



# CCD Color Camera Model CS6910G Interface Specifications

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**TOSHIBA TELI CORPORATION**

## 1. Product Description

CS6910G is the color camera which adopted Gigabit Ethernet. This camera is controlled by communicating on Gigabit Ethernet interface.

In this interface specifications, control method of CS6910G is mentioned.

## 2. Interface connector specification

RJ45 jack has been mounted on rear of main body. Pin assignment is as follows.

• Pin assignment

| Pin No. | I/O | Function |
|---------|-----|----------|
| 1       | I/O | BI_DA+   |
| 2       | I/O | BI_DA-   |
| 3       | I/O | BI_DB+   |
| 4       | I/O | BI_DC+   |
| 5       | I/O | BI_DC-   |
| 6       | I/O | BI_DB-   |
| 7       | I/O | BI_DD+   |
| 8       | I/O | BI_DD-   |

## 3. Communication specification

### 3-1 Command communication protocol

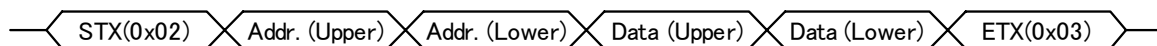
The command communication protocol is the Teli's standard method (A method to set a parameter in registers of camera). The command is transferred on Ethernet packet. However, this chapter explains command communication extracted from Ethernet packet with a schematic view.

In command transfer, hexadecimal address and data are converted to ASCII data.

All ASCII alphabetic characters are using uppercase characters.

• How to write a data to the register. (schematic view)

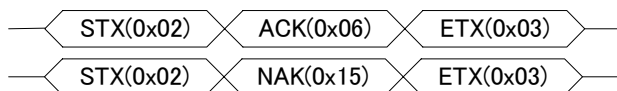
To write data to a register, send a command as follows:



For example, to write data 0x25 to address 0x75, send a command as follows:



The camera responds to the write command with No Error (ACK) or Error (NAK), as follows:



In the case that ACK was sent back, it shows that the sent command has been executed and completed.

In the case that NAK was sent back, it shows a command has not been executed normally because a error occurred. User can get detailed information of the error by accessing status register.

When you want to access registers continuously, please transmit the next command after having confirmed the reception of ACK or NAK from a camera.

- How to read a data from the register. (schematic view)

To read data from a register, send “R” and “Q” following the address.

For example, to read data from address 0x6D, send a command, as follows:



The camera responds to the read request, as follows:



### 3-2 Register Map

The registers accessible to the user are as follows:

|                         | Address           | Function                               | bit7   | bit6                                  | bit5 | bit4 | bit3                     | bit2 | bit1               | bit0               | Default Value |
|-------------------------|-------------------|--|--|---------------------------------------|------|------|--------------------------|------|--------------------|--------------------|---------------|
| Base Registers          | 0x00<br> <br>0x0B | Vendor Name<br>(Read Only)             | Vendor Name<br>"TOSHIBA TELI"                |                                       |      |      |                          |      |                    |                    | <<            |
|                         | 0x0C<br> <br>0x0F | Reserved                               | rsv.   |                                       |      |      |                          |      |                    |                    | 0x00          |
|                         | 0x10<br> <br>0x1F | Model Name<br>(Read Only)              | Model Name<br>"CS6910G"                      |                                       |      |      |                          |      |                    |                    | <<            |
|                         | 0x20<br> <br>0x2F | Serial Number<br>(Read Only)           | Serial Number                                |                                       |      |      |                          |      |                    |                    | -             |
|                         | 0x30<br> <br>0x3F | CPU Version<br>(Read Only)             | CPU Firmware Version<br>ex)"V010000"         |                                       |      |      |                          |      |                    |                    | <<            |
| Self Check Registers    | 0x40              | Self-Check(Read Only)                  | Self-Check Result                            |                                       |      |      |                          |      |                    |                    | -             |
|                         | 0x41              | Status(Read Only)                      | Status Code                                  |                                       |      |      |                          |      |                    |                    | -             |
|                         | 0x42<br> <br>0x4F | Reserved                               | rsv.   |                                       |      |      |                          |      |                    |                    | 0x00          |
|                         | Memory Registers  | 0x50                                   | Memory Information<br>(Read Only)            | Number Of Memory Banks In This Camera |      |      |                          |      |                    |                    |               |
| 0x51                    |                   | Memory Save                            | rsv.   |                                       |      |      | Save Bank No.            |      |                    |                    | -             |
| 0x52                    |                   | Memory Load                            | rsv.   |                                       |      |      | Load Bank No.            |      |                    |                    | -             |
| 0x53                    |                   | Memory Reset                           | rsv.   |                                       |      |      | Reset Bank No.           |      |                    |                    | -             |
| 0x54<br> <br>0x5F       |                   | Reserved                               | rsv.   |                                       |      |      |                          |      |                    |                    | 0x00          |
| Base Function Registers | 0x60              | Update Registers<br>Value (Write Only) | rsv.   |                                       |      |      |                          |      |                    | 1:EXEC             | -             |
|                         | 0x61              | Resolution Information<br>(Read Only)  | Maximum Resolution That This Camera Supports |                                       |      |      |                          |      |                    |                    | 0x07          |
|                         | 0x62              | Frame Rate Information<br>(Read Only)  | Maximum Frame Rate at Maximum Resolution     |                                       |      |      |                          |      |                    |                    | 0x04          |
|                         | 0x63              | Resolution                             | rsv.   |                                       |      |      | 0x04:VGA<br>0x07:SXGA    |      |                    |                    | 0x07          |
|                         | 0x64              | Frame Rate                             | rsv.   |                                       |      |      | 0x03:15fps<br>0x04:30fps |      |                    |                    | 0x04          |
|                         | 0x65              | Shutter Type<br>(Read Only)            | rsv.   |                                       |      |      |                          |      |                    | 0:Global           | 0x00          |
|                         | 0x66              | Shutter Mode                           | rsv.   |                                       |      |      |                          |      |                    | 0:Normal<br>1:RTS  | 0x00          |
|                         | 0x67              | Trigger Polarity                       | rsv.   |                                       |      |      |                          |      |                    | 0:NEG<br>1:POS     | 0x00          |
|                         | 0x68              | Random Trigger<br>Shutter Mode         | rsv.   |                                       |      |      |                          |      |                    | 0:Fix<br>1:Pulse   | 0x00          |
|                         | 0x69              | Exposure Mode                          | rsv.   |                                       |      |      |                          |      |                    | 0:Normal<br>1:Auto | 0x00          |
| 0x6A                    | AE Area           | rsv.                                   |  |                                       |      |      |                          |      | 0:Center<br>1:Spot | 0x00               |               |

|                         | Address           | Function                             | bit7   | bit6                        | bit5 | bit4 | bit3                        | bit2                                   | bit1 | bit0   | Default Value |      |
|-------------------------|-------------------|--------------------------------------|--|-----------------------------|------|------|-----------------------------|--|------|--|---------------|------|
| Base Function Registers | 0x6B              | AE Lock                              | rsv.   |                             |      |      |                             |  |      | 0:OFF<br>1:ON  | 0x00          |      |
|                         | 0x6C              | Exposure Adjust                      | rsv.   |                             |      |      | Exposure Adjust Value (0-9) |  |      |  | 0x06          |      |
|                         | 0x6D              | Denominator Of Exposure Time (Lower) | Denominator Of Exposure Time   |                             |      |      |                             |  |      |  |               | 0x1E |
|                         | 0x6E              | Denominator Of Exposure Time (Upper) | rsv.   | (0x0001-0x3A98)             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0x6F              | Numerator Of Exposure Time           | rsv.   |                             |      |      |                             | Numerator Of Exposure Time (0x01-0x04) |      |  |               | 0x01 |
|                         | 0x70              | Gain                                 | Analog Pre-Gain (0x0000-0x00BF)  |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0x71              | Reserved                             | rsv.   |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0x72              | Reserved                             | rsv.   |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0x73              | Reserved                             | rsv.   |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0x74              | WB Mode                              | rsv.   |                             |      |      |                             |  |      | 0:MWB<br>1:AWB<br>2:OTWB   | 0x00          |      |
|                         | 0x75              | Manual Color Temperature             | 0x1E:3000[K]<br>0x25:3700[K]<br>0x28:4000[K]<br>0x2D:4500[K]<br>0x37:5500[K]<br>0x41:6500[K]<br>0xFF:Manual R and B Gain Available |                             |      |      |                             |  |      |  |               | 0x37 |
|                         | 0x76              | Reserved                             | rsv.   |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0x77              | One-Touch WB (Write Only)            | rsv.   |                             |      |      |                             |  |      | 1:EXEC   | -             |      |
|                         | 0x78              | Manual R Gain                        | rsv.   | R Gain (0x0000-0x005F)      |      |      |                             |  |      |  |               | 0x39 |
|                         | 0x79              | Reserved                             | rsv.   |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0x7A              | Manual B Gain                        | rsv.   | B Gain (0x0000-0x005F)      |      |      |                             |  |      |  |               | 0x2A |
|                         | 0x7B              | Reserved                             | rsv.   |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0x7C              | Aperture                             | rsv.   |                             |      |      |                             | Aperture (0-7)                         |      |  |               | 0x00 |
|                         | 0x7D              | Gamma                                | rsv.   |                             |      |      |                             |  |      | 0: $\gamma=0.45$<br>1: $\gamma=0.65$<br>2: $\gamma=1.0$<br>3: User Preset0 | 0x01          |      |
|                         | 0x7E<br> <br>0xAF | Reserved                             | rsv.   |                             |      |      |                             |  |      |  |               | 0x00 |
| Expansion Registers     | 0xB0              | Target Address 0-7 Register          | Indirect Access Target Address Register (bit0-7)   |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0xB1              | Target Address 8-15 Register         | Indirect Access Target Address Register (bit8-15)  |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0xB2              | Target Address 16-23 Register        | Indirect Access Target Address Register (bit16-23)   |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0xB3              | Target Address 24-31 Register        | Indirect Access Target Address Register (bit24-31)   |                             |      |      |                             |  |      |  |               | 0x00 |
|                         | 0xB4              | Target Address 32-39 Register        | rsv.   |                             |      |      |                             |  |      |  |               | 0x80 |
|                         | 0xB5              | Data Register                        | Indirect Access Data Register  |                             |      |      |                             |  |      |  |               | -    |
|                         | 0xB6              | Data Length Register                 | rsv.   | Indirect Access Data Length |      |      |                             |  |      |  |               | 0x00 |
|                         | 0xB7              | Sum Register                         | Indirect Access Sum Register   |                             |      |      |                             |  |      |  |               | -    |

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|                     | Address           | Function                     | bit7                         | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|---------------------|-------------------|------------------------------|------------------------------|------|------|------|------|------|------|------|---------------|
| Expansion Registers | 0xB8              | Expansion Status (Read Only) | Expansion Status Code        |      |      |      |      |      |      |      | -             |
|                     | 0xB9<br> <br>0xBF | Reserved                     | rsv.                         |      |      |      |      |      |      |      | 0x00          |
|                     | 0xC0              | CRB Coefficient              | Color Matrix CRB Coefficient |      |      |      |      |      |      |      | 0x4B          |
|                     | 0xC1              | CRR Coefficient              | Color Matrix CRR Coefficient |      |      |      |      |      |      |      | 0x64          |
|                     | 0xC2              | CBR Coefficient              | Color Matrix CBR Coefficient |      |      |      |      |      |      |      | 0x41          |
|                     | 0xC3              | CBB Coefficient              | Color Matrix CBB Coefficient |      |      |      |      |      |      |      | 0x5A          |
|                     | 0xC4<br> <br>0xCF | Reserved                     | rsv.                         |      |      |      |      |      |      |      | 0x00          |

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### 3-3 Access to Indirect Registers

To set the user-specified gamma table, use indirect access registers.

For indirect access, seven bytes of direct registers are used. These direct registers are as follows:

|                               |  |
|-------------------------------|--|
| Target Address 0-7 Register   | ( Direct address:0xB0 )  |
| Target Address 8-15 Register  | ( Direct address:0xB1 )  |
| Target Address 16-23 Register | ( Direct address:0xB2 )  |
| Target Address 24-31 Register | ( Direct address:0xB3 )  |
| Target Address 32-39 Register | ( Direct address:0xB4<br>* This register is not used in this camera. ) |
| Data Register                 | ( Direct address:0xB5 )  |
| Data Length Register          | ( Direct address:0xB6 )  |
| Sum Register                  | ( Direct address:0xB7 )  |

The function of each register is as follows.

- Target Address \*-\* Register

Indicates the address whose data is referred to or to which data is written.

- Data Register

During read operation, data stored in the Target Address \*-\* register is read.

During write operation, the specified data is written to the Target Address \*-\* Register.

When read or write operation is completed, the Target Address \*-\* Register is incremented.

- Data Length Register

Set the number of bytes to be read continuously. (Specified value +1) bytes of data are read continuously.

If 0 is specified, one byte of data is read.

- Sum Register

Every time a write or read command is executed for the Data Register, one-byte hexadecimal data read or written is added to the value of this register and the result is stored in this register. When continuous write or continuous read is performed after 0x00 is written into this register, the camera side Check Sum of the data read or written data is stored after the continuous write or continuous read.

With the indirect access registers (Data Register: address 0xB5), continuous data write and continuous data read can be performed.

Up to 32 bytes of data can write or read continuously.

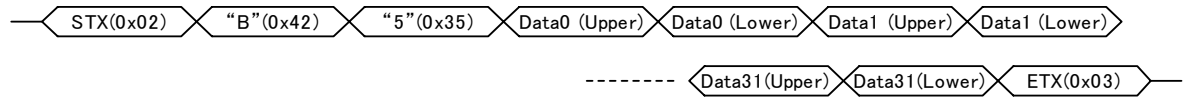
- How to write data to the registers continuously (schematic view)

To perform continuous write, send a command as follows.

In continuous write, data of any length (up to 32 bytes) can be written. The data length for continuous write has no relation to the setting value in the Data Length Register (address 0xB6).

The camera treats a reception of ETX, as the end of data.

For example, to write data 32 byte continuously, send a command as follows:

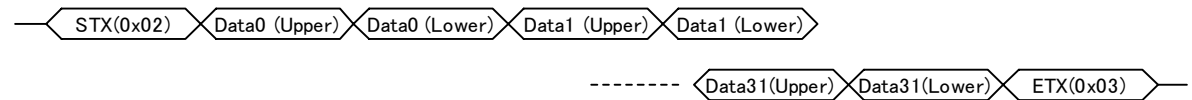


- How to read data from the registers continuously (schematic view)

In continuous read, the camera responds as follows.

If you request a read operation for the Data Register (address 0xB5), the setting value of the Data Length Register (address 0xB6) + 1 byte of data is read continuously.

For example, receive a data as follows when Data Length Register setting 0x1F:



- Register map in the indirect address space

The register map in the indirect address space is as follows.

The output gradation table for each input 1024 gradations is assigned.

Please also refer to the clause of “4-7 gamma setting”.

| Address      | Function     | bit7         | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|--------------|--------------|--------------|------|------|------|------|------|------|------|---------------|
| 0x800000000  | User Gamma 0 | User Gamma 0 |      |      |      |      |      |      |      | -             |
| 0x80000003FF |              |              |      |      |      |      |      |      |      |               |

### 3-4 Error Status

When NAK has been sent back, user can get detailed information of the error by accessing status register.

| Error classification                   | Error details  | Status cord                |                                 |
|--|--|----------------------------|---------------------------------|
|  |  | Base Status<br>(Addr.0x41) | Expansion Status<br>(Addr.0xB8) |
| No Error                               | No Error.  | 0x00                       | 0x00                            |
| General Communication Error            | Packet Format Error has been detected.   | 0x10                       | 0x01                            |
|  | rsv  |                            | 0x02                            |
|  | rsv  |                            | 0x03                            |
|  | Data length of a command exceeded the upper limit.   |                            | 0x04                            |
|  | Communication Time-out.  |                            | 0x05                            |
| General Accessing Error                | The accessed register doesn't exist.   | 0x20                       | 0x01                            |
|  | WRITE ONLY REGISTER was accessed to read.  |                            | 0x02                            |
|  | READ ONLY REGISTER was accessed to write.  |                            | 0x03                            |
|  | Setting value is out of range.   |                            | 0x04                            |
| Memory Accessing Error                 | Can not access to memory because saved data has sum error.                                 | 0x30                       | 0x01                            |
|  | Can not save to memory because update process has not been executed after register change. |                            | 0x02                            |
| Resolution Related Error               | The frame rate and resolution doesn't match.   | 0x40                       | 0x01                            |
|  | Rsv  |                            | 0x02                            |
|  | Exposure time exceeded the upper limit.  |                            | 0x03                            |
| Random Trigger Shutter Related Error   | Full Auto White Balance cannot coexist with Random Trigger Shutter.                        | 0x50                       | 0x01                            |
|  | Auto Exposure cannot coexist with Random Trigger Shutter.                                  |                            | 0x02                            |
|  | One Touch White Balance can not execute during Random Trigger Shutter operation.           |                            | 0x03                            |
| Shutter Related Error                  | Shutter speed value is out of range.   | 0x60                       | 0x01                            |
|  | Exposure time of Full Auto White Balance mode exceeded the upper limit.                    |                            | 0x02                            |
| White Balance Related Error            | Can not operate Full Auto White Balance because of sum error.                              | 0x70                       | 0x01                            |
|  | Can not operate Manual White Balance because of sum error.                                 |                            | 0x02                            |
|  | The light quantity is not adequate to get One Touch White Balance.                         |                            | 0x03                            |
| Gamma Related Error                    | Can not use user gamma table because of sum error.   | 0x80                       | 0x01                            |
| Indirect Access Register Related Error | The accessed indirect register doesn't exist.  | 0x90                       | 0x01                            |
|  | WRITE ONLY REGISTER was accessed to read.  |                            | 0x02                            |
|  | READ ONLY REGISTER was accessed to write.  |                            | 0x03                            |
| General Hardware Error                 | There is a hardware error in the AFE communication.  | 0xFF                       | 0x01                            |
|  | There is a hardware error in the Memory Access.  |                            | 0x02                            |
|  | Rsv  |                            | 0x03                            |
|  | There is a hardware error in the DSP.  |                            | 0x04                            |

## 4. Camera control

### 4-1 Update Register Values

- Explanation of the function

Apply Register Values to camera operation.

The setting values are not applied to camera operation only by writing registers.

If this register is set to 1, Register Values are applied to camera operation.

Please execute Update Register Values before executing Memory Save. If not, Memory Save become error.

- Explanation of the register

**Address : 0x60** Update Register Values

| Function                               | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|--|------|------|------|------|------|------|------|------|---------------|
| Update Register Values<br>(Write Only) | rsv. |      |      |      |      |      |      | EXEC | -             |

This register executes the update register values (Write Only).

- bit7-1 Reserve bit (Please set “0”)
- bit0 Executes the update register values  
1: Execute

When execution is completed, the register value is reset to 0 automatically.

### 4-2 Image output format

- Explanation of the function

The resolution and frame rate of the output image that CS6910G supports is as follows.

- SXGA30fps 1280(H)x960(V)pixels, 30frame / second
- SXGA15fps 1280(H)x960(V) pixels, 15frame / second
- VGA30fps 640(H)x480(V) pixels, 30frame / second

Each performance value of this camera is prescribed in SXGA30fps mode.

●Explanation of the register

**Address : 0x61** Maximum resolution information

| Function                           | bit7   | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|------------------------------------|--|------|------|------|------|------|------|------|---------------|
| Resolution Information (Read Only) | Maximum Resolution That This Camera Supports |      |      |      |      |      |      |      | 0x07          |

This register reads out information of maximum resolution that this camera supports (Read Only).

- bit7-0 Maximum resolution that this camera supports (0x07: SXGA)

Because maximum resolution that CS6910G supports is SXGA, value of register is 0x07.

Correspondence of the register value and resolution is same as Resolution register of address 0x63.

**Address : 0x62** Maximum frame rate information

| Function                           | bit7                                     | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|------------------------------------|--|------|------|------|------|------|------|------|---------------|
| Frame Rate Information (Read Only) | Maximum Frame Rate at Maximum Resolution |      |      |      |      |      |      |      | 0x04          |

This register reads out maximum frame rate at maximum resolution (Read Only).

- bit7-0 Maximum frame rate at maximum resolution (0x04: 30fps)

Because maximum frame rate that CS6910G supports at maximum resolution SXGA is 30fps, register value is 0x04. Correspondence of the register value and frame rate is same as Frame Rate register of address 0x64.

**Address : 0x63** Output image resolution

| Function   | bit7 | bit6 | bit5 | bit4 | bit3 | bit2                    | bit1 | bit0 | Default Value |
|------------|------|------|------|------|------|-------------------------|------|------|---------------|
| Resolution | rsv. |      |      |      |      | Output Image Resolution |      |      | 0x07          |

This register sets the resolution of output image.

- bit7-3 Reserve bit (Please set "0")
- bit2-0 Output image resolution  
0x04: VGA  
0x07: SXGA

**Address : 0x64** Output image frame rate

| Function   | bit7 | bit6 | bit5 | bit4 | bit3 | bit2       | bit1 | bit0 | Default Value |
|------------|------|------|------|------|------|------------|------|------|---------------|
| Frame Rate | rsv. |      |      |      |      | Frame Rate |      |      | 0x04          |

This register sets the frame rate of output image.

- bit7-3 Reserve bit (Please set “0”)
- bit2-0 Output image frame rate  
0x03: 15fps  
0x04: 30fps

Combination of resolution and frame rate which can set is as follows.

(○: Possible , ×: Impossible)

| Resolution | Frame Rate |       |
|------------|------------|-------|
|            | 15fps      | 30fps |
| SXGA       | ○          | ○     |
| VGA        | ×          | ○     |

#### 4-3 Shutter control

- Explanation of the function

CS6910G has two shutter modes below.

- Normal Shutter
- Random Trigger Shutter

In Normal Shutter mode operation, this camera is exposed and outputs images at frame rate cycle.

In Random Trigger Shutter mode, this camera can take images at any time by the external trigger signal input. The trigger signal can be input from DC IN connector. There are two exposure time setting method in Random Trigger Shutter mode, Fix mode and Pulse mode.

In Fix mode, exposure time can be set by camera register value.

In Pulse mode, pulse width of trigger signal become exposure time.

Polarity of the trigger signal can be selected positive or negative by camera register setting.

CS6910G has two exposure modes below.

- Manual mode
- Auto Exposure (AE)

In Manual mode, exposure time can be controlled optional.

In Auto Exposure mode, exposure time is controlled automatically to make brightness of image constant. It has two methods of photometry in auto exposure mode, central part average and spot photometry. In central part average photometry, photometry area is approx. 36 percent of central image. In spot photometry, photometry area is approx. 4 percent of central image.

AE exposure correction value can be controlled by every 1/3EV from -2EV to +1EV.

There is AE Lock function that fix an exposure time.

●Explanation of the register

**Address : 0x65** Shutter Type

| Function                 | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0         | Default Value |
|--------------------------|------|------|------|------|------|------|------|--------------|---------------|
| Shutter Type (Read Only) | rsv. |      |      |      |      |      |      | Shutter Type | 0x00          |

This register reads out the shutter type that this camera supports (Read only).

- bit7-1                      Reservation bit (Please set “0”)
- bit0                         Shutter type (0: Global shutter)

Since CS6910G has adopted the CCD image sensor, the shutter type is only global shutter (all pixels are exposed simultaneously). (Global shutter is a term of CMOS sensor though, we use the same expression for convenience in this specification.)

**Address : 0x66** Shutter mode

| Function     | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0         | Default Value |
|--------------|------|------|------|------|------|------|------|--------------|---------------|
| Shutter Mode | rsv. |      |      |      |      |      |      | Shutter Mode | 0x00          |

This register sets a shutter mode (Normal Shutter or Random Trigger Shutter).

- bit7-1                      Reservation bit (Please set “0”)
- bit0                         Shutter mode  
0: Normal shutter  
1: Random trigger shutter

During any mode of AE, AWB or OTWB is operating, Random Trigger Shutter mode can not operate.

**Address : 0x67** Trigger polarity

| Function         | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0             | Default Value |
|------------------|------|------|------|------|------|------|------|------------------|---------------|
| Trigger Polarity | rsv. |      |      |      |      |      |      | Trigger Polarity | 0x00          |

This register sets up the trigger polarity at Random Trigger Shutter mode.

- bit7-1                      Reservation bit (Please set “0”)
- bit0                         Trigger polarity at Random Trigger Shutter setting  
0: Negative polarity  
1: Positive polarity

Each exposure time setting modes (Fix mode / Pulse mode) operate as follows.

| Polarity    | Fix mode   | Pulse mode                                    |
|-------------|--|---|
| 0: Negative | Exposure starts at falling edge of trigger signal. | Exposure during Low period of trigger signal  |
| 1: Positive | Exposure starts at rising edge of trigger signal.  | Exposure during High period of trigger signal |

**Address : 0x68** Random Trigger Shutter operating mode

| Function                    | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0     | Default Value |
|-----------------------------|------|------|------|------|------|------|------|----------|---------------|
| Random Trigger Shutter Mode | rsv. |      |      |      |      |      |      | RTS Mode | 0x00          |

This register sets operation mode of Random Trigger Shutter (Fix mode / Pulse mode).

- bit7-1                      Reservation bit (Please set “0”)
- bit0                         Random Trigger Shutter operating mode  
0: Fix mode  
1: Pulse mode

**Address : 0x69** Exposure Mode

| Function      | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0          | Default Value |
|---------------|------|------|------|------|------|------|------|---------------|---------------|
| Exposure Mode | rsv. |      |      |      |      |      |      | Exposure Mode | 0x00          |

This register sets exposure mode (Manual mode / Auto Exposure).

- bit7-1                      Reservation bit (Please set “0”)
- bit0                         Exposure Mode  
0: Manual mode  
1: Auto Exposure (AE)

During Random Trigger Shutter mode is operating, Auto Exposure mode can not operate.

**Address : 0x6A** AE photometry area

| Function | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0    | Default Value |
|----------|------|------|------|------|------|------|------|---------|---------------|
| AE Area  | rsv. |      |      |      |      |      |      | AE Area | 0x00          |

This register sets photometry area at auto exposure (AE).

- bit7-1 Reservation bit (Please set "0")
- bit0 Photometry area of Auto Exposure  
0: Central part average photometry  
1: Spot photometry

**Address : 0x6B** AE Lock

| Function | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0    | Default Value |
|----------|------|------|------|------|------|------|------|---------|---------------|
| AE Lock  | rsv. |      |      |      |      |      |      | AE Lock | 0x00          |

This register sets ON or OFF of exposure time lock operating (AE Lock) at auto exposure.

- bit7-1 Reservation bit (Please set "0")
- bit0 AE Lock operation  
0: AE Lock OFF  
1: AE Lock ON

If register is written "1", AE Lock switch to ON. And exposure time at that time is kept (tracking operation of exposure time stops.).

If register is written "0", AE Lock switches to OFF. And tracking operation of exposure time restarts.

\* When Update Register Values executed (set 0x01 to address 0x60), AE Lock is canceled (to be OFF).

**Address : 0x6C** Exposure Adjustment Value of AE

| Function        | bit7 | bit6 | bit5 | bit4 | bit3                      | bit2 | bit1 | bit0 | Default Value |
|-----------------|------|------|------|------|---------------------------|------|------|------|---------------|
| Exposure Adjust | rsv. |      |      |      | Exposure Adjustment Value |      |      |      | 0x06          |

This register sets exposure adjustment value at auto exposure.

- bit7-4 Reservation bit (Please set "0")
- bit3-0 Exposure Adjustment Value ( Setting range: 0x00 to 0x09 )

Correspondence of register value and exposure adjustment value is as follows.

0x00(-2EV), 0x01(-5/3EV), 0x02(-4/3EV), 0x03(-1EV), 0x04(-2/3EV), 0x05(-1/3EV), 0x06(0EV), 0x07(+1/3EV), 0x08(+2/3EV), 0x09(+1EV)

**Address : 0x6D** Denominator Of Exposure Time (Lower Byte)

| Function                             | bit7                                      | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|--------------------------------------|---|------|------|------|------|------|------|------|---------------|
| Denominator Of Exposure Time (Lower) | Denominator Of Exposure Time (Lower Byte) |      |      |      |      |      |      |      | 0x1E          |

This register sets denominator of exposure time at manual shutter operating (Lower byte).

- bit7-0 Denominator Of Exposure Time (Lower Byte)

**Address : 0x6E** Denominator Of Exposure Time (Upper Byte)

| Function                             | bit7 | bit6 | bit5                                      | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|--------------------------------------|------|------|---|------|------|------|------|------|---------------|
| Denominator Of Exposure Time (Upper) | rsv. |      | Denominator Of Exposure Time (Upper Byte) |      |      |      |      |      | 0x00          |

This register sets denominator of exposure time at manual shutter operating (Upper byte).

- bit7-6 Reservation bit (Please set "0")
- bit5-0 Denominator Of Exposure Time (Upper Byte)

**Address : 0x6F** Numerator Of Exposure Time

| Function                   | bit7 | bit6 | bit5 | bit4 | bit3 | bit2                       | bit1 | bit0 | Default Value |
|----------------------------|------|------|------|------|------|----------------------------|------|------|---------------|
| Numerator Of Exposure Time | rsv. |      |      |      |      | Numerator Of Exposure Time |      |      | 0x01          |

This register sets numerator of exposure time at manual shutter operating.

- bit7-3 Reservation bit (Please set "0")
- bit2-0 Numerator Of Exposure Time (Upper Byte)

Exposure time can be set each value of denominator and numerator with form of (numerator) / (denominator) in register. Numerator is set at range of 0x01 to 0x04, and denominator is set at range of 0x0001 to 0x3A98. Each value can be set by 1 step unit. Setting range of exposure time is depends on the output format below.

- SXGA30fps, VGA output      1/15000 to 4s
- SXGA15fps output            1/10000 to 4s

When exposure time is longer than frame rate (e.g. exposure time is more than 1/30sec in 30fps mode, or 1/15sec in 15fps mode), frame rate of output image is as follows.

| 30fps mode       |                                | 15fps mode        |                                |
|------------------|--------------------------------|-------------------|--------------------------------|
| Frame rate       | Exposure time range            | Frame rate        | Exposure time range            |
| 15fps (30fps/2)  | 1/30s < exposure time   1/15s  | 7.5fps (15fps/2)  | 1/15s < exposure time   1/7.5s |
| 10fps (30fps/3)  | 1/15s < exposure time   1/10s  | 5fps (15fps/3)    | 1/7.5s < exposure time   1/5s  |
| 7.5fps (30fps/4) | 1/10s < exposure time   1/7.5s | 3.75fps (15fps/4) | 1/5s < exposure time   1/3.75s |
| 6fps (30fps/5)   | 1/7.5s < exposure time   1/6s  | 3fps (15fps/5)    | 1/3.75s < exposure time   1/3s |
| •                | •                              | •                 | •                              |
| •                | •                              | •                 | •                              |

#### 4-4 Analog Pre-Gain control

- Explanation of the function

This camera can adjust analog gain before ADC. Variable range is 0 to +6dB (calculated value).

- Explanation of the register

**Address : 0x70** Analog Pre-Gain

| Function | bit7            | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|----------|-----------------|------|------|------|------|------|------|------|---------------|
| Gain     | Analog Pre-Gain |      |      |      |      |      |      |      | 0x00          |

This register sets analog pre-gain set value.

- bit7-0 Analog pre-gain set value

In CS6910G, setting range of the analog pre-gain register is 0x0000 to 0x00BF. 0x0000 is 0dB, 0x00BF is approximately +6dB. Gain changes proportional to setting value.

#### 4-5 White Balance control

- Explanation of the function

There are three kinds of white balance modes following.

- Manual White Balance (MWB)
- Full Auto White Balance (AWB)
- One Touch White Balance (OTWB)

In Manual White Balance mode, white balance can be adjusted with manual operation by two methods, using color temperature pre-set value or adjusting R/B gain value.

In color temperature pre-set, there are six kinds of color temperatures, 3000, 3700, 4000, 4500, 5500, 6500[K]. If you want to adjust white balances accurately, you can adjust R/B gain individually to optional value.

In One Touch White Balance mode, execute One Touch White Balance with white object on the whole screen. Then white balance is adjusted automatically.

In Full Auto White Balance mode, white balance responds to object and is adjusted automatically.

●Explanation of the register

**Address : 0x74** White Balance mode

| Function | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1    | bit0 | Default Value |
|----------|------|------|------|------|------|------|---------|------|---------------|
| WB Mode  | rsv. |      |      |      |      |      | WB Mode |      | 0x00          |

This register value sets White Balance mode (Manual / Full Auto / One Touch).

- bit7-2                      Reservation bit (Please set “0”)
- bit1-0                      White Balance mode
  - 0: Manual White Balance (MWB)
  - 1: Full Auto White Balance (AWB)
  - 2: One Touch White Balance (OTWB)

White Balance cannot be adjusted just by writing the value “0x02” in this register. (Just switch to One Touch White Balance mode.) White Balance is adjusted by executing One Touch White Balance (set "0x01" to address "0x77").

During Random Trigger Shutter mode is operating, Full Auto White Balance and One Touch White Balance can not operate.

**Address : 0x75** Color Temperature Preset Value

| Function                 | bit7                                  | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|--------------------------|---------------------------------------|------|------|------|------|------|------|------|---------------|
| Manual Color Temperature | Manual Color Temperature Preset Value |      |      |      |      |      |      |      | 0x37          |

This register sets color temperature preset value at manual white balance mode.

- bit7-0                      Color Temperature Preset Value
  - 0x1E: 3000K
  - 0x25: 3700K
  - 0x28: 4000K
  - 0x2D: 4500K
  - 0x37: 5500K
  - 0x41: 6500K
  - 0xFF: Manual R, B gain setting

Color temperature preset uses preset R, B gains of each color temperature.

When set “0xFF” to this register, white balance mode becomes manual R, G gains setting mode. And setting of Manual R Gain and Manual B Gain, address “0x78” to “0x7B”, become effective.

**Address : 0x77** Getting of One Touch White Balance

| Function                 | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|--------------------------|------|------|------|------|------|------|------|------|---------------|
| One-Push WB (Write Only) | rsv. |      |      |      |      |      |      | EXEC | -             |

This register executes getting of One Touch White Balance (Write Only).

- bit7-1 Reservation bit (Please set “0”)
- bit0 Getting of One Touch White Balance

1: Executing getting of One Touch White Balance

When this register is written “0x01” in this register, one-touch white balance is executed promptly. Update Registers Value (Setting 0x01 to address 0x60) is unnecessary. When getting of White Balance succeeded, this camera responds ACK (0x06). When getting of White Balance failed, this camera responds NAK (0x15).

Even during Manual White Balance or Full Auto White Balance is operating, One Touch Write Balance is executed promptly by writing “0x01” in this register. After execution, white balance mode switch to One Touch White Balance mode automatically (OTWB value “0x02” is set to WB mode address “0x74”), and this register is reset to “0” automatically.

**Address : 0x78** Manual R Gain

| Function      | bit7 | bit6          | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|---------------|------|---------------|------|------|------|------|------|------|---------------|
| Manual R Gain | rsv. | Manual R Gain |      |      |      |      |      |      | 0x39          |

This register sets R gain value when Manual White Balance mode.

- bit7 Reservation bit (Please set “0”)
- bit6-0 R gain value

**Address : 0x7A** Manual B Gain

| Function      | bit7 | bit6          | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|---------------|------|---------------|------|------|------|------|------|------|---------------|
| Manual B Gain | rsv. | Manual B Gain |      |      |      |      |      |      | 0x2A          |

This register sets B gain value when Manual White Balance mode.

- bit7 Reservation bit (Please set “0”)
- bit6-0 B gain value

When “0xFF” is set to Manual Color Temperature Preset Value register address “0x75”, setting of Manual R Gain and Manual B Gain registers become effective.

CS6910G can be set Register Setting Value from “0x0000” to “0x005F”. Gain changes proportional to setting value.

#### 4-6 Edge correction control

●Explanation of the function

This camera can change aperture (edge correction) level of output image at 8 levels (including OFF setting).

The correction filter of CS6910G is 5 square matrices and both edges correction.

●Explanation of the register

**Address : 0x7C** Aperture Level

| Function | bit7 | bit6 | bit5 | bit4 | bit3 | bit2           | bit1 | bit0 | Default Value |
|----------|------|------|------|------|------|----------------|------|------|---------------|
| Aperture | rsv. |      |      |      |      | Aperture Level |      |      | 0x00          |

This register sets aperture (edge correction) level.

- bit7-3 Reservation bit (Please set “0”)
- bit2-0 Aperture level (Setting range: 0-7)

When set value is “0”, aperture correction is OFF. And when set value is “7”, aperture correction is maximum level.

#### 4-7 Gamma setting

- Explanation of the function

You can select gamma correction level of output image. This camera has gamma correction value 1.0, 0.65 or 0.45 and has one user optional gamma table. User gamma table can be set gradation levels (256 gradations) of output image corresponding to each 1024 input gradations optionally.

- Explanation of the register

**Address : 0x7D**  $\gamma$  table

| Function | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1  | bit0 | Default Value |
|----------|------|------|------|------|------|------|-------|------|---------------|
| Gamma    | rsv. |      |      |      |      |      | Gamma |      | 0x01          |

This register sets gamma table.

- bit7-2                      Reservation bit (Please set "0")
- bit2-0                      Setting gamma table
  - 0:  $\gamma=0.45$
  - 1:  $\gamma=0.65$
  - 2:  $\gamma=1.0$
  - 3: User Gamma table

Each gamma table of  $\gamma=0.45/0.65/1.0$  is ready on the firmware for preset value beforehand. User gamma table can be set output gradation levels each corresponding to each 1024 gradations input. The table is assigned to indirect addressing space as follows. Please refer to the clause of "3-3 Access to Indirect Registers" about the access method to indirect addressing space.

| Indirect address | $\gamma$ table data   |
|------------------|---|
| 0x800000000      | Output gradation value against input gradation value "0"    |
| 0x800000001      | Output gradation value against input gradation value "1"    |
| 0x800000002      | Output gradation value against input gradation value "2"    |
| •                | •   |
| •                | •   |
| •                | •   |
| 0x80000003FF     | Output gradation value against input gradation value "1023" |

#### 4-8 Color matrix control

- Explanation of the function

This camera can adjust hue and saturation of output image. For the color-difference signal (Cr\_in, Cb\_in) of image, it executes the following matrix operation.

$$\begin{pmatrix} Cr\_out \\ Cb\_out \end{pmatrix} = \begin{pmatrix} C_{RR} & C_{RB} \\ C_{BR} & C_{BB} \end{pmatrix} \begin{pmatrix} Cr\_in \\ Cb\_in \end{pmatrix}$$

The hue and the saturation of the output image are changed by coefficient (CRR, CRB, CBR, CBB) of the matrix.

- Explanation of the register

**Address : 0xC0** Color Matrix C<sub>RB</sub> Coefficient

| Function        | bit7                         | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|-----------------|------------------------------|------|------|------|------|------|------|------|---------------|
| CRB Coefficient | Color Matrix CRB Coefficient |      |      |      |      |      |      |      | 0x4B          |

This register sets C<sub>RB</sub> coefficient of color matrix.

- bit7-0 Color Matrix C<sub>RB</sub> Coefficient

Setting range of CRB coefficient is from -0.5 to +0.5 (times). The correspondence of the register set value and CRB coefficient is 0x80 (-0.5 times) to 0x00 (0 times) to 0x7F (+0.4961 times).

**Address : 0xC1** Color Matrix C<sub>RR</sub> Coefficient

| Function        | bit7                         | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|-----------------|------------------------------|------|------|------|------|------|------|------|---------------|
| CRR Coefficient | Color Matrix CRR Coefficient |      |      |      |      |      |      |      | 0x64          |

This register sets C<sub>RR</sub> coefficient of color matrix.

- bit7-0 Color Matrix C<sub>RR</sub> Coefficient

Setting range of C<sub>RR</sub> coefficient is from 0 to approximately +4.0 (times). Bit 7 to 6 of register set value is an integer part, and bit 5 to 0 of register set value is decimal part. The correspondence of the register set value and C<sub>RR</sub> coefficient is 0x00 (0 times) to 0x40 (1.0 times) to 0xFF (+3.9844 times).

**Address : 0xC2** Color Matrix C<sub>BR</sub> Coefficient

| Function        | bit7                         | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|-----------------|------------------------------|------|------|------|------|------|------|------|---------------|
| CBR Coefficient | Color Matrix CBR Coefficient |      |      |      |      |      |      |      | 0x41          |

This register sets C<sub>BR</sub> coefficient of color matrix.

- bit7-0 Color Matrix C<sub>BR</sub> Coefficient

Setting range of C<sub>BR</sub> coefficient is from -0.5 to +0.5 (times). The correspondence of the register set value and C<sub>BR</sub> coefficient is 0x80 (-0.5 times) to 0x00 (0 times) to 0x7F (+0.4961 times).

**Address : 0xC3** Color Matrix C<sub>BB</sub> Coefficient

| Function        | bit7                         | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|-----------------|------------------------------|------|------|------|------|------|------|------|---------------|
| CBB Coefficient | Color Matrix CBB Coefficient |      |      |      |      |      |      |      | 0x5A          |

This register sets C<sub>BB</sub> coefficient of color matrix.

- bit7-0 Color Matrix C<sub>BB</sub> Coefficient

Setting range of C<sub>BB</sub> coefficient is from 0 to approximately +4.0 (times). Bit 7 to 6 of register set value is an integer part, and bit 5 to 0 of register set value is decimal part. The correspondence of the register set value and C<sub>BB</sub> coefficient is 0x00 (0 times) to 0x40 (1.0 times) to 0xFF (+3.9844 times).

4-9 Set value memory control

- Explanation of the function

This camera can save each set value to internal memory of camera. Memory is maintained after switch off. Memory has eight banks, and this camera can execute saving, readout, reset to factory default each banks independently. The memory bank 0 is read out when switch on.

- Explanation of the register

**Address : 0x50** Number Of Memory Banks Information

| Function                       | bit7                                  | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|--------------------------------|---------------------------------------|------|------|------|------|------|------|------|---------------|
| Memory Information (Read Only) | Number Of Memory Banks In This Camera |      |      |      |      |      |      |      | 0x08          |

This register reads out number of internal memory banks.

- bit7-0 Number of internal memory banks (0x08: Number of banks is 8)

CS6910G has “8” memory banks, therefore this register value is “0x08”.

**Address : 0x51** Memory Save

| Function    | bit7 | bit6 | bit5 | bit4 | bit3          | bit2 | bit1 | bit0 | Default Value |
|-------------|------|------|------|------|---------------|------|------|------|---------------|
| Memory Save | rsv. |      |      |      | Save Bank No. |      |      |      | -             |

This register saves each register setting value to internal memory.

- bit7-4 Reservation bit (Please set “0”)
- bit3-0 Destination of Memory bank No. (Setting range: 0x00 to 0x07)  
or user  $\gamma$  table (Setting value: 0x10)

Register setting value is saved to internal memory when Destination of Memory bank No. is written. User gamma table is saved to the internal memory when 0x10 is written to this register. But when Update Register Values (setting “0x01” to address “0x60”) has not been executed after changing setting value, it becomes error and Memory Save is not executed. Please execute Update Register Values before Memory Save.

**Address : 0x52** Memory Load

| Function    | bit7 | bit6 | bit5 | bit4 | bit3          | bit2 | bit1 | bit0 | Default Value |
|-------------|------|------|------|------|---------------|------|------|------|---------------|
| Memory Load | rsv. |      |      |      | Load Bank No. |      |      |      | -             |

This register reads out each register set value from internal memory.

- bit7-3 Reservation bit (Please set “0”)
- bit2-0 Load Bank No. (Setting range: 0x00 to 0x07)

When load bank number is written to this register, set value of each registers is read out from internal memory.

**Address : 0x53** Memory Reset

| Function     | bit7 | bit6 | bit5 | bit4 | bit3           | bit2 | bit1 | bit0 | Default Value |
|--------------|------|------|------|------|----------------|------|------|------|---------------|
| Memory Reset | rsv. |      |      |      | Reset Bank No. |      |      |      | -             |

This register resets internal memory to factory default.

- bit7-4 Reservation bit (Please set “0”)
- bit3-0 Reset Bank No. (Setting range: 0x00 to 0x07)  
or user  $\gamma$  table (Setting value: 0x10)

Internal memory is reset to factory default when memory bank number is written to this register. User gamma table is reset to factory default by writing 0x10 to this register.

#### 4-10 Reading out of each camera information

- Explanation of the function

This camera can read out each information of vender name, model name, serial number, CPU (firmware) version by accessing register. And this camera can read out result of self-check when switch on and error information when error occurred by accessing register.

- Explanation of the register

**Address : 0x00-0B** Vender Name Information

| Function                | bit7                     | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|-------------------------|--------------------------|------|------|------|------|------|------|------|---------------|
| Vender Name (Read Only) | Vender Name (ASCII Code) |      |      |      |      |      |      |      | -             |

This register reads out vender name information of this camera.

- bit7-0 Vender name 1 character (By ASCII code)

Vender name information has been stored by one character in one address as follows at ASCII code.

| Address | ASCII code | Character conversion |
|---------|------------|----------------------|
| 0x00    | 0x54       | “T”                  |
| 0x01    | 0x4F       | “O”                  |
| 0x02    | 0x53       | “S”                  |
| 0x03    | 0x48       | “H”                  |
| 0x04    | 0x49       | “I”                  |
| 0x05    | 0x42       | “B”                  |
| 0x06    | 0x41       | “A”                  |
| 0x07    | 0x20       | “ ”                  |
| 0x08    | 0x54       | “T”                  |
| 0x09    | 0x45       | “E”                  |
| 0x0A    | 0x4C       | “L”                  |
| 0x0B    | 0x49       | “I”                  |

***Address : 0x10-1F*** Model Name Information

| Function               | bit7                    | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|------------------------|-------------------------|------|------|------|------|------|------|------|---------------|
| Model Name (Read Only) | Model Name (ASCII Code) |      |      |      |      |      |      |      | -             |

This register reads out the model name information of this camera.

- bit7-0 Model name 1 character (By ASCII code)

Model name information has been stored by one character in one address as follows at ASCII code.

| Address | ASCII code | Character conversion |
|---------|------------|----------------------|
| 0x10    | 0x43       | “C”                  |
| 0x11    | 0x53       | “S”                  |
| 0x12    | 0x36       | “6”                  |
| 0x13    | 0x39       | “9”                  |
| 0x14    | 0x31       | “1”                  |
| 0x15    | 0x30       | “0”                  |
| 0x16    | 0x47       | “G”                  |
| 0x17    | 0x00       | NULL                 |
| 0x18    | 0x00       | NULL                 |
| 0x19    | 0x00       | NULL                 |
| 0x1A    | 0x00       | NULL                 |
| 0x1B    | 0x00       | NULL                 |
| 0x1C    | 0x00       | NULL                 |
| 0x1D    | 0x00       | NULL                 |
| 0x1E    | 0x00       | NULL                 |
| 0x1F    | 0x00       | NULL                 |

**Address : 0x20-2F** Serial Number Information

| Function                  | bit7                       | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|---------------------------|----------------------------|------|------|------|------|------|------|------|---------------|
| Serial Number (Read Only) | Serial Number (ASCII Code) |      |      |      |      |      |      |      | -             |

This register reads out the serial number information of this camera.

- bit7-0 Serial number 1 character (By ASCII code)

Serial number information has been stored by one character in one address as follows at ASCII code.

(For example, in the case of serial number “1234567”)

| Address | ASCII code | Character conversion |
|---------|------------|----------------------|
| 0x20    | 0x31       | “1”                  |
| 0x21    | 0x32       | “2”                  |
| 0x22    | 0x33       | “3”                  |
| 0x23    | 0x34       | “4”                  |
| 0x24    | 0x35       | “5”                  |
| 0x25    | 0x36       | “6”                  |
| 0x26    | 0x37       | “7”                  |
| 0x27    | 0x00       | NULL                 |
| 0x28    | 0x00       | NULL                 |
| 0x29    | 0x00       | NULL                 |
| 0x2A    | 0x00       | NULL                 |
| 0x2B    | 0x00       | NULL                 |
| 0x2C    | 0x00       | NULL                 |
| 0x2D    | 0x00       | NULL                 |
| 0x2E    | 0x00       | NULL                 |
| 0x2F    | 0x00       | NULL                 |

**Address : 0x30-3F** Firmware Version Information

| Function                | bit7                              | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|-------------------------|-----------------------------------|------|------|------|------|------|------|------|---------------|
| CPU Version (Read Only) | CPU Firmware Version (ASCII Code) |      |      |      |      |      |      |      | -             |

This register reads out the version information of CPU firmware that this camera has.

- bit7-0 Version information (By ASCII code)

Version information has been stored by one character in one address as follows at ASCII code.

(For example, in the case of version information “V010000”)

| Address | ASCII code | Character conversion |
|---------|------------|----------------------|
| 0x30    | 0x56       | “V”                  |
| 0x31    | 0x30       | “0”                  |
| 0x32    | 0x31       | “1”                  |
| 0x33    | 0x30       | “0”                  |
| 0x34    | 0x30       | “0”                  |
| 0x35    | 0x30       | “0”                  |
| 0x36    | 0x40       | “0”                  |
| 0x37    | 0x00       | NULL                 |
| 0x38    | 0x00       | NULL                 |
| 0x39    | 0x00       | NULL                 |
| 0x3A    | 0x00       | NULL                 |
| 0x3B    | 0x00       | NULL                 |
| 0x3C    | 0x00       | NULL                 |
| 0x3D    | 0x00       | NULL                 |
| 0x3E    | 0x00       | NULL                 |
| 0x3F    | 0x00       | NULL                 |

**Address : 0x40** Self-Check Result

| Function               | bit7              | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|------------------------|-------------------|------|------|------|------|------|------|------|---------------|
| Self-Check (Read Only) | Self-Check Result |      |      |      |      |      |      |      | -             |

This register reads out information of self-check result when starting.

- bit7-0 Self-Check Result  
0x00: normal  
Except 0x00: abnormality detection

This camera executes self-check at the time of switch on, and stores the result to this register. When this register value is 0x00, it shows self-check result is successful. But, when this register value is not 0x00, please switch on and confirm again, because it shows that hardware abnormality was detected.

**Address : 0x41** Status Code

| Function           | bit7        | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|--------------------|-------------|------|------|------|------|------|------|------|---------------|
| Status (Read Only) | Status Code |      |      |      |      |      |      |      | -             |

This register reads out basic information of a error.

- bit7-0 Status Code

When NAK is received in command control, you can get detailed information of an error by combination of this register and address 0xB8 Expansion Status register. About correspondence list of status cord and error information, please refer to a clause of “3-4 Error Status”.

**Address : 0xB8** Expansion Status Code

| Function                     | bit7                  | bit6 | bit5 | Bit4 | bit3 | bit2 | bit1 | bit0 | Default Value |
|------------------------------|-----------------------|------|------|------|------|------|------|------|---------------|
| Expansion Status (Read Only) | Expansion Status Code |      |      |      |      |      |      |      | -             |

This register can read out detailed information of an error.

- bit7-0 Expansion Status Code

When NAK is received in command control, you can get detailed information of the error by the combination of this register and address 0x41 Status register. About correspondence list of status cord and error information, please refer to a clause of “3-4 Error Status”.



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