

# OFP401P0189

Color Sensor



Interface protocol

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## 1. Control characters

| Character | ASCII value | Function        |
|-----------|-------------|-----------------|
| /         | 0x47        | Start character |
| .         | 0x46        | Stop character  |

## 2. Frame layout for data transmission

|                           | Length        | Notation | Frame section |
|---------------------------|---------------|----------|---------------|
| Start character           | 1 byte (0x47) | /        | Frame header  |
| Length information        | 2 bytes       | SS       |               |
| Command byte              | 2 bytes       | CC       |               |
| 1 <sup>st</sup> data byte | 2 bytes       | DD       | User data     |
| 2 <sup>nd</sup> data byte | 2 bytes       | DD       |               |
| ...                       | ...           | DD       |               |
| n <sup>th</sup> data byte | 2 bytes       | DD       |               |
| Checksum                  | 2 bytes       | qq       | Frame end     |
| Stop character            | 1 byte (0x46) | .        |               |

### 2.1 Frame header

- **Start character (1 byte)**  
Frame start character < / > indicates the beginning of the protocol
- **Length information (2 bytes)**  
Indicates the number of characters in hexadecimal contained in the data field
- **Command byte**  
Specifies the command type

### 2.2 User data

The data stream includes user data which varies in length. The length of the data stream parameters is set in the “Length information” bytes from the frame header.

### 2.3 Frame end

- **Checksum (2 bytes)**  
The checksum must be recalculated for each send frame (see section “2.3.1 Checksum calculation”)
- **Stop character (1 bytes)**  
The stop character < . > indicates the stop of the protocol

### 2.3.1 Checksum calculation

The calculated checksum is used to verify data integrity.

If "qq" used in place of the calculated value, there is no check, but the command is running.

The checksum is generated from an EXOR link to the frame, beginning with the start byte and ends with the last character of the user data.

Example:

|   |     |   |           |                   |
|---|-----|---|-----------|-------------------|
| / | 2Fh | = | 0010 1111 |                   |
| 0 | 30h | = | 0011 0000 |                   |
|   | XOR | = | 0001 1111 |                   |
| 2 | 32h | = | 0011 0010 |                   |
|   | XOR | = | 0010 1101 |                   |
| 0 | 30h | = | 0011 0000 |                   |
|   | XOR | = | 0001 1101 |                   |
| D | 44h | = | 0100 0100 |                   |
|   | XOR | = | 0101 1001 |                   |
| 0 | 30h | = | 0011 0000 |                   |
|   | XOR | = | 0111 1001 |                   |
| 0 | 30h | = | 0011 0000 |                   |
|   | XOR | = | 0101 1001 | => Checksum = 59h |

## 3. Commands

### 3.1 Protocol description

To send a valid command to the sensor it should respect the data layout:

/SSCCDDDD...DDqq.

If the command is valid, the sensor will respond with:

/SS0MCCDDDD...DDqq.

If the frame is valid but some parameters have been detected with invalid values, the response could also be:

/SS0MCCDDDD...DDNOK!!qq.

### 3.2 Commands overview

| Function       | Command |
|----------------|---------|
| Pin function   | P or p  |
| Input/output   | O       |
| Operating mode | m       |
| Filter size    | F       |
| Emitted light  | L       |
| Type select    | J       |
| Test input pin | t       |
| Version        | V       |
| Reset          | R       |
| Read           | D       |
| Expert menu    | E       |
| Status         | W       |

### 3.3 Commands description

In the next sections are explained the sensor commands and the bytes and bits fields used in these commands.

#### 3.3.1 Pin function configuration – first method

The command used to configure the functionality for a pin is **< 0P >** with the next syntax:

| Send frame to sensor          | Received frame |
|-------------------------------|----------------|
| /030P0ifqq. (Write then read) | /SS0M0P0ifqq.  |
| /020P0ifqq. (Read)            |                |

SS : Payload length

qq: Checksum

< i > character refers to the configured pin number, 1, 2 or 3

< f > took a value from "0" to "9" or from "a" to "o", like in the next table:

| <b>&lt; i &gt; data field description</b> |                            |            |            |            |           |           |           |                  |                    |          |
|---|----------------------------|------------|------------|------------|-----------|-----------|-----------|------------------|--------------------|----------|
| <b>I/O pin function</b>                   | <b>Description</b>         | <b>HiZ</b> | <b>NPN</b> | <b>PNP</b> | <b>PP</b> | <b>NO</b> | <b>NC</b> | <b>Ub active</b> | <b>Ub inactive</b> | <b>i</b> |
| Disabled                                  | High impedance state (HiZ) | X          |            |            |           |           |           |                  |                    | 0        |
| Switching Output                          | NPN and NO                 |            | X          |            |           | X         |           |                  |                    | 1        |
|   | PNP and NO                 |            |            | X          |           | X         |           |                  |                    | 2        |
|   | PP and NO                  |            |            |            | X         | X         |           |                  |                    | 3        |
|   | NPN and NC                 |            | X          |            |           |           | X         |                  |                    | 4        |
|   | PNP and NC                 |            |            | X          |           |           | X         |                  |                    | 5        |
|   | PP and NC                  |            |            |            | X         |           | X         |                  |                    | 6        |
| Error output                              | NPN and NO                 |            | X          |            |           | X         |           |                  |                    | 7        |
|   | PNP and NO                 |            |            | X          |           | X         |           |                  |                    | 8        |
|   | PP and NO                  |            |            |            | X         | X         |           |                  |                    | 9        |
|   | NPN and NC                 |            | X          |            |           |           | X         |                  |                    | a        |
|   | PNP and NC                 |            |            | X          |           |           | X         |                  |                    | b        |
|   | PP and NC                  |            |            |            | X         |           | X         |                  |                    | c        |
| Contamination output                      | NPN and NO                 |            | X          |            |           | X         |           |                  |                    | d        |
|   | PNP and NO                 |            |            | X          |           | X         |           |                  |                    | e        |
|   | PP and NO                  |            |            |            | X         | X         |           |                  |                    | f        |
|   | NPN and NC                 |            | X          |            |           |           | X         |                  |                    | g        |
|   | PNP and NC                 |            |            | X          |           |           | X         |                  |                    | h        |
|   | PP and NC                  |            |            |            | X         |           | X         |                  |                    | i        |
| Emitted light                             | Ub active                  |            |            |            |           |           |           | X                |                    | j        |
|   | Ub inactive                |            |            |            |           |           |           |                  | X                  | k        |
| External teach                            | Ub active                  |            |            |            |           |           | X         |                  |                    | l        |
|   | Ub inactive                |            |            |            |           |           |           |                  | X                  | m        |
| Trigger input                             | Ub active                  |            |            |            |           |           | X         |                  |                    | n        |
|   | Ub inactive                |            |            |            |           |           |           |                  | X                  | o        |

When the frame sent to sensor contains invalid parameter, it responds with the frame /SS0P0ifNOK!!qq.

### 3.3.2 Pin function configuration – second method

Another alternative command used to configure the functionality for a pin is < 0p > with the next syntax:

| <b>Send frame to sensor</b>   | <b>Received frame</b> |
|-------------------------------|-----------------------|
| /070p0ijklmnqq.<br>/020p0iqq. | /SS0M0p0ijklmnqq.     |

< i > character refers to the configured pin number, 1, 2 or 3

SS: Payload Length

qq: Checksum

< j, k, l, m, n > characters can be configured like in the next table:

| Output               | j |
|----------------------|---|
| Inactive Output      | 0 |
| Switching Output     | 1 |
| Error Output         | 2 |
| Contamination Output | 3 |

| Input         | k |
|---------------|---|
| Emitted Light | 0 |
| Ext T Ax      | 1 |
| Trigger       | 2 |

| Output Config | l |
|---------------|---|
| PNP           | 0 |
| NPN           | 1 |
| PP            | 2 |
| Hiz           | 3 |

| Output Logic | m |
|--------------|---|
| NO           | 0 |
| NC           | 1 |

| Input Logic | n |
|-------------|---|
| Ub active   | 0 |
| Ub inactive | 1 |

If the configuration is mistaken **/SS0p0ixlmnqq.** it will still keep the last correct configuration active. This is useful when only some of the fields need reconfiguration and others not. The fields that don't need to be configured can be filled with an "illegal" character (for example "x"), and settings will take effect only on those with valid parameter.

### 3.3.3 Assignment Teach-In

| Function   | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|--|----------------------------------|-------------------------------------|---|
| Make Assignment Teach                                | /04000Ai0qq.                     | /SS0M000Ai0qq.                      | /SS0M000AiNOKqq.                            |
| Write then read Assignment Teach Red channel value   | /08000AiRrrrrqq.                 | /SS0M000AiRrrrrqq.                  | -   |
| Read Assignment Teach Red channel value              | /04000AiRqq.                     | /SS0M000AiRrrrrqq.                  | -   |
| Write then read Assignment Teach Green channel value | /08000AiGggggqq.                 | /SS0M000AiGggggqq.                  | -   |
| Read Assignment Teach Green channel value            | /04000AiGqq.                     | /SS0M000AiGggggqq.                  | -   |
| Write then read Assignment Teach Blue channel value  | /08000AiBbbbbqq.                 | /SS0M000AiBbbbbqq.                  | -   |
| Read Assignment Teach Blue channel value             | /04000AiBqq.                     | /SS0M000AiBbbbbqq.                  | -   |

< i > character refers to the configured pin number 1, 2 or 3

<rrrr>, <gggg>, <bbbb> 4 digit hex RGB value for describing Teach assignment values. (4digit hex value; range 0x0000.....0x01FF ; )

SS: Payload Length  
qq: Checksum

### 3.3.4 Window Teach-In

| Function                  | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|---------------------------|----------------------------------|-------------------------------------|---|
| Make Output Window Teach  | /04000ai0qq.                     | /SS0M000ai0qq.                      | /SS0M000aiNOKqq.                            |
| Make Subsequent Teach OK  | /04000ai1qq.                     | /SS0M000ai1qq.                      | /SS0M000aiNOKqq.                            |
| Make Subsequent Teach NOK | /04000ai2qq.                     | /SS0M000ai2qq.                      | /SS0M000aiNOKqq.                            |

< i > character refers to the configured pin number 1, 2 or 3

SS: Payload Length

qq: Checksum

### 3.3.5 Read/Write Switching Points for Hue

| Function                               | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|--|----------------------------------|-------------------------------------|---|
| Write then read switching points Red   | /14000aiRHoffHonLonLoffqq.       | /SS0M000aiRHoffHonLonLoffqq.        | /SS0M000aiNOKqq.                            |
| Read switching points Red              | /04000aiRqq.                     | /SS0M000aiRHoffHonLonLoffqq.        | /SS0M000aiNOKqq.                            |
| Write then read switching points Green | /14000aiGHoffHonLonLoffqq.       | /SS0M000aiGHoffHonLonLoffqq.        | /SS0M000aiNOKqq.                            |
| Read switching points Green            | /04000aiGqq.                     | /SS0M000aiGHoffHonLonLoffqq.        | /SS0M000aiNOKqq.                            |
| Write then read switching points Blue  | /14000aiBHoffHonLonLoffqq.       | /SS0M000aiBHoffHonLonLoffqq.        | /SS0M000aiNOKqq.                            |
| Read switching points Blue             | /04000aiBqq.                     | /SS0M000aiBHoffHonLonLoffqq.        | /SS0M000aiNOKqq.                            |

< i > character refers to the configured pin number, 1, 2 or 3

SS: Payload Length

qq: Checksum

<Hoff><Hon><Lon><Loff>: switching points

Hue is described as a 3 variable complex value, where:

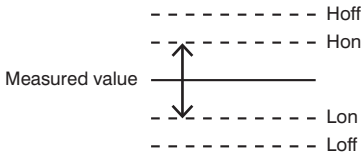
One of the variables is always at maximum (511),

One is always minimum (0) and

One is somewhere in between 1...510

Switching points:

The following switching points are calculated on the basis of the measured value during Teach-In:



$$\text{Hoff} = \text{Hon} + \text{Hysteresis}$$

$$\text{Hon} = \text{Hue value} + \frac{1}{2} \text{ window size}$$

$$\text{Lon} = \text{Hue value} - \frac{1}{2} \text{ window size}$$

(this result can easily become negative)

$$\text{Loff} = \text{Lon} - \frac{1}{2} \text{ Hysteresis}$$

(this result can easily become negative)



**Window** – is the tolerance around the taught value. This is expressed in absolute value and is added and subtracted, making the actual window two times WindowSize.

**Hysteresis** – is usually an internally approximated value that should cover signal noise in processing pipeline in order to avoid parasitic switching when the signal is at the Hon or Lon switching points extreme.

Switching points around a taught value are offset with  $2^{15}$  (in order to facilitate microcontroller processing with positive 16 bit integer values).

Offset value:  $2^{15} = 0x8000 = 32768$

So, the switching point values complete interpretation looks like this:

Hoff = Hon + Hysteresis + 0x8000

Hon = Taught value + window size + 0x8000

Lon = Taught value – window size + 0x8000

Loff = Lon – Hysteresis + 0x8000

Data representation:

Actual value + 0x8000H

Where: - actual value can be positive or negative  
- 0x8000H positive offset value

#### Hue R Channel

|                                      |                                    |
|--------------------------------------|------------------------------------|
| Hoff: Upper switching point off, red | length: 4 Byte (4 digit hex value) |
| Hon: Upper switching point on, red   | length: 4 Byte (4 digit hex value) |
| Lon: Lower switching point on, red   | length: 4 Byte (4 digit hex value) |
| Loff: Lower switching point off, red | length: 4 Byte (4 digit hex value) |

#### Hue G Channel

|  |                                    |
|--|------------------------------------|
| Hoff: Upper switching point off, green | length: 4 Byte (4 digit hex value) |
| Hon: Upper switching point on, green   | length: 4 Byte (4 digit hex value) |
| Lon: Lower switching point on, green   | length: 4 Byte (4 digit hex value) |
| Loff: Lower switching point off, green | length: 4 Byte (4 digit hex value) |

#### Hue B Channel

|                                       |                                    |
|---------------------------------------|------------------------------------|
| Hoff: Upper switching point off, blue | length: 4 Byte (4 digit hex value) |
| Hon: Upper switching point on, blue   | length: 4 Byte (4 digit hex value) |
| Lon: Lower switching point on, blue   | length: 4 Byte (4 digit hex value) |
| Loff: Lower switching point off, blue | length: 4 Byte (4 digit hex value) |

### 3.3.6 Read/Write Teach Switching Points for Saturation and Lightness

| Function                         | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|----------------------------------|----------------------------------|-------------------------------------|---|
| Write then read switching points | /14000aiSHoffHonLonLoffqq.       | /SS0M000aiSHoffHonLonLoffqq.        | Hardware teach                              |
| Read switching points            | /04000aiSq.                      | /SS0M000aiLHoffHonLonLoffqq.        | Hardware teach                              |
| Write then read switching points | /14000aiLHoffHonLonLoffqq.       | /SS0M000aiLHoffHonLonLoffqq.        | Hardware teach                              |
| Read switching points            | /04000aiLqq.                     | /SS0M000aiLHoffHonLonLoffqq.        | Hardware teach                              |

Switching points interpretation is the same as explained at Hue (see chapter “3.3.5 Read/Write Switching Points for Hue” on page 8)

< i > character refers to the configured pin number 1, 2 or 3

SS: Payload Length

qq: Checksum

<Hoff><Hon><Lon><Loff>: switching points

### 3.3.7 Read Out Color Values

#### 3.3.7.1 Read RGB color values

| Function              | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|-----------------------|----------------------------------|-------------------------------------|---|
| Read RGB color values | /020D0s1A.                       | /SS0M0D0srrggbbqq.                  | /SS0M0D0sNOK!!qq.                           |

SS: Payload Length

<rr>: color values to be displayed for red; 2digit hex value; range 0x00.....0xFF

<gg>: color values to be displayed for green; 2digit hex value; range 0x00.....0xFF

<bb>: color values to be displayed for blue; 2digit hex value; range 0x00.....0xFF

<qq>: Checksum

### 3.3.7.2 Read HSL color values

| Function              | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|-----------------------|----------------------------------|-------------------------------------|---|
| Read HSL color values | /020D0p19.                       | /SS0M0D0pHHHhhhHHHSSLLlqq.          | /SS0M0D0pNOK!!qq.                           |

SS: Payload Length

<HHH>: hue color channel red; 3digit hex value; range 0x000.....0x1FF

<hhh>: hue color channel green; 3digit hex value; range 0x000.....0x1FF

<HHH>: hue color channel blue; 3digit hex value; range 0x000.....0x1FF

<SSS>: color saturation; 3digit hex value; range 0x000.....0x1FF

<LLL>: color lightness; 3digit hex value; range 0x000.....0x1FF

qq: Checksum

### 3.3.7.3 Read XYZ color values

| Function              | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|-----------------------|----------------------------------|-------------------------------------|---|
| Read XYZ color values | /020D0r1B.                       | /SS0M0D0rxxxxyyyzzzqq.              | /SS0M0D0rNOK!!qq.                           |

SS: Payload length

<xxx>: compensated channel values for red; 3digit hex value; range 0x000.....0x1FF

<yyy>: compensated channel values for green; 3digit hex value; range 0x000.....0x1FF

<zzz>: compensated channel values for blue; 3digit hex value; range 0x000.....0x1FF

qq: Checksum

### 3.3.8 Adjust Window Size/Tolerance

| Function                               | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|--|----------------------------------|-------------------------------------|---|
| Write then read Window Size            | /070O0bihhhhqq.                  | /SS0M0O0bihhhhqq.                   | /SS0M0O0bihhhhNOK!!qq.                      |
| Read Window Size                       | /030O0biqq.                      | /SS0M0O0bihhhhqq.                   | –   |
| Write then read Window Size Hue        | /070O0cihhhhhqq.                 | /SS0M0O0cihhhhhqq.                  | /SS0M0O0cihhhhhNOK!!qq.                     |
| Read Window Size Hue                   | /030O0ciqq.                      | /SS0M0O0bihhhhqq.                   | –   |
| Write then read Window Size Saturation | /070O0dihhhhqq.                  | /SS0M0O0dihhhhqq.                   | /SS0M0O0dihhhhNOK!!qq.                      |
| Read Window Size Saturation            | /030O0diqq.                      | /SS0M0O0bihhhhqq.                   | –   |
| Write then read Window Size Lightness  | /070O0eihhhhqq.                  | /SS0DM0O0eihhhhqq.                  | /SS0M0O0eihhhhNOK!!qq.                      |
| Read Window Size Lightness             | /030O0eiqq.                      | /SS0M0O0bihhhhqq.                   | –   |
| Write then read Window Size red *      | /080O0ciRhhhhhqq.                | /SS0M0O0ciRhhhhhqq.                 | /SS0M0O0ciRhhhhhNOK!!qq.                    |
| Read Window Size red *                 | /040O0ciRqq.                     | /SS0M0O0biRhhhhhqq.                 | –   |
| Write then read Window Size green *    | /080O0ciGhhhhhqq.                | /SS0M0O0ciGhhhhhqq.                 | /SS0M0O0ciGhhhhhNOK!!qq.                    |
| Read Window Size green *               | /040O0ciGqq.                     | /SS0M0O0biGhhhhhqq.                 | –   |
| Write then read Window Size blue *     | /080O0ciBhhhhhqq.                | /SS0M0O0ciBhhhhhqq.                 | /SS0M0O0ciBhhhhhNOK!!qq.                    |
| Read Window Size blue *                | /040O0ciBqq.                     | /SS0M0O0biBhhhhhqq.                 | –   |

SS: Payload Length

< i > character refers to the configured pin number 1, 2 or 3

< hhhh > : Window Size; 4digit hex value; 0x0000.....0x00FF

qq: Checksum

\* Valid from firmware version: 1.3.1

### 3.3.9 Configuration On-/Off-Delay and Impulse

| Function                  | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|---------------------------|----------------------------------|-------------------------------------|---|
| Write then read On-Delay  | /070O0jihhhhqq.                  | /SS0M0O0jihhhhqq.                   | /SS0M0O0jihhhhNOK!!qq.                      |
| Read On-Delay             | /030O0jiqq.                      | /SS0M0O0jihhhhqq.                   | -   |
| Write then read Off-Delay | /070O0kihhhhqq.                  | /SS0M0O0kihhhhqq.                   | /SS0M0O0kihhhhNOK!!qq.                      |
| Read Off-Delay            | /030O0kiqq.                      | /SS0M0O0kihhhhqq.                   | -   |
| Write then read impulse   | /070O0lihhhhqq.                  | /SS0M0O0lihhhhqq.                   | /SS0M0O0lihhhhNOK!!qq.                      |
| Read impulse              | /031000F0O0liqq.                 | /SS0M0O0lihhhhqq.                   | -   |

< i > character refers to the configured pin number 1, 2 or 3

< hhhh > : 4 digit hex value; Delay value for On-/Off-Delay and Impulse valid values range:

Decimal 0---10000

Hex: 0x0000.....0x2710

representing timings expressed in milliseconds

SS: Payload Length

qq: Checksum

### 3.3.10 Set Sensor Status

#### 3.3.10.1 Operating Mode and Filter Size

| Function                       | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|--------------------------------|----------------------------------|-------------------------------------|---|
| Write then read operating mode | /020M0jq.                        | /SS0M0M0jq.                         | /SS0M0M0jNOK!!qq.                           |
| Read operating mode            | /010M063.                        | /SS0M0M0jq.                         | -   |
| Write then read filter size    | /020F0sqq.                       | /SS0M0F0sqq.                        | /SS0M0F0sNOK!!qq.                           |
| Read filter size               | /010F068.                        | /SS0M0F0sqq.                        | -   |

< j > : j = 0 color detection HSL ; j = 1 color assignment ; j = 2\* color detection RGB

< s > : Filter size. Valid values range 0x0..0xC representing  $2^s$  number of samples on which averaging is performed (eg.  $2^0 = 1 \dots 2^{12} = 4096$ ). Response time increases in direct proportion with this averaging buffer size.

SS: Payload Length

qq: Checksum

\* Valid from firmware version: 1.3.1

### 3.3.10.2 Set sensor select and emitted light

| Function                      | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|-------------------------------|----------------------------------|-------------------------------------|---|
| Write then read emitted light | /020L0jqq.                       | /SS0M0L0iqq.                        | /SS0M0L0iNOK!!qq.                           |
| Read emitted light            | /010L062.                        | /SS0M0L0iqq.                        | –   |
| Write then read sensor select | /020J0jqq.                       | /SS0M0J0iqq.                        | /SS0M0J0iNOK!!qq.                           |
| Read sensor select            | /010J064.                        | /SS0M0J0iqq.                        | –   |

<j> :    j= 0 light OFF                                ;                j= 1 light intensity normal                // emitted light  
           j= 2 light intensity bright                ;                j= 3 light intensity dark                // emitted light

<j> :    j= 0 OFP mode                                ;                j= 1 FP mode                                // Sensor type

SS:      Payload Length

qq:      Checksum

### 3.3.10.3 Test mode: set output state

| Function                                   | Send frame transmitted to sensor | Received frame Returned from sensor | Returned frame from sensor in case of Error |
|--|----------------------------------|-------------------------------------|---|
| Write then read state of sensor Output Pin | /030t0isqq.                      | /SS0M0t0isqq.                       | /SS0M0t0iNOK!!qq.                           |
| Read state of sensor Output Pin            | /020t0iqq.                       | /SS0M0t0isqq.                       | –   |

SS:      Payload Length

< i > :    character refers to the configured pin number 1, 2 or 3

<s> :    s = state {forceHigh, forceLow, running}  
           s = 0 Low;    s = 1 High    ; s = 2 Running (exit test mode)

qq:      Checksum

### 3.3.11 Query Sensor Status

| Function     | Send frame transmitted to sensor | Received frame Returned from sensor |
|--------------|----------------------------------|-------------------------------------|
| Query Status | /000W48.                         | /SS0M0Wpppppeedqq.                  |

#### Receive frame fields:

SS: Payload Length

<pppp>: pin status, 4 digit hex value (this translates into 4×4bit bitfield, “1” pin in high state; “0” pin in low state; b0 state of A1; b1 state of A2; b2 state of A3

<eee>: error status, 3 digit hex value (this translates int 3×4bit bitfield, “1” error state; “0” no error state; (b0 ...b11 TBD)

<d>: contamination status; 3 digit hex value (this translates int 3×4bit bitfield, “1” contamination state; “0” no contamination r state; (b0->overexposure ; b1 underexposure)

qq: Checksum

#### Bitfield definitions:

|                           |                               |
|---------------------------|-------------------------------|
| dirty_UnderExposure       | 0b000000000000000001          |
| dirty_OverExposure        | 0b000000000000000010          |
| dirty_NoName              | 0b0000000000100000 – not used |
| error_LEDTempTooHigh      | 0b000000000000000001          |
| error_LEDTempTooLow       | 0b000000000000000010          |
| error_LEDCurrentMismatch  | 0b000000000000000100          |
| error_TriggerTooFast      | 0b00000000000001000           |
| error_UnableToAssignColor | 0b0000000000010000            |
| error_NoName              | 0b0000000000100000 – not used |
| error_Black               | 0b0000000001000000            |

### 3.3.12 Expert Menu

| Function                    | Send frame transmitted to sensor | Received frame Returned from sensor |
|-----------------------------|----------------------------------|-------------------------------------|
| Write then read Expert Menu | /020Ehhqq.                       | /SS0M0Ehhqq.                        |
| Read Expert Menu            | /000E5A.                         | /SS0M0Ehhqq.                        |

SS: Payload length

<hh>: 2 digit hex value  
0x01 = Expert menu ON  
0x00 = Expert menu OFF

qq: Checksum

### 3.3.13 Execute Sensor Reset

| Function      | Send frame transmitted to sensor | Received frame Returned from sensor |
|---------------|----------------------------------|-------------------------------------|
| Execute Reset | /000R4D.                         | /070Vaa:bbccqq.                     |

SS: Payload length

#### Receive frame fields:

<aa>: Software version

<bb>: Sensor group

<cc>: Sensor select

qq: Checksum

### 3.3.14 Query Sensor Version

| Function            | Send frame transmitted to sensor | Received frame Returned from sensor |
|---------------------|----------------------------------|-------------------------------------|
| Read sensor version | /000V49.                         | /070Vaa:bbccqq.                     |

SS: Payload length

#### Receive frame fields:

<aa>: Software version

<bb>: Sensor group

<cc>: Sensor select

qq: Checksum

## 4. Change Index, Interface protocol

| Version | Date       | Description/Change  |
|---------|------------|---|
| 1.0.0   | 03.04.2013 | Initial version of the Interface protocol   |
| 2.0.0   | 28.04.2016 | <ul style="list-style-type: none"><li>• Addition of operating mode "detection RGB" with appropriate commands (firmware 1.3.1).</li><li>• Adjustments of the telegrams to the sensor with calculated data length, if these not dependent on variables.</li></ul> |