

## TECHNICAL INFORMATION:

PRODUCT:	<b>L-LAS-TB CCD-Line-Laser-Sensor-Series</b>	Date:	21.10.2009
	<i>PC Software - L-LAS-TB-Scope V3.11</i>		(wk)
TOPIC:	RS232-Interface-Protocol for L-LAS-TB Sensors		

### RS232 Interface-Protocol PC ↔ L-LAS-TB Sensor Firmware Version 3.1x

- Standard RS232 serial interface, no hardware handshake
- 3-wire-connection: GND, TXD, RXD
- Speed: 9600 baud, 19200 baud, 38400 baud, 57600 baud oder 115200 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).

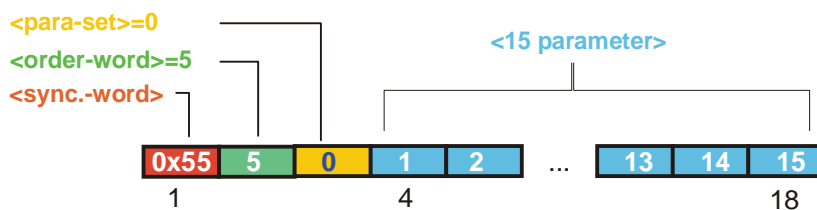
#### METHOD:

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 a further word, which contents parameter-set number 0 or 1 ( **<para-set>** ). The para-set-word is followed by 15 further words **<parameter-word>**, which contents the actual parameters.

Afer 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>** ) of the data-frame (c.f. order-table).

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



Format of the data-frame: <para-set = 0>		
Word	Meaning	Comment
1	<sync-word>	hex-code 0x55, binary=0000 0000 0101 0101, dec.=85
2	<order-word>	Order word (c.f. table below)
3	<parameter-set> = 0	0 = parameter-set number 0
4	POWER	Laser intensity (0 ... 1000)
5	POWER-MODE	Transmitter-mode: ( 0 = STATIC), (1=DYNAMIC), not used
6	POLARITY	Polarity setting for OUT0, OUT1,OUT2 (0=DIRECT, 1=INVERSE)
7	EVAL-MODE	Evaluation mode (0=L-EDGE, 1=R-EDGE, 2=WIDTH, 3=CENTER)
8	E-BEGIN	Evaluation start -pixel ( 1 .. E_END-1 )
9	E-END	Evaluation end-pixel ( E_BEG+1 .. SUBPIXEL)
10	TEACH-VALUE	Teach-value ( 1 ... SUBPIXEL)
11	TOLERANCE-HIGH VALUE	Upper-tolerance TOL-HIGH: (0 ... SUBPIXEL/2)
12	TOLERANCE-LOW-VALUE	Lower-tolerance TOL-LOW: (0 ... SUBPIXEL/2)
13	AVERAGE	Average-setting ( 1,2,4,8,16,32,64,128 oder 256 )
14	TRIGG-MODE	Trigger mode (0=CONTINUOUS, 1=EXT. IN0 L/H, 2=EXT.IN0 HIGH)
15	ANALOG-OUT	Analog-output-mode: (0=DIRECT 0..10V, 1=MAXIMA, 2=MINIMA, 3=MAX-MIN)
16	OPERATION-MODE	CCD-operation-mode (0=LOW-GAIN / 1=HIGH-GAIN)
17	HW-MODE	Enable/disable TOL-potentiometer and button at housing (DISABLE-ALL=0, ENABLE-ALL=1,ENABLE-BTN=2, ENABLE POTI=3)
18	VIDEO-THD-MODE	Video-threshold -mode 0=FIX, 1=AUTO

Format of the data-frame: <para-set = 1>		
Word .	Meaning	Comment
1	<sync-word> = 0x0055	hex-code 0x55, binary=0000 0000 0101 0101, dec.=85
2	<order-word>	Order-word (c.f. table below)
3	<parameter-set> = 1	1 = parameter-set-number 1
4	VIDEO-THD-FIX	Video-threshold (0 ... 100) percent of full ADC-range
5	VIDEO-THD-AUTO	Video-threshold (0 ... 100) percent of full ADC-range
6	RS-232-MODE	Data-recorder-mode: 0 = STATIC, 1=EXT-IN0 L/H, 2=CONTINUOUS
7	RS-232-BAUD	Baudrate: 0=9600, 1=19200, 2=38400, 3=57600 , 4=115200 baud
8	SMOOTH-VIDEO-SIGNAL	Smooth video signal over (1,2,4,6,8,12,16,24,32,48 or 64 ) pixel
9	ANALOG-ZOOM	Zoom-mode for analog-output (0=DIRECT, 1=ZOOMx1, 2=ZOOMx2, 3=ZOOMx4, 4=ZOOMx8, 5=ZOOMx16, 6=WIN-5V, 7=WIN-10V)
10	Parameter 7	0 , not used
11	Parameter 8	0 , not used
12	Parameter 9	0 , not used
13	Parameter 10	0 , not used
14	Parameter 11	0 , not used
15	SLOPE VALUE L-WORD	Slope value for calibration (x 1024), low-word
16	SLOPE VALUE H-WORD	Slope value for calibration (x1024), high-word
17	REF-OFFSET L-WORD	Intersection parameter with offset = 32767
18	REF-OFFSET H-WORD	Intersection parameter (not used)

Meaning of the 2.nd word of the data-frame: <order-word>		ORDER-TABLE
value	Meaning / Action	
0	NOP	no operation
1	Send parameter from PC to L-LAS-RAM	18 words, PC $\Rightarrow$ L-LAS-RAM
2	Get parameter from L-LAS-RAM	18 words, L-LAS-RAM $\Rightarrow$ PC
3	Send parameter from PC to EEPROM	18 words, PC $\Rightarrow$ L-LAS-EEPROM
4	Get parameter from EEPROM of L-LAS	18 words, L-LAS-EEPROM $\Rightarrow$ PC
5	Echo check: Get echo of L-LAS	18 words, erstes Wort=0x00AA=170dec
6	Activate teach at L-LAS, store in RAM	18 words PC $\Rightarrow$ L-LAS-RAM
7	Get software version info of L-LAS	72-bytes, L-LAS $\Rightarrow$ PC
8	<b>Get measured values out of L-LAS-RAM</b>	<b>18 words, L-LAS-RAM <math>\Rightarrow</math> PC</b>
9	Get video-buffer info from L-LAS	64 words, L-LAS-RAM $\Rightarrow$ PC
11	Reset maximum/minimum values at analog-output	18 words PC $\Rightarrow$ L-LAS-RAM
13	Refresh auto-video-threshold to RAM or EEPROM	18 words PC $\Rightarrow$ L-LAS-RAM
18	Get measured values from L-LAS-RAM (data-recorder)	18 words PC $\Rightarrow$ L-LAS-RAM
190	Change RS232-baud-rate (L-LAS-RAM)	18 words PC $\Rightarrow$ L-LAS-RAM

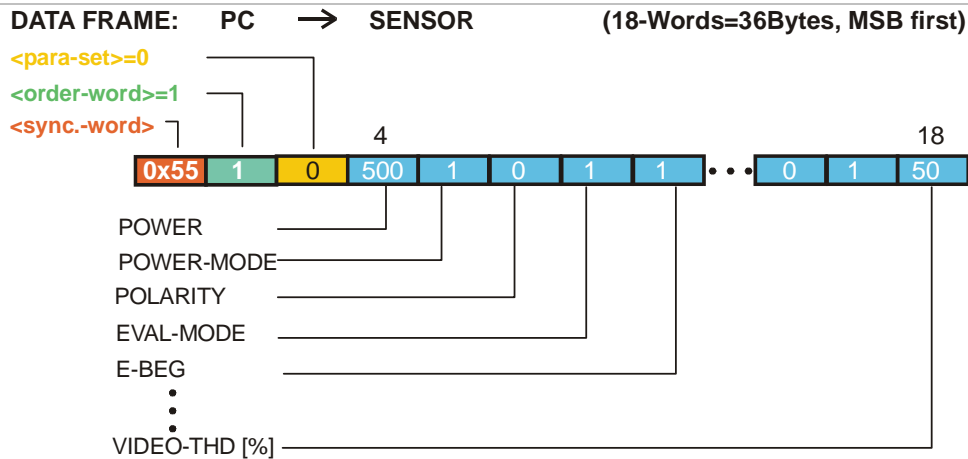
#### Examples for the data-transfer:

Echo check: <order-word> = 5	
<p>&lt;order-word&gt; = 5</p> <p>Echo check: L-LAS sensor sends echo: word=0x00AA=170 to PC</p>	
<p><b>DATA FRAME: PC <math>\rightarrow</math> SENSOR</b> (18-Words=36Bytes, MSB first)</p> <p>&lt;para-set&gt;=0 &lt;order-word&gt;=2 &lt;sync.-word&gt;</p>	
<p><b>DATA FRAME: SENSOR <math>\rightarrow</math> PC</b> (18-Words=36Bytes, MSB first)</p> <p>ECHO=0xAA=170 &lt;sync.-word&gt;</p>	

### SEND parameter-set = 0 to L-LAS-RAM <order-word> = 1

<order-word> = 1    <para-set> = 0

Send the actual parameter (set=0) into the RAM of the L-LAS-sensor

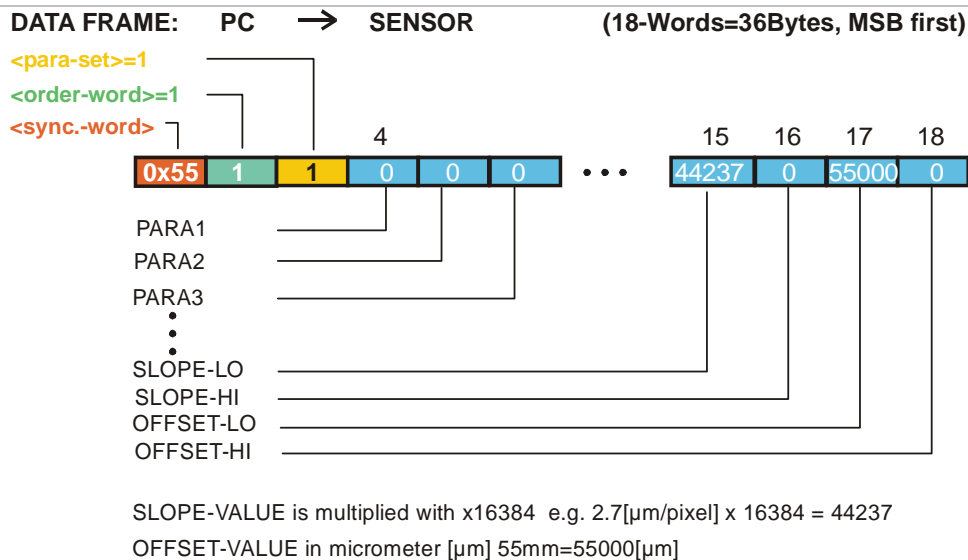


The transmitted data-frame is automatically echoed back by the L-LAS sensor !

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

<order-word> = 1    <para-set> = 1

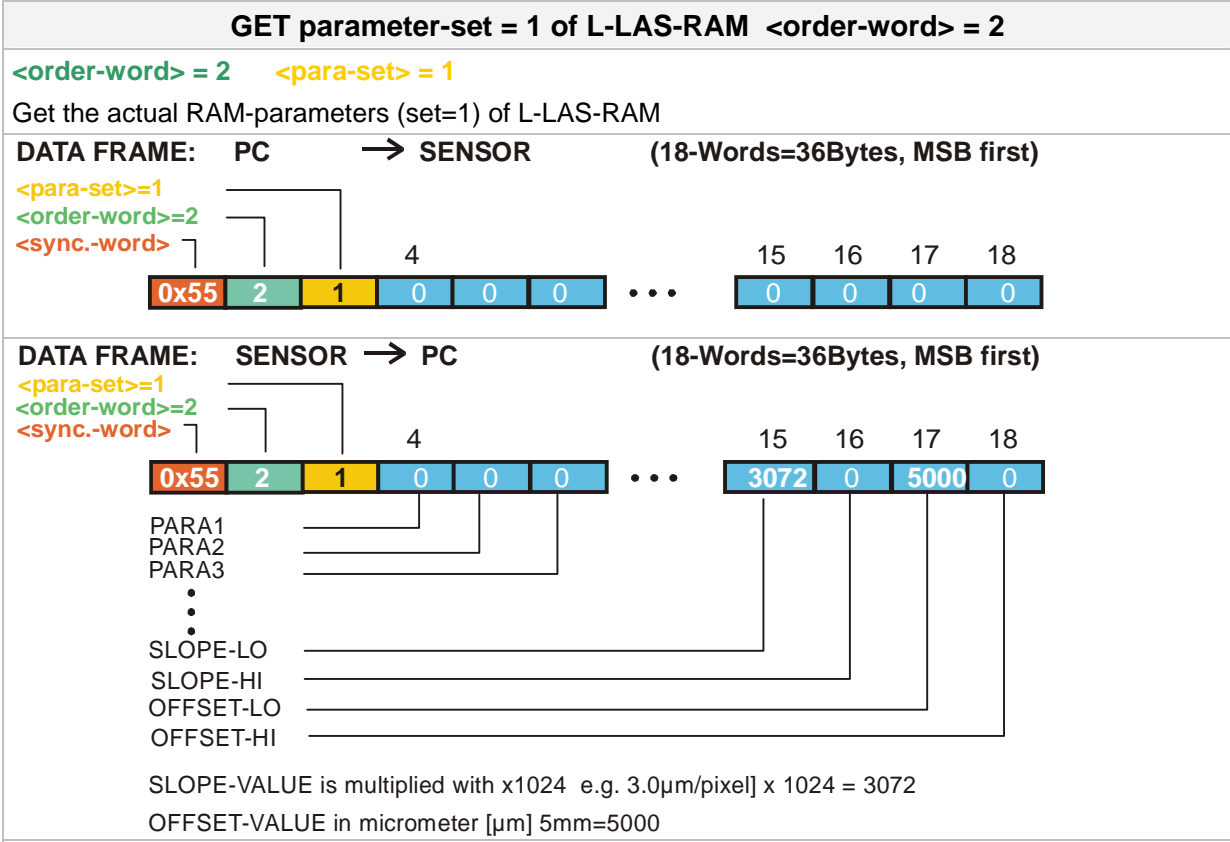
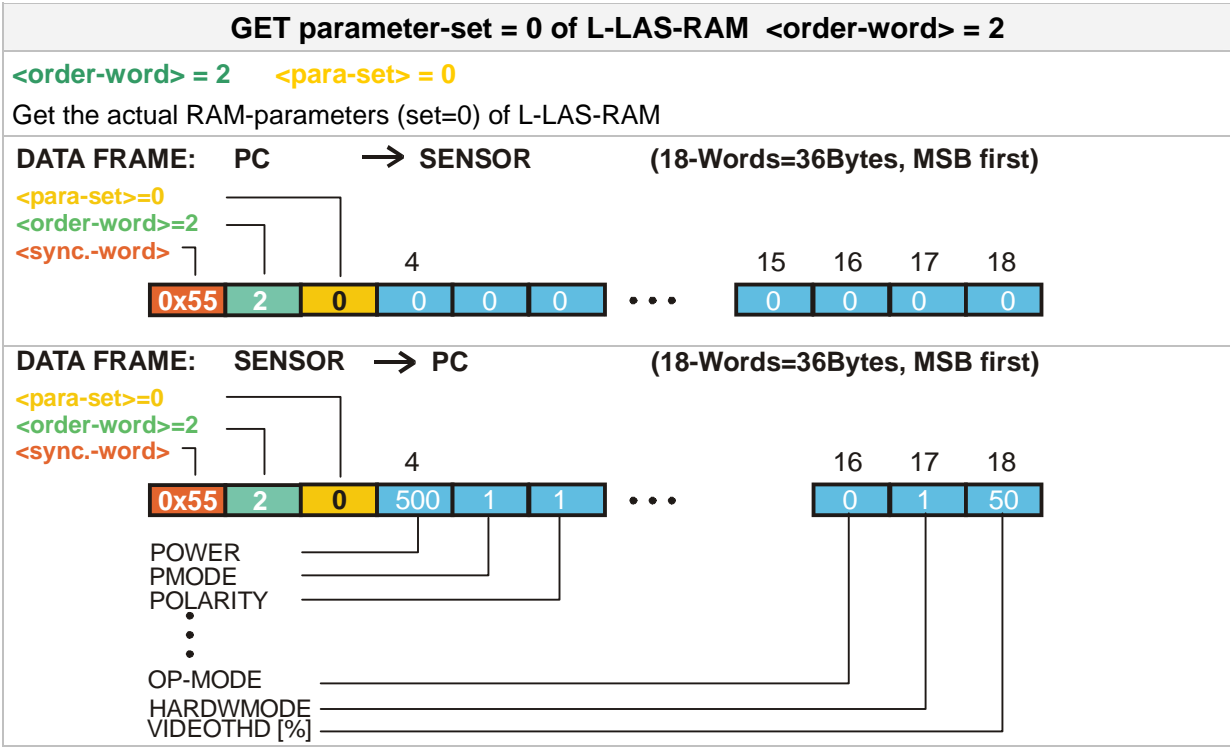
Send the actual parameter (set=0) into the RAM of the L-LAS sensors

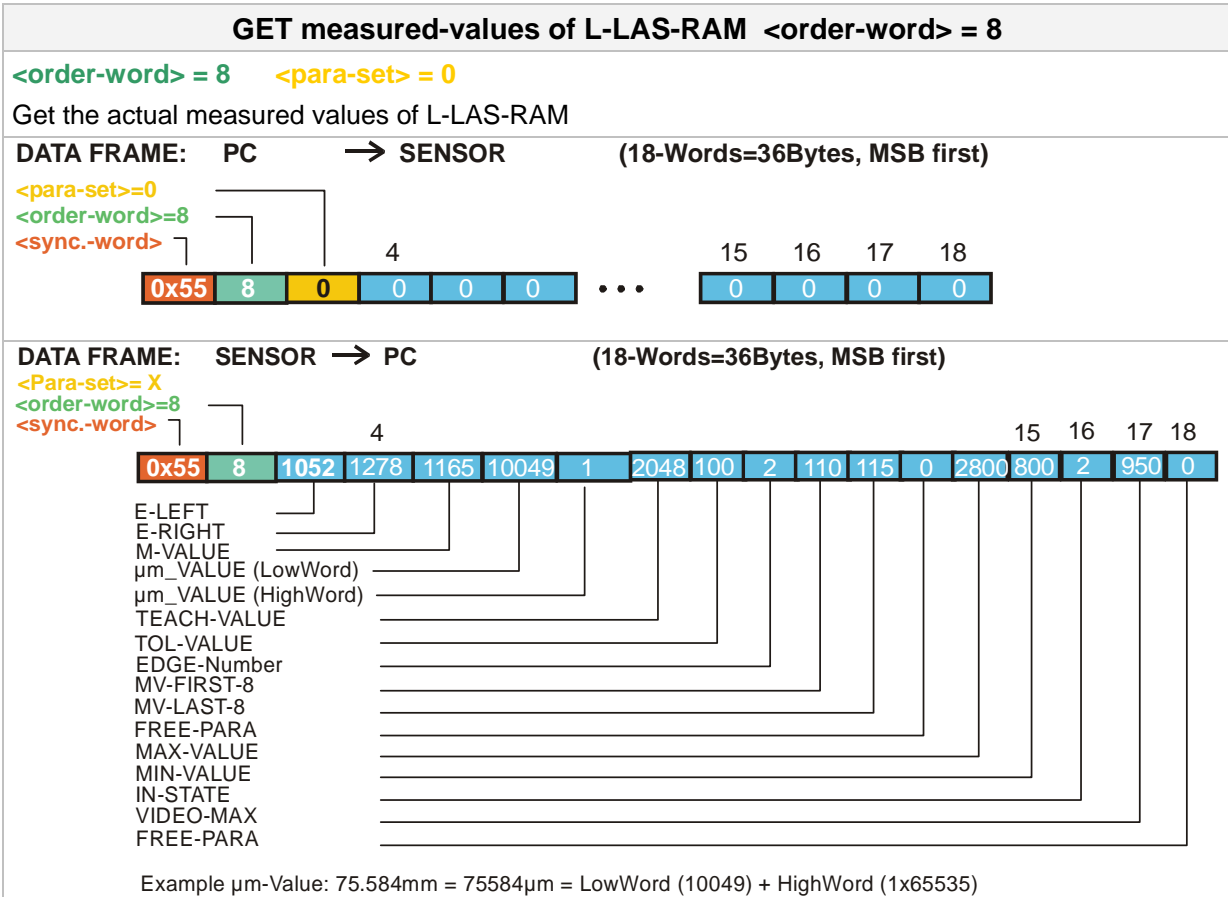
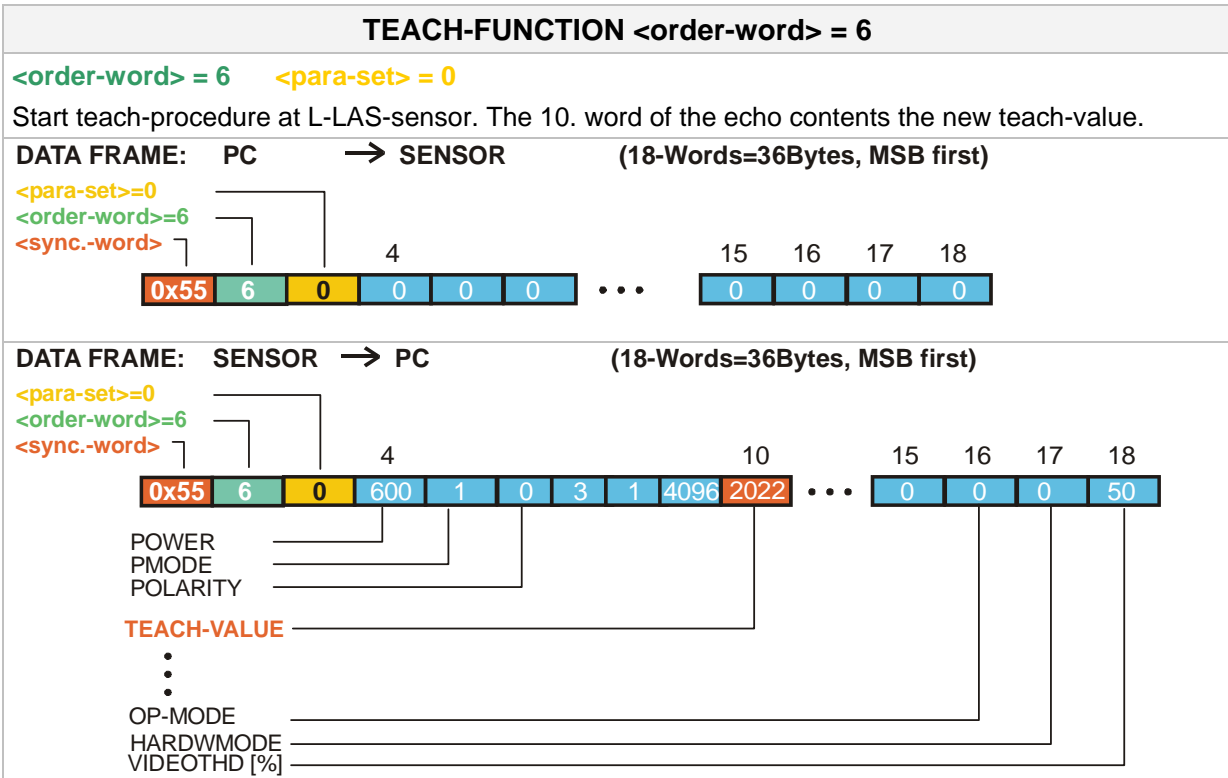


The transmitted data-frame is automatically echoed back by the L-LAS sensor !



To activate the full parameter set (set 0 and set 1) at the L-LAS-sensor, both parameter sets (para-set-0 and para-set-1) must be transmitted!





## REFRESH-VIDEO-THRESHOLD <order-word> = 13

<order-word> = 13    <para-set> = 0

Start the refresh of the auto-video-threshold at L-LAS-sensor. The new video threshold is calculated from the actual intensity profile over the ccd-line. The parameter VIDEO-THD-AUTO is used for calculation.

ATTENTION: Make sure that the laser-beam is not covered before you start this action!

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

<para-set>=1=RAM

<para-set>=2=EE

<order-word>=13

<sync.-word>



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

<para-set>=1 or 2

<order-word>=13

<sync.-word>



1=STORED IN RAM

2=STORED IN EEPROM

VTHD-AUTO [%]

## GET measured-values / recorder-of L-LAS-RAM <order-word> = 18

<order-word> = 18    <para-set> = 0

Get the current measurement values of RAM

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

<para-set>=0

<order-word>=18

<sync.-word>



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

<Para-set>= X

<order-word>=18

<sync.-word>



M-VALUE

E-LEFT

E-RIGHT

µm\_VALUE (LowWord)

µm\_VALUE (HighWord)

EDGE-COUNT

Example µm-Value: 75.584mm = 75584µm = LowWord (10049) + HighWord (1x65535)

## Change baudrate: <order-word> = 190

### <order-word> = 190

Change rs-232-baudrate at the L-LAS Sensor.

The new baudrate-parameter is transmitted in the 3.rd word <para-set>.

9600 baud = 0, 19200 baud = 1, 38400 baud = 2, 57600 baud = 3, 115200 baud = 4

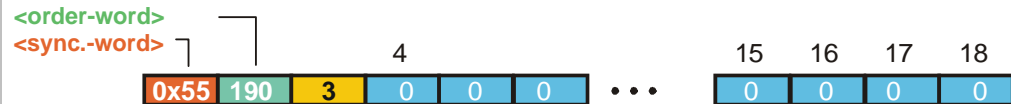
The transmitted data-frame is automatically echoed back from the L-LAS Sensor by using the old baudrate!!

The new baudrate is stored in the RAM-memory (volatile). To change the baudrate permanently this must be done by the parameter RS-232-BAUD of the second parameter-set=1 by saving the parameter frame to the EEPROM ( c.f. order = 3 ).

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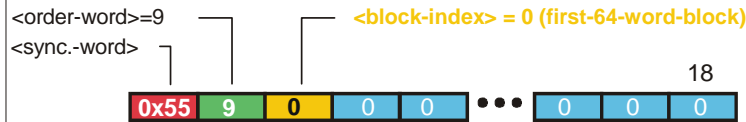


## GET Video-data from L-LAS-RAM <order-word> = 9

<order-word> = 9    <para-set> = 0,64,128 oder 192

Get the current video-data from the RAM (only 256-pixel of the full video-profile are transmitted)

**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

Attention: Only every 8th pixel is transmitted

**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

Attention: Only every 8th pixel is transmitted

**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

Attention: Only every 8th pixel is transmitted

**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

Attention: Only every 8th pixel is transmitted