Sensor Instruments GmbH
Schlinding 11
D-94169 Thurmansbang

# TECHNICAL INFORMATION:

| | | | |
|---|---|---|---|
| **PRODUCT:** | ***L-LAS-TB CCD-Line-Laser-Sensor-Series*** | Date: | 17.10.2006 |
| | *Software – state: V2.01* | | (wk) |
| **TOPIC:** | RS232-Interface-Protocol for L-LAS-TB CCD-Sensors<br>PC-Software-Version *L-LAS-TB-Scope V2.01b* | | |

## RS232 Interface-Protocol PC ⇔ *L-LAS-TB sensor*

- Standard RS232 serial interface, no hardware handshake
- 3-wire connection: GND, TX0, RX0
- Speed: 19200 baud, 8 data-bits, no parity-bit, 1 stop-bit, binary-mode

The control device (PC or PLC) have to send a frame of *18-words (1 word = 2 byte = 16 bit)* to the *L-LAS-TB* hardware. All words must be transmitted in binary format. The most significant byte must be transmitted first (MSB-first).

METHOD:
The microcontroller of the L-LAS-TB sensor is permanently reading (polling) the input-buffer of the RS-232 module. If the incoming word = *0x0055 (0x55 hexadecimal = 85 decimal)*, this is interpreted as the synchronisation-event **<sync-word>**. After this, the 2.nd word with the order number **<order-word>** is read in by the microcontroller.
The order word **<order-word>**, is followed by 16 further words **<parameter-word>**.
After reading the complete data-frame (18-words = 36 bytes), the *L-LAS-TB* sensor hardware executes the order which is coded at the 2.nd word **<order-word>**.

| Format of the parameter-frame: | | |
|---|---|---|
| **Word No.** | **Meaning** | **Comment** |
| 1 | **<sync-word>** = 0x0055 | hex-code 0x55, binary=00000000 01010101, dez.=85 |
| 2 | **<order-word>** | Order word (c.f. table below) |
| 3 | parameter POWER | Laser Intensity (0 ... 1000) |
| 4 | parameter RS232MODE | RS232-mode STAT=0 / CONT=1 (not used in Version 2.0b!) |
| 5 | parameter VIDEOTHD | Threshold for edge detection of video signal (0 …1023) |
| 6 | parameter ANAMODE | Mode of Analog-output: (0=DIRECT, 1=MAX-intern-triggerd, 2=MIN-intern-triggerd, 3=MAX-extern-triggered, 4=MIN-extern-triggerd) |
| 7 | parameter POLARITY | Polarity setting for OUT0, OUT1, (0=DIRECT, 1=INVERSE) |
| 8 | parameter E-MODE | Eval-mode (0=L-EDGE, 1=R-EDGE, 2=WIDTH, 3=CENTER) |
| 9 | parameter E-BEGIN | Evaluation start-pixel ( 1 .. E_END-1 ) |
| 10 | parameter E-END | Evaluation end-pixel ( E_BEG+1 .. 1023 ) |
| 11 | parameter TEACH-VALUE | Teach-value TEACH (1 ...1024) |
| 12 | parameter TOLERANCE | Tolerance-value TOL: (0 ... 512) |
| 13 | parameter CCD-MODE | CCD-Receiver-gain (LOW=0 / HIGH=1) |
| 14 | parameter HARDW-MODE | Enable/disable TOL-potentiometer and Button at Housing (DISABLE-ALL=0, ENABLE-ALL=1,ENABLE-BTN=2, ENABLE POTI=3) |
| 15 | parameter SLOPE | Slope parameter for calibration Y=slope*x + intersect |
| 16 | parameter INTERSECT | Intersection parameter Y=slope*x + intersect |
| 17 | parameter PIXB | Start-pixel |
| 18 | Parameter PIXE | End pixel |

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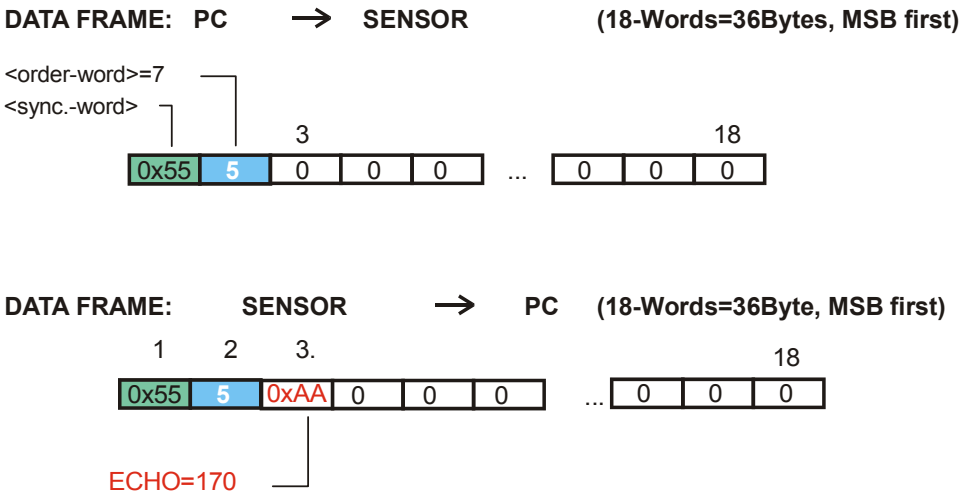
| Meaning of the 2nd word of the data-frame: <order-word> | | |
|---|---|---|
| **Value** | **Meaning / Action** | |
| 0 | Nop | no operation |
| 1 | Send parameter from PC into RAM of L-LAS | volatile: 18 words PC ⇒ L-LAS-RAM |
| 2 | Get L-LAS-RAM-parameter | 18 words, L-LAS-RAM ⇒ PC |
| 3 | Send parameter from PC into EEPROM of L-LAS | 18 words, PC ⇒ L-LAS-EEPROM |
| 4 | Get EEPROM parameters of L-LAS | 18 words, L-LAS-EEPROM ⇒ PC |
| 5 | Echo check: Get echo of L-LAS, line ok = 0xAA | 18 words, 3rd. word=0x00AA (Echo=170) |
| 6 | Activate Teach at L-LAS, store in RAM | 18 words PC ⇒ L-LAS-RAM |
| 7 | Get software version info from L-LAS | 36 words, L-LAS ⇒ PC (version-string) |
| **8** | **Get measured values out of L-LAS-RAM** | **18 words, L-LAS-RAM ⇒ PC** |
| 9 | Get data-buffer-block out of L-LAS-RAM, | 64 words, L-LAS-RAM ⇒ PC |
| 11 | Reset maxima/minima-values (analog-output-mode) | 18 words PC ⇒ L-LAS-RAM |

EXAMPLES:

**Echo check <order-word>=5**

**<order-word> = 5**

Echo check: send echo in 3rd. word to PC



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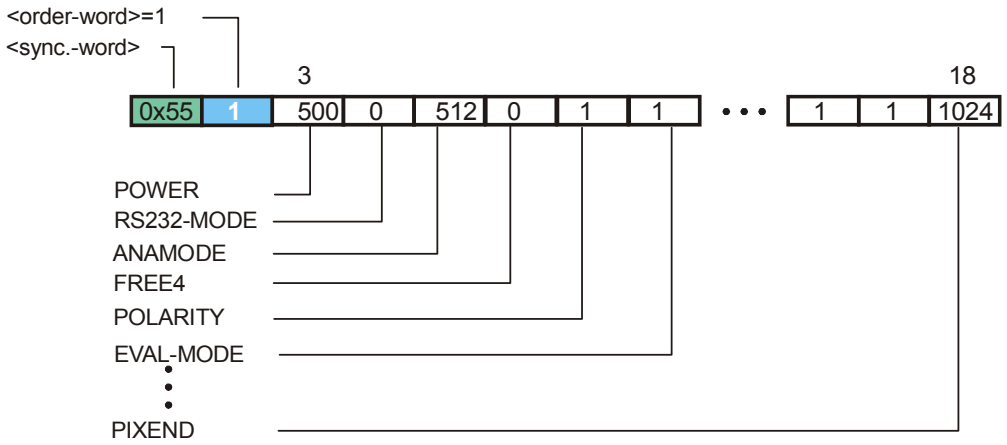
## SEND parameter to L-LAS-RAM <order-word>=1

**<order-word> = 1**

Send actual parameters and store the frame into L-LAS-RAM

No data frame is send back to the PC with the order = 1 !!!

**DATA FRAME: PC → SENSOR (18-Words=36Bytes, MSB first)**

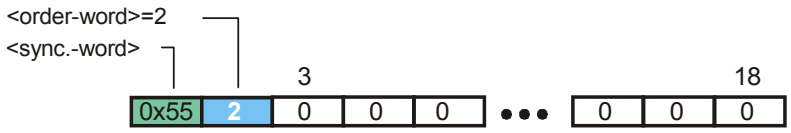



## GET L-LAS-RAM parameter <order-word>=2

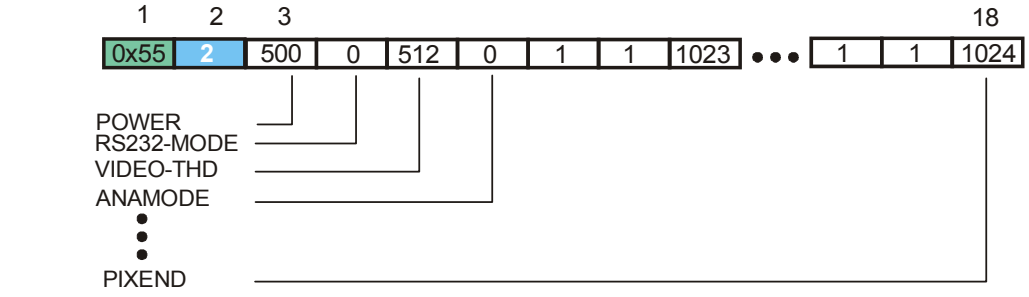
**<order-word> = 2**

GET L-LAS RAM parameter

**DATA FRAME: PC → SENSOR (18-Words=36Bytes, MSB first)**




**DATA FRAME: SENSOR → PC (18-Words=36Byte, MSB first)**



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## GET measured-values of L-LAS-sensor <order-word>=8

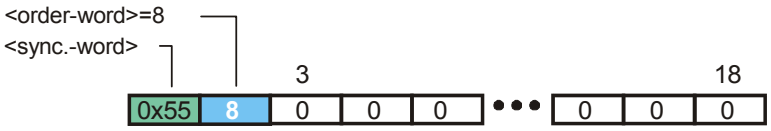
**<order-word> = 8**

The µController sends the actual measured values to the PC.

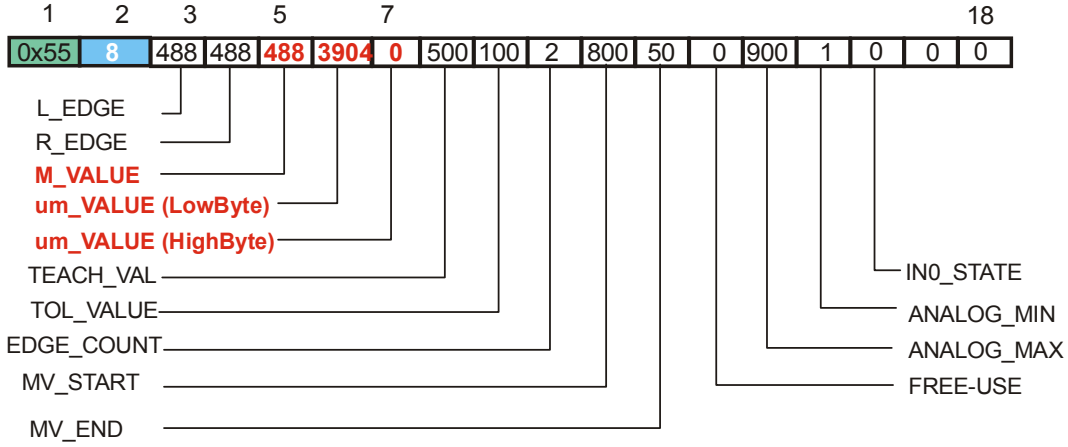
The 5. word of the data-frame represents the actual measured value: **M_VALUE**.

The 6 and 7th. word of the data-frame represents the measured value in micrometer: **um_VALUE**.

**DATA FRAME: PC → L-LAS-sensor (18-Words = 36 Bytes, MSB first)**




**DATA FRAME: L-LAS-sensor → PC (18-Words = 36 Byte, MSB first)**




| | |
|---|---|
| L_EDGE | := left edge of ccd-intensity profile |
| R_EDGE | := right edge of ccd-intenity profile |
| M_VALUE | := measured value (= left edge because EVALMODE=0) |
| um_VALUE_LB | := measured value (LOW-BYTE) in micrometer |
| um_VALUE_HB | := measured value (HIGH-BYTE) in micrometer |
| TEACH-VAL | := teach value |
| TOL-VALUE | := tolerance value |
| EDGE_COUNT | := number of detected edges |
| MV_START | := mean value of the first 8 pixel of the evaluation range of the CCD-line |
| MV_END | := mean value of the last 8 pixel of the evaluation range of the CCD-line |
| FREE_USE | := not used |
| ANALOG_MAX | := currently stored maximum-analog-value ( analog-output ) |
| ANALOG_MIN | := currently stored minimum-analog-value ( analog-output ) |
| IN0_STATE | := state of digital-input IN0,IN1,Button (0,1,2,4,7) |

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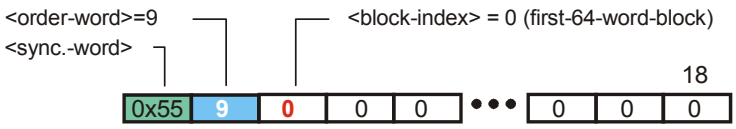
## GET L-LAS-sensor DATA-BUFFER <order-word>=9

**<order-word> = 9**

Due to limited RAM memory at the L-LAS-sensor, the data buffers have to be sent to the PC in blocks of 64-words one after the other. The data buffer contents the 256-pixel of the intensity-profile which is measured at the CCD-receiver.

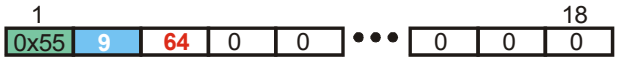
**Step1: DATA FRAME: PC → L-LAS-sensor (18-Words=36Bytes, MSB first)**




**DATA FRAME: L-LAS-sensor → PC (64-Words = 128Byte, MSB first)**

First block of 64 words are the first 64 pixel of the intensity-profile

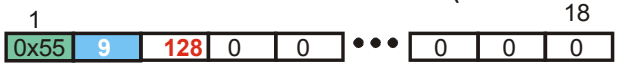
**Step2: DATA FRAME: PC → L-LAS-sensor (18-Words=36Bytes, MSB first)**




**DATA FRAME: L-LAS-sensor → PC (64-Words = 128Byte, MSB first)**

2nd. block of 64 words: pixel 65 to 128

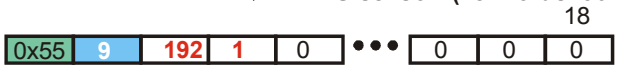
**Step3: DATA FRAME: PC → L-LAS-sensor (18-Words=36Bytes, MSB first)**




**DATA FRAME: L-LAS-sensor → PC (64-Words = 128Byte, MSB first)**

3rd. block of 64 words: pixel 129 to 192

**Step4: DATA FRAME: PC → L-LAS-sensor (18-Words=36Bytes, MSB first)**




**DATA FRAME: L-LAS-sensor → PC (64-Words = 128Byte, MSB first)**

3rd. block of 64 words: pixel 193 to 256