ON-TRAK
Photonics, Inc.

OT-7000 RF
Auto Aligning Straight
Line Laser System

User's Manual

Introduction

Congratulations on the purchase of your OT-7000 Auto Aligning Laser System with 902-928 MHz RF Spread Spectrum communication technology. Optimized for computerized precision laser alignment, the OT-7000 represents the state-of-the-art in laser positioning technology.

By aiming the visible laser beam at the reference target, and then positioning transparent measurement targets along the beam path, your projects are   assured the utmost in alignment accuracy – better than 0.001" over distances of 300 feet. Using RF spread spectrum communication, a closed loop feedback path is established with the reference target to automatically maintain laser alignment. If the laser deviates from the center of the reference target, the laser automatically corrects itself until the laser is realigned. A user interface positioned on the front panel of the OT-7000 RF Controller Module makes system operation convenient and easy to monitor.

We suggest you read this owner's manual carefully to become familiar with the features and how they work. The manual explains in simple steps how to install, use, and care for your Alignment Laser System.

Standard System Components.

The following components are standard with each OT-7000 system. Your standard system consists of:

- Alignment laser (Model OT-7000 LL)

- Central Processing Units (Model OT-7000 CPU)

- Transparent targets (Model OT-7000 TTS4)

- Reference target (Model OT-7000 TS4)

- Controller Module (OT-7000 RF)

- Interface cables

- Power supplies

- Operations Manual

System Set Up

The OT-7000 system is designed to mount in conventional optical tooling fixtures. The alignment laser, reference target, and transparent targets each feature a precision NAS 2.2498 inch diameter stainless steel, chrome plated boss that mounts into a standard optical tooling sphere.

Setting up the Alignment laser (OT-7000 AL)

Mount the front of the laser into a tooling sphere assembly similar to those in the "Recommended Accessories" section at the end of this manual. The laser should be mounted in the sphere such that the sphere is in between the two parallel scribe lines on the laser front. There is a notch at the rear of the laser. This should be in the up position. The rear of the laser is best mounted in a device (Model 71-5170 Alignment Telescope Bracket) that allows tip/tilt movement for the rough alignment necessary to put the laser spot within +/- 0.050" on the Reference Target. Once mounted, the alignment laser is positioned to produce a visible beam that emits from the center of the sphere. It is critical that the center of the sphere be at a known reference point.

Internal and External Radiation Paths

The internal radiation paths are as follows:

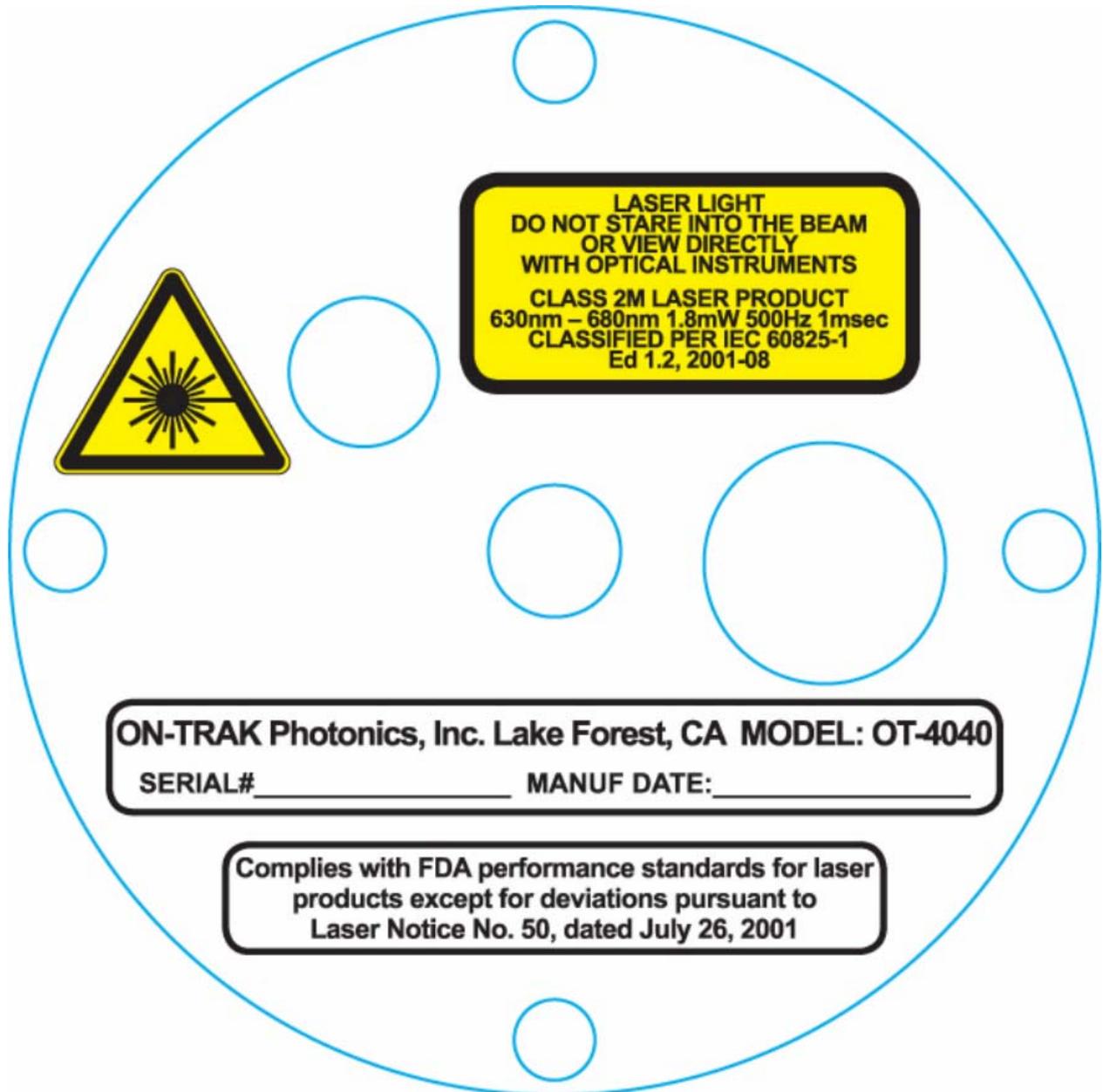Laser light is generated by one visible laser diode and emitted by at the laser aperture.

Radiation Field Specification:

Wavelength	635nm
Power (Peak)	1.8mW
Frequency	***500Hz***
Pulse Width	1mS
Diameter	8.2mm
Mode	TEM00
Radiation	Non Ionizing
CDRH Class	2M

Recommended Eyewear

Due to the Class 2M classification of this product safety eyewear is only required for performing service on the OT-4040. See the service documentation for data on the recommended eye wear.

Since the OT-4040 does not emit higher than Class 2M levels of laser light, no eyewear is required for normal operation.

LASER LIGHT
DO NOT STARE INTO THE BEAM
OR VIEW DIRECTLY
WITH OPTICAL INSTRUMENTS

CLASS 2M LASER PRODUCT
630nm – 680nm 1.8mW 500Hz 1msec
CLASSIFIED PER IEC 60825-1
Ed 1.2, 2001-08

ON-TRAK Photonics, Inc. Lake Forest, CA MODEL: OT-4040

SERIAL#_____   MANUF DATE:_____

Complies with FDA performance standards for laser
products except for deviations pursuant to
Laser Notice No. 50, dated July 26, 2001

"LASER LIGHT - DO NOT STARE INTO THE BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS"

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Since the OT-7000 LL alignment laser is powered by the OT-7000 Controller Module. Connect the laser to the Controller Module front panel via the supplied military style bayonet connector. Connect the 12V/5A power supply to the Controller Module back panel.

Setting up the Reference target (OT-7000 TS4)

Connect the target to the dedicated CPU using the supplied DB15 cable.   It is important that each target and CPU are paired with like serial numbers. If the target is accidentally plugged into the wrong CPU, the CPU will give "Prob Err" as an indication a mismatch has occurred. It will also flash the serial number of the target that it expects. . Like the alignment laser, the reference target is mounted into a tooling sphere. The target center is coincident with the center of the sphere. The reference target is installed at the opposite end of the alignment structure. This way, when the laser is switched on, a straight line in space is established between the sphere centers .

Setting up the Transparent Targets (OT-7000 TTS4)

Connect the target to the dedicated CPU using the supplied DB15 cable. It is important that each target and CPU are paired with like serial numbers. If the target is accidentally plugged into the wrong CPU, the CPU will give "Prob Err" as an indication a mismatch has occurred. It will also flash the serial number of the target that it expects. Transparent targets are mounted into tooling spheres, which are in

turn mounted onto the structures that need to be brought into alignment. Each transparent target is positioned such that the laser beam passes through the target. The transparent target then reads the X and Y position of the structure, and sends the data back to the OT-7000 Controller Module via RF spread spectrum transmission.

Connecting, Squaring Up and Leveling the Targets

To complete the setup process, level and square the targets to the laser beam. The reference target and transparent targets include a 30 minute bubble vial that should be aligned within the circular scribe of the vial. Next, the target should be squared to the incoming laser beam. This is easily accomplished with the OT-7000 system. Each target reflects about 4% of the visible beam back towards the laser. When the reflected beam is within the 2.5-inch diameter of the laser face, the targets are sufficiently squared to the beam. The targets only need to be square and level to within 4 degrees for proper operation.

OT-7000 Power Up Sequence

To begin using the OT-7000 Auto Aligning Straight Line Laser system, we recommend that the CPU's are turned on first. Then, turn on the OT-7000 Controller Module. The controller will start the system in the "Manual Align" mode. The laser will be on.

The first step, after power up, will be to adjust the external physical mounting system that holds the laser such that the beam falls within +/- 0.050" for X and Y on the reference target. After doing this you are ready to begin system operation.

System Operation

Auto Aligning

With the alignment laser, reference target, and transparent targets all set up on the factory floor and in the "Manual Align" mode, you can now press "Auto align" and begin using the system.

IMPORTANT – IF THE BEAM PATH TO THE REFERENCE TARGET IS INTERUPTED DURING AUTOALIGN INITIALIZATION, THE SYSTEM WILL REVERT TO THE MANUAL ALIGN MODE.

The system does this because, during the initialization process, the laser is "learning" the distance to the target by moving the beam in the X and Y direction on the reference target. An interrupted beam will cause the system to compute the distance incorrectly. Therefore, the system monitors for beam path interruptions. The initialization process typically takes approximately 30 seconds.

The OT-7000 Controller Module gives you the ability to modify and control many different system parameters that effect the operation of the closed loop process used for auto aligning the laser on the reference target. The following text describes some of the user controllable parameters available.

System Operation – OT-7000 Controller Module

The OT-7000 Controller Module provides four primary functions. It allows setup of system parameters, display of target position data, power to the OT-7000 AL Laser, and RF spread spectrum closed loop control of the OT-7000 TS4 Reference Target. There is also an RS-232 interface for computer control (see engineering manual for details).

To setup the Auto-align system parameters or view the target data, press the "Menu" button on the front panel.

Setup of System Parameters

The OT-7000 has an LCD display which allows the user to define the system operation parameters. To enter the menu of options, press the right arrow key. This allows access to the following setup options:

Max Dev.
Zero Pos.
Time
Max Pos.

The four arrows to the right of the display allow the user to navigate the menu structure. The "up/down" buttons move between the individual setup options. The "left/right" buttons increase and decrease the value of the selected option.

"Max Dev." Is the maximum distance the laser is allowed to travel from center before auto aligning takes place. The minimum allowed value is 0.002". The maximum is 0.050". This value is automatically at least 0.001" greater than the "Zero Pos."

"Zero Pos." is the distance from center (X=0.000, Y=0.000) that the auto aligning process corrects to. This has a minimum value of

0.001" and a maximum of 0.010". It can't be greater than the "Max Dev." value

"Time" is the time that the laser can be outside "Max Dev." before the system initiates auto aligning. The minimum value is 1 second. The maximum value is 10 seconds.

"Max Pos." is the maximum the laser can travel before it is "out of range". The minimum value is 0.100". The maximum value is 0.400".

To exit, press the "Menu" button. Press the Auto Align button to begin using the system.

Display of target position data

After pressing the menu key, use the down arrow to select "View all targets". The right arrow key will display the target data for all targets in the alignment string. The reference target is always target #1.

The display will give data for six targets at a time. If additional
targets are in the chain, use the down arrow key to scroll down.

To exit, press the "Menu" key.

RS-232 / USB communication

The OT-7000 RF Controller module has two communication options.
RS-232 communication is facilitated via a 9 pin standard (pin 2 to 2,
pin 3 to 3, ect..) RS-232 connector on the front panel. A USB
connector is also provided on the front panel. When the system is first
used with a new computer, Windows must install the necessary

drivers to recognize the new hardware (OT-7000 RF Controller). The necessary drivers are provided on a CD with the system.

The installation process for the drivers are as follows:

1. Turn on the OT-7000 RF Controller
2. Plug in the USB cable to both the OT-7000 RF and the computer.
3. Windows will indicate that it has found new hardware and the found new hardware wizard will appear.
4. You will be asked to connect to Windows Update to find the appropriate drivers. Select No.
5. Insert the OT-7000 USB Driver CD at the prompt and choose to "install from a list or specific location."
6. Check the box that says "Include this location in search" and browse to find the directory containing the CD with the OT-7000 USB Driver disk. Click on "Next" and the software will find the appropriate drivers.
7. On some computers this process must be completed twice for all the drivers to be installed.

You are ready to communicate with the OT-7000 RF controller via computer.

System Operation - OT-7000 CPU

User Interface

After turning on power to the CPU, the POWER LED will illuminate.

The display will turn all segments on for about two seconds and

briefly display four dashes. Then, the display will show the CPU/target ID number and the preamble setting. As an example:

I 3
p 4

This means that the target ID is "3" and the preamble is "4". A typical laser alignment system consists of one laser, a controller, and several targets. All the targets in a specific setup communicate via one common preamble number. In this case, all the targets are communicating on preamble number 4. Different systems have different preamble numbers. This allows multiple systems to operate adjacent to each other without any unwanted crosstalk between systems. The preamble and ID settings are in software and can be modified in the calibration process. Each target within a given laser alignment system has a unique CPU/target ID number for communication and data processing purposes. This allows the OT-7000 RF Controller to identify each CPU/target in the laser chain.

After the preamble and CPU/target ID number are shown, the CPU will display the model number of the CPU and the serial number of the target it is expecting. For example:

7000
3289

The CPU model is 7000. The serial number of the target the CPU expects is #3289. Each CPU is calibrated with a specific target. Target linearity and centering calibration data is loaded into the CPU for the requested target. The CPU will only work with the target it is paired with.

When the CPU is ready to operate, the display will show four dashes (- - - -), indicating standby mode. When a laser strike is detected, the red LASER LED will illuminate on the CPU and the target.

WARNING: **DO NOT CONNECT OR DISCONNECT THE REMOTE SENSOR WHILE THE POWER IS TURNED ON**.

The CPU will display and update the beam position to a resolution of 0.001". If no laser is detected the OT-7000 CPU will return to standby mode and will display four dashes (- - - -).   Background illumination is sensed automatically and compensated for. If the total illumination (background plus laser pulse) exceeds the maximum level, the display will show EEEE.

Average Mode

The OT-7000 CPU has a user selectable averaging feature. Readings can be averaged over a period of time. The E/N button controls the averaging time (note that the button is recessed and requires a small tool for operation). When the E/N button is pressed, the average time

in seconds is incremented and displayed. The range of values is from 0.25 seconds to 5.00 seconds. After displaying the value, the unit defaults back to normal operation.

Zero Offset

The zero offset feature can be activated by pressing the recessed button. This will have the effect of defining the current position as X=0.000 and Y=0.000. All subsequent measurements will be relative to the new zero. The indicator light above the button will be activated when this feature is in use.

Display Brightness

The OT-7000 CPU has three selectable levels of display brightness and one off condition. The display intensity can be increased or decreased (conserving battery power).

Gain Control

The OT-7000 CPU has automatic gain control. The system will automatically select the optimum internal gain for laser sources with peak output power between 0.3mW and 2mW. There are four gain levels numbered 1 through 4. When the OT-7000 is powered up, the

gain defaults to a maximum. Any time the OT-7000 detects a signal that is too high, the gain is reduced. If the gain is accidentally set too high due to a strobe light or other bright, momentary source, the OT-7000 may stop detecting the laser. If this occurs, the OT-7000 CPU will auto range to reset the optimum gain range.

Battery Operation

The OT-7000 CPU has rechargeable internal NiMH batteries. When the battery charge state is low, the BAT LED will light up. The unit should be recharged at this point with the supplied 15V/1.5A wall charger. The CPU can continue to operate while it is charging. The OT-7000 CPU will automatically turn itself off when the battery reaches a critical level.

Approximate battery life in operating mode is listed as follows:

Mode	Battery Life (Approx.)
Display Off	20 hrs.
Minimum Brightness	16 hrs.
Maximum Brightness	12 hrs.

A wall transformer charger is supplied with the OT-7000 CPU. Charge time is approximately 8 hours.

OT-7000 Power Down Sequence

The OT-7000 system automatically centers the laser upon system shutdown. This process takes approximately 45 seconds to complete. Upon completion, power is then shutoff to the laser and controller and the laser is ready for its next use.

PLEASE DO NOT UNPLUG POWER TO THE CONTROLLER MODULE WHILE THE SYSTEM IS IN THE SHUTDOWN SEQUENCE

If power is removed from the controller during this process, the OT-7000 Controller will center the laser the next time the system is activated.

Recommended Accessories

Model 187-S Stride Level

Designed for leveling cylindrical surfaces between 2-3 inches in diameter. Compatible with the OT-7000LL Ultralign laser. Indicates off-level conditions as small as one arc-second.

Model 521 Spherical Mount

Capable of mounting any 2 ¼ - inch diameter cylindrical laser or target assembly in the model 560-2 Adjustable cup mount. Compatible with ON-TRAK NAS standard compatible targets and lasers.

Model 560-2 Adjustable cup mount

Steel cup mount on iron base to hold Model 521 Spherical Mount.

Model 565 Spring Clamp

Modified "U" shape clamp is designed to hold a model 521 spherical mount in a model 560-2 cup mount.

Model 71-5170 Alignment Telescope Bracket

Supports and provides a means for adjusting the position of the OT-7000LL and OT-7000LL Ultralign laser. It can be attached to the model 560-2 Adjustable cup mount.

Service Instructions

Contact ON-TRAK Photonics, Inc. for return authorization number. Be sure to include on all paperwork and on outside of shipping box. Put a note or letter into the package identifying you as the owner of the equipment. Explain the problem, be sure to include a return address and telephone number. If the unit is in the warranty period, provide verification of the order date. Estimates of charges for non-warranty or other work will be supplied, if requested, before work begins. If estimates are not requested, repair work will begin as soon as possible. Pack the equipment securely in the original carton. For a quick turn around, "2nd Day Air" or airfreight is recommended. There will be no charge for repair of instruments that may cause problems due to defective materials and/or workmanship under warranty, except for "one-way" transportation charges.

SEND REPAIRS TO:

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