metralight

Portable laser micrometer

Technical specification (rev.C, May 2020), sensor version: v2 r2419

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1. Introduction

- Handheld Inovation in Non-Contact Measurement
- Battery Powered (runs from internal Li-Ion battery – up to 18 hours, or USB powered)
- Integrated Wi-Fi (802.11b/g)
- 1GB memory storage
- Fast Measurement (3000m/s) and High Accuracy
- Intuitive User Interface, (High resolution color OLED Display, Membrane/capacitive Keyboard, USB 2.0)
- Laser Device (Laser Diode 670 nm Class I)
- Custom Modes Available: Centering, Minimum Measurement, Maximum Measurement, Thickness, Range of Tolerances
- Sample Application with Source Code for PC
- Custom Interface Available (Analog, Parallel, RS232, SPI, Ethernet)

2. Specification

Measurement Range	28 mm (1.10″)
Resolution	0.4375 µm
Repeatability	3 µm (Edge Position, Calibrated Distance)
Response Time	0.333 ms
Non-Linearity	< 10 µm (Edge Position, Calibrated Distance)
Measuring Modes	Edge1, Edge2, Diameter, Gap, Center, Solid
Power	USB Powered (5 V/150 mA) / Internal Li-Ion (up to 18 h running)
Wired Connection/Interface	USB mini B connector
Wireless	Wi-Fi 802.11b/g
Display	OLED, 320 x 320
Memory	1GB FLASH
Overall Dimension	131 x 97 x 23 mm (5.16″ x 3.82″ x 0.9″)
Weight	280 g (9.88 oz)

Table 1: Sensor specification

3. Description

3.1 Dimensions

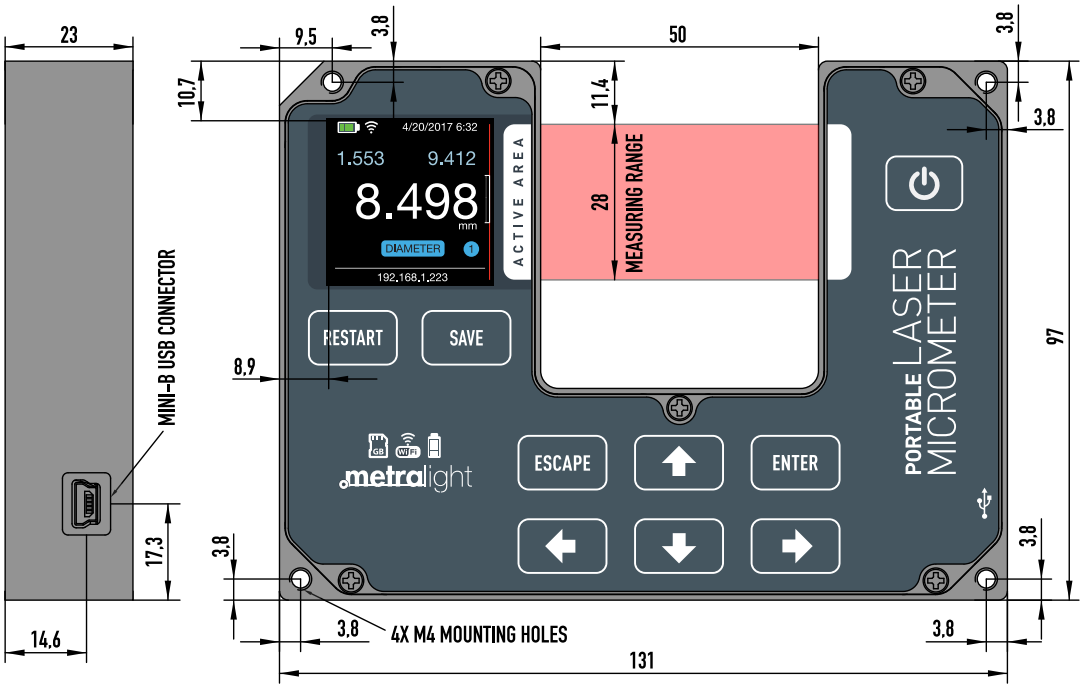


Image 1: Portable sensor dimensions (mm)

3.2 Interface

3.2.1 USB 2.0

Communication with the sensor and charging is provided by Mini-B USB connector. Drivers needs to be installed first for communication in OS Windows (see chapter Driver installation (page 9) for details).

The USB driver creates a Virtual Com Port (VCP) whenever sensor is connected. For communication with the sensor via VCP please use following setting:

- BaudRate: 115200 b/s
- Databits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

4. Wifi and web interface

To access the sensor using web browser, the Wi-Fi has to be either in AP mode or client mode (see chapter Settings (page 15) for details). When in AP mode, sensor creates own wireless network. Any device capable of connecting to wifi network (PC, mobile phone), can be used to connect to network of the sensor. When in Client mode, the sensor can connect to any available wireless network in the area. In both cases, if the second device is connected to same network, the web interface of sensor can be accessed by typing its IP address in the address bar of web browser. The ip address of sensor is shown either on main measuring screen or in wifi settings under Status option.

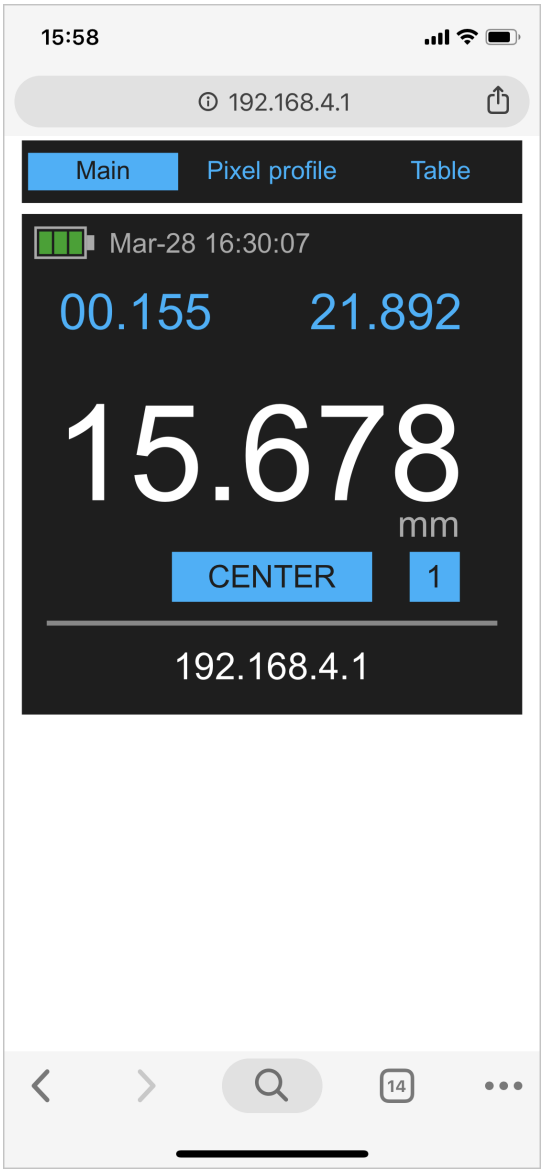
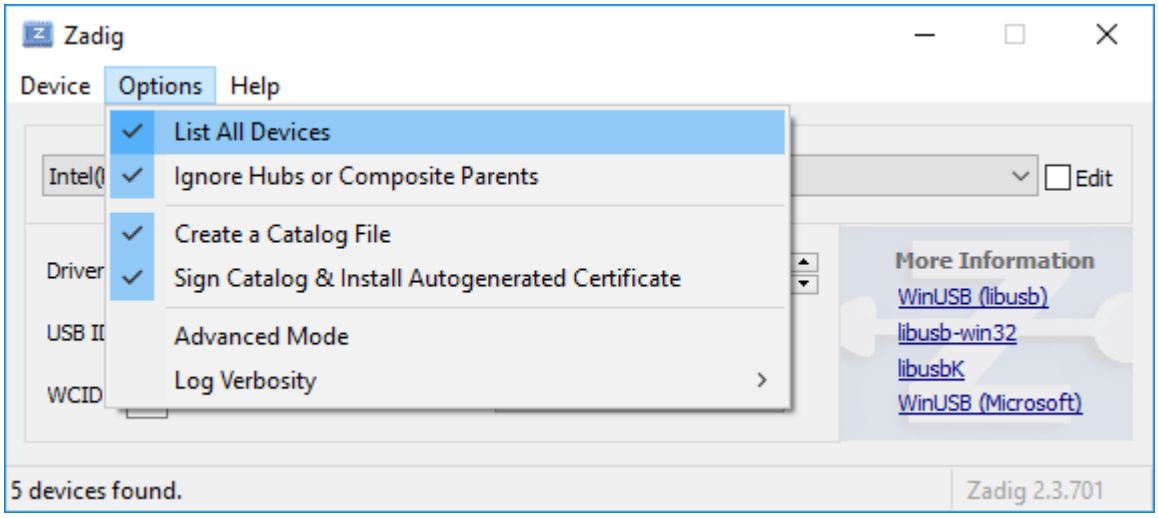


Image 2: Web interface on Iphone XS

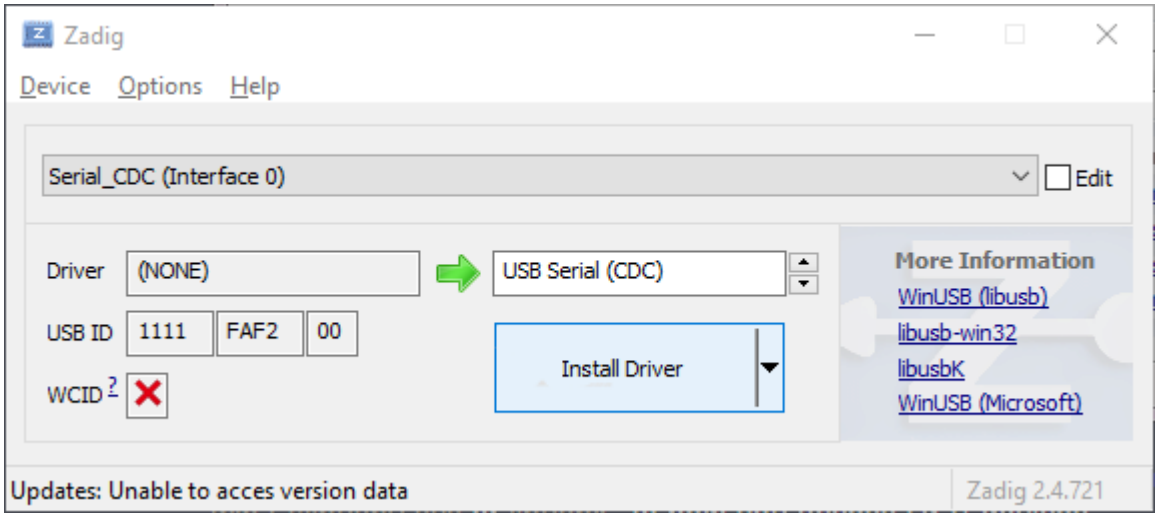
5. Driver installation

Driver has to be installed to communicate with sensor over USB. Complete following steps to install the driver:

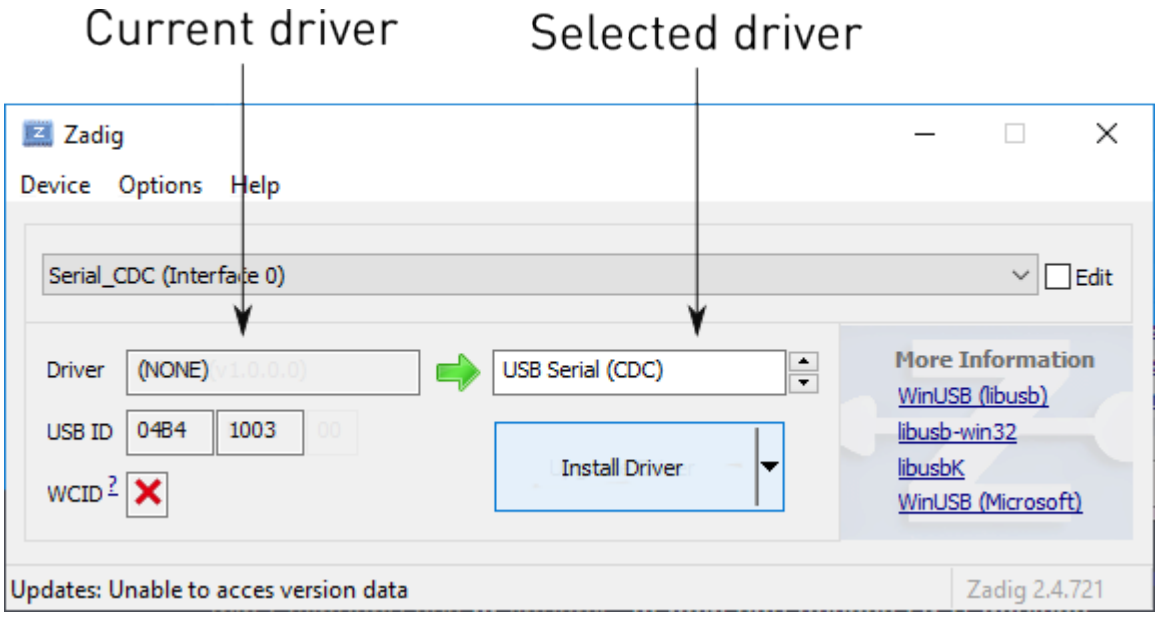
1. Download Zadig from zadig.akeo.ie or metralight.com
2. Run program
3. Check "List all devices" option in Options menu



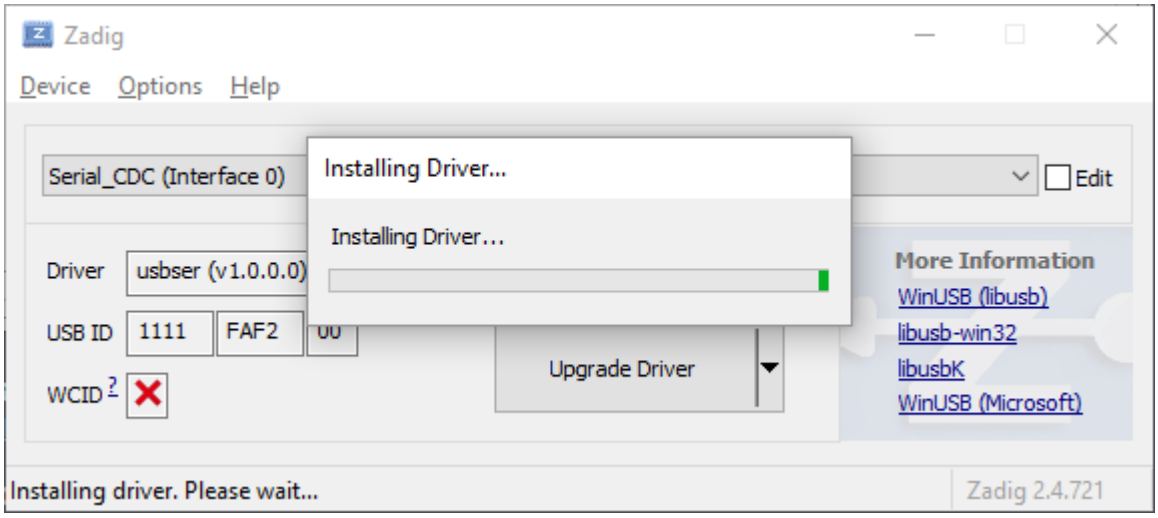
4. In devices list, select "Serial_CDC (Interface 0)"



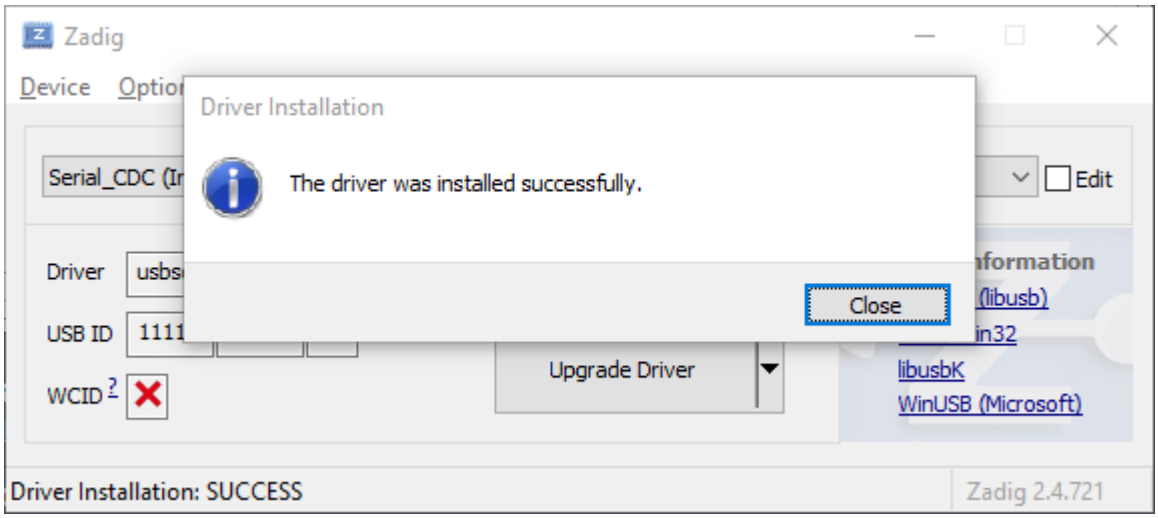
5. On left side, current driver is displayed. On right side in available drivers list, choose "USB Serial (CDC)"



6. Important! Make sure "Serial_CDC (Interface 0)" is selected in devices list and then press Install button to install USB Serial driver for Portable sensor



7. "The driver was installed succesfully" message is displayed


Zadig
Device
Driver Installation
The driver was installed successfully.
Close
Serial_CDC (In
Edit
Driver
USB ID
WCID
Upgrade Driver
libusbK
WinUSB (Microsoft)
Driver Installation: SUCCESS
Zadig 2.4.721

6. Measuring modes

Portable laser micrometer can measure edge position of an object (EDGE1, EDGE2 modes), diameter (DIA mode), center position (CENTER mode), gap between more objects (GAP mode) and edge position of solid object (SOLID mode). Other custom measuring modes. e.g. number of objects, vibration, etc. are available upon customer request. Measuring mode can be set via sensor buttons or from HOST PC via USB.

See appendix Measuring modes (page 25) for details.

7. Display screens

Display screen can be changed using LEFT/RIGHT arrows.

7.1 Table

Screen contains table with sampled values and the time stamp. Current value is displayed in the bottom row. SAVE button stores current values in the table. Using UP/DOWN arrows, specific saved value can be selected (triangle before the row indicates selected row) and deleted using RESTART button. Red font color indicates MIN and MAX values.

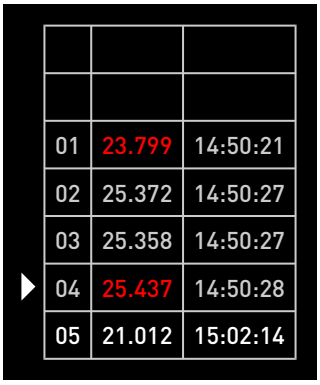


Image 2: Table screen

7.2 Measuring

Main screen contains:

- **Battery:** Indicates current battery level.
- **Charging status:** Displayed only when battery is charging.
- **Wifi status:** Displayed only when wifi is either in AP or client mode.
- **Min, Max:** Minimum and maximum measured values. RESTART button resets stored MIN&MAX.
- **Actual value:** Display currently measured value.
- **Units:** measuring units.
- **Mode:** Measuring mode. ENTER button changes the Mode.
- **Object-in status:** Displays number of detected objects in measuring zone
- **IP address:** Sensor's IP address when WiFi is on.

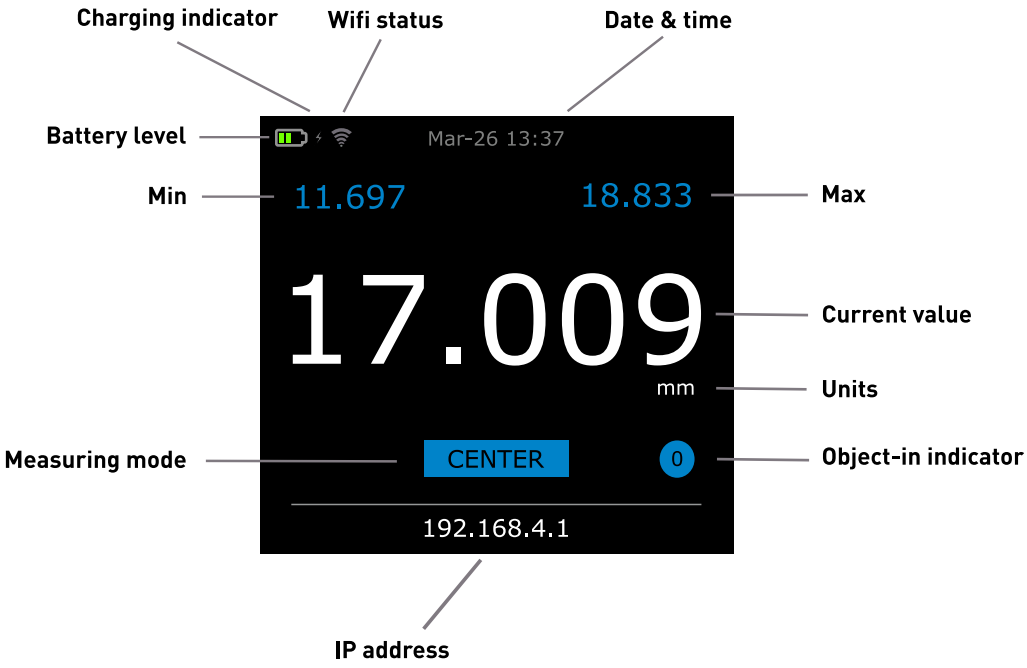


Image 3: Measuring screen

7.3 Pixel profile

Display sensor pixels profile and threshold.

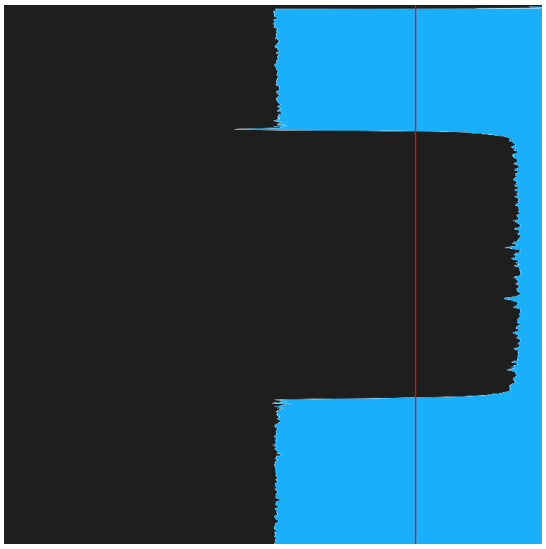


Image 4: Pixel profile and threshold

7.4 Settings

Sensor parameters settings screen:

- Mode - select measuring mode
- Average - select number of samples for value averaging
- Wi-Fi
    - WiFi - configures mode of operation:
        - On-client (connects to existing WiFi network)
        - On-AP (creates own network)
        - Off
    - SSID - list of available networks
    - AP name - configure network name
    - AP password - configure network password
    - AP channel - configure channel
    - Status - shows current status and IP address
- Date - Set date and time
- Normalize - performs user normalization
- Normalization - normalization type is selected:
    - user (normalization made using previous menu option or by command via USB)
    - default (factory)
- Units
    - mm
    - inch
- System info - system information: version, CPU temperature, etc.

8. Command set

All requests to the sensor are done as read/write of specific address in memory. The address and data of memory read/write specifies type of command and its parameters. Request are sent as request packets. Sensor responses by sending response packets. All values are encoded in Little-endian format (low byte first). Data are read in 16bit words - data request for 1 data will result into response message of one 16bit word value.

8.1 Request packet format

Request packet (8B)				
CMD (1B)	CHECKSUM (1B)	TAG (2B)	ADRESS (2B)	DATA / DATA_LEN (2B)

Table 2: Request packet format

- **CMD - specifies type of request, possible values:**
  - SYNC - 0x1 - special command type (set other fields to zero), sensor will stop all streams and reset buffers
  - WRITE - 0x2 - writes data on the specified address
  - READ - 0x3 - reads data from specified address, data contains number of values to read
  - SAMPLE - 0x4 - reads data repeatedly in frequency configured by fields Stream frequency divider and Stream samples count
- **CHECKSUM:** Sum of all request bytes modulo 256. Using checksum is optional - when zero is used, checksum is not checked in the sensor.
- **TAG:** Optional field to pair request with response using custom request identifier
- **ADRESS:** Address to read or write
- **DATA / DATA_LEN:** Data to write or number of values to read

8.2 Response packet format

Response packet (>=6B)				
Header (6B)				Data (optional)
RESPONSE_CODE (1B)	CHECKSUM (1B)	TAG (2B)	DATA_COUNT (2B)	DATA (optional) (DATA_COUNT × 2B)

Table 3: Response packet format

- **RESPONSE_CODE - possible values:**
    - 0x1 - OK - success response on request
    - 0xA – SAMPLE - success - sample data response
    - 0xB – LAST – success - last data of sample stream
    - 0x2 – BADARG - error - invalid data
    - 0x3 – BADADR - error- invalid address
    - 0x4 – RDONLY – error - read only address
    - 0x5 – TOOBIG – error - requested data length too big - overlaps memory region
- **CHECKSUM:** Always valid checksum. Sum of all header bytes modulo 256
- **TAG:** Optional field copied from request packet
- **DATA_COUNT:** number of values in data field
- **DATA:** DATA_COUNT × 2B of bytes

8.3 Memory map

Memory map - part 1				
Addr	**Size**	**Description**	**Read/ write**	**Note**
0x0000	word	Stream frequency divider	R/W	Possible values: 1 for 3kHz, 10 for 300Hz, 3000 for 1Hz
0x0001	word	Stream samples count	R/W	Write requested number of values for sample stream or 0 for infinite stream
0x0002-0x0008		RESERVED		
0x0009	word	Filtering in time	R/W	Averaging filter size
0x000A	word	Laser off	R/W	Possible values: 1 for sensor off, 0 for sensor ON (state is not saved in flash)
0x000B	word	Normalization	Write only	write 1 to do user normalization
0x000C	word	Save volatile to flash	Write only	Write 1 to save parameters to flash
0x000D	word	Measuring mode in GUI	Read only	Number of measuring mode in sensor GUI
0x000E	word	Write current measure to sampling table	Write only	Write 1 to save current data to sampling table
0x000F	word	Delete row from sampling table	Write only	Write table row index or 0 to delete all
0x0010	2B	RESERVED		
0x0011	2B	RESERVED		
0x0012	word	Normalization source	R/W	Write 1 to use user normalization, write 2 for factory normalization
0x0013	word	Turn sensor off	W	Write any value higher than zero to turn sensor off (only for fw version equal or higher than 2419)

Table 4: Sensor memory map - part 1

Memory map - part 2				
Addr	**Size**	**Description**	**Read/ write**	**Note**
0x0200	word	Firmware revision number	Read only	
0x0201	8B	Product name	Read only	
0x0205	word	PCB version	Read only	
0x1000	word	Measured value - Mode Edge 1	Read only	Value can be read independently on measuring mode selected in sensor
0x1001	word	Measured value - Mode Edge 2	Read only	Value can be read independently on measuring mode selected in sensor
0x1002	word	Measured value - Mode Diameter	Read only	Value can be read independently on measuring mode selected in sensor
0x1003	word	Measured value - Mode Gap	Read only	Value can be read independently on measuring mode selected in sensor
0x1004	word	Measured value - Mode Center	Read only	Value can be read independently on measuring mode selected in sensor
0x1005	word	Measured value - Mode Solid	Read only	Value can be read independently on measuring mode selected in sensor
0x1100	word	Number of intersections with threshold	Read only	Number higher than zero means object is in measurng area

Table 5: Sensor memory map - part 2

Memory map - part 3				
Addr	**Size**	**Description**	**Read/write**	**Note**
0x1200	word	History table element count	Read only	Number of rows in sampling table
0x1203-0x1205	6B	Sampling table element 1	Read only	Subpixel value (2B) + unix timestamp (4B)
0x1206-0x1208	6B	Sampling table Element 2	Read only	Subpixel value (2B) + unix timestamp (4B)
0x12XX-0x12XX	6B	Sampling table Element XX	Read only	Subpixel value (2B) + unix timestamp (4B)
0x2000-0x7FFF		RESERVED	Read only	
0x8000	2092 × word	Raw profile	Read only	
0x9000	2040 × word	Profile normalized	Read only	
0xa000	2040 × word	Profile normalized filtered	Read only	Each value is sum of 8 pixels

Table 6: Sensor memory map - part 3

8.4 Measured values format

Values measured in any measuring mode are returned in pixels. To get values in milimeters, multiply returned values by pixel size and divide by 1000.

Pixel size = 0.4375 µm.

> Example calculation:
> Diameter value from sensor = 11619
> Diameter value in mm = (11627 * 0.4375) / 1000 = 5.086 mm

8.5 Examples

8.5.1 Read measured value

Example 1 - read diameter

PC request: [0x3, 0x1c, 0x6, 0x0, 0x2, 0x10, 0x1, 0x0]
CMD = 0x3 = READ
CHECKSUM = 0x1c = sum of header bytes = 0x3 + 0x6 + 0x2 + 0x10 + 0x1
TAG (optional) = 0x6
ADDRESS = 0x1002 LEN = 0x1

Sensor response: [0x1, 0x8, 0x6, 0x0, 0x1, 0x0, 0xfb, 0x2d]
RESPONSE_CODE = 0x1 = OK
CHECKSUM = 0x8 = sum of header bytes = 0x1 + 0x6 + 0x1
TAG (from request) = 0x6
DATA_COUNT = 0x1
DATA = 0x2dfb = 11771 px = 5.15 mm = measured diameter

Example 2 - read values of all modes at once

PC request: [0x3, 0x1d, 0x4, 0x0, 0x0, 0x10, 0x6, 0x0]
CMD = 0x3 = READ
CHECKSUM = 0x1d = sum of header bytes = 0x3 + 0x4 + 0x10 + 0x6
TAG (optional) = 0x4
ADDRESS = 0x1000 LEN = 0x6

Sensor response: [0x1, 0xb, 0x4, 0x0, 0x6, 0x0, 0xbd, 0x8b, 0x97, 0x5d, 0x25, 0x2e, 0x0, 0x0, 0xaa, 0x74, 0x0, 0x0]
RESPONSE_CODE = 0x1 = OK
CHECKSUM = 0xb = sum of header bytes = 0x1 + 0x4 + 0x6
TAG (from request) = 0x4
DATA_COUNT = 0x6

DATA_1 = 0x8bbd = 35773 px = 15.65 mm = measured edge 1
DATA_2 = 0x5d97 = 23959 px = 10.482 mm = measured edge 2
DATA_3 = 0x2e25 = 11813 px = 5.168 mm = measured diameter
DATA_4 = 0x0
DATA_5 = 0x74aa = 29866 px = 13.066 mm = measured center
DATA_6 = 0x0

8.5.2 User normalization

Example - perform user normalization

PC request: [0x2, 0xf, 0x1, 0x0, 0xb, 0x0, 0x1, 0x0]
CMD = 0x2 = WRITE
CHECKSUM = 0xf = sum of header bytes = 0x2 + 0x1 + 0xb + 0x1
TAG (optional) = 0x1
ADDRESS = 0xb DATA = 0x1

Sensor response: [0x1, 0x2, 0x1, 0x0, 0x0, 0x0]
RESPONSE_CODE = 0x1 = OK
CHECKSUM = 0x2 = sum of header bytes = 0x1 + 0x1
TAG (from request) = 0x1
DATA_COUNT = 0x0
DATA = none

Example - select user normalization type

PC request: [0x2, 0x17, 0x2, 0x0, 0x12, 0x0, 0x1, 0x0]
CMD = 0x2 = WRITE
CHECKSUM = 0x17 = sum of header bytes = 0x2 + 0x2 + 0x12 + 0x1
TAG (optional) = 0x2
ADDRESS = 0x12 DATA = 0x1

Sensor response: [0x1, 0x3, 0x2, 0x0, 0x0, 0x0]
RESPONSE_CODE = 0x1 = OK
CHECKSUM = 0x3 = sum of header bytes = 0x1 + 0x2
TAG (from request) = 0x2
DATA_COUNT = 0x0
DATA = none

9. Installation

USE APPROPRIATE MOUNTING SCREWS (SEE MECHANICAL DRAWING)
AVOID ESPECIALLY DIRECT SUNLIGHT AND ALL OTHER LIGHT SOURCES WITH WAVELENGTH CLOSE TO 670nm (see Optical filter transmittance on figure below).
ALWAYS KEEP OPTICAL WINDOWS CLEAN, FREE FROM DUST AND FINGERPRINTS, AVOID SCRATCHES ON THE OPTICAL WINDOWS.

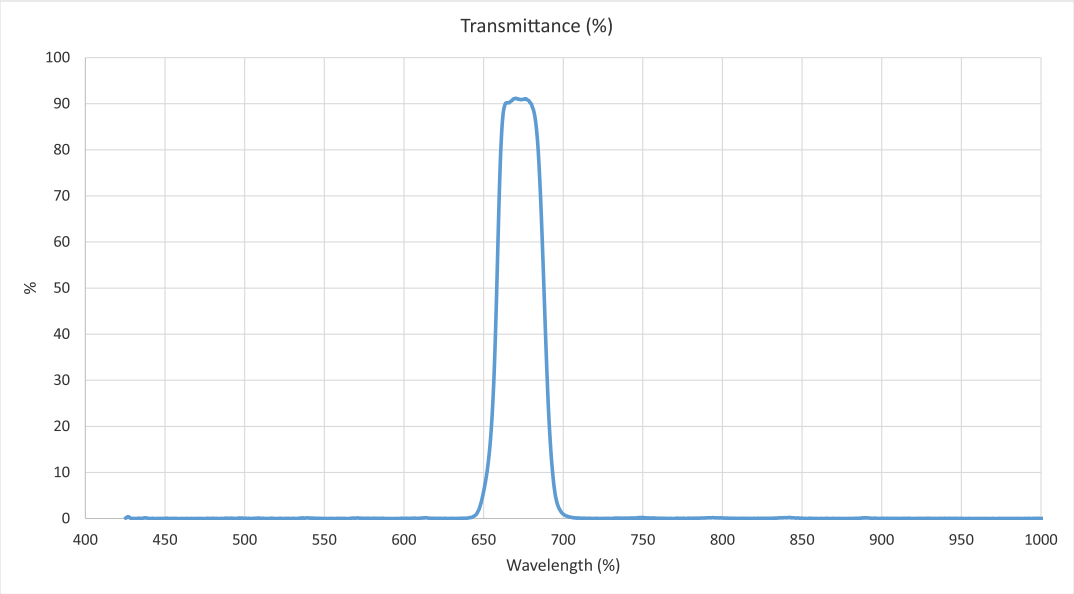


Image 5: Ambient light optical filter transmittance

Laser Safety

Portable sensor is classified as Class 1 Laser device. A Class 1 laser is safe for all conditions of use.

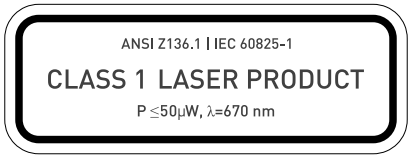


Image 6: Class 1 Laser safety label

10. Package, warranty, contacts

Package components:

- 1x Portable laser micrometer
- Transport plastic case
- USB cable

Warranty
METRALIGHT provides a ONE YEAR manufacturer's limited warranty against defective materials and workmanship. Please do not attempt to open the unit, as this will void all warranties.

Contacts
METRALIGHT, Inc.
533 Airport Blvd. Suite # 400
Burlingame, CA 94010
phone: (650) 581 3088
fax: (650) 808 9830
email: sales@metralight.com
technical support: support@metralight.com
web site: http://www.metralight.com

Appendix A. Measuring modes

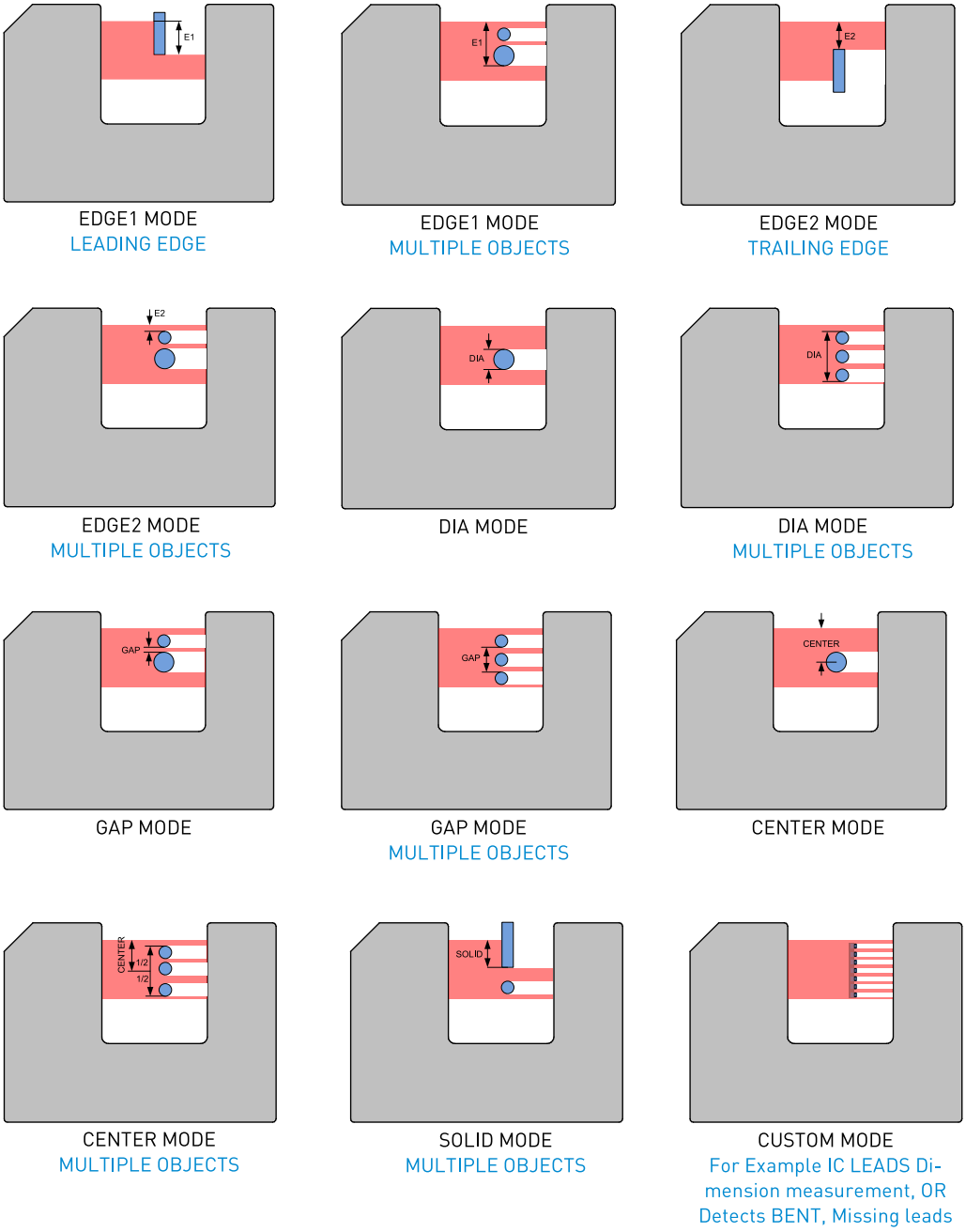


Image 7: Measuring modes