

## TECHNICAL INFORMATION:

|                 |   |       |            |
|-----------------|---|-------|------------|
| <b>PRODUCT:</b> | <b>L-LAS-TB CCD-Line-Laser-Sensor-Series</b>  | Date: | 13.06.2008 |
|                 | <i>PC Software - state: V2.42</i>   |       | (wk)       |
| <b>TOPIC:</b>   | RS232-Interface-Protocol for L-LAS-TB CCD-Sensors<br>PC-Software-Version L-LAS-TB-Scope V2.42 |       |            |

### 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>**.

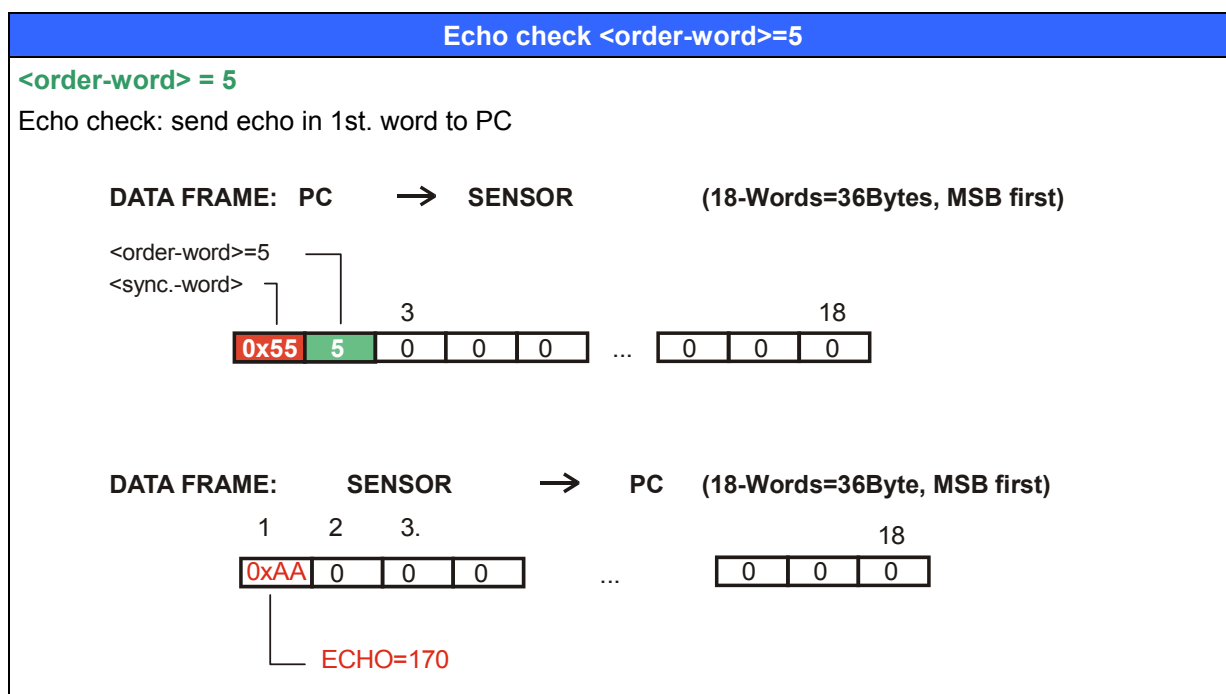
After reading the complete data-frame (18-words = 36 bytes), the **L-LAS-TB** sensor hardware executes the order which is coded at the 2.nd word **<order-word>**.

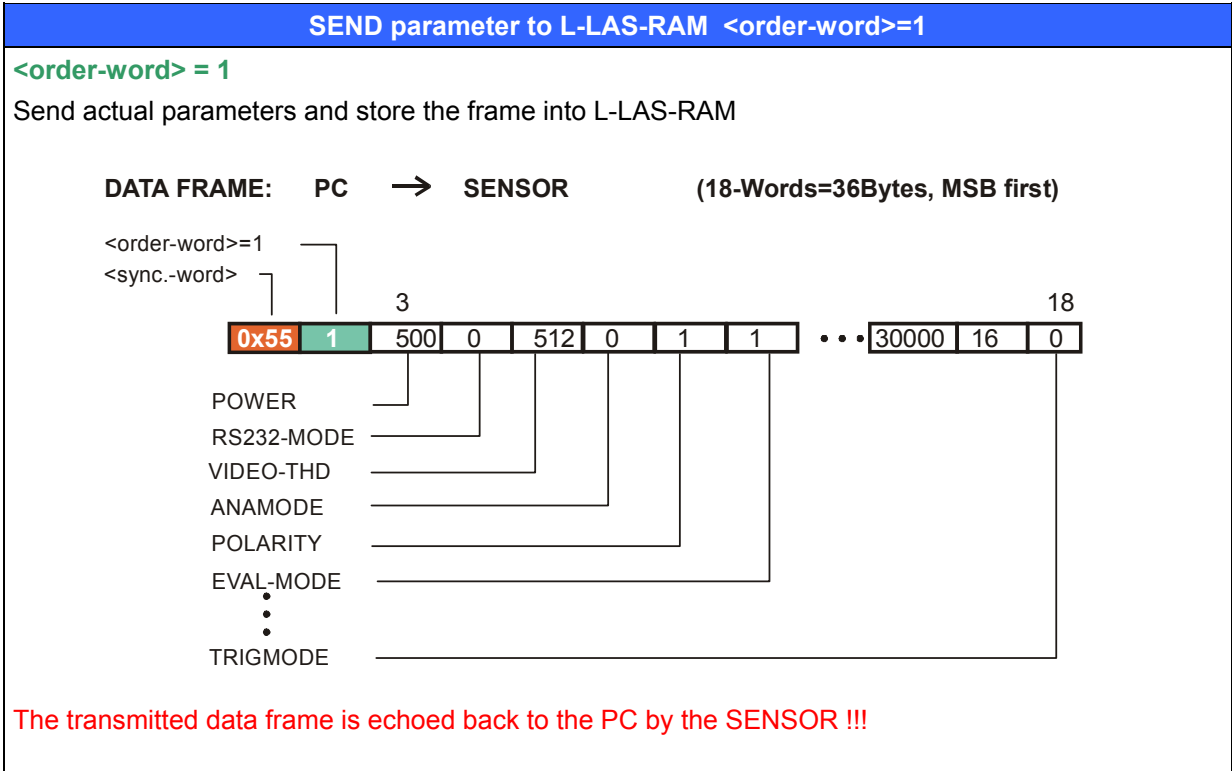
#### Format of the parameter-frame:

| Word No. | Meaning                           | Comment   |
|----------|-----------------------------------|---|
| <b>1</b> | <b>&lt;sync-word&gt;</b> = 0x0055 | hex-code 0x55, binary=0000 0000 0101 0101, dec.=85  |
| <b>2</b> | <b>&lt;order-word&gt;</b>         | Order word (c.f. table below)   |
| 3        | parameter POWER                   | Laser Intensity (0 ... 1000)  |
| 4        | parameter RS232MODE               | RS232-mode STAT=0 / CONT=1 (continous data output)  |
| 5        | parameter VIDEOTHD                | Threshold for edge detection of video signal (1 ...ADC-max)   |
| 6        | parameter ANAMODE                 | Mode of Analog-output: (0=DIRECT, 1=DIRECT no AVG, 2=MAX, 3=MIN, 4=MAX-MIN ).   |
| 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 .. MAXPIXEL )  |
| 11       | parameter TEACH-VALUE             | Teach-value TEACH (1 ...MAXPIXEL)   |
| 12       | parameter TOLERANCE               | Tolerance-value TOL: (0 ... MAXPIXEL/2)   |
| 13       | parameter OP-MODE                 | Operation-Mode (LOW = 0 / HIGH = 1) gain or video-readout-mode (ADC-CNV = 1 / DIG-COMP = 0 )  |
| 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 $Y = \text{slope} \cdot x + \text{intersect}$<br>Float-value is multiplied with 1024 (TB-8,TB-50,TB-75 )<br>Float value is multiplied with 512 (TB-100) |
| 16       | parameter INTERSECT               | Intersection parameter $Y = \text{slope} \cdot x + \text{intersect}$<br>Intersection has offset of 30000  |
| 17       | parameter AVERAGE                 | Average setting: 1,2,4,8,16,32,64,128 or 256  |
| 18       | Parameter TRIGMODE                | Trigger-Mode (0=CONTINUOUS, 1=EXT.IN0-L/H, 2=EXT.-IN0-HIGH)   |

| Meaning of the 2 <sup>nd</sup> 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 $\Rightarrow$ L-LAS-RAM          |
| 2   | Get L-LAS-RAM-parameter                         | 18 words, L-LAS-RAM $\Rightarrow$ PC                   |
| 3   | Send parameter from PC into EEPROM of L-LAS     | 18 words, PC $\Rightarrow$ L-LAS-EEPROM                |
| 4   | Get EEPROM parameters of L-LAS                  | 18 words, L-LAS-EEPROM $\Rightarrow$ PC                |
| 5   | Echo check: Get echo of L-LAS, line ok = 0xAA   | 18 words, 1 <sup>st</sup> . word=0x00AA (Echo=170)     |
| 6   | Activate Teach at L-LAS, store in RAM           | 18 words PC $\Rightarrow$ L-LAS-RAM                    |
| 7   | Get software version info from L-LAS            | 36 words, L-LAS $\Rightarrow$ PC (version-string)      |
| 8   | <b>Get measured values out of L-LAS-RAM</b>     | <b>18 words, L-LAS-RAM <math>\Rightarrow</math> PC</b> |
| 9   | Get data-buffer-block out of L-LAS-RAM,         | 64 words, L-LAS-RAM $\Rightarrow$ PC                   |
| 11  | Reset maxima/minima-values (analog-output-mode) | 18 words PC $\Rightarrow$ L-LAS-RAM                    |

EXAMPLES:





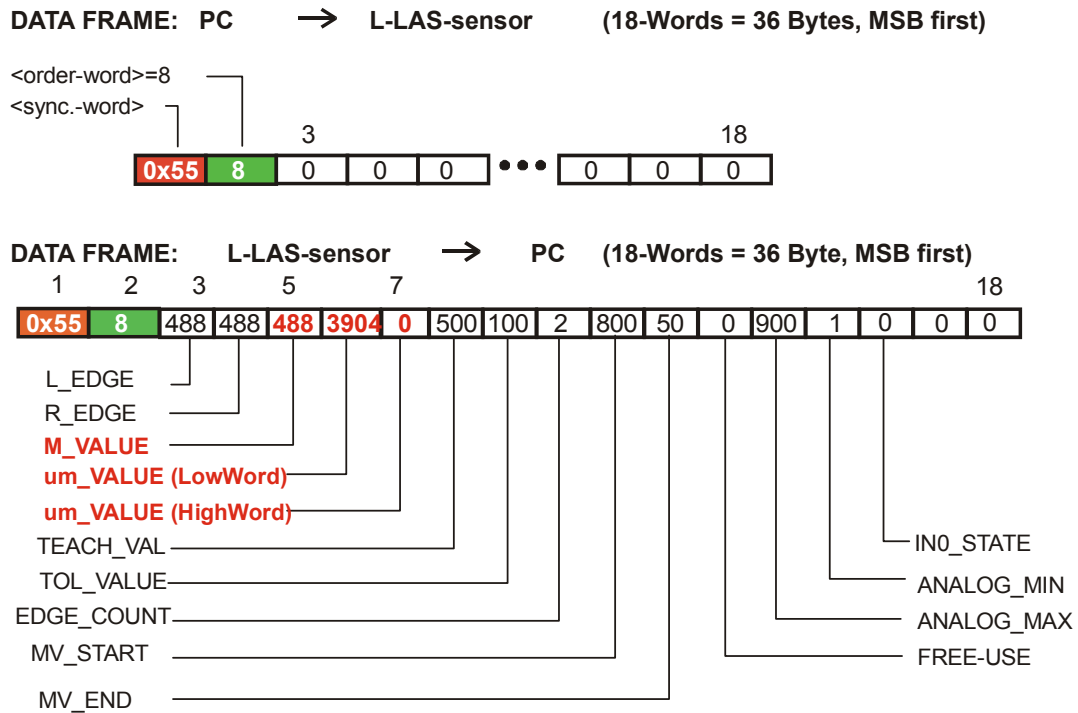
## GET measured-values of L-LAS-sensor <order-word>=8

<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**.



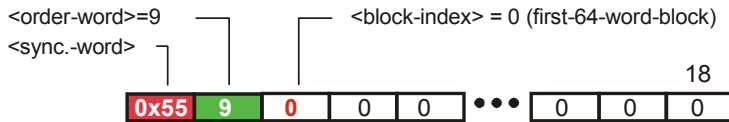
L\_EDGE := left edge of ccd-intensity profile  
 R\_EDGE := right edge of ccd-intensity profile  
 M\_VALUE := measured value (= left edge because EVALMODE=0)  
 um\_VALUE\_LB := measured value (LOW-BYTE) in micrometer  
 um\_VALUE\_HB := measured value (HIGH-BYTE) in micrometer  
 TEACH-VAL := teach 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)

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

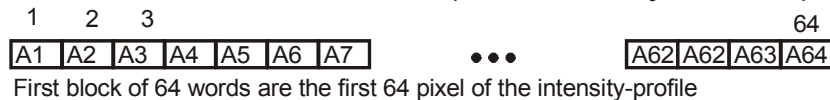
**<order-word> = 9**

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 is limited to 256-pixel of the intensity-profile which is measured at the CCD-receiver.

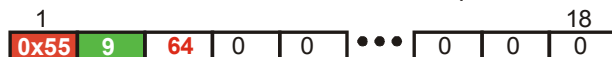
**Step1: DATA FRAME: PC → L-LAS-sensor (18-Words=36Bytes, MSB first)**



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



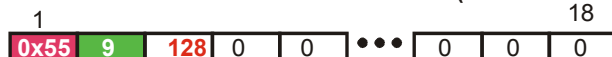
**Step2: DATA FRAME: PC → L-LAS-sensor (18-Words=36Bytes, MSB first)**



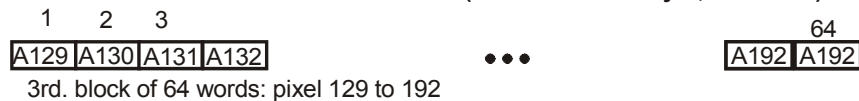
**DATA FRAME: L-LAS-sensor → PC (64-Words = 128Byte, MSB first)**



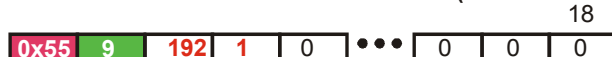
**Step3: DATA FRAME: PC → L-LAS-sensor (18-Words=36Bytes, MSB first)**



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



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



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

