MX2 LASER MICROMETER

Features

Compact size

No Separate External Controllers

Measurement Range: 0 to 28mm

Sub-micron Resolution of 0.4375 µm

Non-Linearity <5µm

Repeatability <3µm

Very Fast 2500 measurements/s

RS232 or Analog or USB or Ethernet

Laser diode 670nm Class I

Robust aluminum body with locking connectors

Applications

Measurement of various types of materials in a wide range of industries (metal ,plastic, glass, ceramics, wood and others)

Measurement of Edge, Gap, Diameter, Position, Thickness, Height, Profile, and Vibration of objects.

Diameter measurement of tube and pipe (in process or sampling)

Precise and fast online/offline non-contact measurement of objects.

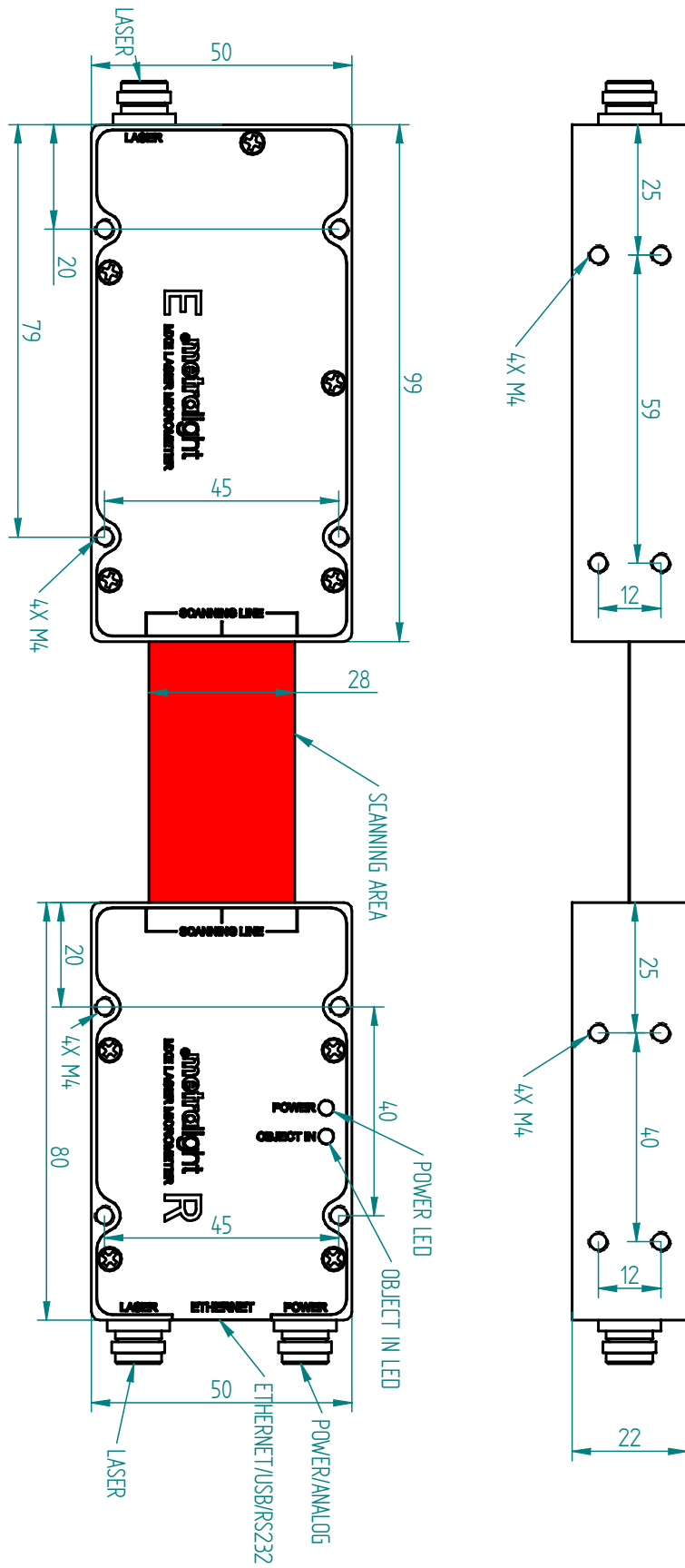Semiconductor atmospheric/vacuum prealigner
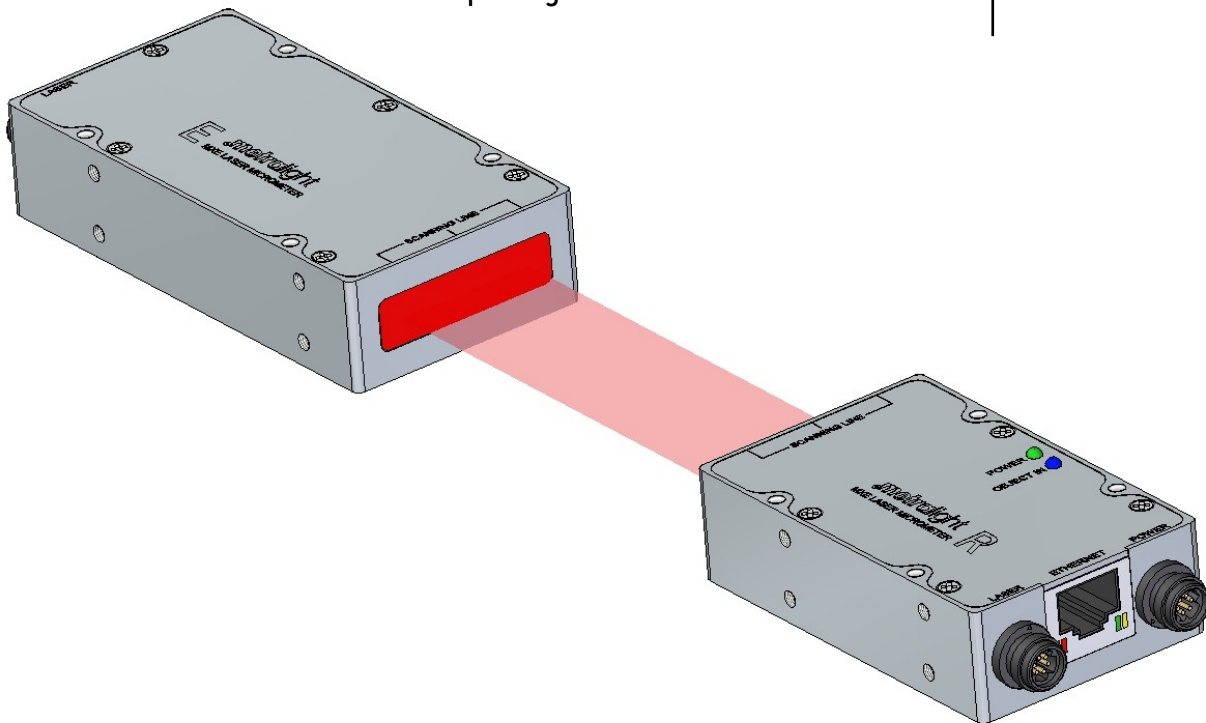
Options

| Parallel, cable/box (easy PLC integration) | SPI, other serial interface |
| Custom Modes: Centering, MIN/MAX measurement, Thickness, Range of Tolerances, Runout, object filtering, eccentricity | Integrated OLED display | Custom Sensor Size and Package available |
Custom Applications |

LASER

50

20

79

99

E

45

SCANNING LINE

28

SCANNING AREA

4X M4

25

59

12

4X M4

SCANNING LINE

20

4X M4

80

R

45

POWER

OBJECT IN

40

POWER LED

OBJECT IN LED

LASER

ETHERNET

POWER

50

LASER

ETHERNET/USB/RS232

POWER/ANALOG

25

40

12

4X M4

22

For detailed dimensions, please download 2D drawing or 3D model from http://www.metralight.com or email at: info@metralight.com

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3. SPECIFICATION | MX2 LASER MICROMETER

Measurement

Sensor Range	140µm (0.006 in) up to 28 mm (1.1 in)
Resolution (Pixel size)	0.4375 µm
Repeatability	3 µm (Edge position, calibrated distance) *
Response Time	0.391 ms
Non-Linearity	<5 µm (Edge position, calibrated distance) *
Measuring Modes	Edge1, Edge2, Diameter, Gap, Center, Solid
Custom Modes	*Call Metralight for additional custom modes*

Interface

Indicators	Green LED = Sensor ON ; Blue LED = Object Present
I/O connectors	DB9, DB25, DB37, MINI-B USB, RJ45 or Custom
Interface (I/O)	Serial (RS232)/Analog, Parallel binary (TTL), USB, Ethernet
Power supply	12 to 24 VDC / 80mA (200mA for MXE sensor)

General

Detection Method	670nm Class I Laser Diode through-beam with CCD
Overall Dimension	99 x 50 x 22 mm (3.9" x 1.9" x 0.9") | 80 x 50 x 22 mm (3.15" x 1.9" x 0.9")
Mounting holes	M4 (8 positions) each box
Weight	236g (8oz)
Operating Temp.	0ºC to 50ºC (32ºF to 122ºF)
Storage Temp.	-20ºC to 70ºC (-4ºF to 158ºF)

*) If mounted on Rail.

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MX2 Laser Micrometer uses a parallel beam to measure position or size of objects. An object is simply placed in the detection line, and the measured edge (in case of diameter - both edges) must be in the active area.

The position and size of the shadow is measured via the CCD detector. Gap and Center can also be measured (see picture bellow).
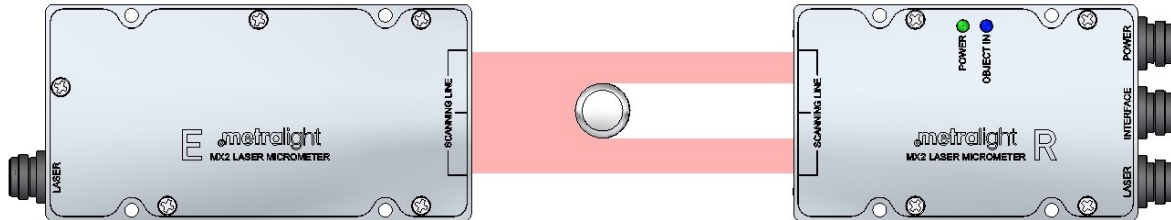

Figure: Parallel beam and shadow of an object

The Receiver and the Emitter part must be aligned properly. Since the emitted light is wider than the CCD detector line, alignment is simple and easy.

If the requirements of the application are for the highest accuracy, it is recommended that the unit be mounted on a rail from the factory.
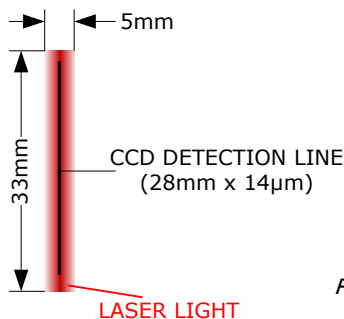

Figure: Size of emitted light and CCD detection line (notice intensity change towards sides)

Sensor processes CCD data and outputs measurement in a binary pixel format representing position/size of object(s). Sensor processing can also be customized upon customer request, to include maximum/minimum, average values, etc.

MX2 Laser Micrometer has RS232/Analog or USB/Analog or Ethernet output. For industrial integration with PLC Metralight provides controller box (with DIN rail mount) for conversion of RS232 signal into parallel or analog.
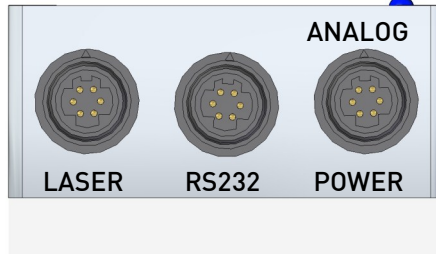

Figure: MX2 RS232, Analog interface

MX2 RS232 sensor comes with 3 cables with circular connector on one/both ends (HIROSE HR30). One has circular latching connectors on both ends and is used as LASER Interconnect between Receiver and Emitter of MX sensor. Second cable has DB9 Female connector (used for RS232). This can be connected directly to PC. Third cable, used for powering of sensor has 6 pigtail wires on end. Connect RED to +12 to 24VDC. Connect BLACK to GND. Other wires can be used for Analog output.

Note: If Analog interface is not used leave GREEN and BROWN wire unconnected.

3.1 RS232

Pinout
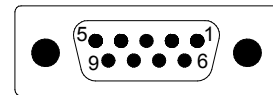| Pin 1: NC | Pin 2: TXD | Pin 3: RXD | Pin 4: NC | Pin 5: GND |
| Pin 6: NC | Pin 7: NC | Pin 8: NC | Pin 9: NC |

Figure: DB9 Female connector (from sensor)

COM PORT Settings
| BaudRate: 115200 b/s | Databits: 8 | Parity: None | Stop Bits: 1 | Flow Control: None |

For connection between sensor and host (e.g. PC) use only straight wired extension cable DB9M to DB9FM (not crossed or null modem).

3.2 Analog

For Analog interface connect POWER/ANALOG cable (cable with pigtail wires on the end) and LASER Interconnect cable (cable with circular connectors on both ends). See figure bellow for connection.
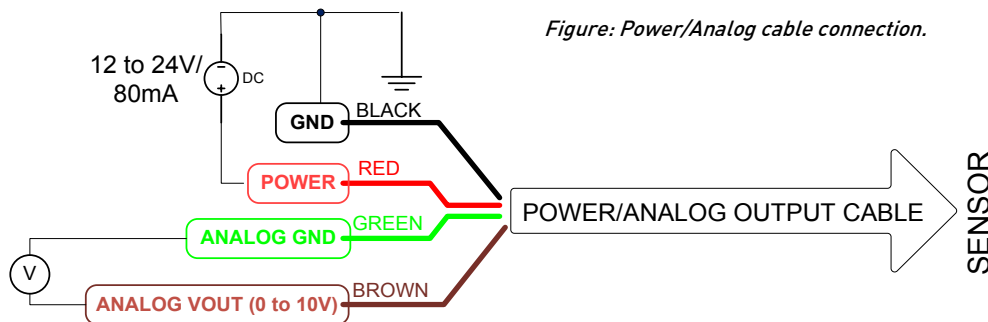

Figure: Power/Analog cable connection.

3.3 USB

MX2 USB Laser Micrometer uses MINI-B type USB connector. Sensor is powered from USB port. After driver installation Virtual Com Port (VCP) is created, therefore communication with the sensor is exactly the same as with RS232 interface (see Command Set in following chapter).
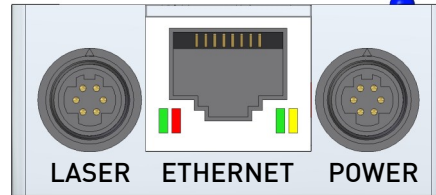
Figure: MX2 USB 2.0 and Analog interface

Figure: Ethernet interface

3.4 Ethernet

MX2 Ethernet Laser Micrometer uses RJ45 connector. Sensor is powered via POWER cable (12V to 24V (connect RED pigtail wire on 12 to 24V and BLACK wire on GND) or alternatively thru RJ45 connector. Use LASER interconnect cable to connect Emitter with Receiver.
Sensor allows to communicate via TCP protocol. PING command (ICMP protocol) can be used for sensor detection. MX2 Ethernet sensor has RESET IP SWITCH. Default address from factory is set to 192.168.0.16, port 1024. For reset of IP address press and hold the switch during power on of sensor (reset address: 192.168.0.15, port 1024). This reset IP is not stored in EEPROM, user need to change IP to desired value via TCP commands in order to store is in EEPROM.
Recommended utilities:
I/O Ninja terminal: http:tibbo.com/ninja/   simple, powerful terminal
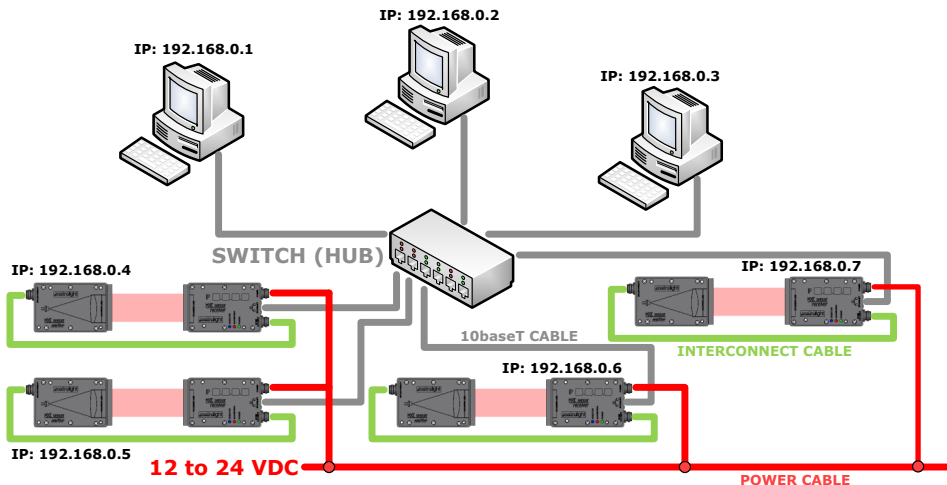
Figure: Example of 4 sensors connected on local network

Use following Command Set when using RS232, USB and Ethernet interface.

For the MX2 Laser Micrometer there are 3 basic commands: DATA, STREAM and MODE. There is always 1 byte command being sent from PC to micrometer. Sensor's response varies in length for different commands. For DATA command there are 3 bytes for each data request (or multiple of three if more datas are requested). STREAM START command triggers sensor to send 3-byte length data packets until STREAM STOP is issued. There is no response for STREAM STOP command. MODE command has 1 byte response (echoes back MODE command).
Command's byte high nibble determines command type and low nibble represents parameter of this command:
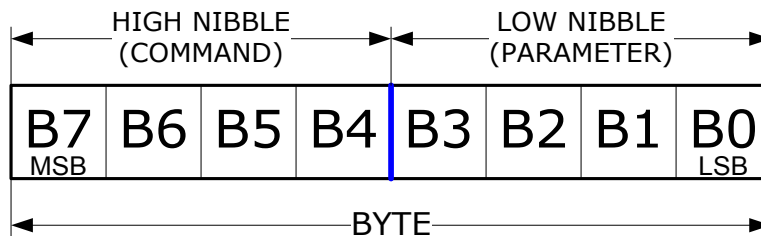

Figure: Command with parameter structure

When data are requested (DATA command or STREAM START), micrometer responds with 3 byte-length packets (2 bytes for data and 1 info byte).

M2,M1,M0…. Mode bits
#AV…………. AVERAGE NOT VALID (if 0 then data average valid)
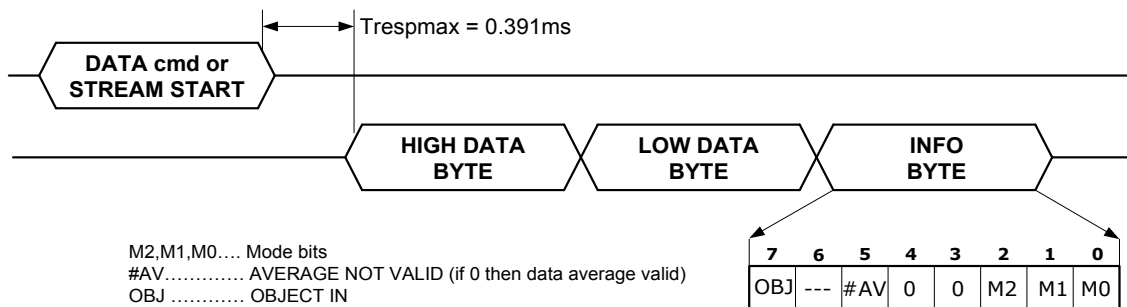OBJ ………… OBJECT IN

Figure: 1 Data Packet (3 bytes)

If more data is requested then response is multiplier of 3 bytes. E.g. PC requests 4 data (via DATA command) then micrometer returns 12 bytes. If STREAM START command is issued then Micrometer continuously sends 3 byte packets until STREAM STOP command is sent. Typical PC cannot read data in full speed mode (2500 readings/s) when 1 data only is requested and sensor triggered again. For high speed applications more data should be requested per one command (DATA command with parameter for more than 1 data or STREAM command). This method allows constant data sampling frequency. This constant frequency is also maximum data frequency.

4.1 DATA command

HIGH NIBBLE (COMMAND)				LOW NIBBLE (PARAMETER)			
0	0	0	1	z	z	z	z
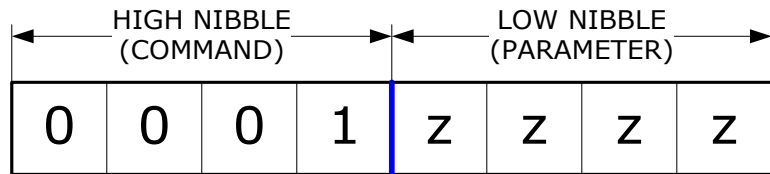
Parameter: **zzzz** represent number of data (2^{zzzz}) being requested
Response: 2^{zzzz}{data}, where {data} is 3 byte-length packet response
Response length (bytes): $3 * 2^{zzzz}$

Example 1: This command serves as basic Get Data command. Let's say we need to read size of object, just once:

PC sends: 00010000 (0x10) | Micrometer response: 10100100 10110111 10000010

Description: First two (data) bytes = 10100100 10110111= 0xA4B7=42167, this is diameter in pixels.
1 pixel measures 0.4375µm, then diameter = 42167 * 0.4375 = 18.448mm

Last (info) byte =10000010. Bit OBJ=1 (object present), #AV=0 (average valid), MODE=010 (Diameter mode)

Example 2: User request 16 continuous datas:
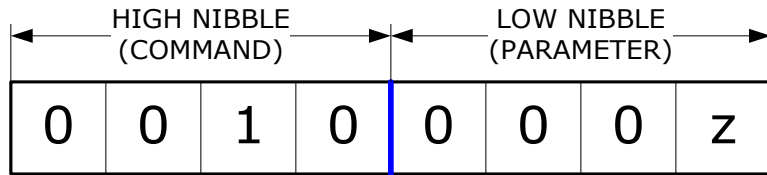
PC sends: 00010100 (0x14) | Micrometer response: Sixteen 3 bytes packets

4.2 STREAM command

HIGH NIBBLE (COMMAND)				LOW NIBBLE (PARAMETER)			
0	0	1	0	0	0	0	z

Parameter: **z=1 for STREAM START, z=0 for STREAM STOP**
Response: {data}{data$_{n+1}$}{data$_{n+2}$}{data$_{n+3}$}{data$_{n+..}$}, where {data} is 3 byte-length packet response
Response length (bytes): finite number (multiplier of 3) starting with STREAM START and ends with STREAM STOP.
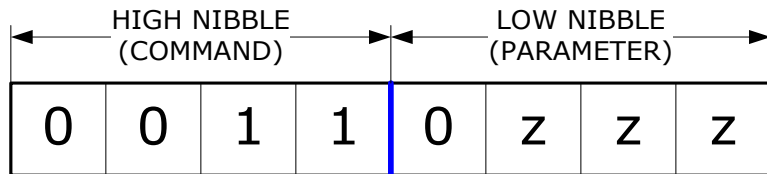
Example 1: Start of data stream.

PC sends: 00100001 (0x21)
Micrometer response: {data}{data$_{n+1}$}{data$_{n+2}$}{data$_{n+3}$}{data$_{n+}$}...,

Example 2: Stop of data stream

PC sends: 00100000 (0x20) | Micrometer response: No response

4.3 MODE command

HIGH NIBBLE (COMMAND)				LOW NIBBLE (PARAMETER)			
0	0	1	1	0	z	z	z

Parameter: **zzz=000 to 111** (see mode table and MODES DEFINITION)
Response: echoes back sent byte
Response length (bytes): 1

Example 1: Set Diameter Mode

PC sends: 00110010 (0x32)
Micrometer response: 00110010 (0x32)

zzz	000b	001b	010b	011b	100b	101b	110b	111b
Mode	Edge 1	Edge 2	Dia	Gap	Center	Solid Edge	Custom	Custom

Figure: Mode table

4.4 UNLOCK command

command: FE F1 F9 E0 | response: E0

Unlock command is issued once after Power-Up. It enabled some extra commands (e.g. READ RAW DATA command)

4.5 READ RAW DATA command

command: D0 | response: 2090 bytes
READ RAW DATA command read dumps raw image sensor intensity profile, see figure bellow. Unlock command has to be issued before.
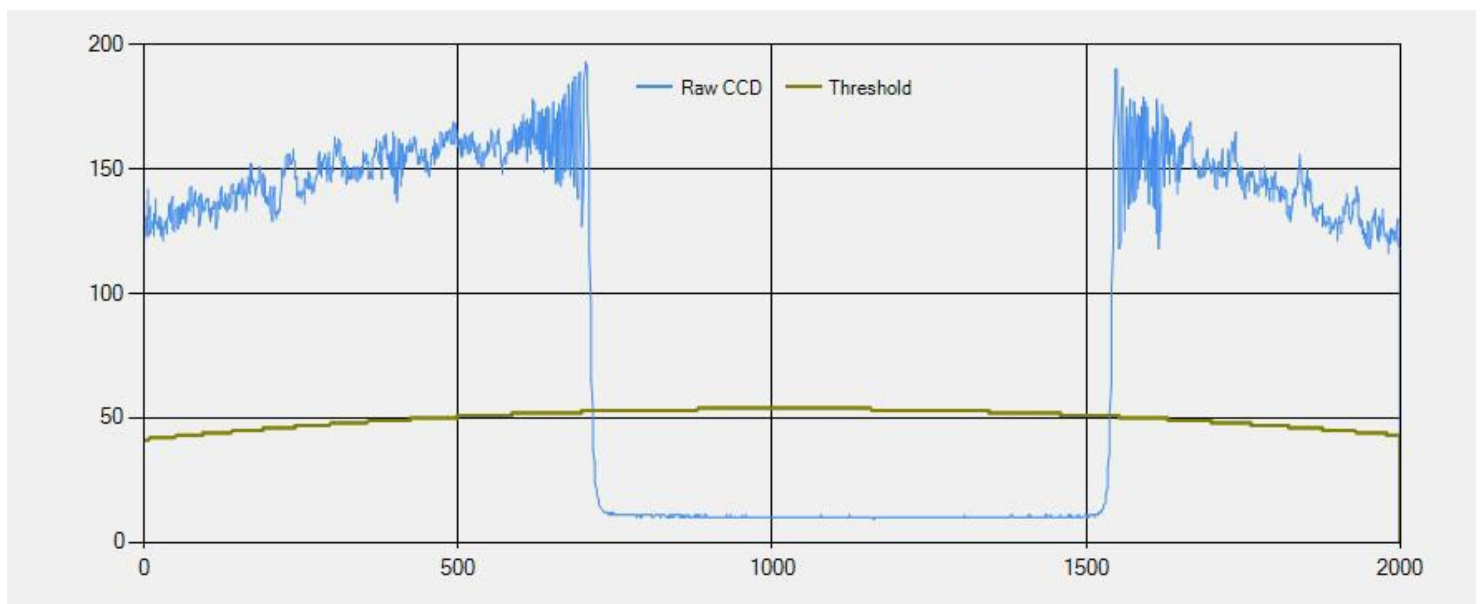

Figure: Intensity profile and threshold

4.5 READ THRESHOLD command

command: D1 | response: 2090 bytes
READ THRESHOLD command read threshold profile from EEPROM, see figure above. Unlock command has to be issued before.

Code example RS232 or USB interface (Microsoft VB.NET)

```vbnet
Dim buffer(0) As Byte = 16              '1 data command in Byte format
Dim Value As Single                     'Measured value in µm
Dim ObjectIn As Boolean                      'Object in
SerialPort.ReadExisting()               'Clear buffer
SerialPort.Write(buffer, 0, 1)          'Writes data command
Value = 0.4375*(256 * SerialPort.ReadByte() + SerialPort.ReadByte()) 'Reads high and low byte
If SerialPort.ReadByte() > 127 Then  ObjectIn = True Else ObjectIn = False  'Checks Object  and set
```

Code example ETHERNET interface (Microsoft VB.NET)

```vbnet
Dim tcpC1 As TcpClient
Dim stream1 As NetworkStream
Dim out_buffer(4) As Byte     'command string
Dim bytes As Int32
Dim rdata = New [Byte](2094) {}

tcpC1 = New TcpClient()
stream1 = tcpC1.GetStream()
out_buffer=&h10       'single data command
stream1.Write(out_buffer, 0, 1)

'wait some time here and then..

If tcpC1.Available = 3 Then
  bytes = stream1.Read(rdata, 0, rdata.Length)
  myval1 = ((256 * rdata(0)) + rdata(1)) * (14/32)       'result in µm
tcpC1.Close()
```

5. SAMPLE APPLICATION | MX2 LASER MICROMETER

Metralight provides sample application (MX_Terminal, see below), this is a demonstration application which reads and display/save data (and export to Excel). Source code is included for custom modification. Please contact Metralight for any SW modification/development. Metralight provides a complete solution HW+SW and mechanical.


Figure: MicroStudio SW

- USE APPROPRIATE MOUNTING SCREWS (SEE MECHANICAL DRAWING)

- AVOID 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.

- APPLY CORRECT VOLTAGE - SEE ELECTRICAL SPECIFICATION
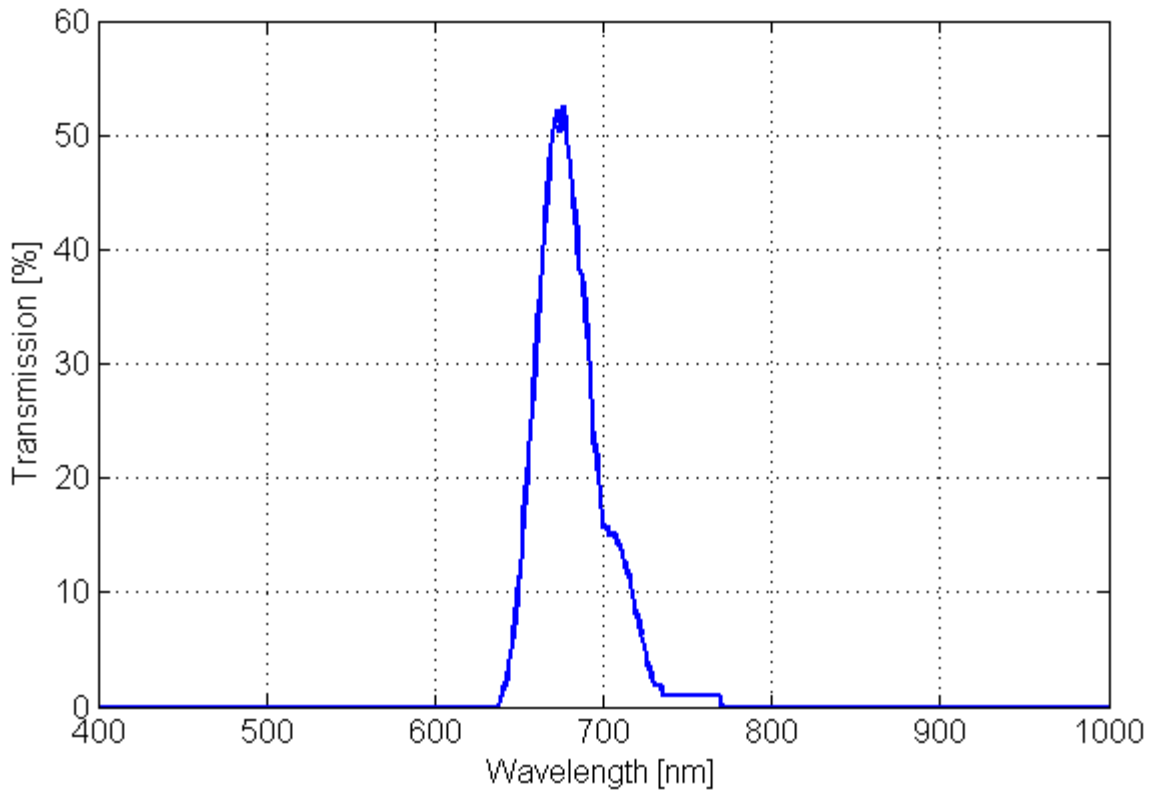
Figure: Ambient light optical filter

5. PACKAGE, WARRANTY | MX2 LASER MICROMETER

Package components

· Sensor units: 1x Laser light source and 1x Receiver
· Interconnect cable
· Power/Analog cable
· RS232 cable (some units)
· USB cable (some units)
· RJ45 Ethernet cable (some units)
· Mounting rail: As an option

War ranty

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.
1670 S. Amphlett Blvd., Unit # 214-M
Mailstop # 1008
San Mateo, CA 94402
phone: (650) 581 3088
fax: (650) 808 9830
email: sales@metralight.com
technical support: support@metralight.com
web site: http://www.metralight.com
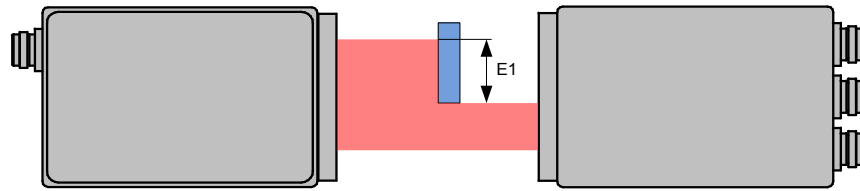
Figure: **EDGE1 MODE**, LEADING EDGE
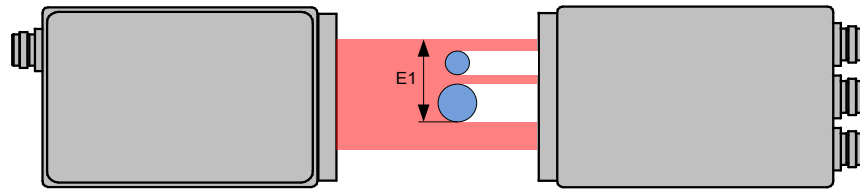
Figure: **EDGE1 MODE**, MULTIPLE OBJECTS
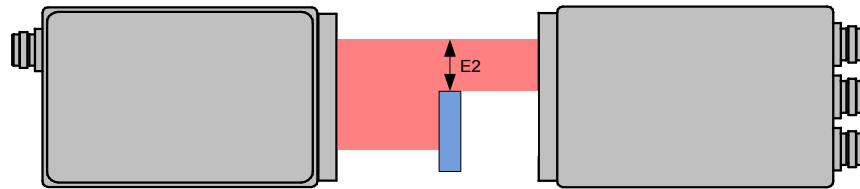
Figure: **EDGE2 MODE**, TRAILING EDGE
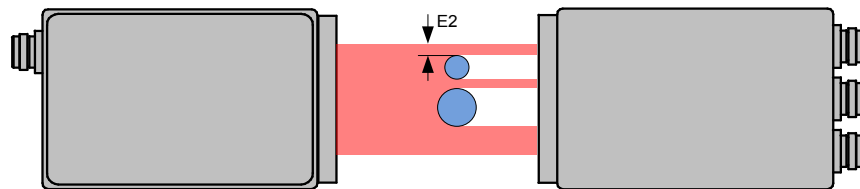
Figure: **EDGE2 MODE**, MULTIPLE OBJECTS
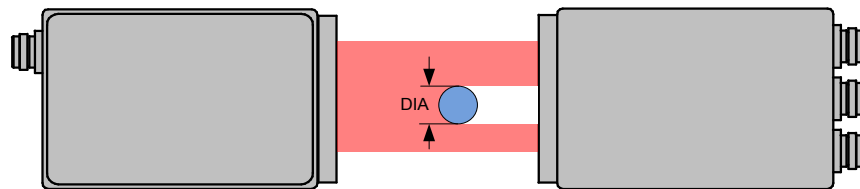
Figure: **DIA MODE**
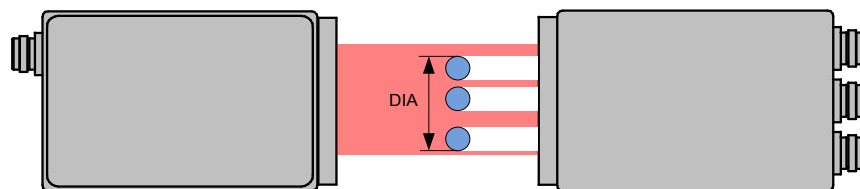
Figure: **DIA MODE**, MULTIPLE OBJECTS
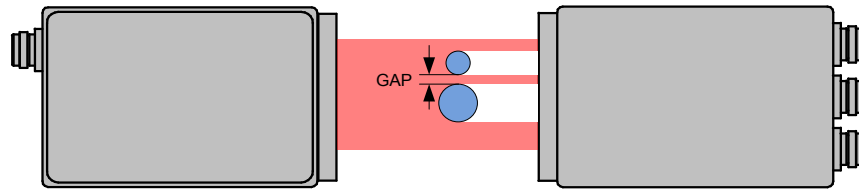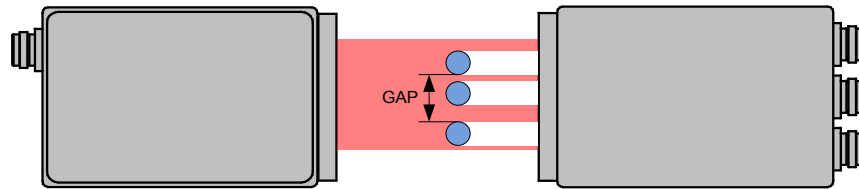
Figure: **GAP MODE**

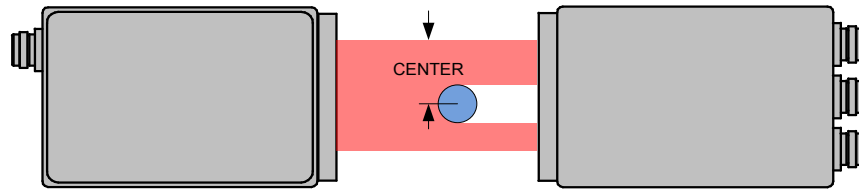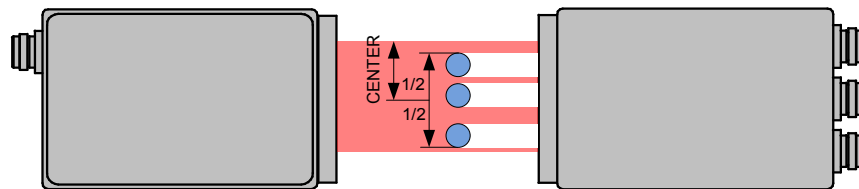*Figure:* **GAP MODE,** MULTIPLE OBJECTS

Figure: **CENTER MODE**

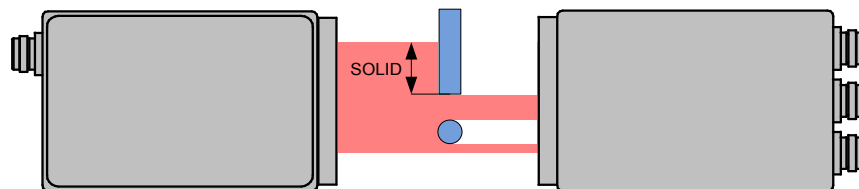*Figure:* **CENTER MODE,** MULTIPLE OBJECTS
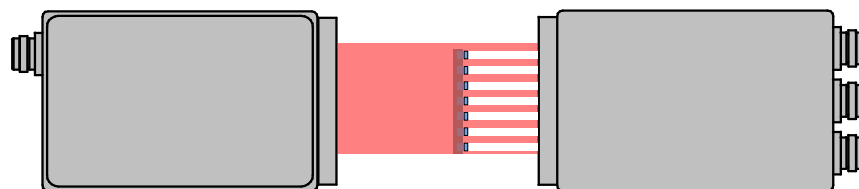

Figure: **SOLID MODE,** MULTIPLE OBJECTS

Figure: **CUSTOM MODE,** For Example IC LEADS Dimension measurement OR Detects BENT Leads or Missing Leads.