

Operations Manual

Read9 Alignment Software

November 2013



HAMAR LASER INSTRUMENTS, INC.
www.hamarlaser.com

Five Ye Olde Road, Danbury, CT 06810
Phone: (800) 826-6185 Fax: (203) 730-4611

WARRANTY

Hamar Laser Instruments, Inc., warrants each instrument and other articles of equipment manufactured by it to be free from defects in materials and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument and other article of equipment which shall, within one year after shipment of each instrument and other article of equipment to the original purchaser, be returned intact to Hamar with transportation prepaid, and which Hamar's examination shall disclose to Hamar's satisfaction to have been thus defective; other than this express warranty, Hamar neither assumes nor authorizes any other persons to assume for it any other liability or obligation in connection with the sale of its products.

This warranty is not applicable to instruments or other articles of equipment manufactured by other companies and limited by a warranty extending for less than one year. In such an event, the more limited warranty applies to said instrument or article of equipment.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the Hamar factory, nor which has been subject to misuse, negligence, or use not in accord with instructions furnished by the manufacturer.

The software described in this manual is furnished under a license agreement and may be used or copied only in accordance with the terms of the agreement. It is against the law to copy the software on any medium for any purpose other than the purchaser's personal use.

The information in this manual is subject to change without notice. No part of this manual may be reproduced by any means, electronic or mechanical, without written permission from Hamar Laser Instruments, Inc.

**© Copyright Hamar Laser Instruments, Incorporated, 2014
5 Ye Olde Road, Danbury, Connecticut 06810**

Table of Contents

Introducing the READ9 Program.....	1
Unidentified USB Device.....	1
Restoring Read9 Software	2
Model 1 – Restoring Read9 Software from the SD Card (Dell & HP iPaq PDA)	2
Model 2 – Restoring Read9 Software for the HP Model 211 PDA	2
Model 3 – Restoring Read9 Software for the Nomad Trimble ZigBee.....	2
Using READ9 with the Nomad PDA Equipped with a ZigBee Radio	3
Getting Started.....	3
Using the Read9 Program (Setup Tab).....	4
The READ Screen (READ Tab)	5
Value	5
OFF TGT	5
Blank Readout.....	5
Low Battery/Excessive Light Warnings	5
Mode Buttons.....	6
Averaging Slider Bar	6
Target Bank Checkbox.....	6
The SETUP Screen (SETUP Tab).....	7
Communications Setup	7
Data I/O Mode (IR, RADIO and RADIO LISTEN)	7
Target/Display Settings	8
The MODE Screen (MODE Tab).....	9
Relative Alignment	9
Discrete Alignment	9
The ALIGN Screen (ALIGN Tab).....	10
Relative Alignment/Slope.....	10
Relative Alignment/Slope+Offset.....	10
Discrete Alignment	11
Using Target Extensions (EXT. Tab).....	11
Entering Values for Target Extensions	12
A-1519/1520 Type II Universal Wireless Targets - Overview	13
Identifying Target Features.....	13
Using the UniTargets in RS-485 Mode	14
Using the Target as a Height Gage.....	14
Appendix A – Restoring the Read9 Software.....	15
Restoring the Read9 Software to the Dell Axim® PDA	15
Method 1 – Restoring the Read9 Software Using the Data Backup Utility.....	15
Restoring the READ9 Software to the HP 211 PDA	15
Performing a Hard Reset.....	15
Restoring the READ9 Software.....	16
Appendix B – Connecting UniTargets in RS-485 Mode	17
Programming Considerations for UniTargets	19
Acquiring Data in RS-485 Mode	19

Introducing the READ9 Program

Read9 is an alignment program that runs under Windows CE™ on handheld computers. The program acts as a multi-target readout when used with Hamar Laser's Universal Wireless Targets and a scanning laser, providing a graphic display for basic alignment functions.

This manual assumes that you are familiar with the operation of the PDA and the Windows CE™ program. To navigate through the Read9 software, *use the tabs at the bottom of the screen*. Except when instructed, clicking the **OK** button in the upper right-hand corner of the screen will close the program. Before performing an alignment, it is suggested that you view each program screen and follow the descriptions of the features in this manual. Selecting the Read9 icon displays the opening screen (see Figure 1).

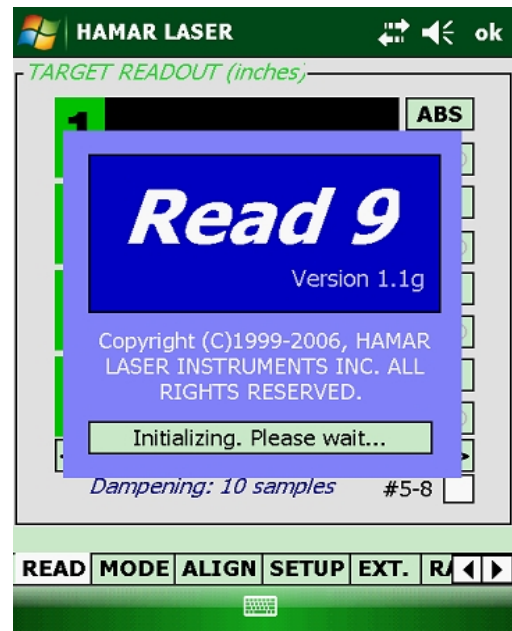
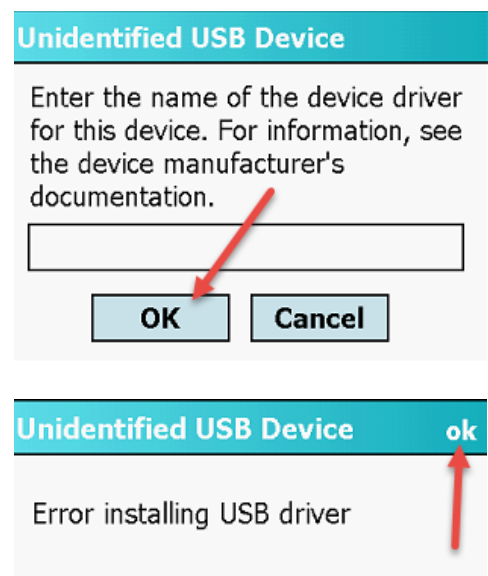


Figure 1 – Read9 Opening Screen

Unidentified USB Device

When the Nomad PDA is shut down and restarted, the pop-up message **Unidentified USB Device** displays. Press **OK**. A second pop-up message **Error Installing USB Driver** displays. Press **OK**. *The driver has been installed and is working correctly.*

If you press **CANCEL** in the previous step, the PDA must be rebooted. Pressing **CANCEL** turns off the ZigBee radio card and the device will no longer receive a signal from the target. The name of the driver is entered when Hamar Laser Instruments installs the Zigbee card and software, so entering the name of the USB driver is unnecessary.



Restoring Read9 Software

Note: *Also see Appendix A beginning on Page 15.*

Model 1 – Restoring Read9 Software from the SD Card (Dell & HP iPaq PDA)

Note: *If you have a factory backup on your SD Card, please refer to Appendix A on Page 15.*

1. Close all programs.
2. Click **Programs** from the top-level menu.
3. Click the **File Explorer** icon to open the browser.
4. Click **My Devices** located on the upper left of the screen, and scroll down to **SD Card**.
5. Install the listed software in the following sequence:
 (STEP 1) **elSer...**
 (STEP 2) **msv...**
 (STEP 3) **Read...**
6. Reboot the PDA by pressing the **Reset** button located on the back of the unit.

Model 2 – Restoring Read9 Software for the HP Model 211 PDA

See Appendix A beginning on Page 15 for complete instructions.

Model 3 – Restoring Read9 Software for the Nomad Trimble ZigBee

1. Close all programs.
2. Click **Programs** from the top-level menu.
3. Click the **File Explorer** icon to open the browser.
4. Click **My Devices** located on the upper left of the screen, and scroll down to **Program Files/Read9 Backup**.
5. Install the listed software in the following sequence:
 msvbppc.armv4
 Prog-ZB_Setup
 Read9_11g.Ar...
6. Reboot the PDA by holding down the **Green** power button until the countdown begins and release to show the **Power Menu**. Select **Reset** to reboot.
7. Upon restart, if the message *Unknown USB Device* displays, press **OK**. **Do not press CANCEL**. If you press **CANCEL**, you must reboot the PDA again. When the *Unknown USB Device* message displays, press **OK**. Pressing **CANCEL** turns off the ZigBee radio card and you will no longer receive any signal from the target.

Using READ9 with the Nomad PDA Equipped with a ZigBee Radio

Your Nomad PDA comes with two preinstalled versions of Read9. Both versions are accessible from the Start Menu.



READ9 is the main application. It includes all standard functions, such as **Align** and **Target Extensions**.



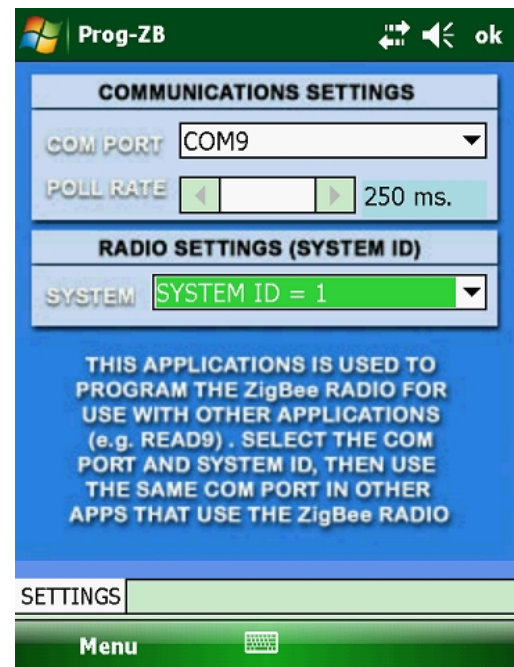
PROG-ZB At present, this application is used primarily for programming the System ID used by the ZigBee radio to communicate with the A-1519 and A-1520 targets.



Getting Started

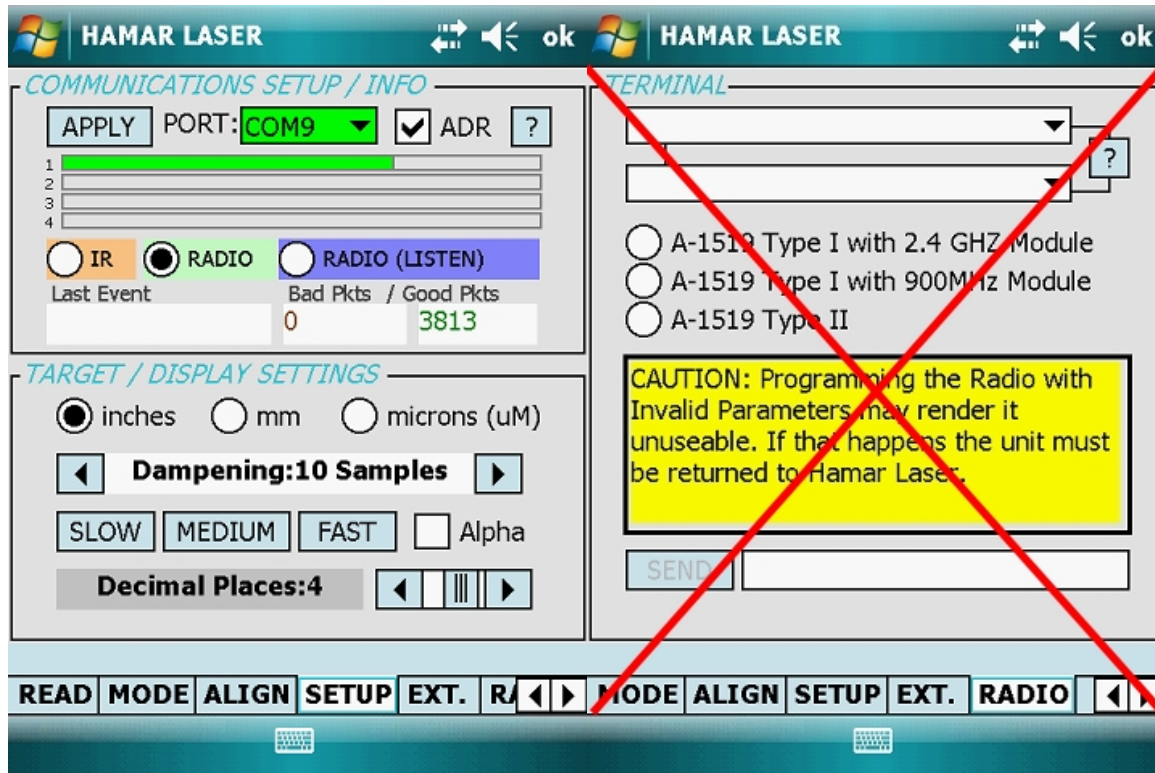
1. Run **Prog-ZB** and select **COM9**.
2. Select a **SYSTEM ID** that matches the System ID setting of your A-1519 or A-1520 target(s).
3. Close this application by clicking **OK**, located in the upper right corner of the screen.
4. Open Read9.

NOTE: *READ9 will not be able to access the ZigBee radio while this application is active.*



Using the Read9 Program (Setup Tab)

1. Run **READ9** from the **Start** menu. Click the **Setup** tab after the program initializes.
2. Select **COM9** as the port.
3. Select **RADIO**. *The IR and RADIO (LISTEN) options are not applicable to ZigBee units.*
4. Tap **APPLY**. If your laser is powered on and hitting the center of the target(s), the bars numbered 1-4 light in green as shown below.



WARNING: Do not use the **TERMINAL** function in READ9. It is not applicable to ZigBee radio units. Use the Prog-ZB application to change the ZigBee radio System ID (Getting Started, Step 2 on Page 3).

The READ Screen (READ Tab)

The READ screen provides a numeric display of values for the connected targets. The characters 1 through 4 refer to the corresponding labels on the targets (up to four target readings can be displayed simultaneously, as shown in Figure 2). Each READ target box can display one of the following:

Value

A numeric value represents the position of the laser plane relative to the target centerline (see Figure 3). A *positive* reading indicates that target is *above* the laser plane; a *negative* reading indicates that the target is *below* the laser plane.

OFF TGT

If OFF TGT is displayed in a READ target box, the Universal Wireless Target is detected, but the laser plane does not intercept it. Make target setup adjustments until the laser beam hits the target.

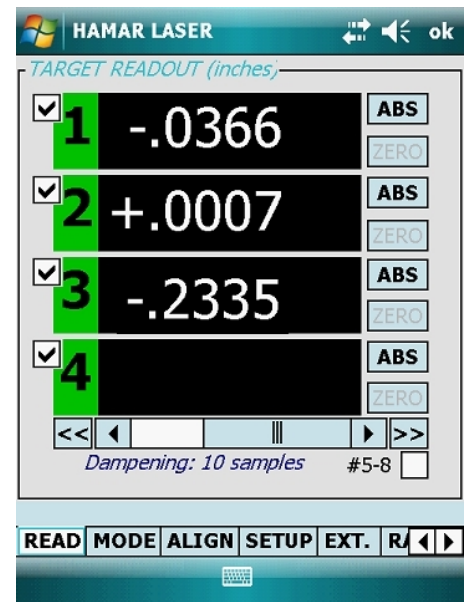


Figure 2 – Read9 Read Screen

Blank Readout

If *no* information is displayed in a READ target box, either a target (1-4) is not present or it is out of range of the ZigBee Receiver. The green bars on the SETUP screen indicate the strength of the infrared signal received from the targets (see *The Setup Screen* beginning on Page 7).



Figure 3 -- Universal Wireless Target (showing centerline)

Low Battery/Excessive Light Warnings

The Universal Wireless Targets feature automatic background-light correction for extremely accurate readings. Read9 provides warnings (by target number) when target battery is low or when there is excessive background light affecting a target (see Figure 4).

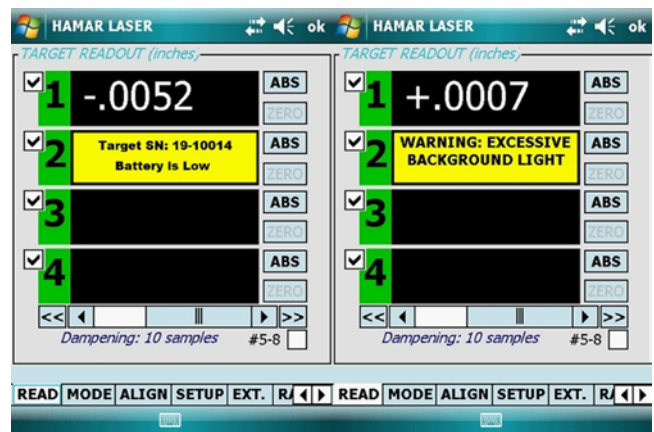


Figure 4 – Low Battery and Excessive Light Warnings

Mode Buttons

The buttons located to the right of the target boxes are used to set the reading mode (see Figure 5). Click on ABS or REL to toggle between ABSolute and RELative modes.

- **ABSolute Mode** – an absolute value indicates *exactly* where the laser plane hits the target cell. The numbers in the reading will be white.
- **RELative Mode** – when relative mode is selected, click ZERO to zero the target at the point where the laser plane hits the target cell. This applies an offset to subsequent readings, indicated by yellow numbers.

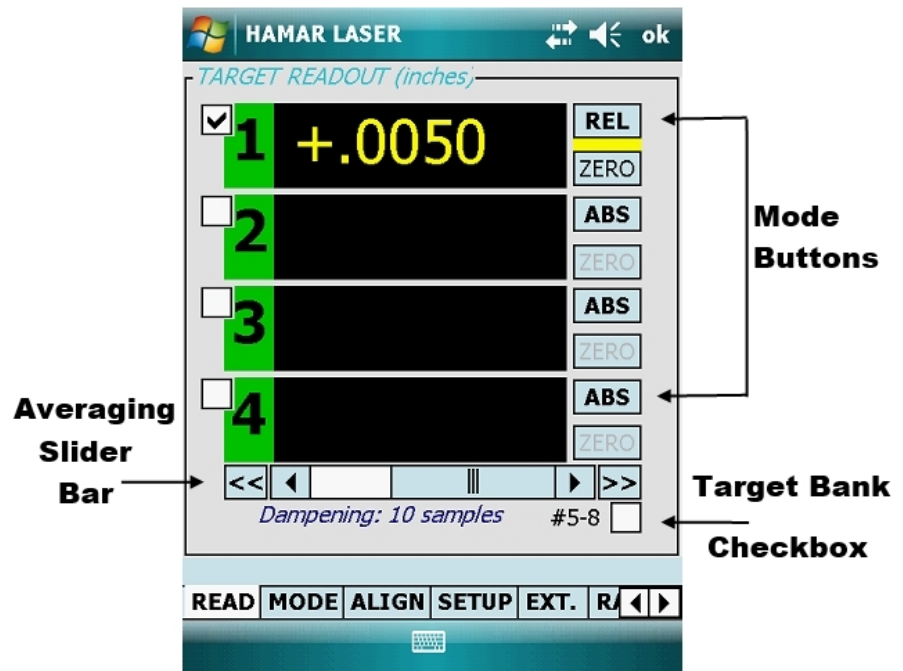


Figure 5 –READ Screen showing Mode Buttons, Averaging Slider Bar and Target Bank Checkbox

Averaging Slider Bar

Located under the last READ box is an Averaging Slider Bar that indicates the level of averaging selected in the SETUP screen and allows the level to be increased or decreased. Click on the *right* single arrow to *increase* the number of samples by one and the *left* single arrow to *decrease* the number of samples by one. Clicking on the left *double* arrow disables averaging and clicking on the right *double* arrow sets the maximum number of samples defined in the SETUP screen (up to 99 samples).

When severe turbulence or vibration exists in an alignment situation, the level of averaging that is required to provide a stable reading may result in a slow reading refresh rate. If a slow refresh rate is causing a reading to lag when dynamic adjustments are being made, reduce or completely disable averaging. Once adjustments are made, full averaging can be enabled.

Target Bank Checkbox

Read 9 can simultaneously display position readings for only four targets. By default it will display readings for Targets 1-4. To display readings for Targets 5-8, check the box marked #5-8 located below the averaging bar.

The SETUP Screen (SETUP Tab)

The SETUP screen is used to configure and set up wireless communication, units of measure, display resolution and averaging. Before returning to another screen, the program asks if you wish to save the new configuration as the default. *The Read9 program will always initialize with the last saved configuration.*

Communications Setup

When using the PDA with the ZigBee receiver, the default communication port is COM9. **Do not change this setting.** Under most operating conditions, no changes need to be made to the communications setup.

The four green status bars labeled 1-4 indicate the strength of the ZigBee signal received from each connected target. These bars change in length as the signal increases or decreases, but under normal conditions, they should be at 50-100 percent for a medium to strong signal. The three white fields below the status bars indicate the last communication error and bad/good packets received. It is normal to receive occasional bad packets.

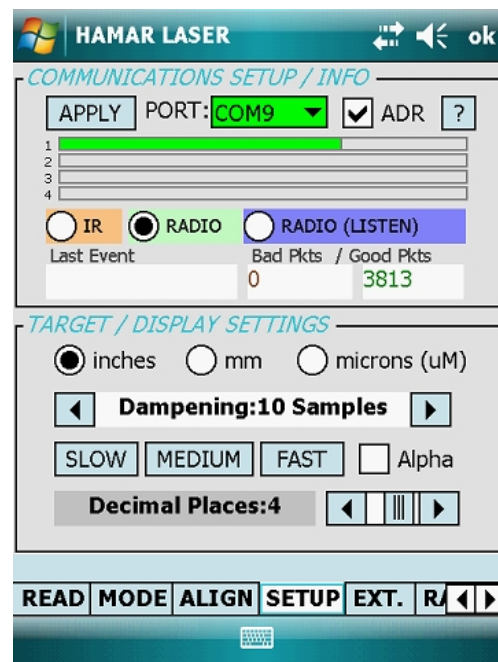


Figure 6 – The Read9 SETUP Screen

Data I/O Mode (IR, RADIO and RADIO LISTEN)

RADIO (see Figure 6) is selected on the Nomad PDA (Bluetooth is not currently supported).

When RADIO mode is selected, remove the check marks from the boxes next to targets that are *not* present in the physical setup (see Figure 7) to ensure the fastest refresh rate.

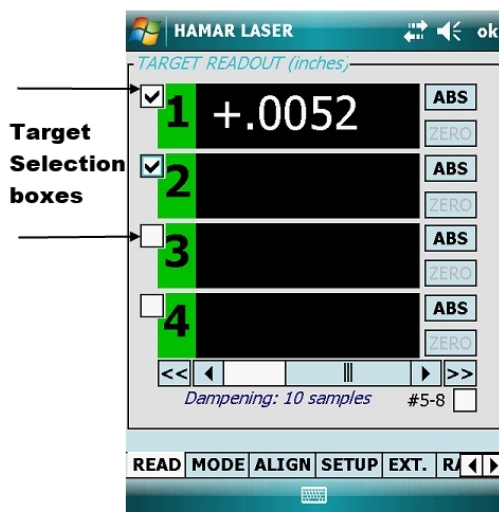


Figure 7 – Target Selection Boxes

Target/Display Settings

(Refer to Figure 6)

1. Select the Unit of Measure to be used
 - Inches
 - Millimeters
 - Microns (millionths of a meter)
2. Set **Dampening** (running average). Experiment for the best setting, using the fewest number of samples that will provide a stable reading under your operating conditions.
 - Click on the left arrow to reduce the number of samples for a faster reading upgrade, or disable Dampening.
 - Click on the right arrow to increase the number of samples (up to 99 samples per reading).
 - Use one of the quick setting buttons. SLOW provides 25 samples per reading; MEDium provides 10 samples per reading; FAST provides 5 samples per reading.
3. Set the number of Decimal Places by clicking on the left or right arrow. The number of allowable decimal places depends on the Unit of Measure setting.
 - *Inches* allows 1 to 5 decimal places (.0 to .00000). The default is 3 decimal places (.000).
 - *Millimeters* allows 1 to 4 decimal places (0.0 to .0000). The default is 2 decimal places (0.00).
 - *Microns* (no decimal places).

The MODE Screen (MODE Tab)

The MODE screen is used to specify the target configuration and the alignment mode that displays in the ALIGN Screen. Select either Relative or Discrete mode according to the type of alignment being performed.

Relative Alignment

Select this mode when aligning two target points to a laser plane or a laser plane to two target points. An example of this would be roll alignment.

1. Select any two targets, the first target being the one located nearest to the laser unit and the second being the one located farthest from the laser unit. For example, if Target 1 is nearest to the laser and Target 2 is the farthest away, select TARGET 1-2 from the scrolling list.
2. Select SLOPE if setting only the parallelism of the line defined by the two target points to the laser plane. When SLOPE is selected, the reading displayed in the ALIGN screen is the difference between the two target readings.
3. If offset information (the distance of the line defined by the targets to the laser plane) is also required, then select SLOPE + OFFSET.

Discrete Alignment

Discrete Alignment allows one or two laser planes to be aligned with up to three targets simultaneously. Only Targets 1, 2 and 3 can be used in this mode. An example of Discrete Alignment would be bucking in a laser to three points on a surface.

Click on the box next to the target label to select the target. Click on the button next to the target label to switch between HORIZONTAL or VERTICAL plane orientations, depending upon your physical target setup.

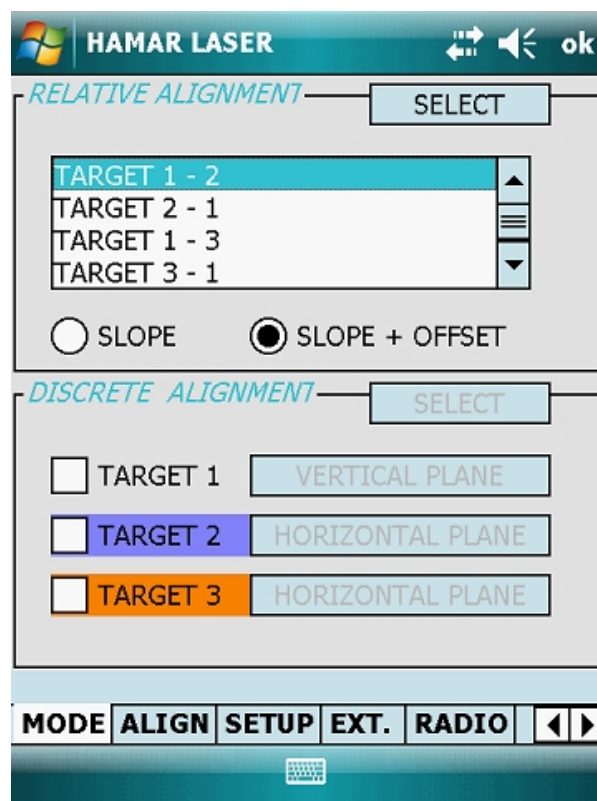


Figure 8 – The Read9 MODE Screen

The ALIGN Screen (ALIGN Tab)

The ALIGN screen is a graphic representation of the target readings, showing alignment as defined in the MODE screen. The graphic display scales up automatically to fit the readings, and it can be downscaled by clicking the ZOOM button in the bottom right-hand corner. When Relative Alignment is the selected mode, the screen view can be rotated 90 degrees by clicking anywhere within the two scale bars of the graphic display. Included with the descriptions of the three MODE screen options (Relative Alignment/Slope, Relative Alignment/Slope+Offset and Discrete Alignment) are the corresponding ALIGN screens, showing how the results would be displayed.

Note: On the graphic displays, Target 1 is labeled A, Target 2 is labeled B, Target 3 is labeled C, etc.

Relative Alignment/Slope

Relative Alignment/Slope is illustrated in Figure 9. Targets 1 and 2 are the selected targets. The numeric display shows the reading of Target 1 minus the reading of Target 2 = (-.1553).

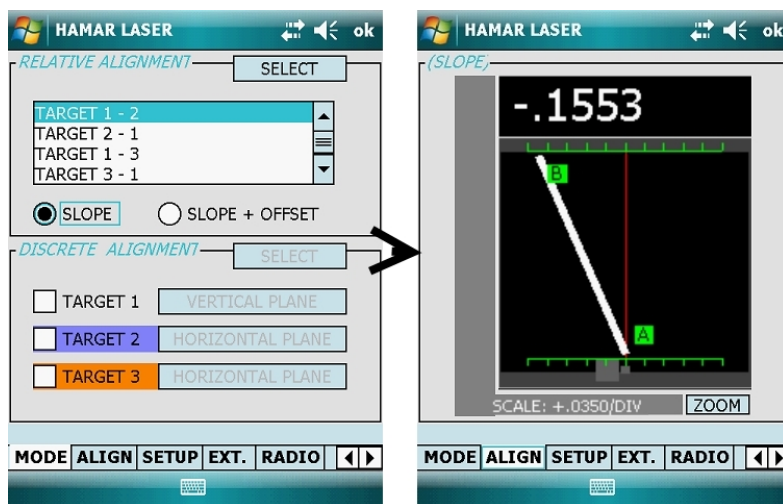


Figure 9 – Relative Alignment/Slope

Relative Alignment/Slope+Offset

Relative Alignment/Slope+Offset is illustrated in Figure 10. Targets 1 and 2 are the selected targets. The numeric display shows the reading of Target 1 minus the reading of Target 2 = (.1553). The lower scale reading shows Slope+Offset, while the upper scale shows Offset only.

Note: On the graphic displays, Target 1 is labeled A, Target 2 is labeled B, Target 3 is labeled C, etc.

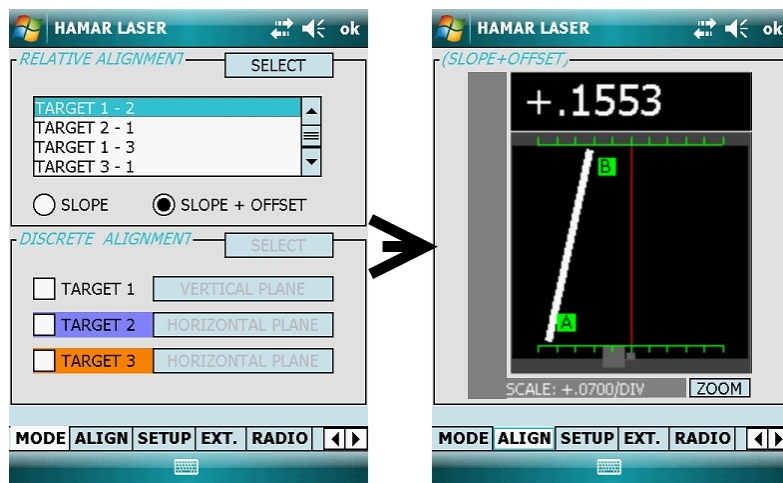


Figure 10 – Relative Alignment/Slope+Offset

Discrete Alignment

Discrete Alignment is illustrated in Figure 11. Targets 1 and 2 are selected. Target 1 is on the Horizontal laser plane and uses the left/right scale. Target 2 is on the Vertical laser plane and uses the upper/lower scale. The numeric display shows the value for Target 2, (the Target 2 button is selected at the left of the numeric display).

Note: On the graphic displays, Target 1 is labeled A, Target 2 is labeled B, Target 3 is labeled C, etc.

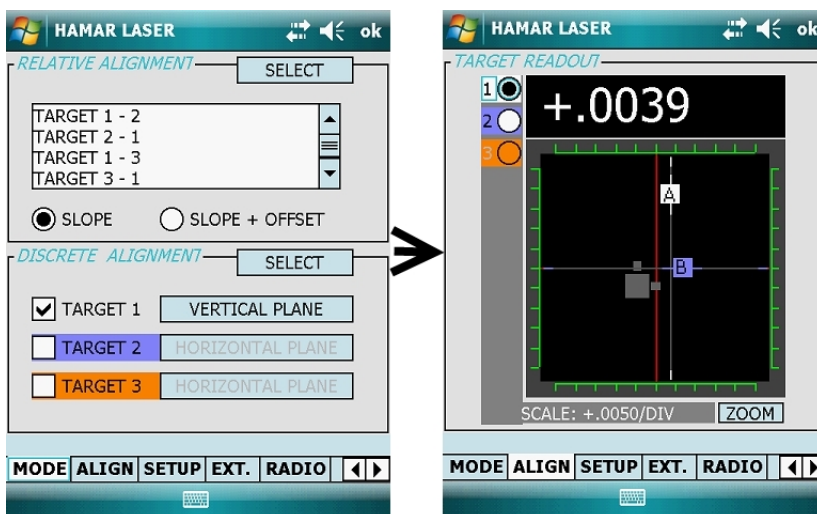


Figure 11 – Discrete Mode Alignment

Using Target Extensions (EXT. Tab)

By default, the Read9 software displays the position of the laser plane relative to the Target Centerline as shown in Figure 3. Some applications require measuring the absolute elevation of the laser plane above a surface. For that purpose, the Read9 software allows you to specify up to four precision extensions (including the tip extension), as shown in Figure 12.

Note: For further information on using target extensions, see *Using the Target as a Height Gage on Page 14*.

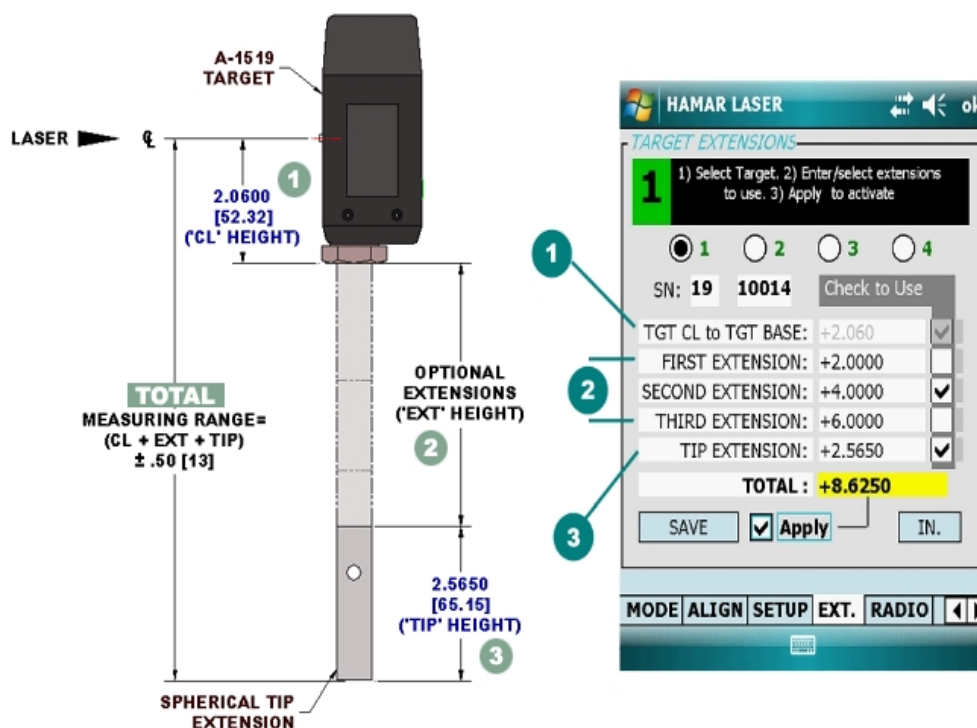


Figure 12 – Using Target Extensions

The **Tgt CL** to **Tgt Base** distance is factory calibrated and cannot be changed. The first, second and third extensions are optional. The Standard Tip Extension supplied by Hamar Laser is 2.565" high. This is the minimum height required for use with the standard Magnetic Base.

Entering Values for Target Extensions

1. Select The Target Number (1-4) corresponding to the Target Number Label on the side of the target. If the target is detected, the serial number will automatically display. If the target is not present or it is not detected, enter the target serial number manually.
2. Enter the extension length(s) and click on the checkbox next to each extension to enable it.
3. Check or uncheck the **Apply** box to display the target position on the READ screen, with or without the extensions applied.

***Note:** The font size in the readout boxes on the READ screen changes to a smaller font when the extensions are being applied (see Figure 13).*

4. Click **Save** to store the extension data to the PDA memory.



Figure 13 – The READ Screen font changes when extensions are applied

A-1519/1520 Type II Universal Wireless Targets - Overview

The A-1519/1520 Type II Universal Wireless Targets incorporate new features and provide greater capabilities than previous wireless targets offered by Hamar Laser. New features include:

- Built-in radio transceiver, available in either 900 MHz or 2.4GHz ISM band
- Internal Li-Polymer rechargeable battery with twice the capacity of previously offered targets
- Rechargeable through a plug-in power supply or an optional charging station/cradle
- Field-Programmability: System ID and Target Network ID programmable via rotary DIP switches. Firmware Updates, Calibration and Other Parameters configurable through the USB Port, using the A-1519/1520 Configuration Utility.
- Three data communication modes: Wireless (Radio), RS-485 and USB
- Auxiliary Port for future expansion, such as a numerical display or external temperature sensor
- Improved Background light noise suppression
- Internal dampening by averaging of 2 to 64 laser position scans

Identifying Target Features



(1) Right Side Auxiliary Ports	(2) Front View	(3) Left Side ID Switches	(4) Rear View
1-1 Auxiliary Port. Expansion Port. 1-2 USB Port. Used to update target firmware, upload calibration data, configure operating parameters and run diagnostics. Can also be used as a Data I/O port, compatible with standard applications.	2-1 Target Status LEDs. <i>Steady</i> when the laser scanner is detected and all conditions are normal. <i>Blinks</i> at different rates when an abnormal condition is detected. 2-2 Battery Charging Indicator. 2-3 Low Battery Indicator. 2-4 Position Sensor Aperture Window. 2-5 Optional Light Shield Mounting Holes (4x).	3-1 System ID rotary switch used to set the System ID Group Number 0-9. 3-2 Target Network ID. Used to set the Target Network ID from 01 to 99.	4-1 Radio regulatory information. 4-2 RS-485 and plug-in power supply connector. 4-3 Serial Number Label.

Figure 14 – Universal Wireless Targets

Using the UniTargets in RS-485 Mode

There may be occasions when it is preferable to have the UniTargets hard-wired to your computer rather than using them in wireless mode. Possible reasons may be that more than four targets are necessary for an application, an ZigBee receiver has become disabled, or the user would prefer to write his own application software. This may be done using the RS-485 port and additional connectors available from Hamar Laser. This procedure, along with a connection diagram and technical considerations for writing software applications is discussed in Appendix B, beginning on Page 17.

Using the Target as a Height Gage

The UniTargets can be easily converted to a height gage by attaching precision spacers and the spherical tip to the base of the target. Since the center of the target has been set to a tightly controlled dimension, the exact dimension from laser plane to the measured surface can be obtained. Optional precision spacers are available in 1" (25.4 mm), 2" (51 mm), 3" (76 mm) and 6" (154 mm) sizes, all of which are accurate to .0003" (.008 mm).

The precision spacers screw into the threaded hole in the base of the target where the shaft for the magnetic base is normally installed. The spherical tip screws into the bottom precision spacer. Multiple precision spacers can be screwed together to ensure that the target reaches the laser plane, but the spherical tip, which is used to touch the surface being measured, must be on the bottom.

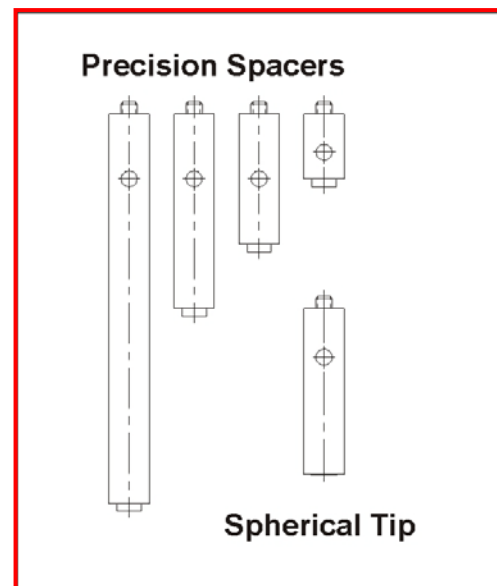


Figure 15 – Precision Spacers/Spherical Tip

Appendix A – Restoring the Read9 Software

Restoring the Read9 Software to the Dell Axim® PDA

The Dell PDA stores some software in volatile (non-permanent) computer memory. This type of memory requires a very low power level to maintain the stored software. When power is shut off to the PDA, it goes into “sleep mode” and will retain the Read9 software for months, as long as the battery is fully charged when you power down the PDA. However, the Read9 software and accompanying data files may be lost if the PDA is unused for long periods or the battery is allowed to drain completely. Note that the PDA battery will drain more quickly if the unit is stored in a cold area.

Hamar Laser installs an SD (Secure Digital) memory card containing the Read9 installation files in every Dell PDA. In addition, some models are supplied with a factory backup performed with the built-in data backup utility (not all models and operating systems provide this backup method). The SD card memory is permanent (non-volatile) and *will not* be erased if the PDA battery is allowed to drain completely.

The restore method varies depending on the Dell PDA model and the revision of the Microsoft Operating System. Use one of the following methods to return the PDA to the factory installation level.

Method 1 – Restoring the Read9 Software Using the Data Backup Utility

1. Click **Programs** from the top-level menu.
2. Click **Data Backup** to open the backup/restore utility.
3. Click the **Restore** tab located on the lower part of the screen. The Hamar Laser backup is named *FACTORY*. Follow the screen instructions to restore the PDA to the factory installation level

Restoring the READ9 Software to the HP 211 PDA

Performing a Hard Reset

Note: *Back up all data before performing a hard reset.*

Before performing a hard reset, you can save all your data in **iPAQ File Store** and then perform a hard reset. After performing a hard reset, you can reinstall the applications on the iPAQ device. Follow these steps to perform a hard reset of the device.

1. Press and hold the **Record**, **Start/Windows** and **OK** buttons at the same time. Using the stylus, press and release the **Reset** button.

1 - Record
2 - Start/Windows
3 - OK
4 - Reset

2. Continue to press and hold the **Record**, **Start/Windows** and **OK** buttons.
3. A *Clean Boot* message displays indicating successful restoration of factory settings on your device.



Restoring the READ9 Software

1. Select **Start>File Explorer** and tap **SD Card** (see Figure 17).
2. Select **(Step 2) msvb** to install the first part of the software. After installing Step 2, the PDA may need to be rebooted. Follow the screen prompts, and after rebooting, repeat Step 1 to continue the Read9 installation.
3. Select **(Step3) Read** to install the Read9 software (see Figure 18).
4. Start Read9 and select the Setup tab. Use the drop-down arrow to select COM1.
5. Check the circle next to Radio and tap **Apply** (see Figure 19).



Figure 16 – File Explorer>SD Card

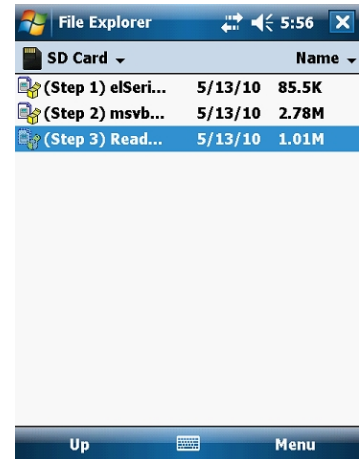


Figure 17 – msvb and Read9 installation files on SD Card

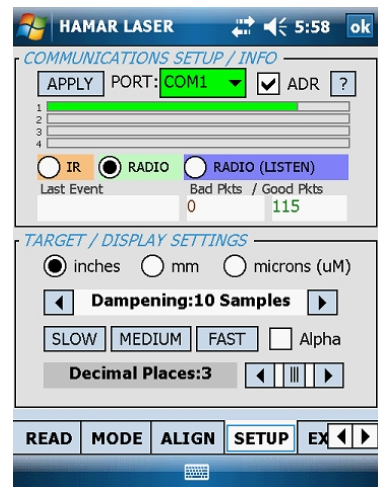


Figure 18 – Read9 SETUP Menu

Appendix B – Connecting UniTargets in RS-485 Mode

As discussed on Page 14, (*Using the UniTargets in RS-485 Mode*) instances may occur when the UniTargets cannot be used in wireless mode. When the need arises for more than four targets, when a ZigBee 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 (see Figure 14) located on the back of each target. Each junction box controls four targets.

Typical equipment includes a junction box, (or hub) an alternate power supply to power each junction box, 10-foot or 20-foot cables, and cables from the junction box to an RS-485 to RS-232 converter and to the computer serial port. Figure 19 on Page 18 shows a sample arrangement of targets, junction boxes, alternate power supplies and cables.

- Targets are connected to the junction box, or hub, from the RS-485 port in each target.
- The junction box is connected to an RS-485 to RS-232 converter.
- The converter is connected to the computer serial port.

In addition, as many junction boxes as necessary may be connected together.

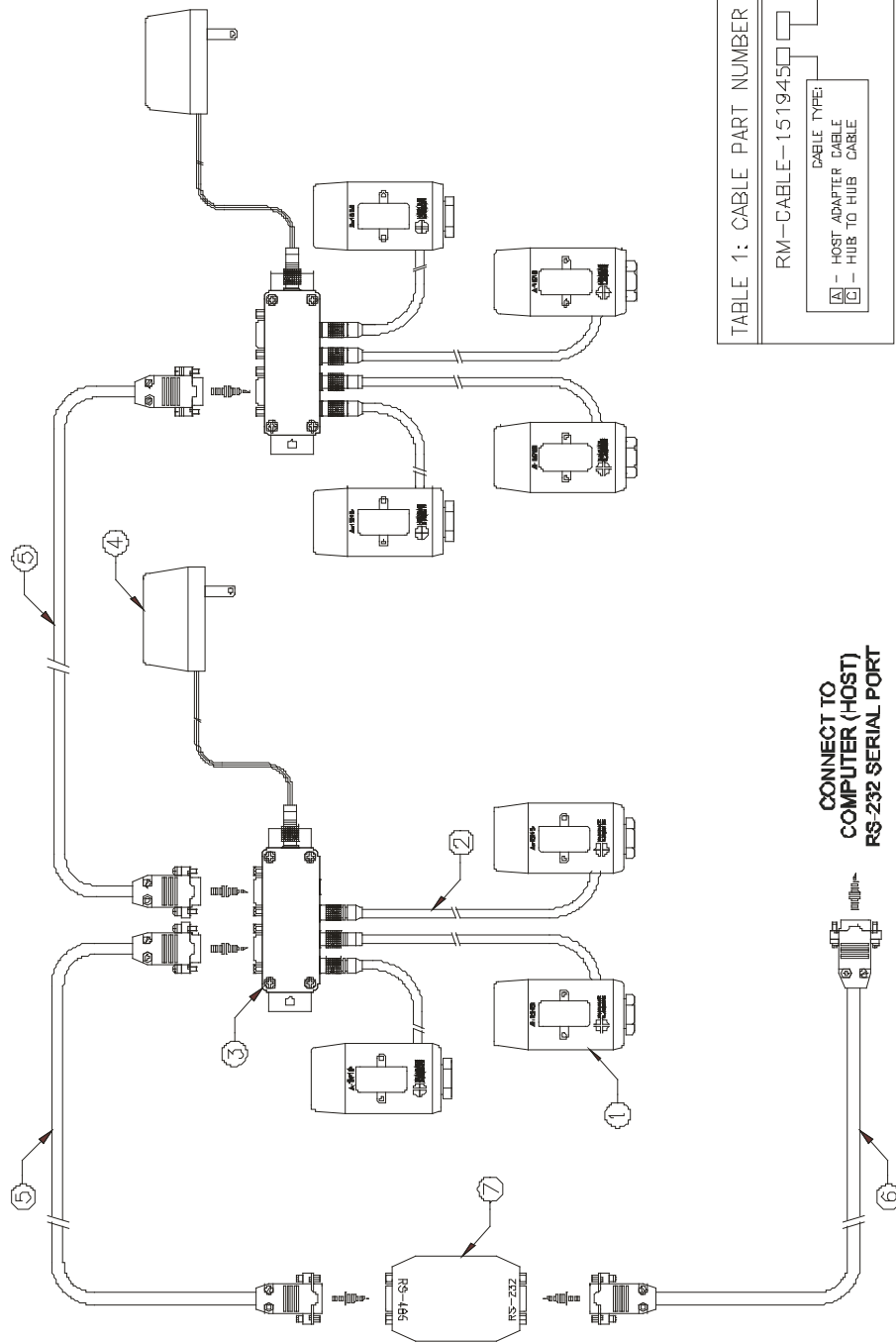


Figure 19 – Using the RS-485 to Connect Multiple UniTargets

TABLE 1: CABLE PART NUMBER (HUB-HUB OR HOST)	
<div> <div> <div>A</div> <div>- HOST ADAPTER CABLE</div> </div> <div> <div>C</div> <div>- HUB TO HUB CABLE</div> </div> </div>	<div> <div> <div>RM-CABLE-151945</div> <div></div> </div> <div> <div>CABLE LENGTH IN FEET:</div> <div>E.G. [20] = 20' CABLE</div> </div> </div>

TABLE 2: CABLE PART NUMBER (TARGET TO HUB)	
<div> <div> <div>RM-CABLE-1519C</div> <div></div> </div> <div> <div>PLUG TYPE, TARGET SIDE:</div> <div>[S] = STRAIGHT PLUG</div> <div>[R] = RIGHT ANGLE PLUG</div> </div> </div>	<div> <div> <div>RM-CABLE-1519C</div> <div></div> </div> <div> <div>CABLE LENGTH IN FEET:</div> <div>E.G. [20] = 20' CABLE</div> </div> </div>

ITEM	QTY	DESCRIPTION	HAMAR P/N	REV	MANUFACTURER	NOTES
7	1	RS-485 to RS-232 CONVERTER	RM-TGTAC-NWSD08R		B&B ELECT.	
6	1	RS-485 HUB COMPUTER (HOST) CABLE, 20'	RM-CABLE-151945A2D		HUI	SEE TABLE 1
5	2	RS-485 HUB INTERCONNECTING CABLE, 20'	RM-CABLE-151945C20		HUI	SEE TABLE 1
4	2	RS-485 HUB, POWER SUPPLY, 6VDC@2A	RM-TGTAC-151945PS		HUI	
3	2	RS-485 FOUR PORT POWERED HUB	RM-TGTAC-A151945		HUI	
2	7	TARGET CABLE (RS TYPE), 20'	RM-CABLE-1519CRS2D		HUI	SEE TABLE 2
1	7	A-1519 UNITARGET	RM-TARGET-A1519		HUI	

Programming Considerations for UniTargets

Acquiring Data in RS-485 Mode

The UniTarget measures the laser position by capturing the beam from a scanning laser as it crosses the target's internal position sensor device (PSD). At a scanner speed of 200 rpm, the target will acquire a new laser position every 300 ms (i.e. scan cycle). At a scanner speed of 300 rpm, the target will acquire a new laser position every 200 ms; therefore, the position refresh rate is dependent upon the rotation speed of the laser.

To acquire data from a target, the host¹ must send the appropriate packet request code for that target (see the table on Page 20). Once a target receives its code, it replies with an 18 byte packet of data. It takes the target approximately 12-15 ms to process the request code and transmit the data packet. To ensure that the full packet is received, the host should wait for a reply for an additional 10 ms longer than the time it takes the target to reply.

Typically, the target/host data transfer occurs within 25 ms. If this does not occur, it is most likely due to one of the following conditions:

- a) The target was in the process of capturing a new laser position. While the laser beam is on target, (crossing the PSD) it cannot reply to a request from the host to transmit data.
- b) The laser was 'not on-target' or the target is off.

It is impossible to re-acquire data from the same target at an interval shorter than one scan cycle, but it is theoretically possible to acquire data from 15 different targets within a 300 ms scan cycle. The practical limit is more likely to be 8-9 targets/300ms scan cycle, because of the overhead required by the host to process the data.

If you are developing your own software, we recommend an interval between target requests of 35 ms (25 ms to acquire the data plus 10 ms to process the data). Depending on the processing speed of the host computer, you should be able to request, receive, and process data from eight different targets in approximately ½ second.

¹ Host: computer or device that controls the RS-485 network. The host is responsible for transmitting the target request codes, (i.e. polling), and processing the data received from the targets.

To extract data from the target(s), the host must poll each target, in turn, by transmitting to the target a single-byte request code, as follows:

<i>To read Target #:</i>	<i>Host sends Request Code (ASCII decimal value)</i>
=====	=====
1	01
2	02
3	03
4	04
5	05
6	06
7	07
8	08
...	...
250	250

Code 251 resets all targets. Transmit this code (251) only if one or more targets fail to respond with a valid data packet. Codes 0, 252-255 are reserved for Hamar Laser's use only.

Example: Host procedure for interrogating 8 targets in the RS-485 mode.

- a) *Host*: Start timer
- b) *Host*: clear the receive buffer
- c) *Host*: Transmit request code for target *n*. (*n*=01 for target #1, *n*=02 for target #2 ...)
- c) *Host*: Reset timer to zero, immediately after sending the request code
- d) *Host*: Wait in a loop for the target to reply while checking the receive buffer and the timer. Exit the wait loop if 18 bytes have been received or the timer>=25ms.

NOTE: If the target fails to reply within 25 ms, it will not reply again unless the host re-transmits the request code and a new position reading has been acquired. If a reply is not received, you may re-send the request as many times as necessary to receive a reply or simply skip that target until the next read cycle. If you decide to interrogate the target again, you should wait for a period of at least 35 ms after the last request code is sent before re-transmitting a request code to the same target.

- e) If the target replied with an 18 byte data packet: Verify the packet checksum, parse the packet, and then store the position, battery voltage and other pertinent data.
- f) Repeat the procedure for all other targets, starting with Step b.

After reading all eight targets, wait in a delay loop for a period of at least one scan cycle (~300 ms) to allow the targets sufficient time to acquire a new position reading. If you skip this delay between read cycles, the targets may not reply the next time they are interrogated.

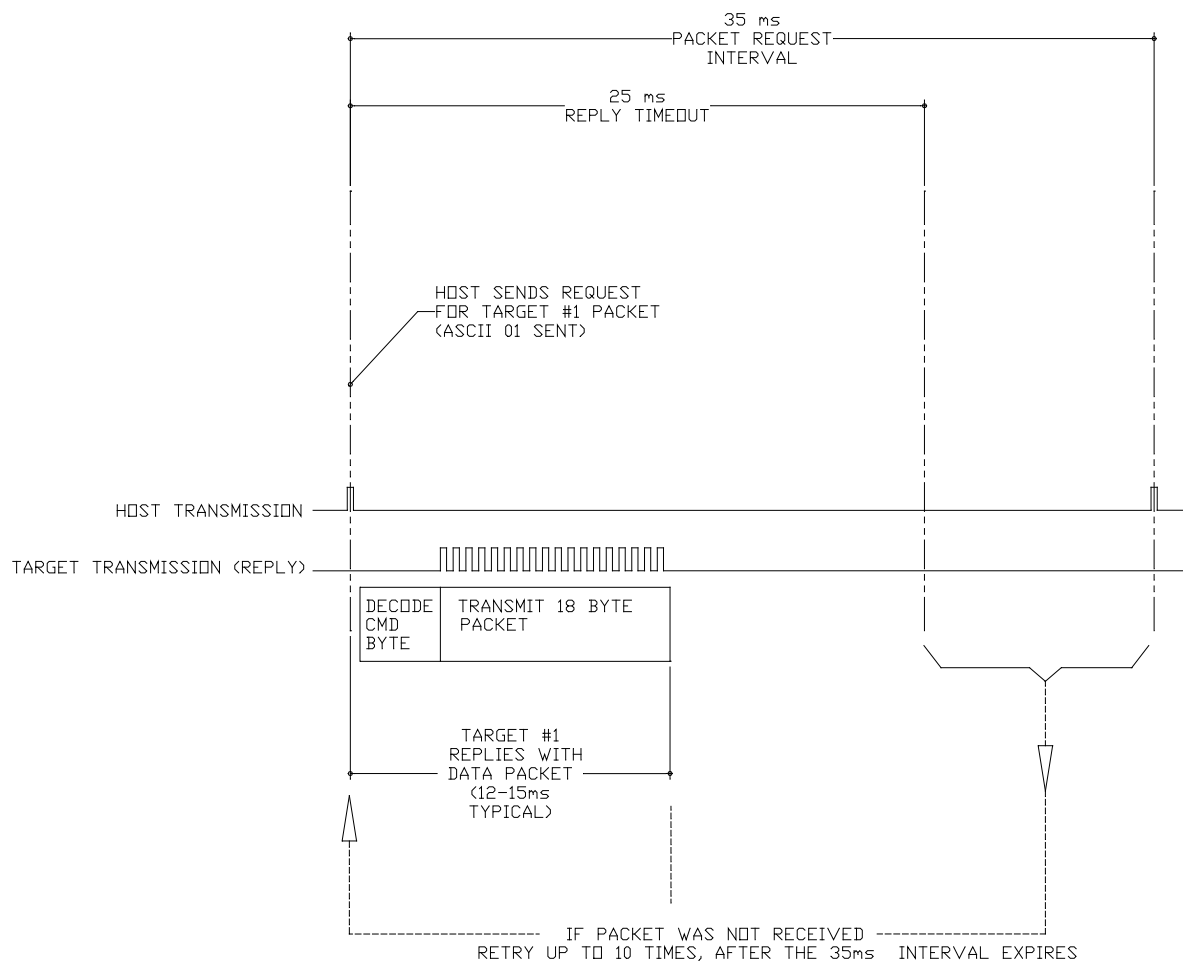


Figure 20 – RS-485 Host/Target timing example.

A-1519/1520 UNITARGET - STANDARD DATA PACKET applicable to IR and RS-485 modes

SOM	LEN	DEV	DSN	OPC	TID	DST	VP	VO	BAT	TC	CHK
-----	-----	-----	-----	-----	-----	-----	----	----	-----	----	-----

ABBRE- VIATION	DESCRIPTION (see footnotes)	VALUE/RANGE	# BYTES
SOM	START OF MESSAGE	64 (40 HEX)	1
LEN	LENGTH OF MESSAGE	18 (12 HEX)	1
DEV	DEVICE TYPE ²	19, 20 (13, 14 HEX)	1
DSN	DEVICE SERIAL NUMBER ³	0 TO 65536	2
OPC	OPERATIONAL MODE CODE ⁴	0 TO 255	1
TID	TARGET ID	1 TO 255	1
DST	DEVICE STATUS ⁵	0 TO 255	1
VP	VERTICAL POSITION (counts) ⁶	-32768 TO 32767	2 [♦]
VO	VERTICAL CENTER OFFSET (counts) ⁷	-32768 TO 32767	2
BAT	BATTERY VOLTAGE (mV) ⁸	0-5000	2
TC	INTERNAL TEMPERATURE (C * 16) ⁹	-32768 TO 32767	2
CHK	PACKET CHECKSUM ¹⁰	-32768 TO 32767	2

COMMUNICATION SETTINGS:

BAUD RATE: 19,200 BPS
PARITY: NONE
BITS/WORD: 8
STOP BITS: 1

² DEV, Device type 19 = Model #A-1519, Device type 20 = Model #A-1520

³ The full Target serial number is comprised of the device type (DEV) followed by the device serial number (DSN), such as 19-32767

⁴ OPC, Op Mode Code: 0= reserved, 1= External Calibration, 2 = External Calibration, w/ Temperature Sensor, 3 = Internally calibrated, w/ Internal Temperature Sensor

⁵ DST, Device status: Background light level and Laser status (IR mode only).

⁶ VP, Laser beam position relative to the center of the target in A2D counts. A-1519: 1 count = 0.5 microns, A-1520: 1 count = 0.25 microns.

[♦] Two byte integer values (e.g. VP) transmitted as LSB byte followed by MSB byte. Value = (MSB * 256) + LSB. With the exception of DSN, the unsigned integer values ranging from (0 – 65536) must be converted to signed integers ranging from (-32768 to 32767). For example: If MSB=128 (80 hex) and LSB=1 (01 hex) the signed integer value is 32769. Because that value is greater than 32767 it must be converted to a signed integer Value = 32769 – 65536 = -32766

⁷ VO: Vertical center offset (difference between mechanical center and electrical center), *Used by Hamar Laser for calibration purposes only.*

⁸ BAT: battery voltage. Normal operating range is 4600-5000. Recharge battery when voltage drops below 4600

⁹ TC: Internal Temperature: Divide TC by 16 to obtain internal target temperature in degrees Centigrade

¹⁰ CHK , used to validate packet. Packet is considered valid when the (Sum of all byte values, excluding last 2 bytes + CHK) = zero