Optotrak Certus
Tool Strober Guide

Revision 2
October 2005

IMPORTANT
Please read this entire
document before using
the Tool Strober

Revision Status

Revision Number	Date	Description
2	05/10/05	ToolBench refences removed. General update to new template.

Part number: IL-1070076

Printed in Canada.

Disclaimer of Warranties and Limitation of Liability

Published by:

Northern Digital Inc.
103 Randall Dr.
Waterloo, Ontario, Canada N2V 1C5

Telephone:	+1 (519) 884-5142
Toll Free:	+1 (877) 634 634 0
Global:	++ (800) 634 634 00
Facsimile:	+1 (519) 884-5184
Website:	www.ndigital.com

Disclaimer of Warranties and Limitation of Liabilities

Northern Digital Inc. 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 Northern Digital Inc.'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. Northern Digital Inc. has carefully reviewed this document for technical accuracy. If errors are suspected, the user should consult with Northern Digital Inc. prior to proceeding. Northern Digital Inc. 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.

Northern Digital Inc. makes no representation, condition or warranty to the user or any other party with respect to the adequacy of this document 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 Northern Digital Inc. shall be limited to the amount paid by the user to Northern Digital Inc. for the provision of this document. In no event shall Northern Digital Inc. be liable for special, col-

lateral, 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.

Table of Contents

Read Me First!

Read this section before continuing with the rest of the guide.

Warnings

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

1. An e-type strober must be connected to an e-type port on the e-type System Control Unit to maintain Type BF isolation. Check that the colours of both connectors match. The keying for the different types of connectors is unique to prevent using an s-type strober in an e-type port.
2. To maintain type BF isolation, all components between the e-type ports on an e-type System Control Unit and the patient must meet or exceed the certifications and approvals of the Optotrak Certus System. Serious personal injury could result if the appropriate type of isolation is not maintained.
3. Ensure that the correct rigid body file is used with the corresponding rigid body. If the rigid body definition does not match the rigid body, the rigid body may still be tracked but will report incorrect data. If a rigid body definition contains imaginary markers, but is used with the incorrect rigid body, the rigid body may still be tracked, but will report incorrect data for the imaginary points. Incorrect data could cause personal injury and/or property damage.

Cautions

Caution! In all NDI documentation, cautions are marked with the word "Caution!". Follow the information in the accompanying paragraph to avoid damage to equipment.

1. For cautions specific to the devices in your measurement system please refer to all the manuals accompanying your system.

Contact Information

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

INTERNATIONAL HEADQUARTERS:
NORTHERN DIGITAL INC.

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

Email: optotrak@ndigital.com
Website: www.ndigital.com

EUROPEAN OFFICE:
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

Email: optotrak@ndieurope.com
Website: www.ndieurope.com

ASIA PACIFIC OFFICE:
NDI ASIA PACIFIC

Room 2603, 26th Floor
Office Tower, Convention Plaza
1 Harbour Road
Wanchai, Hong Kong

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

Email: APinfo@ndigital.com
Website: www.ndigital.com

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

1 Introduction

The tool strober is designed to allow up to four custom tools to be connected to the system. Each tool may accomodate up to twenty markers, three switches and four light emitting diodes (LEDs). The tool strober incorporates plug and play functionality that allows for automatic recognition of tools.

This guide contains information for both the e-type and s-type tool strobers. To use the tool strober, you must be familiar with the Optotrak Certus System. Refer to the "*Optotrak Certus User Guide"* for information about the Optotrak Certus System.

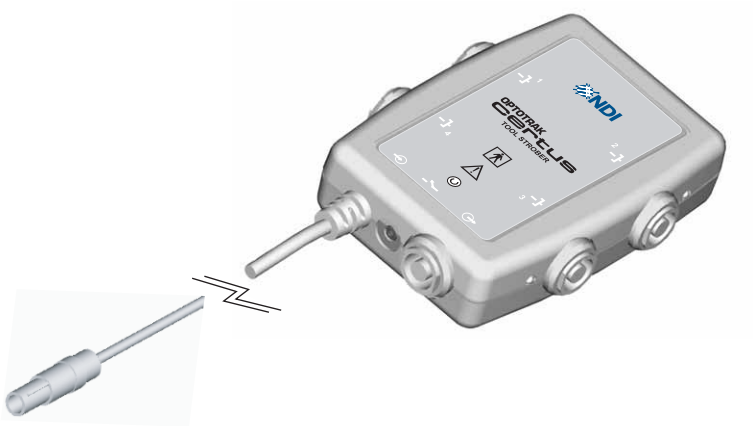


Figure 1-1: E-type Tool Strober

E-type tool strobers will only connect to e-type Optotrak Certus System Control Units. S-type tool strobers connect to s-type Optotrak Certus System Control Units and the s-type strober port on e-type Optotrak Certus System Control Units.

The tool strober can be used with switches and tools that you purchase or wire yourself. Wiring a tool or switch requires a basic knowledge of electronics and good wiring practices.

This guide includes information on:

- strober capabilities
- connecting the strober to the System Control Unit
- connecting tools to the strober
- using the swivel clip
- wiring switches
- troubleshooting
- available parts

1.1 Related Accessories

Other strobers that are available for the Optotrak Certus System include:

- axon strober, which has a DB25 connector that can be used for either markers, rigid bodies or a tool.
- marker strober, which can activate up to 24 markers attached to RJH connectors.
- 3020 strober adapter, which allows Optotrak 3020 strobers to be used with the Optotrak Certus System.

2 Strober Capabilities

The tool strober is designed to allow up to four custom tools to be connected to the system. Each tool may accomodate up to twenty markers, three switches and four LEDs. The tool strober is also compatible with Polaris tools, that incorporate metallic markers.

Three strobers (marker, axon and tool), the strober extension cable, and the System Control Unit are available in both s-type and e-type. The e-type components are intended for applications that require type BF isolation. The e-type System Control Unit includes two e-type strober ports and a single s-type strober port. All of the strober ports on the s-type System Control Unit are s-type.

2.1 LED and Switch Support

The tool strober has a visible strober status LED, four tool port LEDs, and two optional, external switches connected directly to the strober through a 2.5 mm headphone jack connection. The external switches are intended for feedback from the user to the application software. The signal returned from these switches is not fast enough to be considered real time, and cannot be used to synchronize the Optotrak Certus System with external devices.

2.2 Communications

The strober receives marker activation information from the Optotrak Certus System and sends tool and status information back to the system. The strober powers the markers in the order specified by software running on the host computer.

2.3 Compatibility

Tool strobers can be used simultaneously with other strobers, as well as the 3020 strober adapter. Strober types can be mixed within a daisy chain; 3020 strober adapters must always be located at the end of the chain.

2.4 Convenience

A swivel clip, which allows the strober to be attached to objects and rotate, is included with the strober. This facilitates fastening the strober to the subject.

2.5 Software Configuration

Using either application software or the routines described in the device handle section of the Application Programmers' Interface, you can set the:

- name of the strober
- number of markers to be activated
- order in which markers will be activated
- behaviour of the system in response to a change in the status of the switches
- behaviour of visible LEDs on tools
- information about a rigid body that includes the marker(s) being controlled by the strober
- marker power

3 Connecting the Strober and Tools

3.1 Connecting the Strober to the System Control Unit

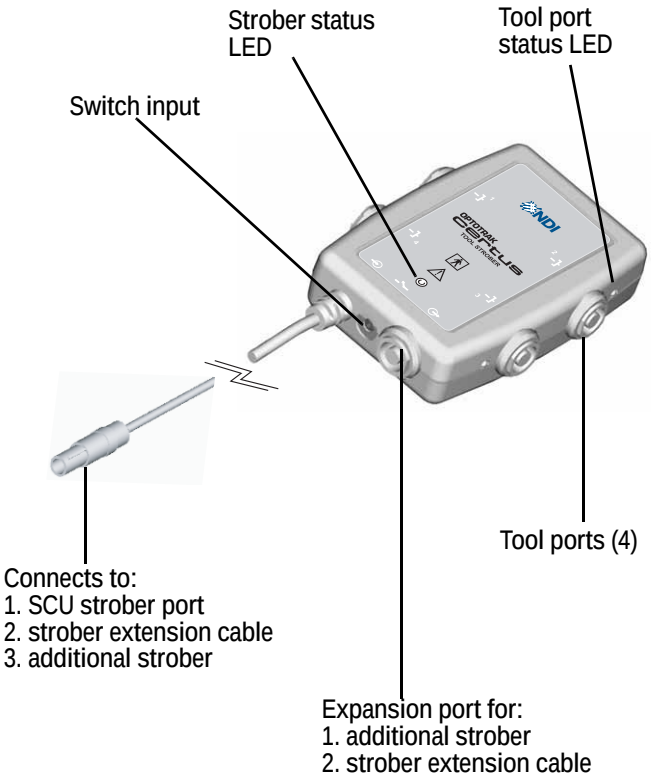


Figure 3-1: E-type Tool Strober - Connection

3.2 Strober Port Connections

Strobers designed for s-type applications have connectors equipped with a blue nut on both the strober port connector and the expansion port. They will connect to a port that is also equipped with a blue nut.

Strobers designed for applications requiring type BF isolation have connectors equipped with a black nut on both the strober port connector and the expansion port. They will connect to a port that is also equipped with a black nut. A strober designed for type BF isolation is also labelled with the Type BF symbol:

Figure 3-2: Type BF Symbol

Warning! An e-type strober must be connected to an e-type port on the e-type System Control Unit to maintain Type BF isolation. Check that the colours of both connectors match. The keying for the different types of connectors is unique to prevent using an s-type strober in an e-type port.

3.3 Strober Status LED

The strober status LED will flash in one of three default patterns.

The three default patterns are:

- a slow flash means the strober is connected to, and has communicated with, the System Control Unit.
- a fast flash means the markers are being activated. (In rare cases, a fast flash may mean there is a communication problem.)
- a solid light means there is a communication problem. See "Troubleshooting" on page 16.

3.4 Tool Port Connections

When designing tools for applications that do not require type BF isolation, you should use entirely grey tool port connectors to signify the tool is s-type. An s-type tool port is keyed differently from an e-type tool port.

When designing tools for applications requiring type BF isolation, you should use entirely black tool port connectors to signify it is an e-type tool. An e-type tool port is keyed differently from an s-type tool port.

Note: More detailed technical descriptions of the Optotrak Certus System components are included in the "***Optotrak Certus User Guide***".

3.5 Strober Activation Order

The order in which strobers and tools are activated is determined by the strober port to which they are connected. All the strobers which are connected to strober port 1 are activated before the strobers on port 2, which are activated before the strobers on port 3.

Tools and tool strobers are activated so that the tools connected to a tool strober are activated directly after the tool strober itself, and before the next strober in the chain. See Figure 3-3 on page 8, where the strobers and tools are numbered I to VIII.

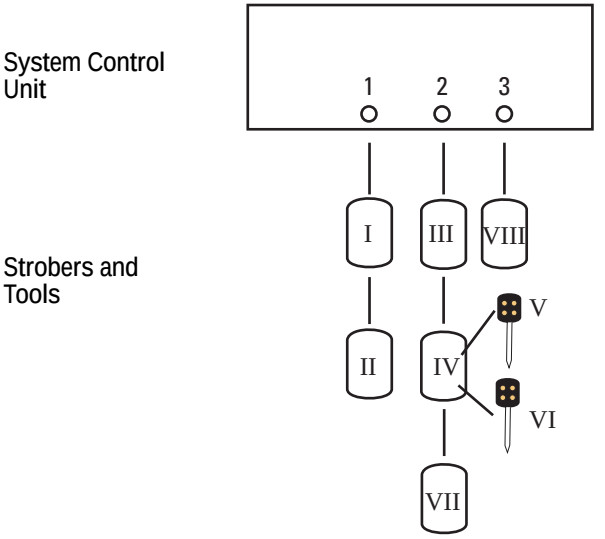


Figure 3-3: Strober and Tool Activation Order

3.6 Strober Extension Cable

The strober extension cable can be used to increase the distance between:

- the strober and the System Control Unit
- two strobers

The distance from the strober to the System Control Unit should be as short as possible as the amount of power available to the markers decreases with both the length of the cable and the number of connectors. Alternatively, strobers should all have the same separations from the System Control Unit to allow for even power to all markers.

Both s-type and e-type strober extension cables are available. Check that the colours of all connectors match each other. The keying for the different types of connectors is also unique to prevent using an s-type strober extension cable in an e-type port.

To maintain type BF isolation, all components between the e-type ports on an e-type System Control Unit and the patient must meet or exceed the certifications and approvals of the Optotrak Certus System. Serious personal injury could result if the appropriate type of isolation is not maintained.

3.7 Connecting Tools to the Strober

Tools are connected to the strober through a 10 pin, circular plastic connector. The tool port number is shown beside each tool port.

Tools can be plugged into any tool port. For example, tools could be plugged into tool ports 1 and 3, leaving tool ports 2 and 4 unoccupied.

The tool port status LED is located beside the tool port connectors on the side of the tool strober. The status LED may be:

- off when there is no tool plugged in
- green to indicate that the system is ready to track tools
- yellow if the tool has been recognised as present, but has not yet been initialized

Ensure that the correct rigid body file is used with the corresponding rigid body. If the rigid body definition does not match the rigid body, the rigid body may still be tracked but will report incorrect data. If a rigid body definition contains imaginary markers, but is used with the incorrect rigid body, the rigid body may still be tracked, but will report incorrect data for the imaginary points. Incorrect data could cause personal injury and/or property damage.

To ensure maximum tool and connector life, make sure you hold the connectors and not the cables when connecting and disconnecting tools.

4 Using the Swivel Clip

The swivel clip consists of:

- a clip, which attaches to items such as a belt, collar or shoe.
- a tab, which is permanently fastened to the strober and can be quickly disconnected from the clip.

The supplied clip is designed to provide rotation in two dimensions. The default orientation of the strober will depend on the location of the circular tab:

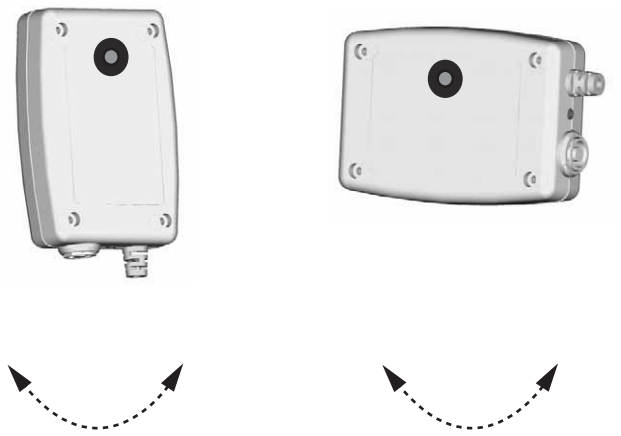


Figure 4-1: Possible Positions for Swivel Clip Tab

Note: Be sure to place the tab on the back of the strober so that the strober status LED is visible when the strober is in use.

The orientation will also affect the amount of strain on both the marker and strober cables. It is a good practice to minimize the strain that might cause cable breakage as much as possible.

4.1 Fastening the Tab to the Strober

1. Clean both the back of the strober and the back of the tab with a small amount of isopropyl alcohol (rubbing alcohol).
2. Remove the backing from one side of the adhesive strip and apply it to the tab.
3. Remove the backing from the other side of the adhesive strip and press the tab firmly onto the back of the strober in the preferred location.
4. If possible, do not use the tab for 24 hours to allow the adhesive to set firmly.

4.2 Clip Orientation

1. Slide the tab into the slot on the clip.
2. Position the clip as shown below:

Figure 4-2: Preferred Orientation of the Clip

4.3 Removing the Strober from the Swivel Clip

To release the locking mechanism, press the release button and slide the tab towards the release button:

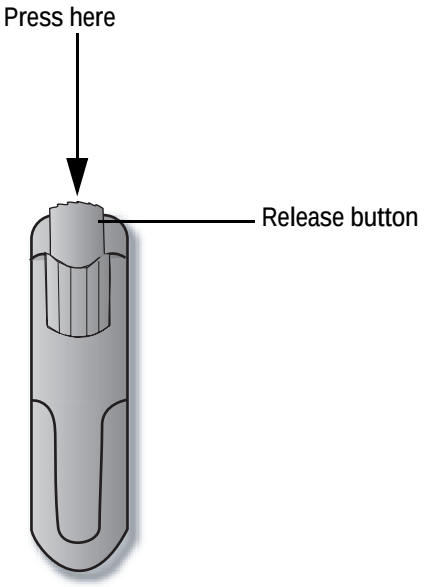


Figure 4-3: Releasing the Tab From the Clip

5 Wiring Switches

Note: If the tool strober will be used with NDI application software, it is important that the external switches have a “normally open” contact configuration.

Externally, a 2.5 mm headphone jack generally appears as shown in Figure 5-1.

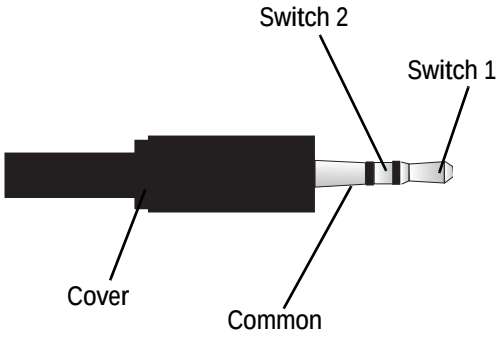


Figure 5-1: External Appearance of 2.5 mm Headphone Jack

Wire the headphone jack as follows:

1. Remove the black cover from the jack by unscrewing or sliding off the cover.
2. Refer to Figure 5-2 and for each switch, solder one wire to the ground terminal and one wire to the required switch terminal.

Note: Use solder designed for electronic applications.

It is preferable to use multi-strand wire rather than solid core wire. Multi-strand wire is less susceptible to fatigue and breakage.

3. Refit the cover, removed in step 1.

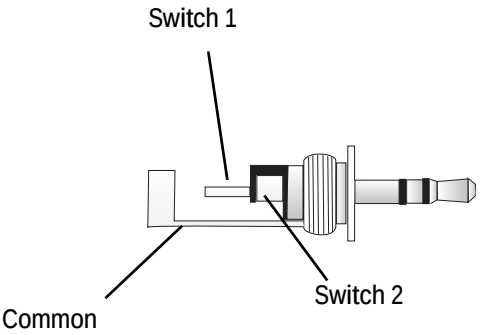


Figure 5-2: Internal Appearance of Headphone Jack

6 Abbreviations and Acronyms

Abbreviation or Acronym	Definition
LED	Light Emitting Diode
NDI	Northern Digital Inc.

7 Troubleshooting

The strober connector won't fit into the strober port connector on the System Control Unit.

You may be trying to connect an s-type connector into an e-type connector, or vice-versa. Check that the colour of the connectors match.

You may be trying to plug a tool connector in a strober port, or vice versa. Strober connectors have seven pins, while tool connectors have ten. S-type tool connectors are entirely grey, while e-type tool connectors are entirely black. Strober connectors are bi-coloured, with a grey end and a coloured nut.

When the strober is plugged into the System Control Unit, the strober status LED is off, a solid green or flashing quickly.

The strober connector may not be firmly seated in the receptacle. Check that all connectors are firmly connected. There is an audible 'click' when a connector is correctly seated.

Either the strober or the strober extension cable (if used) is faulty. To determine if either of these possibilities is the source:

a) Connect another strober to the extension cable. If the second strober works, there is a problem with the first strober.

b) Connect the strober without the extension cable. If the strober operates correctly, there is a problem with the extension cable.

Markers are missing.

The tool connector may not be firmly seated in the tool port. Check that all connectors are firmly connected. There is an audible 'click' when a connector is correctly seated.

Use the IR detection strip to determine if the marker is activated.

Ensure that the marker is directly facing the Position Sensor and is located in the measurement volume.

Some markers at the start of a frame may go missing at some combinations of high frame and marker frequencies. This can be resolved by decreasing either the frame or marker frequency.

The tool is not recognized.

The tool will not be recognized if the SROM device and FET were not included in the tool or if either of these devices is broken.

Ensure the tool does include both an SROM device and a FET and repair if necessary.

8 Equipment Symbols

These symbols are on either the tool strober or in this guide and have the following meanings:

Table 8-1: Symbols

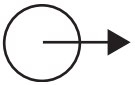
Symbol	Meaning	Location
	Follow the information in this paragraph to avoid personal injury and/or property damage	Documents
	Signal in	Tool strober
	Signal out	Tool strober
	Switch input	Tool strober
	Tool port	Tool strober

Table 8-1: Symbols (Continued)

Symbol	Meaning	Location
	Type BF equipment	e-type tool strober
	WARNING: Please consult accompanying documentation	Tool strober
	Static sensitive: Take electrostatic discharge precautions	Tool strober
	Strober status	Tool strober

Index

Numerics

A

B

C

E

H

I

L

M

R

S

T

W