12) are changed.

Camera Parameter

| Address | Bit | | | | | | | |
|---------|---------------|----------------------|----------------|----------------|--------------|---------|---------|---------|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0x193 | DIGIT OUT | DYC RANGE | COLOR ID | | CLK PHASE | (fixed) | (fixed) | (fixed) |
| | 0:OFF 1:ON | 0:16-235 1: 1-254 | 0:Cb, Y, Cr, Y | 1:Y, Cb, Y, Cr | 0: ↑ 1: ↓ | 1 | 1 | 1 |

*Factory setting value: 0x47



e. g. 5) To change the range of the digital output value to 16-235.
(digital output ON, others are left at the default setting)

The data byte to be transmitted to the digital output setting(address: 0x193) is 0x87.

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|-----------|-----------|----------------|---|-----------|---------|---------|---------|
| Parameter | DIGIT OUT | DYC RANGE | COLOR ID | | CLK PHASE | (fixed) | (fixed) | (fixed) |
| | 1:ON | 0:16-235 | 0:Cb, Y, Cr, Y | | 0: ↑ | 1 | 1 | 1 |
| bit setting | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| data value | 0x87 | | | | | | | |

Send following data bytes to the indirect registers for SPI control (address: 0x0036 to 0x003B).

| | | | | | | |
|------------|------|------|------|------|------|------|
| address | 0x36 | 0x37 | 0x38 | 0x39 | 0x3A | 0x3B |
| symbol | C1 | C2 | ADR | DAT | CS | ST |
| value(hex) | 04 | 82 | 93 | 87 | A0 | AA |

5.2.4 DIGITAL OUTPUT ON/OFF (DIGIT OUT)

By using DIGIT OUT, the digital output will be turned ON/OFF. (It is same function as address 0x5E2 Bit-0.)

Camera Parameter

| Address | Bit | | | | | | | |
|---------|-----------------|-----------------------|------------------------------------|------------------------------------|--------------|---------|---------|---------|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0x193 | DIGIT OUT | DYC RANGE | COLOR ID | | CLK PHASE | (fixed) | (fixed) | (fixed) |
| | 0: OFF 1: ON | 0: 16-235 1: 1-254 | 0: Cb, Y, Cr, Y 2: Cr, Y, Cb, Y | 1: Y, Cb, Y, Cr 3: Y, Cr, Y, Cb | 0: ↑ 1: ↓ | 1 | 1 | 1 |

*Factory setting value: 0x47

e.g. 6) turn ON the digital output function
(Others are left at the default setting)

The data byte to be transmitted to the digital output setting(address: 0x193) is 0xC7.

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|-----------|-----------|----------|---|-----------|---------|---------|---------|
| Parameter | DIGIT OUT | DYC RANGE | COLOR ID | | CLK PHASE | (fixed) | (fixed) | (fixed) |
| bit setting | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| data value | 0xC7 | | | | | | | |

Send following data bytes to the indirect registers for SPI control (address: 0x0036 to 0x003B).

| アドレス | 0x36 | 0x37 | 0x38 | 0x39 | 0x3A | 0x3B |
|------|------|------|------|------|------|------|
| シンボル | C1 | C2 | ADR | DAT | CS | ST |
| 値 | 04 | 82 | 93 | C7 | E0 | AA |

5.3 DIGITAL OUTPUT GAIN (DIGITAL Y GAIN)

By using this address byte, the gain of the digital data is adjustable.

Camera Parameter

| Address | Bit | | | | | | | |
|---------|------------------------|---|---|---|---|---|---|---|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0x082 | DIGITAL Y GAIN | | | | | | | |
| | 0x00 ... 0xA0 ... 0xFF | | | | | | | |

*Factory setting value: 0xA0

e.g. 7) To change the gain of digital data to 0xB0.

Send following data bytes to the indirect registers for SPI control (address: 0x0036 to 0x003B).

| アドレス | 0x36 | 0x37 | 0x38 | 0x39 | 0x3A | 0x3B |
|------|------|------|------|------|------|------|
| シンボル | C1 | C2 | ADR | DAT | CS | ST |
| 値 | 04 | 81 | 82 | B0 | B7 | AA |