# Optris CT/ CTlaser/ CTvideo communication interface

## Serial interface parameters

| | |
|---|---|
| **Baud rate:** | **9600…115200, set by user (factory default: 115200)** |
| **Data bits:** | **8** |
| **Parity:** | **none** |
| **Stop bits:** | **1** |
| **Flow control:** | **off** |

## Protocol

The protocol of the optris CT/ CTlaser/ CTvideo is a binary protocol. Checksum is needed for set commands but not for read commands. The protocol has no additional overhead with CR, LR or ACK bytes. This makes the communication fast.
To get the current object temperature the user must send a simple $01_{hex}$ byte and the CT/ CTlaser/ CTvideo will respond with the two byte temperature. To get the temperature as a floating value subtract 1000 and divide by 10.

## Checksum's

If the device is setup to use checksums any SET command must have a checksum suffix. The checksum can be switched off with command AD. After every "Power on" the device will expect the checksum again. The checksum byte is built by the arithmetical XOR of all command bytes except of the address prefix.

To switch off the checksums with the SET command AD you must send the checksum.
To switch on the checksums with the SET command AD you must not send the checksum.

## Addressing RS485

This is relevant for communication with the RS485 bus only. Optris CT's with RS232 or USB communication will respond to any address. If you use the RS485 interface board you must use the multidrop addresses.
A multidrop address is a simple prefix byte to the command. The byte is built by adding the hexadecimal value B0 to the device address. B5 01 will read the temperature from the device with the address 5.

The address of any device can be set by the device user interface ("M__01") or by the communication interface with the command 90.

A special case is address prefix B0 for <u>set</u> commands. Because there is no multidrop address 0 this addresses no certain device. But a SET command with prefix broadcast the command to all devices at the RS485 bus.
Note: The command is executed immediately on any of the devices even if they do not respond to the command. That is because all are slaves and can't talk at the same time.



Optris GmbH
Ferdinand-Buisson-Str. 14
13127 Berlin
Germany
Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10
info@optris.global
www.optris.global

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Optris GmbH
Ferdinand-Buisson-Str. 14
13127 Berlin
Germany
Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10
info@optris.global
www.optris.global

# 1 Basic Functions

| DECIMAL | HEX | Command | Data | Answer | Result | Unit |
|---|---|---|---|---|---|---|
| 1 | 0x01 | READ Temp. - process | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C |
| 2 | 0x02 | READ Temp. - Head | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C |
| 3 | 0x03 | READ Temp. - Box | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C |
| 129 | 0x81 | READ Temp. - Act. | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C |

### 1.1 IR- Settings

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 4 | 0x04 | READ Epsilon | none | byte1 byte2 | =(byte1*256 + byte2) / 1000 | | no |
| 132 | 0x84 | SET Epsilon | byte1 byte2 | byte1 byte2 | =(byte1*256 + byte2) / 1000 | | yes |
| 5 | 0x05 | READ Transmission | none | byte1 byte2 | =(byte1*256 + byte2) / 1000 | | no |
| 133 | 0x85 | SET Transmission | byte1 byte2 | byte1 byte2 | =(byte1*256 + byte2) / 1000 | | yes |

### 1.2 Aiming

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 37 | 0x25 | READ Spot Illumination (Laser) | none | byte1 | = ON if byte1 =1 , OFF if byte1=0 | | no |
| 165 | 0xA5 | SET Spot Illumination (Laser) | byte1 | byte1 | = ON if byte1 =1 , OFF if byte1=0 | | yes |

# 2 Signal Processing

### 2.1 Averaging

Smart averaging stops averaging if big temperature changes are occurring. For more information see manual.

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 6 | 0x06 | READ AVG Time | none | byte1 byte2 | = (byte1*256 + byte2) / 10 | seconds | no |
| 134 | 0x86 | SET AVG Time | byte1 byte2 | byte1 byte2 | = (byte1*256 + byte2) / 10 | seconds | yes |
| 28 | 0x1C | READ AVG Mode (smart averaging) | none | byte1 | 1 = smart averaging<br>0 = normal | | no |
| 156 | 0x9C | SET AVG Mode (smart averaging) | byte1 | byte1 | 1 = smart averaging<br>0 = normal | | yes |



Optris GmbH
Ferdinand-Buisson-Str. 14
13127 Berlin
Germany
Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10
info@optris.global
www.optris.global

## 2.2 Hold Functions

To set peak or valley hold set a value >0 seconds. Valley hold disables peak hold and vice versa. Note, that the peak pick function is only available on short wavelength sensors (1M, 2M, 3M), see manual.

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 8 | 0x08 | READ Peak Hold Time | none | byte1 byte2 | =(byte1*256 + byte2) / 10 | seconds | no |
| 136 | 0x88 | SET Peak Hold Time | byte1 byte2 | byte1 byte2 | =(byte1*256 + byte2) / 10 | seconds | yes |
| 7 | 0x07 | READ Valley Hold Time | none | byte1 byte2 | =(byte1*256 + byte2) / 10 | seconds | no |
| 135 | 0x87 | SET Valley Hold Time | byte1 byte2 | byte1 byte2 | =(byte1*256 + byte2) / 10 | seconds | yes |
| 29 | 0x1D | READ Advanced Hold Mode | none | byte1 | 0 = off , 1 = Peak , 2 = Valley | | no |
| 157 | 0x9D | SET Advanced Hold Mode | byte1 | byte1 | 0 = off , 1 = Peak , 2 = Valley | | yes |
| 30 | 0x1E | READ Advanced Hold threshold | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | | no |
| 158 | 0x9E | SET Advanced Hold Threshold | byte1 byte2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | | yes |
| 34 | 0x22 | READ Adv. Hold Hysteresis | none | byte1 byte2 | = (byte1*256 + byte2 ) / 10 | | no |
| 162 | 0xA2 | SET Adv. Hold Hysteresis | byte1 byte2 | byte1 byte2 | = (byte1*256 + byte2 ) / 10 | | yes |
| 65 | 0x41 | READ Pick Mode | none | byte1 | 0 - off , 1 - Peak Pick 2 - Valley Pick | | no |
| 174 | 0xAE | SET Pick Mode | byte1 | byte1 | 0 - off , 1 - Peak Pick 2 - Valley Pick | | yes |

# 3 Analog output settings

For the analog output there are the output channels 1 and 2. They are to be set up with the ALARMx. An output which is set up to digital is an alarm output. Details are shown in the tables below. For further information see the examples.

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 40 | 0x28 | READ ALARMx Mode | byte1 | byte1 byte2 | See following description | | no |
| 168 | 0xA8 | SET ALARMx Mode | byte1 byte2 | byte1 byte2 | See following description | | yes |

**First byte defines the output channel to be set up.**

| BYTE1 | ALARM |
|---|---|
| 0 | Alarm 1 |
| 1 | Alarm 2 |
| 2 | Output channel 2 (ambient / head temperature) |
| 3 | Output channel 1 (IR / Object temperature) |



Optris GmbH
Ferdinand-Buisson-Str. 14
13127 Berlin
Germany
Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10
info@optris.global
www.optris.global

Byte 2 is the sum of bit0-bit7

| BIT | DESCRIPTION | VALENCE |
|---|---|---|
| Bit7 | Source for the alarm is the box temperature | 128 |
| Bit6 | Source for the alarm is the head temperature | 64 |
| Bit5 | Source for the alarm is the object temperature | 32 |
| Bit4 | 0 = contact is normally closed, 1 = contact is normally open | 16 |
| Bit3 | 0 = Output is digital, 1 = output is analog (if not used for alarm) | 8 |

Bit2, Bit1 and Bit0 decode binary the value 0 to 5:

0 = Output as 0…10 mV
1 = Output as 0…5 V
2 = Output as 0…20 mA
3 = Output as 4…20 mA
4 = Output as TCK
5 = Output as TCJ

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 24 | 0x18 | READ Low End for outputs | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | no |
| 152 | 0x98 | SET Low End for outputs | byte1 byte 2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | yes |
| 25 | 0x19 | READ High End for outputs | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | no |
| 153 | 0x99 | SET High End for outputs | byte1 byte 2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | yes |
| 17 | 0x11 | READ Skal_Out_Min | none | byte1 byte2 | mV or µA | | no |
| 145 | 0x91 | SET Skal_Out_Min | byte1 byte2 | byte1 byte2 | mV or µA | | yes |
| 18 | 0x12 | READ Skal_Out_Max | none | byte1 byte2 | mV or µA | | no |
| 146 | 0x92 | SET Skal_Out_Max | byte1 byte2 | byte1 byte2 | mV or µA | | yes |

# 4 Alarm Settings

The optris CT/ CTlaser/ CTvideo has 4 alarms: AL 1 sets the blue LED of the electronic box, AL 2 sets the red LED and the open collector output AL2, AL3 sets the ambient temperature output (OUT-AMB) to an alarm output.
Note that the (OUT-AMB) only provides voltages and is only available on optris CTLT and optris CTlaserLT sensors. AL4 sets the analog output (out-mV/mA) to an alarm output.

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 10 | 0x0A | READ AL1 value | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | no |
| 138 | 0x8A | SET AL1 value | byte1 byte2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | yes |
| 11 | 0x0B | READ AL2 value | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | no |
| 139 | 0x8B | SET AL2 value | byte1 byte2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | yes |
| 12 | 0x0C | READ AL3 value | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | no |
| 140 | 0x8C | SET AL3 value | byte1 byte2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | yes |
| 13 | 0x0D | READ AL4 value | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | no |
| 141 | 0x8D | SET AL4 value | byte1 byte2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | yes |



Optris GmbH
Ferdinand-Buisson-Str. 14
13127 Berlin
Germany
Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10
info@optris.global
www.optris.global

# 5 Advanced Settings

## 5.1 Sensor Information/ Calibration

If sensor head or electronic is exchanged it is necessary to set the right head code. With the tweak function the sensor can be linear recalibrated.

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 14 | 0x0E | READ Serial number | none | byte1 byte2 byte3 | =byte1*65536 + byte2*256 + byte3 | | no |
| 15 | 0x0F | READ FW Rev. | none | byte1 byte2 | =byte1*256 + byte2 | | no |
| 69 | 0x45 | READ Sensor information | none | byte1 - byte6 | byte1,byte2 = Modelword, byte3,byte4 = lower temperature, byte5,byte6 = upper temperature | | no |
| 36 | 0x24 | READ Head Code | byte1 | byte1 byte2 byte3 byte4 | byte1 = Block Nr. byte 2-4 = Headcode (5 bit per character) | | no |
| 164 | 0xA4 | SET Head Code | byte1 byte2 byte3 byte4 | byte1 byte2 byte3 byte4 | byte1 = Block No. byte 2-4 = Headcode (5 bit per character) | | yes |
| 38 | 0x26 | READ Tweak Offset | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | | no |
| 166 | 0xA6 | SET Tweak Offset | byte1 byte2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | | yes |
| 39 | 0x27 | READ Tweak Gain | none | byte1 byte2 | = (1/2^15) * (byte1*256 + byte2) | | no |
| 167 | 0xA7 | SET Tweak Gain | byte1 byte2 | byte1 byte2 | = (1/2^15) * (byte1*256 + byte2) | | yes |

## 5.2 Advanced IR-Settings

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 19 | 0x13 | READ Amb. Temp. Source | none | byte1 | 1 = ext. Analog , 2 = ext. FIX 3 = Head Temp | | no |
| 147 | 0x93 | SET Amb. Temp. Source | byte1 | byte1 | 1 = ext. Analog , 2 = ext. FIX 3 = Head Temp | | yes |
| 20 | 0x14 | READ Amb. Temp. Fix Value | none | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | | no |
| 148 | 0x94 | SET Amb. Temp. Fix Value | byte1 byte 2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | | yes |
| 21 | 0x15 | READ Eps. Source | none | byte1 | 1 = ext. Analog , 2 = ext. FIX 3 = table | | no |
| 149 | 0x95 | SET Eps. Source | byte1 | byte1 | 1 = ext. Analog , 2 = ext. FIX 3 = table | | yes |



Optris GmbH
Ferdinand-Buisson-Str. 14
13127 Berlin
Germany
Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10
info@optris.global
www.optris.global

### 5.3 Advances Digital Communication Settings

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 45 | 0x2D | READ if check sum expected | none | byte1 | 0 - without check sum<br>1 - with check sum | | no |
| 173 | 0xAD | SET check sum expected | byte1 | byte1 | 0 - CT expects no check sum<br>1 - CT expects check sum | | yes |
| 80 | 0x50 | Read out Burst String | | byte1 byte2 byte3 byte4 | Burstmode Description below | | no |
| 81 | 0x51 | Set Burst String | byte1 byte2 byte3 byte4 | byte1 byte2 byte3 byte4 | | | yes |
| 82 | 0x52 | Set Burstmode | byte1 | byte1 | 1 = start , 0 = stop | | yes |
| 130 | 0x82 | SET Baudrate | byte1 | | Parameter byte1 =<br>0 - 9600<br>1 - 19200<br>2 - 38400<br>3 - 57600<br>4 - 115200 | | yes |

### 5.4 Loop Maintenance

In order to simulate hot objects in the scene and double check the analog circuits the loop maintenance makes the analog output sending fixed values. Note: It is necessary to reset DAC percentage to get back to measure mode.

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 26 | 0x1A | READ Out value for IR-DAC percentage | none | | | | no |
| 154 | 0x9A | SET IR DAC percentage | byte1 | byte1 | 0..100 | | yes |
| 27 | 0x1B | READ Out value for Amb. DAC percentage | none | | | | no |
| 155 | 0x9B | SET AMB. DAC percentage | byte1 | byte1 | 0..100 | | yes |
| 143 | 0x8F | RESET the DAC percentage output | none | | | | yes |

### 5.5 Emissivity Determination

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 159 | 0x9F | SET Emissivity determination target temp | byte1 byte2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | yes |
| 160 | 0xA0 | SET Emissivity determination actual temp | byte1 byte2 | byte1 byte2 | = (byte1*256 + byte2 - 1000) / 10 | °C | yes |
| 161 | 0xA1 | SET Emissivity determination status | byte1 | byte1 | 0 = off, 1 = on | °C | yes |



Optris GmbH
Ferdinand-Buisson-Str. 14
13127 Berlin
Germany
Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10
info@optris.global
www.optris.global

## 5.6 Failsafe Mode

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 22 | 0x16 | **READ IR Failsafe Mode** | **none** | **byte1** | **0 = always HIGH<br>1 = under → HIGH over → LOW<br>2 = always LOW<br>3 = under → LOW over → HIGH** | | **no** |
| 23 | 0x17 | **READ Amb. Failsafe Mode** | **none** | **byte 1** | **0 = always HIGH<br>1 = under → HIGH over → LOW<br>2 = always LOW<br>3 = under → LOW over → HIGH** | | **no** |
| 150 | 0x96 | **SET IR Failsafe Mode** | **byte 1** | **byte 1** | **0 = always HIGH<br>1 = under → HIGH over → LOW<br>2 = always LOW<br>3 = under → LOW over → HIGH** | | **yes** |
| 151 | 0x97 | **SET Amb. Failsafe Mode** | **byte 1** | **byte 1** | **0 = always HIGH<br>1 = under → HIGH over → LOW<br>2 = always LOW<br>3 = under → LOW over → HIGH** | | **yes** |

## 5.7 Further Advanced Settings

| DECIMAL | HEX | Command | Data | Answer | Result | Unit | Check sum |
|---|---|---|---|---|---|---|---|
| 169 | 0xA9 | **SET DEFAULT** | **none** | **byte1** | **Set CT default Data<br>(as MODE + DOWN button)** | | **yes** |
| 67 | 0x43 | **READ PANEL LOCK** | **none** | **byte1** | **0 - Keys available<br>1 - Keys locked** | | **no** |
| 68 | 0x44 | **SET PANEL LOCK** | **byte1** | **byte1** | **0 - Keys available<br>1 - Keys locked** | | **yes** |
| 9 | 0x09 | **READ Temp. Unit** | **none** | **byte1** | **°C if byte1 = 1<br>°F if byte1 = 1** | | **no** |
| 137 | 0x89 | **SET Temp. Unit** | **byte1** | **byte1** | **°C if byte1 = 1<br>°F if byte1 = 1** | | **yes** |
| 112 | 0x70 | **SET Save Settings after changing** | **byte1** | **byte1** | **1 = Data are not written in flash anymore<br>0 = Data are written in flash** | | **yes** |
| 113 | 0x71 | **READ Save Settings after changing** | **byte1** | **byte1** | **1 = Data are not written in flash anymore<br>0 = Data are written in flash** | | **no** |
| 117 *) | 0x75 | **READ Functional Inputs** | **none** | **byte1 – byte 6** | **F1 = byte1*256 + byte2 (0 or 1)<br>F2 = byte3*256 + byte4 (0…10000 mV)<br>F3 = byte5*256 + byte6 (0…10000 mV)** | | **no** |

*) The command for reading the functional inputs can only be used for 1M/2M/3M models



Optris GmbH
Ferdinand-Buisson-Str. 14
13127 Berlin
Germany

Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10

info@optris.global
www.optris.global

# 6 Examples

| READ COMMANDS | SEND | RECEIVE | |
|---|---|---|---|
| Reading a target temperature | 01 | 04 D3 | $(04D3_{hex}$ -1000) / 10 = (1235-1000) / 10 = 23.5°C |
| Reading a target temp. with device address 5 | B5 01 | 04 D3 | 23.5°C |
| Reading emissivity | 04 | 03 B6 | $03B6_{hex}$ / 1000 = 950 / 1000 = 0.950 |
| Reading serial number | 0E | 3D CC 5D | $3DCC5D_{hex}$ = 4050013 |
| Query whether the device uses checksums | 2D | 01 | 01 = Device uses checksums |

| SET COMMANDS | SEND *) | RECEIVE | |
|---|---|---|---|
| Setting the alarm 1 value | 8A 04 D3 [5D] | 04 D3 | $(04D3_{hex}$ -1000) / 10 = (1235-1000) / 10 = 23.5°C |
| Setting the alarm 1 value with device address 5 | B5 8A 04 D3 [5D] | 04 D3 | 23.5°C |
| Setting the emissivity to 0.95 | 84 03 B6 [31] | 03 B6 | $03B6_{hex}$ / 1000 = 950 / 1000 = 0.950 |
| Giving the device with address 5 the new address 6 | B5 90 06 [96] | 06 | After this command you have to use B6 as address prefix |
| Switch the checksums off, if the device uses checksums | AD 00 [AD] | 00 | |
| Switch the checksums on, if the device does not use checksums | AD 01 | 01 | |
| Setting the baud rate of all devices at the same time to 115200 baud | B0 82 04 [86] | | After this the communication baud rate is set to 115200 and the master device must change its own baud rate too. |

*) Checksum in square brackets

| LINE MODE COMMANDS | SEND | RECEIVE | |
|---|---|---|---|
| Reading the target temperatures from the devices with addresses 1..5 one time: | B0 2E 05 | 04 D3 04 4C 04 B0 05 14 05 78 | Address 1 = $04D3_{hex}$ = 23.5 °C<br>Address 2 = $044C_{hex}$ = 10.0 °C<br>Address 3 = $04B0_{hex}$ = 20.0 °C<br>Address 4 = $0514_{hex}$ = 30.0 °C<br>Address 5 = $0578_{hex}$ = 40.0 °C |
| Reading the target temperatures from the devices with addresses 1..5 continuously with a cycle time of 50 ms, timer is device 3 | B3 2F 32 05 | 2E 05 04 D3 04 4C 04 B0 05 14 05 78 | 2E 05 is the continuously repeated command of time device 3 temperatures: (23.5°, 10°, 20°, 30°, 40°) |
| Stopping the continuously line mode of timer device 3 | B3 2F 00 00 | - | This stops line mode of timer device 3. Note: If you setup a big number of devices with a short cycle time it is possible that the line mode can't be stopped. |

## 6.1 Head Code

The head code commands (read 24, set A4) must be sent for any of the three blocks of the head code. The first byte of the command is the head code block number.
The three following data bytes of any of the three commands encode the four digits of any block in a 5-bit-format.

| | BIT7 | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 |
|---|---|---|---|---|---|---|---|---|
| Byte2 | | | | | d3.4 | d3.3 | d3.2 | d3.1 |
| Byte3 | d3.0 | d2.4 | d2.3 | d2.2 | d2.1 | d2.0 | d1.4 | d1.3 |
| Byte4 | d1.2 | d1.1 | d1.0 | d0.4 | d0.3 | d0.2 | d0.1 | d0.0 |

**dx.4 .. dx.0 encodes the bytes of the block in a 5-bit-format (the ASCII-numbers followed by the ASCII-letters):**

| 00000 | 00001 | 00010 | 00011 | 00100 | 00101 | 00110 | 00111 | 01000 | 01001 | 01010 | 01011 | 01100 | 01101 | 01110 | 01111 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | C | E | F |



Optris GmbH
Ferdinand-Buisson-Str. 14
13127 Berlin
Germany
Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10
info@optris.global
www.optris.global

| 10000 | 10001 | 10010 | 10011 | 10100 | 10101 | 10110 | 10111 | 11000 | 11001 | 11010 | 11011 | 11100 | 11101 | 11110 | 11111 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |

**Example**: (head code is B6JG M2IM 0IKC):
Send the two bytes 24 01 to retrieve the second block of the Head code:
The command responds: 01 0B 0A 56
This is binary: 00000001 00001011 00001010 01010110
With other words: 10110 00010 10010 10110 → M2IM

| READ/SET HEAD CODE | SEND *) | RECEIVE | |
|---|---|---|---|
| Read head code block 1 | 24 00 | 00 05 9A 70 | B6JG |
| Read head code block 2 | 24 01 | 01 0B 0A 56 | M2IM |
| Read head code block 3 | 24 02 | 02 00 4A 8C | 0IKC |
| Set head code block 1 to B6JG | A4 00 05 9A 70 [4B] | 00 05 9A 70 | B6JG |
| Set head code block 2 to M2IM | A4 01 0B 0A 56 [F2] | 01 0B 0A 56 | M2IM |
| Set head code block 3 to 0IKC | A4 02 00 4A 8C [60] | 02 00 4A 8C | 0IKC |

***) Checksum in square brackets**

## 6.2 Alarm mode

The optris CT/ CTlaser/ CTvideo has 4 alarms. These alarm modes can be controlled by the Alarm mode command (read 28, set A8).
To read or set an alarm mode a byte must follow the command byte that specifies the alarm:

| BYTE1 | ALARM |
|---|---|
| 0 | Alarm 1 |
| 1 | Alarm 2 |
| 2 | Output channel 2 (ambient / head temperature) |
| 3 | Output channel 1 (IR / Object temperature) |

The data byte (byte2) contains the following information

| BIT | DESCRIPTION | | RELEVANT FOR ALARM | | | |
|---|---|---|---|---|---|---|
| | | | 0 | 1 | 2 | 3 |
| Bit7 | Source for the alarm is the box temperature | | x | x | x | - |
| Bit6 | Source for the alarm is the head temperature | | x | x | x | - |
| Bit5 | Source for the alarm is the object temperature | | x | x | x | x |
| Bit4 | 0 = contact is normally closed, 1 = contact is normally open | | x | x | x | x |
| Bit3 | 0 = Output is digital, 1 = output is analog (if not used for alarm) | | - | - | x | x |
| Bit0…2 | 0 = Output as 0…10 mV | 1 = Output as 0…5 V | - | - | x | x |
| | 2 = Output as 0…20 mA<br>4 = Output as TCK | 3 = Output as 4…20 mA<br>5 = Output as TCJ | - | - | - | x |

**Note:** Not every setting is relevant for all alarms. For example the IR-Output can't watch the box temperature, but it is the only one that can be configured as Thermocouple J.

| READ/SET ALARM EXAMPLES | SEND *) | RECEIVE | |
|---|---|---|---|
| Read alarm mode, alarm 1 | 28 00 | 00 80 | Source=TBox, normally closed |
| Read alarm 1 value | 0A | 04 1A | 5 °C |
| Read alarm mode, alarm 2 | 28 01 | 01 90 | Source=TBox, normally open |
| Read alarm 2 value | 0B | 05 DC | 50 °C |
| Read alarm mode, ambient output | 28 02 | 02 51 | Source=THead, normally open, digital |
| Read ambient output alarm value | 0C | 06 A5 | 70.1 °C |
| Read alarm mode, IR output | 28 03 | 03 23 | Source=TObj, normally closed, digital, 4..20 mA |
| Read IR output alarm value | 0D | 0B B8 | 200 °C |
| Set alarm mode, IR output | A8 03 03 [88] | 03 23 | Source=TObj, normally closed, digital, 4..20 mA |
| Set IR output alarm value | 8D 07 D0 [5A] | 07 D0 | 100 °C |

***) Checksum in square brackets**



Optris GmbH
Ferdinand-Buisson-Str. 14
13127 Berlin
Germany
Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10
info@optris.global
www.optris.global

### 6.3 Material table

The material table is organized in 8 rows and 4 columns. The rows correspond with the 8 entries in the table and the columns are defined as follow:

| COLUMN | CONTENT | |
|---|---|---|
| 0 | Epsilon | = (byte2*256 + byte3) / 1000 |
| 1 | Alarm value A | = (byte2*256 + byte3 - 1000) / 10 |
| 2 | Alarm value B | = (byte2*256 + byte3 - 1000) / 10 |
| 3 | Device<br>(is the same for all 8 entries) | Higher 4 bit of byte3: source of alarm A<br>Lower 4 bit of byte3: source of alarm B<br>Alarm sources:<br>0 = alarm 1 (blue backlight)<br>1 = alarm 2 (red backlight)<br>2 = output channel 2 (ambient output)<br>3 = output channel 1 (IR output)<br>4 = alarm is not used by material table |

Also see the optris CT/ CTlaser/ CTvideo manual for material table editing.

To read or set a value in the material table a byte must follow the command byte that specifies row and column in the table.
The higher 4 bit of this byte determines the table entry number (0..7).
The lower 4 bit determines the column (0 = Eps., 1 = Alarm A, 2 = Alarm B, 3 = Device).

| READ/SET MATERIAL TABLE | SEND *) | RECEIVE | |
|---|---|---|---|
| Read material table entry 0, epsilon | 23 00 | 00 03 C0 | $03C0_{hex}$ / 1000 = 960 / 1000 = 0.96 |
| Read material table entry 0, alarm A | 23 01 | 01 04 B0 | ($04B0_{hex}$ -1000) / 10 = (1200-1000) / 10 = 20 °C |
| Read material table entry 0, alarm B | 23 02 | 02 07 D0 | ($07D0_{hex}$ -1000) / 10 = (2000-1000) / 10 = 100 °C |
| Read material table entry 0, device | 23 03 | 03 00 31 | Source for alarm A: 3 = IR output<br>Source for alarm B: 1 = alarm 2 |
| Set material table entry 7, epsilon | A3 70 03 D4 [04] | 70 03 D4 | ε = 0.98 |
| Set material table entry 7, alarm A | A3 71 17 70 [B5] | 71 17 70 | 500 °C |
| Set material table entry 7, alarm B | A3 72 1F 40 [8D] | 72 1F 40 | 700 °C |
| Set material table entry 7, device | A3 73 00 31 [E1] | 73 00 31 | Source for alarm A: 3 = IR output<br>Source for alarm B: 1 = alarm 2 |

*) Checksum in square brackets



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### 6.4 Burst mode

The burst string consists of 8 "half bytes".

| HALF BYTE | VALUE |
|---|---|
| 1 | Target temperature |
| 2 | Head temperature |
| 3 | Box temperature |
| 4 | Current target temperature |
| 5 | Emissivity |
| 6 | Transmissivity |
| 7-15 | not used |
| 0 | End of burst string |

| READ/SET BURST EXAMPLES | SEND *) | RECEIVE | |
|---|---|---|---|
| Command for read out of burst string | 50 | 12 34 56 78 | reads the burst string |
| Set burst string | 51 12 00 00 00 | 12 00 00 00 | sets burst string to target and head temperature |
| Start burst mode | 52 01 | AA AA xx xx xx xx xx xx | starts the burst mode; AA AA is for synchronization, will be send in front of each new burst |
| Stop burst mode | 52 00 | | stops the burst mode |

# 7 Contact information

**If you plan your own software to query and control the optris CT/ CTlaser/ CTvideo sensor and you have further questions please contact:**

**Optris GmbH**
**Ferdinand-Buisson-Str. 14**
**13127 Berlin**
**Germany**

**Tel.: +49 30 500197-0**
**Fax.: +49 30 500197-10**

**email: info@optris.global**
**web: www.optris.global**



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13127 Berlin
Germany
Tel. +49 (0)30 500 197-0
Fax +49 (0)30 500 197-10
info@optris.global
www.optris.global