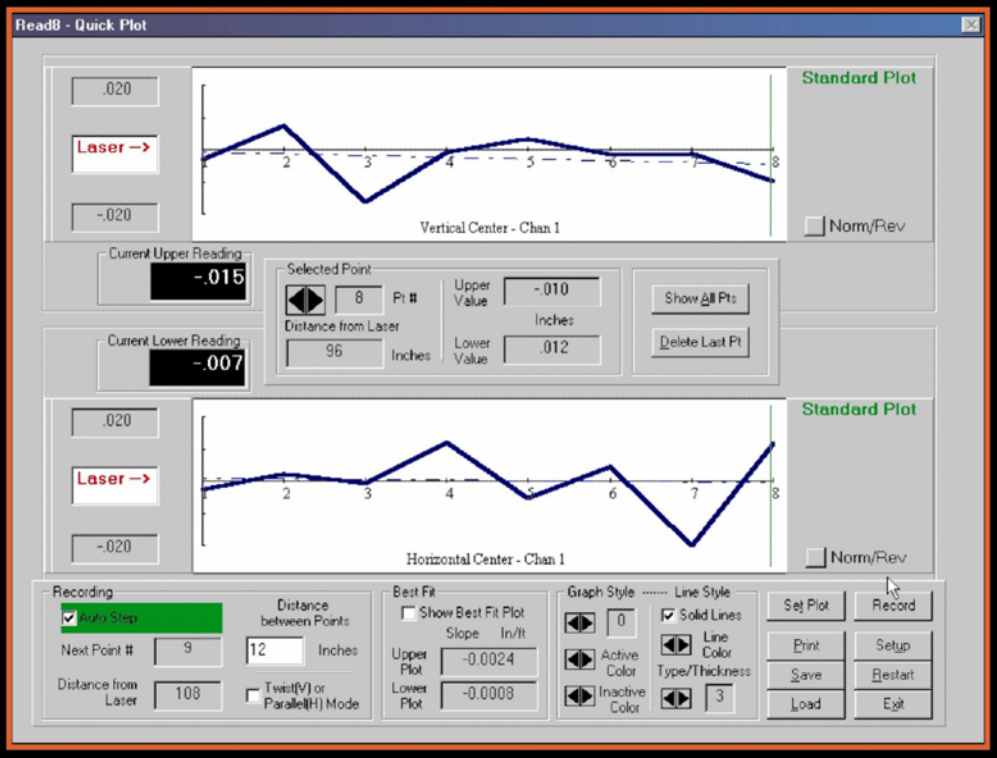

Operations Manual

Read8 with *Bore8*

Multi-Function Laser Alignment Software
including Bore8 for aligning and measuring multiple bores

September 2011

HAMAR LASER®

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Introducing READ8

READ8 is a general-purpose program for Hamar Laser alignment equipment. When a target (or targets) is connected to a Hamar Laser computer interface and a personal computer, the program acts as a target readout and provides the following utilities:

Plot The Plot Screens combine numerical *readings* from the target and a *graphical display* of the data to show where the laser beam is striking the target. Both center and angular alignment can be displayed in a plot, with numbers denoting slope given in italics. Depending on the target in use, different plots are available from the View Menu.

Offsets The offset development utility allows the creation of offsets, or corrections to the display, so that it shows only misalignment. Various options are offered for creating offsets, all of which are accompanied by a graphical representation and prompts for information.

Record Data This utility combines several data recording functions: a general purpose logging utility called air noise, a utility to check the repeatability of readings, a utility to monitor variations in readings over time (such as thermal growth) and the new Quick Plot option that plots target readings on a graph. The recorded data can be saved, reviewed, printed, and imported into a spreadsheet program.

Features

- **Live display**
  The plot displays move with each adjustment, allowing the user to see the misalignment and correct it easily.

- **Four types of graphic displays**
  Depending on the laser and target setup, data can be displayed in four different graphic formats:

  _ ***Standard Plot***, which shows either two center readings for two different targets or center and slope readings for a single 4-axis target.
  _ ***Combined Plot***, which shows a perspective view of center and slope readings for a single 4-axis target.
  _ ***Spindle Plot***, which shows graphical views of spindle misalignment.
  _ ***Scan Plot***, which shows the vertical position for up to four targets.
  _ ***Bore Plot,*** which measures and aligns multiple bores.

- **Offsets**
  READ8 allows the user to develop or enter various offsets or error corrections. The offsets can be toggled on and off as required and include the following capabilities:

  – Zero – Buckin – Spindle – Manual Offset
  – Align Target – Align Laser – Virtual Center in Front – Virtual Center Behind

- **Four data recording methods, including the new Quick Plot mode**
  In addition to the Air Noise, Repeat Mode and STimer mode of data recording, the new Quick Plot recording mode provides a fast way of recording and plotting straight-line alignment information on a customizable graph.

- **Save, print and analyze recorded data**

The user can save and print recorded data, as well as recall for review previously saved information. Saved data may be imported into Microsoft Excel for further analysis.

Compensating for Mounting Errors

Target and laser mounting errors must be compensated for in order to get accurate results in bore and spindle work. READ8 uses the NORMIN method, a quick and precise way of canceling out these errors, developed by Hamar Laser to eliminate the need for complicated, expensive fixtures. The word "NORMIN" is a contraction of "NORMal-INverted," which briefly describes the method.

One unit, target or laser, is set in the normal (cable down) position, the other rotated 180 degrees to the INverted (cable up) position, and a set of INverted readings is taken. Then the laser and target are both set in the NORMal (cable down) position and the readings recorded (in some cases, three readings are taken: target normal and laser inverted, laser normal and target inverted, and both units normal). The readings are then averaged to cancel out both centering and angular mounting errors and provide a very accurate result. The NORMIN procedure is fully explained in Appendix A, beginning on Page 61 of this user's guide.

Preparing for an Alignment

There are several preparations that need to be made before beginning a measurement or alignment process. Ensure that accurate records are kept for all procedures.

Hardware Preparation

- Determine what hardware is necessary to perform the alignment, including the laser, target, mounting fixtures, readouts or interface, cables, etc. Make a note of the target model number so that the information can be entered into the program setup.
- If a test or measurement is expected to take more than 3-4 hours, be sure to connect portable computers, interfaces, and other battery-operated devices to their external power supplies.
- Observe safety precautions when setting up hardware. Lock out machines for stationary procedures. If a machine is running, set up barriers and/or warning signs and route all cables away from moving parts. Clean and check all equipment, fixtures, and mounting surfaces before beginning any alignment process.

Connecting to a Computer Interface

Hamar Laser's computer interfaces couple with a portable computer to act as a readout and allow the use of the READ8 program to perform calculations, display live laser beam-to-target position information, and plot results.

- The **R-355 Interface** attaches to the computer with an RS-232 cable and operates on normal current (115 V AC). It is equipped with LED's on the front of the unit to indicate when the laser beam is on target.
- The **R-358 Interface** attaches to the computer with an RS-232 cable and is powered by a lithium ion battery or an AC adapter. The R-358 is available in both standard (.0001") and high-resolution (.00004") versions.
- The wireless **R-359 Interface** operates with a sophisticated frequency-modulated IR transmitter and uses the A-908 IR Receiver, which attaches to the computer with an RS-232 cable.
- If wireless targets are used, (the A-1519 and A-1520 or the T-1275 Wireless Coupling Target) data is sent to the Read8 program via the **A-908 IR Receiver** and no separate computer interface is required. The A-908 connects to the computer serial port with a standard RS-232 cable.
- The **RS-485 Interface** selection can be used under circumstances where Hamar Laser's Universal Wireless Targets cannot be used in wireless mode. When the need arises for more than four targets, when an IR receiver becomes disabled, or when a user wishes to write his own application software, the targets may be hard-wired using junction boxes and the RS-485 port located on the back of each target. Each junction box controls four targets, and as many junction boxes as necessary may be connected together. For a complete description and diagrams of the RS-485 connections, see the *Read9 Alignment Software and Unitargets* user manual.

Connecting to the R-355 Computer Interface (Four-Axis Operation)

1. **Plug the target or targets directly into Port A or Port B of the R-355 Interface.**
   Port A is assigned either Channel 1 or Channel 2 in the software setup. Port B is assigned either Channel 3 or Channel 4.
2. **Continue with Steps 4 and 5 on Page 4.**

Connecting to the R-355 Computer Interface (Two-Axis Operation)

1. **Plug the T-237C Target Adapter Cable into Port A of the R-355 Interface.**
   Two adapter cables may be used, (one on Port A and one on Port B) enabling the use of up to four targets. The locations of ports and switches on the R-355 Interface are shown in Figure 3.
2. **Plug the target into the T-237C Target Adapter Cable.**
   Plug the target cable into one of the leads from the Target Adapter Cable. Each lead has a tag attached with either the numbers **1/3** or **2/4** (see Figure 1). Cables plugged into Port A are assigned either Channel 1 or 2 in the software setup, depending on the lead to which the target cable is connected. Cables plugged into Port B are assigned either Channel 3 or 4 in the software setup, depending on the lead to which the target cable is connected. See Figure 2 for a connection diagram. Note the Port designation for use in the software setup.

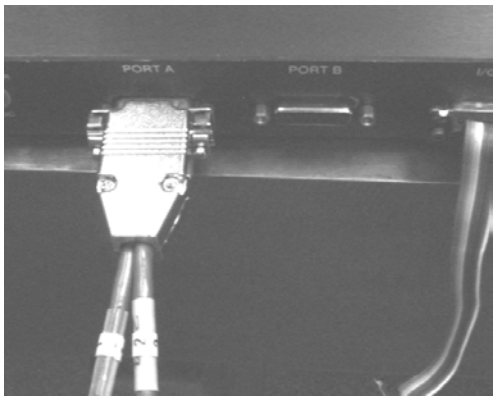


Figure 1 – *T-237C Target Adapter Cable Connected to Port A of the R-355 Interface*

3. Continue with Steps 4 and 5 on Page 4.

Connecting to the R-355 Computer Interface (One-Axis Operation)

If you're using a target that is compatible with a scanning laser, the procedure is the same as that for two-axis operation except that a T-251 Target Scanner Preamp must be connected between each target and the T-237 Target Adapter (see Figure 2).

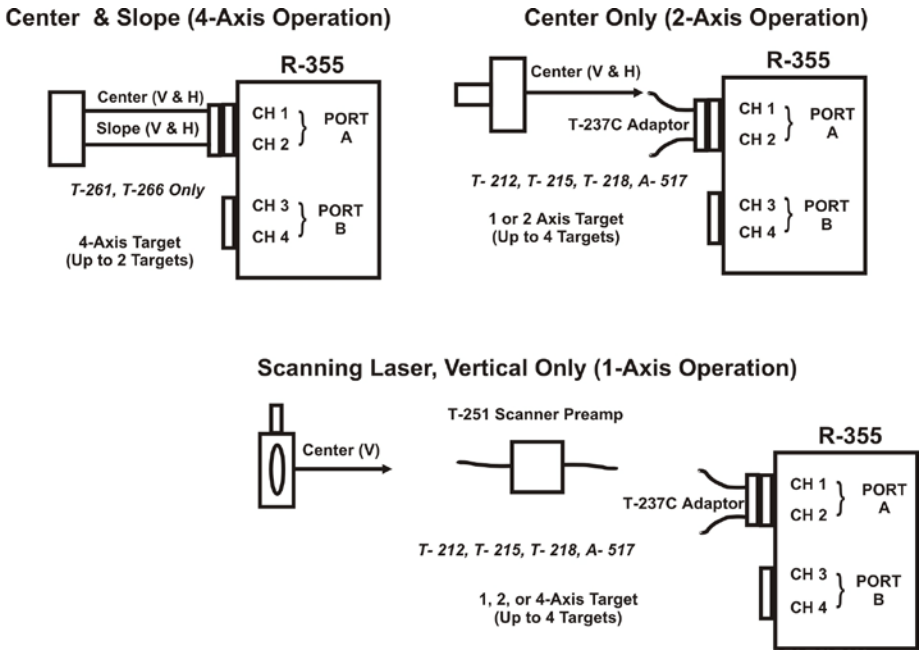
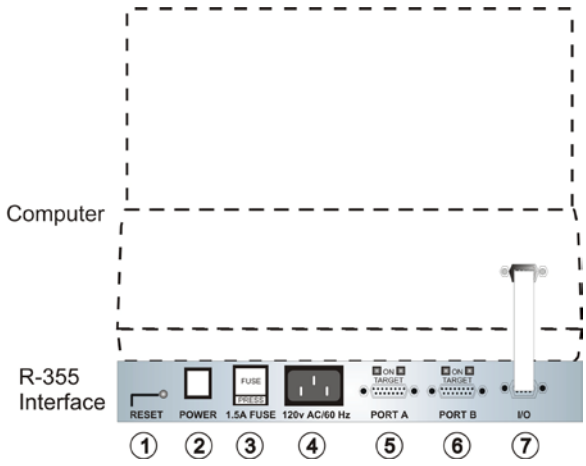


Figure 2 – *Connecting to the R-355 Computer Interface*

4. Connect the R-355 Interface to the computer.

Connect the interface to the computer serial port using the special small ribbon cable provided. The connector for the cable is located on the back of the R-355 Interface (see Figure 3).



1. Reset Button*
2. Power Pushbutton
3. Fuse
4. Power Cord Receptacle
5. Port A (Target Port)
6. Port B (Target Port)
7. Interface to Computer Serial Port

*Pressing the Reset Button resets the memory buffer in the R-355 Interface. If the READ8 software stops recording data, try pressing the Reset Button to re-establish communication with the interface.

Figure 3 - *R-355 Computer Interface, Rear View*

5. Turn on the R-355 Interface and the computer.

Connect the power cord to the interface and press the Power pushbutton. Turn on the computer.

Connecting to the R-358 Computer Interface

Note: *Before using the R-358 Computer Interface, ensure that the battery is fully charged or that the AC charger/adapter is plugged in. Make all connections with computer power off.*

1. **Connect the target(s) to the INPUT connector on the front of the R-358 Interface.**
   The interface can support one 4-axis target. It can also support two 2-axis targets with the use of an optional splitter cable.

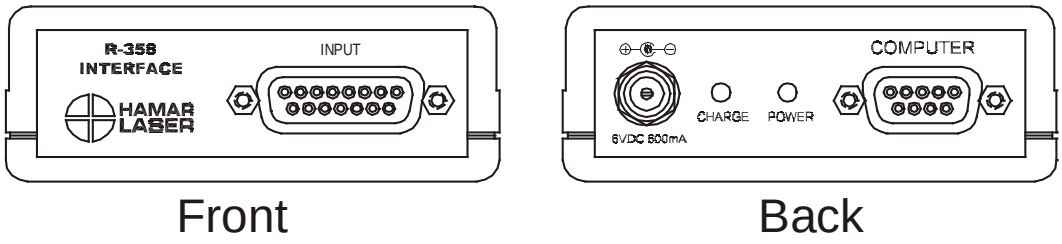


Figure 4 – *R-358 Interface Connections*

2. **Connect the R-358 Interface to the computer.**
   Connect the interface to the computer serial port using the standard RS-232 cable provided. The connector for the cable is located on the back of the unit and is labeled COMPUTER.
3. **Turn on the computer.**

The Model R-1307 Readout

The Model R-1307 Readout supports both wireless Unitargets, such as the A-1519, or local (cabled) targets. It is available with a radio frequency of either 900 MHz or 2.4 GHz ISM band. The R-1307 can be used as the primary readout or as an additional readout to copy position data captured by another R-1307.

Figure 5 – *R-1307 Readout*

R-1307 Control Panel

Figure 6 shows the features of the R-1307 Control Panel.

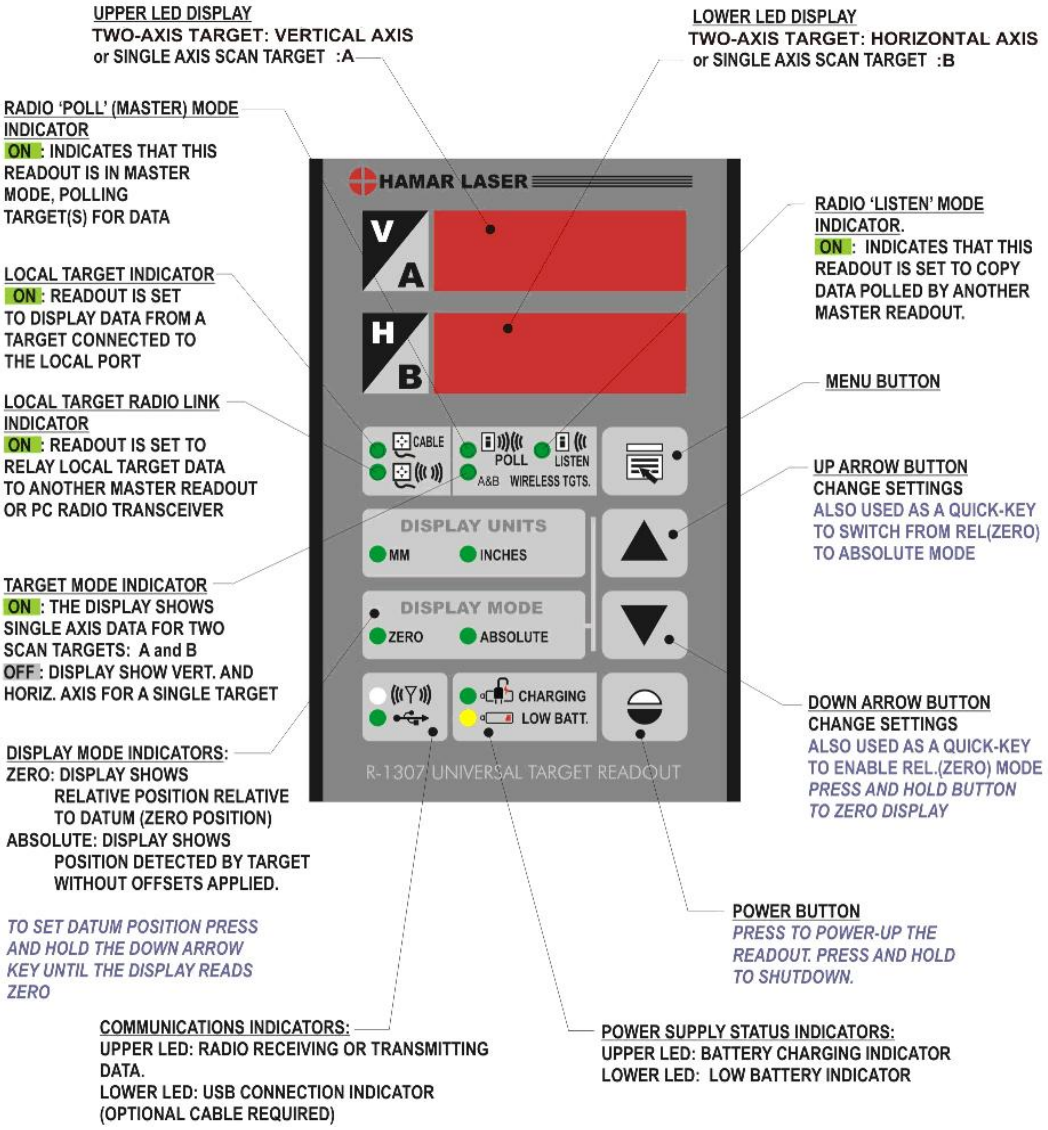


Figure 6 -- *R-1307 Readout Control Panel Features*

Using Lasers with Pulse/Continuous Modes

On lasers equipped with a **Pulse/Continuous switch,** manually set the switch to select the laser mode compatible with the readout/interface being used. The R-1307C, R-1307-900 and R-1307-2.4 use Pulse Mode to automatically remove the effects of excess (ambient) background light providing a truer reading.

Configuring the R-1307 for a Local Target

Note: *Shut off power to the readout before connecting or disconnecting a target from the local port.*

1. **Connect the cabled target to the local port of the readout**
2. **Press and hold the MENU button for approximately 2 seconds to enter configuration mode.**
3. **Set the Measurement Units**
   Press the MENU button until the upper display shows UNITS ☐☐ Use the UP and DOWN arrow keys to select either INCH ☐for inches or mm ☐for millimeters.
4. **Set the Dampening Level**
   Press the MENU button until the upper display shows AUGS. Use the UP and DOWN arrow keys to set the number of averages. Adjust this value as required to suit the application. The default for this application should be changed to at least 8. For long distance shots, use 16 or 32.
5. **Set the Readout Function to Local Target**
   Press the MENU button until the upper display shows FUNCTS. Use the UP and DOWN arrow keys to select FUNCTS LOCAL.
6. **Select the PSD descriptor applicable to your target**
   Press the MENU button until the upper display shows ☐TGTS nn, where nn designates the target number. Each R-1307 has three target descriptors:
   - TGT=0 (for HLI use only. Do not use)
   - TGT = nn, P.10.10 (pulsed beam mode)
   - TGT = nn, F.10.10 (fixed beam mode)

   nn= R-1037 Readout number and Matching Target number

   Press the UP or DOWN arrow to select the correct target number and to change the second window. For example, TGTS-02 F.10.10 or TGTS-02 P.10.10 for R-1307 #2

   WARNING: ***Targets are matched to specific R-1307 Readouts. For example, Target #1 must be connected to Readout #1 or the calibration is void.***

7. **To exit configuration mode, press and hold the MENU button for approximately three seconds until the display returns to normal mode.**
   The R-1307 will also return to normal mode automatically after approximately four seconds of inactivity.

Getting Started with READ8

If the READ8 program is purchased with an alignment system, the software is installed on the computer's hard drive. If the software is purchased separately or as an upgrade to the Read7 software, install the program on your computer as follows:

Program Installation

1. Insert the program CD in the appropriate drive.
2. Click **Start** and select **Run**.
3. Type A:\Setup and click **OK**. If you are installing from a CD, use the letter of your CD ROM drive in place of A:. Follow the instructions on your screen.

Quick Start

This section is designed to introduce the actions used to select features and tasks while using the Read8 software and to provide a quick start to users already familiar with Hamar Laser's Read7 program. For further information about the Windows interface, see the manual for your operating system.

The following terminology and conventions are used frequently in this book:

- Click = click *once* with the left mouse button
- Double click = click *twice* with the left mouse button
- Keyboard shortcuts
  - The **Alt** key can be used in combination with an underlined character to quickly access a screen or select a menu item. For example, pressing **Alt-M** while working in **Setup** displays information for the **Machine Setup** tab.
  - Several Ctrl+Key "hot key" combinations are defined on the View and Setup Menus. These hot keys may be used anywhere in the program. For example, pressing **Ctrl-P** displays a standard plot screen.
- The names of buttons in the READ8 program are referred to in bold type: for example, **OK**.

To begin using READ8, double click the READ8 icon or select the program from the Windows Start Menu. The initialization screen displays, providing the number of the current software version. Click **OK** or press Enter to initialize **Setup** (see Figure 7). Setup categories are arranged on tabs. To activate a category, click the tab or press and hold down the Alt key while pressing the underlined character, for example, **Alt-M** to display the **Machine Setup** tab.

All operating modes and parameters must be defined through **Setup** before running the Read8 program, including targets and channels to be used, units of measure, etc. **Setup** may be accessed at any time by clicking **Setup** on the Status Bar, located at the bottom of the Read8 screen. All *individual* setup tabs may be accessed by clicking **Setup** on the Menu Bar or by pressing **Alt-S** (see Figure 8).

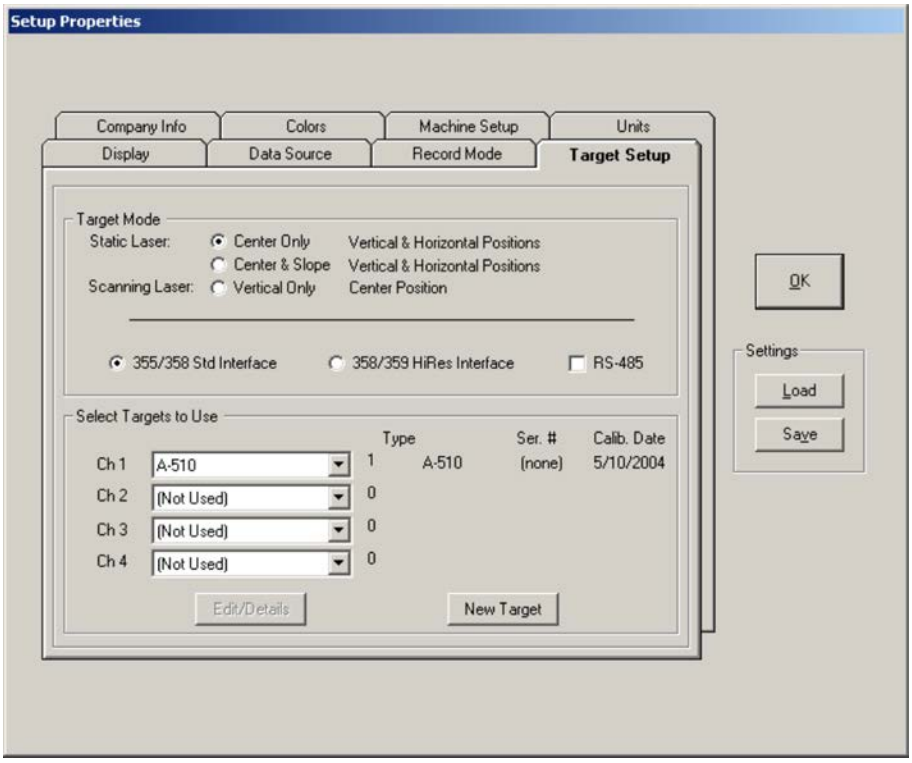


Figure 7 – *Setup Menu showing Target Setup*

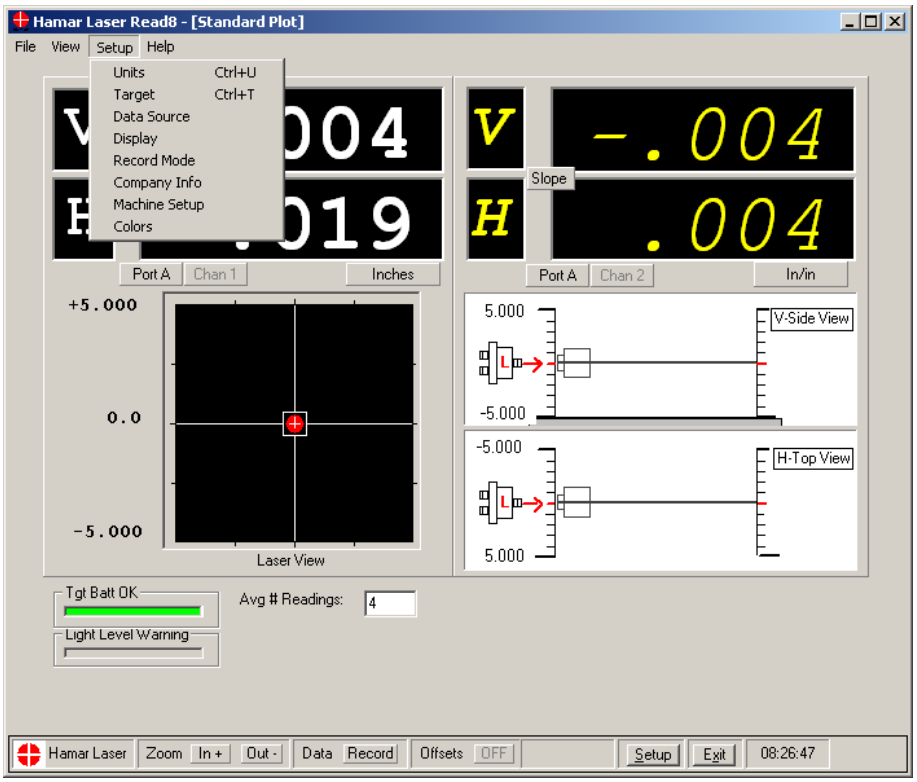


Figure 8 - *Setup Dropdown Menu on the Menu Bar*

Briefly, the user performs the following actions from **Setup** (for a detailed discussion, see the section of this user's guide titled *Using Setup* beginning on Page 13).

- Specify a target and laser mode of operation.
- Select the source of data input: an actual target, manual data entry or random data entry (for demonstration purposes).
- Select target(s) to be used.
- Specify any other relevant operating parameters by clicking the various **Setup** tabs.

Once parameters are entered, they may be saved to a file by clicking **Save** or by pressing **Alt-V**. Specify a name for the file or accept the default filename provided, and then click **OK** to begin reading and displaying data on the default plot screen. You may also load previously saved data by clicking **Load** or by pressing **Alt-L**.

When working in the plot screens, do the following:

- **To change to a different plot screen**
  - click **View** on the Menu Bar and select a new plot screen.
- **To record the current target data:**
  - press the spacebar from any plot screen or click **Record** on the Status Bar at the bottom of the screen.
- **To view recorded data:**
  - click **View** on the Menu Bar, then **Record Data** (**Ctrl-R**) or double-click **Data** on the status bar at the bottom of the screen.
- **To define offsets:**
  - click **View** on the Menu Bar and select **Offsets** (**Ctrl-O**) or double-click **Offsets** on the status bar at the bottom of the screen.
- **To change operating modes and parameters:**
  - display **Setup** by clicking **Setup** on the Status Bar
  - click **Setup** on the Menu Bar (or press **Alt-S**) and select the specific item to be changed.

Note: *Changing targets and operating modes clears offsets and recorded data. You are prompted to save the data before beginning a new mode of operation.*

The plot screens, Record Data Screen, and Offsets Screen all display data for up to four target axes at a time. The actual channels displayed depend on the number and types of targets attached, as well as the laser and target modes selected from **Setup** (Select Targets tab).

- **To change displayed channels in Static Laser: Center and Slope Mode**
  On the plot screens, click **Center** or **Slope** in the numeric displays to toggle between center and slope displays. Click **Port A** or **Port B** to toggle between targets attached to the two ports.
  Note: *The Port B label is not visible unless a target is attached to Port B, as defined from the* ***Setup****, Select Targets tab.*
- **To change displayed channels in Static Laser: Center Only Mode**
  Click **Channel** to step through Channels 1 through 4.
  Note: *Only active channels specified from* ***Setup****, Select Targets tab are available.*
- **To change displayed channels in Scanning Laser: Vertical Only Mode**
  Vertical displays from all four possible channels are always visible on the Scan Plot screen, but only those channels for which targets have been selected from **Setup**, Select Targets tab show actual data. Other channels show dashes in the numeric display areas.

Notes:

1. *The numeric displays for all screens show dashes (- -) on channels for which a target is not connected and/or not communicating, as well as on channels for which no target is selected from* ***Setup****, Select Targets tab.*
2. *The numeric displays show OFF TGT for any channel for which a target is selected, connected, and communicating, but which the laser beam is not currently hitting.*

Standard Features of the Read8 Plot Screens

Once the setup parameters are entered, click **OK** to bring up the default plot screen and begin receiving data. All plot screens contain a Menu Bar at the top and a Status Bar at the bottom to facilitate program navigation.

Using the Menu Bar

The Menu Bar in the Read8 program is located at the top of the screen under the program banner. The options are **File (Alt-F)**, **View (Alt-V)**, **Setup (Alt-S)**, and **Help (Alt-H)**. Click with the mouse on one of these options to see the associated drop-down menu.

Figure 9 – *Read8 Menu Bar*

Once a Menu Bar dropdown menu opens, you can access any item on the menu by clicking it once with the mouse. Additionally, many Menu Bar items also have a quick access option using the **Ctrl** key that can be used from any part of the Read8 program. For example, pressing **Ctrl+T** displays the Target Setup screen.

The File Menu

Set Printer Font	Opens a dialog box to specify a font to print saved data.
Exit Read8	Stores all current settings, prompts the user to save any unsaved data, and exits the Read8 program.

The View Menu

Standard Plot	Ctrl+P	Displays the Standard Plot screen.
Combined Plot	Ctrl+C	Displays the Combined Plot screen.
Spindle Plot	Ctrl+S	Displays the Spindle Plot screen.
Bore Plot	Ctrl+B	Displays the Bore Plot screen.
Scan Plot	Ctrl+N	Displays the Scan Plot screen.
Record Data	Ctrl+R	Initializes the data recording utility of the Read8 software.
Offsets	Ctrl+O	Initializes the offset selection and recording utility of the Read8 software.

The Setup Menu

Units	Ctrl+U	Displays the Units tab.
Target	Ctrl+T	Displays the Target tab.
Data Source		Displays the Data Source tab.
Display		Displays the Display tab.
Record Mode		Displays the Record Mode tab.
Company Info		Displays the Company Info tab.
Machine Setup		Displays the Machine Setup tab.
Colors		Displays the Colors tab.

Using the Status Bar

The Status Bar at the bottom of the READ8 screen becomes active when **Setup** closes, providing a convenient way to select common program options. When positioned on the Status Bar, the cursor changes to either a single or double-headed arrow, indicating that the selection should be made with either a single or double click.

Figure 10 – *The Read8 Status Bar*

Zoom (Auto)

The Zoom option increases or decreases the scale of the viewing area in any of the READ8 plot screens. To zoom *in* on an area, click **In+**. To zoom *out* on an area, click **Out-**. When the READ8 program reaches the limit for the zoom feature, the button turns gray. Double clicking *Zoom* changes the option to *Auto* and the display window *automatically* zooms out to accommodate a target reading that exceeds the scale. The program does not automatically zoom *in* when operating with Auto enabled, but clicking **In+** and **Out-** still performs the Zoom function manually.

Data / Record

Double-click **Data** to display the Record Data screen, where recorded data may be viewed, saved, or printed. Click **Record** or press the spacebar to record readings at any time. This reading is entered in the currently selected data mode: Air Noise, Repeat Mode, STimer or Quick Plot.

Offsets

Double-click **Offsets** to display the Offsets screen and calculate and store offsets, or corrections. Offsets may be subtracted from the readout values to give a more accurate or appropriate reading. Offsets can be toggled on or off from the Status Bar by clicking **Offsets** ON/OFF to show raw or corrected readings. When offsets are on, this is also indicated in the plot window.

For a complete discussion about using offsets, see the section of this user's guide titled *Calculating Offsets* beginning on Page 31.

Setup

Click *Setup* to initialize the **Setup** menu. For a complete discussion of **Setup** procedures, see the section of this user's guide titled *Using Setup*, beginning on Page 13.

Using the Read8 Software

This section provides detailed instructions for using the individual features of the Read8 software, including program setup and personalization, selecting target information, viewing and recording target data, and applying corrective offsets.

Using Setup

Setup displays tabs corresponding to each feature of the READ8 program. All program settings are defined from **Setup**, either by selecting the appropriate tab or by using the keyboard shortcuts. For example, to select Machine Setup either click the Machine Setup Tab from **Setup** or press **Alt-M** while **Setup** is active. To exit **Setup**, click **OK** or use the keyboard shortcut, **Alt-O**.

Note: *The Read8 program records all selections made in* ***Setup*** *each time they are changed. When the program starts, it uses the setup information recorded during the* ***previous session.*** *For example, company name and address information entered on the Company Info tab displays automatically the next time the program starts.*

Company Information (Alt-C)

Click the Company Info tab to personalize your version of the READ8 program. The READ8 program uses this information as part of a report header when printing reports. To move among the fields, either press the Tab key or position the mouse cursor in each field and click.

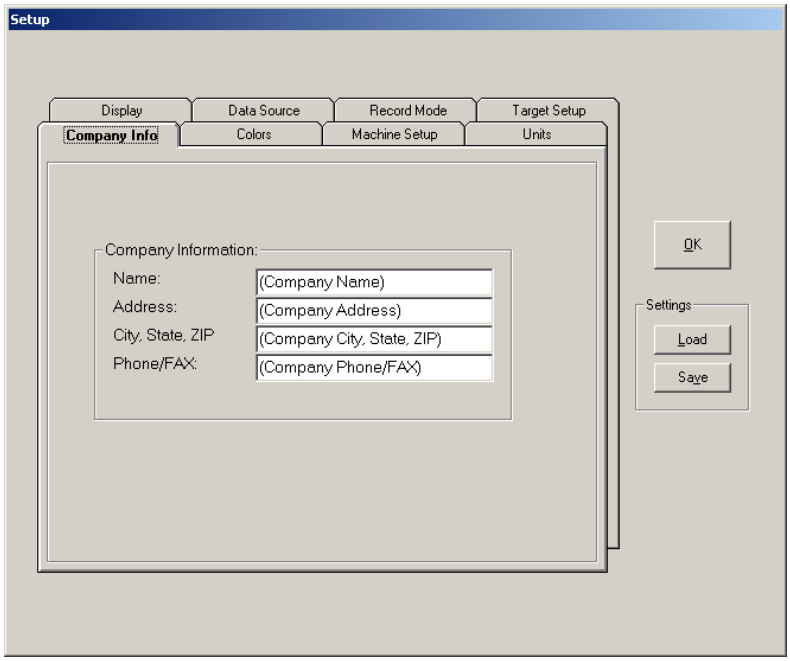


Figure 11 – *Company Info*

Colors

Click the Colors tab to change the numeral colors and backgrounds used by the READ8 program. You may also use the keyboard shortcuts **Alt-B** (black numbers on a white background) and **Alt-W** (white numbers on a black background).

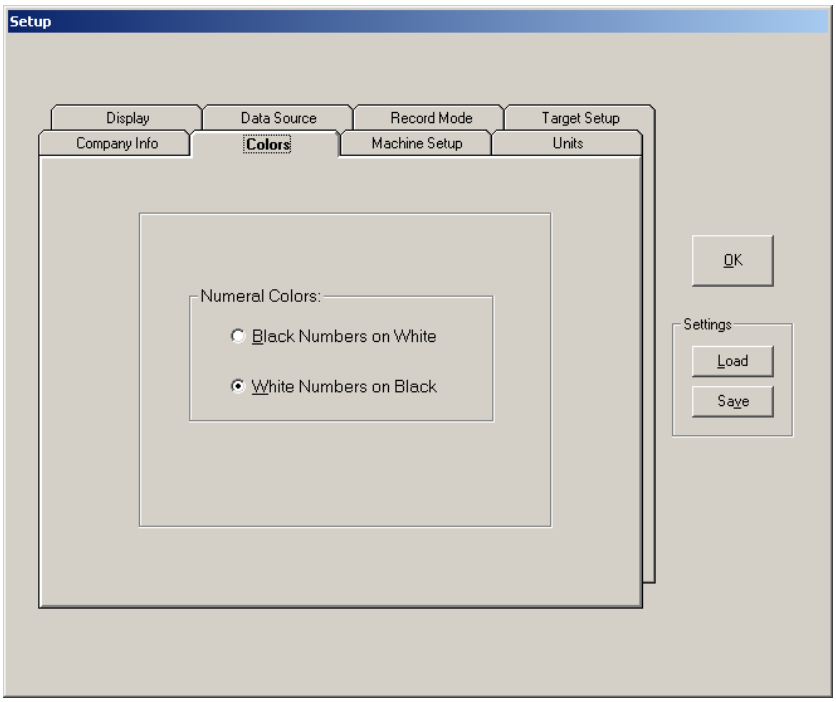


Figure 12 - *Colors*

Machine Setup (Alt-M)

Click Machine Setup to enter factory and machine information, as well as any additional notes on a particular machine setup. This information is also incorporated into the header of printed reports. To move among the fields, either press the Tab key or click in each field. When the text of a note fills the Notes box, (see Figure 13) click the up arrow (↑) or down arrow (↓) in the scrollbar to the right of the box to see the entire text of the note.

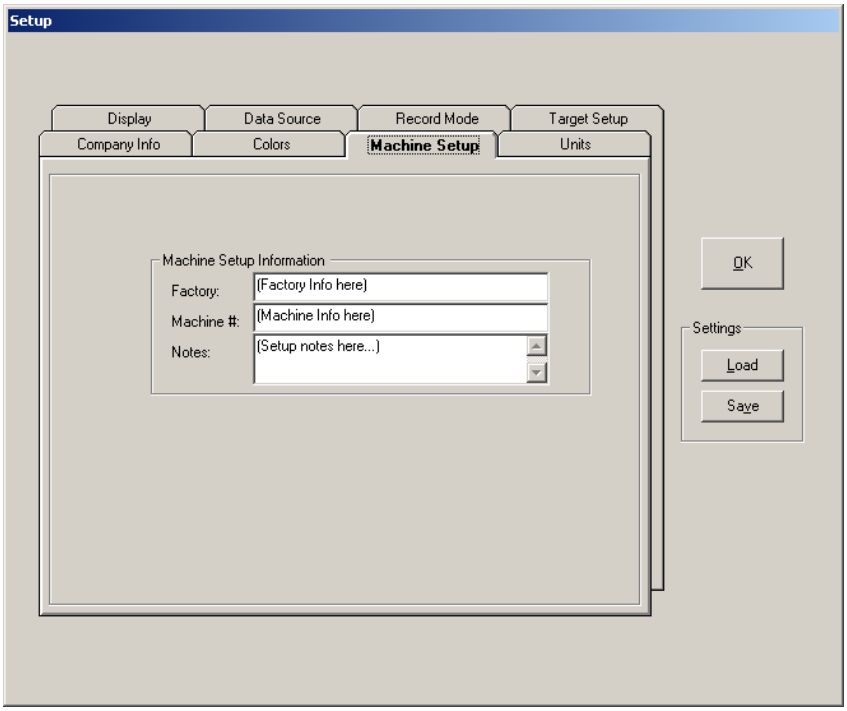


Figure 13 – *Machine Setup*

Units

Click Units to specify measurements in either inches or millimeters. Units of measure for the slope can also be specified. The choice is reflected in all display windows of the READ8 program.

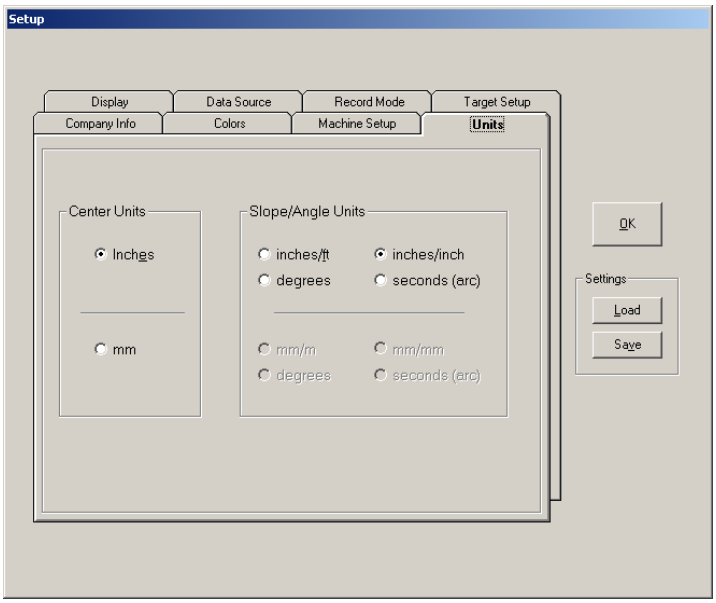


Figure 14 – *Units*

Display

Click Display to configure the Read8 zoom feature, the size of numbers and the number of decimal places to be shown in the numeric display of the plot screens, whether or not tolerance bands are used, and the size of the tolerance band.

AutoScalePlot – When AutoScalePlot is ON, any plot screen automatically zooms *out* to accommodate a target reading that exceeds the scale. The program does not automatically zoom *in*, however, because this would be unnecessarily confusing when performing an alignment. Clicking **In+** and **Out-** always performs manual zooms. When **AutoScalePlot** is activated, **Zoom** on the Status Bar is replaced by **Auto**. When AutoScalePlot is OFF, **Zoom** replaces **Auto** on the Status Bar and the display window *must* be zoomed manually using **In+** and **Out-**.

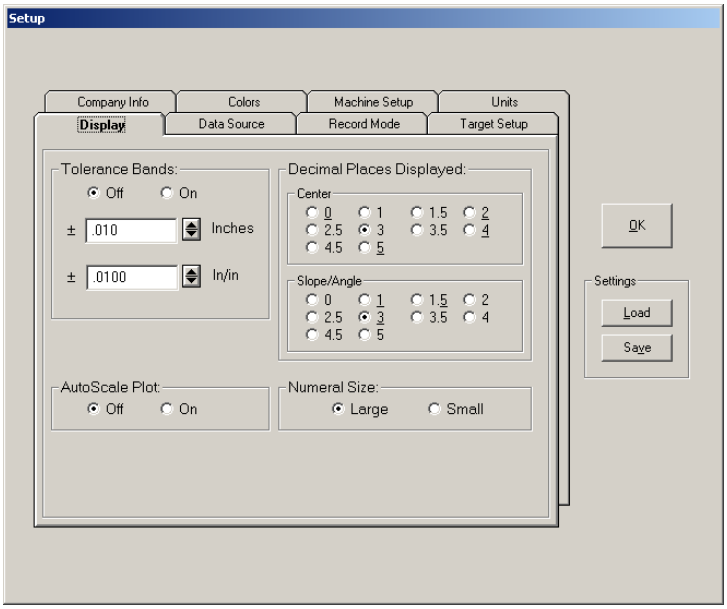


Figure 15 – *Display*

Decimal Places Displayed – Select the number of decimal places to display target data in the Read8 plot windows. For example, when Units is set to *inches* and 3 decimal places are selected, target data displays in thousandths. When Units is set to *millimeters* and 3 decimal places are selected, target data displays in thousandths of a millimeter.

Tolerance Bands – When the Tolerance Bands feature is ON and a tolerance number is assigned, the display windows for Standard Plot, Spindle Plot, and Scan Plot show an error bar scaled to the value specified. A green bar indicates that a reading is *within* the specified tolerance. When a reading is *outside* the specified tolerance, the bar turns red. The tolerance bars are scaled to represent the actual tolerance range.

Numeral Size – Select LARGE or SMALL to change the numeral size used in the display window.

Data Source

Click Data Source to specify if an actual target is used, if data is entered into the program manually or if you wish to use data that is randomly generated by the software. The Data Source screen is also used to specify the communication port of your computer to which an interface is connected.

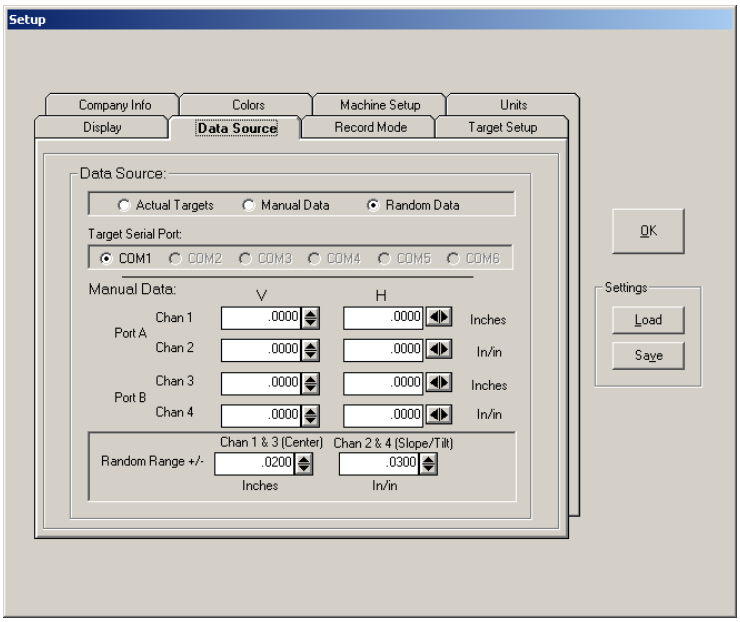


Figure 16 – *Data Source*

Actual Targets – Select to use data generated by the actual target or targets in use.

Manual Data – Allows the user to enter data to create a demonstration plot with specific numbers or to perform an alignment with data obtained from readouts such as the R-307 or R-308. Manual data can also be used when learning the program or performing training exercises. Click the horizontal and vertical arrows to increase or decrease the values or type in the numerical data obtained from the readouts.

Random Data - Select Random Data to run the program with software-generated random numbers. This mode is allows the user to become familiar with the software without connecting to an actual target.

Note: *Actual target data being received by the readout are ignored when Manual Data or Random Data modes are selected.*

Target Serial Port – Select the computer serial port (COM 1 to COM 6) to which your Computer Interface is connected.

Step Size/Random Range± – select the increment by which the manual data numbers increase or decrease. If **Random Data** is selected as the mode of operation in the Target Setup Screen, (see Page 19) the **Step Size** option changes to **Random Range ±**, allowing the user to select the maximum range of values that are generated randomly.

Record Mode

Click Record Mode to specify the method the READ8 program uses to record data. Once data are recorded and saved, it can be imported into Microsoft® Excel for further analysis. For a detailed discussion of data recording, see the section of this user's guide titled *Recording Data* beginning on Page 48.

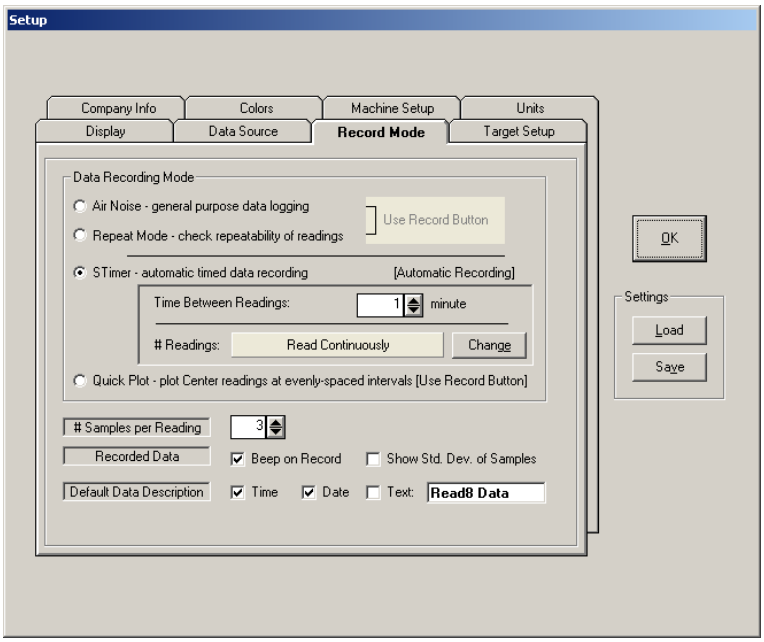


Figure 17 – *Record Mode*

Air Noise, Repeat Mode and STimer all allow the following settings to be specified:

- Number of samples per reading. Samples are averaged and the average is recorded.
- Default description stored beside each item recorded, such as date, time, and any other text.
- Audio feedback as each reading is taken.
- Standard Deviations for each averaged reading.

Air Noise

Air noise is a general-purpose data logging utility that collects data by repeatedly taking samples, averages out the effects of air turbulence (noise) on a reading, and provides statistical data on each reading. Press the spacebar or click the **Record** button on the Status Bar to take each reading.

Repeat Mode

Repeat Mode is a data logging utility that checks the variation in a specified number of target readings. This utility is typically used to check target or laser mounting repeatability. Press the spacebar or click the **Record** button on the Status Bar to take each reading.

STimer Mode

The Statistical Timer (STimer) utility records readings at regular intervals, continuously or for a fixed period of time, to determine conditions such as thermal growth, the effect of tides or the influence of heavy equipment usage on machine alignment. The **Start** button on the Record screen turns the timer on or off. When the timer is on, data are automatically recorded at the specified interval. Data may also be recorded manually by pressing the spacebar or by clicking the **Record** button on the Status Bar. STimer allows the number of readings to be specified, or the time span over which readings are taken (see Figure 18).

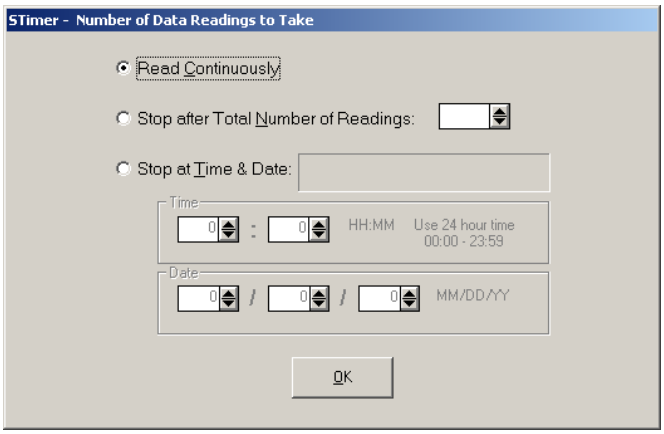


Figure 18 – *STimer Data Readings Screen*

Additional information provided includes the average of readings and drift.

After selecting STimer mode, specify an interval for Time Between Readings (the minimum is 30 seconds) and then click **Change (Alt-E)** to specify the following:

- whether the readings should be performed continuously (no limit)
- whether a specific number of readings should be taken.
- whether readings should end on a specific date at a specific time (see
- Figure 18).

Recorded data for Air Noise Mode, Repeat Mode and STimer Mode are viewed on the Record Data screen (see Figure 63 on Page 48).

Quick Plot

Quick Plot Mode provides a fast way of collecting and plotting straight-line alignment information. To use the basic functions of Quick Plot, the user sets up the laser and target, bucks in the laser beam, enters the distance from the laser to the target in the Quick Plot screen and begins recording data. Data is plotted on a graph as it is taken (see Figure 19). Quick Plot is designed to plot vertical (side view) and horizontal (top view) *centers* and is used for straight-line measurement, such as plotting the elevation of a way, measuring the vertical and horizontal position of a series of bores or providing a profile of an extruder barrel. For an in-depth description of the Quick Plot Mode, see the section of this user's guide titled *Using Quick Plot* beginning on Page 54.

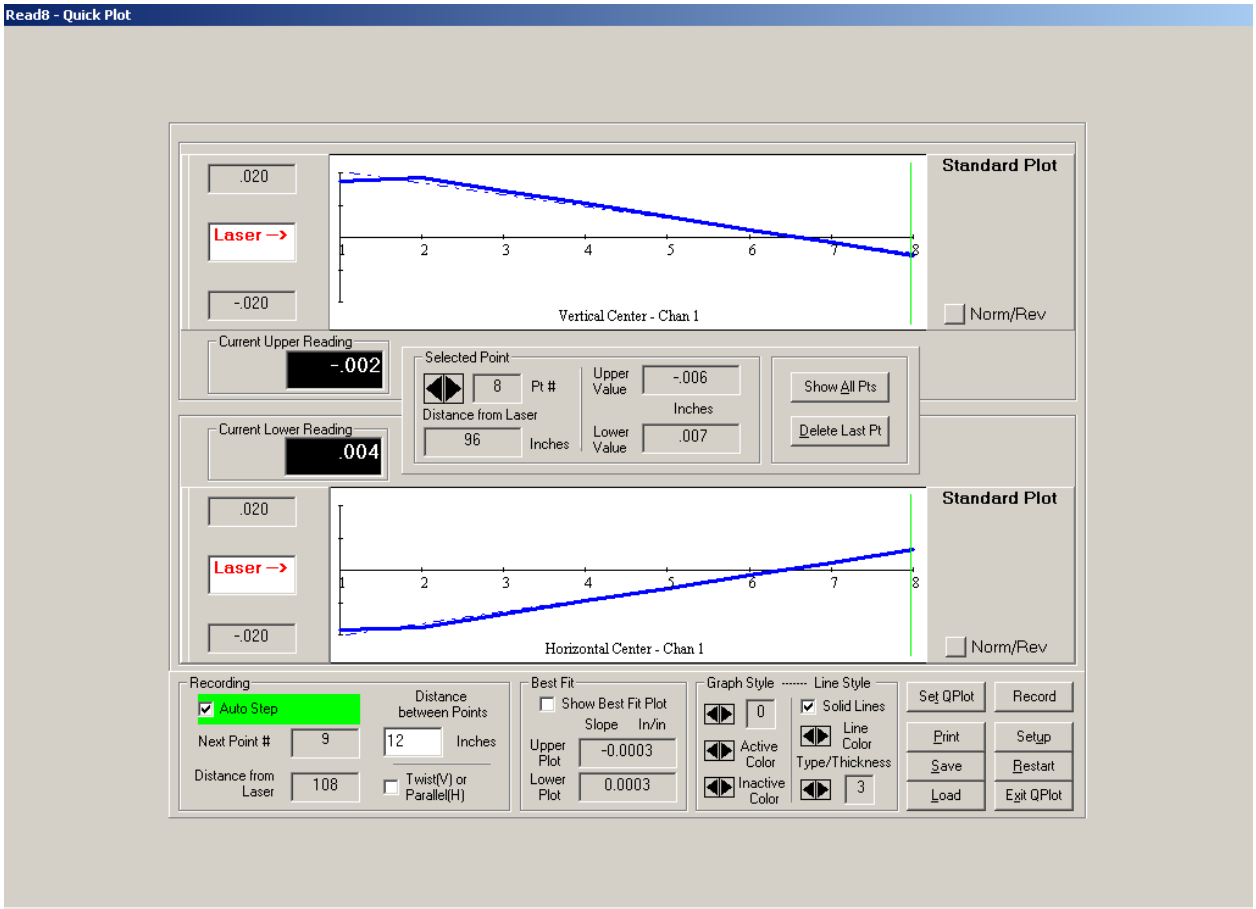


Figure 19 – *Quick Plot Data Recording*

Target Setup

Click Target Setup to specify and set up a target and to select a laser mode that reflects the type of work being performed.

Target Mode

Static Laser/Scanning Laser - Select the type of laser to use for the alignment, depending upon the application. **Static Laser** is usually selected for straight beam lasers and spindle applications while **Scanning Laser** is selected for scanning lasers and targets. A scanning laser, however, may also be used to take Center Only and Center and Slope readings.

Interface - Select the computer interface in use. When Hamar Laser's wireless targets are selected, (A-1519, A-1520 or T-1275) the interface selection is grayed out except for the RS-485.

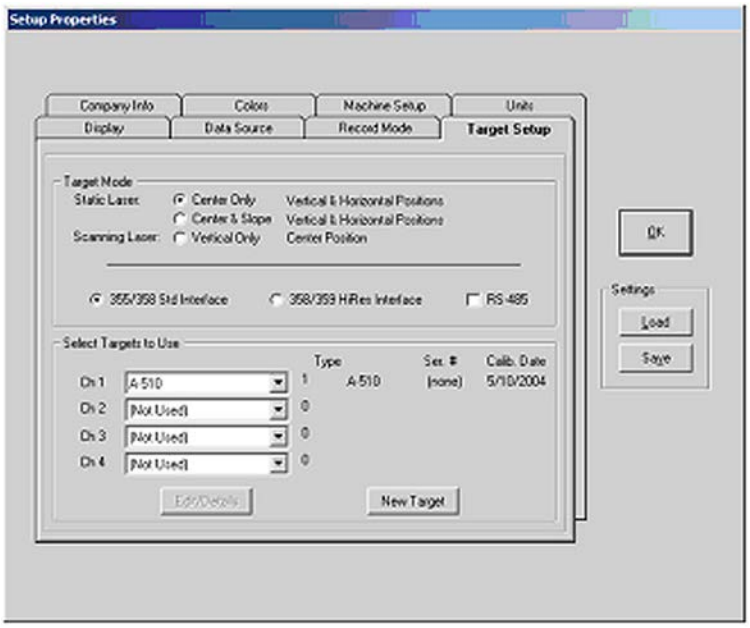


Figure 20 – *Target Setup*

Using the A-1519 Target with the R-1307 Readout

When using the A-1519 Target with the R-1307 Readout, select **Center Only** as the Target Mode. Ensure that both the RS-485 (A-910) and the A-910 Dual Axis Mode boxes are checked. In **Select Targets to Use**, click the arrow next to Channel 1 and select R-1307 (A-1519 Target) from the dropdown menu. This target must be selected under Channel 1 *only*.

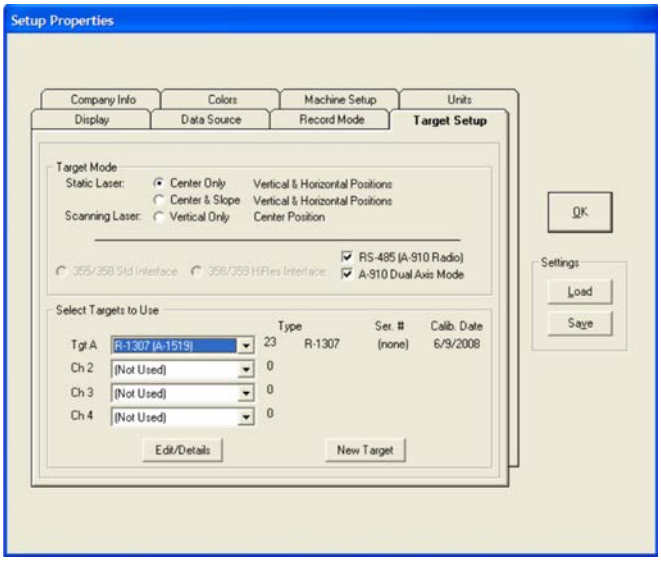


Figure 21 – *Selecting the A-1519 Target with the R-1307 Readout*

Selecting Targets to Use

If a target is purchased with a complete system, all the information for that target, including the calibration factors, is included in the Read8 software. If a *new* target is added to the system, the target name must be added and the target should be calibrated. The complete calibration procedure is discussed in Appendix B beginning on Page 61 of this user's manual.

If **Static Laser: Center only** or **Scanning Laser: Vertical only** modes are selected, (see Figure 20) select the correct target for Channel 1, Channel 2, Channel 3 or Channel 4, or for as many channels as are in use. All targets previously defined and saved can be displayed by clicking the down arrow (↓) in each Channel list box (see Figure 22).

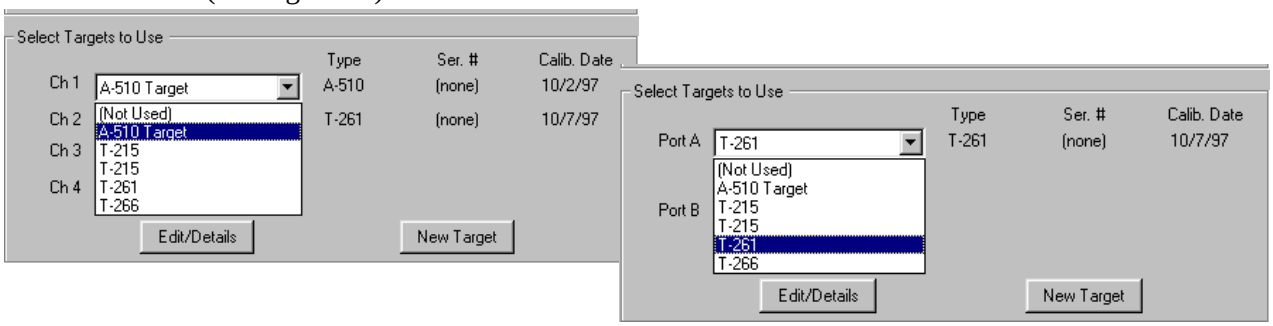


Figure 22 – *Viewing Previously Defined Targets*

Note: *If* **Static Laser: Center and Slope** *is selected in the Target Mode area of this screen (see* Figure 20*) and a center-only target is selected from the target list, a message displays stating that slope cannot be displayed for this target (see* Figure 23*). In addition, the plot screen displays dashes for the slope values until* **SLOPE** *is clicked; then center readings display in both windows.*

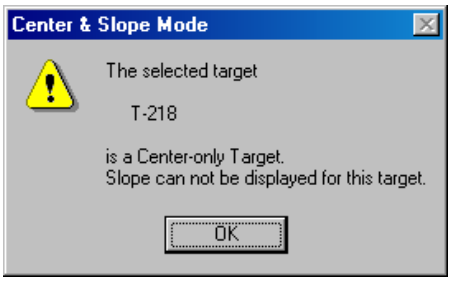


Figure 23 – *Center-Only Warning*

If **Static Laser: Center and Slope** is selected, (see Figure 20) select the correct target for Port A, Port B or both ports if they are both in use. All targets previously defined can be displayed by clicking the down arrow (↓) in the Port A or Port B list box (see Figure 22).

To change information that has been saved for a target, highlight the target name in the saved list and click **Edit/Details**. The Edit Target screen displays (see

Figure 24). From this screen, selected targets can be recalibrated or deleted from the list and saved information can be modified or printed.

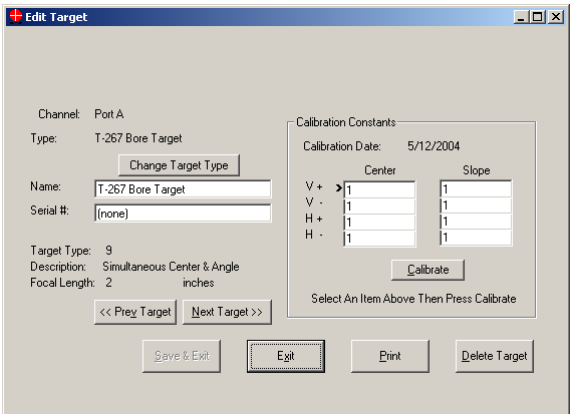


Figure 24 – *Edit Target Screen*

Defining a New Target

If no targets have been selected previously or if you wish to add a new target, do the following from the Target Setup screen:

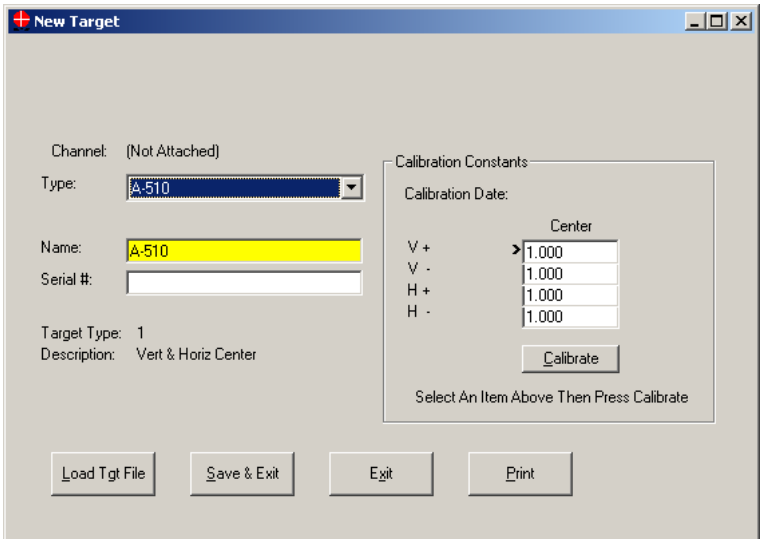


Figure 25 – *New Target Screen*

1. **Click New Target to display the New Target screen** (see Figure 25)**.**

2. **Select the target you are going to use from the list.**
   Click the down arrow (↓) in the Type list box to view the list of all target types. Enter a name for the target in the Name field, (or keep the default model number as a name) and the target serial number (optional) by clicking in the field and typing the information. The Tab key may also be used to navigate within the New Target screen.

3a. Load the Calibration Constants from a file (Alt-L).
Load the file containing the target calibration constants (**Load Tgt File**) and proceed to Step 5. Hamar Laser provides this file on a diskette when a target is purchased.
--OR--

3b. Manually enter the calibration constants provided.
You may also calibrate the target yourself. Specify the Channel (single or 2-axis targets) or the Port (4-axis targets) to which the target is connected to the interface. Click **OK**. You are now ready to calibrate the new target.
--OR--

3c. Start the calibration procedure defined in Appendix B, beginning on Page 61.

Note: *The T-1275, A-1519 and A-1520 Wireless Targets use Linearization Coefficients rather than Calibration Constants. These are provided with each target and may loaded from diskette using* **Load Tgt File** *(Step 3a) or entered manually (Step 3b).*

4. **Save the information.**
   When the target is selected and calibrated, click **Save** (**Alt-S**) on the New Target screen. Click **Print** or press **Alt-P** to print this information.

Selecting ATram or DTram Targets

Selecting either the ATram (averaging) or DTram (differential) targets from the target list allows any two dual-axis targets to be connected to Channel 1 and Channel 2 of Port A. This configuration then *simulates* a 4-axis target with any desired separation between the two cell planes (the default separation is 12 inches as shown in Figure 26). **Static Laser: Center and Slope** must *always* be selected as the Target Mode for both ATram and DTram targets (see Figure 20).

Results from ATram and DTram targets display only on a Standard Plot screen. For further information about reading the plot displays for ATram or DTram targets, see *Standard Plot Screen Displays for ATram and DTram Targets* on Page 24.

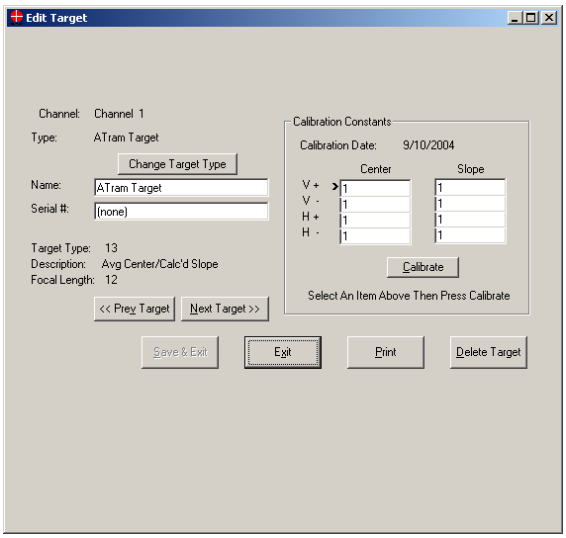


Figure 26 – *Editing the Target Setup for ATram Targets*

Selecting a Wireless Target (T-1275 IR Coupling Target or A-1519/A-1520 Unitargets)

If no targets have been selected previously or if you wish to add a wireless target, do the following from the Target Setup screen (the T-1275 IR Coupling Target is used in this example):

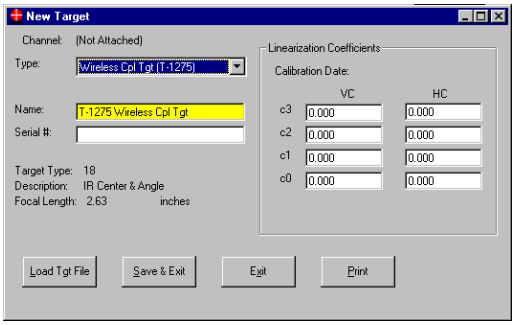


Figure 27 – *Defining the T-1275 IR Coupling Target*

1. **Click the New Target button on the Target Setup screen to display the New Target screen (**see Figure 27**).**

2. **Select the T-1275 IR Coupling Target from the list.**
   Click the down arrow (↓) in the Type list box to select a T-1275 IR Coupling target. Enter a name for the target in the Name field, (or keep the default model number as a name) and the target serial number (optional) by clicking in the field and typing the information. The Tab key may also be used to navigate within the New Target screen.

3. **Load the Target File (Alt-L).**
   Load the file containing the target linearization coefficients. Hamar Laser provides this file on a diskette when a T-1275 target is purchased (see Figure 28).

4. **Save the information.**
   Click **Save** (**Alt-S**) on the New Target screen when the target is selected and information from the target file is loaded. Click **Print** or press **Alt-P** to print this information.

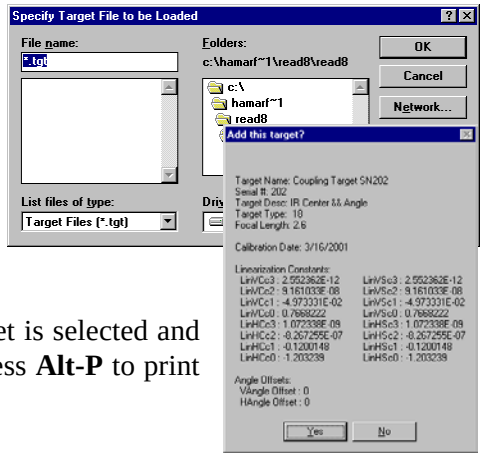


Figure 28 – *Loading Target File*

Viewing the Plot Screens

The plot screens show where the laser beam is striking the target, displaying the numerical readings for vertical and horizontal center and slope, along with a graphic representation of the alignment. Using these plot screens, the user can align the laser beam to a target cell to a specific center and slope. Usually the center point is zero inches or millimeters and the slope is zero inches/foot or millimeters/meter, although that may change with the alignment task and whether or not an offset is being used. Both the numerical and graphic displays are "live"; that is, they show any adjustments or changes to alignment *as they are made*. The graphic plots are available in four forms, depending on the target setup in use.

- **Standard plot**, showing the results for one or two 1-axis or 2-axis targets or center and slope for a 4-axis target.
- **Combined plot**, showing center and slope readings for a 4-axis target from a shaft-end perspective.
- **Spindle plot**, showing a graphic representation of a spindle alignment, combining center and angle for both top and side views of the spindles.
- **Scan plot**, showing the vertical scanning position for up to four targets.
- **Bore plot**, showing the measurement and alignment of multiple bores.

To change the plot mode, select **View** on the Menu Bar and click the desired plot or use the appropriate Ctrl-key combination. Plots that are grayed out are inappropriate for the selected target mode.

Standard Plot (Ctrl-P)

The standard plot is the default plot screen. *All* targets can be displayed in the standard plot format. A standard plot can display the readings for one or two 1-axis or 2-axis targets or center and slope for a 4-axis target. The two *center* readings are displayed together and the two *slope* readings are displayed together. Figure 29 shows a plot for one 2-axis target (center-only) with the features of the Standard Plot screen identified. This plot screen displays a *zero reading*; that is, the crosshairs completely overlap.

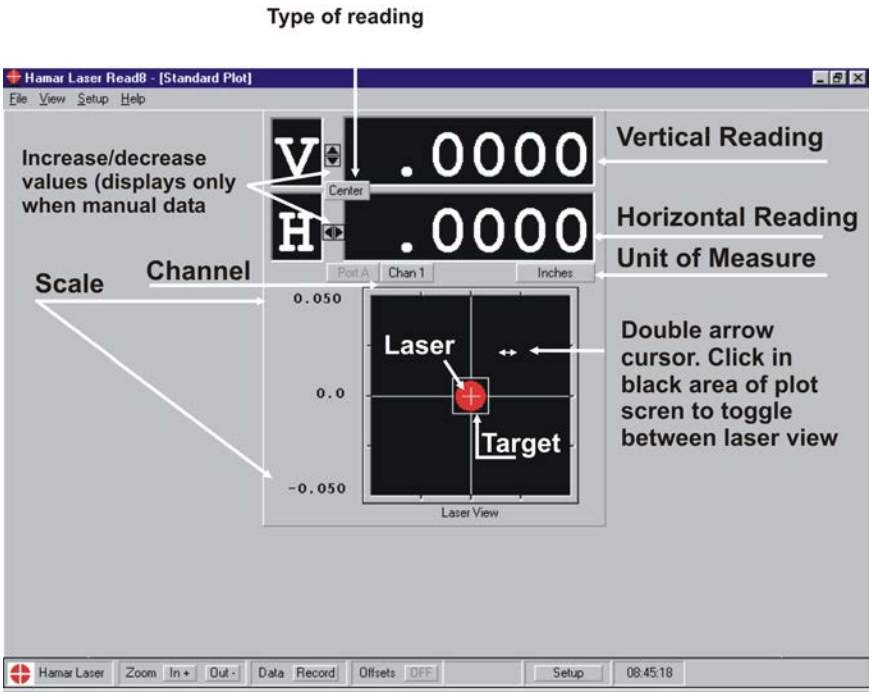


Figure 29 – *Standard Plot Screen (One Target Showing Center Only)*

Figure 30 – *Standard Plot Screen: Two Targets, Center Only*

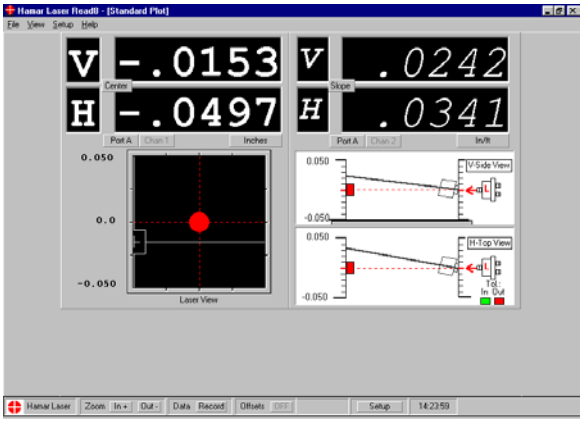


Figure 31 – *Standard Plot Screen: One 4-Axis Target, Center and Slope*

Figure 30 and Figure 31 show the Standard Plot displays for *two* targets showing center only and one 4-axis target showing center and slope.

Standard Plot Screen Displays for ATram and DTram Targets

If a center and slope target is selected, clicking either the **CENTER** or **SLOPE** buttons in the numeric readout area changes to the other view. This is true for all center and slope targets *except* ATram and DTram. In the case of these two targets, the left side of the Standard Plot screen *always* shows Center and the right side can show either Center or Slope. When the DTram target is selected, the left side of the display shows the vertical and horizontal center readings for Target 1. When the ATram target is selected, the left side of the display shows the *average* of the center readings of both targets. The results displayed on the left and right screens are described in detail in the table below.

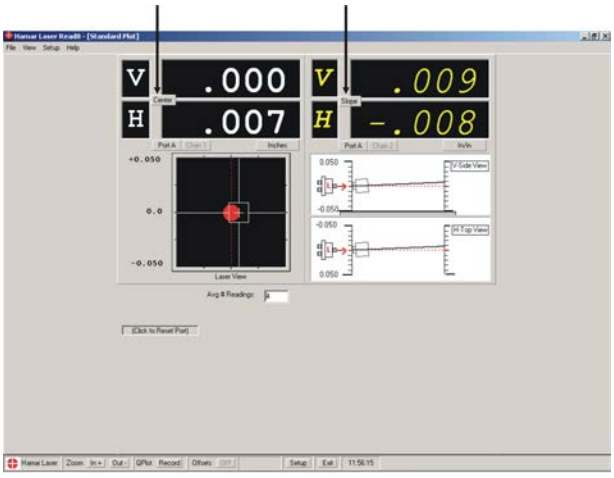


Figure 32 – *Center and Slope Buttons*

Selected Plot Display	DTRAM Target – Left Display	DTRAM Target – Right Display
Left Center/Right Center	VC 1 and HC 1	VC 2 and HC 2
Left Center/Right Slope	VC 1 and HC 1	VC 2 minus VC 1 divided by the separation value and HC 2 minus HC 1 divided by the separation value.
Selected Plot Display	**ATRAM Target – Left Display**	**ATRAM Target – Right Display**
Left Center/Right Center	VC 1 and HC 1	VC 2 and HC 2
Left Center/Right Slope	Average of VC 1 and VC 2 and the average of HC 1 and HC 2	VC 2 minus VC1 divided by the separation value and HC 2 minus HC1 divided by the separation value.

- **VC1 and HC1 = the vertical and horizontal centers of the 2-axis target connected to Channel 1.**
- **VC2 and HC2 = the vertical and horizontal centers of the 2 axis target connected to Channel 2.**
- **Separation value = the distance from the front of the Channel 1 target to the front of the Channel 2 target** (see Figure 26).

Standard Plot Screen Displays for Wireless Targets

When a wireless target is selected in Target Setup, (A-1519, A-1520 or T-1275) the Standard Plot and Scan Plot screens display indicators that reflect the status of the background light level and its effect on the target, and the battery strength of the target (see Figure 33). In addition, a warning displays when the IR Receiver battery is low.

Background light level status – indicates the amount of background light from sunlight or overhead lights that reaches the target.

Message	Color	Condition
Light Level OK	**Green**	Acceptable light level.
Light Level Warning	**Yellow**	High level of background light.
Light Level High	**Red**	Too much background light. The target may provide invalid readings.
Weak Laser		Insufficient light hitting target from the laser.

Target Battery Warnings

Message	Color
Target Battery OK	**Green**
Target Battery Weak	**Yellow**
Target Battery Bad	**Red**

IR Receiver Battery Warning

When the IR Receiver battery is low, the program displays a warning message in red on the bottom of the Standard Plot and Scan Plot screens (see Figure 34).

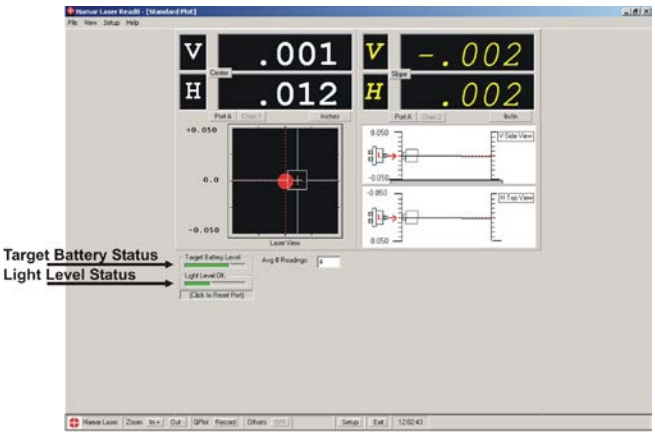


Figure 33 – *Wireless Target status indicators*

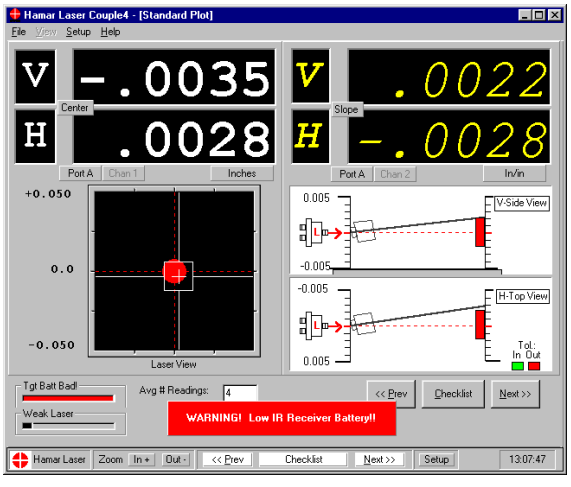


Figure 34 – *IR Receiver low battery warning*

Laser View and Target View in the Standard Plot Screen

The change from Laser View to Target View in the Standard Plot screen is illustrated in Figure 35, where Laser View is the view from behind the laser looking toward the target and Target View is the view from behind the target looking toward the laser. A red circle represents the laser beam and a white square represents the target. In Laser View, this circle or laser "beam" is solid and in Target View, where the user would be looking through the target to the laser, the laser "beam" becomes a red outline. Position the mouse cursor in the black area of the plot screen until it becomes a double-headed arrow and click once to toggle between Laser View and Target View.

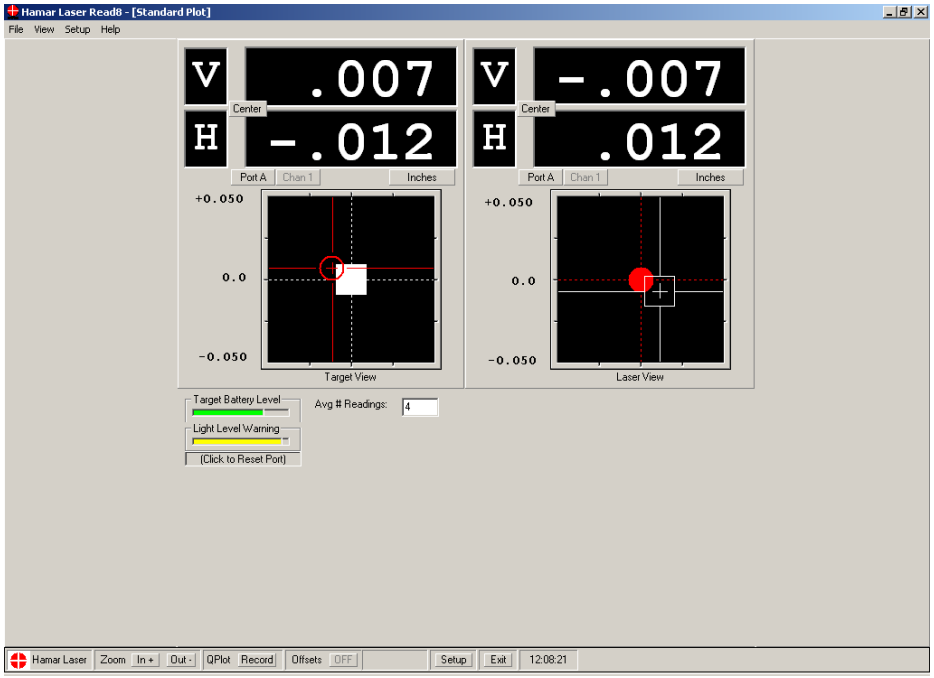


Figure 35 – *Laser View and Target View from the same Standard Plot Screen*

Note: *In Laser View, the white "target" moves. In Target View, the target is stationary and the laser moves. Target View is used when adjusting the laser.*

Performing Tasks in the Standard Plot Screen

To change the scale:	Click the numerical scale values to increase or decrease the magnification of the plot screen. This performs the same function as the Zoom feature on the Status Bar.
To change the unit of measure:	Double-click the button indicating the unit of measure to access the Units tab.
To change the number of decimal places or the size of the numbers displayed, or to activate AutoScale Plot:	Double-click any numerical display window when the cursor becomes a double-headed vertical arrow to access the Display tab.
To change tolerance values or turn tolerance indicators off or on: (slope view only)	Move the cursor into the slope view until it becomes a double-headed, vertical arrow and click to activate the Display tab.
To change between center and slope views: (center and slope targets only)	If a center and slope target is selected, clicking **CENTER** or **SLOPE** changes to the other view. When offsets are on, this information is also displayed on this button.
To toggle between laser view and target view: (center view only)	Click once in the black area of the center view. The active view is always indicated directly below the center view.
To change alignment setup perspective from left to right or right to left: (slope view only – see Figure 36**)**	Move the cursor into the slope view until it becomes a double-headed, horizontal arrow and click to reverse the view.
To record data:	Press the spacebar or click **Record** in the Status Bar to record a reading in the currently selected mode.
To calculate offsets:	Select **Offsets** from the Status Bar, select **View…Offsets** from the Menu Bar, or press **Ctrl-O**.
To toggle offsets ON and OFF:	Click **ON/OFF** in the Offsets area of the Status Bar.
To change setup information:	Click **Setup** in the Status Bar.

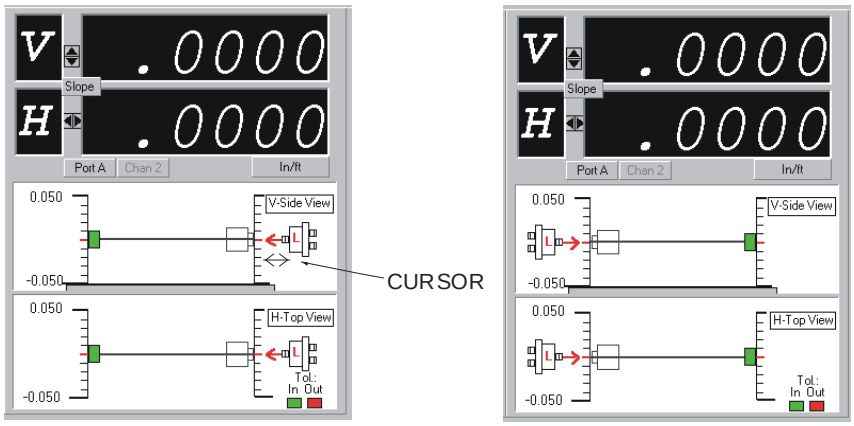


Figure 36 – *Changing the Alignment Setup Perspective in the Slope Display*

Combined Plot (Ctrl-C)

The Combined Plot is an *end-view* presentation of simultaneous center and slope readings, showing two center and two slope readings in one plot. The advantage of this plot screen is that center and slope misalignment can be viewed at the same time as if the user were looking in the end of a piece of machinery.

Laser View and Target View in the Combined Plot Screen

The change from Laser View to Target View in the Combined Plot screen is illustrated in Figure 37, where Laser View is the view from behind the laser looking toward the target and Target View is the view from behind the target looking toward the laser. A red circle represents the laser beam, a white square represents the front of the target, and a gray square represents the back of the target. In Laser View, the laser "beam" is solid and in Target View, where the user would be looking *through* the target to the laser, the laser "beam" becomes a red outline. Position the mouse cursor within the black area of the plot screen until it becomes a double-headed arrow and click once to toggle between Laser View and Target View, or click the target icons on the left side of the screen.

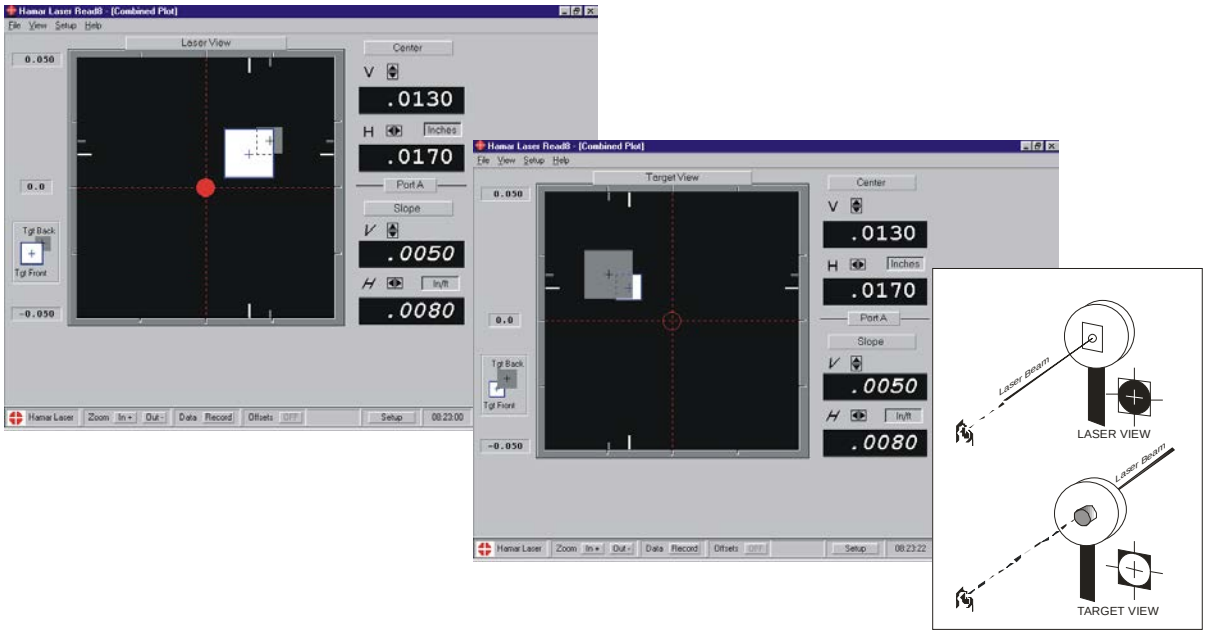


Figure 37- *Combined Plot Screen, 4-Axis Target Showing Center and Slope readings, Laser View and Target View*

Performing Tasks in the Combined Plot Screen

To change the scale:	Click the numerical scale values to increase or decrease the magnification of the plot screen. This performs the same function as the Zoom feature on the Status Bar.
To change the unit of measure:	Double-click the button indicating the unit of measure to access the Units tab.
To change the number of decimal places or the size of the numbers displayed, or to activate AutoScale Plot:	Double-click in any numerical display window when the cursor becomes a double-headed vertical arrow to access the Display tab.
To toggle between laser view and target view:	Click once in the black area of the center view. The active view is always indicated directly above the plot area.
To record data:	Press the spacebar or click **Record** in the Status Bar to record a reading in the currently selected mode.
To calculate offsets:	Select **Offsets** from the Status Bar, select **View…Offsets** from the Menu Bar, or press **Ctrl-O**.
To toggle offsets ON and OFF:	Click **ON/OFF** in the Offsets area of the Status Bar.
To change setup information:	Click **Setup** in the Status Bar.

Spindle Plot (Ctrl-S)

The Spindle Plot shows combined center and slope readings for both side and top views of a moveable unit (spindle) and an opposing fixed unit (master part). The vertical and horizontal position of the moveable unit changes to reflect the angular and center misalignment between the two units. The moveable side can be switched to the left or right to reflect the actual hardware setup (see Figure 38).

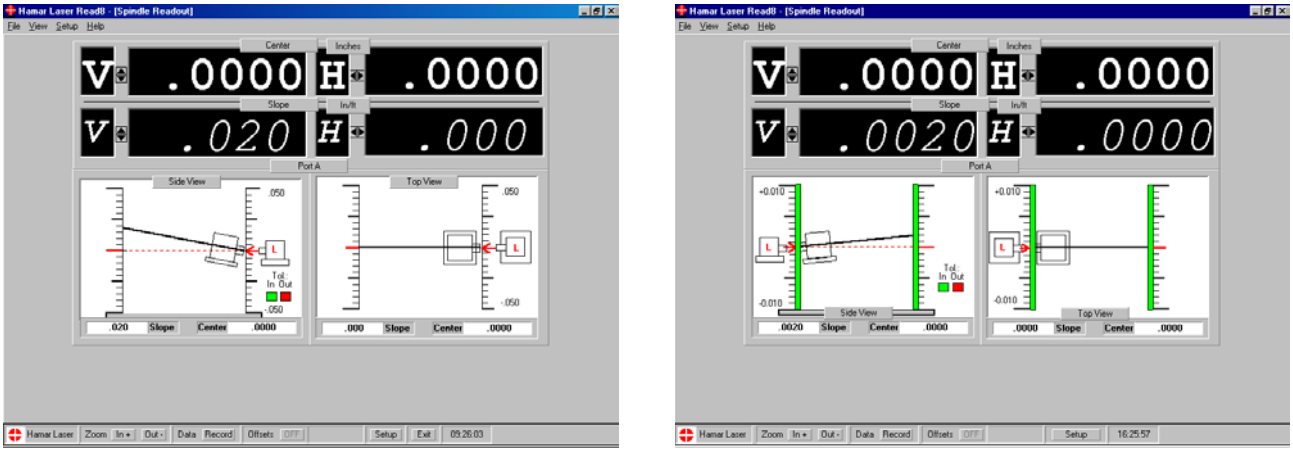


Figure 38 - *Spindle Plot Screen, 4-Axis Target Showing Center and Slope readings and alignment setup side change*

Performing Tasks in the Spindle Plot Screen

To change the scale:	Click the numerical scale values to increase or decrease the magnification of the plot screen. This performs the same function as the Zoom feature on the Status Bar.
To change the unit of measure:	Double-click the button indicating the unit of measure to access the Units tab.
To change the number of decimal places or the size of the numbers displayed, or to activate AutoScale Plot:	Double-click in any numerical display window when the cursor becomes a double-headed vertical arrow to access the Display tab.
To change tolerance values or turn tolerance indicators off or on:	Move the cursor into the plot screen until it becomes a double-headed, vertical arrow and click to activate the Display tab.
To change alignment setup perspective from left to right or right to left:	Move the cursor into the plot screen until it becomes a double-headed, horizontal arrow and click to reverse the view.
To record data:	Press the spacebar or click **Record** in the Status Bar to record a reading in the currently selected mode.
To calculate offsets:	Select **Offsets** from the Status Bar, select **View…Offsets** from the Menu Bar, or press **Ctrl-O**.
To toggle offsets ON and OFF:	Click **ON/OFF** in the Offsets area of the Status Bar.
To change setup information:	Click **Setup** in the Status Bar.

Scan Plot (Ctrl-N)

The Scan Plot allows the user to view up to four scanning lasers at the same time. Numeric displays are shown for all channels in use, both in the standard large readout format *and* at the bottom of each channel graphic. Channels that are *not* used display dashes.

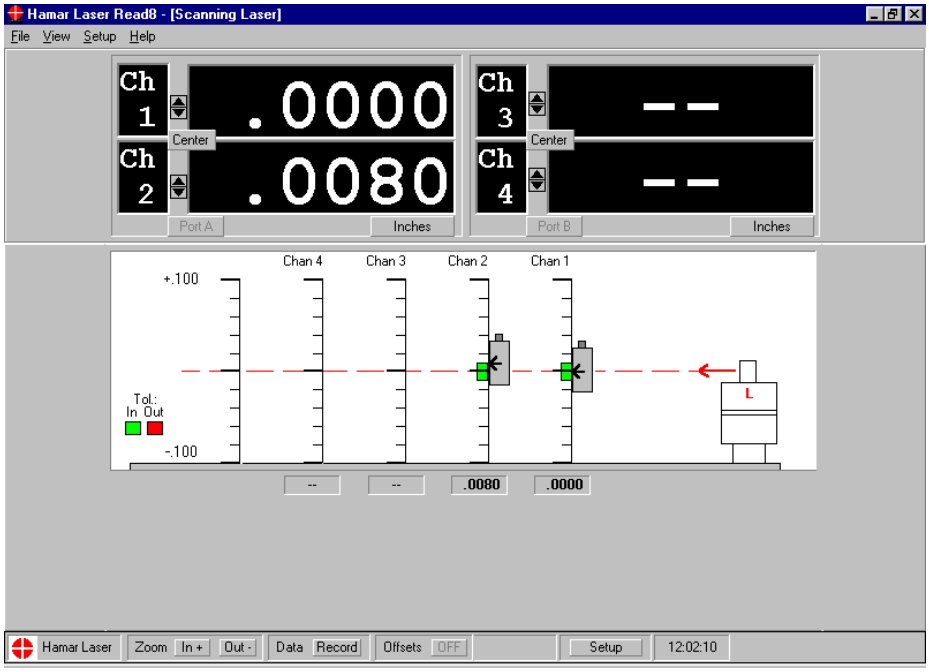


Figure 39 – *Scan Plot showing two targets connected to Channel 1 and Channel 2*

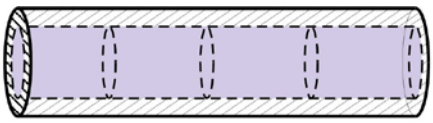
Performing Tasks in the Scan Plot Screen

To change the scale:	Click the numerical scale values to increase or decrease the magnification of the plot screen. This performs the same function as the Zoom feature on the Status Bar.
To change the unit of measure:	Double-click the button indicating the unit of measure to access the Units tab.
To change the number of decimal places or the size of the numbers displayed, to change tolerance values or turn tolerance indicators off or on or to activate AutoScale Plot:	Double-click in any numerical display window when the cursor becomes a double-headed vertical arrow to access the Display tab.
To record data:	Press the spacebar or click **Record** in the Status Bar to record a reading in the currently selected mode.
To calculate offsets:	Select Offsets from the Status Bar, select View…Offsets from the Menu Bar, or press Ctrl-O.
To toggle offsets ON and OFF:	Click **ON/OFF** in the Offsets area of the Status Bar.
To change setup information:	Click **Setup** in the Status Bar.

Bore Plot (Ctrl-B)

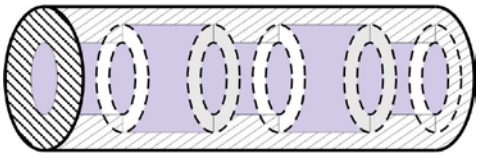
Bore Plot measures and displays the alignment of multiple bores. It measures bore straightness (axis centering) and size (diameter) using one of the bores as a reference. Applications include turbines, engine blocks, rotary compressors, extruder barrels, gun barrels, hydraulic cylinders and printing press bearings.

Continuous vs. Individual Bores



Continuous Bore

Continuous bores, such as rifle barrels, are single bores whose lengths are comparatively greater than their diameters. Measurements are taken by selecting points along the length of the continuous bore and taking readings at these cross sections.



Individual Bores

Individual bores, such as bearing mounts in an engine block, are separate from one another and usually have lengths which are comparatively shorter than their diameters. One reading is taken at the center of each bore. If the bore is very narrow, the target may need to be mounted to a face and centered.

Error Correction: The NORMIN Procedure

In order to get accurate results, target mounting and other errors must be compensated for in some fashion. The NORMIN Procedure was developed as a way of canceling out these errors. It is used in conjunction with simple fixtures and targets which allow inexpensive, precision measurement. For an in-depth discussion of the NORMIN Procedure, see Appendix A beginning on Page 61.

Measuring Alignment and Size

- To measure alignment of several bores, the laser should be bucked into (making the laser parallel to) the two end bores. The target is then moved from bore to bore, using the error correction (NORMIN) procedure (see **Error Correction: The NORMIN Procedure** on Page 33). For the most accurate results, the same target should be used for all of the bores. If using multiple targets, (up to 4 two-axis targets) the same target should be used to do both error correction readings in the same bore.

  Note: *The NORMIN procedure is necessary when performing bore* ***measurement*** *with any target. The NORMIN procedure is necessary for performing bore* ***alignment*** *with all bore targets* ***except*** *the A-510 Self-Centering Target.*

- To measure the sizes of several bores with respect to a reference bore, a reference bore with a known size is selected. The same target is moved from bore to bore (taking care to square up the target as closely as possible), taking error correction readings. The program calculates and displays the actual diameters of the individual bores.

The following are the steps common to the different types of bore measurement:

Hardware Setup
Two targets are set up in the two end bores for bucking in. The laser is positioned on its stand. The targets are connected to the interface, and the interface to the computer.

Bucking In
The buckin procedure is only necessary if you need to plot data *relative to the laser*, such as when aligning an extruder barrel to a gearbox. The laser is positioned by adjusting the laser beam (using a beam translator) to center on the near target, and then adjusting the laser itself to point the beam on the target in the far position. This is repeated until the target gives the same reading in both positions.

Bore Setup (Alt-T)
The user enters information In the Bore8 Setup Screen, such as the number of and distance between bores, the diameter of the reference bore, and the spacing between points to be measured.

Recording Data
The user moves the target from bore to bore, taking data. Data may be taken in any order desired, but the simplest way is to measure bores in numerical order). When taking NORMIN readings to cancel out errors, both the normal and inverted readings can be taken for one bore before moving to the next or the normal readings can be taken for each bore in one pass, and the inverted readings in the next.

Plotting Results
The resulting data is displayed on the screen as a two-view graph.

Saving, Printing, and Reviewing Results
Data may be saved and customized for review and for generating a printed report.

Setting up a Bore Plot

When Bore Plot is selected from the View menu, the user is instructed to set up the plot from the Bore Setup screen (see Figure 40). The Bore Setup screen may also be accessed from the Bore Plot at any time by clicking **Bore Setup (Alt-T)**. The following information is specified in the Bore Setup:

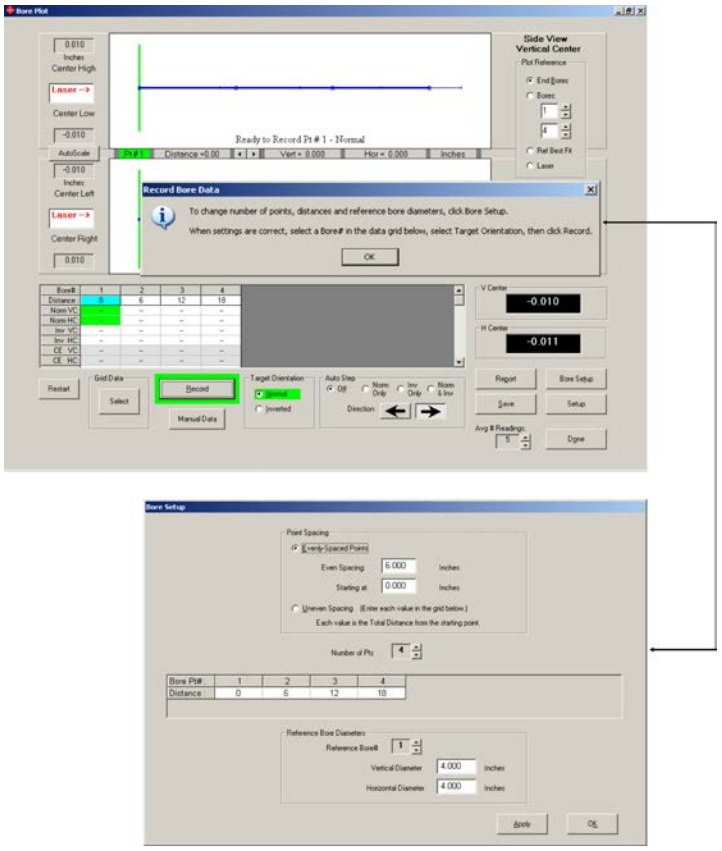


Figure 40 – *Initial Bore Plot screen with Bore Setup*

Point Spacing – Specify whether the points to be measured are evenly or unevenly spaced. If they are evenly spaced (Alt-E), enter the common distance between points and the starting value. If they are unevenly spaced (Alt-U), enter the distance between individual points in the grid.

Number of points – Enter the number of points to be measured, either by typing in the number or using the up and down arrows. The grid below reflects the number. A minimum of three and a maximum of 30 points can be specified.

Reference Bore Diameters – If you are measuring several bores with respect to a reference bore, select the number of the bore to designate as a reference and supply its vertical and horizontal diameter.

Click **Apply** to apply these specifications, and then click **OK** to return to the Bore Plot screen.

Using the Bore Plot Screen

Figure 41 shows a bore plot with four recorded points, using the end bores as the reference. The top plot shows the Side View/Vertical Center view and the bottom plot shows the Top View/Horizontal Center. The centerline represents the selected reference. For example, if End Bores is selected as the reference, the centerline would represent a line drawn through the end bores.

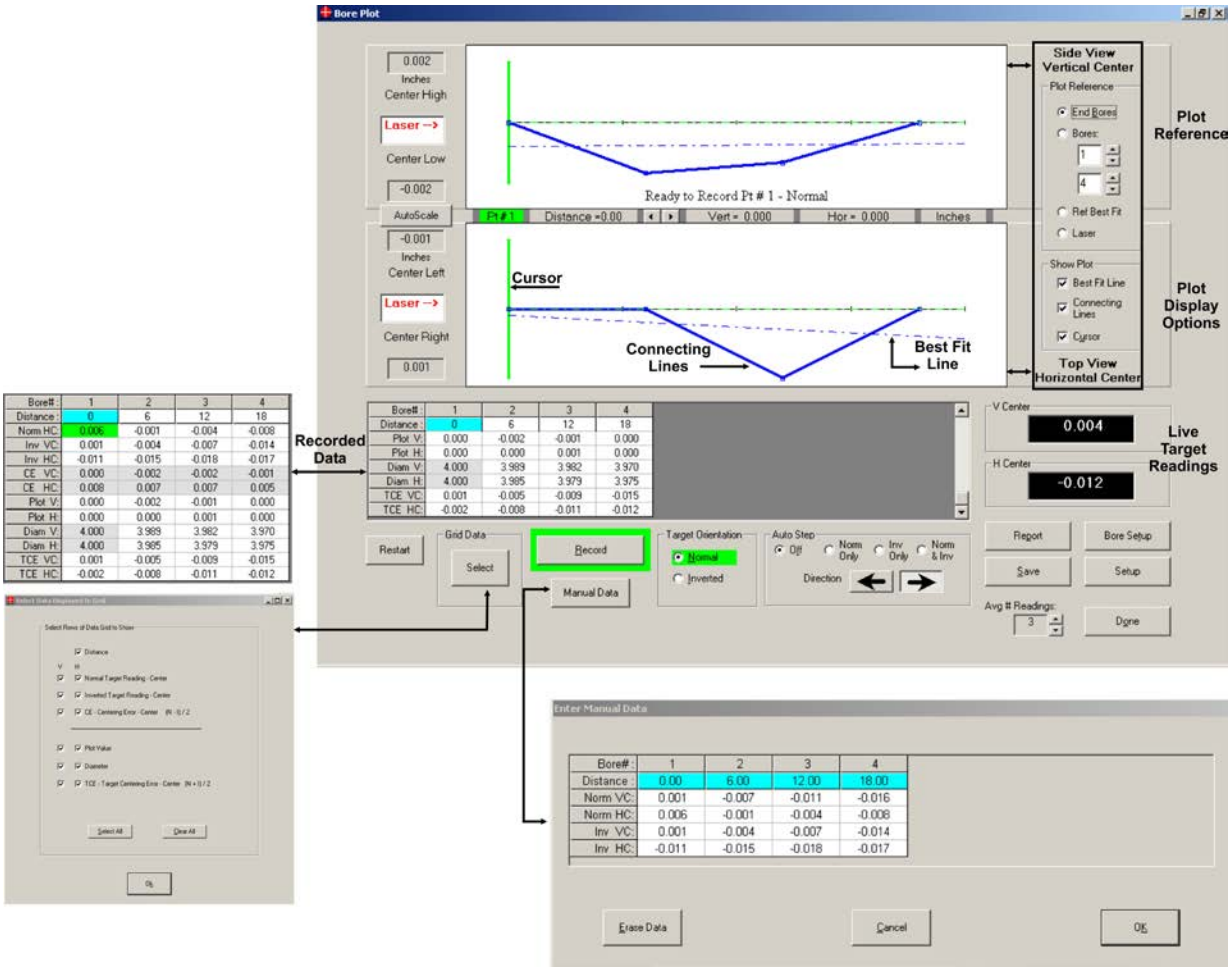


Figure 41 – *Bore Plot Screen showing Manual Data Screen and Grid Selection*

Plot Reference

The Plot Reference can be changed to reflect the data as follows:

End Bores – Shows the position of the centerline of the bores relative to the end bores. This view makes the end bores the "zero" point, and plots the positions of the remaining bores in relation to the end bores.

Bore Numbers – Shows the position of the centerline of the bores relative to the selected bore numbers. This view makes the designated bore numbers the "zero" point and plots the positions of the remaining bores in relation to selected bore numbers.

Best Fit – Shows the position of the centerline of the bores relative to the Best Fit line rather than to the laser beam. This least-squares best-fit algorithm built into the software removes the slope by finding a line that "best fits" the raw data. It is especially useful because the laser beam does not have to be exactly centered in the bore to get accurate straightness measurements.

Laser – Shows the position the centerline of the bores relative to the laser beam.

Note: *If you wish to change the orientation of the laser beam on the screen to reflect your physical setup, move the cursor into the box marked Laser. When the cursor becomes a double-headed arrow, click to change the laser orientation from one side to the other (see* Figure 42).

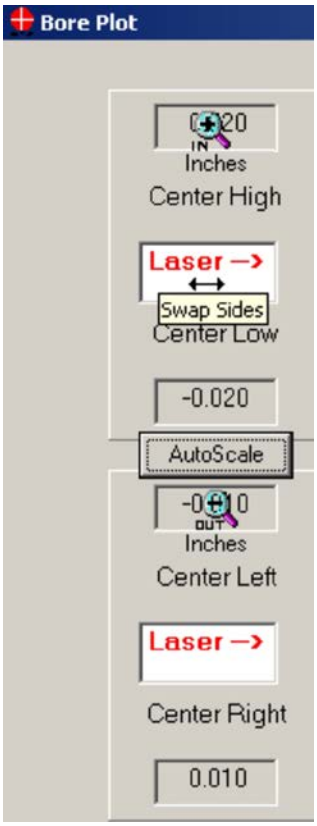


Figure 42 – *Changing laser orientation and using the AutoScale and Zoom features*

Show Plot

To show or hide a descriptive line on the plot, either check or uncheck the appropriate box.

Best Fit Line – The Best Fit line is shown on the plot as a dotted blue line.

Connecting Lines – These solid blue lines connect each recorded point.

Cursor – Shows the current recording position. A solid green line denotes normal readings and a solid yellow line denotes readings taken with the target inverted. Clicking the right or left arrows in the bar between the two plot views moves the cursor from point to point.

Other Features of the Bore Plot Screen

AutoScale/Zoom (Figure 42**)**
To increase or decrease the scale of a specific plot window, hold the cursor over the reading until it becomes a magnifier. Click to zoom in (+) or out (-). Click **AutoScale** to automatically scale the data in both plot windows.

Manual Data (Figure 41)
Click **Manual Data** to enter data into the program manually. You may enter data manually if an interface is not available or if you want to create a demonstration plot with specific numbers.

Grid Data (Figure 41)
Click **Select** in the Grid Data box to add or hide rows of the data grid.

Target Orientation/Auto Step (Figure 41)
Select the target orientation to record by clicking **Normal** (displayed in green on both the grid and the plot screen) or **Inverted** (displayed in yellow). **Auto Step** automatically moves from one point to the next, either in Normal Mode, Inverted Mode, or in both modes. To change the direction to record data, click the left or right **Direction** arrow.

Generating a Report

Click **Report** (Alt-P) to view and customize a report of the collected data. To include or exclude specific data, check or uncheck the appropriate boxes. You may add comments, print or save the report, or load previously saved reports for review. To enlarge the graph images, hold the cursor over the report graph until it becomes a magnifier and click.

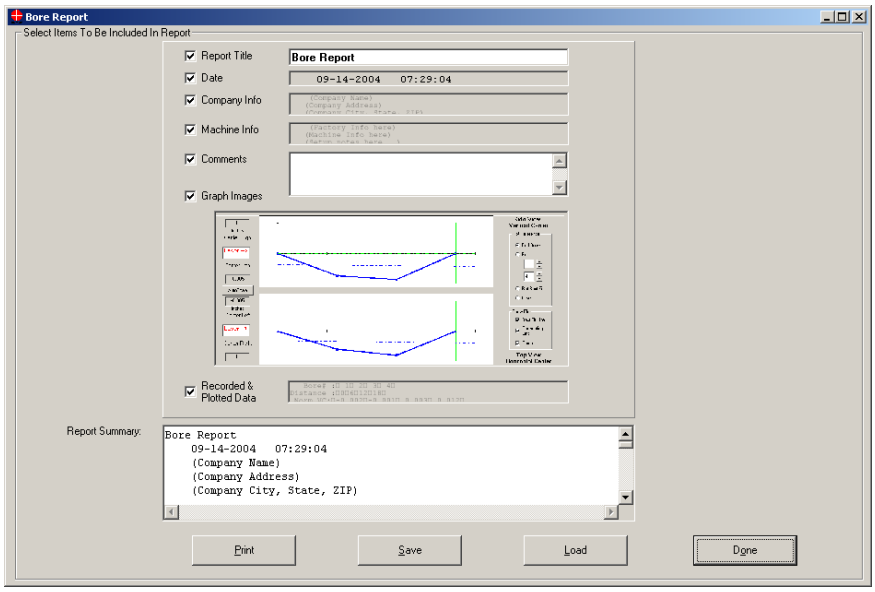


Figure 43 – *Bore8 Report Screen*

Performing Tasks in the Bore Plot Screen

To change the number of points to be recorded, the distances between bores and reference bore diameters:	Click **Bore Setup** on the Bore Plot Screen or press **Alt-T**.
To record data:	Press the spacebar or click **Record**.
To automatically scale the plot data to fit the plot screens:	Click **AutoScale**.
To change setup information:	Click **Setup** in the Bore Plot Screen.
To enter data manually:	Click **Manual Data** in the Bore Plot Screen and fill in the data in the resulting table.
To show or hide items in the grid:	Click **Select** in the Grid Data box and check or uncheck the appropriate selections.
To generate a report:	Click **Report** or press **Alt-P**.

Calculating Offsets (Ctrl-O)

The Offsets Utility provides eight different ways to develop offsets, or corrections for misalignment of the target and laser, which are subtracted from the raw target data to provide a more accurate reading. Uses for offsets include mounting error correction, assisting in the buckin process, and for aligning a laser or target to its mounting stud. Offsets may be toggled on or off to see raw or corrected readings.

The offsets available depend on which Target Mode is selected in **Setup.**

Target Mode	Offsets Available
Center Only	Zero, Buckin, Align Target, Align Laser, Manual Offset
Center and Slope	Zero, Virtual Center in Front, Virtual Center Behind, Spindle, Align Target, Align Laser, Manual Offset
Vertical Only (scanning laser)	Zero, Buckin, Align Target, Align Laser, Manual Offset

Offset Name	Function
Zero	Resets the numerical readings and the plot information to zero at the current reading. Subsequent readings show only the *difference* from the original reading. For example, if the reading is zeroed at .0015", then a raw reading of .0020" is displayed as .0005" (.0020" - .0015").
Buckin	Calculates setpoints for bucking a laser in to two or more points on a surface or in a line, and then zeroes the numerical display and the plot information on those setpoints.
Align Target	Uses NORMIN readings to determine mounting and other errors in a fixture-mounted target and adjusts the numerical readings and plot information to remove the error from the readings. This offset is commonly used to align a target to a mounting stud.
Align Laser	Uses NORMIN readings to determine mounting and other errors in a fixture-mounted laser and adjusts the numerical readings and plot information to remove the error from the readings. This offset is commonly used to align a laser to a mounting stud.
Manual Offset	Allows predetermined offset information to be entered for two or four axes, calculates the applied offsets and subtracts those offsets from the readings.
Spindle	Uses NORMIN readings to determine mounting and other errors in a spindle-mounted target and laser setup and adjusts the display to remove the mounting error from the readings.
Virtual Center in Front/ Virtual Center Behind	A calculation that enables a measurement to be taken at an axial point different from the cell plane of the target. This is useful when it would be impossible or impractical to physically mount a target, for example, in the center of a bore.

Using the Offsets Screen

An offset creation screen is displayed in Figure 44. The screen features a numerical display as well as a display of recorded data and calculated data for the selected offset. After all necessary values have been recorded for the selected offset, the offsets are calculated and stored in the 'calculated offset' table. When offsets are turned on, the values in this table are subtracted from the corresponding raw data values currently being read for each displayed channel.

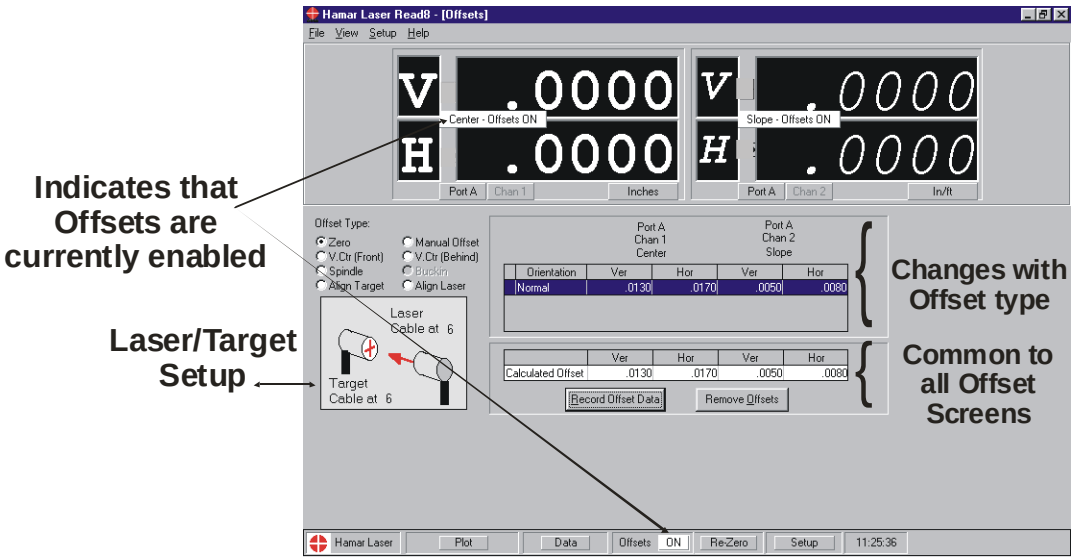


Figure 44 – *Offsets Screen Showing Zero Offsets Display*

To create an offset:	Double-click **Offsets** from the Status Bar, or select **View…Offsets** from the Menu Bar, or press **Ctrl-O** while in any plot screen.
To select an offset type:	Click the button next to the desired offset. If an offset is not available for particular setup, the selection is grayed-out. When an offset is selected, a graphic representation displays, showing the position of the laser and target for each reading.
To take readings:	Press the spacebar, press **Alt-R**, or click **Record Offset Data**.
To toggle an offset on or off:	Click **Remove Offsets**, click the **ON/OFF** button next to Offsets on the Status Bar, or Press **Alt-O**. The **ON/OFF** button on the Status Bar can be used to turn offsets on or off from any Plot or Record Data screen.

Note: *Only one type of offset can be active at a time. If the Zero Offset is active, the Re-Zero button on the Status Bar allows the display to be re-zeroed at any time. For all other selected offsets, the Status Bar displays the current type of offset.*

Selecting an Offset Type

The following is a detailed discussion of each offset type and how to record these offsets.

Zero Offset

The Zero Offset resets the readout to zero at the current target position; that is, the software keeps the current reading in memory and then subtracts it from all future readings. While offsets are ON, subsequent readings show only the *difference* from the original reading.

1. **Coarse-align the laser and target on the numerical display.**
   Ensure that that laser and target are in position and the numerical display is showing readings.
2. **Double-click Offsets on the Status Bar.**
   The Offsets screen displays with the Offset Type listing in the upper left of the screen.
3. **Select *Zero*.**
   The graphic below Offset Type displays the proper orientation of the laser and target for taking a reading (see Figure 45).
4. **Press the spacebar to take a reading.**
   Press the spacebar or click **Record Offset Data (Alt-R)** to take a reading at the current position of the target and laser. The upper chart shown in Figure 46 displays the reading and the lower chart displays the calculated offset. The plot screen now reads zero for that position and the **Center/Slope** buttons and Status Bar indicate that the Zero Offset is ON. Any further readings display with this value subtracted.

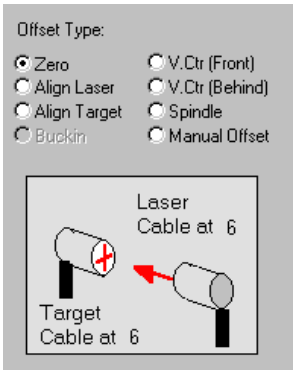


Figure 45 – *Selecting Zero Offset*

Note: *When Zero Offset is applied, the Status Bar displays a* **Re-Zero** *button. Clicking this button re-zeros the display at any time, as long as the zero offset is ON.*

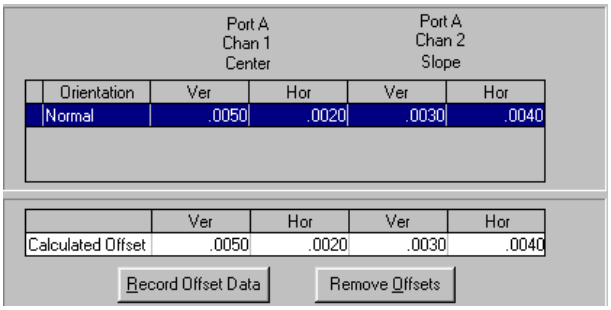


Figure 46 – *Raw Reading and Calculated Offset Values*

Spindle Offset

The Spindle Offset uses NORMIN readings (see Appendix A) to determine mounting and other errors in a spindle-mounted target and laser setup and adjusts the display to remove the error from the readings.

1. **Coarse-align the laser and target on the numerical display.**
   Ensure that that laser and target are in position and the numerical display is showing readings.

2. **Double-click Offsets on the Status Bar.**
   The Offsets screen displays with the Offset Type listing in the upper left of the screen.

3. **Select *Spindle*.**
   The graphic below Offset Type, showing the laser with the cable at "12", displays the proper orientation of the laser and target for taking the first reading (see Figure 47). Ensure that the laser is in the rotated position in its fixture or spindle and leveled.

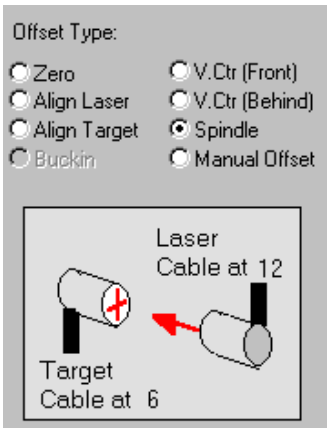


Figure 47 – *Spindle Offset – First Reading (laser inverted)*

4. **Press the spacebar to take a reading.**
   Press the spacebar or click **Record Offset Data (Alt-R)** to take a reading at the current position of the target and laser. Wait until the program takes all of its samples and displays the readings before performing the next step. The cursor moves automatically to the next field and the graphic showing the laser and target orientation changes.

5. **Invert the target 180 degrees and return the laser to normal position.**
   Rotate the laser 180 degrees to its normal position and level. Rotate the target 180 degrees in its fixture or spindle to the inverted position and level (see Figure 48).

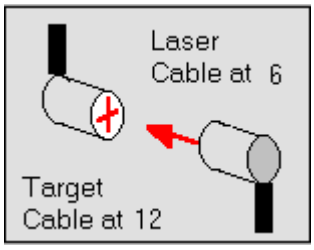


Figure 48 – *Spindle Offset – Second Reading (target inverted)*

6. **Press the spacebar to take a reading.**
   Press the spacebar or click **Record Offset Data (Alt-R)** to take a reading at the current position of the target and laser. Wait until the program takes all of its samples and displays the readings before performing the next step. The cursor moves automatically to the next field and the graphic showing the laser and target orientation changes.

7. **Return the target and laser to the normal position.**
   Reset the laser and target to normal position (see Figure 49) and level.

8. **Press the spacebar to take a reading.**
   Press the spacebar or click **Record Offset Data (Alt-R)** to take a reading at the current position of the target and laser. Wait until the program takes all of its samples and displays the readings.

   The plot screen now displays corrected readings and the **Center/Slope** buttons and Status Bar indicate that Spindle offsets are ON. Any further readings display with this value subtracted.

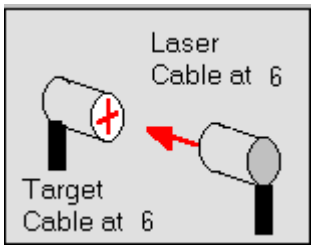


Figure 49 – *Spindle Offset – Third Reading (laser and target in normal position)*

Manual Offset

The Manual Offset allows the user to enter pre-determined offset information for two or four axes, then calculates applied offsets and deducts those offsets from the readings.

1. **Double-click Offsets on the Status Bar.**
   The Offsets screen displays with the Offset Type listing in the upper left of the screen.
2. **Select *Manual Offset*.**
   The Enter Manual Offset Values screen displays.
3. **Select the offset axis and type in the offset amount.**
   Use the Tab key to move from one box to another or click in each box with the mouse. Enter a value for all axes.
4. **Click Record Offset Data (Alt-R) or press the spacebar to calculate the offset.**
   The **Center/Slope** buttons and Status Bar now indicate that Manual offsets are ON. Any further readings display with this value subtracted.

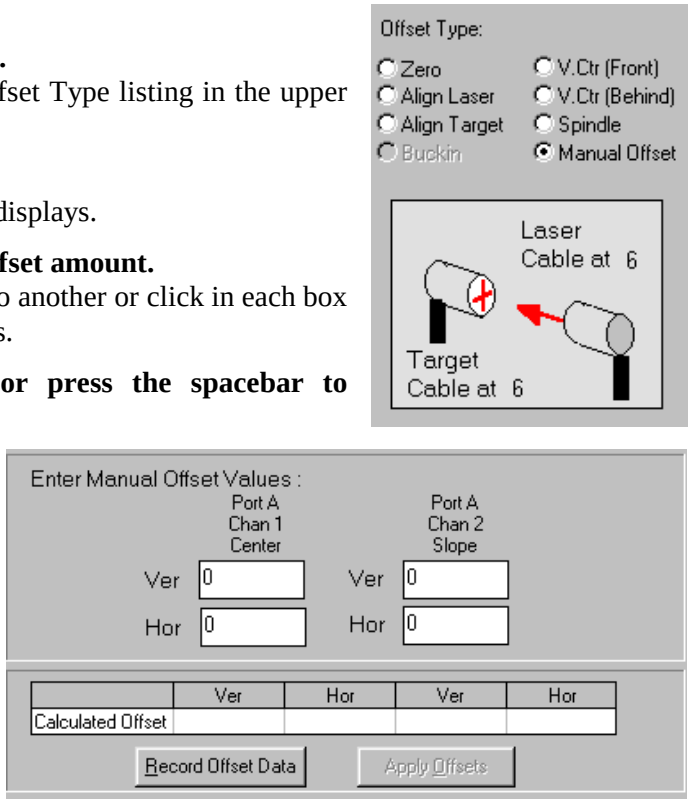


Figure 50 – *Manual Offsets Screen for 4-Axis Target*

Align Laser Offset

The Align Laser Offset uses NORMIN readings to determine mounting and other errors in a fixture-mounted laser and adjusts the display to remove the error from the readings.

1. **Coarse-align the laser and target on the numerical display.**
   Ensure that that laser and target are in position and the numerical display is showing readings.

2. **Double-click Offsets on the Status Bar.**
   The Offsets screen displays with the Offset Type listing in the upper left of the screen.

3. **Select *Align Laser* and orient the laser as shown in Figure 51**.
   The graphic below Offset Type, showing the laser with the cable at "12", displays the proper orientation of the laser and target for taking the first reading. Ensure that the laser is in the rotated position in its fixture or spindle and leveled.

4. **Press the spacebar to take a reading.**
   Press the spacebar or click **Record Offset Data (Alt-R)** to take a reading at the current position of the target and laser. Wait until the program takes all of its samples and displays the readings before performing the next step. The cursor moves automatically to the next field and the graphic showing the laser and target orientation changes.

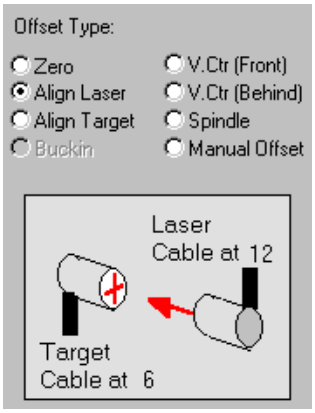


Figure 51- *Align Laser Offset – First Reading (laser inverted)*

5. **Return the laser to the normal position.**
   Reset the laser to normal position and level (see Figure 52).

6. **Press the spacebar to take a reading.**
   Press the spacebar or click **Record Offset Data (Alt-R)** to take a reading at the current position of the target and laser. Wait until the program takes all of its samples and displays the readings before performing the next step. The cursor moves automatically to the next field and the graphic showing the laser and target orientation changes.

   The plot screen now reads the laser beam misalignment (less fixture mounting errors). The **Center/Slope** buttons and Status Bar indicate that Align Laser offsets are ON. Any further readings display with this value subtracted.

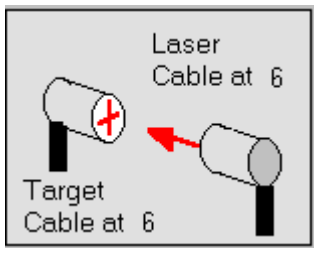


Figure 52 – *Align Laser Offset – Second Reading – (laser and target in normal position).*

Align Target Offset

The Align Target Offset uses NORMIN readings to determine mounting and other errors in a fixture-mounted target and adjusts the display to remove the error from the readings.

1. **Coarse-align the laser and target on the numerical display.**
   Ensure that that laser and target are in position and the numerical display is showing readings.

2. **Double-click Offsets on the Status Bar.**
   The Offsets screen displays with the Offset Type listing in the upper left of the screen.

3. **Select *Align Target.***
   The graphic below Offset Type, showing the target with the cable at "12", displays the proper orientation of the laser and target for taking the first reading (see Figure 53). Ensure that the laser is in the rotated position in its fixture or spindle and leveled.

4. **Press the spacebar to take a reading.**
   Press the spacebar or click **Record Offset Data (Alt-R)** to take a reading at the current position of the target and laser. Wait until the program takes all of its samples and displays the readings before performing the next step. The cursor moves automatically to the next field and the graphic showing the laser and target orientation changes.

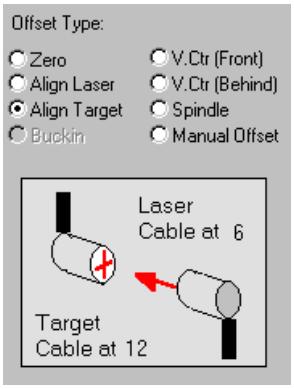


Figure 53- *Align Target Offset – First Reading (target inverted)*

5. **Return the target to the normal position.**
   Reset the target to normal position and level (see Figure 54).

6. **Press the spacebar to take a reading.**
   Press the spacebar or click **Record Offset Data (Alt-R)** to take a reading at the current position of the target and laser. Wait until the program takes all of its samples and displays the readings before performing the next step. The cursor moves automatically to the next field and the graphic showing the laser and target orientation changes.

   The plot screen now reads the laser beam misalignment (less fixture mounting errors). The **Center/Slope** buttons and Status Bar indicate that Align Target offsets are ON. Any further readings display with this value subtracted.

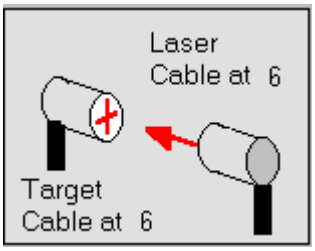


Figure 54 – *Align Target Offset – Second Reading – (laser and target in normal position).*

Buckin Offset

The Buckin Offset allows the user to calculate setpoints for bucking a laser to two or more points on a surface or in a line, and then zeroes the display on those setpoints. It is preferable to use a single target for bucking in, moving it from the near position to the far position (see Figure 55). The target shown with a dotted outline represents the target in the *near* position; the target with a solid outline represents the same target in the *far* position). The buckin offset utility offers five interactive screens, where the user is prompted for information step-by-step.

1. **Coarse-align the laser and target on the numerical display.**
   Ensure that that laser and target are in position and the numerical display is showing readings.

2. **Document the hardware setup.**
   The diagram below shows a laser-target setup. Make note of the distance between the laser pivot point and the near target (L1) and of the distance between the near and far targets (L2).

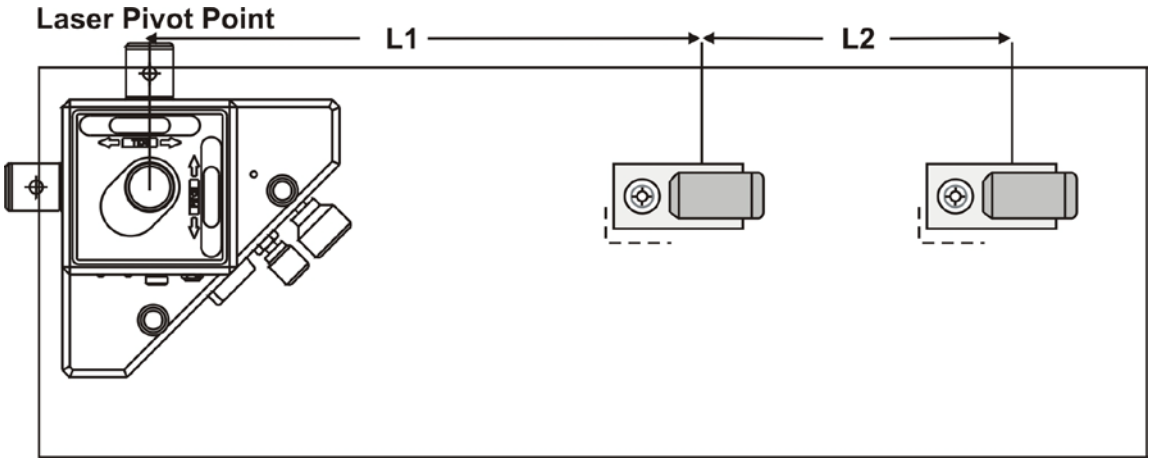


Figure 55 – *Laser-Target Setup for Buckin Showing Scanning Laser*

3. **Visually adjust the laser to be parallel to the surface.**
   Hold a piece of cardboard near the laser until the beam can be seen on the cardboard. Slowly move the cardboard back to the far position and adjust the laser visually.

4. **Center the target on the laser (near position).**
   Set the target in the near position and center the target on the laser. For bore buckin, use a beam translator (see Step 16).

5. **Double-click Offsets on the Status Bar.**
   The Offsets screen displays with the Offset Type listing in the upper left of the screen.

6. **Select *Buckin.***
   The graphic below Offset Type, showing all cables at "6 o'clock", displays the proper orientation of the laser and target (see Figure 56).

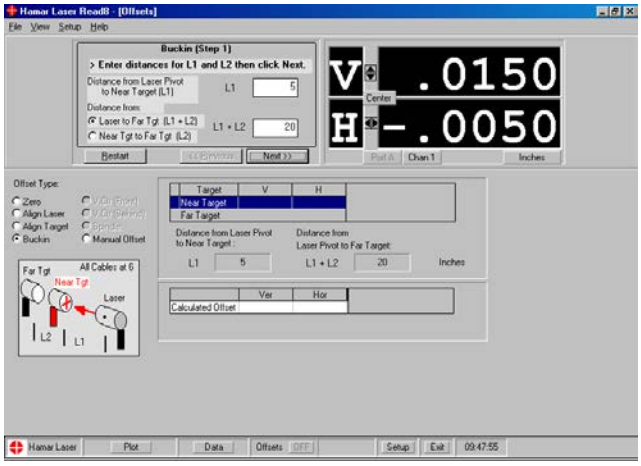


Figure 56- *Buckin Offset Screen – Enter Distances (Step 1)*

7. **Enter the required distances.**
   In the boxes provided, (see Figure 56) enter individual values for L1 and L2 or the sum of the two values where L1 is the distance from the laser pivot point to the near target and L2 is the distance between the near and far target positions.
8. **Click Next to proceed to Step 2** (see Figure 57).
9. **Click the Channel button on the readout to the *right* to select the near target channel.**
10. **Click Next to record data from the near target and proceed to Step 3** (see Figure 58).
11. **Move the target to the far position.**
    Set the target in the far position without making any adjustments.
12. **Click the Channel button on the readout to the *left* to select the far target channel.**
13. **Click Next to record data from the far target and proceed to Step 4** (see Figure 59).
14. **Tilt the laser until the center vertical and horizontal values at the far target are zeroed.**
    Tilt the entire laser unit with the adjusting screws and micrometers until the target is zeroed (see Figure 59) At this point, the beam is parallel to the surface, but the target may not be centered on the laser beam. See Item 16 on Page 46.

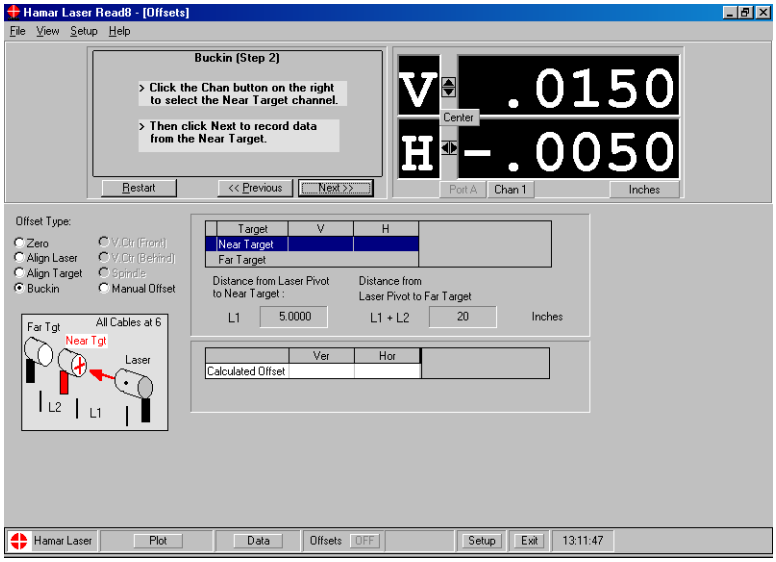


Figure 57 – *Buckin Offset Screen – Record Near Target (Step 2)*

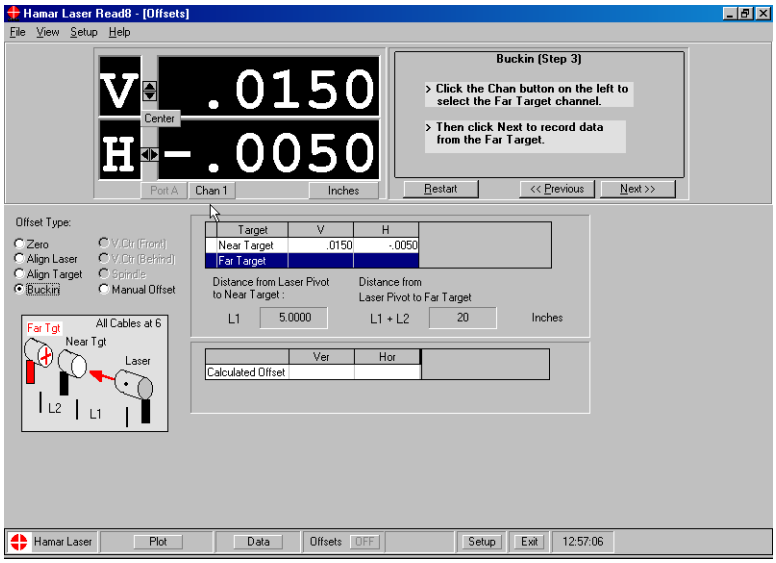


Figure 58 – *Buckin Offset Screen – Recording Far Target (Step 3)*

15. **Click Next to proceed to Step 5** (Figure 60)**.**
    Clicking on Next also removes offsets.

16. **For general purpose buckin (ways or surfaces):**
    Adjust the far target with the micrometer until it is centered and the display reads zero.

    For bore buckin:
    Use a beam translator to adjust the laser until the desired vertical and horizontal center values are obtained.

    Note: *Item 16 can be performed with the target in either the near or far position, as the laser beam is now parallel to/coincident with the centerline formed by the targets.*

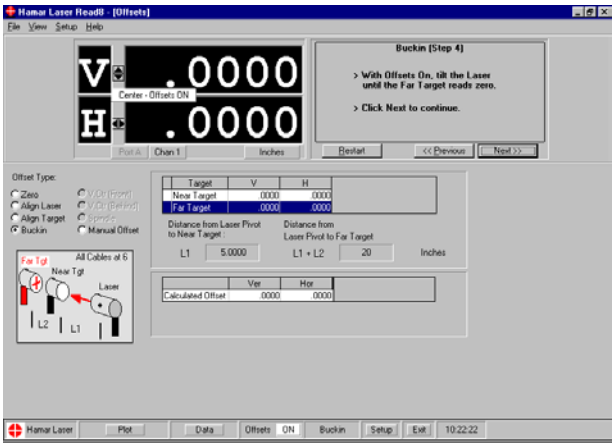


Figure 59 - *Buckin Offset Screen – Zero and Remove Offsets (Step 4)*

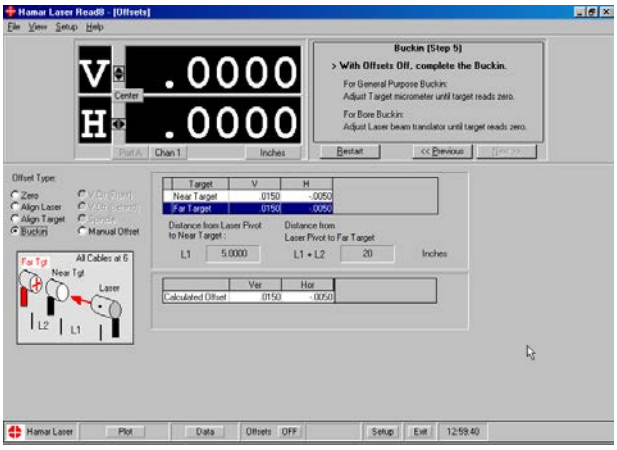


Figure 60 - *Buckin Offset Screen – Finish Buckin (Step 5)*

Virtual Center (Behind) and Virtual Center (Front) Offsets

The Virtual Center (Behind) and Virtual Center (Front) offsets are applied when it is necessary to know the center misalignment at an axial location in front of or behind the actual target. The offset that is calculated by the Read8 program provides the misalignment at a *virtual* target, a location determined by the user. This offset is useful when a misalignment occurs in an area where a target cannot be placed, for example, inside a bore.

Note: *These offsets are available with Center and Slope targets only.*

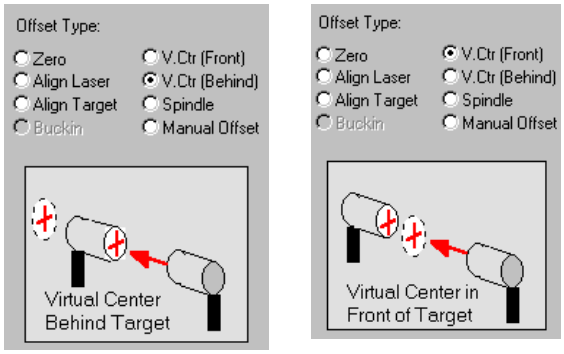


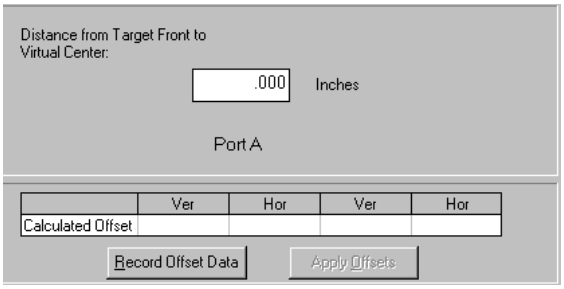
Figure 61 – *Setup for Virtual Offsets*

1. **Double-click Offsets on the Status Bar.**
   The Offsets screen displays with the Offset Type listing in the upper left of the screen.

2. **Select *V. Ctr (Front) or V. Ctr (Behind)***
   The graphic below Offset Type displays the proper orientation of the laser and target (see Figure 61).

4. **Enter the required distances from the front of the target to the desired virtual center.**
   In the box provided, enter the measurement from the front of the target to either the desired *virtual center* behind or in front of the target. This distance is indicated by a black square in Figure 62.

5. **Click Record Offset Data (Alt-R) or press the spacebar to calculate the offset.**
   The **Center/Slope** buttons and Status Bar now indicate that virtual offsets (front or behind) are ON.



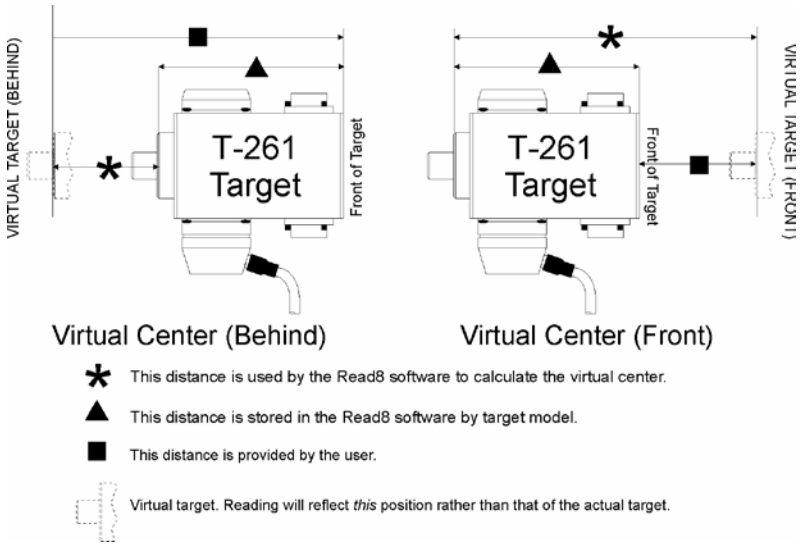


Figure 62 – *Finding Virtual Center Offsets*

Recording Data (Ctrl-R)

The Record Data utility provides four ways to record target information:

Air Noise
Air noise is a general-purpose data logging utility that collects data by repeatedly taking samples, averages out the effects of air turbulence (noise) on a reading, and provides statistical data on each reading.

Repeat Mode
This utility tests the repeatability of results obtained with a specific fixture or hardware setup. The laser or target is inserted in the fixture, a reading is taken, and the laser or target is removed. This procedure is then performed and the results recorded a number of times to determine how well the results can be repeated.

STimer (Statistical Timer)
This utility records readings at regular intervals for a fixed period of time to determine changes such as thermal growth. It can also be used to determine the effects of regularly occurring events, such as seasonal temperature variations or vibrations from delivery trucks on the accuracy of machines and processes. The user can specify the amount of time between readings, the number of readings to be taken, and a date and time to stop taking readings.

All the data and standard deviations recorded with these utilities can be saved, printed, or edited from within the Read8 program. This information can also be imported into a Microsoft® Excel spreadsheet (see *To import data into a Microsoft® Excel spreadsheet* on Page 49).

Quick Plot
Quick Plot Mode plots recorded data on a graph. It is designed to plot vertical and horizontal *centers* and is used for straight-line measurement, such as plotting the elevation of a way, measuring the vertical and horizontal position of a series of bores or providing a profile of an extruder barrel. The user can set up the appearance of the graph and specify a number of options. Quick Plot data can be saved to a file and a Quick Plot report can be printed.

Using the Data Recording Screen

The Data Recording screen is displayed in Figure 63. The screen features a numerical display as well as an area to display recorded data. The **Mode (Alt-M)** button allows the user to change the recording mode at any time; however changing modes deletes all unsaved, recorded data (the program displays a reminder to save data before changing modes).

The screen also contains buttons to save, print, and edit data, as well as to clear the screen of information and to restore previously saved information.

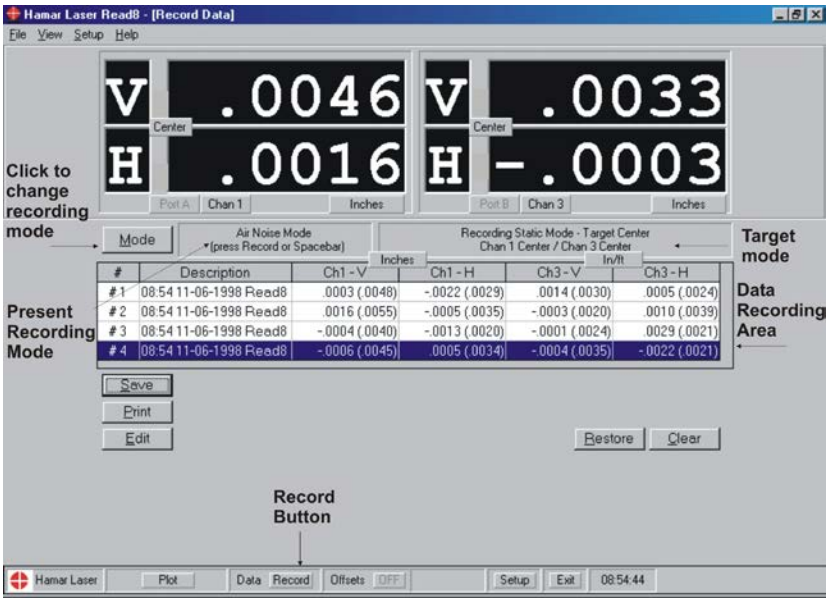


Figure 63 – *Data Recording Screen*

To access the Data Recording Screen:

Double-click **Data** on the Status Bar, or select **View…Record Data** from the Menu Bar, or press **Ctrl-R** while in any plot screen.

To select a Data Recording Mode:

Click **Mode (Alt-M)** on the Data Recording screen or double-click the Present Recording Mode panel (see Figure 63). This accesses the Record Mode tab of the Setup Menu. Select one of the three recording modes (see Figure 64).

To change Data Recording Mode defaults:

Data recording defaults are located at the bottom of the Record Mode tab of the Setup Menu (see Figure 64). These include the number of samples per reading, whether to include the time and date on each reading, whether to send audio feedback after recording, whether Standard Deviation of Samples should be displayed and whether to include a text notation in each Description field when recording data.

Notes:

1. *The default number of samples per reading is three. In order to obtain a truer reading, the program collects the specified number of samples and averages them before displaying a reading.*
2. *If Standard Deviation of Samples is checked, the standard deviation for an individual reading is shown in parentheses when data are recorded. In Repeat Mode, the standard deviation of all readings is recorded.*

To take readings:

Press the spacebar or click **Record** on the Status Bar.

To clear recorded data from the screen:

Click **Clear (Alt-C)** on the Data Recording screen. If recorded data has not been saved, you are prompted to do so.

To save recorded data:

Click **Save (Alt-S)**. The default filename for the first saved data file is **data0001.dat**. Every time data are saved, the number for the new filename increments by one, for example, **data0002.dat**, and **data0003.dat**. You can provide a new filename or change the directory for the saved files.

To restore saved data:

Click **Restore (Alt-R)** to bring up the list of previously saved files.

To print recorded data:

Click **Print (Alt-P)**.

To edit a data description:

Click **Edit (Alt-E)**. The edit box displays with the current description for a highlighted line of data. This information may be changed or comments may be added (see Figure 65). When finished, click **Done (Alt-D)**.

To import data into a Microsoft® Excel spreadsheet:
(not applicable to Quick Plot)

1. In the Record Data screen, save data to a file (see *To save recorded data* above).
2. Start Microsoft® Excel.
3. Select **File/Open** and select the Read8 saved file from the Read8 directory. Excel begins the Import Wizard. The range of data to import between labels "///Start Import to Excel///" and "End Import to Excel///" in the Excel Preview of File displays.
4. Check the **Delimited** option (the data in the **.dat** file is *tab-delimited*).
5. Specify **Start Import** at any row beyond the "///Start Import to Excel///" label.
6. Select **File Origin: Windows (ANSI)**.
7. Click **Finish** and the data is imported into the Excel worksheet.

8. To keep only the valid data:
   a. Move down to the row containing "///End Import to Excel///" and click Column A.
   b. Hold down **Ctrl-Shift** and tap the **End** key to select the worksheet beyond the data to be kept.
   c. Press the **Delete** key to delete the selected data.
9. To format the valid data:
   a. Select Column C through Column J and all rows from the first data item to the last.
   b. Choose the Format|Cells|Number menu and select 0.0000 to format all selected numeric data.
10. Save the worksheet.

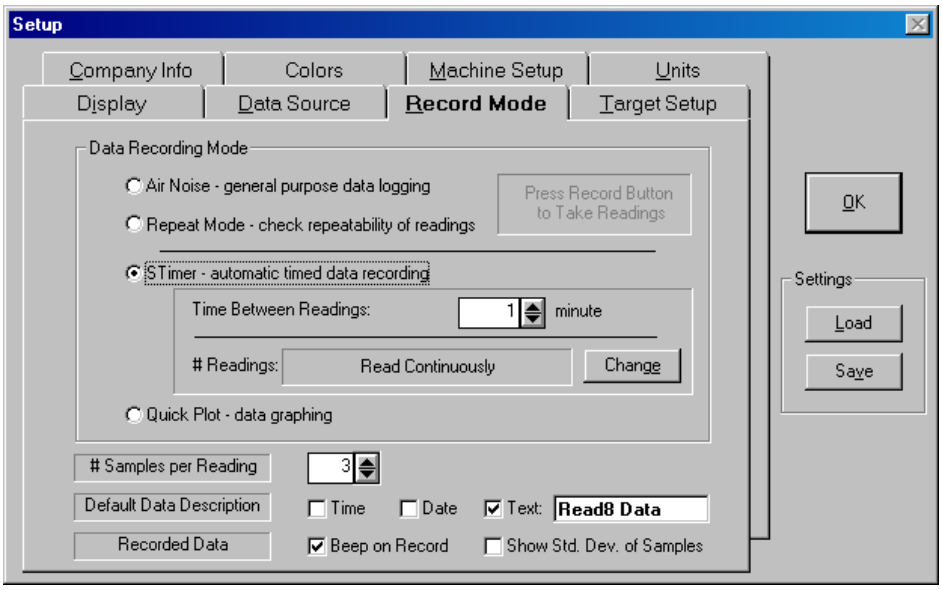


Figure 64 – *Record Mode*

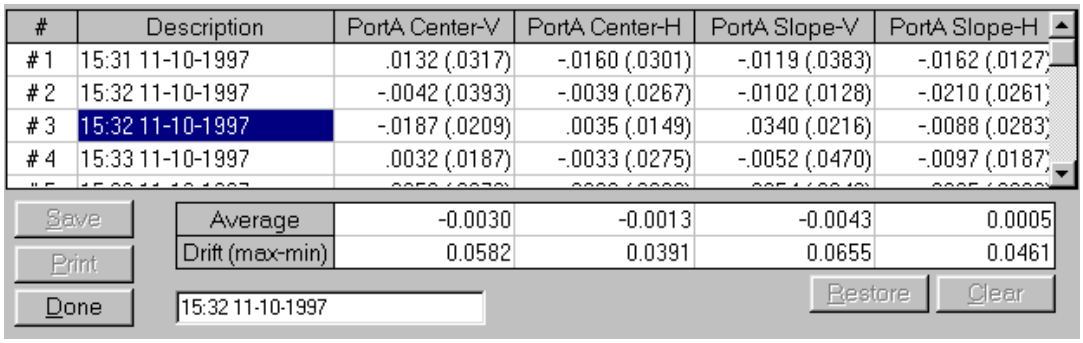


Figure 65 – *Adding a Comment to a Reading*

Performing the Repeat Mode Test

This utility tests the repeatability of results obtained with a specific fixture or hardware setup. The laser or target is inserted in the fixture, a reading is taken, and the laser or target is removed. This procedure is then performed and the results recorded a number of times to determine how well the results can be repeated.

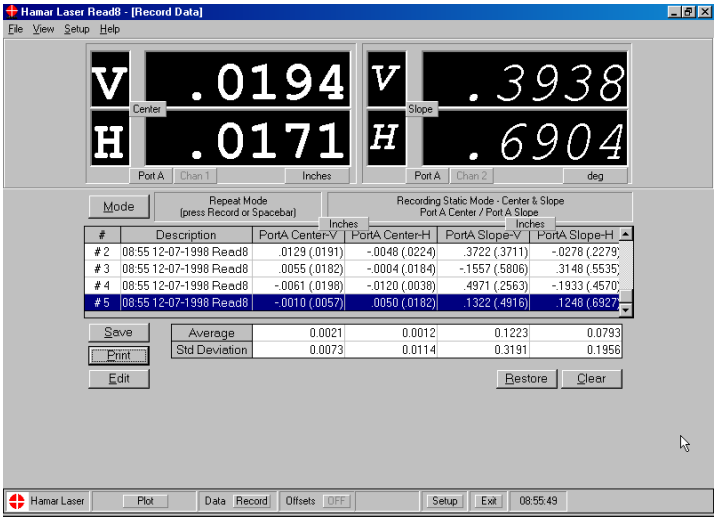


Figure 66 – *Data Recording Screen (Repeat Mode)*

1. **Set the instrument (laser or target) in a mounting fixture.**
   Lock the fixture securely in place (for example, in a jaw chuck or magnetic mount). Secure the laser or target to be tested in the fixture.

2. **Align the laser and target to the desired reading on the numeric readout screen.**
   Align the laser and target to zero or to the desired reading by moving the laser or target (whichever is *not* mounted in the fixture). If such coarse alignment is not possible, zero the readout at its current position by pressing Re-Zero on the Status Bar.

3. **Click Data on the Status Bar to bring up the Record Data screen.**
   If there is previously recorded information on this screen, either save it or clear it by selecting **Save** or **Clear**.

4. **Click Mode and select Repeat Mode.**

5. **Press the spacebar or click Record on the Status Bar to take a reading.**
   Wait until the program takes all of the samples before continuing.

6. **Remove and replace the instrument mounted in the fixture without moving the fixture.**
   Gently remove the laser or target from the fixture without moving either the fixture or the other instrument. Replace the laser or target in the fixture.

7. **Press the spacebar or click Record on the Status Bar to take a reading.**
   Wait until the program takes all of the samples before continuing. The average error and the standard deviation displays below the readings.

8. **Repeat Steps 6 and 7 as required.**
   Repeat the previous two steps for as many readings as necessary to establish the repeatability of the instrument and fixture. Each reading updates the standard deviation and average error information.

9. **Click Plot on the Status Bar to return to the plot screen.**

Performing the Air Noise Test

Air noise is a general-purpose data logging utility that collects data by repeatedly taking samples, averages out the effects of air turbulence (noise) on a reading, and provides statistical data on each reading.

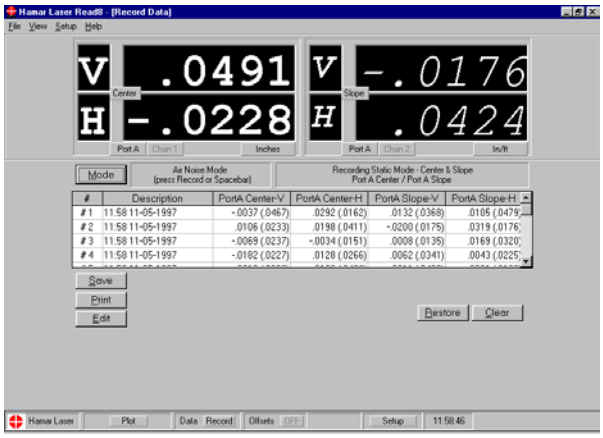


Figure 67 - *Data Recording Screen (Air Noise)*

1. **Set the instrument (laser or target) in a mounting fixture.**
   Lock the fixture securely in place (for example, in a jaw chuck or magnetic mount). Secure the laser or target to be tested in the fixture.

2. **Align the laser and target to the desired reading on the numeric readout screen.**
   Align the laser and target to zero or to the desired reading by moving the laser or target (whichever is *not* mounted in the fixture). If such coarse alignment is not possible, zero the readout at its current position by pressing Re-Zero on the Status Bar.

3. **Click Data on the Status Bar to bring up the Record Data screen.**
   If there is previously recorded information on this screen, either save it or clear it by selecting **Save** or **Clear**.

4. **Click Mode and select Air Noise.**

5. **Press the spacebar or click Record on the Status Bar to take a reading.**
   Wait until the program takes all of the samples before continuing. Continue taking readings until enough data has been collected to establish an average.

6. **Click Plot on the Status Bar to return to the plot screen.**

Performing the Statistical Time (STimer) Test

This utility records readings at regular intervals for a fixed period of time to determine changes such as thermal growth. It can also be used to determine the effects of regularly occurring events, such as seasonal temperature variations or vibrations from delivery trucks on the accuracy of machines and processes. The user can specify the amount of time between readings, the number of readings to be taken, and a date and time to stop taking readings.

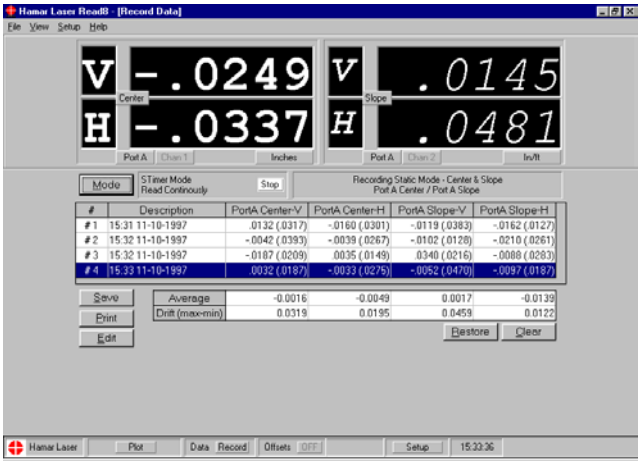


Figure 68 – *Data Recording Screen (STimer)*

1. **Set the instrument (laser or target) in a mounting fixture.**
   Lock the fixture(s) securely in place (for example, coupling posts on machine housings). Secure the laser and target in their fixture(s) or other mounting position.

   Note: *Never run a machine with a target or laser mounted on or in a moving part. If the machine must be running during this procedure, as with thermal growth monitoring, the target and laser should be mounted on stationary parts such as machine housings. Make sure all cables are routed away from moving parts and warning signs or barriers are set up.*

2. **Align the laser and target to the desired reading on the numeric readout screen.**
   Align the laser and target to zero or to the desired reading by moving one or both instruments. If such coarse alignment is not possible, zero the readout at its current position by pressing Re-Zero on the Status Bar.

3. **Click Data on the Status Bar to bring up the Record Data screen.**
   If there is previously recorded information on this screen, either save it or clear it by selecting **Save** or **Clear**.

4. **Click Mode and select STimer.**

5. **Enter the setup information.**
   Specify an amount of time between readings. The default is one minute, but the increment may be lowered to as little as 30 seconds. If you wish to run the test continuously, click **OK.** If you want to specify a specific number of readings to be taken or a specific stop time or date, click **Change (Alt-E).** This displays the STimer – Number of Data Readings to Take screen (see Figure 69).

6. **Click Start on the STimer Data Recording Screen.**
   The first reading is taken immediately, with each subsequent reading taken after the selected interval has expired. Additional readings may be taken at any time by pressing the spacebar or clicking **Record** on the Status Bar. STimer stops automatically when the stop time or date has been reached or when the specified number of readings has been taken. Click **Stop** on the STimer Data Recording Screen to stop data recording at any time (see Figure 68).

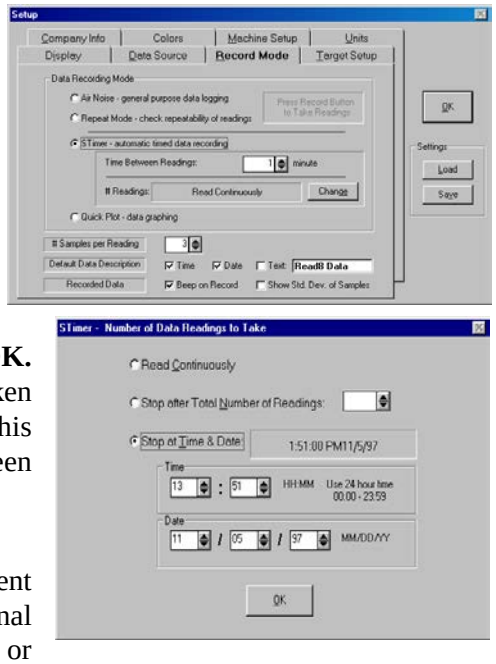


Figure 69 - *STimer Setup Information*

Using Quick Plot

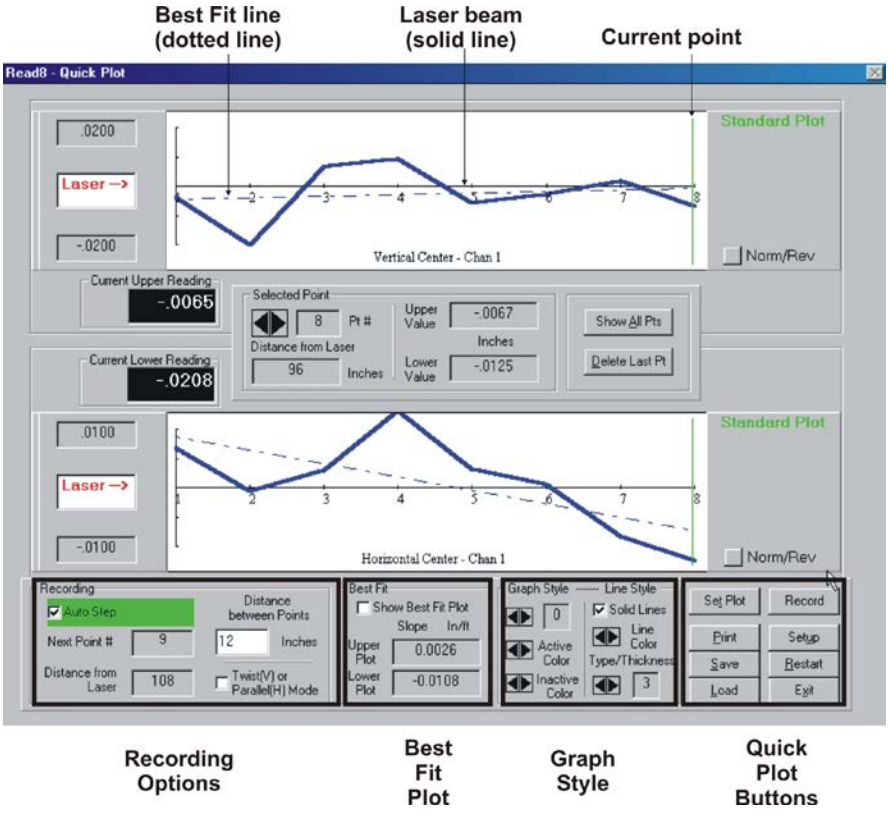


Figure 70 – *Standard Quick Plot Screen*

Quick Plot provides the Read8 user with a fast way of collecting and plotting straight-line alignment information. The user sets up the laser and target and bucks in the laser beam. The target is placed a specific distance from the laser, then moved that *same* distance for as many points as readings are needed. For example, if the target is 12 inches away from the laser, this data is recorded as Point 1. The target is then moved another 12 inches away from the laser and recorded as Point 2 (24 inches from the laser). This procedure is repeated at 36 inches, 48 inches, and so on until the desired number of readings is collected. The recorded information provides a plot of variations in vertical (side view) and horizontal (top view) center position. By using a scanning laser and two scanning targets, both the vertical and horizontal readings can be taken at the same time. If only one target is available, vertical readings can be taken separately from horizontal readings. A straight laser beam and a two-axis target can also be used.

Figure 70 displays a Standard Quick Plot screen with eight recorded points. In this Quick Plot screen

a. the upper graph reads the values for the *vertical* center and the lower graph reads the values for the *horizontal* center,
b. the vertical line at Point 8 (marked “Current point” in Figure 70) indicates that this is the current recorded point,
c. the *solid* line indicates the laser beam,
d. the *dotted* line indicates the “best fit” line, or the *average* of all recorded points, and
e. the values marked *Upper Value* and *Lower Value* between the two graphs denote the actual target reading at any given point. For example, if you click the arrows beneath **Selected Point** and select Point 8, the *Upper Value* reading is the target reading at Point 8 for the upper graph and the *Lower* reading is the target reading at Point 8 for the lower graph (see Figure 70).

Quick Plot contains a number of options for recording and viewing readings and for setting up the appearance of the graph (refer to Figure 70, beginning in the lower right-hand corner). The Graph Style and Best Fit Plot options can be displayed or hidden, depending upon the selections made in the Setup Quick Plot Targets and Display screen (see Figure 71).

Using the Quick Plot Buttons

The eight buttons at the bottom right of the Quick Plot screen are used as follows:

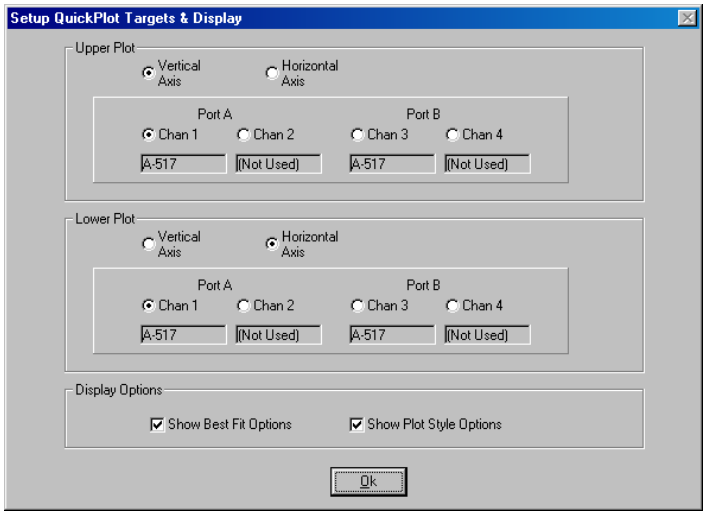


Figure 71 – *Setup Targets and Display Screen*

Set Plot
Click **Set Plot** or press **Alt-T** to display the Setup Quick Plot Targets and Display screen (see Figure 71). From this screen the user may specify the plot on which the vertical readings display and the plot on which the horizontal readings display, as well as the port and channel to which a target (or targets) is connected. In the Display Options section of this screen, the user can choose to display or hide the Best Fit and Plot Style Options on the Quick Plot screen by checking or removing the check from the appropriate box.

Record
Click **Record** or press the spacebar to record data.

Print
Click **Print** or press **Alt-P** to customize and print a Quick Plot report. Click the box next to an option to include that information in the printed report (see Figure 72).

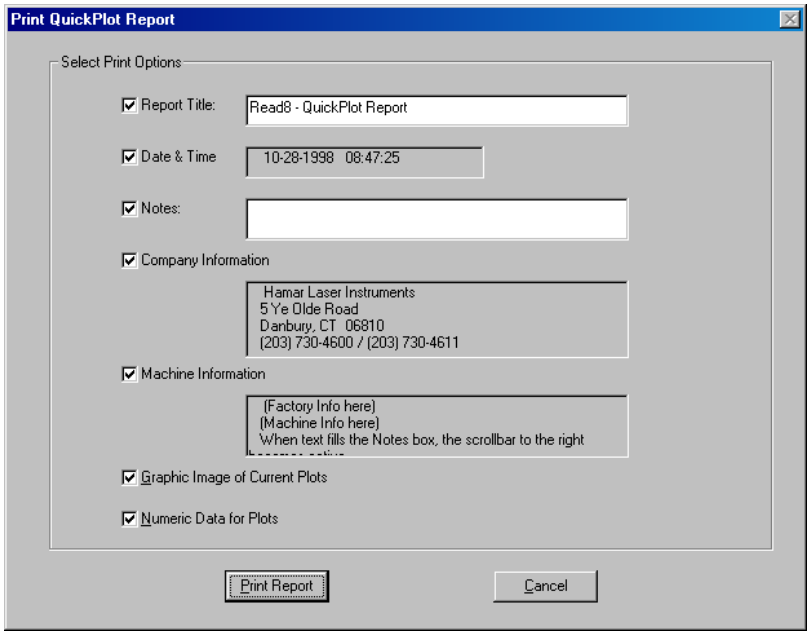


Figure 72 – *Printing a Quick Plot Report*

Setup
Click **Setup** or press **Alt-U** to access the Setup Menu.

Save
Click **Save** or press **Alt-S** to save a Quick Plot file. A saved file may be loaded and viewed. You cannot record data when a saved file displays on the screen.

Restart
Click **Restart** or press **Alt-R** to clear all recorded or previously saved data from the Quick Plot screen and begin a new plot.

Load
Click **Load** or press **Alt-L** to load a previously saved Quick Plot file.

Exit
Click **Exit** or press **Alt-X** to close Quick Plot and return to the current plot screen.

Customizing the Quick Plot Graph with Graph Style and Line Style

Note: *If the Graph/Line Style options do not display on your Quick Plot screen, click the* **Set Plot** *button or press* **Alt-T** *and then click the Set Plot Style Options box to activate this feature.*

Options for changing the graph and line styles are located to the left of the Quick Plot buttons. Choices of line color, line style and thickness, plot style and background color for the active and inactive plots (for information on inactive plot windows, see *Twist(V) or Parallel(H) Mode* on Page 57) can be made by clicking the arrows next to the style to be changed. All Quick Plot graph and line style settings are retained after Read8 is shut down.

Best Fit

Note: *If the Best Fit options do not display on your Quick Plot screen, click the* **Set Plot** *button or press* **Alt-T** *and then click the Show Best Fit Options box to activate this feature.*

Click the **Show Best Fit Plot** box to toggle the Best Fit feature on and off. When Best Fit is *off*, the actual target readings are recorded on the graphs, as well as an average or "best fit" (dotted line). When Best Fit is *on*, data is plotted relative to the best fit line rather than the laser plane, (see Figure 73) and the *difference* between each reading and the best fit line is displayed rather than the actual target readings. The Best Fit plot shows the maximum plus and minus deviations for all points from the best fit line, as well as the *difference* of the plus and minus deviations.

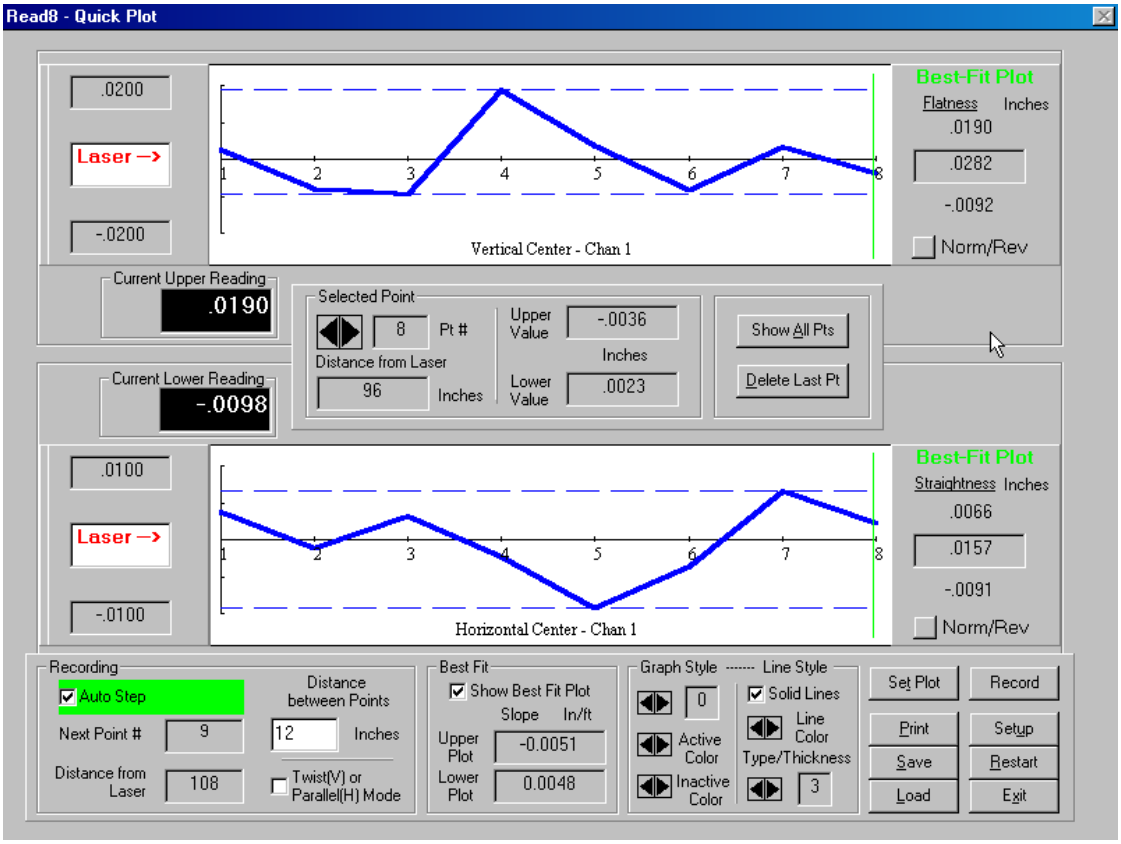


Figure 73 – *Best Fit Quick Plot Screen*

As previously discussed, the values marked *Upper Value* and *Lower Value* between the two graphs denote the actual target reading at any given point. For example, if you click the arrows beneath **Selected Point** and select a specific point, the *Upper Value* reading is the target reading at that point for the upper graph and the *Lower* reading is the target reading at that point for the lower graph. Similarly, the readings for *Upper Value* and *Lower Value* in the boxes beneath the **Show Best Fit Plot** box reflect the *slope* of the best fit line for the upper graph and lower graph (see Figure 74).

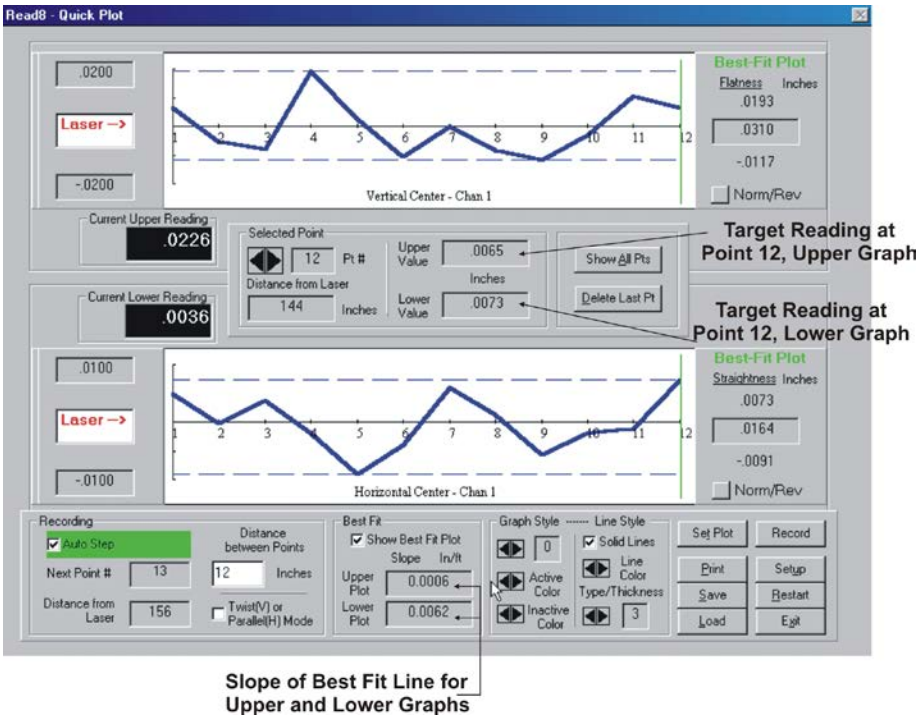


Figure 74 – *Target readings by point and slope of Best Fit line.*

The readings to the right of the Best Fit plot graphs (see Figure 75) indicate the *maximum*, *difference* and *minimum* values of the points on the Best Fit plot. The difference between the maximum and minimum values is the overall measure of straightness or flatness.

Recording Options

Auto Step – Check the box marked *Auto Step* to toggle the Auto Step feature on and off. When Auto Step is *on*, the cursor automatically advances to the next position when data is recorded. When Auto Step is *off*, data records at the same position and overwrites the previous data recording. Disabling Auto Step allows the user to move the target to a point where data has previously been recorded, select that point on the plot and retake the reading.

Distance between Points – Enter a number in this box to reflect the starting distance from the laser to the target. Move the target away from the laser the same distance each time it is moved. For example, if the original distance from the laser to the target is 12 inches, enter the number 12 in the Distance between Points field. The two boxes to the left (Next Point # and Distance from Laser) indicate that you are recording the first point 12 inches from the laser. When data is recorded at this distance, Next Point # changes to 2 and Distance from Laser changes to 24, indicating that you are recording the second point 24 inches from the laser.

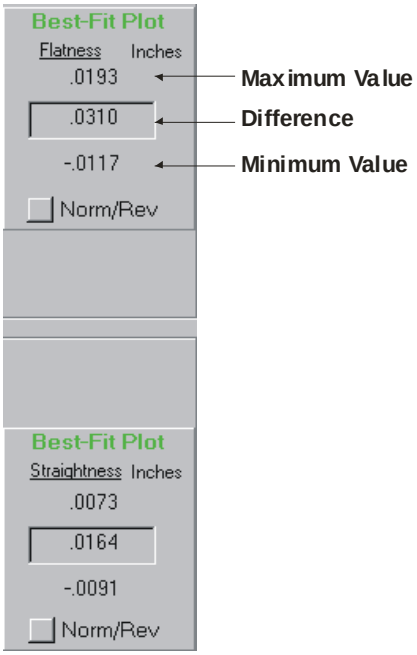


Figure 75 – *Maximum, Difference and Minimum Values for Best Fit Plot*

Twist(V) or Parallel(H) Mode

Click the box marked **Twist(V) or Parallel(H) Mode** to toggle Twist/Parallel mode on or off. This feature allows the user to plot two graphs independently for comparison purposes; parallelism is determined by taking two sets of *horizontal* readings and twist is determined by taking two sets of *vertical* readings. It is also possible to set one graph for vertical readings and one for horizontal readings and to take each *set* of readings (twist and parallelism) separately.

The following example shows how to check the two guideways of a way for parallelism:

1. Click **Set Plot** or press **Alt-T** to display the Setup Target Channels screen.
2. Set both the upper and lower plot to take *Horizontal* center readings (see
3. Figure 76).
4. Click the **Twist/Parallel Mode** box to enable this feature. If there is any information from previous readings on the screen, click **Restart** or press **Alt-R** to clear the plot screen. The first set of readings are recorded in the upper plot.
5. Move the target down one guideway and record the desired number of readings.
6. Set up the laser and target for the parallel guideway.
7. Click the lower plot screen or click the **Lower Plot** button to enable the lower plot and take the same number of readings on the *parallel* guideway

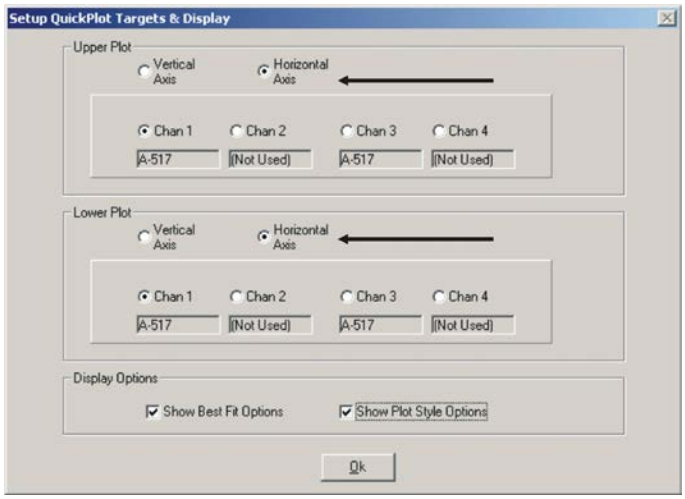


Figure 76 – *Setting both plots for horizontal readings*

The measure of parallelism is depicted in Figure 77 and is calculated by taking the difference between the slopes of the two guideways. Adjust the guideways *only* if the parallelism number is out of tolerance. After adjustments are made, repeat the above procedure to determine if the parallelism number is within tolerance.

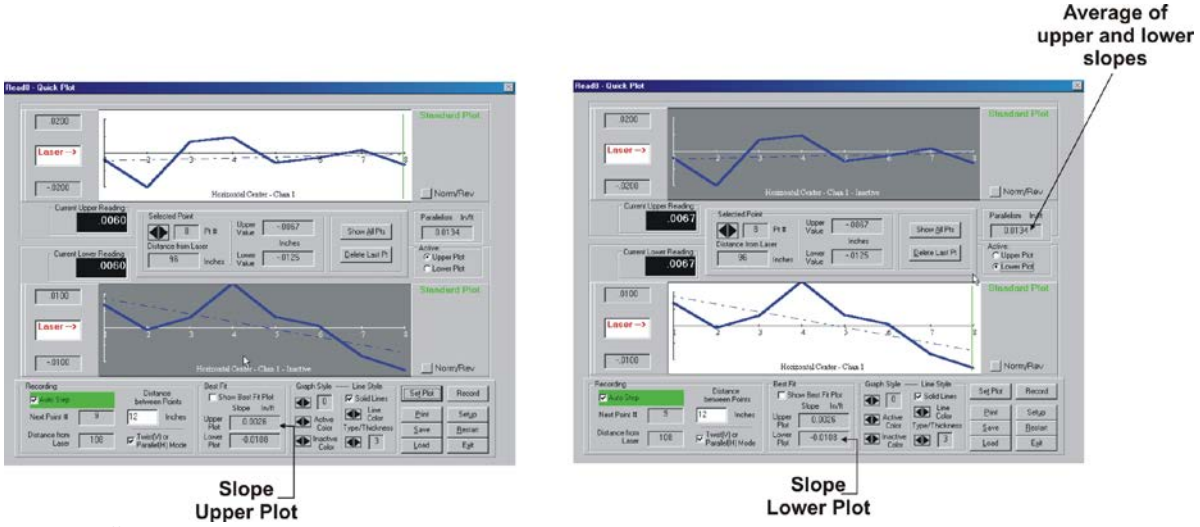


Figure 77 – *Differences between upper and lower slopes*

Using Normal/Reversed Modes

Occasionally it is necessary to mount a target upside down, causing all readings to be negatives of what they would normally be. Click **Norm/Rev** to switch to Reversed Mode (see Figure 78). This inverts the values for convenience in displaying and interpreting the numbers read from the target.

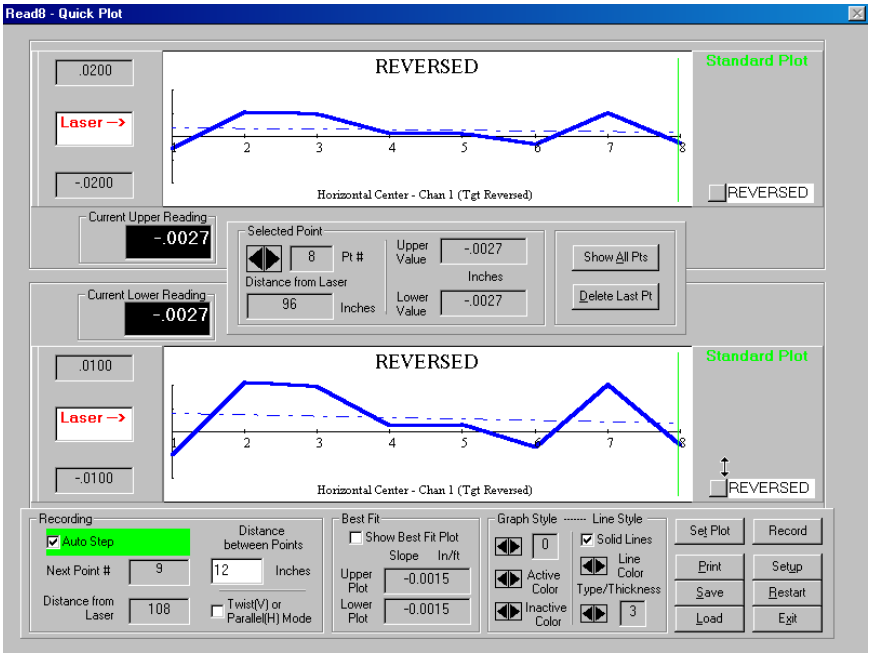


Figure 78 – *Reversed Mode*

Changing Laser Orientation

To change the orientation of the laser on the screen to match your physical setup, move the cursor into the box marked **Laser**. The cursor becomes a double-headed arrow. Click to change the laser orientation from one side to the other.

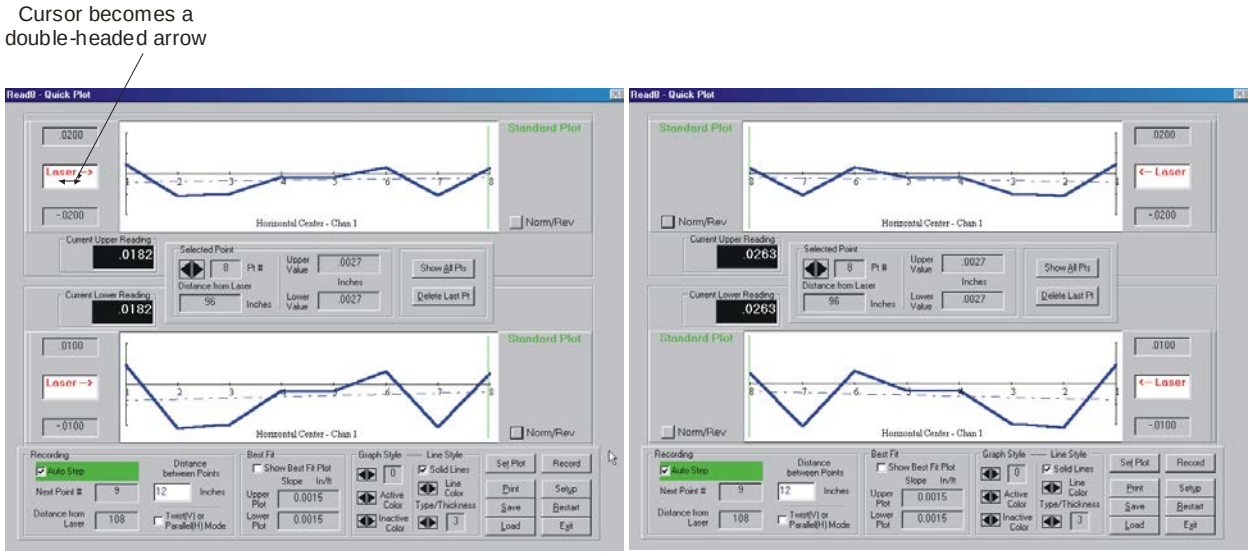


Figure 79 – *Changing laser orientation*

Delete Last Point

Click **Delete Last Point (Alt-D)** to delete the last point of any *enabled* graph. If both graphs are enabled, the last point is deleted on both graphs. If only one graph is enabled, for example when using the Twist/Parallelism mode, only the last point of the enabled graph is deleted.

Zooming In and Using Show All Points

Click the left mouse button on or near a point to zoom in or magnify a specific area of a graph. Hold the left mouse button down and drag the vertical line that displays to any *other* point. In Figure 80, Point 2 has been selected and dragged to Point 3. When the two points are selected, click the *right* mouse button to magnify or zoom in on that area. Auto Step is automatically disabled and recording overwrites the selected point. To return to the full graph view, click **Show All Points**, press **Alt-A**, or click the *right* mouse button while the cursor is positioned in the graph. To resume using Auto Step, enable the **Auto Step** button.

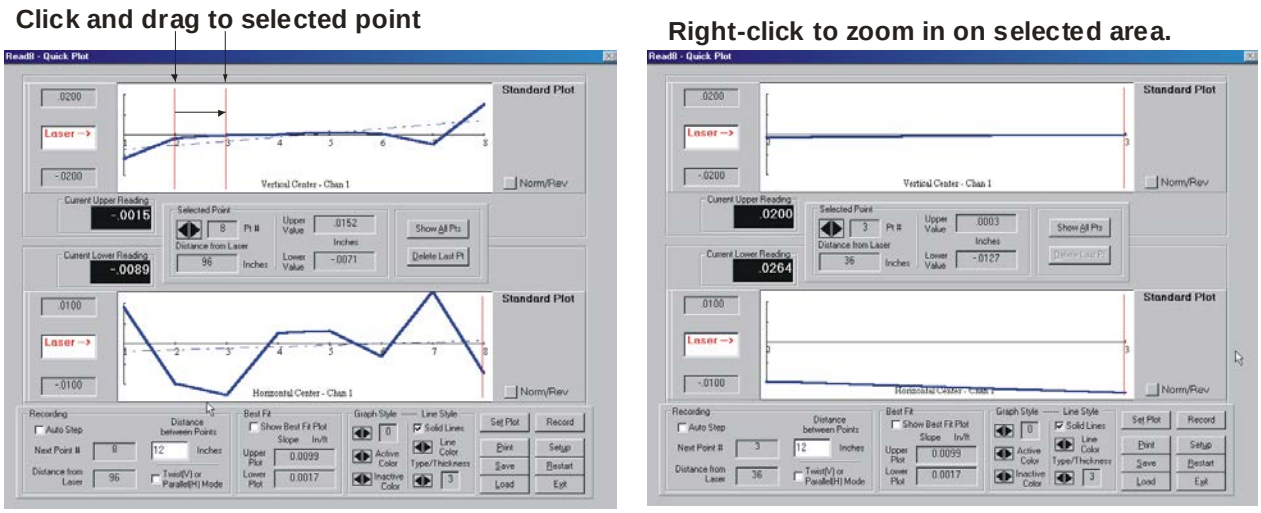


Figure 80 – *Zooming in on a graph*

Appendix A - The NORMIN Procedure

The NORMIN method was developed by Hamar Laser Instruments as a way of compensating for laser or target mounting errors in bore or spindle work. The word is a contraction of "NORMal-INverted," which briefly describes the method. It is quite similar to the four clock readings taken with dial indicators, but uses a laser and a target instead. The NORMIN method is used in conjunction with simple fixtures and targets that allow inexpensive, precision measurement. The target/fixture is set in the bore or spindle in the NORMal position (cable down) and the readings are recorded. Then the target/fixture is rotated 180 degrees to the INverted (cable up) position, and a second set of readings is obtained. The two sets of readings cancel out centering errors and provide a very accurate result.

There are three centers involved in bore alignments: the True Bore Center, the Target Center, and the Laser Beam Center. If mounting fixtures were perfect, the Target Center would be located at the True Bore Center, and if perfectly aligned, the True Bore Center would be located at the laser beam center. In reality, however, they seldom line up. An example of the three centers with respect to one another is shown in Figure 81.

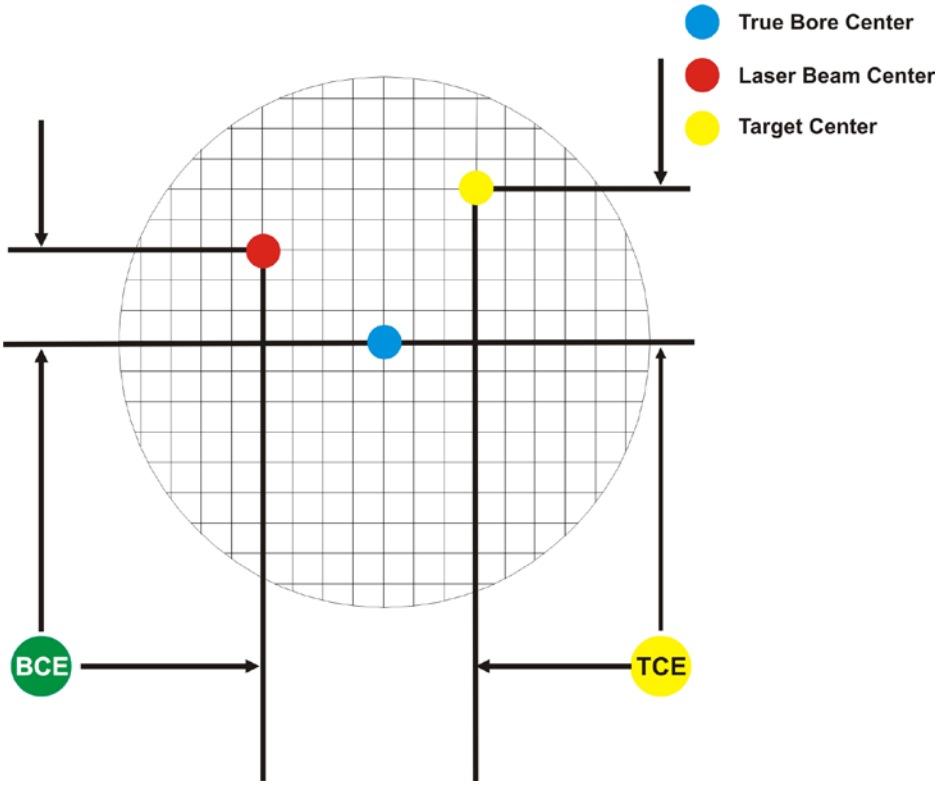


Figure 81 – *Three centers of bore alignment*

Two relationships can be calculated from these three centers and two sets of NORMIN readings: the Target Center Error (TCE) and the Bore Center Error (BCE). The Bore Center Error (BCE) is used when it is desirable to know the true bore centerline position relative to the laser beam center without fixture errors. Usually, the laser beam center is where a bore center *should* be located, and the BCE shows its *actual* location. The Target Center Error (TCE) is used if the operator wants to place the laser beam center exactly in the middle of a bore.

The general rule is: buck in to the TCE and measure the BCE.

The readout always shows the displacement between the Target Center and the Laser Beam Center. When the Target Center is not on the True Bore Center, the numbers and the signs on the readout will change when the target is rotated because the Target Center is moved to a different location in relationship to the laser beam.

Figure 82 represents the target in the NORMal position, with the cable *down*. If each square represents .001", the Target Center is .001" higher than the Laser Beam Center (+.001") and is .007" to the right of the Laser Beam Center (+.007").

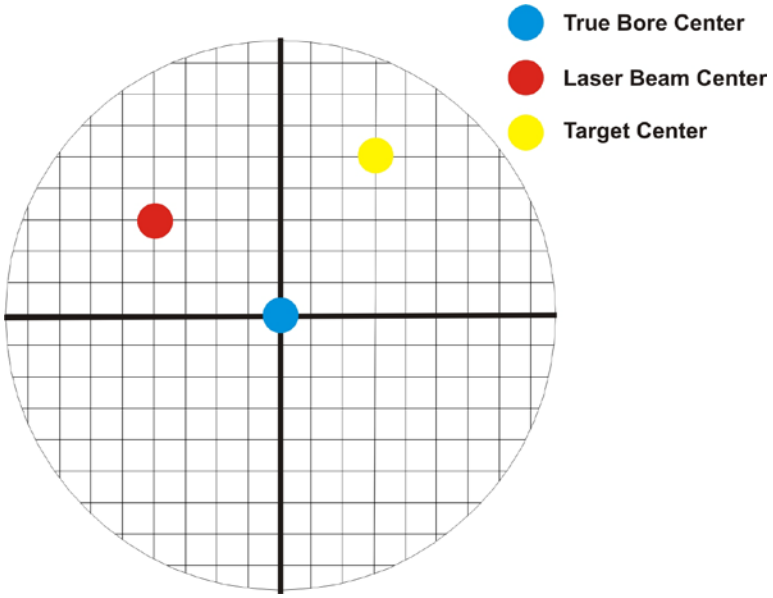


Figure 82 – *Target in the NORMal position*

Figure 83 represents the target in the INverted position, with the cable *up*. When the target is rotated, the *signs* on the readout are also rotated. Therefore, although the Target Center appears to be to the right of and lower than the Laser Beam Center in Figure 83, the vertical readings will be positive and the horizontal readings will be negative. When the vertical TCE is calculated, (NORMal+INverted divided by 2) the Target Center is .004" higher and .003" to the right of the True Bore Center in the NORMal position.

The table below shows the calculation of the vertical and horizontal TCE values.

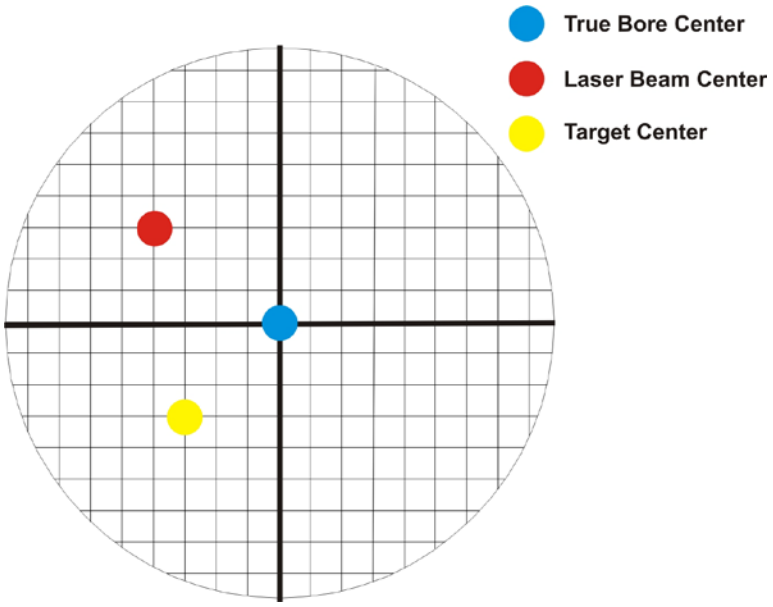


Figure 83 – *Target in the INverted position*

NORMal Vertical Reading	+.001"		NORMal Horizontal Reading	+.007"
INverted Vertical Reading	+.007"		INverted Horizontal Reading	-.001"
Total	+.008"		Total	+.006"
Divide by 2 = **Vertical TCE**	**+.004"**		Divide by 2 = **Horizontal TCE**	**+.003"**

If you place the Laser Beam Center exactly on the True Bore Center with the target in the NORMal position, the readings will show Vertical +.004" and Horizontal +.003".

Appendix B – The A-910 Radio Transceiver/Hub

Front Panel Features

1. **Power ON indicator and Low Battery indicator**
2. **Internal backup battery charging indicator and USB LINK ESTABLISHED indicator**
3. **TX indicator:** blinks when device is transmitting data to the target(s)
4. **RX indicator:** blinks when the device is receiving data from targets or other transceivers.
5. **System ID setting switch:** set to the same number as the R-1307's CH (Channel) number.

Figure 84 – *The A-910 Radio Transceiver/Hub FRONT PANEL*

Rear Panel Features

1. **Not used**
2. **USB/Data I/O Port**
3. **Power Switch**
4. **External power supply:** required only for computers that cannot provide adequate power (5V, 400 mA) through the USB port.
   Note: *When using the USB Extender™ cable extension kit, plug the A-910-2.4 into an A/C power supply.*
5. **Antenna**

Figure 85 – *The A-910 Radio Transceiver/Hub REAR PANEL*

See Appendix C for radio specification details.

MODEL NUMBER	PRIMARY FREQUENCY
A-910-900	900 MHz
A-910-2.4	2.4 GHz

Using the R-1307 with a Local Target and the A-910 Radio Transceiver

Setting the Target Network ID and System ID for the R-1307 Readout

To make the unit visible to all other radio-enabled devices, you must set the Target Network ID and the System ID for the readout.

1. **Set the Local Readout/Target Network ID**
   Press the MENU button until the *upper* display shows id□: nn □(nn is also equal to the R-1037 number) and the matching Target number with the current Target ID (nn) blinking. Use the UP and DOWN arrow keys to set the Target ID.

   Press the MENU button again until the lower display shows id. □nn □with the current Target ID (nn) blinking. Use the UP and DOWN arrow keys to set the Target ID to the same value as that of the upper display's Target ID.

2. **Set the System ID (Radio Channel)**
   Press the MENU button until the upper display shows ch□: nn, with the current System ID (nn) blinking. Use the UP and DOWN arrow keys to set the System ID.
   Note that **nn** must be set to the same number as the channel switch setting of the A-910 radio transceiver (see Figure 84, #5).

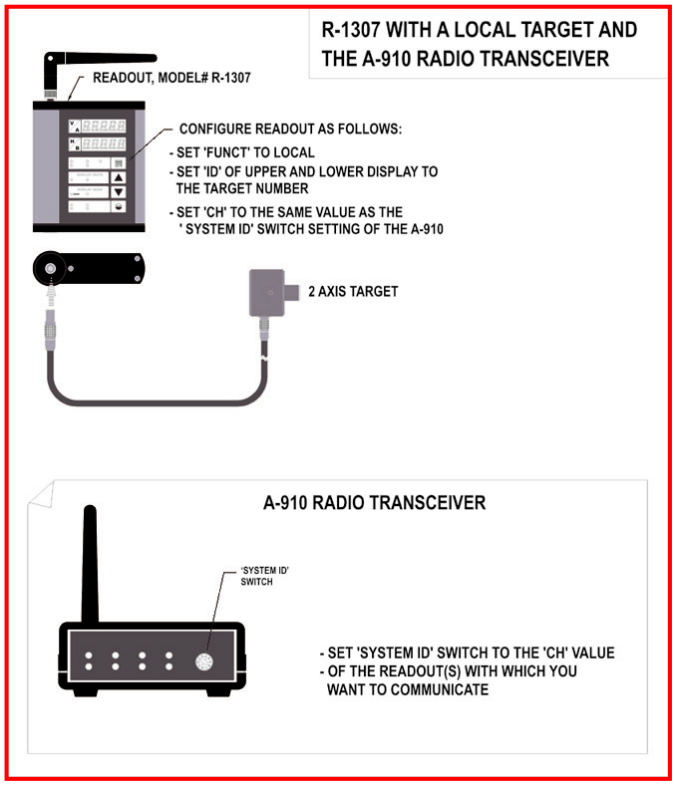


Figure 86 -- *R-1307 with Local Target and A-910 Radio Transceiver*

Miscellaneous Display Messages

-HLI-	
r 1.00	Startup Message. Lower Display shows firmware Revision Number.
...	3 moving dots. Wireless target is not responding to a polling request from Readout. Check ID and Channel settings. Check Target(s).
- - -	3 dashes. Target detected but the laser is not on target. Check laser.
ch:no	
rAd io	Radio channel cannot be selected because no Radio is present or detected. Standard message for R-1307C. For Models R-1307 or R-1307W, this message indicates a fault in the radio module.
FAuLt	
PSd	Indicates a problem with the connection to the Local Target's Position Sensing Device (PSD). Check plugs and cable(s).
tGt_n	
UncAL	Target 'n' descriptor does not contain target calibration data.

See Appendix D on Page 68 for the complete R-1307 menu.

Appendix C - Agency Certifications

Agency Certifications for the 2.4 GHz Radio Transceiver

FCC (United States of America) Certification

Contains FCC ID: OUR-24XSTREAM
The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

⚠ RF EXPOSURE WARNING: This equipment is approved only for mobile and base station transmitting devices, separation distances of (i) 20 centimeters or more for antennas with gains < 6 dBi or (ii) 2 meters or more for antennas with gains ≥ 6 dBi should be maintained between the antenna of this device and nearby persons during operation. To ensure compliance, operation at distances closer than this is not recommended

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IC (Industry Canada) Certification

Contains Model 24XStream Radio (2.4 GHz), IC: 4214A 12008
Complies with IC ICES-003

CE ⓘ

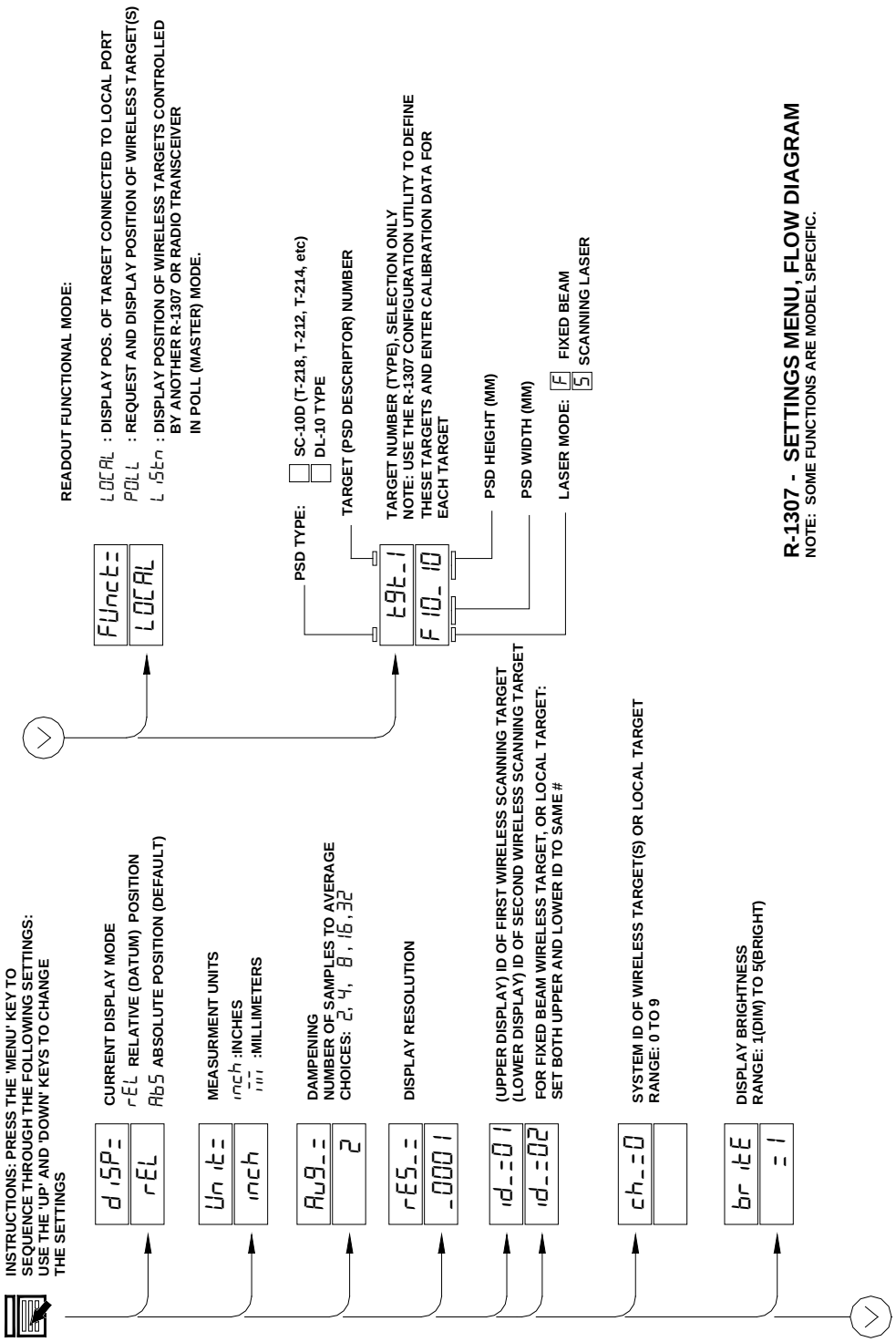
Complies with ETSI. *France – France imposes restrictions on the 2.4 GHz band. Go to www.art-telecom.Fr or contact MaxStream♦ for more information. Norway – Norway prohibits operation near Ny-Alesund in Svalbard. More information can be found at the Norway Posts and Telecommunications site (www.npt.no).*

Since the 2.4 GHz band is not harmonized throughout Europe, other restrictions may apply to your country.

Technical Data:
• OEM radio transceiver, model number: 24XStream
• Frequency Band: 2400.0 – 2483.5 MHz
• Modulation: Frequency Shift Keying
• Channel Spacing: 400 kHz
• ITU Classification: 400KF1D
• Output Power: 100 mW EIRP max.
• Notified Body Number: 0891

♦ The radio Transceiver contained in the A-1519/A-1520 Type II Universal Wireless Targets is manufactured by MaxStream®. For more information pertaining exclusively to the Radio Transceiver please contact MaxStream at 1.801.765.9885 or visit their web site: http://www.maxstream.net

Appendix D – The R-1307 Menu



Appendix E – Using the Zigbee® Radio Utility

Pre-installing the Common USB Port Driver (A-910-2.4ZB)

This driver is required for the A-910-2.4ZB Transceiver and to communicate with targets via the computer's USB port. The driver creates a virtual COM Port that is recognized by the applications as a standard serial port.

Note: *You must pre-install this driver prior to connecting the device(s) to the computer through the USB port.*

Installing the Driver

1. Insert the A-910-2.4ZB Radio Programmer CD in the CD ROM drive.
2. Select **My Computer**, locate the CD ROM icon and click to open it.
3. Select the USB Drivers folder.
4. Select the correct Operating System installed on your computer (Windows 2000, Windows XP, etc.) and open the folder.
5. Locate the **CP210x_VCP** icon and click to initiate the installation process. The **Install Driver** dialog box displays.
6. Click **Browse** to select an installation folder different from the default folder (optional).
7. Click **Install** to continue. Once the installation is complete, the **Installation Successful** message displays (see Figure 87).

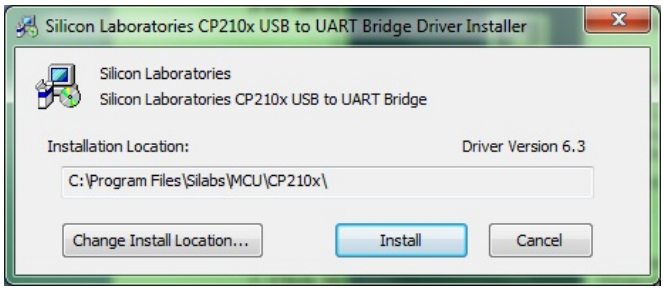


Figure 87 - *USB Common Driver Install*

Installing the A-910 Utility Software

1. Insert the A-910-2.4ZB Radio Programmer CD in the CD ROM drive.
2. Select **My Computer**, locate the CD ROM icon and click to open it.
3. Locate the **Setup** icon and click to initiate the installation process. Click **NEXT** to continue.
4. Click **Browse** to select an installation folder different from the default folder (optional).
5. Click **Next** to continue. Once the installation is complete, the **Installation Complete** message displays. Select **Close.**

Configuring the Hardware and Utility Settings

1. Insert the A-910 ZB dongle into any unused USB Port (see Figure 88). The computer should automatically assign a COM port number to the dongle.
2. Start the A-910 Utility Software. The software should display the COM port assigned to the Zigbee Dongle (see Figure 89). If the utility does not automatically detect the COM port, it must be manually selected (see **Manually Selecting a COM Port** on Page 71).
3. The Target System ID or R-1307 CH (channel) is the number associated with the A-1519/1520 targets or R-1307 Readout. If using both the A-1519/1520 targets and an R-1307 Readout, both need to be set to the same system ID and channel (see Figure 90).

Figure 88 – *A-910 Zigbee Dongle*

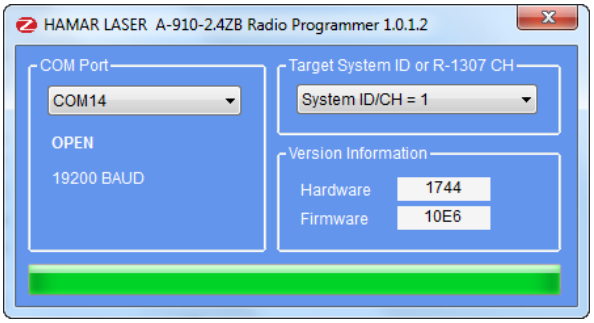


Figure 89 – *A-910 Utility showing the COM Port, System ID and Channel settings*

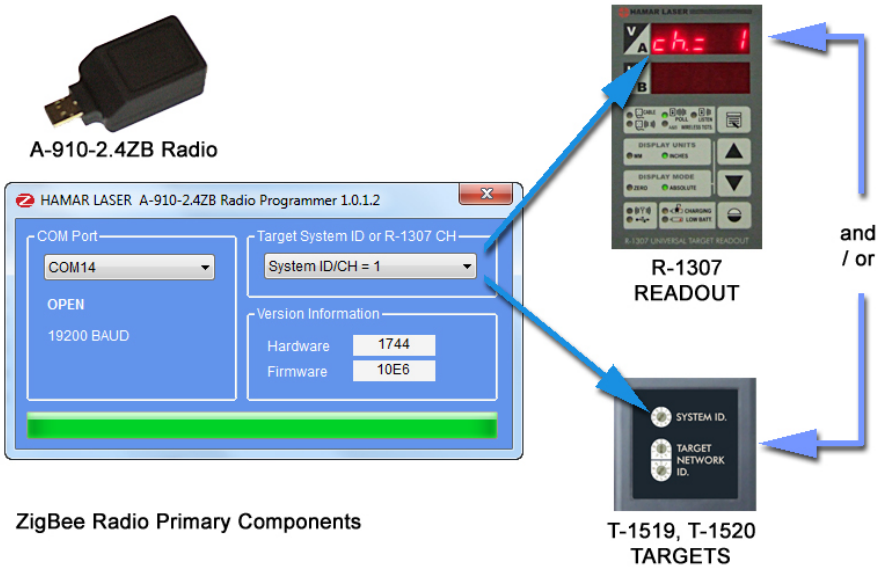


Figure 90 – *System ID Setup*

Manually Selecting the COM Port

The A-910 Utility should automatically detect the COM Port upon startup. If not, use the following steps to locate the correct COM Port.

Windows XP

1. Right-click My Computer.
2. Click **Properties** and then select the **Hardware** tab.
3. Click **Device Manager**.

Windows 7

1. Click the **Start** button and select **Control Panel**.
2. Click the **System** icon.
3. In the **System** window, click on the Device Manager link located under the **System** heading.
4. In Device Manager, scroll down to **Ports.** Expand the listings under **Ports** to reveal all the ports installed.
5. Locate **SILICON LABS CP210x USB to UART Bridge (COM x)** (see Figure 91**).**
6. Note the COM Port listed and select that COM Port in the A-910 Zigbee Utility software using the drop-down arrow (see Figure 90).

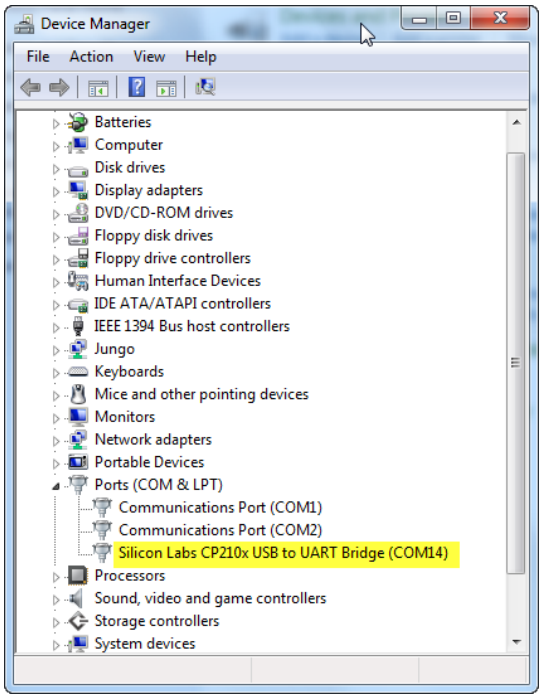


Figure 91 -- *Device Manager showing COM Port for A-910 Dongle*

Setting the Target System ID and Target Network ID

The System ID is a Radio Network Address that is used by the Radio Communications Protocol to filter unwanted data from other radio transceivers and targets using a different address. Only targets and radio transceivers that are set to a matching System ID can communicate with each other.

Because no two targets with the same System ID can transmit simultaneously, it is necessary for each target to be programmed to respond only when it is being addressed. The Target Network ID is the target address on the communications network. Under Host (computer) control, the radio transceiver transmits a message called a *polling request* that contains the Target Network ID of one specific target. All targets receive all polling requests, but only the target with a Network ID matching the ID contained in the polling message will reply (Transmit Data to the Host).

There are three rotary DIP switches located on the right side of the target, shown in Figure 92:

- The uppermost switch sets the System ID.
- The two lower switches are used to set the target network ID.

Figure 92 – *Unitarget ID Switch set to1*

Setting the System ID

Note: *Before selecting a System ID, ensure that it is not already in use by another system within the radio coverage area.*

Using a small screwdriver, rotate Switch 1 to align the arrowhead with the System ID number (0-9). Figure 92 shows the System ID switch set to 1.

Setting the Target Network ID and System ID for the R-1307 Readout

To make the unit visible to all other radio-enabled devices, you must set the Target Network ID and the System ID for the readout.

1. **Set the Local Readout/Target Network ID**
   Press the MENU button until the *upper* display shows `id=nn` (nn is also equal to the R-1307 number) and the matching target number with the current target ID (`nn`) blinking. Use the UP and DOWN arrow keys to set the Target ID.

   Press the MENU button again until the lower display shows `id=nn`, with the current target ID (`nn`) blinking. Use the UP and DOWN arrow keys to set the Target ID to the same value as that of the upper display's Target ID.

2. **Set the System ID (Radio Channel)**
   Press the MENU button until the upper display shows `ch = nn`, with the current System ID (`nn`) blinking. Use the UP and DOWN arrow keys to set the System ID.
   Note that **nn** must be set to the same number as the channel switch setting of the A-910 radio transceiver (see Figure 93).

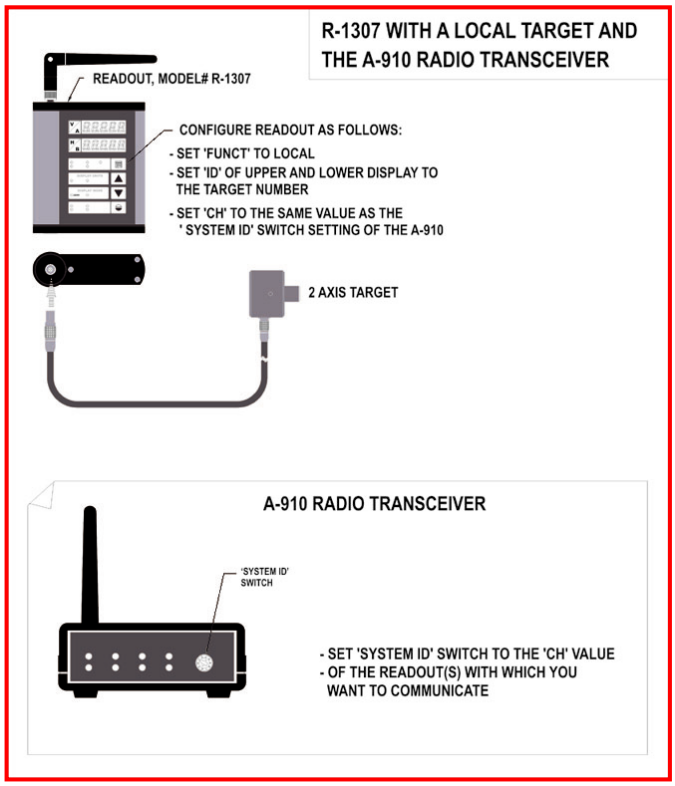


Figure 93– *R-1307 with Cabled (Local) Target and A-910 Radio Transceiver*

Miscellaneous Display Messages

`-HLI-`	
`r 1.00`	Startup Message. Lower Display shows firmware Revision Number.
`...`	3 moving dots. Wireless target is not responding to a polling request from Readout. Check ID and Channel settings. Check Target(s).
`- - -`	3 dashes. Target detected but the laser is not on target. Check laser.
`ch=no`	
`rAd io`	Radio channel cannot be selected because no Radio is present or detected. Standard message for R-1307C. For Models R-1307 or R-1307W, this message indicates a fault in the radio module.
`FAuLt`	
`PSd`	Indicates a problem with the connection to the Cabled (Local) Target's Position Sensing Device (PSD). Check plugs and cable(s).
`tGt_n`	
`UncAL`	Target 'n' descriptor does not contain target calibration data.