MTI Instruments Technical Manual 7001-0006
Revision 1.3 – October 31, 2013

Microtrak™ 3
Laser Triangulation Sensor

Users Manual

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REVISION HISTORY

Rev 1.0 ..... Release

Rev 1.1 ..... ECN #3787 Part # change; (was 7000-9063).

Rev 1.2 ..... ECN #3847 Change cable length

Rev 1.3 ..... ECN #4138 Add choking hazard warning label to page iv for CE

WARRANTY

Seller warrants to the Purchaser that equipment to be delivered hereunder which is of Seller's own manufacture will be free from defects in material or workmanship and will be of the kind and quality designed or specified in the contract. Any parts of the equipment which have been purchased by Seller are warranted only to the extent of the original manufacturer's warranty.

This warranty shall apply only to defects appearing within 1 year from the date of shipment by Seller. If the equipment delivered hereunder does not meet the above warranty, and if the Purchaser promptly notifies Seller, Seller shall thereupon correct any defect, including nonconformance with the specifications, either, at its option, by repairing any defective or damaged parts of the equipment, or by making available at Seller's plant necessary repaired or replacement parts. No allowance will be made for repairs or alterations made by others without Seller's written consent or approval. Seller assumes no responsibility for damage caused by improper installation or by operation in violation of its rated operating condition, intentional or otherwise, or by improper handling or maintenance. The liability of Seller under this warranty (except as to title), or for any loss or damage to the equipment, whether the claim is based on contract or negligence, shall not in any case exceed the cost of correcting defects in the equipment as herein provided and upon the expiration of the warranty period of all such a liability shall terminate. The foregoing shall constitute the exclusive remedy of the purchaser and the exclusive liability of the Seller.

The foregoing warranty is exclusive and in lieu of all warranties, whether written, oral, implied or statutory (except as to title). There are no warranties which extend beyond those expressly stated in this contract.

FCC NOTICE

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instruction manual, may cause interference with radio and television reception. This equipment has been designed as a Class A digital device of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Relocate the instrument with respect to the other device.
- Plug the instrument into a different outlet so that the instrument and the other device are on different branch circuits.

If necessary, consult a representative of MTI Instruments. You may find the following booklet helpful: *FCC Interference Handbook*, 1986, available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00450-7.

FDA NOTICE

This product complies with FDA CFR Title 21 Parts 1040.10 and 1040.11 excepting for variations relevant to FDA Laser Notice No. 50 (June 24, 2007).

IEC NOTICE

This product complies with IEC 60825-1:2007.

Information in this manual is subject to change without notice.

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SAFETY WARNINGS

WARNING: DO NOT STARE DIRECTLY INTO THE BEAM
This product emits laser radiation. Do not stare directly into the beam. Do not stare at reflections of the beam.

WARNING: DO NOT USE TO PROTECT THE HUMAN BODY
This device is not intended to be used in applications or systems where it will directly or indirectly function to protect the human body.

WARNING: DO NOT USE IN EXPLOSIVE ENVIRONMENTS
Do not use this product in environments containing flammable liquids, flammable gases, or flammable particulate matter

WARNING: DO OPEN OR MODIFY THE LASER HEAD
Laser radiation levels inside the head can exceed the rated levels outside of the head. Modification of the laser head may expose users to unsafe laser radiation levels beyond the rated levels of the head. There are no user serviceable parts inside the laser head.

WARNING: CHOKING HAZARD
When improperly mounted, the cable for this product can present a strangulation hazard. Route cable in a manner that avoids excessive free slack or presents free disconnect at the connector when tug is applied.

Warning Symbol Definitions

 Laser Aperture.

 Electrical Shock/Electrocution Hazard.

Warning Label Explanations

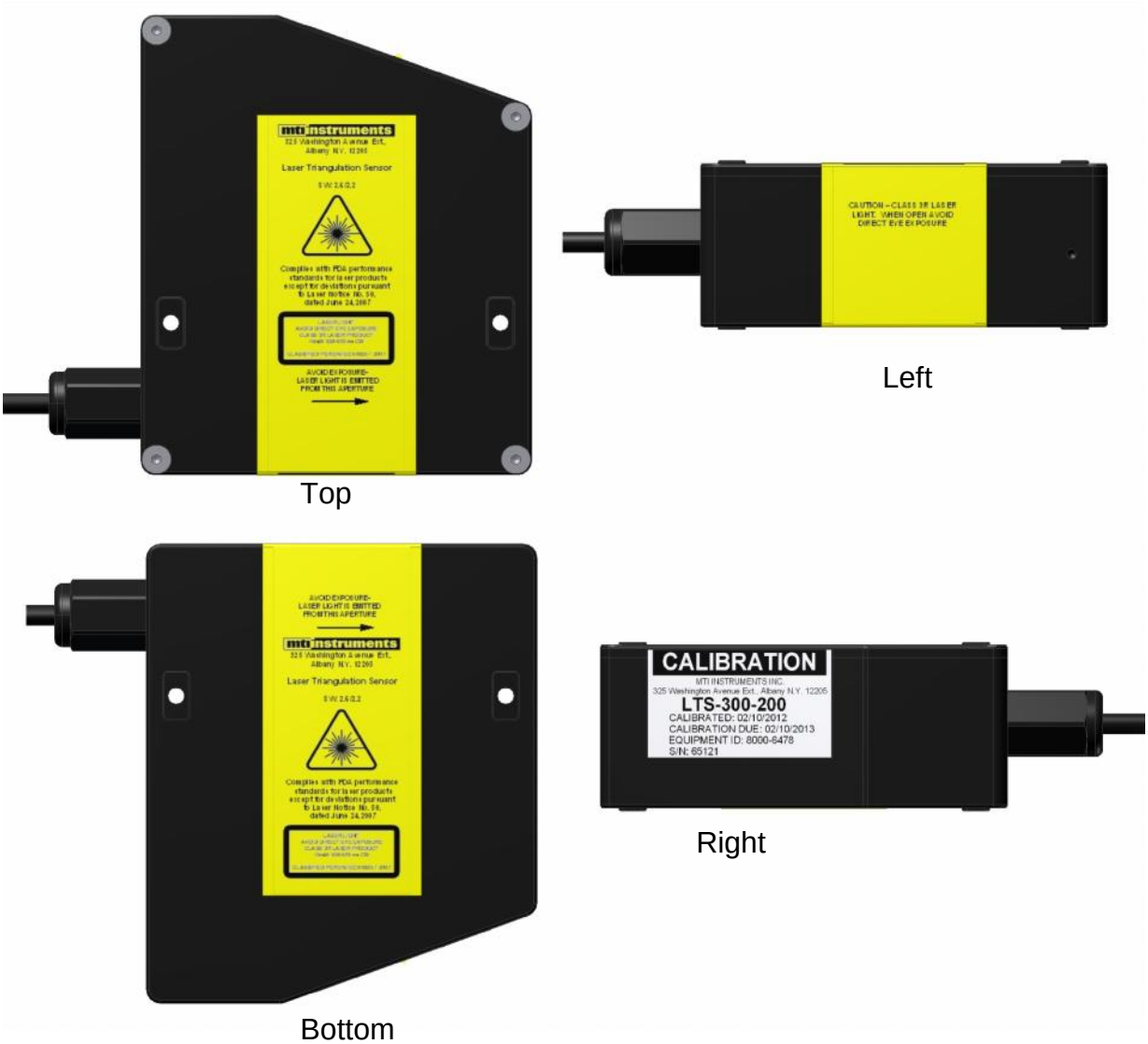
Class 3R: Is considered safe if handled carefully, with restricted beam viewing.

DISCLAIMERS

Language Requirements

DISCLAIMER: EU LANGUAGE REQUIREMENTS
This is the Original Instructions version of the User Manual. It is illegal to operate this equipment in a European Union (EU) Member State unless the manual is written in an official language of the Member State. Contact MTI Instruments for the availability of translated manuals.

Warning and Informational Label Locations



Top

Left

Bottom

Right

Models: 300-200, 200-100,120-20, 120-40

Top

Left

Bottom

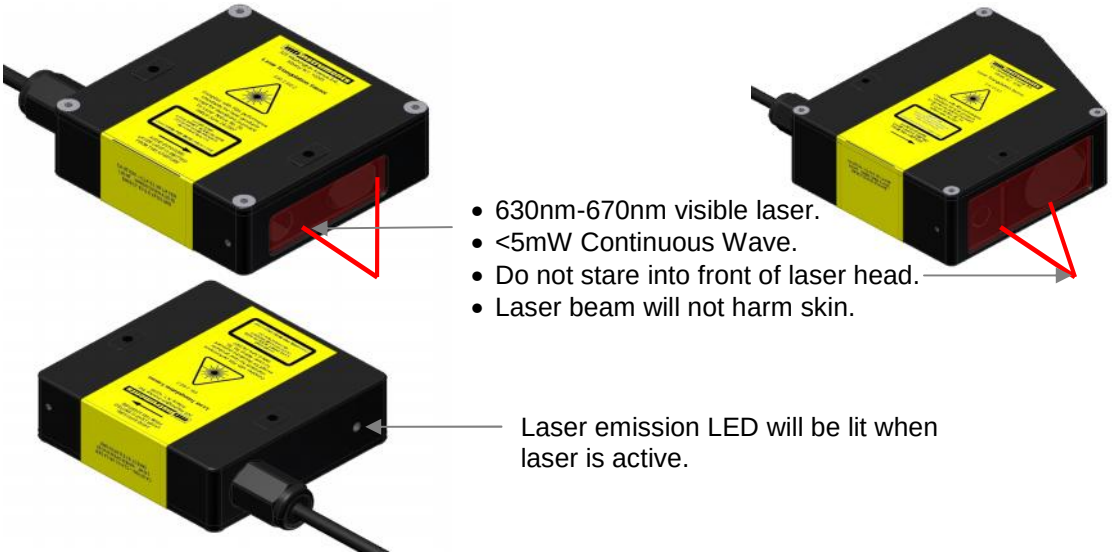
Right

Models: 25-02, 25-04, 50-10, 50-20

SAFETY FEATURES

Aperture Cover-For Class 3B laser (inclusive) and higher class laser heads, an aperture cover will be supplied. This cover will block the laser light from exiting the laser head. For Class 3R (inclusive) and lower class laser heads, an aperture cover will not be provided.
Remote On/Off-Unless otherwise specified, Microtrak™ 3 laser heads have a remote ON lead. The default setting for this wire is floating, which forces the laser diode to the OFF position. To turn the laser head on, this lead must be tied to the ground terminal of the laser head.
Laser ON LED-This product has a range indicator LED which also functions as a Laser ON indicator. When the range LED indicator is on (any color), the laser diode is activated.

HAZARD AREAS



Although the lasers are not considered hazardous during normal operation, **do not stare directly into the laser beam.**

Due to the hazard potential associated with a class **3R and 3B lasers**, only persons who have received appropriate training should be placed in control of this equipment.

GENERAL SAFETY INFORMATION

1. Do not stare directly into the laser beam.
2. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. Deviation from the manual or alterations to the product may compromise the safety features of this product.
3. Use caution when aiming the beam at highly reflective targets, as the reflected beam may be inadvertently directed into the eyes of the user.
4. Observe the sensor head warning labels.
5. Do not open the unit for repair or make any internal adjustments. The laser head does not contain any user serviceable items. Opening or disassembling the head will void the warranty.
6. Customer must provide SELV (Safety Extra Low Voltage) power. MTI Instruments supplies SELV power sources that are low noise and tested for use with the Microtrak™ 3 lasers. Contact MTI Instruments for further information.

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1 INTRODUCTION

1.1 Microtrak™ 3 System Description

The Microtrak™ 3 uses laser triangulation to compute the standoff to target displacement.

CAUTION
The Microtrak™ 3 laser heads are sensitive to Electrostatic Discharge (ESD). Use proper ESD techniques when handling this product.

1.2 Microtrak™ 3 Head Specifications

1.2.1 General Specifications

Supply Voltage:	SELV[1] 15-28VDC
Maximum Power Supply Ripple:	25mVpp
Nominal Supply Voltage:	SELV 24VDC
Maximum Power Draw:	2.8W
Output Impedance:	50Ω
Nameplate Range Voltage Output:	1-9V
Extended Range Voltage Output:	0-10V
Cable Length:	2.0m
Cable Connector:	Phoenix 1857948
Cable Mating Connector:	Phoenix 1803633
Cable Bend Radius:	50mm
Cable Tug Rating:	4.5kg
Wire Gauge:	0.455mm (26AWG)
Frequency Response:	Up to 20kHz
Sampling Frequency	40kHz
Software Selectable Filters:	0.1Hz, 1Hz, 25Hz, 200Hz, 1kHz, 4kHz, 20kHz
Nominal Laser Wavelength[2]:	670nm
Laser Power[3]:	<5mW
Laser Class (IEC 60825)[4]:	3R

[1] **S**afety **E**xtra **L**ow **V**oltage
[2] Nominal laser wavelength is based on standard products. Custom products may have a different wavelength. The actual wavelength will be noted on the product label.
[3] Laser power is based on standard products. Custom products may have a different laser power settings. The actual maximum power level will be noted on the product label.
[4] Laser class based on power level. Non standard products may have a different power class level. The power class will be noted on the product label.

Operating Temperature Range: 0ºC – 40ºC
Storage Temperature Range: -20ºC – 70ºC
Humidity Range: 10-95% Non-Condensing
Temperature Stability: 0.05% FSR/ºC

Digital Interface: RS-485
Communication Type: Half Duplex
Baud Rate (Default): 57,600
Protocol (Default): N-8-1
Address (Default): 0

1.2.1 Specific Head Specifications[5]

Model		25-02	25-04	50-10	50-20	120-20	120-40	200-100	300-200
Range	**mm**	2	4	10	20	20	40	100	200
Extended Range	**mm**	2.5	5	12.5	25	25	50	125	250
Close Extended Range	**mm**	23.75	22.5	43.75	37.5	107.5	95	137.5	175
Close Range	**mm**	24	23	45	40	110	100	150	200
Standoff	**mm**	25	25	50	50	120	120	200	300
Far Range	**mm**	26	27	55	60	130	140	250	400
Far Extended Range	**mm**	26.25	27.5	56.25	62.5	132.5	145	262.5	425
Linearity	**%FSR**	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Noise[6]	«**m**	0.325	0.65	1.625	3.25	3.25	6.5	16.25	32.5
Analog Out Sensitivity[7]	«**m/mV**	0.25	0.5	1.25	2.5	2.5	5	12.5	25
Spot Size[8]	«**m**	30	30	25	36	100	100	100	130
1 LSB Resolution[9]	«**m**	0.0381	0.0763	0.1907	0.3815	0.3815	0.7630	1.9074	3.8148

1.2.2 Microtrak™ 3 Basic Setup Program Requirements

Operating System: Windows® XP, Vista, 7
Disk Space: 4MB

[5] Unless otherwise noted, specifications based on digital output.
[6] ±Peak noise at the center range of white photo paper with frame rate of 40kHz.
[7] Extended Range / 10V.
[8] Major diameter measured at standoff.
[9] Extended Range / 65535.

1.3 Receiving Inspection Procedure

The Microtrak™ 3 laser head is shipped from MTII fully assembled and packed in a cardboard carton with foam supports to guard against shipping damage. Upon receipt, perform the following procedure before using the unit to perform dimensional measurements:

1) Inspect the exterior of the shipping carton. Note any obvious damage. If shipping damage is evident, file a claim with the carrier.
2) Remove the laser head from the shipping carton. Inspect the head and accessories for any signs of damage.
3) If any problems are found, contact MTII at 1-518-218-2550.

1.4 Return Shipment Procedure

Prior to shipping the instrument, contact MTI Instruments, Inc. at 1-518-218-2550 to receive return authorization (RMA) number. Reference the instrument's name, model and serial numbers on all correspondence. Be sure to include a brief description of the reason for the return. Place the instrument in the original shipping carton (if available) and forward prepaid to:

MTI Instruments, Inc.
Supervisor of Manufacturing
325 Washington Avenue Extension
Albany, NY 12205-5505

Mark "RMA" and the RMA number (if a number is issued) on the outside of the box. If the original packing materials are not available:

1) Wrap the instrument in plastic or heavy paper.
2) Place packing material around all sides of the instrument and pack it in a cardboard carton.
3) Place instrument and inner container in a sturdy cardboard carton or wooden box.

2 OPERATING PRINCIPLES

2.1 System Description

MTI Instruments' Microtrak™ family of 1D precision single-point laser triangulation systems use the triangulation principle to obtain a 1-dimensional height profile of target surfaces to measure parameters such as vibration, profiling, distance, displacement, thickness, alignment, warpage, step height and flatness.

In contrast to 2D laser scanner systems, such as MTI Instruments' 2D laser line sensors, Microtrak™ 3 1D laser displacement sensors project a single point laser spot onto the surface of the object to be measured. The return laser beam is registered on a CMOS array by a high quality optical system. The 1024 element CMOS detector determines Z-axis distance information. CMOS type detectors determine spot position more precisely than older PSD type detectors by monitoring the intensity of light received on a pixel array. Lesser energy reflections from surface scattering are ignored, providing a more accurate and repeatable measurement,

MTI Instruments' Microtrak™ 3 family of 1D laser triangulation measure all types of diffuse surfaces such as black, colored, metallic, wood, ceramic, steel, or plastic.

2.2 Key Highlights

- A 5-color position indicating LED to aid in precise distance placement at the laser mounting location.
- The laser head's visible laser spot allows for easy positioning and alignment of the laser head.
- 8 different diffuse type laser head models with ranges from 2-mm up to 300-mm.
- Available accessories including:
    - Extension cables
    - Mounting brackets
    - A power supply
    - Data Acquisition Hardware
    - A Software Development Kit (SDK)
- Auto Gain circuitry automatically adjusts laser current for accurate, repeatable measurements on highly reflective to dull surfaces.
- Microtrak™ 3 Lasers are highly compact and have an IP67 intrusion rating.

2.3 Key Product Features

- 0-10 VDC analog and serial digital RS-485 output are standard. A RS-485 to USB converter is also provided.
- 20 kHz Response Time (Selectable) Analog.
- 40 kHz Sample rate.
- High Linearity.
- High Repeatability.
- Simple Software Interface displays data on a PC as well as saves it to Excel readable format.
- Built in low pass filter.
- Built in function to bridge gaps on the target using the cut-time feature.

3 INSTALLATION

3.1 Physical Setup

3.1.1 Environmental Conditions to Avoid

This device operates by emitting a coherent light source and monitoring the reflected response. As such, using this device in any environment that impairs optical operation will adversely affect performance. Environments that are known to cause difficulties include:

- Conditions where condensation is likely to occur on the exterior surfaces of the product.
- Conditions where water is directly sprayed on the product during operation.
- High dust or small particulate matter environments.
- Environments where chemicals, particularly organic solvents, can damage seals and glass surfaces.
- Environments where gaseous chemicals can penetrate the seals and damage components inside the head.
- Mounting to items that experience shock or vibration.
- Mounting in areas that have high ambient light levels, particularly light levels between 630nm and 800nm (visible red to near infrared).
- Use in any environment where ambient conditions exceed the rated ambient conditions of the product.

Additionally, the laser head should not be used in locations where gases or high surface area particulate matter can combust.

3.1.2 Mounting Hardware

There are 2 mounting holes on the Microtrak™ 3. The holes are sized for a M3.5 metric screw or a #6 ANSI/ASME screw. When tightening the screws, do not exceed a force of 2.3N-m (20in-lbs). Use of an appropriate thread locking mechanism is recommended.

MTI Instruments can also provide 90º mounting brackets. Contact MTI Instruments or their authorized representative for more information regarding the brackets.

3.1.3 Head Orientation

3.1.3.1 Moving targets

The orientation of the head relative to the direction of travel can affect the performance of the product. In general, the head should be mounted such that the broad side of the head is perpendicular to the motion of the target.

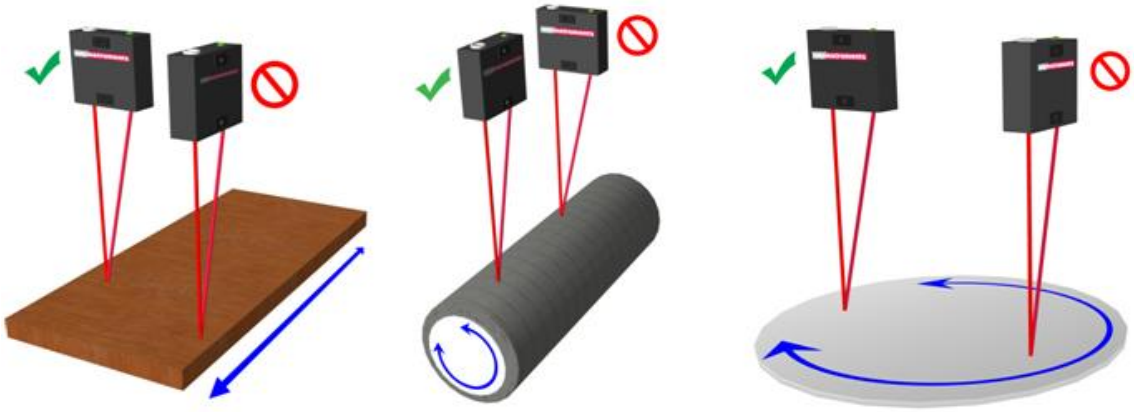


Figure 1:Moving Target Orientation

3.1.3.2 Slots, Holes, and Walls

The Microtrak™ 3 uses triangulation to determine displacement. When measuring down into slots/holes or near walls, it is important that the head is oriented such that the return beam is not obstructed by sidewalls.

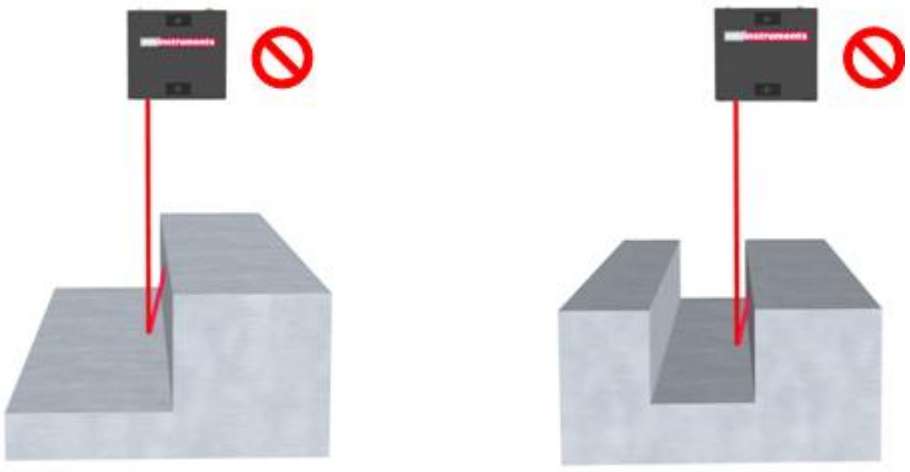


Figure 2: Slots, Holes, and Walls Blocked Beam

3.1.4 Mounting

To help assure the coplanearity, the product has been manufactured such that 3 surfaces on the head form precise orthogonal reference planes. The primary plane is formed by the raised mounts on the bottom of the head (Reference Plane A). The second reference plane is front metallic face of the head m(Reference Plane B). Finally, the side of the head closest to the laser emitter side is Reference Plane C).

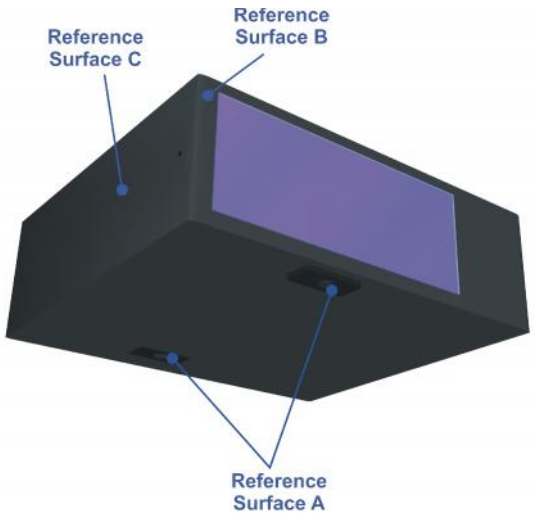


Figure 3: Reference Plane Identification

When mounting the head, the goal is to have Reference Plane B parallel as possible to the plane of the target. The standoff from the head to the target is measured from Reference Plane B to the nominal target. Mechanical squares or precision gauge blocks can be helpful in squaring the head to the target but care must be taken not to scratch the window of the laser head nor to leave debris or oils on the window of the laser head.

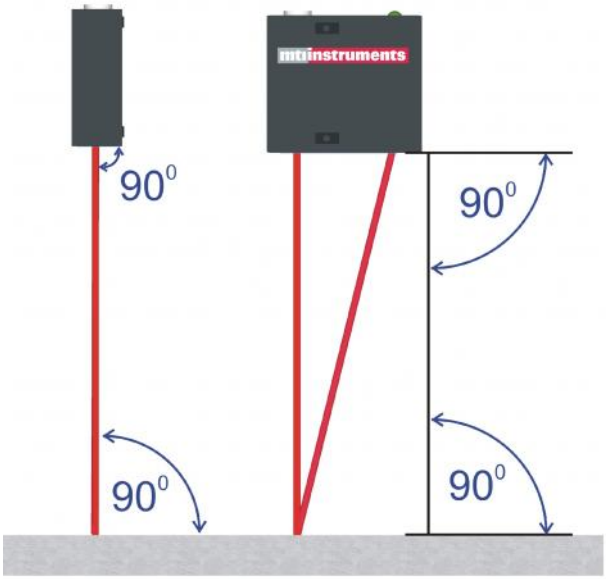
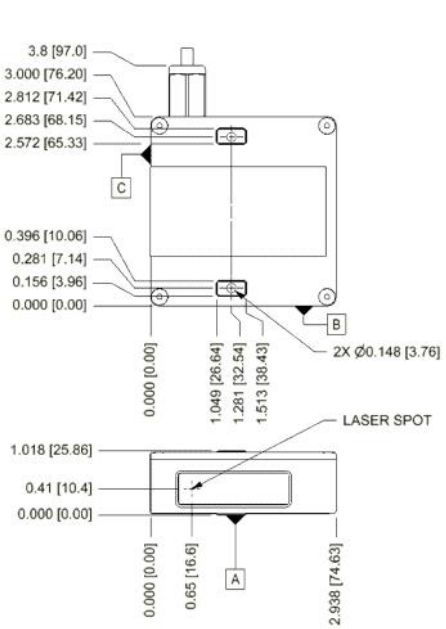
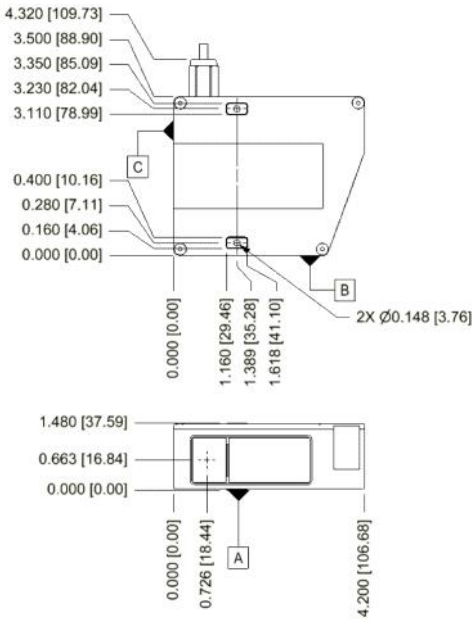


Figure 4:Mounting the Head referenced to Target



25mm and 50mm laser heads



120mm and 200mm and 300mm laser

Figure 5:Mounting Hole Locations

3.2 Electrical Connections

3.2.1 Power Requirements

Refer to the specification section of this manual for information on power requirements. In general, the head will operate over a wide range of voltages, but for best performance, the head should be operated at its nominal voltage level. While the unit can operate satisfactorily in many applications using switch mode power supplies that have proper ripple filtering, best performance can be achieved using simple linear supplies which typically have less than 1mV of noise ripple. Note that some switch mode power supplies that have a switching frequency near the operation frequency of this product (40kHz) may result in signal noise, particularly on the analog outputs.

3.2.2 Signal Definitions

The standard Microtrak™ 3 will ship from the factory with a terminal connector pre-attached. The connector is a quick connect type. The terminals themselves are screw down compression type connectors.

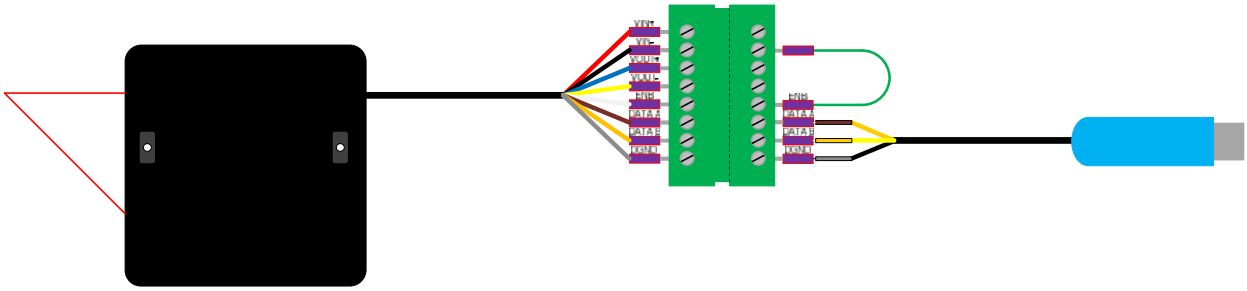


Figure 6:Standard Shipped Prewired Connector

RED	VIN(+)	Power 15-28VDC, 2.8W
BLACK	VIN(-)	Power Ground
BLUE	VOUT(+)	Analog Output 0-10VDC
YELLOW	VOUT(-)	Analog Output Ground
WHITE	EN_B	Laser Diode Enable. Tie to Ground to turn on
BROWN	DATA A(-)	RS-485 "A" Signal
ORANGE	DATA B(+)	RS-485 "B" Signal
GRAY	DATA GND	RS-485 Ground

Figure 7:Cable Connection Color Codes

Note that the laser diode will remain off unless the white cable (EN_B) is connected to ground. The status indicator LED will move to the RED color if the EN_B wire is not tied to ground or the head is operating outside its extended range.

3.2.3 RS-485 Driver

The Microtrak™ 3 contains an RS-485 Driver and operates in half duplex mode. The driver IC is a Maxim MAX3430 driver or equivalent.

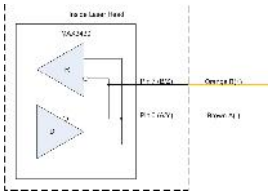


Figure 8:RS-485 Driver Circuit

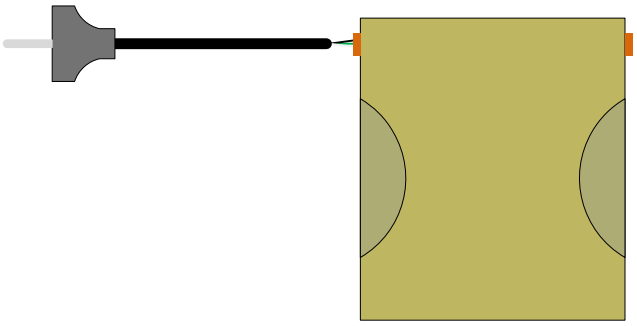
3.2.4 Cable Routing

Microtrak™ 3 is shipped with integral special cable which is 2.0m in length. For noise and signal integrity purposes, certain pairs are twisted together and one pair has its own shield. In addition, the entire cable is shielded. If extension cables are desired, they are available from MTI Instruments.

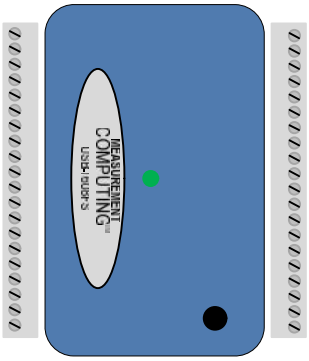
When routing the cable, care should be taken to make sure that the cable is not routed near sources of high electrical noise, such as switching relays or variable speed motors. When routing thru raceways, be aware of the electrical noise generated by other wires in the raceway.

Do not make bends in the cable that are smaller than the bend radius listed in the product specifications located elsewhere in this manual.

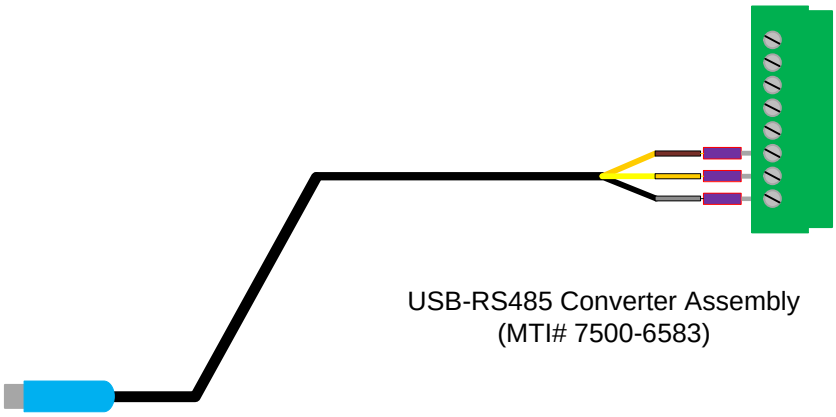
3.2.5 Wiring Diagrams



24VDC Universal Power Supply Assembly
(MTI# 8000-6925)

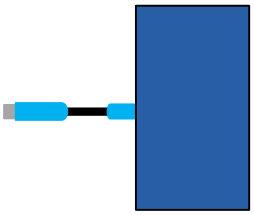


Measurement Computing
USB-1608FS+ Multifunction
Analog to Digital Converter
(MTI# 2025-5160)



USB-RS485 Converter Assembly
(MTI# 7500-6583)

BNC to Ferrule Assembly
(MTI# 8000-6782)



USB HUB

SPST Switch

Figure 9:Wiring Diagram Key

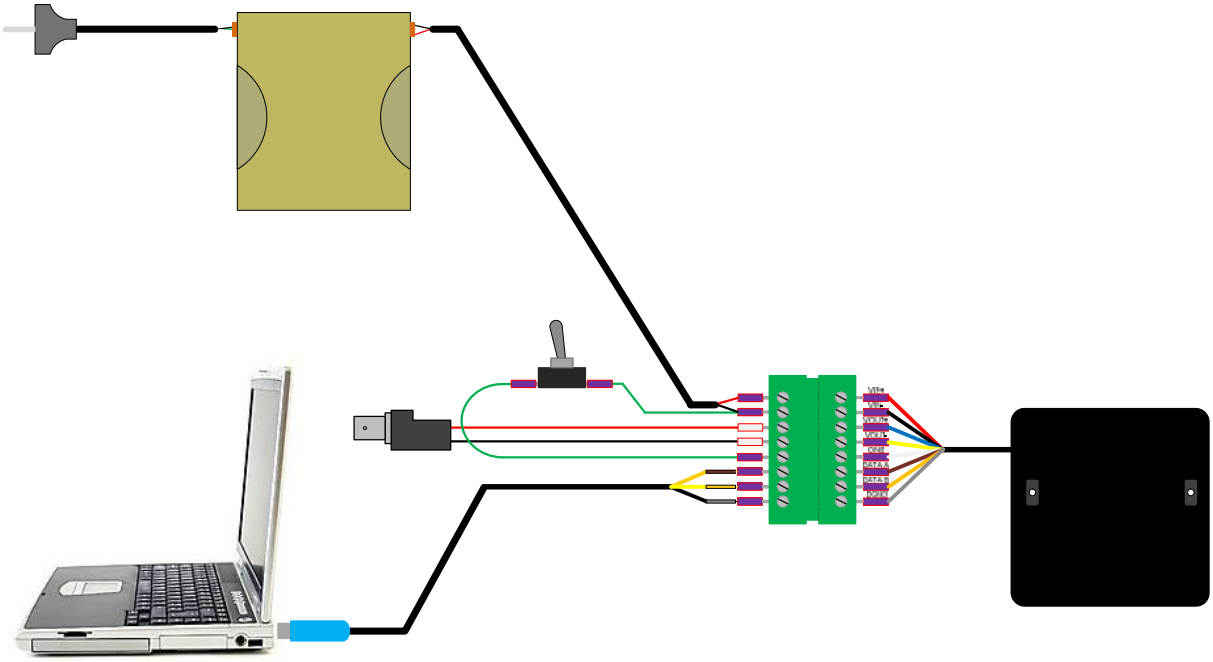


Figure 10:Wiring Typical Single Head and USB

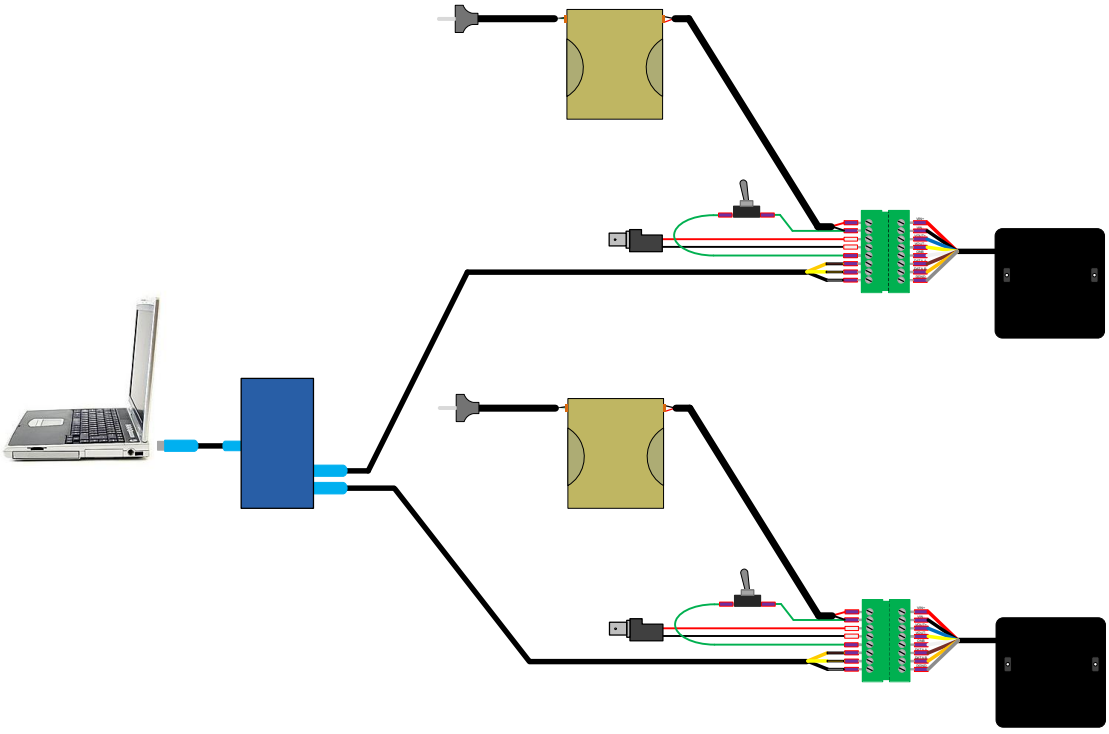


Figure 11:Wiring Multi-head USB using USB Hub

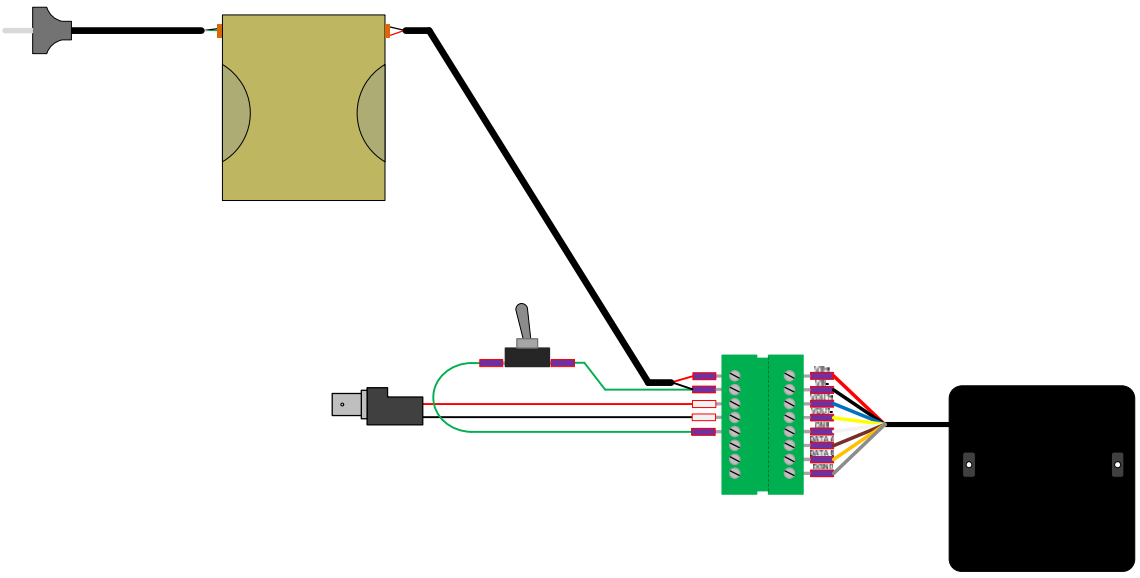


Figure 12:Wiring without USB Control

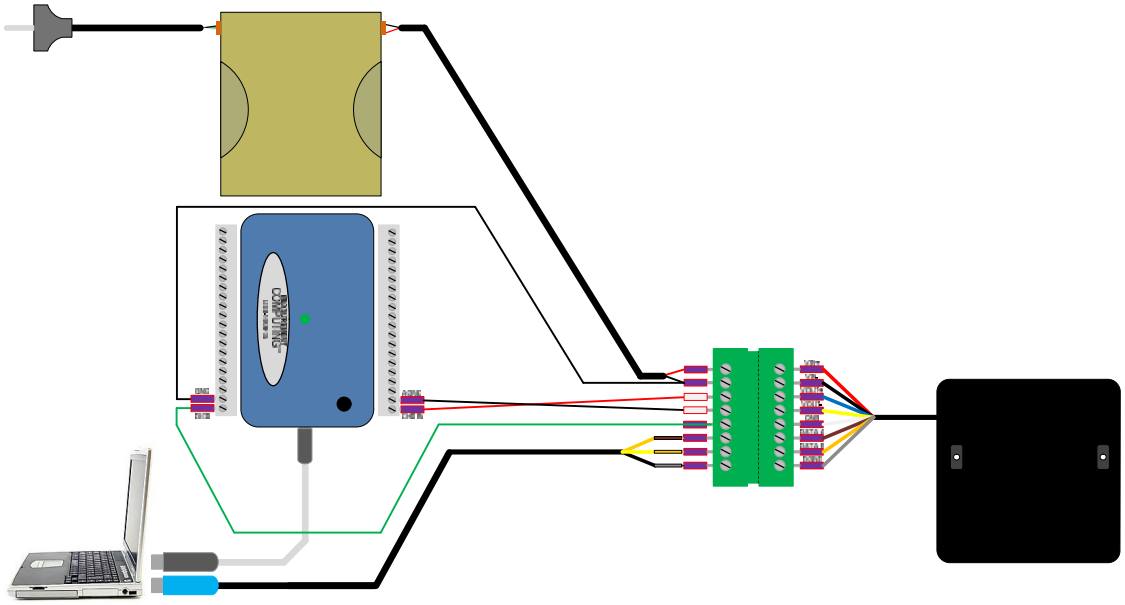


Figure 13:Single Head with Measurement Computing ADC

3.3 Microtrak™ 3 Basic Support Program Installation

The Microtrak™ 3 Basic Support Program allows the user to establish and verify digital communications, set the firmware selectable items (such as settings), and to perform basic logging functions. The basic program will support one instance within Windows® and one head. For more advanced functionality and to aid with system integration, a Microtrak™ 3 Software Development Kit is available. Contact MTI Instruments for more information on the Software Development Kit.

3.3.1 Installing the Basic Support Software

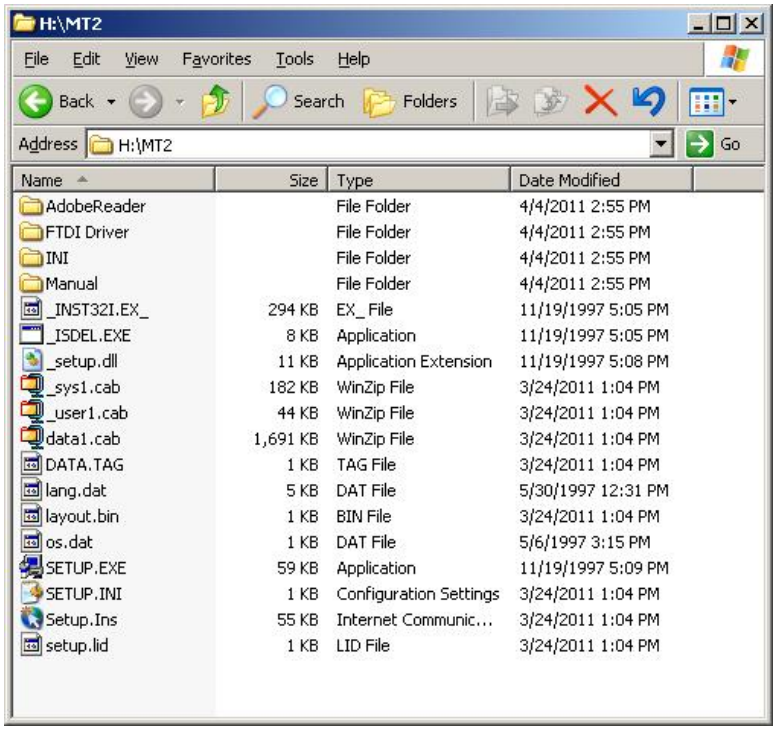
The Microtrak™ 3 laser ships with a Software USB Flash Drive that contains the Microtrak™ 3 Basic Support Software program.

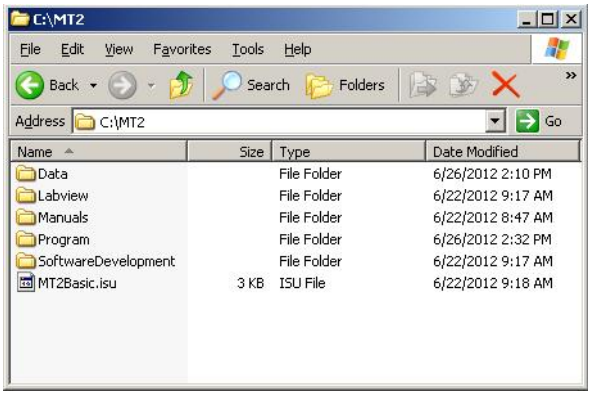
Insert the USB Flash Disk into the computer USB port and use Windows Explorer to locate and execute the installation program SETUP.EXE.

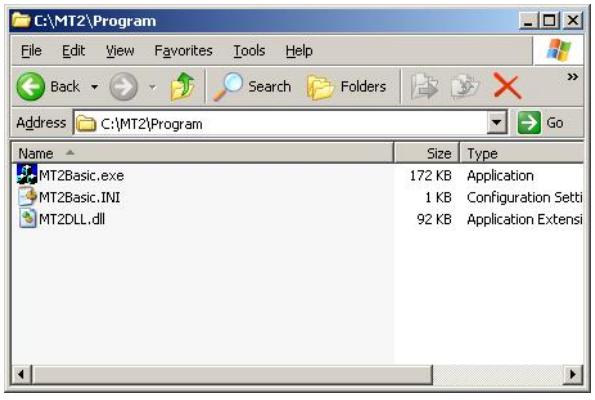
Follow the on screen instructions to complete the software installation.

By default, the software installs into the folder C:\MT3 and uses the Data and Program sub-folders.

The optional Microtrak™ 3 Communications DLL package, included with the SDK, also installs into the C:\MT3 folder but uses other sub-folders.



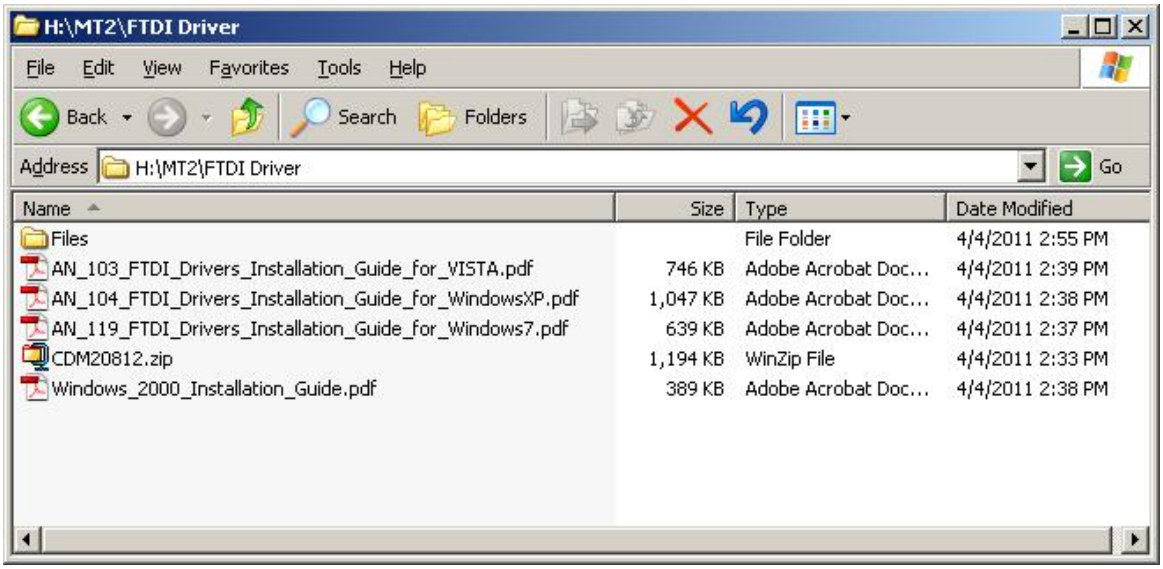


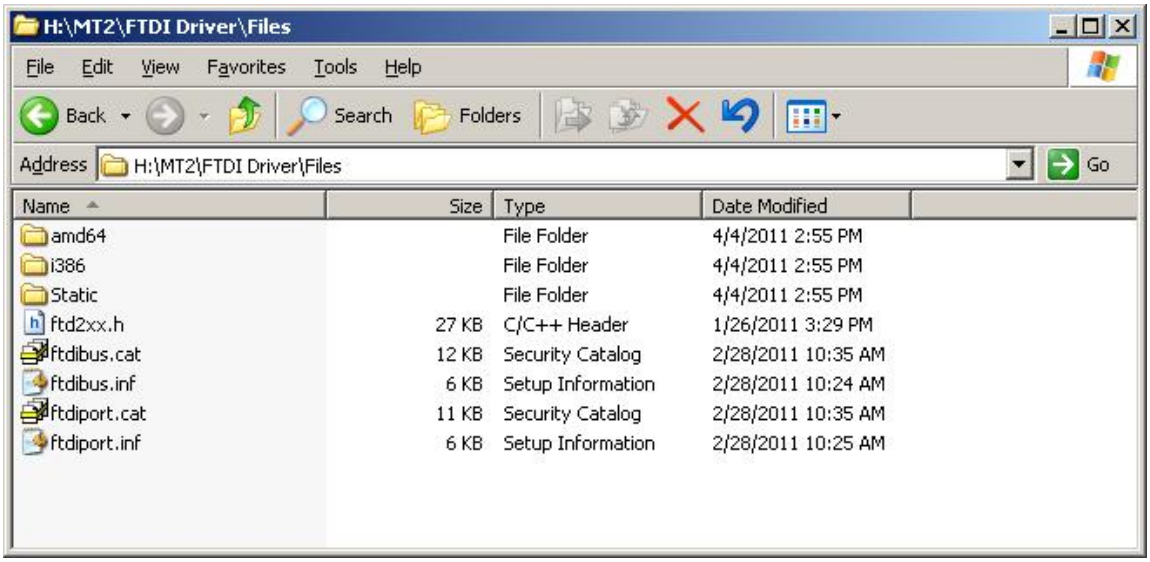


3.3.2 Installing the USB to RS-485 Driver Software

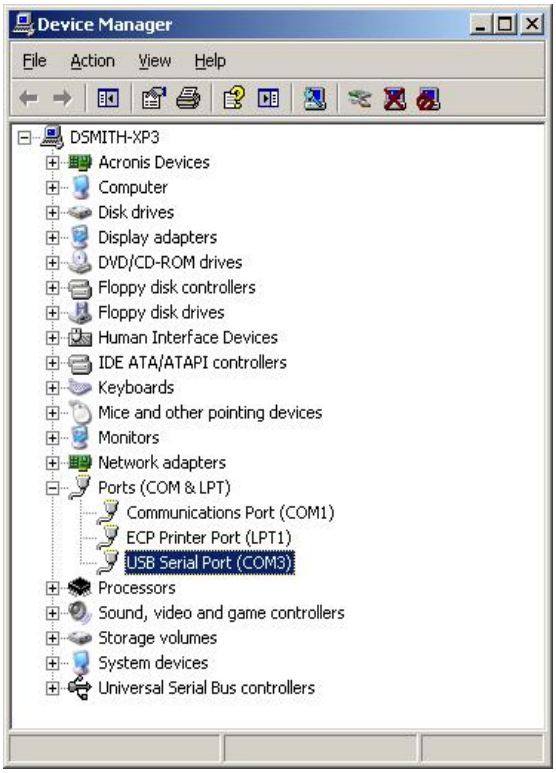
The USB Flash Drive that ships with the Microtrak™ 3 contains the device driver for the RS-485 USB adapter in folder FTDI Driver. Instructions for each version of Windows (2000, XP, Vista, and 7) are contained in separate PDF files.

Follow the instructions in the FTDI Drivers Installation Guide for the correct version of Windows. Both 32-bit and 64-bit drivers are supported.





3.3.3 Determining Windows COM Port Assignments



The Microtrak™ 3 laser uses an RS-485 serial communications channel for device control and data recovery. The FTDI USB to RS-485 adapter and driver software implement the RS-485 communications channel as a virtual COM port on a Windows-based PC.

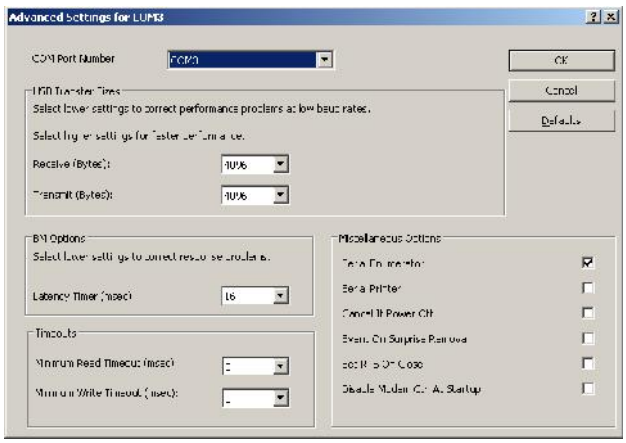
To use the Microtrak™ 3 support software, the end user must determine the COM port assignment for the FTDI adapter. This can be easily done using the Windows device manager.

Activate the Windows Control Panel (**Start**-**Settings**-**Control Panel**) and double click in the System icon. Click the **Hardware** tab and then click the **Device Manager** button. Expand the **Ports** category by clicking on the + sign and look for the **USB Serial Port** entry.

The COM port assignment will be visible at the end of the entry enclosed within parenthesis. In the example shown, the FTDI USB to RS-485 adapter has been assigned to COM3.

On some computer systems, it may become necessary to change the COM port assignment. The Microtrak™ 3 Support Software program requires a COM port between COM1 and COM12 inclusive.

To change the COM port assignment, right click on the entry and select the **Properties** menu item. On the Properties page, click the **Port Settings** tab and then click the **Advanced** button.

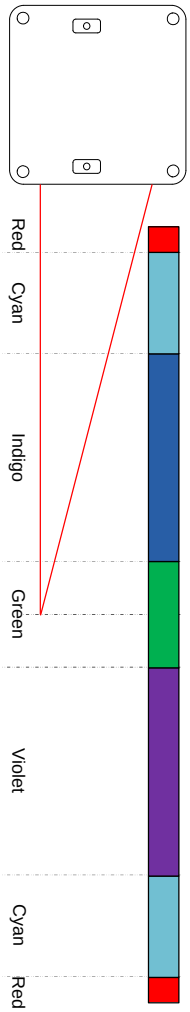


Select a different **COM Port Number** setting from the drop down list.

4 OPERATION

4.1 LED Range Indicator

The Microtrak™ 3 has a built in range indicator that provides at a glance indication of whether the target is in range of the product and the current range mode the device is using.



Distances in mm								Digital is Exact		Analog is Approximate	
2502	**2504**	**5010**	**5020**	**12020**	**12040**	**200100**	**300200**	**Counts**	**%FSR**	**Vout**	**mAout**
23.75	22.5	43.75	37.5	107.5	95	137.5	175	1	+62.5	0	4
24	23	45	40	110	100	150	200	6554	+50	1	5.6
24.92	24.84	49.6	49.2	119.2	118.4	196	292	30671	+4	4.68	11.36
25	25	50	50	120	120	200	300	32768	StandOff	5	12
25.08	25.16	50.4	50.8	120.8	121.6	204	308	34865	-4	5.32	12.64
26	27	55	60	130	140	250	400	58982	-50	9	18.4
26.25	27.5	56.25	62.5	132.5	145	262.5	425	65534	-62.5	10	20

Figure 14:LED Range Indicator Operation

Note: The status indicator LED will move to the RED color if the EN_B wire is not tied to ground or the head is operating outside its extended range.

4.2 Microtrak™ 3 Basic Support Software Program

Microtrak™ 3 Basic Support Software is a dedicated program for a Windows® based PC to remotely communicate with MTI Instruments' Microtrak™ 3 Laser Displacement Sensor via a PC serial port. This program can graphically display the displacement signals measured from the laser as well as capture and store the data into a file. The Microtrak™ 3 Basic Support Program is limited to supporting a single head connection at any given time and only one instance of the application can be running at any given time.

4.2.1 Program Startup

When the Microtrak™ 3 Basic Support Software initially starts, the screen shown below will be displayed.

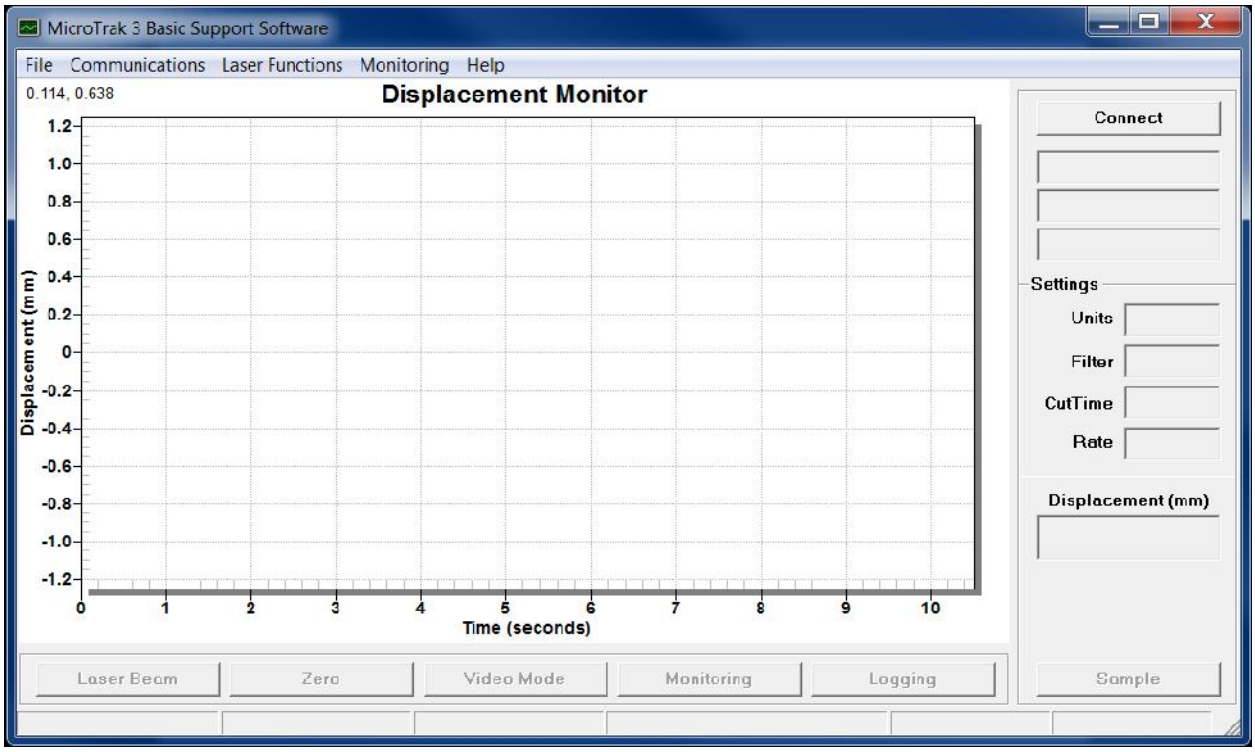
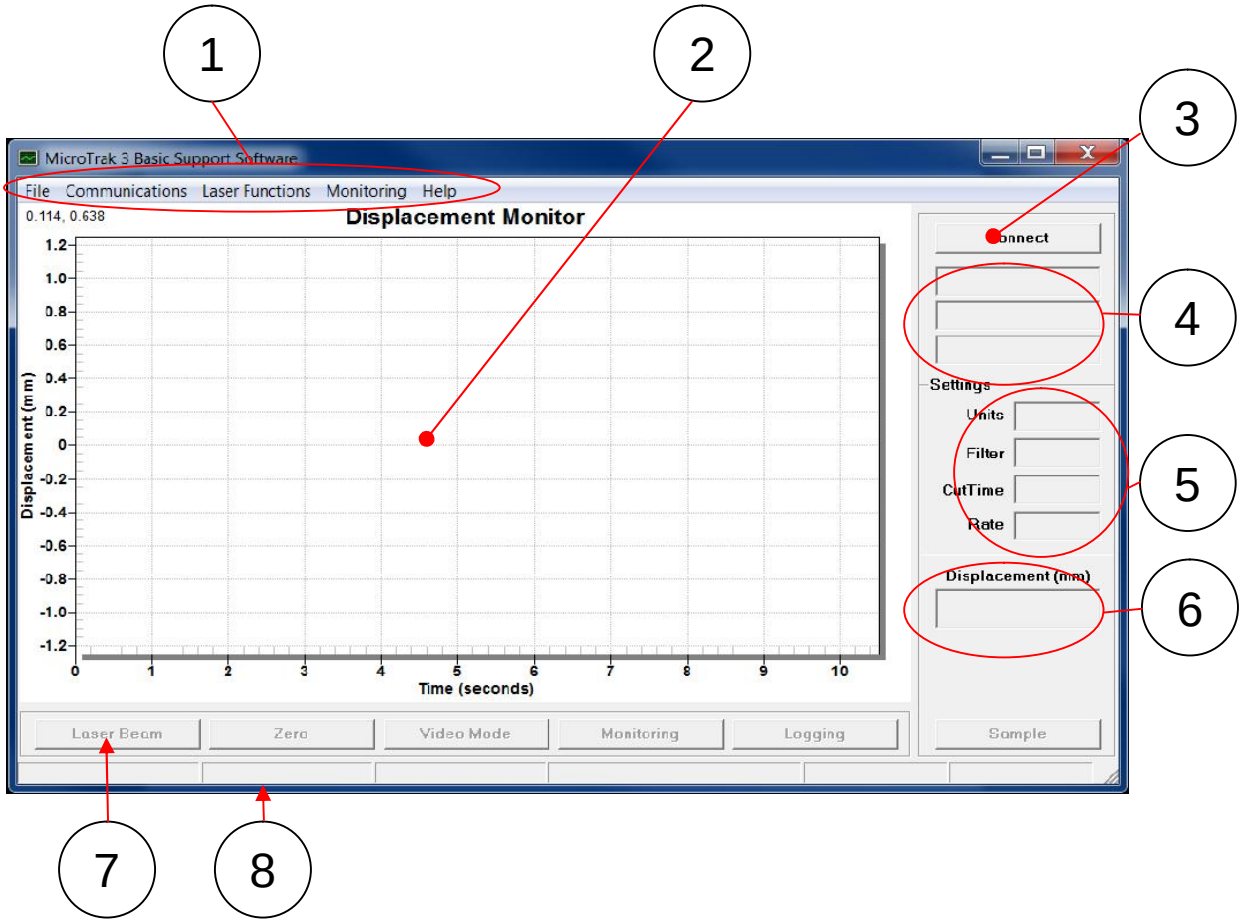


Figure 15:Microtrak™ 3 Basic Support Program Home Screen

Initially most of the screen controls will be disabled. After defining the communications configuration and connecting to Microtrak™ 3 laser head, the screen controls will become enabled.

4.2.2 Description Of Main Screen

The Microtrak™ 3 Basic Support Software main screen is composed of eight major items as shown in the figure below.



1. Menu Bar
2. Plot Area
3. Connect / Disconnect Button
4. Laser Identification Information
5. Current Laser Settings
6. Manual Sampling Button and Displacement Display
7. Function Buttons
8. Status Bar

4.2.3 Menu Summary

Menu	Menu Item	Description
File	**Save Data Points**	Saves the logged data points to the computer as a comma separated values (CSV) file.
	Save Screen Bitmap	Save a bitmap screen capture of the current displayed screen.
	Print Plot	Prints the current displayed graph to the attached Windows® Printer.
	Exit	Exit Program
Communications	**Connect**	Connect to laser
	Disconnect	Disconnect from laser
	Simulate Laser	Enable simulation mode
	COM Port	Define host serial communications port
	Baud Rate	Define host and laser serial baud rate
	Laser Address	Define laser address
Laser Functions	**Units**	Set laser measurement units
	Filter	Set laser filter
	Cut Time	Set laser cut time
	Laser Beam	Toggle laser beam on and off
	Zero	Toggle laser zero (tare) on and off
	Video Mode	Toggle laser between normal and video out mode
	Setup Laser Head	Set laser communications and other parameters
Monitoring	**Start Monitoring**	Start recovering and displaying data
	Stop Monitoring	Stop recovering and displaying data
	Start Logging	Start recovering, logging and displaying data
	Stop Logging	Stop recovering, logging and displaying data
	Set Sample Rate	Set data sampling rate
	Set Plot Window Size	Define plot window display size
	Acquire Video Data	Acquire video image data from Microtrak
Help	**Manual**	Display MicroTrak User Manual
	About	Display information about software

4.2.4 Status Bar Summary

The Microtrak™ 3 Basic Software Support program status bar displays important status information during program operation. The status bar is composed of six data fields.

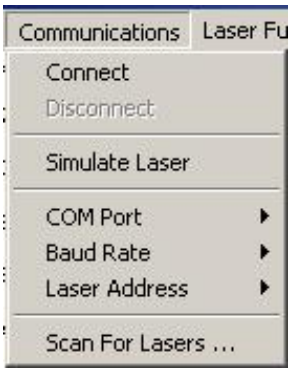
1. Laser Beam Status — This item displays the ON/OFF status of the laser beam.
2. Zero Status — This item displays the ON/OFF status of the zero (tare) function.
3. Laser Mode Status — This item displays the current laser mode (NORMAL or VIDEO OUT).
4. Logging Filename — This item defines the data logging filename whenever logging is active.
5. Logging Point Count — This item defines the number of data points written to the data logging file.
6. Communications Summary — This item summarizes the COM Port, baud rate and laser address currently in use.

Note: If the main display screen window is sized too small, not all of the status bar fields will be displayed.

4.2.5 Simulation Mode

For training and software familiarization, it is sometimes inconvenient to require the availability of actual laser heads. The Microtrak™ 3 Basic Support Software provides a simulation capability that addresses this issue. When the **Simulate Laser** menu item is checked, the software will internally simulate the command responses and the acquired data of an actual laser head.

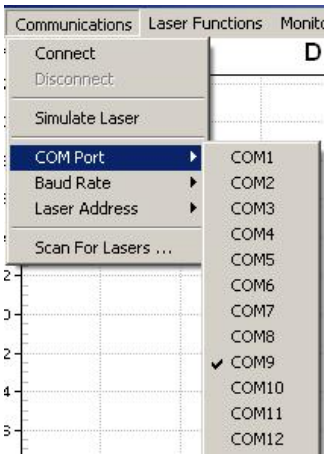
4.2.6 Establishing Communications



Before establishing communications, the Microtrak™ 3 Basic Support Program must be configured. The key configuration items are the COM port number, the baud rate, protocol, and the RS-485 head address. These values are set in the Communications menu.

If the head parameters are unknown, the Scan for Lasers Utility can be used to detect the settings by cycling through all valid settings and waiting for a response.

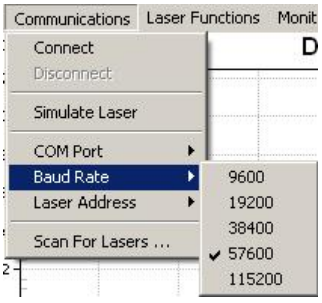
4.2.6.1 Define The Communications Port



Select the computer COM port where the RS-232 to RS-485 adapter or USB serial adapter is connected to the Microtrak™ 3 laser.

This setting will be automatically stored in the program INI file and will be recalled each time the program is executed.

4.2.6.2 Define The Communications Baud Rate

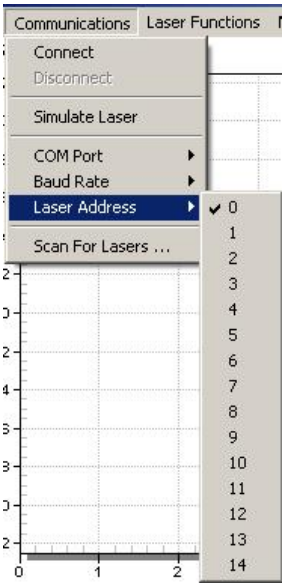


Select the communications baud rate to use. The Microtrak™ 3 laser must be setup to use the same baud rate. The factory default baud rate is 57600.

This setting will be automatically stored in the program INI file and will be recalled each time the program is executed.

Changing this parameter does not change the baud rate that the laser uses for communications. Select the **Laser Functions** – **Setup Laser Head** menu item to change the baud rate used by the laser.

4.2.6.3 Define The Laser Address

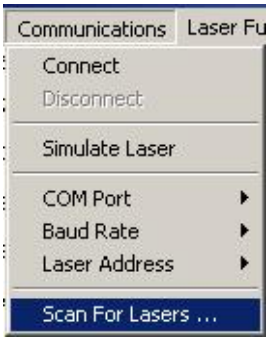


Select the laser address to use. For the head to communicate, the address stored in the Microtrak™ 3 laser must match the address selected in the Microtrak™ Basic Support Program. The factory default address is 0.

This setting will be automatically stored in the program INI file and will be recalled each time the program is executed.

Changing this parameter does not change the address that the laser uses for communications. Select the **Laser Functions** – **Setup Laser Head** menu item to change the address used by the laser.

4.2.7 Scan For Lasers Utility

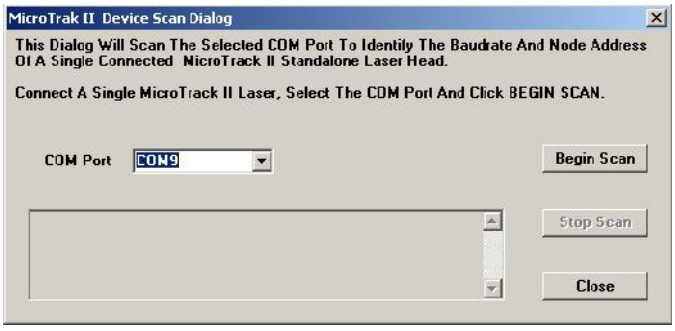


Select the **Communications-Scan For Lasers** menu item to activate the MicroTrak Device Scan Dialog.

MicroTrak Device Scan Dialog is useful for determining the RS-485 address and the serial baud rate for an unknown Microtrak laser head.

First, ensure that only one Microtrak laser is connected to the computer.

Next, select the communications port to scan.



Click the **Begin Scan** button.

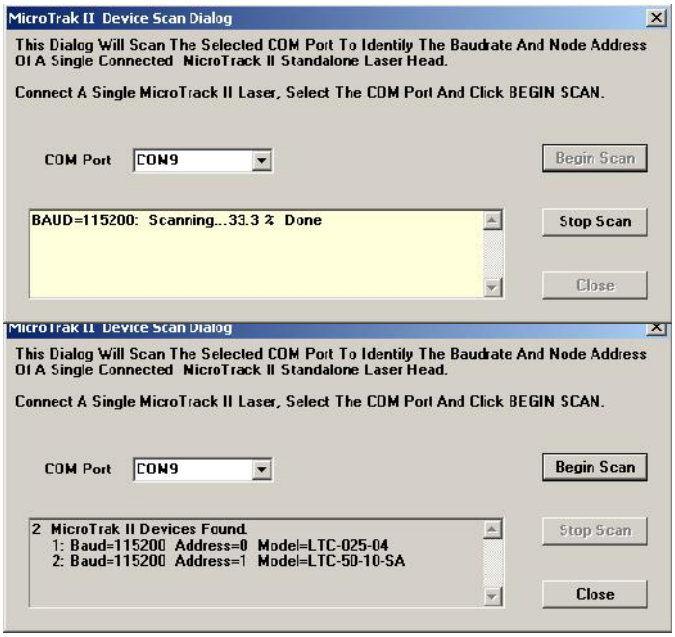
The software will scan the selected COM port using all baud rates and all laser head addresses as it attempts to identify the laser head.

While the scan process is running, a progress message will be displayed by the dialog box.

When the scan is complete, the RS-485 address and baud rate of any detected laser head will be displayed by the dialog box.

Multiple laser heads can be detected provided they have different RS-485 addresses.

A scan may be prematurely terminated by clicking the **Stop Scan** button.



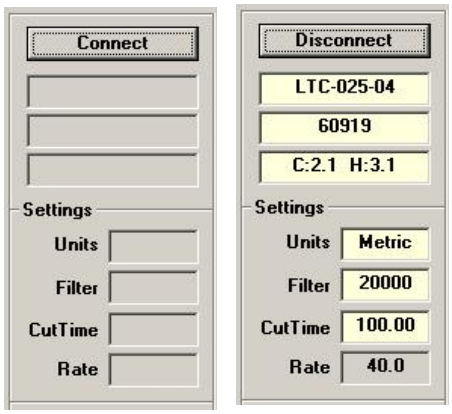
Click the **Close** button to exit the dialog and to return to the main display window.

4.2.8 Connect To Laser

Once the communications parameters have been defined, communications with the laser can be established by clicking the **Connect** button.

Once connected, the laser identification information (mode, serial number, versions) will be displayed. The current laser settings will also be displayed.

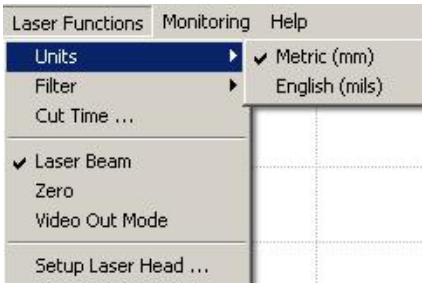
Click the **Disconnect** button to close communications with the laser.



4.2.9 Laser Functions

The Laser Functions menu provides several functions for setting laser operational parameters. A utility is also provided for defining laser communications parameters as well as a more convenient method for setting the laser operational parameters.

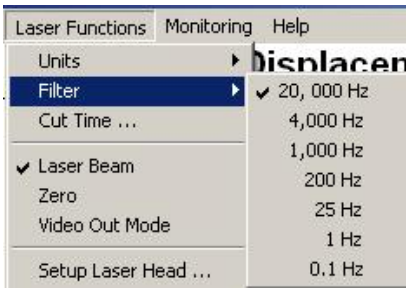
4.2.10 Measurement Units



Use the **Units** menu item to define either Metric (mm) or English (mils) measurement units for the displacement data returned by the laser.

This setting is stored internally by the laser and will be recalled each time the laser is powered up.

4.2.11 Filter Frequency

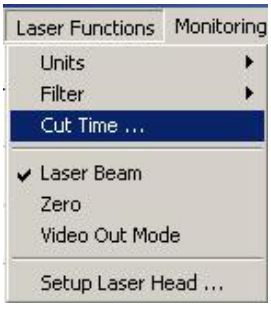


To reduce the bandwidth of the analog output, the laser head is equipped with a built in low pass filter. The filter can help eliminate undesirable high frequency noise or artifacts in the signal being measured. When a filter other than 20kHz is chosen, the effective sampling rate of the head will be reduced from 40kHz to 20kHz. This will permit a longer integration time on the CMOS sensor, which can be useful on absorbing (dark) targets.

The values available are 20 kHz, 4 kHz, 1 kHz, 200 Hz, 25 Hz, 1 Hz, 0.1 Hz.

This setting is stored internally by the laser and will be recalled each time the laser is powered up.

4.2.12 Cut Time



The power level control loop used will measure the received light on the optic sensor and adjust the laser diode power so that the returned light will remain in the active region of the CMOS sensor. Although the Microtrak™ 3 has an automatic power intensity function that is designed to compensate for the reflectivity of various targets, the overall level of compensation is finite. For some targets, full intensity output will not provide a sufficient return signal for the CMOS sensor to register. For other targets, the lowest laser diode output setting will result in too much light striking the CMOS sensor, thus saturating the sensor. This often occurs when measuring highly porous targets that are moving. In such a case, the laser may, momentarily, enter into a deep pore and be out of range.

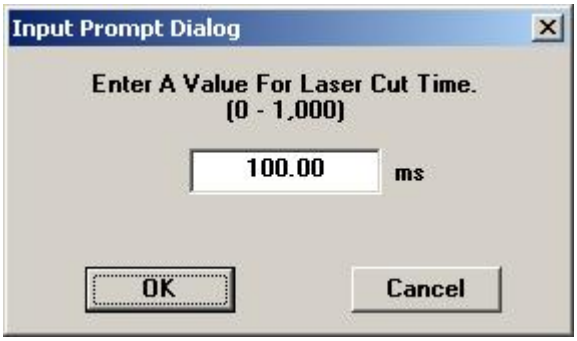
The Microtrak™ 3 is capable of detecting when the return signal is outside of acceptable ranges. In cut time mode, instead of outputting a full scale output signal when light intensity exceeds these limits, the laser will send the last valid value it read before exceeding the intensity limit. The value will be sent for the specified cut time or until the target is again detected. After that time, if the light intensity still exceeds

the limit, all outputs go into full-scale saturation mode. If intensity is within limits, the instrument will return to normal measurement output.

Cut time can be set from 0 to 1 second in 0.0001 second increments. A cut time value of 0 sec disables this feature.

This feature is excellent for ignoring holes and gaps in moving surfaces being measured.

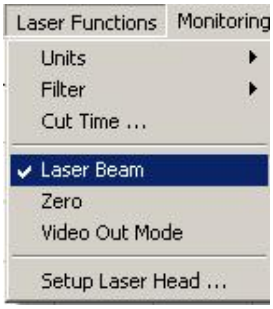
This setting is stored internally by the laser and will be recalled each time the laser is powered up.



4.2.13 Laser Beam

The **Laser Beam** menu item is used to toggle the laser beam on and off. When the laser beam is on, this menu item will have a check mark in front of it.

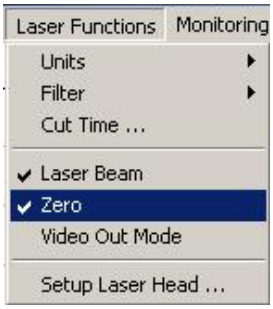
Clicking the **Laser Beam** button will also toggle the laser beam on and off.



4.2.14 Zero

A zero reference is used to establish a base line for relative measurements. This is sometimes called a tare function. When **Zero** is commanded, the current displacement value of the laser is stored internally and used to offset subsequent data measurements. When the zero function is active, this menu item will have a check mark in front of it.

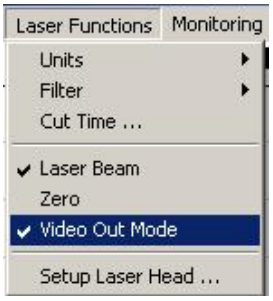
Clicking the **Zero** button will also toggle the zero function on and off.



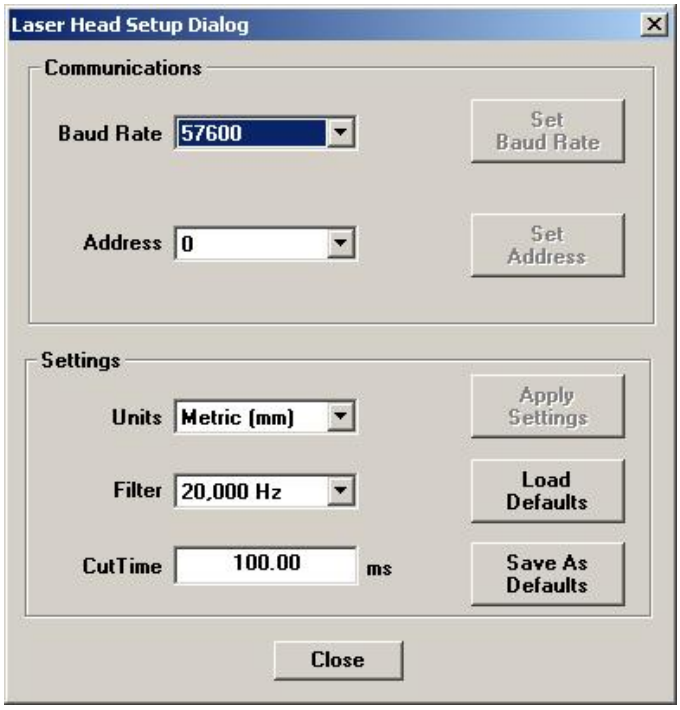
4.2.15 Video Out Mode

The **Video Out Mode** menu item is used to toggle the laser between normal and video out mode. During Video Out Mode, the sensor image is routed to the analog output so that it may be viewed on an oscilloscope. This mode is useful in troubleshooting measurement problems as it displays exactly what the CMOS sensor is seeing. When the video out mode is active, this menu item will have a check mark in front of it.

Clicking the **Video Mode** button will also toggle between normal and video out mode.



4.2.16 Setup Laser Head



The Laser Head Setup Dialog is used to define the laser side of the RS-485 communications link and to conveniently define the laser settings. The dialog permits the loading and saving of default settings to facilitate the setup of multiple laser heads with similar settings. All values changed in this dialog will affect the settings inside the head and will be stored into the head. Use caution when changing communications settings in the head as it may become difficult to re-establish communications once the new settings take effect. If the communications settings become unknown, utilize the Scan for Lasers Utility to re-establish the communications parameters

Select the desired baud rate for laser communications. The Microtrak™ 3 laser head supports baud rates of 9600 and 57600. Click the **Set Baud Rate** button to activate the new baud rate.

Select the desired laser head address. Normally the address is always set to zero unless multiple laser are connected on the same communications port. Click the **Set Address** button to active the new address.

Define the laser settings as need. Click the **Apply Settings** button to download the new settings to the laser head. The **Load Defaults** button may be clicked to load a previous saved set of settings. The **Save As Defaults** button may be clicked to save the currently defined settings as defaults.

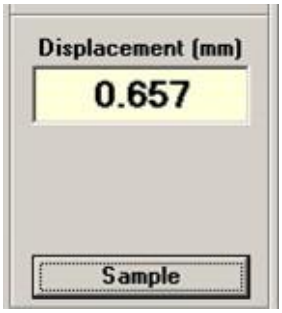
The settings may not take effect until the head is power cycled.

4.2.17 Measuring Data

The **Monitoring** menu controls the sampling and recording of laser displacement data.

4.2.18 Manual Sampling

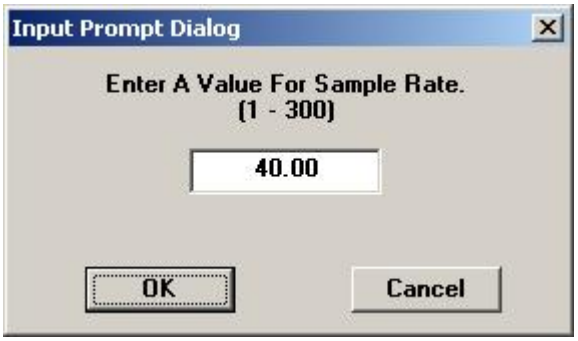
Sampling may be initiated manually by pressing the **Sample** button. A single measurement will be taken and displayed. Manually sampled data points are not plotted.



4.2.19 Set Sampling Rate

The sampling rate controls the rate at which data points are retrieved from the Microtrak™ 3 laser head during the monitoring and logging functions. The highest rate is 300 samples per second.

After monitoring or logging begins, this parameter cannot be changed.



4.2.20 Set Plot Window Size

The plot window size parameter controls the width of the data plot time axis. The plot behaves similar to a strip chart recorder and will display the amount of data as defined by the window size.

After monitoring or logging begins, this parameter cannot be changed.

4.2.21 Start Monitoring

Monitoring continuously acquires laser displacement data and graphs each point in the plot window. The plot window behaves like a strip chart recorder. After the plot window fills, data will fall off the left side of the plot as new data points are added on the right side.

Monitoring mode does not store data to a disk file. However, it does store the data points in 32,500 point memory array. When monitoring is stopped, this memory array is plotted in its entirety.

Monitoring may also be started and stopped by clicking the **Monitoring** button.

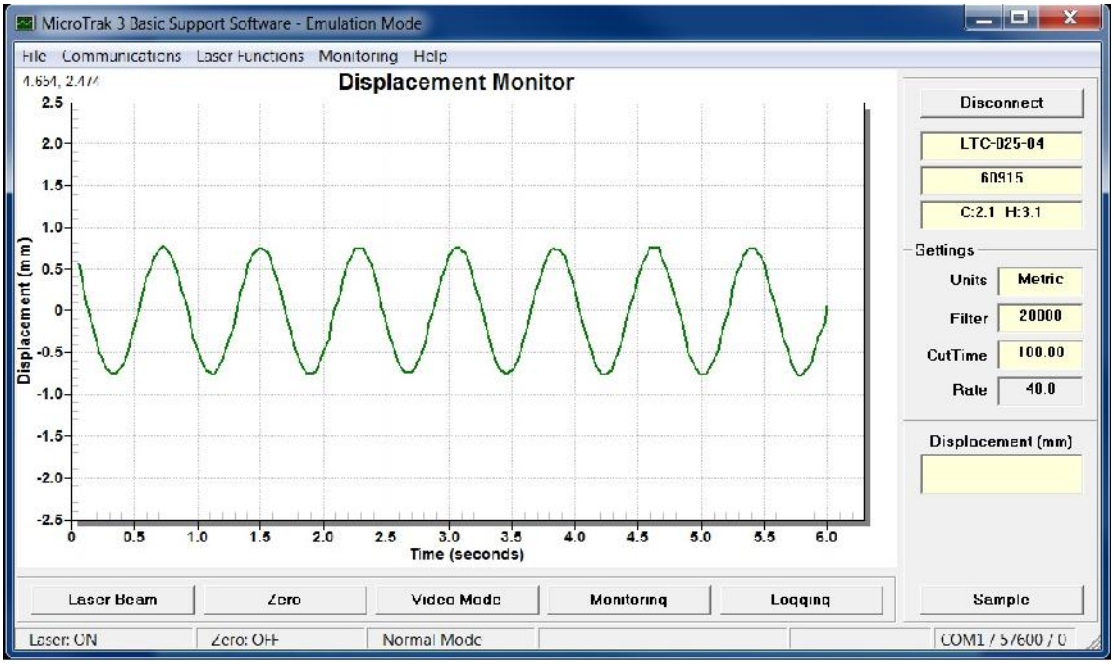


Figure 16:Displacement Monitor Window Screenshot

4.2.22 Stop Monitoring

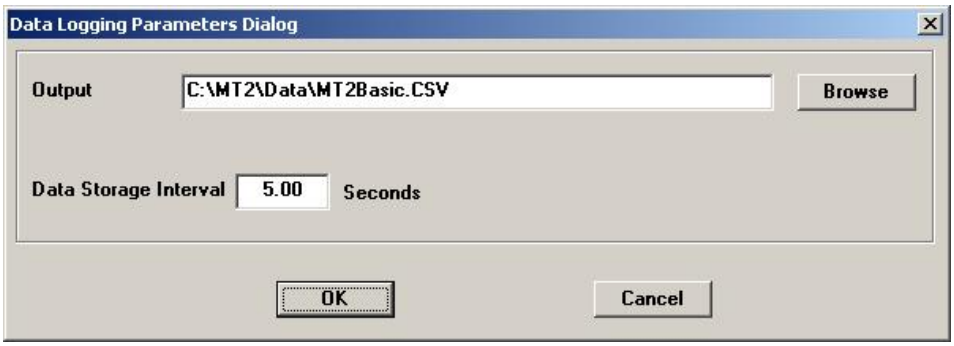
Clicking the **Stop Monitoring** menu item will stop the data monitoring process. When monitoring is stopped, the internal data memory is graphed in the plot window.

Monitoring may also be started and stopped by clicking the **Monitoring** button.

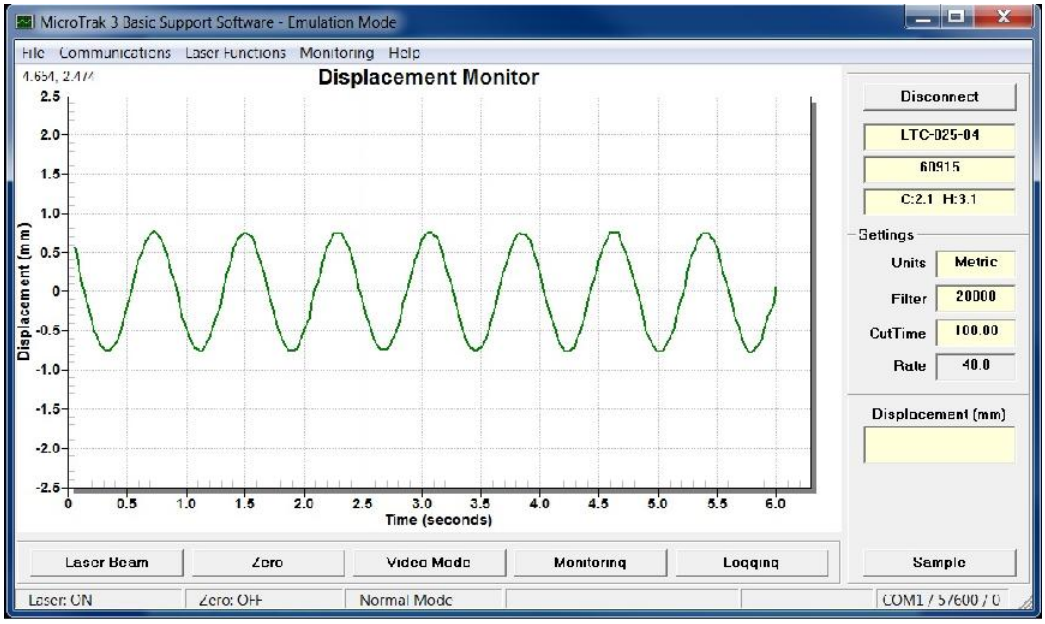
4.2.23 Start Logging

Logging is the same as monitoring except that the sampled data points are periodically stored to a disk file (CSV format). When the **Start Logging** menu item is selected, the Data Logging Parameters Dialog will be displayed.

This dialog allows the operator to specify an output data filename. The Data Storage Interval sets the number of seconds between writes to the hard drive.



After specifying the output filename and storage interval, click the **OK** button and monitor/logging will begin. The output filename and stored data count will be displayed in the status bar of the program window.



Logging may also be started and stopped by clicking the **Logging** button.

4.2.24 Stop Logging

Clicking the **Stop Logging** menu item will stop the data monitoring process. When logging is stopped, the internal data memory is graphed in the plot window.

Logging may also be started and stopped by clicking the **Logging** button.

4.2.25 Data Plot Menu Functions

Right clicking in the data plot with the mouse will bring up a pop-up menu of auxiliary functions.

4.2.25.1 Maximize

Maximizes the plot to fill the entire screen. Click in the title bar of the maximized plot window or press the **Esc** key to return to the normal plot display window.

4.2.25.2 Reset Zoom

The plot can be zoomed using the mouse by left clicking, holding the button down and dragging the mouse to form a zoom rectangle. The **Reset Zoom** menu function will return the plot to normal display mode.

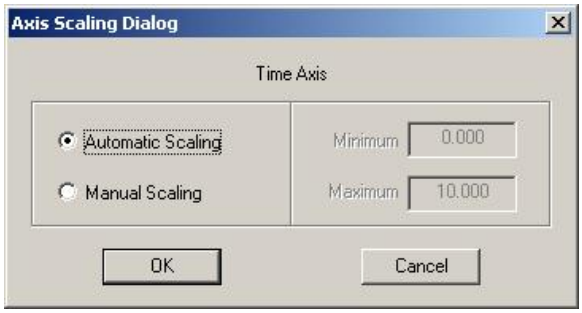
While monitoring or logging is active, only the vertical axis can be zoomed.

4.4.25.3 Clear Plot

Clears all the data points currently being plotted.

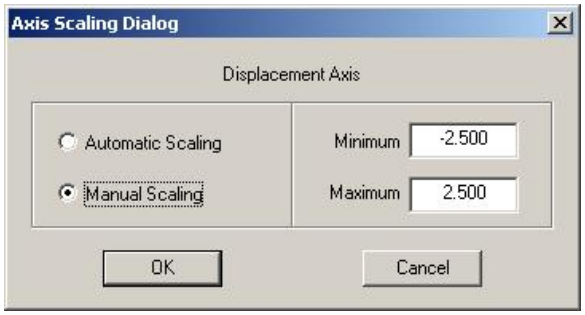
4.4.25.4 Time Axis Scaling

Allows the Time Axis to be manually or automatically scaled.



4.4.25.5 Displacement Axis Scaling

Allows the Displacement Axis to be manually or automatically scaled.

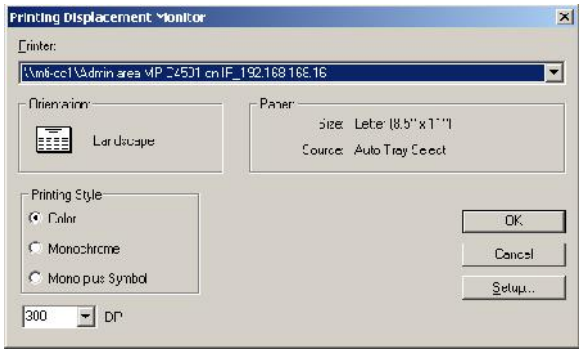


4.4.25.6 Customize

Click this menu function to bring up a Plot Customization Dialog that will allow the operator to change numerous features of the plot, such as line width, line color, etc.

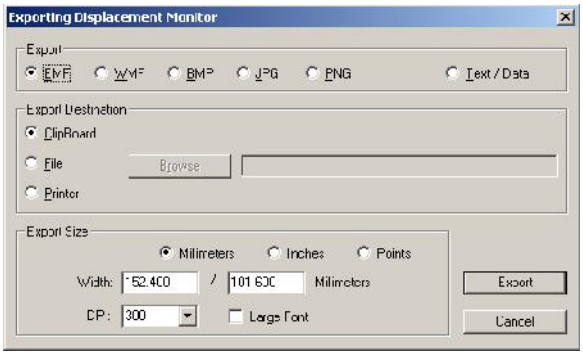
4.4.25.7 Print Plot

Click this menu function to bring up a Plot Print Dialog that will allow the current plot to be printed on any available system printer.



4.4.25.8 Export Plot

Click this menu function to bring up a Plot Export Dialog that will allow the current plot to be exported to a disk file or the Windows clipboard.

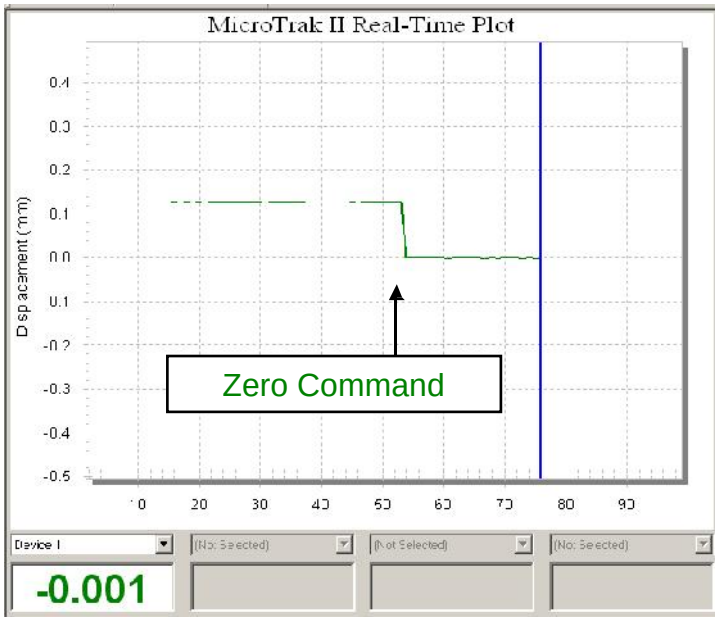


4.4.26 Establishing A Zero Reference

A zero reference is used to establish a base line for relative measurements. This is sometimes called a tare function. When **Zero** is commanded, the current displacement value of the laser head is stored internally and used to offset subsequent data points.

The plot at the right illustrates the effect of the **Zero** function.

Select the **Zero** menu function again or click the **Zero** button to return to normal data measurement mode.



4.4.27 Acquiring Video Image Data

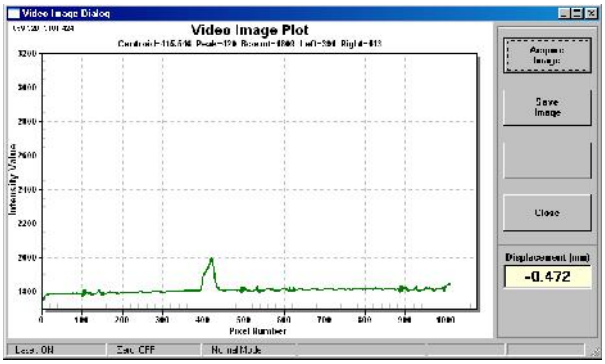
The laser head operates by acquiring image data from a CMOS Image Sensor and processing the image data to determine displacement. The quality of the displacement data can be affected by the quality of the image data. The quality of the image data can be degraded by the target surface quality. The Microtrak™ 3 Basic Support Software provides a function to recover the CMOS image data so that target quality issues can be assessed and corrected.

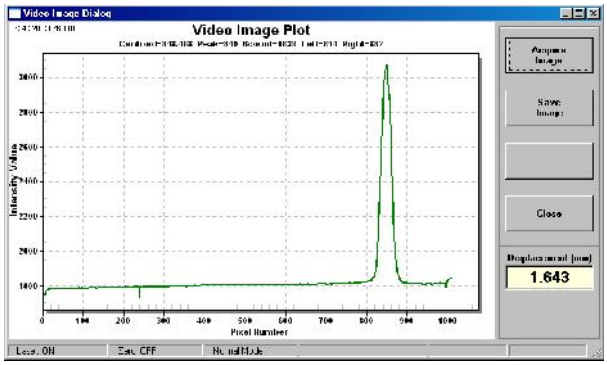
Note: When recovering image data, the Microtrak™ 3 laser head is in a special operating mode that does not process the CMOS images to determine displacement.

Select the **Monitoring-Acquire Video Image** menu function to activate the Microtrak™ 3 Video Image Dialog.

Click the **Acquire Image** button to capture and retrieve a video image.

After recovering the image data, a plot such as shown below will be displayed. The plot on the right shows the image from a good target, while the plot on the left shows the image from a poorly reflective target.





The image data may be saved to a disk file for later analysis by clicking the **Save Image** button.

Click the **Close** button to exit this dialog and return to the main screen display.

4.4.28 Error Messages and Error Codes

Abnormal conditions may occur during software operation. Generally an error message will be displayed in a pop message box or in the **Messages** area of the main dialog screen. Some of the error codes used by the Microtrak™ 3 Support Software Program are identified in the table below.

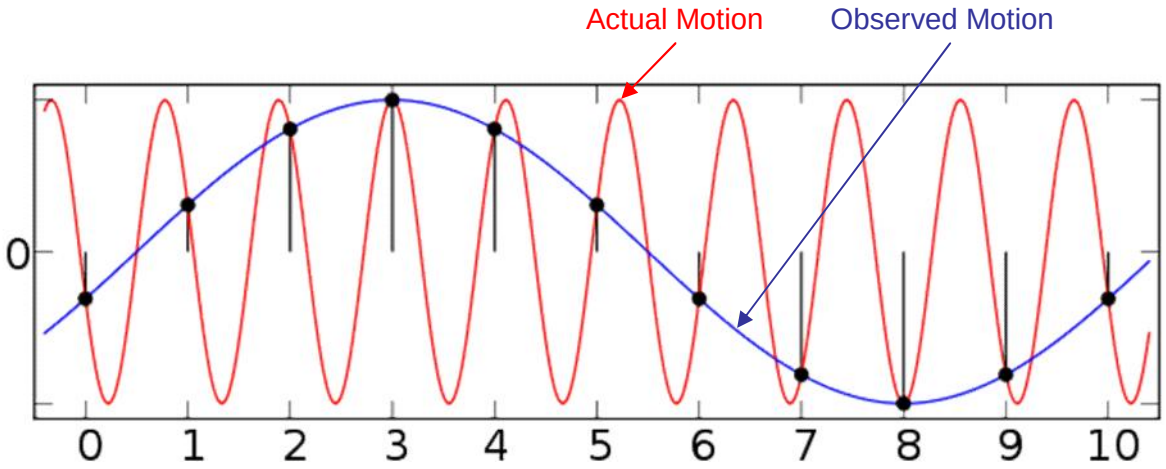
Code	Name	Description
-1	MT3ERR_NO_ARG	One of the laser communications functions was called but a required return argument was not provided.
0	MT3ERR_SUCCESS	No errors occurred during execution of the requested function.
0	MT3ERR_NO_ERROR	No errors occurred during execution of the requested function.
1301	MT3ERR_CONNECT_ERROR	An error occurred while attempting to establish communications with a laser device. The connection could not be established.
1304	MT3ERR_SEND_ERROR	The low level software was unable to send a message over the serial communications port. Exit the MT3Basic software and unplug the USB communications device. Plug the USB device in again and restart the software.
1305	MT3ERR_RECEIVE_TIMEOUT	A message was sent to the laser and a reply was expected, but that reply was never received. Intermittent errors are acceptable. If the error becomes persistent, troubleshoot the communications cables and USB serial hardware.
1306	MT3ERR_INVALID_SOURCE	A low level communications protocol error has occurred. The laser may be sending corrupted data. Cycle laser power and try again.
1307	MT3ERR_INVALID_DESTINATION	A low level communications protocol error has occurred. The laser may be sending corrupted data. Cycle laser power and try again.
1308	MT3ERR_INVALID_USER_COMMAND	A low level communications protocol error has occurred. The laser may be sending corrupted data. Cycle laser power and try again.
1309	MT3ERR_INVALID_LENGTH	A low level communications protocol error has occurred. The message length is not correct. The laser may be sending corrupted data. Cycle laser power and try again.
1310	MT3ERR_INVALID_CHECKSUM	A low level communications protocol error has occurred. The message checksum is not correct. The laser may be sending corrupted data. Cycle laser power and try again.
1312	MT3ERR_INVALID_REPLY	A low level communications protocol error has occurred. The laser did not sent the expected reply. The laser may be sending corrupted data. Cycle laser power and try again.
1313	MT3ERR_INVALID_ARGUMENT	An invalid argument was passed to one of the low level laser communications interface functions. The operator may have supplied an inappropriate input value.
1321	MT3ERR_INVALID_DEVICE	An invalid device index was passed to a laser communications interface function. Select one of the devices (lasers) actually connected to your system.
1322	MT3ERR_INVALID_UNITS	An invalid measurement units type was specified. Select either ENGLISH or METRIC units.
1323	MT3ERR_INVALID_FILTER	An invalid filter value was specified. Select one of the legal filter values.
1324	MT3ERR_DEVICE_NOT_PRESENT	An attempt was made to remove a device (laser) from the communications interface that does not exist.
1325	MT3ERR_INVALID_ADDRESS	An invalid laser address was passed to a communications interface function. Select an address in the range 0 to 14 inclusive.
1326	MT3ERR_SEARCH_FAILURE	The laser communications bus was searched and no laser devices were found. Ensure that all communications cables are connected and that all lasers are powered.

1327	MT3ERR_DEVICE_ALREADY_EXISTS	An attempt was made to manually add a laser device to the communications interface but communications could not be established with that device. Ensure that the device is physically present and powered and that its communications cable is connected.
1328	MT3ERR_TOO_MANY_DEVICES	An attempt was made to add more laser devices than the communications software can handle.
1331	MT3ERR_INVALID_HANDLE	An invalid handle was passed to passed to one of the laser communications interface functions. Either the handle has become corrupted or the corresponding laser device was never connected.
1332	MT3ERR_MEMORY_ALLOCATION	Memory could not be allocated while attempting to open a communications interface to the laser. Exit the MT3Basic program and run it again.
1333	MT3ERR_INVALID_COMMAND_PARAMETER	An invalid argument was passed to one of the laser communications interface functions. The operator may have supplied an inappropriate input value.

5 TROUBLESHOOTING AND APPLICATION NOTES

5.1 Aliasing

In a digital process, if the resolution in either the time or amplitude axis is too low, the reconstructed image can become distorted such that the reconstructed image becomes unrelated to the actual image. An example of digital aliasing is shown below:



As shown, a single set of sample points (black dots) can be connected such that two solutions are possible. In the case above, the low sampling rate used relative to the frequency of the red line can result in a distorted reconstruction of the red line (the blue line).

As a general rule, a higher sampling rate will provide better reconstruction of the original signal such that as the sampling rate approaches infinity, the signal reconstruction error becomes zero. A realizable system that uses digital sampling techniques cannot have an infinite sampling rate, and therefore there will always be some level of reconstruction error.

The Microtrak™ 3 uses digital sampling techniques to determine displacement, and is therefore susceptible to digital (video) aliasing. To minimize the effects of aliasing, the Microtrak™ 3 should be set to sample at the maximum rate (40kHz sampling, 20kHz bandwidth). According to Nyquist theory, with some restrictions, a sample rate of 40kHz can adequately recreate a bandwidth limited analog signal of 20kHz. Due to the restriction clauses of the Nyquist theory, most signals will require a sampling rate 3.5 to 4x that of the original signal. For Microtrak™ 3 set at its maximum bandwidth, this means that the maximum change rate of the target is approximately 10kHz to 11kHz.

Also note that as the maximum laser output is finite, for some surfaces, particularly dark surfaces, a balance needs to be struck between sample rate and exposure time such that the sampling rate is high enough to prevent aliasing, but the CMOS exposure time is long enough to provide a usable image. In some cases, in order to achieve adequate CMOS exposure, it will be necessary to set the head to the slower speed (20kHz sampling, 4kHz bandwidth).

5.2 Data Rate Using RS-485 Communications

The Microtrak™ 3 series laser heads provide an RS-485 digital communications link. Although the primary purpose of this link is to provide a control mechanism for the head, it can also be used to directly export digital displacement data from the head.

The maximum supported baud rate is 57600 and the topology is half duplex. In half duplex communications, transmit and receive messages share the same physical line and therefore, the head can either be transmitting data or receiving data, but not both at the same time. Accounting for typical message lengths and turnaround times, a typical single Microtrak™ 3 head will sustain an RS-485 data rate of approximately 300Hz.

MTI Instruments does not recommend the use of the multidrop RS-485 topology and favors the use of multiple virtual COM ports via a USB to RS-485 converter connected through a USB Hub (Figure 11:Wiring Multi-head USB using USB Hub). For applications where higher data rates are required, MTI Instruments recommends digitizing the analog output signal using and external analog to digital converter (Figure 13:Single Head with Measurement Computing ADC).

5.3 Explanation on Filters and Sampling Rate

Microtrak™ 3 has a software selectable provision for choosing between 7 different filter settings (0.1Hz, 1Hz, 25Hz, 200Hz, 1kHz, 4kHz, 20kHz). The firmware implemented filter in the head is a discrete time, first order, exponential, low pass filter.

When the 20kHz filter is selected, the head will automatically select a sample rate of 40kHz. When any filter other than 20kHz is selected, the sample rate is lowered to an effective rate of 20kHz. The effective 20kHz rate is achieved by clocking the CMOS sensor at the 40kHz frame rate and resetting the cells every other frame (as opposed to issuing a reset every frame as it is done at the 40kHz sample rate), then ignoring the data collected from the 1st frame. As a result, the CMOS exposure time at the 4kHz filter selection (inclusive) and lower will be twice that of the 20kHz rate.

5.4 Troubleshooting Chart

Laser does not power on	1. Make sure ONB is connected to ground.
	2. Check that power supply is outputting between 12-28VDC.
	3. Verify that the power supply can deliver 2.8W.
	4. Verify that the RED wire is connected to (+) and the BLACK wire is connected to (-).
	5. Verify that none of the unused wires are shorting.
	6. Verify that the aperature cover is not covering the laser beam.
Range indicator LED is RED	1. Verify that the target is parallel to surface B.
	2. Verify that the distance between the target and the laser head surface B is within the range of the laser head.
	3. Verify that the emission or return signal is not blocked.
	4. Verify that the software has not put the head into video monitor mode.
	5. Verify that there is sufficent signal by using video image or video monitor mode.
Head will not communicate	1. Verify that the correct COM port is selected in Microtrak™ 3 Basic Support Software
	2. Use the Scan for Lasers Utility in the Microtrak™ 3 remote program to establish communications settings.
	3. Verify that the power supply is meeting the power requirements of the head.
	4. Verify that the RS-485 A and B lines are not reversed.
	5. Verify that there is a common ground to the host computer.
Head produces erratic results with static targets	1. On shiny or dark targets, verify the signal integrity by using video image mode or video monitor mode.
	2. Change the bandwidth to 4kHz or lower.
	3. Verify that the setup does not vibrate.
	4. Verify that the mounting structure is not varying with temperature.
	5. Verify that the power supply is not producing noise.
	6. Verify that cable routing is not inducing noise.
	7. Verify that the laser head window is free of debris.
Head provides erratic results with moving targets	1. Verify the target peak to peak roughness vs its RMS roughness.
	2. Verfy that the pores or plateaus of the target do not put the head out of range. Consider using cut time option.
	3. Verify that the target motion system is not contributing to measurement errors.
	4. On shiny or dark targets, verify the signal integrity by using video image mode or video monitor mode.
	5. Change the bandwidth to 4kHz or lower.
	6. Verify that the target motion is within the bandwidth of the head (see Aliasing description in manual)
	7. Verify that the power supply is not producing noise.
	8. Verify that cable routing is not inducing noise.
	9. Verify that the laser head window is free of debris.

6 OPTIONS AND ACCESSORIES

6.1 Microtrak™ 3 Software Development Kit

To aid with product integration, MTI offers a Microtrak™ 3 Software Development Kit. The Microtrak™ 3 SDK provides the following:

- Windows installable DLL.
- Source code examples.
- A National Instruments Driver.
- Executable copies of the source code examples.
- Command documentation.

6.2 Other Accessories and Assemblies

MTI Optional Accessories:

MTI#	Comment
2100-2085	Laser Side Connector
2100-2086	Mating Connector
2025-5160	Multifunction ADC
8000-6431	FS6-1 Right Angle Bracket (25/50)
8000-6432	FS6-2 Right Angle Bracket (120/200/300)
8000-6725	FS-5 Laser Head Mount and Positioner
8000-6782	BNC to Ferrule Converter
8000-6925	Universal input power supply (DIN Mount) Assembly
8000-6923-001	Extension cable 1m
8000-6923-002	Extension cable 2m
8000-6923-005	Extension cable 5m

Head Dimensions (25mm standoff)

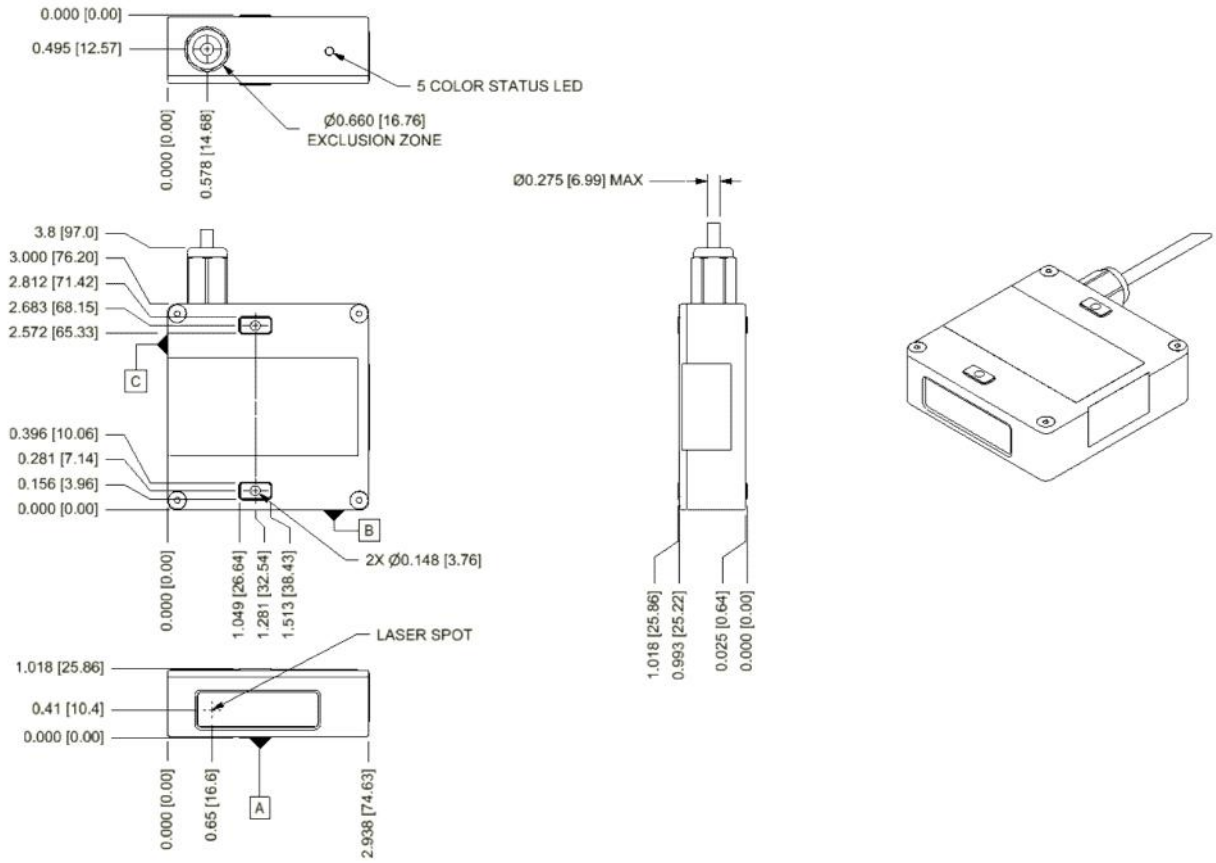


Figure 17: 25mm head mechanical specifications

Weight…….. 0.61lbs 227grams)

Head Dimension (50mm standoff)

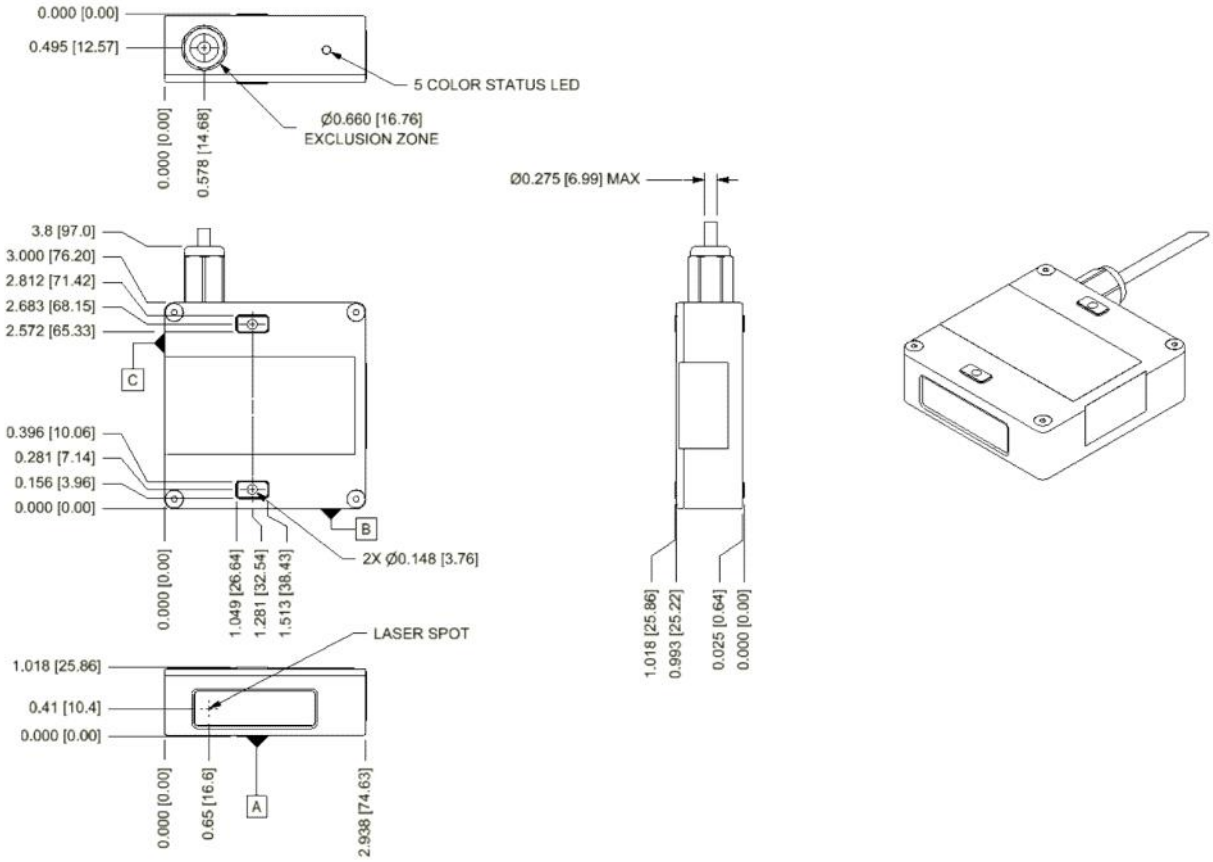


Figure 18: 50mm head mechanical specifications

Weight…….. 0.61lbs 227grams)

Head Dimension (120mm standoff)

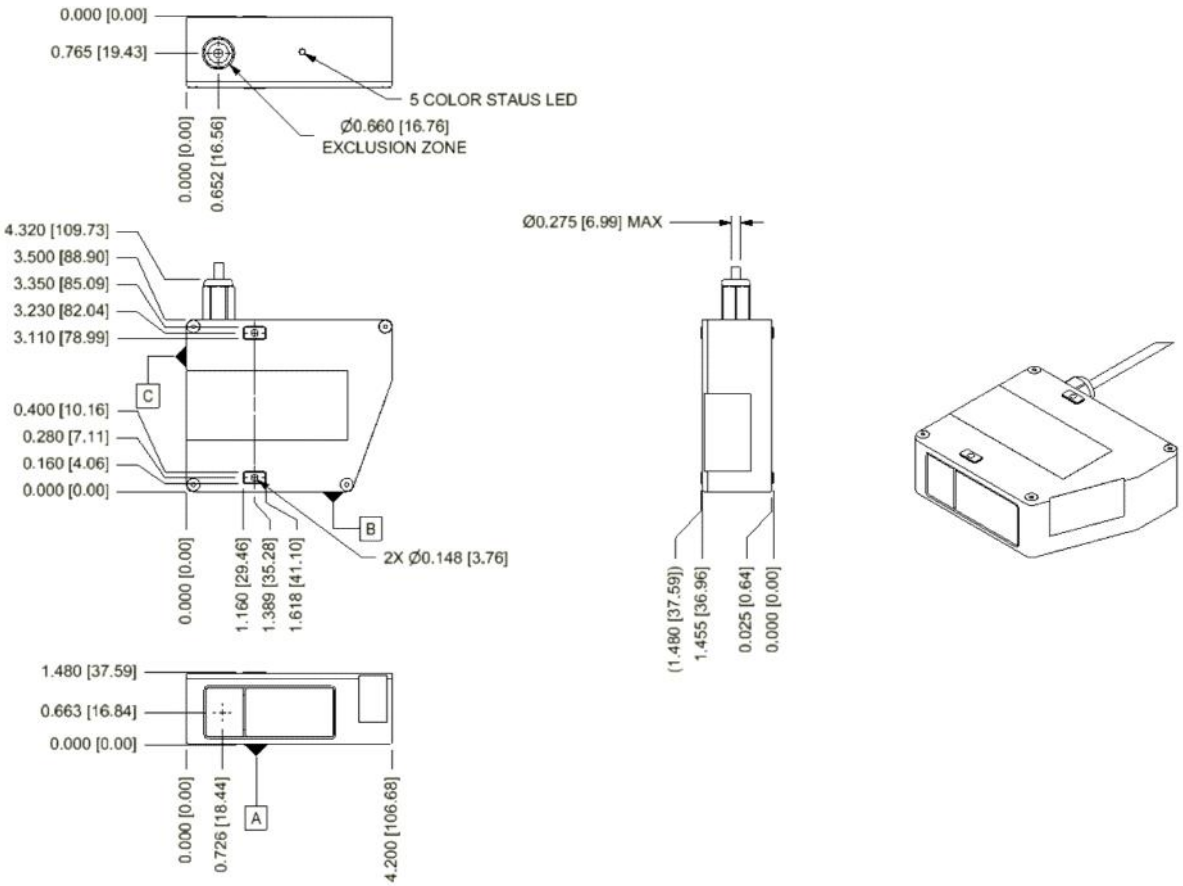


Figure 19: 120mm head mechanical specifications

Weight…….. 1.1 lb (413 grams)

Head Dimension (200mm standoff)

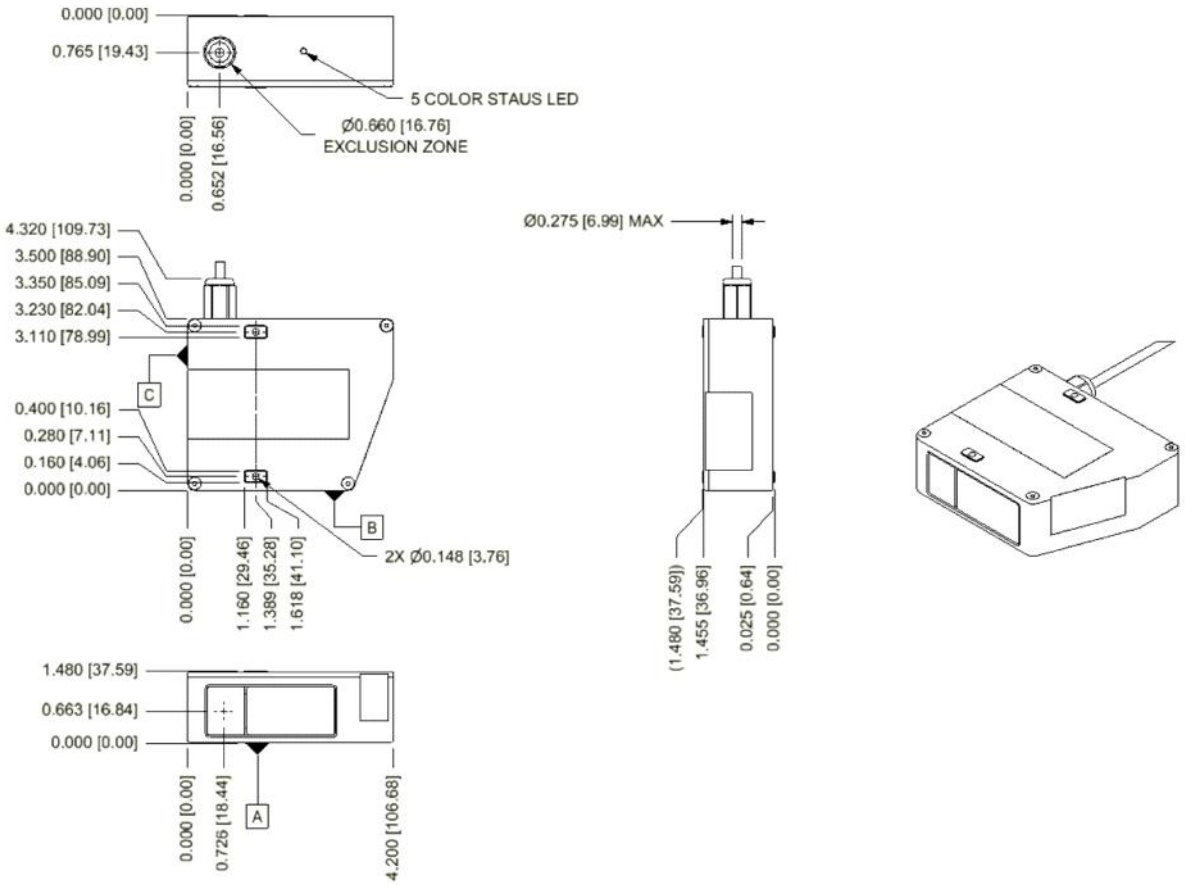


Figure 20: 200mm head mechanical specifications

Weight…….. 1.1 lb (413 grams)

Head Dimension (300mm standoff)

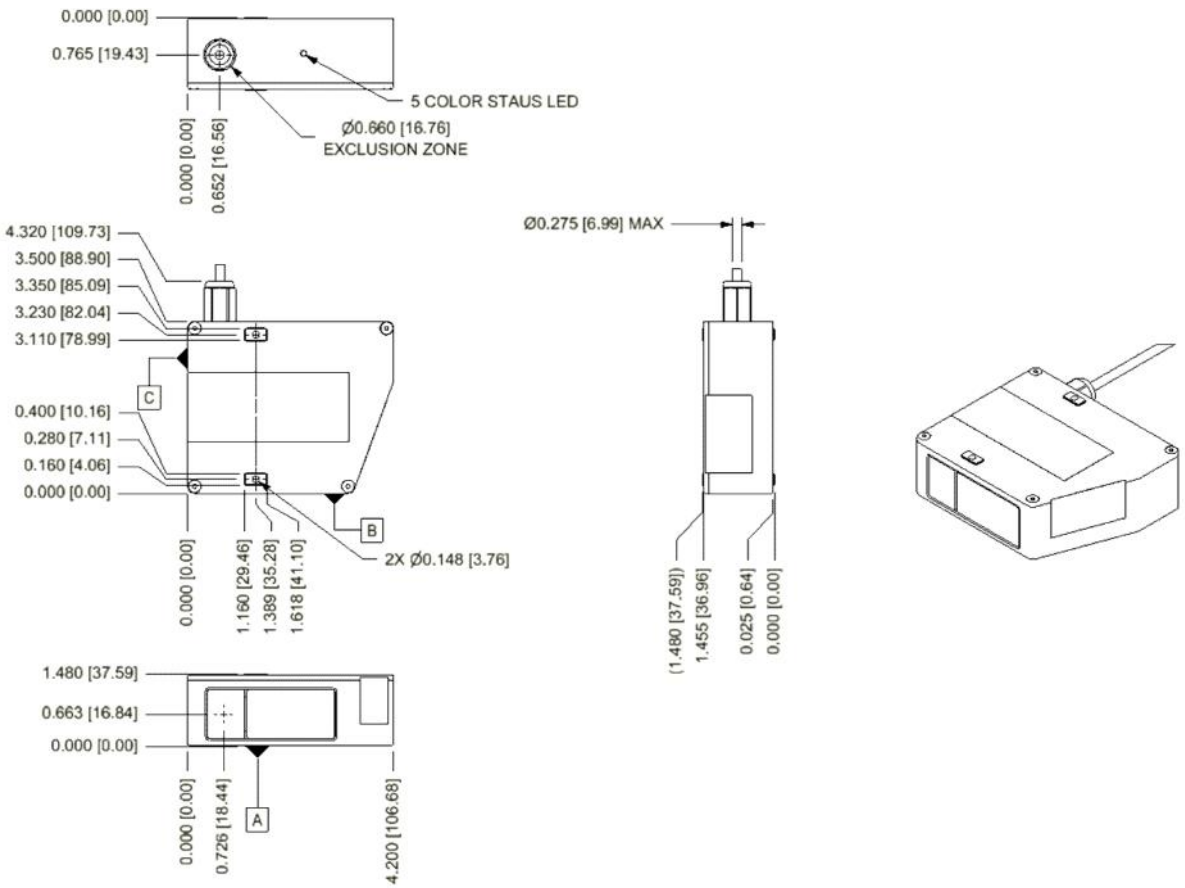
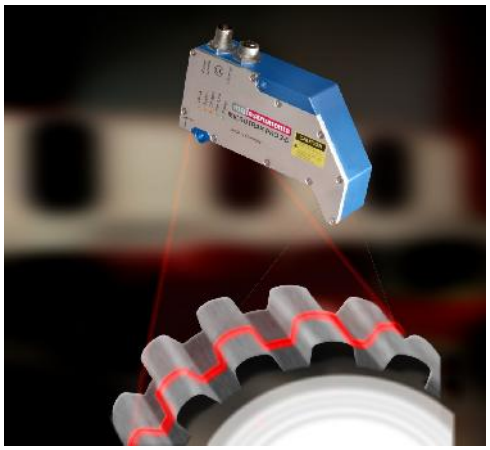


Figure 21: 300mm head mechanical specifications

Weight…….. 1.1 lb (413 grams)

OTHER METROLOGY PRODUCTS FROM MTI INSTRUMENTS

Microtrak™ Pro - 2D (2D Laser Triangulation)



MTI-2100 (Photonic)

Accumeasure™ 9000 (Capacitance)

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