OPTOTRAK PROseries System User Guide

IMPORTANT

Please read this guide and any supplements to this
guide before using the OPTOTRAK PROseries System.

For better assistance if you should require technical support, please

record your Optical Tracker serial number here (pg 5):

_____

and

record your System Controller serial number here (pg 7):

_____

record serial numbers for any accessories here:

_____

_____

_____

_____

_____

_____

_____

Part Number: IL-1070135

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITIES

Northern Digital Inc. (NDI) has taken due care in preparing this document and the programs and data on the electronic media accompanying this document including research, development, and testing.

This document describes the state of NDI's knowledge respecting the subject matter herein at the time of its publication, and may not reflect its state of knowledge at all times in the future. NDI has carefully reviewed this document for technical accuracy. If errors are suspected, the user should consult with NDI prior to proceeding. NDI makes no expressed or implied warranty of any kind with regard to this document or the programs and data on the electronic media accompanying this document.

NDI makes no representation, condition or warranty to the user or any other party with respect to the adequacy of this document or accompanying media for any particular purpose or with respect to its adequacy to produce a particular result. The user's right to recover damages caused by fault or negligence on the part of NDI shall be limited to the amount paid by the user to NDI for the provision of this document. In no event shall NDI be liable for special, collateral, incidental, direct, indirect or consequential damages, losses, costs, charges, claims, demands, or claim for lost profits, data, fees or expenses of any nature or kind.

Product names listed are trademarks of their respective manufacturers. Company names listed are trademarks or trade names of their respective companies.

MINPACK COPYRIGHT NOTICE (1999) UNIVERSITY OF CHICAGO. ALL RIGHT RESERVED.

1. Redistribution of source code must retain the above copyright notice, this list of conditions and the following disclaimer.

2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

3. The end-user documentation included with the redistribution, if any, must include the following acknowledgment:

    "This product includes software developed by the University of Chicago, as Operator of Argonne National Laboratory."

4. WARRANTY DISCLAIMER. THE SOFTWARE IS SUPPLIED "AS IS" WITHOUT WARRANTY OF ANY KIND. THE COPYRIGHT HOLDER, THE UNITED STATES, THE UNITED STATES DEPARTMENT OF ENERGY, AND THEIR EMPLOYEES: (1) DISCLAIM ANY WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OR NON-INFRINGEMENT, (2) DO NOT ASSUME ANY LEGAL LIABILITY OR RESPONSIBILITY FOR THE ACCURACY, COMPLETENESS, OR USEFULNESS OF THE SOFTWARE, (3) DO NOT REPRESENT THAT USE OF THE SOFTWARE WOULD NOT INFRINGE PRIVATELY OWNED RIGHTS, (4) DO NOT WARRANT THAT THE SOFTWARE WILL FUNCTION UNINTERRUPTED, THAT IT IS ERROR-FREE OR THAT ANY ERRORS WILL BE CORRECTED.

5. LIMITATION OF LIABILITY. IN NO EVENT WILL THE COPYRIGHT HOLDER, THE UNITED STATES, THE UNITED STATES DEPARTMENT OF ENERGY, OR THEIR EMPLOYEES: BE LIABLE FOR ANY INDIRECT, INCIDENTAL, CONSEQUENTIAL, SPECIAL OR PUNITIVE DAMAGES OF ANY KIND OR NATURE, INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS OR LOSS OF DATA, FOR ANY REASON WHATSOEVER, WHETHER SUCH LIABILITY IS ASSERTED ON THE BASIS OF CONTRACT, TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY), OR OTHERWISE, EVEN IF ANY OF SAID PARTIES HAS BEEN WARNED OF THE POSSIBILITY OF SUCH LOSS OR DAMAGES.

Table of Contents

Table of Contents

Read Me First

Read this section before operating the OPTOTRAK® PROseries System.

Note   See the other tabs in this binder for warnings and cautions specific to those utilities, devices, or accessories.

Warnings

⚠ Warning!   In all NDI documentation, warnings are marked by this symbol. Follow the information in the accompanying paragraph to avoid personal injury.

1. LASER - Do not look directly into the laser-emitting aperture. The class 2M laser module on the Optical Tracker emits radiation that is visible and harmful to the human eye. Direct viewing of the laser diode emission at close range, or through the use of far-seeing optical instruments such as binoculars, may cause eye damage.

2. LASER - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

3. Do not use the OPTOTRAK PROseries System in the presence of flammable gases or fumes. Doing so may present an explosion hazard.

4. Unless stated otherwise, there are no user-serviceable parts in the OPTOTRAK PROseries System. Any servicing or disassembly must be performed by trained technicians or referred to NDI. Unauthorized servicing or disassembly will void your warranty and could result in equipment damage and/or personal injury.

5. Do not allow fluid of any kind to enter the Optical Tracker or other system equipment in any way. Spillage can damage the system and may present a fire or shock hazard.

6. Disconnect the System Controller and Optical Tracker from their power sources before cleaning the equipment or changing fuses. Failure to disconnect the System Controller and Optical Tracker may result in personal injury.

Cautions

1. To move or ship the OPTOTRAK PROseries System, repack all components in the original containers together with all protective packaging to prevent equipment damage.

2. Do not use the OPTOTRAK PROseries System in the vicinity of radio frequency communications equipment. Radio frequency communications equipment, including portable and mobile devices, may affect the OPTOTRAK PROseries System and the accuracy of your measurements.

3. Do not cover the openings on the Optical Tracker or System Controller when the system is powered on. Obstructing ventilation will restrict airflow, which will affect measurement accuracy and cause equipment damage.

4. Avoid using the OPTOTRAK PROseries components in dusty, wet, or humid environments. Harsh environments can damage components, and may affect system accuracy.

5. The Optical Tracker requires a warm up time to stabilize. Failure to allow the Optical Tracker sufficient time to warm up may affect the accuracy of your measurements.

6. Do not subject the Optical Tracker to thermal and/or mechanical shock, as they can affect system accuracy. It is your responsibility to confirm system accuracy using the AUTOscale procedure. If accuracy is still in doubt, return the Optical Tracker to NDI for repair and calibration services.

7. Do not subject the AUTOscale reference bar to rough handling or impacts. The AUTOscale reference bar is a finely calibrated artifact. Using a damaged reference bar will produce invalid AUTOscale results and affect measurement accuracy.

8. The Optical Tracker must be securely mounted and stable during measurement and cannot be subjected to outside contact or movement, as this will affect the accuracy of your results. Use dynamic referencing if the Optical Tracker has the potential to move during measurement.

9. Only operate the Optical Tracker when end mount filters are in place. If end mount filters are not in place, dirt may enter and damage the Optical Tracker.

10. Use only a cloth damp with water and mild detergent to clean component exteriors, as other substances may damage the finish or remove the panel lettering.

11. The reference bar and stand must remain completely still during AUTOscale length measurements. Any movement of the bar or stand during AUTOscale measurements will produce invalid results and affect measurement accuracy.

12. Do not use an AUTOscale reference bar that was not specifically calibrated for your system. Using the wrong reference bar will result in significant measurement errors.

Disclaimers

1. This device has been investigated and found to be in compliance with the standards listed in the Appendixes of this user guide. Such compliance does not preclude:

    a) that the use of this device may create disturbances, which interfere with the operation of other equipment; or

    b) that the use of other equipment may create emissions, which interfere with the operation of this device.

    In the event that either of these cases are suspected, use of this device should be suspended and the appropriate technical personnel consulted.

2. This equipment has been investigated with regard to safety from electrical shock and fire hazard. The inspection authority has not investigated other physiological effects.

3. All NDI OPTOTRAK PROseries systems are designed to operate using NDI-specified system settings and exclusively use NDI-specific components (i.e. NDI Optical Trackers are manufactured to accurately track NDI tools). NDI is not responsible for any outcome that could arise from using non-NDI components or from unauthorized alteration of system settings, including without limitation equipment or other property damage and/or personal injury.

4. It is the end user's responsibility to define and enforce work safety standards related to the transport, handling, installation, and mounting of OPTOTRAK PROseries System equipment.

5. The OPTOTRAK PROseries System requires special precautions regarding electromagnetic compatibility (EMC) and electrostatic discharge (ESD), and must be installed and put into service according to the EMC information provided in this guide. See "Electromagnetic (EMC) and Electrostatic Discharge (ESD) Concerns" on page 38 and "Approvals and Classifications" on page 40.

6. Due to continuous improvements and ongoing product changes, the information in this manual is subject to change without notice. The examples and diagrams in this document are included solely for illustrative purposes and may vary from those which actually appear on your system.

7. The OPTOTRAK PROseries is a general metrology instrument. Use in a particular application must be determined by the user.

Contact Information

If you have any questions regarding the content of this guide or the operation of this product, please contact us:

NDI
103 Randall Drive
Waterloo, ON, Canada N2V 1C5

Phone: +1 (519) 884-5142
Toll Free: +1 (877) 634-6340
Global: + (800) 634-634-00
Fax: +1 (519) 884-5184

support@ndigital.com
www.ndi.ca

NDI EUROPE GmbH
Fritz-Reichle-Ring 2
D-78315 Radolfzell
Germany

Phone: + 49 (77 32) 939 19 00
Global: + (800) 634 634 00
Fax: + 49 (77 32) 939 19 09

NDI ASIA PACIFIC
Unit 301, 3/F Core Building 1
No. 1 Science Park East Avenue,
Hong Kong Science Park,
Shatin, New Territories,
Hong Kong

Phone: + (852) 2802 2205
Fax: + (852) 2802 0060

Updates

NDI is committed to continuous improvements in the quality and versatility of its software and hardware. To obtain the best results with your NDI system, check the NDI Support Site regularly for update information:

http://support.ndigital.com

About This Guide

This guide contains basic information necessary to set up and use the OPTOTRAK PROseries Optical Tracker. For information about specific accessories and additional software utilities, see the appropriate tab.

Organization of Content

This guide contains the following information:

Product Introduction and Component Descriptions

- **"Basic System Overview"** introduces the OPTOTRAK PROseries System and provides a high-level overview of system operation.

- **"Component Descriptions"** provides detailed information about the core OPTOTRAK PROseries components.

Step-By-Step System Setup and Usage Task List

- **"Setting Up the System"** describes how to connect the system hardware components, configure the host computer, place the Optical Tracker, and power on the system.

- **"Calibrating Probe Styli"** describes how to calibrate the system for individual probe styli (a prerequisite to performing the first AUTOscale adjustment).

- **"Optical Tracker AUTOscale"** describes how to set up and use the AUTOscale Reference Kit, which is used to maintain and verify system accuracy.

System Maintenance

- **"Maintenance"** provides information about how to clean and maintain system components.

Appendices

The appendices provide reference information regarding technical specifications and regulatory information.

- **"Operational Considerations"** provides information about electromagnetic and environmental requirements to ensure correct and safe operation of the OPTOTRAK PROseries System.

- **"Approvals and Classifications"** provides important information regarding equipment regulatory approvals and classifications.

1 Basic System Overview

1.1 Introduction

The OPTOTRAK PROseries System is a portable, high-accuracy optical platform for measuring and tracking the three-dimensional (3D) positions of specially designed targets. Up to 512 targets can be tracked by the system, with each target automatically identified in real time and without user intervention. This greatly enhances measurement throughput and helps eliminate user error. The OPTOTRAK PROseries System's high-speed data capability allows users to record up to 4500 measurements per second, enabling precise tracking of dynamic motion.

Depending on accessories and software options, the system can report the 3D locations of discrete targets, or the position and orientation of one or more objects to which targets have been attached. Specially designed digitizing probes and laser scanners, incorporating similar targets, provide a means to measure surface coordinates and hidden points. Depending on your configuration, the "all-in-one" Optical Tracker can perform precision probing, non-contact scanning, and full 3D/six-degrees-of-freedom (6DOF) tracking.

An example OPTOTRAK PROseries configuration is shown below.

Figure 1-1   Example OPTOTRAK PROseries System

1.2   Measurement Volumes

The measurement volume is the 3D space within which the Optical Tracker can take measurements.

All measurements
are in metres

Model 540

1.4

1.3

2

2.25

4

2.4

5.4m^3
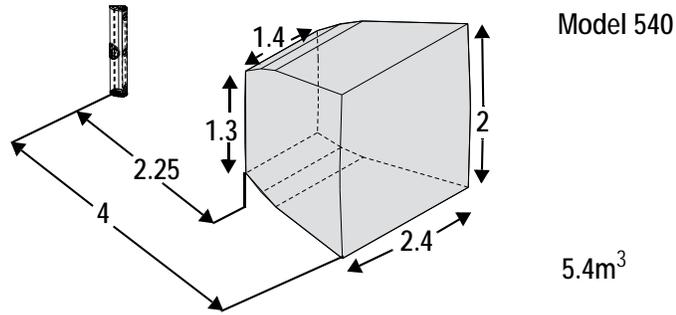
Figure 1-2   Measurement Volume - Model 540

All measurements
are in metres

Model 1000

0.5

1.5

2.2

4.5

2.8

10m^3
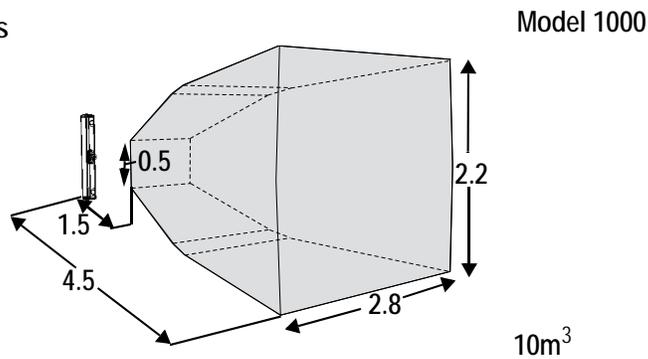
Figure 1-3   Measurement Volume - Model 1000

All measurements
are in metres

Model 2000

0.5

1.5

2.7

6.0

3.7

20m^3
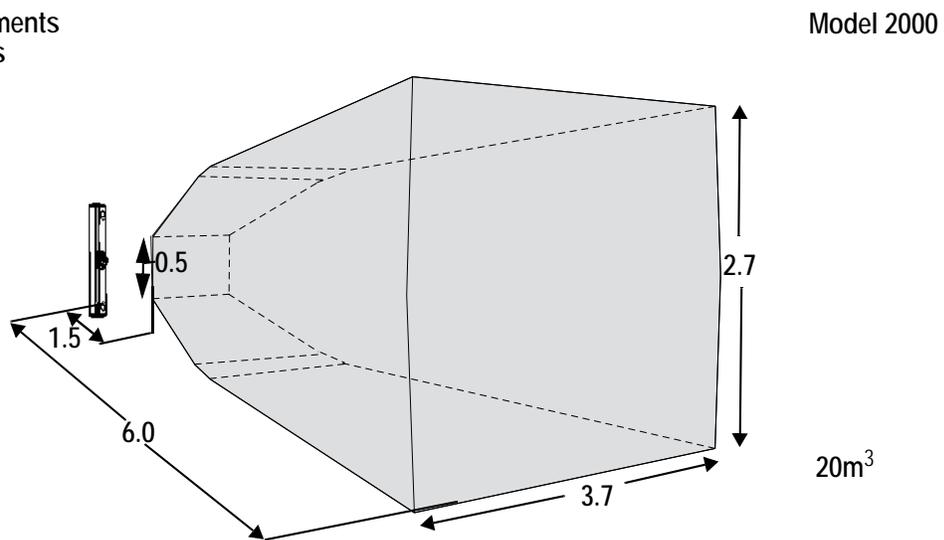
Figure 1-4   Measurement Volume - Model 2000

2   Component Descriptions

Your OPTOTRAK PROseries configuration is based on your purchased accessories and upgrades. Table 2-1 describes where to find detailed information on the basic hardware and software components of the OPTOTRAK PROseries System.

Table 2-1   Components of the OPTOTRAK PROseries System

Component	Name	See
	Optical Tracker	Page 4
	System Controller	Page 6
	USB Interface	Page 8
	AUTOscale Reference Kit	Page 9
	Stylus Calibration Utility	Installing - Page 12 Starting - Page 18
	AUTOscale Utility	Installing - Page 12 Starting - Page 25
	Host Computer Requirements Ethernet setup PCI Card setup USB Interface	Page 11 Page 12 Page 12 Page 12
	Cables	Page 10
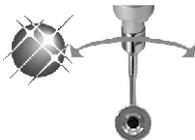
2.1 Optical Tracker

The Optical Tracker is the device that detects targets.

Figure 2-1   OPTOTRAK PROseries Optical Tracker

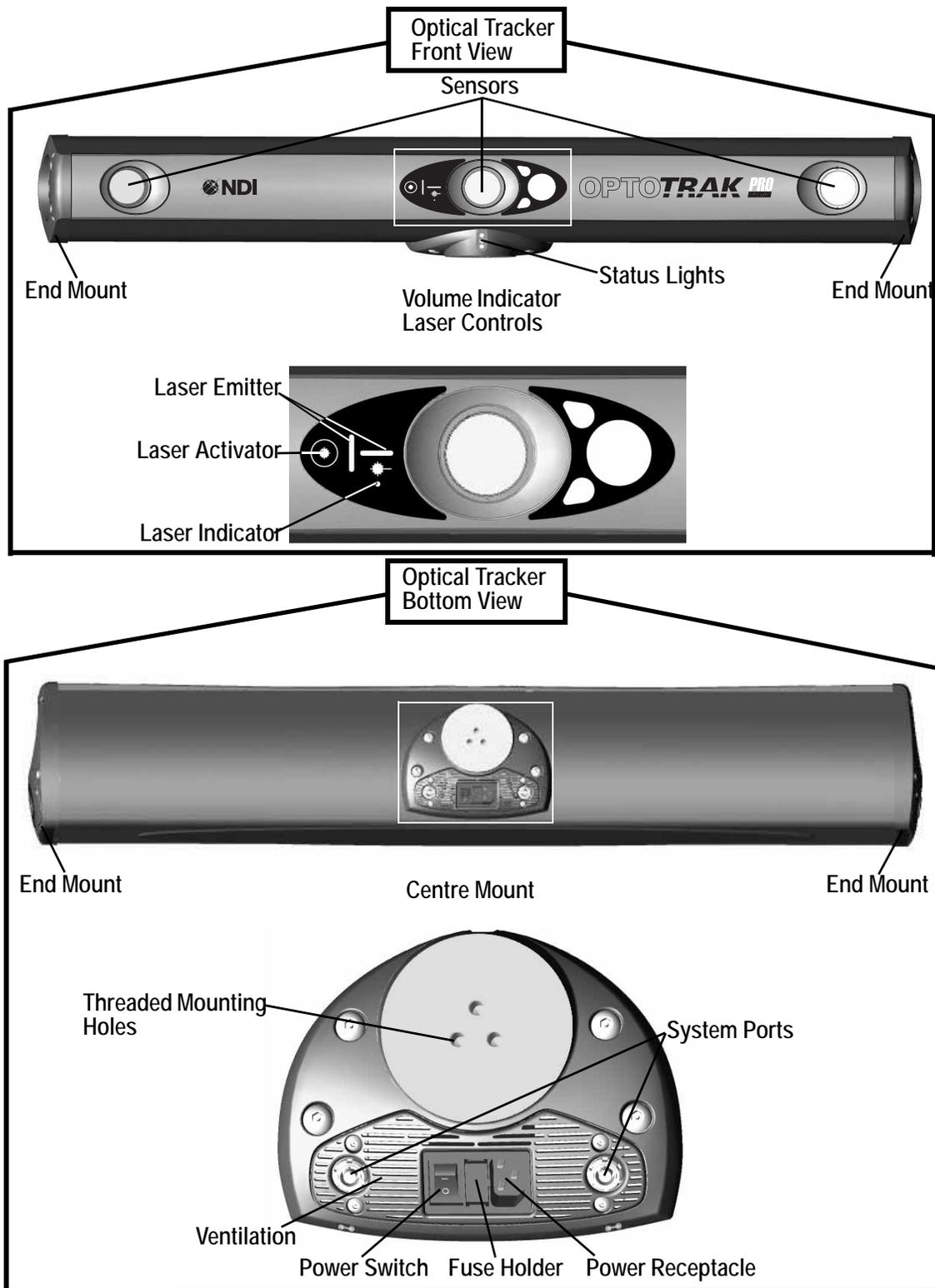|	
Caution!	Do not subject the Optical Tracker to thermal and/or mechanical shock, as they can affect system accuracy. It is your responsibility to confirm system accuracy using the AUTOscale procedure. If accuracy is still in doubt, return the Optical Tracker to NDI for repair and calibration services.

Sensors These track the 3D position of targets.

Volume Indicator Laser

The volume indicator laser projects the approximate extents of the measurement volume.

⚠️ **Warning!**	LASER - Do not look directly into the laser-emitting aperture. The class 2M laser module on the Optical Tracker emits radiation that is visible and harmful to the human eye. Direct viewing of the laser diode emission at close range, or through the use of far-seeing optical instruments such as binoculars, may cause eye damage. LASER - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Laser Activator This touch-sensitive pad activates and deactivates the volume indicator laser.

Laser Indicator The laser indicator lights when the volume indicator laser powers on.

Laser Emitter The laser emitter projects the laser crosshair.

For more information about the volume indicator laser, see "Using the Volume Indicator Laser" on page 30 and "Laser Safety Information" on page 39.

Centre Mount

The centre mount is used to attach the Optical Tracker to a stand.

System Ports   These ports are for connecting the Optical Tracker to the System Controller.

Threaded Mounting Holes These secure the Optical Tracker to a mounting point via M8 fasteners.

Ventilation These openings provide airflow inside the Optical Tracker.

Power Receptacle This connects to the AC power mains at 100 - 240V AC, 50/60 Hz, 1.0A.

Fuse Holder This contains two type T1.0A, 250V fuses.

End Mount

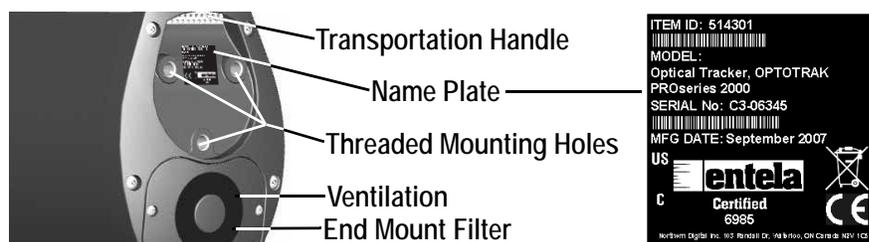The end mount provides ventilation and mounting to available NDI-supplied vertical stands only.

Figure 2-2   End Mount and Example Name Plate

Transportation Handle Use the handle on each end mount to carry the Optical Tracker.

Threaded Mounting Holes These secure the Optical Tracker to NDI-supplied vertical stands via M8 fasteners.

Ventilation These openings provide airflow inside the Optical Tracker.

Caution! Do not cover the openings on the Optical Tracker or System Controller when the system is powered on. Obstructing ventilation will restrict airflow, which will affect measurement accuracy and cause equipment damage.

End Mount Filter This prevents dust and debris from entering the Optical Tracker.

Name Plate This shows the item identification number, model number, serial number, and manufacturing date of your Optical Tracker. To assist your support representative, record this information in the space provided on the back of this guide's title page.

Status Lights
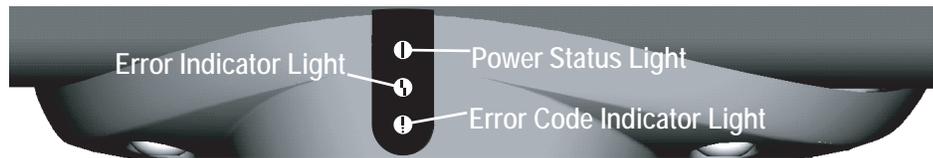
Figure 2-3   Optical Tracker Status Lights

Power Status Light (green) This lights when the power to the Optical Tracker is on.

Error Indicator Light (amber)   This lights when a system error is present, and on initial power up.

Error Code Indicator Light (amber) This flashes an error code sequence when a system error is present. The sequence is used by your support representative to assist with troubleshooting.

2.2   System Controller

For systems without a USB Interface, the System Controller is the central connection and communication point for all of your tools and accessories.

Figure 2-4   System Controller - Front View

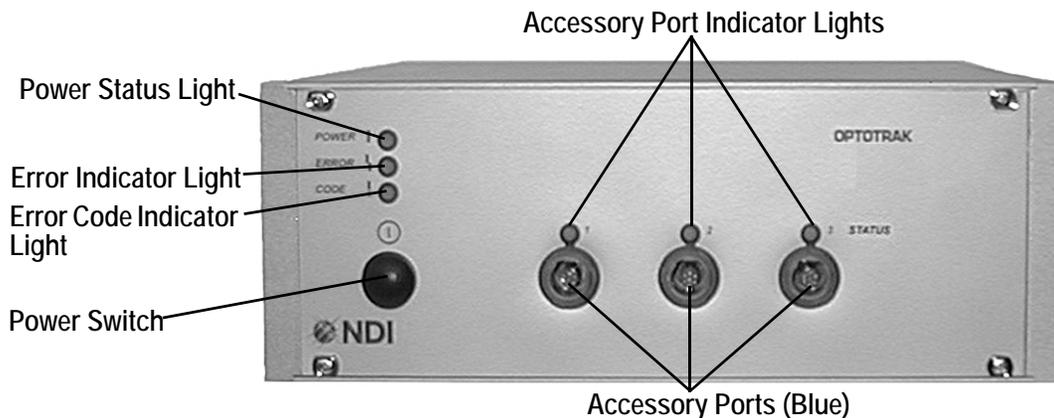| Note	To complete a hardware reset of the System Controller, the power must be off for 10 seconds to ensure that all of the electronic components have discharged.

Power Status Light (green) This lights when the power to the System Controller is on.

Error Indicator Light (amber) This lights if a system error is present, and on initial power up.

Error Code Indicator Light (amber) This flashes an error code sequence when a system error is present. The sequence is used by your support representative to assist with troubleshooting.

Accessory Port These ports are coloured blue and connect hardware accessories, such as probes and target controllers, to the System Controller.

Accessory Port Indicator Light This displays the status for each corresponding accessory port.

The indicator light:

- **is off** when there is no accessory plugged in

- **flashes amber** when the system is processing an equipment change or initializing on start-up

- **is steady green** when an accessory has been plugged in and initialized, and the system is ready to track
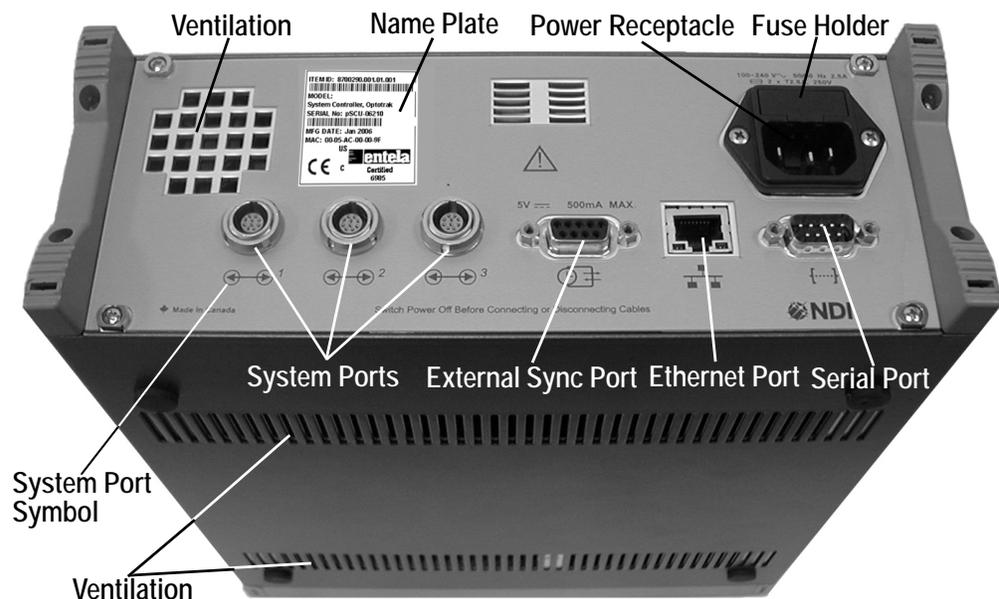
Figure 2-5   System Controller - Back View

System Ports These ports are labelled with a black "System Port" symbol and are for connecting the System Controller to the Optical Tracker or the PCI card (if required) on the host computer. The ports are numbered 1 to 3.

External Sync Port This has a female DB9 connector to provide external synchronization or trigger signals to the System Controller, or to provide frame and target timing information from the System Controller to external devices. Contact your support representative before attempting user-developed procedures that involve the use of this feature.

Ethernet Port This has an RJ45 connection that operates at 10/100 Mbps. This can be used to establish a connection to the host computer through an Ethernet network (if required).

Serial Port This has an RS-232, null modem cable. This is used to access and modify embedded data such as IP address and firmware packages.

Power Receptacle This connects to the AC mains power. The power regulation circuit inside the System Controller is self-switching. It can operate when connected to an AC power supply which provides power between 100 and 240V AC at 50 - 60 Hz.

Fuse Holder This contains two fuses of type T2.5A, 250V.

Ventilation These openings provide airflow inside the System Controller.

Caution! Do not cover the openings on the Optical Tracker or System Controller when the system is powered on. Obstructing ventilation will restrict airflow, which will affect measurement accuracy and cause equipment damage.

Name Plate This shows the item identification number, model number, serial number, and manufacturing date of the System Controller. To assist your support representative, record the name plate information in the space provided on the back of this guide's title page.

2.3　USB Interface

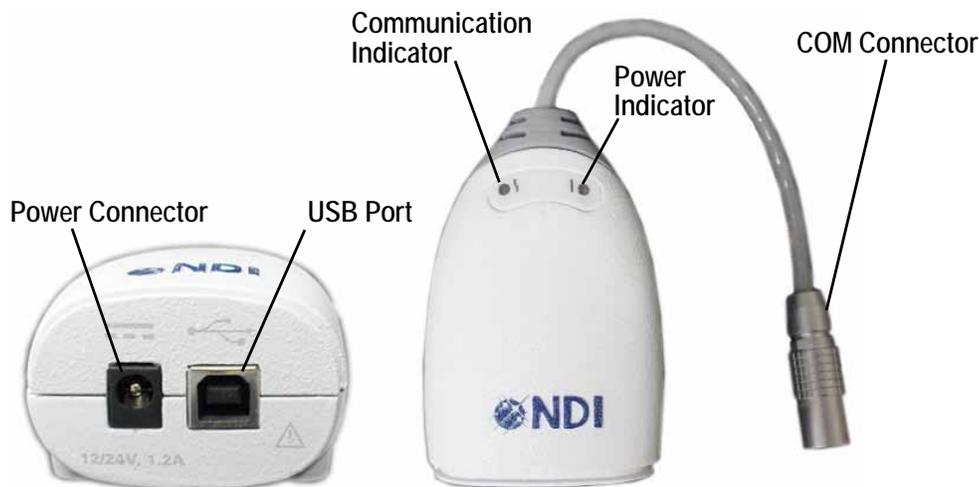The USB Interface connects the Optical Tracker directly to the host computer.

Figure 2-6　USB Interface

Power Connector The USB Interface draws power from a USB port, and requires no external power connection. The provided AC adapter cable is an optional component.

USB Port Connects to the USB cable, which connects to a USB port on the host computer.

Communication Indicator: Lights blue when the USB Interface is communicating with the system. It also flashes briefly when the USB Interface is first powered on.

Power Indicator: Lights green when power is being supplied to the USB Interface.

COM Connector: Connects to the system cable, which connects to an Optical Tracker system port.

Serial Number Label The serial number label is located on the bottom of the USB Interface and shows the item ID, model, serial number, and manufacture date of the USB Interface.

ITEM ID: 8700486.000.01
MODEL: Optotrak USB Interface
MFG DATE: July 2007
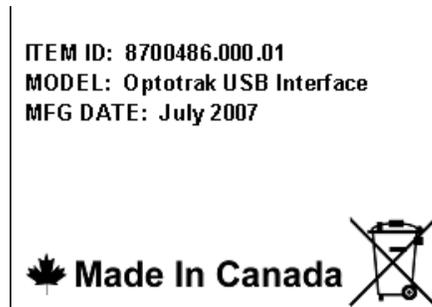
Made In Canada

Figure 2-7   USB Interface Name Plate

2.4   AUTOscale Reference Kit

The AUTOscale Reference kit allows you to verify and ensure that the system is capable of delivering its best performance given the current environmental conditions and physical state of the Optical Tracker. The kit consists of the following components:

AUTOscale Reference Bar This is a bar with six divots machined at positions 0, 100, 250, 500, 750, and 1000 mm. The bar is made of Invar™, a thermally stable material.

Caution! Do not subject the AUTOscale reference bar to rough handling or impacts. The AUTOscale reference bar is a finely calibrated artifact. Using a damaged reference bar will produce invalid AUTOscale results and affect measurement accuracy.

Reference Bar Support and Stand This supports the reference bar and allows you to place it in various orientations.The reference bar stand is provided as a cost-effective, portable method of securing and positioning the reference bar during AUTOscale procedures. To achieve valid AUTOscale results that will maintain the system's accuracy specifications, stand stability is critical.

AUTOscale Utility This software utility checks and adjusts the system to optimize accuracy.

Probe See the appropriate documentation binder tab, or third-party documentation, for your probe's setup and usage information.

Figure 2-8   Reference Bar and Stand

2.5   OPTOTRAK PROseries System Cabling

Table 2-2 lists system cables and their connection points. Cabling differs depending on your system type and interface choice.

Table 2-2   OPTOTRAK PROseries System Cabling

Cable	Connection 1	Connection 2
Host Cable	System Controller system port (black symbol)	Host computer PCI Card
USB Cable	USB port on USB Interface	USB port on Host Computer
System Cable	Optical Tracker system port (white symbol)	System Controller system port (black symbol) or USB Interface COM Connector
Accessory Cable	System Controller accessory port (blue)	Accessory (red)
Ethernet Cable	System Controller Ethernet port	Host computer Ethernet port
Power Cable	Optical Tracker and System Controller	Power Mains

Cable Connector Colouring

The accessory and system cable connectors are colour-coded for convenience and to ensure that both ends of a cable are not accidentally connected to the same device.

3 Setting Up the System

Chapters 3, 4, and 5 of this guide provide core setup and usage information for the OPTOTRAK PROseries System. Use the sections in this chapter as your master task list for setting up the system. This task list assumes the system is being set up for the first time, so some actions may be optional. Set up the OPTOTRAK PROseries System by completing the following actions:

3.1 Configuring the Host Computer

The host computer operates software required to collect data and configure OPTOTRAK hardware. In cases where the system arrives with a pre-configured host computer, no software configuration is required.

Table 3-1   Host Computer Requirements

Feature	Minimum Requirements
Processor	Pentium III Processor
System Memory	256 MB RAM
Free Hard Drive Space	500 MB
Display Resolution	1152 X 864
Monitor	17″ Monitor
Operating Systems	Microsoft® Windows® Microsoft XP Service Pack 2

Note   Third-party software, such as part-to-CAD programs, may have additional computer requirements.

Selecting an Interface Device for User-Supplied Host Computers

System Controller-Based OPTOTRAK PROseries

If your system has a System Controller, you must configure an Ethernet connection (see "Ethernet Connection Setup" on page 12) or install a NDI PCI card. To install an NDI PCI card, follow the instructions contained in the computer manual and the *"PCI Interface Card Installation Guide"*.

USB Interface-Based OPTOTRAK PROseries

The USB Interface requires no additional software configuration.

Ethernet Connection Setup

The Ethernet network connection between the System Controller and host computer must be dedicated and closed. The System Controller cannot be connected to the host computer as part of a larger local or wide area network.

NDI-Supplied Host Computer

If the host computer is meant to be on a network, it will have two preconfigured Ethernet ports. One port is for connecting to local or wide area networks. The other port, which will be labelled, is the dedicated line for communication between the System Controller and host computer.

User-Supplied Host Computer

The network connection between the System Controller and host computer must be closed to other network traffic. Set your host computer to a static IP address of 192.168.101.100, and a Subnet mask of 255.255.255.0. Refer to your operating system documentation for more information about configuring your computer's TCP/IP settings.

Note   To avoid possible network problems, it is recommended that the OPTOTRAK-dedicated Ethernet port on user-supplied host computers be clearly labelled so that only the System Controller will be connected to it.

3.2   Installing Software – Third-party, NDI, and Reference Bar Nominals

Install Third-Party Software First

Install third-party software on the host computer before you install NDI software.

NDI Software Installation

If a preconfigured host computer has not been supplied, you must install NDI software.

1. Insert the NDI OPTOTRAK PROseries software installation CD into your CD drive. If the setup screen does not automatically launch, double-click the **setup.exe** file on the CD.

Note   Select an appropriate third-party integration during installation if you are using third-party software.

2. Insert the AUTOscale Reference Kit CD into your CD drive. If the setup screen does not automatically launch, double-click the **setup.exe** file on the CD.

Installing Third-Party Software after NDI Software

The host computer may arrive with NDI software pre-installed before third-party software. In this case, install third-party software and then launch the setup program on the NDI software installation CD. Select the integration for your third-party software from the available packages.

3.3   Mounting the Optical Tracker

For information about mounting using third-party equipment, see the documentation that came with your mounting equipment. For information about mounting with NDI equipment, see the appropriate tab in this documentation binder.

3.4   Connecting the Main Components

Note   If you have an OPTOTRAK PROseries ScanTRAK system, see the ScanTRAK tab in this documentation binder for component connections and setup instructions.

1. If the Optical Tracker has not already been unpacked and mounted, use the transportation handles to remove it from the box.

Note   NDI strongly recommends that you mount the Optical Tracker. If you cannot mount the Optical Tracker, place it on a stable surface.

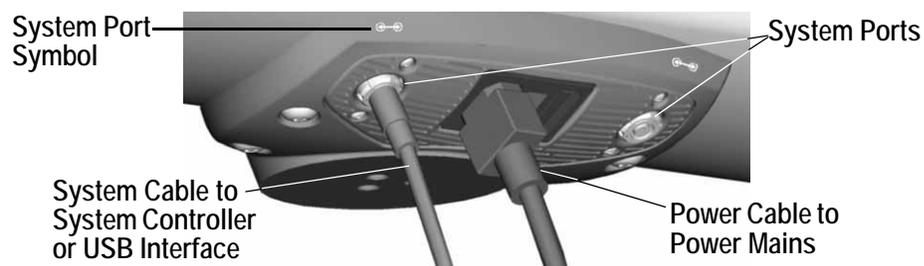2. Connect cables as shown below.

Figure 3-1   Optical Tracker Cable Connections

3. If you have a USB Interface, see "USB Interface Connections" on page 13. If you have a system controller, see "System Controller Connections" on page 14.

USB Interface Connections

1. Connect the system cable coming from the Optical Tracker system port to the USB Interface COM connector.

2. Connect the USB cable to a USB port on the host computer.

Figure 3-2   USB Interface Cable Connections

Note   When you connect the USB Interface to the host computer for the first time, the Windows hardware installation wizard launches. Point the wizard to the location of the USB Interface drivers. The drivers are located on the NDI OPTOTRAK PROseries software installation CD. The drivers are also placed in the C:\ndigital\drivers\usb directory when you install OPTOTRAK PROseries software.

System Controller Connections

1. Unpack the System Controller and place it on a level, stable surface.
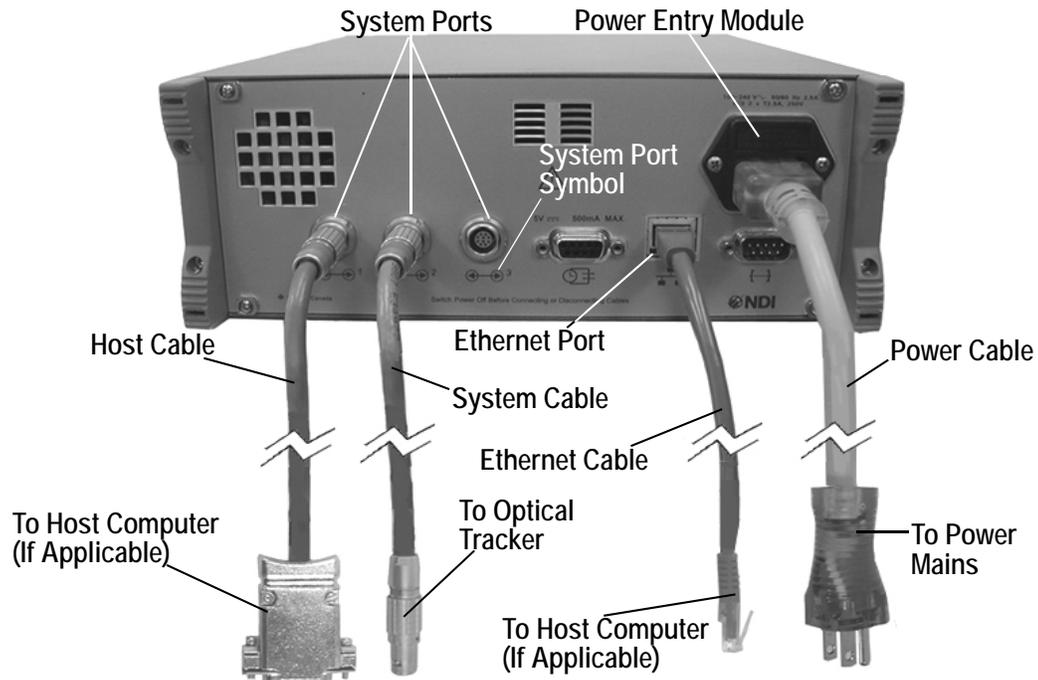

Figure 3-3   System Controller Back - Cable Connections

2. Connect the System Controller to the host computer:

    •   If you are using a PCI card, connect the black end of the host cable to any system port on the System Controller, and the other end to the port on the PCI card.

    •   If you are using Ethernet, connect the Ethernet cable from the Ethernet port on the back of the System Controller to the host computer's Ethernet port. See "Ethernet Connection Setup" on page 12.

3. Connect the System Controller to the power mains.

4. Connect the system cable coming from the Optical Tracker system port to a System Controller system port ( ).

5. Connect the Optical Tracker to the power mains.

3.5   Positioning the Optical Tracker

Consider the following guidelines when positioning your Optical Tracker:

1. **Position the Optical Tracker so that all targets, including those embedded in tools, are within the Optical Tracker's measurement volume during data collection.**

2. **Make sure there are no objects, transparent or otherwise, placed between the Optical Tracker and targets.** Obscuring the line of sight during measurement will cause inaccurate measurements.

3. **Position the Optical Tracker such that targets, including probe body targets, face the Optical Tracker lenses and deviate no more than 50°.**

4. **Ensure the Optical Tracker is completely stable and free of vibrations.** Because the Optical Tracker measures accuracy at the micron level, vibrations and movement in the tracker can significantly affect the accuracy of the measurement results. A stamping press running nearby can cause floor vibrations. If you place the Optical Tracker on a soft surface, such as carpet, it will shift over time, and could shift during measurement. Use dynamic referencing when the Optical Tracker or measurement object are expected to move during measurement.

5. **Avoid placing the Optical Tracker so that it points towards any source of infrared (IR) light, such as a window, or any object capable of reflecting IR light.** Even if the source of IR light, including sunlight, is outside the measurement volume, it can still interfere with the system. Minimize the source of IR light by closing blinds and blocking windows.

6. **Avoid placing the Optical Tracker in areas with strong air currents, heat sources, or temperature gradients.**

7. **Place the Optical Tracker so that the object you are measuring is as close as possible to the front end of the measurement volume.** The measurement volume begins 1.5 m from the Optical Tracker and is initially 0.5 m high and 0.9 m wide before expanding outwards (see "Measurement Volumes" on page 2).

Caution!   Avoid using the OPTOTRAK PROseries components in dusty, wet, or humid environments. Harsh environments can damage components, and may affect system accuracy.

3.6   Connecting Accessories

For wired accessories, connect the blue end of the accessory cable to the blue accessory port on the System Controller, and the red end of the accessory cable to the red accessory port on your OPTOTRAK device (such as a target controller). For more information about connecting and using a specific accessory, see the appropriate documentation binder tab.

Accessory Ports

Figure 3-4   Wired Accessory Connections

Connecting Wireless Accessories

Wireless accessories do not require any physical connection to the system and are designed to operate within the measurement volume. For information about configuring and using wireless accessories, see the appropriate documentation binder tab.

3.7   Powering on the System

Warning!   Do not use the OPTOTRAK PROseries System in the presence of flammable gases or fumes. Doing so may present an explosion hazard.

USB Interface Configuration

1. Remove the three lens caps and power on the Optical Tracker by pressing the black power switch on the centre mount. The green power status light turns on.

Note   NDI recommends that you plug the USB Interface's Power Adapter Cable into the power mains.

System Controller Configuration

1. Power on the System Controller by pressing the power switch on the front of the unit. The green power light on the System Controller turns on.

2. Remove the three lens caps and power on the Optical Tracker by pressing the black power switch on the centre mount. The green power status light turns on.

3.8   Guidelines for Determining Warm Up Time

When the Optical Tracker is powered on, it requires time to warm up before it stabilizes. The time it takes to warm up the Optical Tracker can be affected by the atmospheric conditions in your operating environment.

Typically, when it is powered off and stored at room temperature, allow at least 30-60 minutes for the Optical Tracker to warm up before measuring. When the Optical Tracker has been stored at or transported at low or high temperatures, allow the Optical Tracker to warm up for as long as possible before measuring. Use the AUTOscale procedure to verify system accuracy at any time.

3.9 Stylus Calibration and AUTOscale

If required, perform a stylus calibration followed by an AUTOscale adjustment. See "Calibrating Probe Styli" on page 18 and "Optical Tracker AUTOscale" on page 23.

3.10 Getting Started

Caution! The Optical Tracker requires a warm up time to stabilize. Failure to allow the Optical Tracker sufficient time to warm up may affect the accuracy of your measurements.

Portable CMM Applications

See the **NDI ToolTray** tab for information about starting and using ToolTray. Then, if applicable, see the Additional Info tab in this documentation binder for tips about using NDI equipment with supported third-party software applications.

DMM Applications

See the Additional Info tab in this documentation binder.

4   Calibrating Probe Styli

The stylus for the probe used with the OPTOTRAK PROseries System must be calibrated to ensure accurate results for AUTOscale adjustments and probe measurements. The stylus calibration procedure should be performed whenever there is concern about the accuracy of the system. Situations that should cause concern include the probe suffering an impact, or when there is uncertainty regarding whether the probe has been calibrated with the attached stylus.

This section presents the following topics:

- Starting the Stylus Calibration Utility

- Using the System Information Window

- Understanding the **Measure** Button

- Stylus Calibration Window

- Stylus Calibration Procedure

- Stylus Calibration Results Window

4.1   Starting the Stylus Calibration Utility

Note   Only run one NDI software utility at a time. Running more than one utility will result in communication errors.

To start the Stylus Calibration Utility, right-click the ToolTray icon in the system tray and select it. When the Stylus Calibration Utility starts, the **System Information** window appears.

4.2   Using the System Information Window

Figure 4-1   Example Stylus Calibration System Information Window

The information in this window allows you to track how the system has been verified in the past, allowing you to make decisions regarding what adjustments or utilities may be required. The first time you see the **System Information Window**, most of the fields will be blank.

System Information This displays the Optical Tracker's serial number and the current air temperature.

AUTOscale Information This displays statistics regarding the last AUTOscale adjustment, including the air temperature recorded at the time of the adjustment.

Stylus Information This displays statistics regarding the last stylus calibration. If you are using smart styli, the attached smart stylus information is displayed in the **Smart Stylus** field.

4.3   Understanding the Measure Button

Unless you are calibrating a Multi-Sided Probe (MSP) stylus, by default you must take measurement points by clicking the appropriate hardware or software button. In OPTOTRAK PROseries procedures, "clicking a **Measure** button" refers to taking a measurement, regardless of the method used.

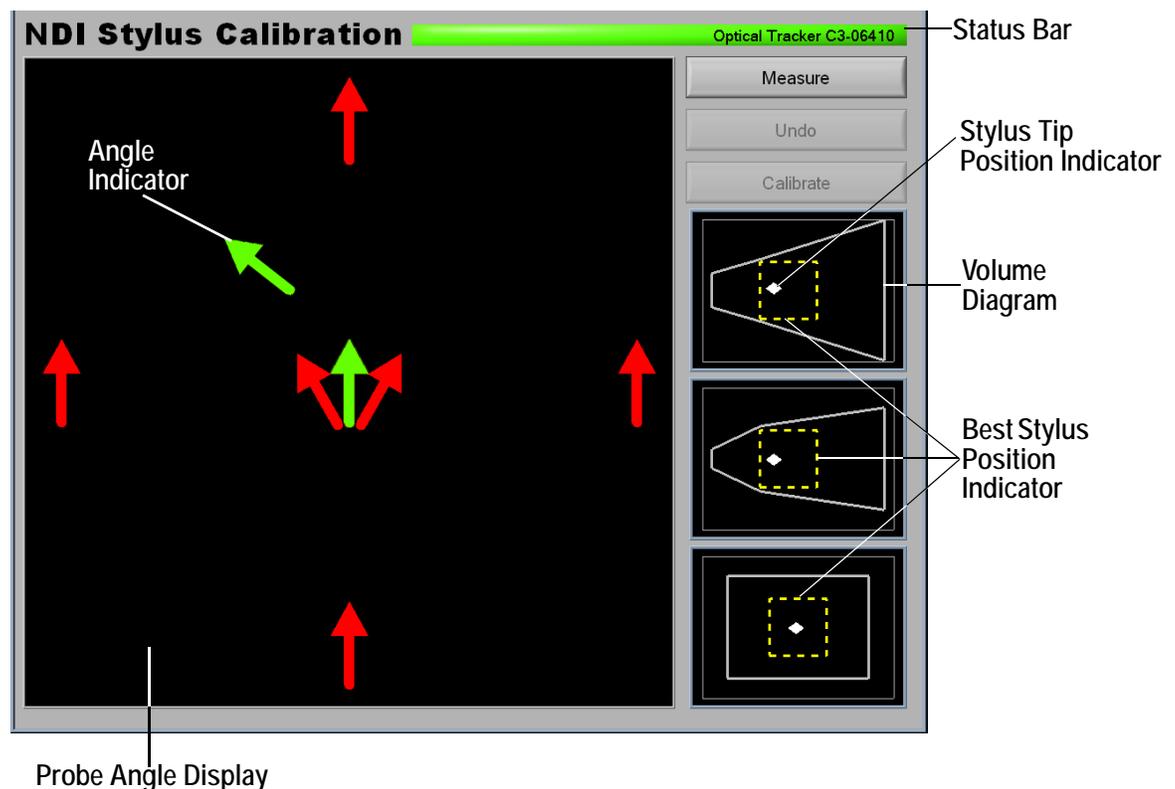## 4.4   Stylus Calibration Window

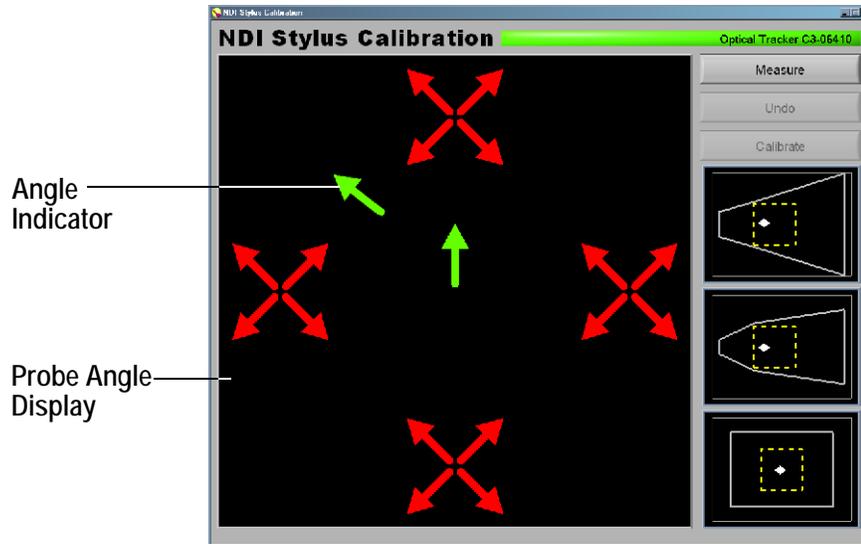Figure 4-2   Stylus Calibration Window for Single-Faced Probes

Figure 4-3   Stylus Calibration Window for MSP

Probe Angle Display This shows the measurement points to be taken during the stylus calibration procedure.

Angle Indicator This indicates the current probe angle.

Stylus Tip Position Indicator This diamond indicates the probe's current position in the volume.

Best Stylus Position Indicator This box shows the best region in the measurement volume to conduct the stylus calibration procedure. The optimal position is in the centre of this box.

Measure Button This takes a measurement point.

Undo Button This cancels the last measurement point.

Calibrate Button This displays the **Stylus Calibration Results** window. This button is disabled until all required measurement points have been taken.

Status Bar This displays program version information when clicked.

4.5   Stylus Calibration Procedure

The object of the stylus calibration procedure is to accurately determine the stylus offset and enter the ball diameter.

Understanding the Probe Angle Display

When the probe is first brought into the Optical Tracker's view, the centre arrow in the probe angle display turns green to indicate that the system is ready for you to take the first measurement point. Take measurements by orienting the probe so the **Angle Indicator** moves over each of the red arrows. When the **Angle Indicator** is oriented correctly and overlaps a red arrow, the arrow turns green. When you click a **Measure** button, the system records a measurement and the red arrow is permanently changed to green.

MSP Probe Angle Display

When calibrating an MSP stylus, you only need to click the measure button once to begin the procedure. Measurements are automatically taken when you place the **Angle Indicator** over a red arrow.

Procedure

1. Position the Stylus Calibration Fixture so that when the stylus tip is placed in a divot, the **Stylus Tip Position Indicator** is at the centre of each of the **Best Stylus Position Indicator** boxes.

2. Position the probe so that it is vertical (straight up and down), with the probe targets facing the Optical Tracker (as shown in Figure 4-4 below).

Note   When performing a stylus calibration with the MSP, orient the MSP so that the quick release faces away from the Optical Tracker.

Direction of
Optical Tracker

Stylus Calibration Fixture
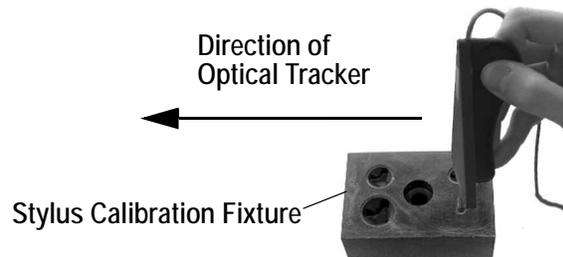
Figure 4-4   Probe Position for First Measurement Point

The **Angle Indicator** remains in the centre of the **Probe Angle Display** until the first measurement point is taken.

Note   Ensure that the probe stylus tip remains constrained in the stylus calibration fixture throughout the stylus calibration procedure. Ensure that the fixture remains completely still during the procedure.

3. Click a **Measure** button to take the first measurement point.

Note   When calibrating an MSP stylus, you only need to click the measure button once to begin the procedure. Subsequent measurements are automatically taken when you place the Angle Indicator over a red arrow.

4. Orient the probe so that the **Angle Indicator** overlaps one of the red arrows.

Note   When orienting the MSP, hold and guide the cable with one hand to avoid tangling.

5. When the arrow turns green, click a **Measure** button.

6. Repeat steps **4** and **5** for each arrow in any order until all of the arrows are solid green.

7. Click the **Calibrate** button and view the results in the **Stylus Calibration Results** window.

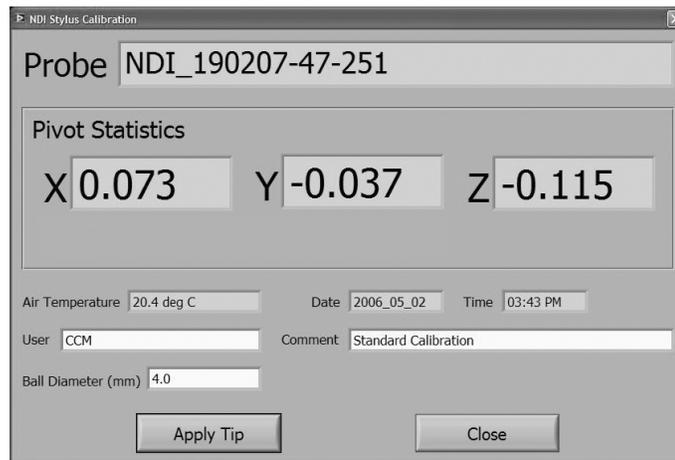## 4.6   Stylus Calibration Results Window

Figure 4-5   Stylus Calibration Results Window

Pivot Statistics This displays the offset of the stylus tip.

Air Temperature This displays the ambient room temperature at the time of the stylus calibration.

Date This displays the date of the stylus calibration.

Time This displays the time of the stylus calibration.

User This is an optional field to enter a user name for the **System Information** window.

Comment This is an optional field to enter user comments for the **System Information** window.

Ball Diameter This is a mandatory field to enter the diameter of the stylus tip, which is required by some third-party applications. For a pointer stylus, enter 0.

Apply Tip Button This adjusts the system based on the calibration results and closes the **Stylus Calibration** utility.

Close Button This does not apply the results, returns you to the **Stylus Calibration** window, and restarts the stylus calibration procedure.

4.7   Applying the Results

The system will inform you if the results are less than ideal. This can be caused by probe instability and operator error, such as accidentally removing the stylus tip from the divot during the procedure.

You can press the **Apply Tip** button to accept the calibration, or you can press the **Close** button to start again.

5   Optical Tracker AUTOscale

Caution!   The reference bar and stand must remain completely still during AUTOscale length measurements. Any movement of the bar or stand during AUTOscale measurements will produce invalid results and affect measurement accuracy.

The OPTOTRAK PROseries System includes an **AUTOscale Reference Kit**, which allows you to verify measurement accuracy and apply an appropriate scale, if required, to maximize performance. AUTOscale is used to make basic adjustments to compensate for current environmental conditions and effects resulting from minor thermal or mechanical shock during storage, use, and transportation. The AUTOscale procedure can be repeated to confirm the effect of the applied scale.

This section presents the following topics:

- Recommended Probe Stylus Dimensions

- Set up the Reference Bar

- Reference Bar Divots

- AUTOscale Usage Guidelines

- Positioning the Reference Bar

- Starting the AUTOscale Utility

- AUTOscale Window

- AUTOscale Procedure

- AUTOscale Results Window

- AUTOscale Results Verification

- Using the Volume Indicator Laser

5.1   Recommended Probe Stylus Dimensions for AUTOscale

Accuracy specifications are based on a probe stylus that is 50 mm long, with a ball tip diameter of 4 mm. When performing AUTOscale adjustments, NDI recommends you use the shortest possible stylus with a ball tip diameter between 4 mm and 6 mm.

5.2   Setting up the Reference Bar

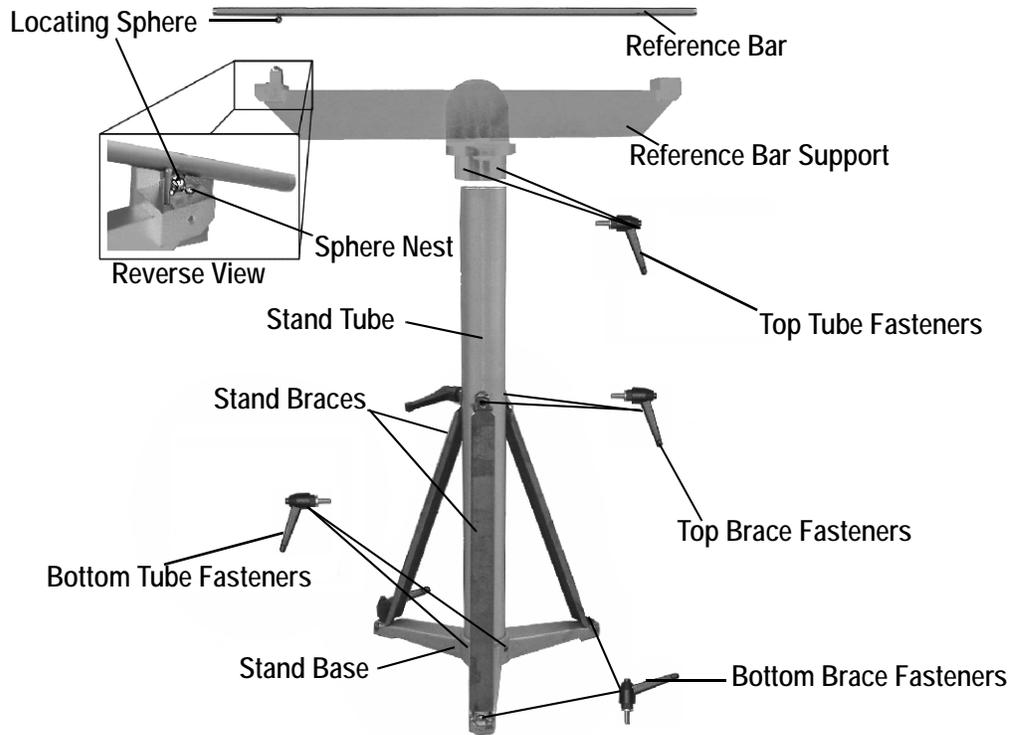To set up the reference bar, follow the procedure while referring to Figure 5-1.

Figure 5-1   Reference Bar Assembly

1. Assemble the reference bar support, stand tube, stand base, and fasteners, but do not tighten anything.

2. Tighten the top brace fasteners, and then tighten the bottom brace fasteners.

3. Tighten the bottom tube fasteners on the stand base.

4. Tighten the top tube fasteners on the reference bar support while applying pressure to the support as shown in Figure 5-2.

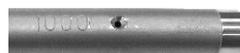Figure 5-2   Reference Bar Support Tightening

5.3   Reference Bar Divots

Figure 5-3   Reference Bar Divot

Divots are indentations along the 1000 mm length of the reference bar that indicate the precise location of points at the following intervals (in millimetres): 0, 100, 250, 500, 750, and 1000.

5.4   AUTOscale Use Guidelines

Because accuracy requirements, operating environments, and degree of usage vary, it is not possible to provide precise instructions on how often the AUTOscale procedure should be performed. NDI can, however, list important factors to consider when establishing AUTOscale practices for your OPTOTRAK PROseries System.

Perform the AUTOscale procedure:

- before critical measurements, and whenever system accuracy is in doubt

- when the Optical Tracker has been transported from one facility to another

- when the Optical Tracker is received and unpacked for the first time

- after the Optical Tracker has been left in storage for a period of time

- when the Optical Tracker has been subjected to strong vibrations or any impact

- when the room temperature changes during measurement by a few degrees or more

- when the Optical Tracker experiences extreme or rapid external temperature variations

- when the Optical Tracker is moved from a horizontal to a vertical position, or vice versa

- according to an interval-based schedule determined by you

Note   To function correctly, the AUTOscale procedure must be performed with a properly calibrated probe stylus. See "Calibrating Probe Styli" on page 18.

Positioning the Reference Bar

During the AUTOscale procedure, you must position the reference bar in various orientations inside the measurement volume. You can change the reference bar's pan angle by rotating the entire reference bar assembly (stand, support, and bar). Change the bar's tilt angle by loosening the support bolt, tilting the support, and tightening the bolt again.
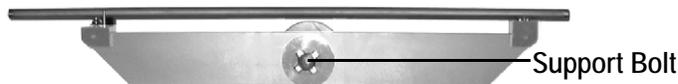

Support Bolt

Figure 5-4   Reference Bar Vertical Position Adjustment

5.5   Starting the AUTOscale Utility

Note   Only run one NDI software utility at a time. Running more than one utility will cause communication errors.

To start the AUTOscale Utility, right-click the ToolTray icon in the system tray and select it.

When the AUTOscale Utility starts it displays the **System Information** window, which is shown in Figure 4-1 on page 18. In addition to the information shown for stylus calibration, the AUTOscale **System Information** window displays the serial number associated with your bar, and when it was last calibrated.
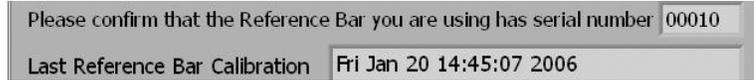
Figure 5-5   Reference Bar System Information

Verify that the stylus you are using matches with the system information, and that you are using the correct reference bar. If you are using smart styli, the **System Information** window shows calibration information for the attached smart stylus.

Caution!   Do not use an AUTOscale reference bar that was not specifically calibrated for your system. Using the wrong reference bar will result in significant measurement errors.
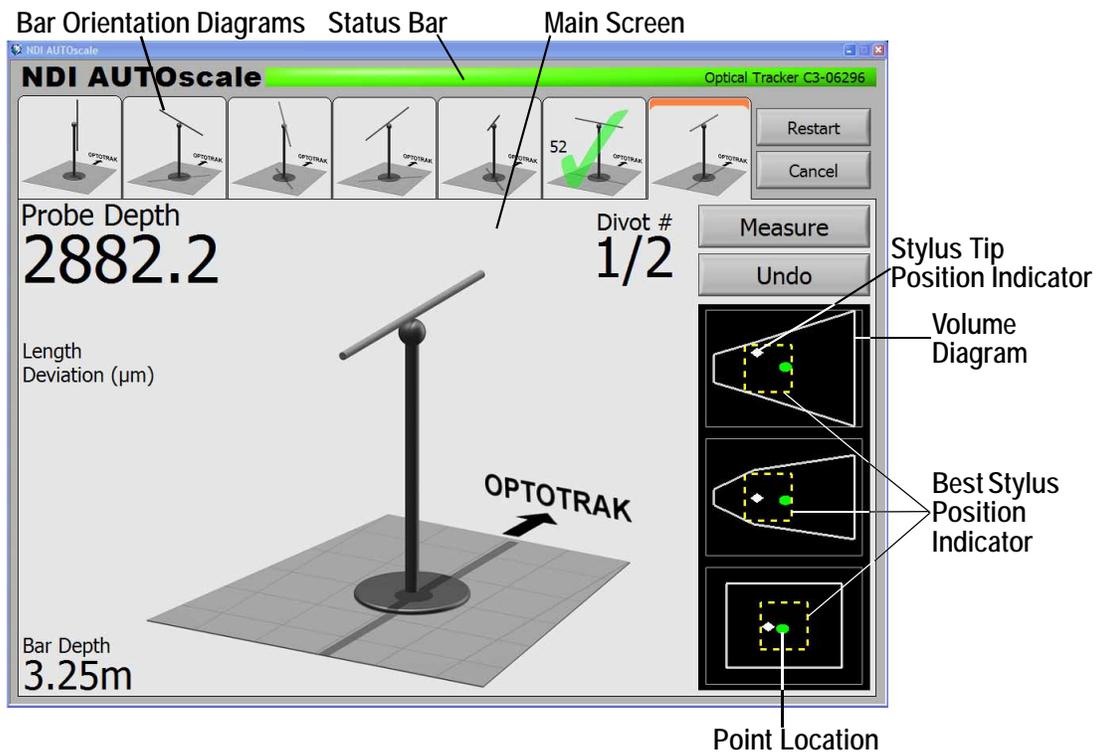
5.6   AUTOscale Window

Figure 5-6   Model 1000 AUTOscale Window

Bar Orientation Diagrams These diagrams show the seven bar orientations that must be measured. When you complete a bar orientation, the length deviation appears in the bar orientation diagram.

Volume Diagrams These are a side, top, and front view of the measurement volume.

Best Bar Position Indicator This shows the best place in the volume to position the reference bar.

Stylus Tip Position Indicator This diamond indicates the probe's current position in the volume.

Point Location This indicates the location of points that have been taken for the current orientation.

Bar Depth This shows how far from the Optical Tracker you should place the stand for the current set of orientation measurements.

Probe Depth This displays the current distance of the probe stylus tip from the Optical Tracker.

Divot # This indicates how many divots you have measured for the current orientation.

Length Deviation (microns) This shows you length deviation as calculated by subtracting the known length from the measured length.

Restart Button This restarts the AUTOscale procedure.

Measure Button This corresponds to the probe's measure button and takes a measurement point, or moves to the next part of the procedure. The button name changes to indicate the current function.

Undo Button This cancels a measurement. When an orientation is completed, the button changes to **Previous** — clicking it will navigate to the previous orientation. When you click on a completed **Bar Orientation Diagram**, the button changes to **Redo** and clicking it will restart that orientation.

Status Bar This bar indicates the system's tracking status — green means the system is tracking a device, red means the system is not tracking, and grey indicates no system connection.

5.7   AUTOscale Procedure

The AUTOscale procedure requires you to measure the 0 mm and 1000 mm divots at two locations for seven different reference bar orientations (one location for Model 300). To undo measurements and redo orientations, click the **Undo** button in the application or on the probe (if applicable).

Note   The ambient room temperature must remain stable during the AUTOscale procedure.

1. Power on your OPTOTRAK PROseries System and provide sufficient warm up time.

2. Connect your probe to the system.

3. Start the AUTOscale Utility, as described in "Starting the AUTOscale Utility" on page 25.

4. Examine the **System Information** window to confirm that you are using the correct reference bar and stylus, and click **OK**.

5. Select the appropriate Optical Tracker orientation.

    You can select the orientation using a mouse or, if applicable, you can scroll through the pictures using the probe's **Undo** button and select orientations using the probe's **Measure** button.

6. Place the reference bar inside the Optical Tracker's measurement volume at the depth indicated by **Reference Bar Depth** on the **AUTOscale** window.

7. Place the probe stylus tip in the 500 mm divot and use the **Best Bar Position Indicator** and **Stylus Tip Position Indicator** to make final adjustments to the reference bar's location. The best place for the 500 mm divot is in the exact centre of the **Best Bar Position Indicator**.

    A best practice is to place the stylus tip in the 0 mm and 1000 mm divots while watching the **Stylus Tip Position Indicator** in each **Volume Diagram**. Ensure that the entire length of the bar is within the boundaries of all three **Best Bar Position Indicators**.

8. Position the reference bar in one of the seven orientations depicted on the **AUTOscale** window.

The **Main Screen** will display a suggested orientation, but you can measure the orientations in any order you choose. The utility automatically displays the orientation you are completing when the divots are measured. If you want to see a different orientation on the **Main Screen**, click the appropriate **Bar Orientation Diagram**.

Adhere to the following measurement guidelines to ensure a problem-free procedure:

- When you are measuring the Z orientation, lower the end of the bar closest to the Optical Tracker a few degrees towards the floor to prevent target blockage.

- For angled orientations, the correct bar angle is between 35° and 45° to the floor.

9. Carefully place the probe stylus tip inside the 0 mm divot and click a **Measure** button. Keep the stylus tip in position until you hear a second tone from the computer or probe.

Caution! The reference bar and stand must remain completely still during AUTOscale length measurements. Any movement of the bar or stand during AUTOscale measurements will produce invalid results and affect measurement accuracy.

The **Divot #** indicator displays "1/2" on the **Main Screen**.

10. Carefully place the probe stylus tip in the 1000 mm divot.

The system automatically detects which orientation you are measuring and displays it on the **Main Screen**. If you accidentally try to measure an orientation that has already been completed, or attempt to measure an invalid orientation, the AUTOscale Utility will inform you.

11. Click a **Measure** button.

The **Divot #** indicator displays "2/2" on the **Main Screen**, and the **Length Deviation** field displays the measurement error. The bar orientation remains on the **Main Screen** for three seconds before the utility displays the next suggested orientation to be measured.

12. Complete one of the two following actions:

- Continue the procedure by measuring the next bar orientation.

- Cancel one or both divot measurements by clicking the probe's **Undo** button once or twice. You can also click the **Undo** button on the **AUTOscale Window**. Cancel if you suspect that reference bar stability was compromised while you were measuring.

13. Repeat steps **8** to **12** until all measurement orientations have been processed.

Note With the exception of the Model 300, after you have completed seven orientations at one measurement volume position, you will be prompted to move the reference bar to a new measurement volume position. Complete measurements for all seven orientations again at the new position, as described in steps 8 to 12.

The **AUTOscale Results** window appears.

14. Examine the information in the **AUTOscale Results** window. The window shows the "As Found" values of the measurements taken for all orientations and the system's "As adjusted" values based on the known distance between divots. Choose one of the following actions:

- Apply the adjustments by clicking the **Apply Scale** button.

- Click the **Close** button to proceed without applying adjustments.

  For advice about whether you should apply or cancel, see "Applying the Scale" on page 30.

15. It is recommended that you verify the results of the AUTOscale, as described in "AUTOscale Results Verification" on page 30.

5.8 AUTOscale Results Window

Figure 5-7   AUTOscale Results Window

Depth This column displays the measurement volume depth for each measured orientation.

Orientation This column shows the bar orientation associated with each finding, with numbers "1 to 7" on the **Results** window corresponding to the **Bar Orientation Diagrams** as they appear from "left to right" at the top of the **AUTOscale** window.

dL As Found This column displays the long or short measurement error for all measurements taken under your previous scaling settings. The unit of measurement is microns.

dL As Adjusted This column displays what the long or short measurement error would be if you applied the scale adjustments calculated by the system. The unit of measurement is microns.

Apply Scale Button This applies accuracy adjustments to the system based on the results.

Print Button This prints the results.

Close Button This does not apply adjustments and returns you to the **AUTOscale** window. When you confirm a cancellation, you must restart the AUTOscale procedure from the beginning.

Applying the Scale

The AUTOscale procedure uses each measurement to maximize overall system accuracy for the current environmental conditions. As shown by the first measurement in Figure 5-7, some of the "As Adjusted" errors actually increase to achieve a better overall result. In general, a good practice is to apply the scale if the "As Found" measurements for any of the accuracy zones fall outside your requirements. If you are satisfied that the system meets your accuracy requirements, cancel the scale application by clicking the **Close** button. Even when the AUTOscale results suggest the need to apply a scale, you may choose to cancel and restart the procedure. For example, cancel and restart if you suspect that the bar or stand were moved in between divot measurements for an orientation.

5.9   AUTOscale Results Verification

Once you have applied an AUTOscale result, it is strongly recommended that you verify that the Optical Tracker has been properly scaled. To do this, record the results of the first AUTOscale and perform the AUTOscale procedure again up to step **14**. In the **AUTOscale Results** window, the "As Found" values should be generally consistent with the "As Adjusted" values of the **previous** AUTOscale result.

If the values are still not satisfactory, it may indicate that your Optical Tracker requires servicing, in which case you should contact your support representative for further instruction. **Do not perform measurements when Optical Tracker accuracy cannot be properly verified.**

5.10   Using the Volume Indicator Laser

When you are ready to begin measurements, use the volume indicator laser to align the Optical Tracker with your measurement object.

1. Lightly touch the laser activator on the Optical Tracker to turn the volume indicator laser on or off. The laser projects a crosshair that scales to the height and width of the volume.

2. Orient the Optical Tracker so that the laser crosshair strikes the object's centre.

3. Using the laser crosshair as a guide, position the Optical Tracker so that objects you want to measure are as close as possible to the front of the measurement volume while still allowing room for all applicable targets to be seen by the Optical Tracker.

⚠ Warning!

LASER - Do not look directly into the laser-emitting aperture. The class 2M laser module on the Optical Tracker emits radiation that is visible and harmful to the human eye. Direct viewing of the laser diode emission at close range, or through the use of far-seeing optical instruments such as binoculars, may cause eye damage.

LASER - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
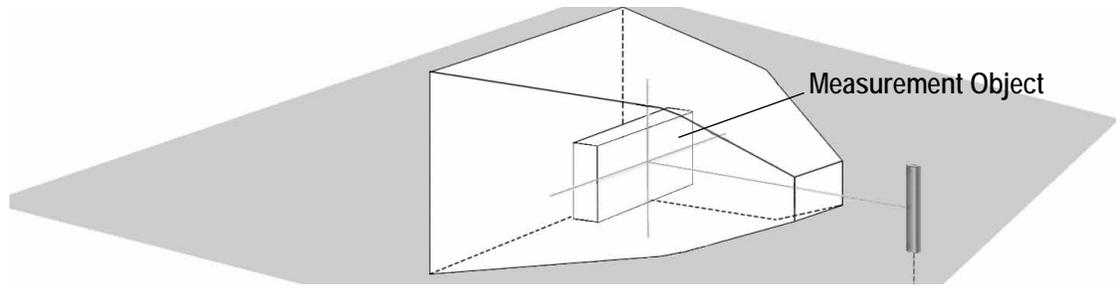
Figure 5-8   Using the Volume Indicator Laser

For the volume indicator laser's specifications, see "Laser Safety Information" on page 39.

6   Maintenance

User maintenance of the OPTOTRAK PROseries System is limited to the following procedures:

- Cleaning and Storing the Optical Tracker

- Replacing End Mount Filters

- Replacing Optical Tracker and System Controller Fuses

⚠ Warning!   Disconnect the System Controller and Optical Tracker from their power sources before cleaning the equipment or changing fuses. Failure to disconnect the System Controller and Optical Tracker may result in personal injury.

Unless stated otherwise, there are no user-serviceable parts in the OPTOTRAK PROseries System. Any servicing or disassembly must be performed by trained technicians or referred to NDI. Unauthorized servicing or disassembly will void your warranty and could result in equipment damage and/or personal injury.

Caution!   To move or ship the OPTOTRAK PROseries System, repack all components in the original containers together with all protective packaging to prevent equipment damage.

6.1   Cleaning and Storing the Optical Tracker

Caution!   Use only a cloth damp with water and mild detergent to clean component exteriors, as other substances may damage the finish or remove the panel lettering.

1. Remove dust from the chassis with a dry, soft cloth.

2. Remove dirt or finger marks from the chassis using a damp cloth and dry immediately.

Lenses

Inspect all lenses regularly and clean only if necessary.

1. Before wiping the lens, remove any dust using an aerosol clean air can.

2. Clean lenses with a minimal amount of methanol using a lint-free, optical grade tissue by wet-wiping each lens once, and then dry wiping each lens once.

3. Cover the sensors with lens caps when the Optical Tracker is not in use or being transported.

6.2   Replacing End Mount Filters

Caution!   Only operate the Optical Tracker when end mount filters are in place. If end mount filters are not in place, dirt may enter and damage the Optical Tracker.

If an end mount filter is dirty or damaged, it should be replaced. Replacement end mount filters can be purchased from NDI.

Remove a dirty filter by pinching and gently pulling it from the end mount. Insert a clean filter by pinching and gently inserting it into the end mount.

6.3   Replacing Optical Tracker and System Controller Fuses

Optical Tracker

1.   Unplug the Optical Tracker from the power supply.
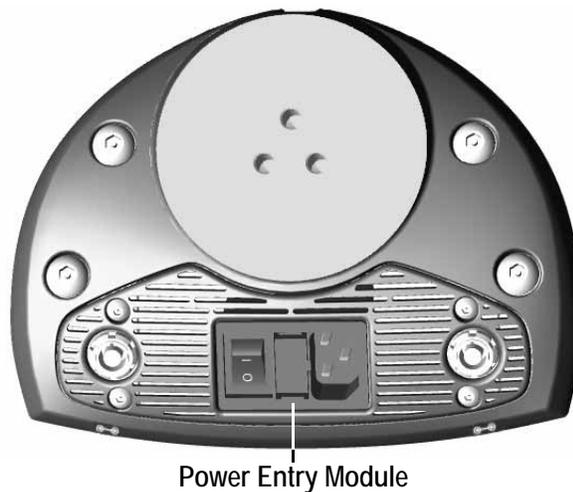
Power Entry Module

Figure 6-1   Optical Tracker - Centre Mount

2.   Release the two fuse holder tabs simultaneously, with the aid of a tool such as a screwdriver, and pull upward. The tabs are marked with arrows for identification.
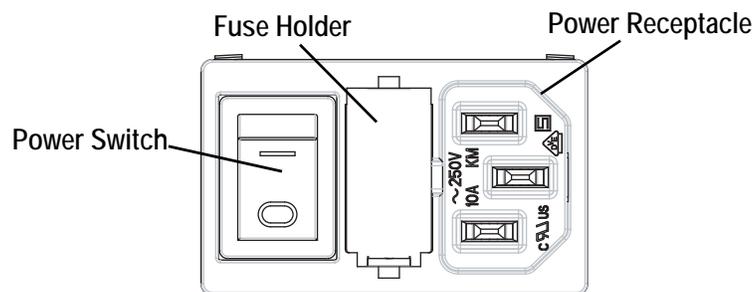
Figure 6-2   Optical Tracker - Power Entry Module

3. Remove the fuses from the fuse drawer and examine the metal wire. A blown fuse has a broken wire.

4. Replace the fuses as required with two new T1.0A, 250V fuses for continued protection against risk of fire.

5. Push the fuse holder back in place, ensuring that it latches correctly.

If the Optical Tracker does not power up, contact your support representative. If fuses blow frequently, return the unit to NDI for servicing.

System Controller

1. Switch off the power and unplug the power cable.
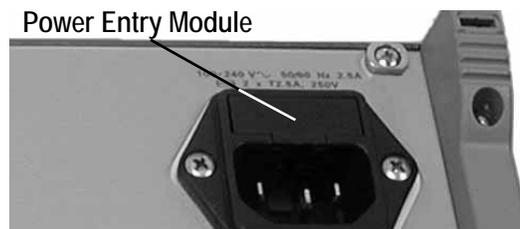
Power Entry Module

Figure 6-3   System Controller - Power Entry Module

2. Locate the power entry module on the back of the System Controller.

3. Insert a small screwdriver into the slot to release the locking mechanism.

4. Pull out the fuse drawer.

Slots

Fuse Holder

Power Receptacle
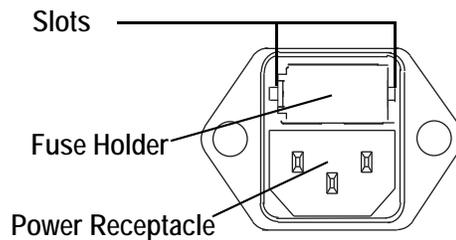
Figure 6-4   System Controller - Power Entry Module

5. Remove the fuse from the fuse drawer and examine the metal wire. A blown fuse has a broken wire.

6. Replace as required with two new T2.5A, 250V fuses for continued protection against risk of fire.

7. Push the fuse drawer in gently until it clicks into place.

If the System Controller will not power up after the fuses have been replaced, please contact your support representative. If fuses blow frequently, return the unit to NDI for servicing.

6.4   Guidelines for Optical Tracker Servicing and Calibration

It is important to understand the difference between AUTOscale adjustments and Optical Tracker repair and calibration services. The OPTOTRAK PROseries System includes the **AUTOscale Reference Kit**, which allows you to ensure that the system is capable of delivering its best performance given the current environmental conditions and physical state of the Optical Tracker.

However, as with all measurement and testing instruments, industry practice dictates that the Optical Tracker should be periodically serviced by NDI. It is recommended that you send the Optical Tracker to NDI for servicing at least once every 18 months and the reference bar once every two years. However, you should choose a servicing interval that reflects your stability requirements, purpose, and degree of usage.

If a concern arises about system accuracy that cannot be resolved using the AUTOscale procedure, contact your support representative immediately and arrange to have the Optical Tracker sent to NDI for repair and calibration. If necessary, adjust your established servicing interval.

7   Equipment Symbols

Symbol	Meaning	Location
	Power on/off switch	System Controller
	On (power, connected to mains)	Optical Tracker
	Off (power, disconnection from mains)	Optical Tracker
	Fuse	System Controller, Optical Tracker
	Alternating current	System Controller, Optical Tracker
	Direct current	System Controller, USB Interface
	RS-232 serial communication port	System Controller
	External synchronization port	System Controller
	Accessory in	target controllers, probes, probe controllers
	System port	System Controller, Optical Tracker
	Error code	System Controller, Optical Tracker
	Error	System Controller, Optical Tracker
	Network interface port	System Controller
	Device status	AUTOscale probe port, target ports, and System
	USB Port	USB Interface
	Volume Indicator Laser Warning (see "Laser Safety Information" on page 39.)	Optical Tracker

8   Abbreviations and Acronyms

Acronym/ Abbreviation	Definition
6DOF	Six Degrees of Freedom
EM	Electromagnetic
EMC	Electromagnetic
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
IR	Infrared
NDI	Northern Digital Inc.
PCI	Peripheral Component Interconnect
RAM	Random Access Memory
SC	System Controller
VDC	Volts of Direct Current

Appendix A   Operational Considerations

This appendix describes the system's electromagnetic, environmental, and emission specifications to ensure correct and safe operation of the OPTOTRAK PROseries System.

A.1   Electromagnetic (EMC) and Electrostatic Discharge (ESD) Concerns

Care should be taken to mitigate the production of electrostatic charges to avoid damage to the equipment that could affect the accuracy of returned data. These measures can include, but are not limited to, appropriate air conditioning, humidification, conductive floor coverings, attire etc.

It is not good practice to use the OPTOTRAK PROseries System either adjacent to or stacked with other equipment. Verify that the OPTOTRAK PROseries System is operating normally if it is used either adjacent to or stacked with other equipment. "Approvals and Classifications" on page 40 provides information on specific EMC approvals and equipment classifications.

Caution!   Do not use the OPTOTRAK PROseries System in the vicinity of radio frequency communications equipment. Radio frequency communications equipment, including portable and mobile devices, may affect the OPTOTRAK PROseries System and the accuracy of your measurements.

A.2   Environmental Requirements

The environmental requirements listed in Table A-1 apply to all OPTOTRAK PROseries components.

Caution!   To move or ship the OPTOTRAK PROseries System, repack all components in the original containers together with all protective packaging to prevent equipment damage.

Table A-1 Required Environmental Conditions

Environmental Factors	Operating Environment	Transportation/ Storage Environment
Atmospheric Pressure	70 to 106 kPa	50 to 106 kPa
Relative Humidity	30% to 75%	10% to 90% non-condensing
Temperature	+10 to +35 $^{\circ}$C	–10 to +50 $^{\circ}$C

A.3 Laser Safety Information

Warning! LASER - Do not look directly into the laser-emitting aperture. The class 2M laser module on the Optical Tracker emits radiation that is visible and harmful to the human eye. Direct viewing of the laser diode emission at close range, or through the use of far-seeing optical instruments such as binoculars, may cause eye damage.

LASER - Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

The laser information label is displayed on one of the Optical Tracker's end mounts and contains the following information:
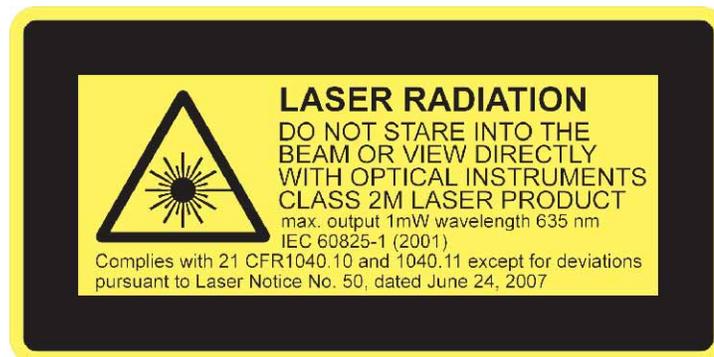
Figure A-1   Laser Safety Label

Appendix B   Approvals and Classifications

B.1   Approvals

These approvals are for a measurement system consisting of an Optical Tracker, System Controller, NDI probe, NDI PCI card, host cable, system cable, and accessory cable.

SAFETY:	IEC/EN 61010-1, Ed. 1:90+A1/92+A2/95	
	CAN/CSA C22.2 No. 1010.1:92+A2:95, 1010.1B:97	
	UL 61010A-1 (2002)	
EMC/EMI:	FCC Part 15, Subpart B, Class A Unintentional Radiators	
	CISPR 22/EN 55022 Class A ITE Equipment	
	IEC/EN 61326:1997+A1/98+A2/2001 (IEC 61326:2002) Industrial Locations, including:	IEC/EN 61000-3-2: Harmonic emissions (Class A)
		IEC/EN 61000-3-3: Voltage fluctuations/flicker emissions
		IEC/EN 61000-4-2: Electrostatic discharge
		IEC/EN 61000-4-3: Radiated RF immunity
		IEC/EN 61000-4-4: Electrical fast transient/burst
		IEC/EN 61000-4-5: Surge
		IEC/EN 61000-4-6: Conducted RF immunity
		IEC/EN 61000-4-8: Magnetic Filed Immunity
		IEC/EN 61000-4-11: Dips, Dropouts, Interrupts

B.2   Classifications

These classifications apply to all OPTOTRAK PROseries equipment.

Table B-1   Equipment Classifications

Electric Shock Protection	Class I - protectively earthed with power from supply mains
Insulation Coordination	Installation Category (Overvoltage Category) II
Degree of Protection Against Ingress of Liquids	Ordinary equipment
Flammable Atmosphere	Not suitable for use in the presence of flammable gases or fumes
Mode of Operation	Continuous when supplied by mains

Index