Operations Manual

R-1307 Target Readouts

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HAMAR LASER®
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HAMAR LASER INSTRUMENTS, INC.
www.hamarlaser.com

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

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5 Ye Olde Road, Danbury, Connecticut 06810

Table of Contents

Critical Note on Calibration

When configuring the R-1307 Readout, it is critical to match the target ID with the target ID identified on the serial number of the target. For example, if the target ID on the target serial number label is 2, then the R-1307 must also be set to the number 2. If the target and readout and not matched, a centering error of up to .004 in. (0.10 mm) can occur. In addition, the laser switch setting (CONT. *or Fixed* **vs. PULSE) must also agree with the R-1307 Readout setting (F10.10 vs. P10.10).**

For example: tGt=02 F.10.10 or tGt=02 P.10.10 for R-1307 #2

For more information on the Pulse/CONTinuous modes on the laser, see *Pulse/Continuous Modes (L-705, L-706 and L-708 Lasers)* on Page 12. For complete information on matching the target to the readout, see *Configuring the R-1307 Readouts* on Page 13.

R-1307 Target Readouts – Overview

The Model R-1307 Readouts support both wireless targets (such as the A-1519) and cabled (local) targets. The wide choice of configurations (R-1307B-2.4ZB, R-1307BC, R-1307C, R-1307-900/2.4, R-1307-2.4ZB, R-1307W-900/2.4, R-1307W-2.4ZB and R-1307+R) is designed to suit a user's specific needs, with the R-1307B-2.4ZB, the R-1307-2.4ZB, The R-1307+R and the R-1307W-2.4 ZB models featuring ZigBee® radio technology. Please note that some features described in sections of this manual may not be applicable to the unit purchased.

The readout is available with a radio frequency of either 900 MHz or 2.4 GHz and can be used as the *primary* readout or as an additional readout to copy position data captured by another R-1307.

Figure 1 – *R-1307 Readout*

Model R-1307B-2.4ZB/R-1307-2.4XBE

- Supports both wireless targets (A-1519-900, A-1519-2.4ZB, A-1519-2.4XBE etc.) or cabled (local) targets
- Supports both pulsed-beam and continuous laser modes
- Supports 4x4 mm, 10x10 mm or 20x20 mm PSD cabled targets
- May be used as a Master Readout or as a secondary readout to display data from a second R-1307
- Can be configured to display data from one cabled 2-axis target or to receive data from a second R-1307B-2.4ZBR-1307B-2.4XBE Readout connected to one 2-axis target

Model R-1307BC

- Supports 2-axis cabled (local) targets
- Supports both pulsed-beam and continuous laser modes
- Supports 4x4 mm, 10x10 mm or 20x20 mm PSD cabled targets

Model R-1307C

- Supports cabled (local) targets only
- Supports both pulsed-beam and continuous laser modes
- Functional replacement for the R-307 Analog Readout

Models R-1307W-900/2.4 and R-1307W-2.4ZB/XBE

- Supports wireless targets (A-1519-900, A-1519-2.4, etc.) only
- Radio frequency available in either 900 MHz or 2.4 GHz ISM band

Model R-1307-900/2.4 and R-1307-2.4ZB/XBE

- Supports both wireless targets (A-1519-900, A-1519-2.4, etc.) or cabled (local) targets
- Supports both pulsed-beam and continuous laser modes
- Radio frequency available in either 900 MHz or 2.4 GHz ISM band
- Can be used as an additional readout to receive data alignment data transmitted from another R-1307 unit in master (poll) mode

Model R-1307+R

- Supports both wireless targets (A-1519-900, A-1519-2.4, etc.) and cabled (local) targets
- Displays the rotation angle of the 2-axis target in degrees or with a symbol to indicate the target is at "top dead center"
- Supports both pulsed-beam and continuous laser modes
- Radio frequency available in either 900 MHz or 2.4 GHz ISM band
- Can be used as an additional readout to receive data alignment data transmitted from another R-1307 unit in master (poll) mode

R-1307 Target Readout Accessories

The A-1307KS Readout Stand

Hamar Laser's new A-1307KS Readout Stand allows for the secure and convenient positioning of the R-1307 Readout. The Readout Stand includes the following features:

Figure 2 – *A-1307KS Readout Stand*

- Four stand positions: 180°, 135°, 45° (shown in photo) and 0° (closed).
- The stand support leg, when opened to 180°, can be used as a hanger.
- Magnets on the back of the stand hold the Readout securely to steel objects.
- When the A-1307KS is assembled to the Readout, magnets are installed on the bottom so the unit can stand upright.

The A-1307KS can be retrofitted to any existing R-1307 Readout.

The T-231-A2l Adapter Cable

The T-231-A21 Adapter cable provides the ability to connect an older (cabled) target that has a 7-pin Amp connector to the R-1307's 14-pin Lemo connector. Newer targets come with Lemo connectors and older targets can be retrofitted if necessary.

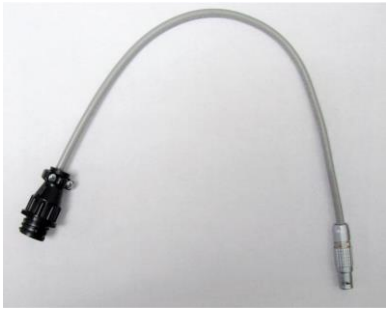


Figure 3 – *T-231-A21 Adapter Cable*

R-1307 Readout Features

Model R-1307B-2.4ZB/XBE and Model R-1307BC – Control Panels

The R-1307B-2.4ZB/XBE and the R-1307BC Basic Series target readouts are available in two configurations. The R-1307BC supports 2-axis cabled targets and the R-1307B-2.4ZB is a combination readout for cabled targets with the capability to wirelessly transmit target data to a second R-1307 or to the A-910-2.4ZB computer data receiver. Both models support blinking and continuous laser modes. Power is provided by a 2500 mAh Lithium-Polymer rechargeable battery for 7-22 hours of continuous use, depending on the model, radio type and display brightness settings.

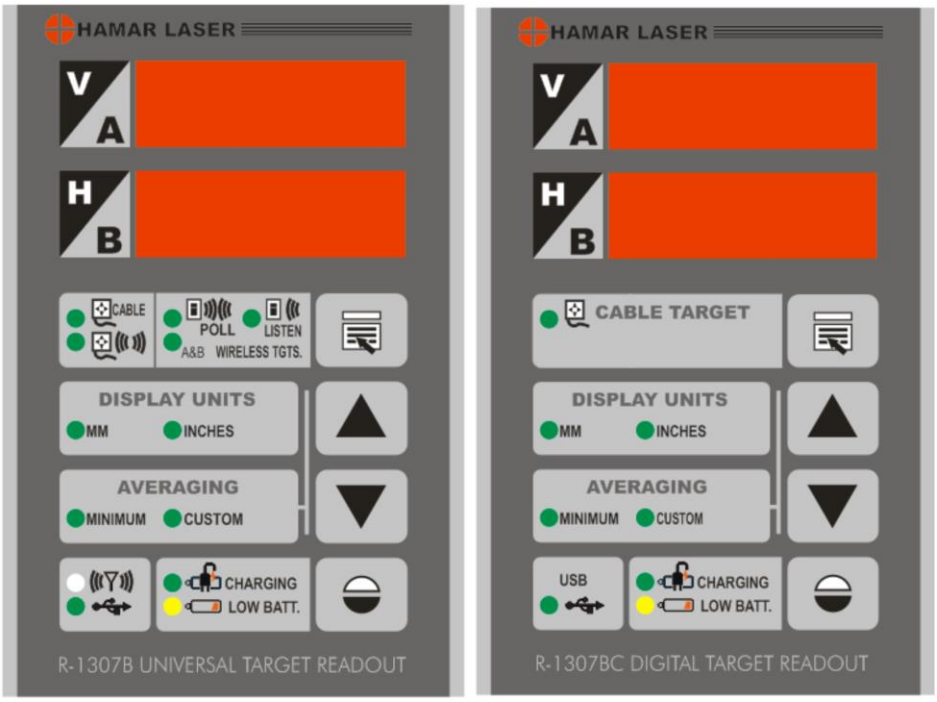


Figure 4 – *R-1307B and R-1307BC Models Control Panel Features*

The following chart lists the menu items available for each unit:

R-1307B-2.4ZB/XBE	R-1307BC
Display Units allows the selection of either inches or millimeters to display readings.	**Display Units** allows the selection of either inches or millimeters to display readings.
Resolution (selected from the MENU button) allows the selection of display digits up to a maximum of .0001 in. or 0.001 mm.	**Resolution (selected from the MENU button)** allows the selection of display digits up to a maximum of .0001 in. or 0.001 mm.
Averaging allows the selection of 2 to 64 samples for difficult atmospheric conditions.	**Averaging** allows the selection of 2 to 64 samples for difficult atmospheric conditions.
Up and **Down** arrow keys switch between the minimum number of sample (8 samples) and the menu-selectable number of sample (custom).	**Up** and **Down** arrow keys switch between the minimum number of sample (8 samples) and the menu-selectable number of sample (custom).
Channel Selection (selected from the MENU button) sets the System ID (radio channel).	

Model R-1307 Readouts – Control Panel

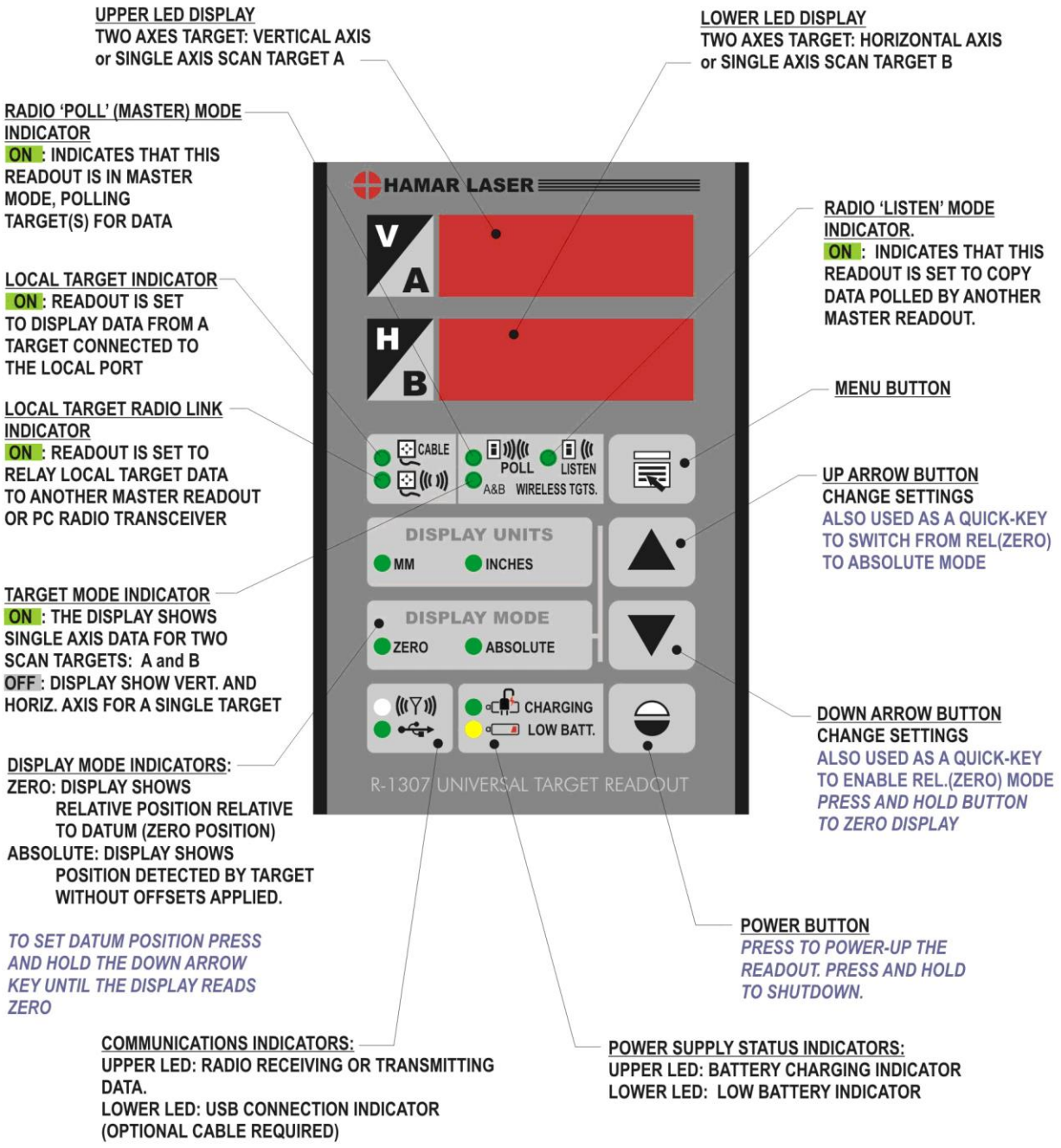


Figure 5 – *R-1307 Models Control Panel Features*

Model R-1307W Readout – Control Panel

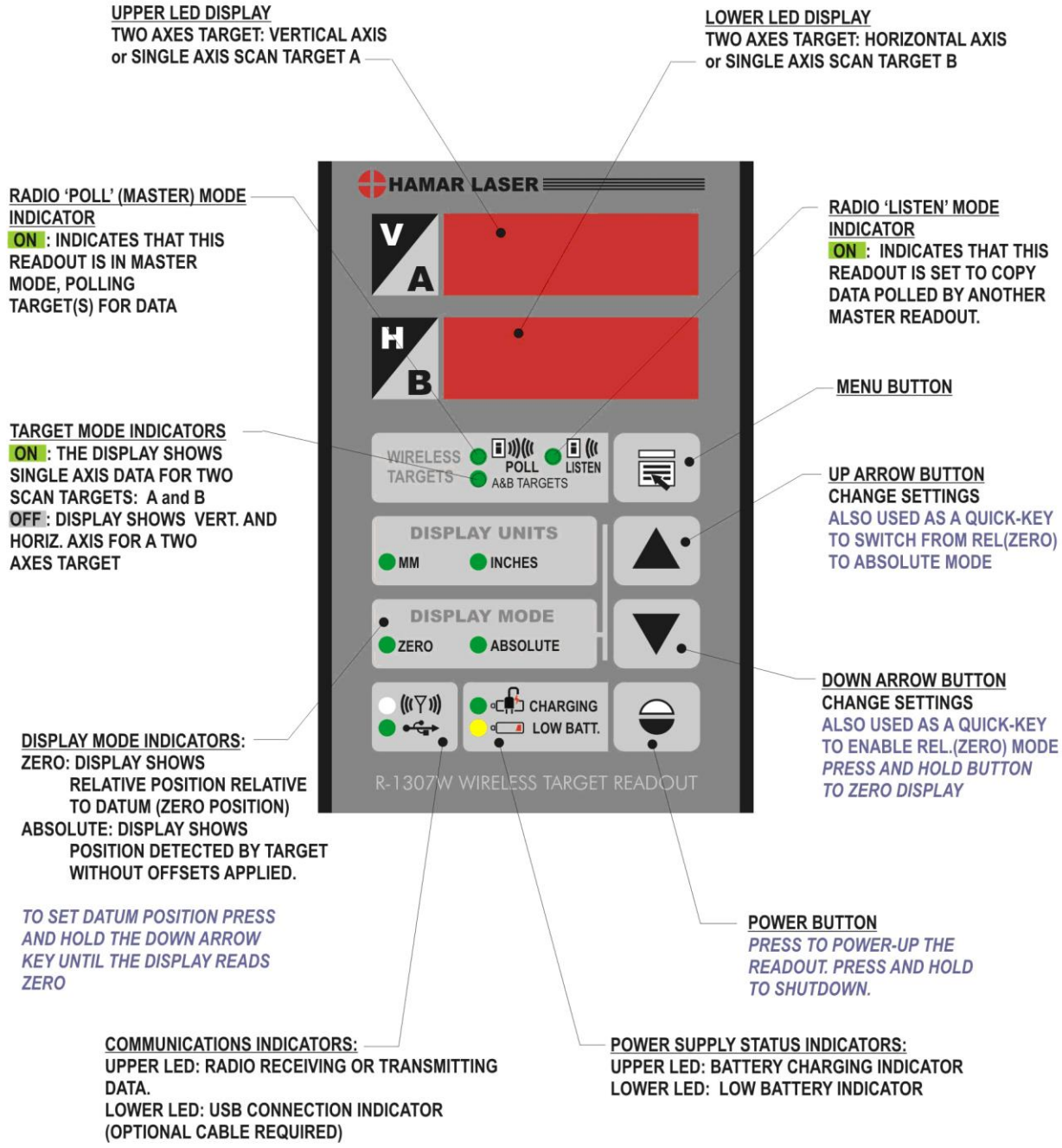


Figure 6 – *R-1307W Readout Control Panel Features*

Model R-1307C Readout – Control Panel

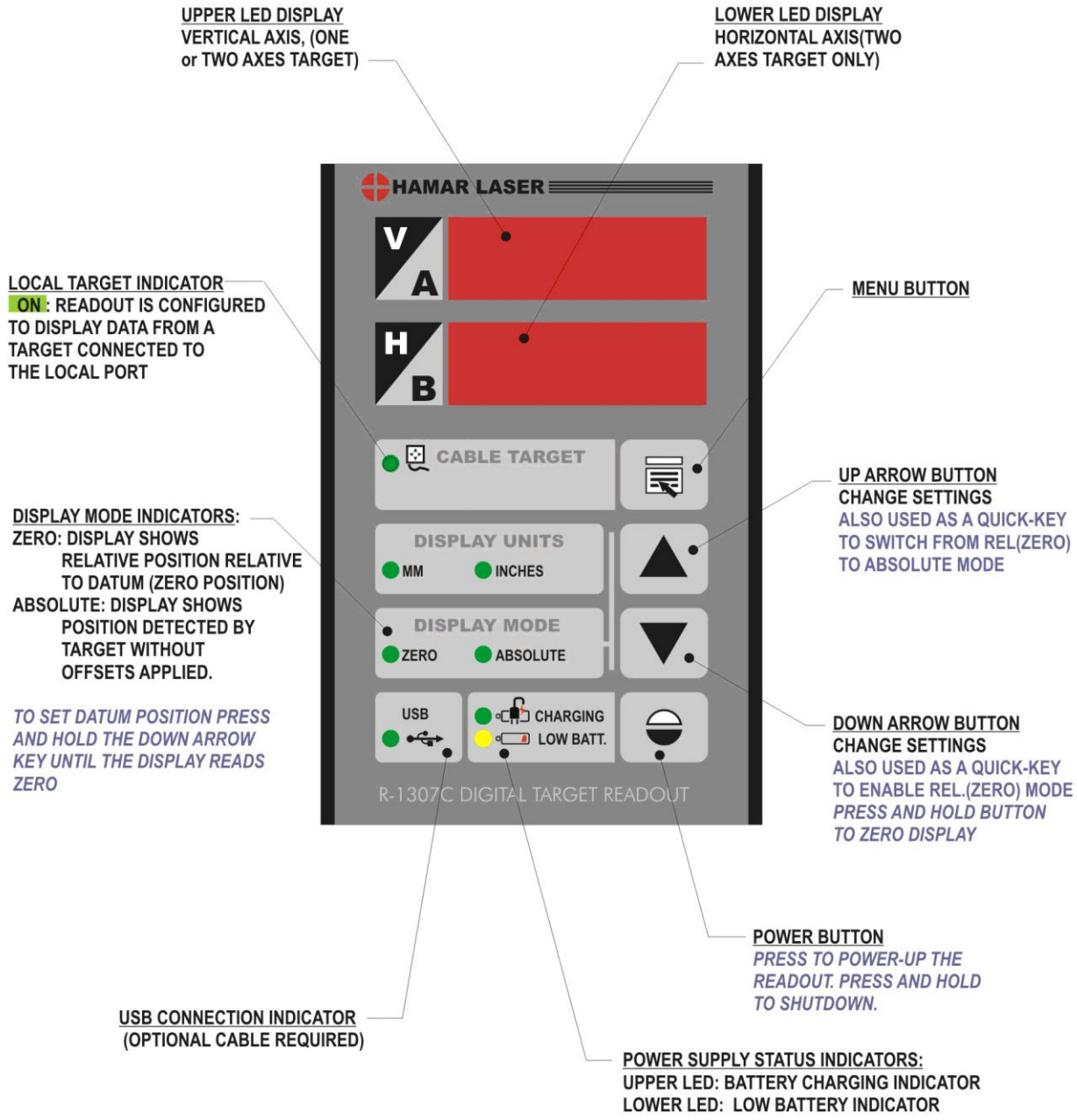


Figure 7 – *R-1307C Readout Control Panel Features*

The Model R-1307+R – Control Panel

The Model R-1307+R Readout supports both wireless targets such as the A-1519, or local (cabled) targets and may be used as the primary readout or as an additional readout to copy position data captured by another R-1307. The R-1307+R displays the rotation angle of the 2-axis target, either in degrees or with a symbol to indicate when the target is at "top dead center," (TDC) which is important for accurate bore alignment.

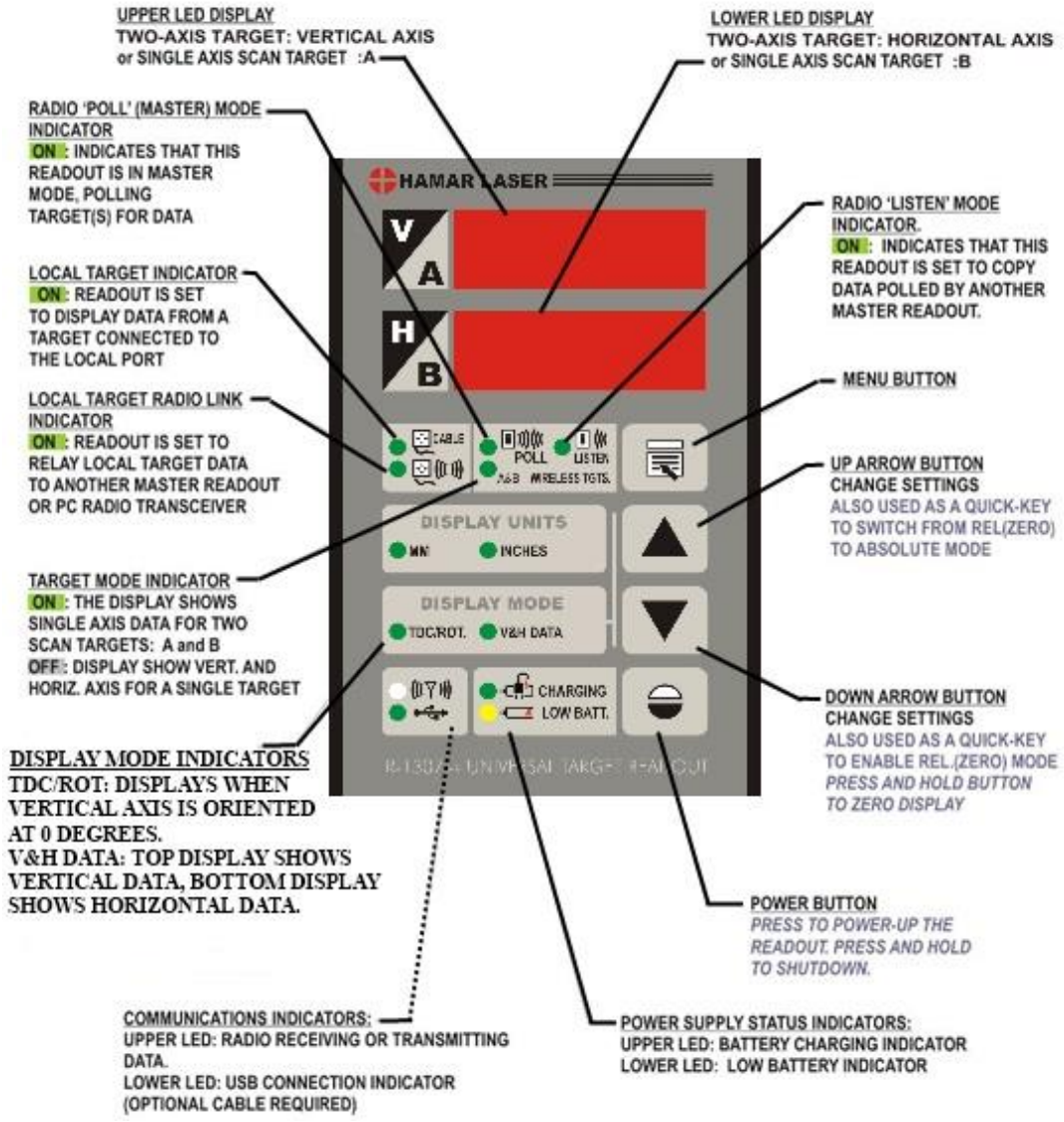


Figure 8 – *R-1307+R Readout Control Panel Features*

Using TDC/ROT Mode with the R-1307+R Readout

When a target is inserted into a bore, the target may rotate. This rotation can cause accuracy problems. For example, a 5 degree rotation with a 1.00 mm vertical value will cause up to a 50 micron error.

To ensure maximum accuracy, it is important that the orientation of the alignment axes of the A-516 Self-Centering Target (or any other HLI bore target) relative to the bore is the same throughout the data-taking process. In other words, always keep the vertical axis oriented to 0 degrees (12:00).

One way to do this is to use a level vial to keep track of the target's rotation orientation as it is inserted into the barrel. Another is to use an accelerometer inside the target housing. This example was done with the A-516 Target, where an accelerometer supplies the rotation-axis "levelness" of the target so the user can maintain the rotation orientation of the target for each measurement point. The TDC/ROT indicator on the R-1307 lights when the target's vertical axis is at Top Dead Center (TDC), indicating that the vertical axis is oriented to 12:00 (0 degrees). See Figure 11 for further information.

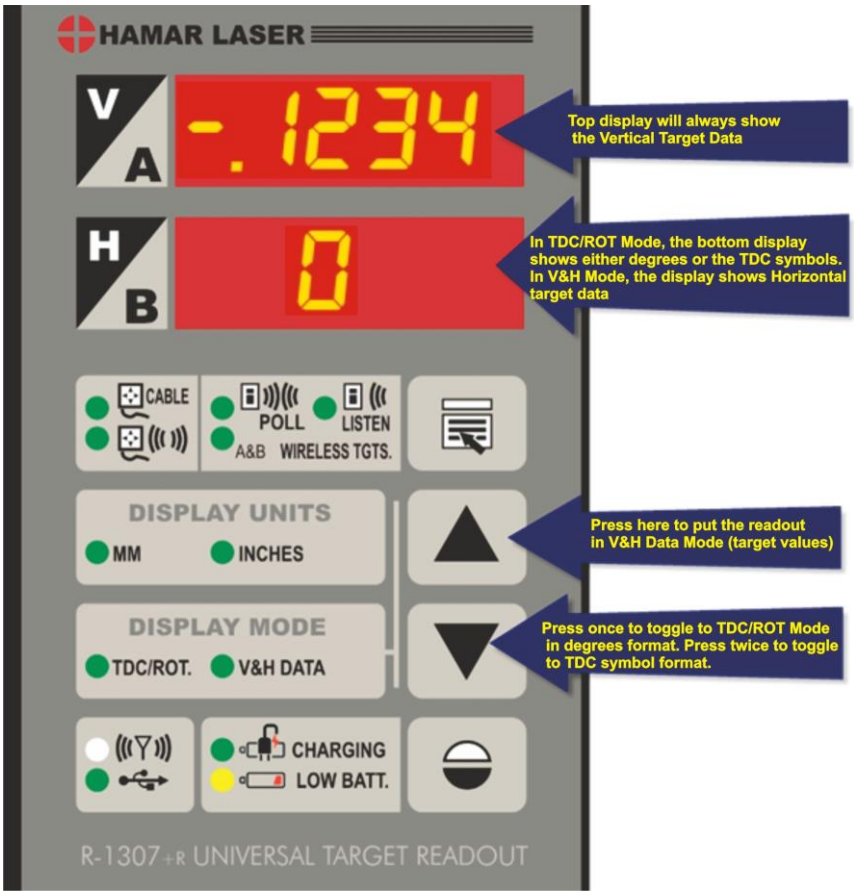


Figure 9 – *Using the R-1307+R in TDC/ROT Mode*

TDC/ROT Mode Procedure

1. Insert the A-516 Self-Centering Target into the bore.
2. Connect the R-1307 Readout and power on.
3. Press the **Down Arrow** on the R-1307 to activate TDC/ROT mode (see Figure 9). The **H** display indicates the rotation levelness of the target and the **V** display indicates the Vertical axis data.
   Note: *Press the* **Down Arrow** *again to switch back and forth between the level indicator (TDC Mode) and ROT Degrees Mode (see* Figure 11*). Press the* **UP Arrow** *to return it to H&V mode.*

Figure 10 – *H and V Displays*

4. Slowly rotate the target by pushing and pulling the target and rotating the pole until the **H** display shows the target to be at ± 1 degrees or the TDC indicator displays "0" or "-|" or "|-"(see the top left and second left screens in Figure 11). Take the data point by pressing the spacebar or clicking **Record** in Bore9.
   Note: *While the H display indicates the target's rotation axis data, the alignment data transmitted by the R-1307 to the target includes the H axis data. Therefore, it is* ***not*** *necessary to switch back to H&V Mode to record the data point. When recording alignment, always keep the R-1307+R in TDC/ROT mode.*
5. Repeat Steps 4 and 5 for each data point taken.

The following screens describe how the R-1307+R-2.4ZB Readout displays the rotation angle data for both the TDC and ROT modes.
Note: *In general, it is best to keep the rotation angle within ± 1 degree from zero. For TDC mode, acceptable values are "|-", "0" or "-|". See the screens below for more information.*

TDC Mode

Target rotation at 0 within ± 1°. **Good to take data.**

Target rotation ≥ 1° but <2°. **OK to take data.**

Target rotation ≥ 2° but <3°. **Do NOT take data.**

Target rotation ≥ 3° but <4°. **Do NOT take data.**

Target rotation ≥ 4° but < 5°. **Do NOT take data.**

Target rotation ≥ 5° but < 45°. **Do NOT take data.**

Target rotation < 45°. **Do NOT take data.**

ROT Mode

Target rotation at 0° within ± 0.9°. **OK to take data up to ± 2°.**

Target rotation at 12° within ± 0.9°. **Do NOT take data if rotation angle is ≥ 2.**

Limit of rotation display is ± 45°.

Target rotation > 45°. **Do NOT take data.**

Figure 11 – *R-1307+R Readout TDC/ROT Mode*

Using the MENU Key

The **Menu Key** provides access to the operational functions of the R-1307, such as display mode, measurement units, dampening, display resolution and display brightness. In addition, communication parameters between the target and readout are set through the **Menu Key**.

To use the **Menu Key**, press and hold the key for 2 seconds to enter C*onfiguration Mode*, and then press the **Menu Key** to cycle through the menu selections. Press the UP arrow key (↑) or the DOWN arrow key (↓) to change the settings for a selection.

Menu Selection	Selectable Options	Meaning
d ISP	rEL Abs	Relative (datum) position Absolute (default) position
Un itS	inch mm	Inches Millimeters
AUg_=	**2, 4, 8, 16, 32**	Dampening Number of Samples to Average
rES		Display Resolution
id_=	**Upper Display** id_=01 **Lower Display** id_=02	ID of first wireless scanning target ID of second wireless scanning target **Note:** *For fixed beam wireless target or local target, set both upper and lower ID to the same number*
ch-=	**0-9**	System ID of Wireless Target(s) or local target
br itE	**1 (dim) to 5 (bright)**	Display brightness
FUnct=	LOCAL POLL L iStn	Display position of target connected to local port Request and display position of wireless target(s) Display position of wireless targets controlled by another R-1307 or radio transceiver in Poll (Master) mode
	Following is an example of the information displayed for the selected target:	
	=tgt_ 1 F 10_ 10	Displays the PSD type (SC-100D or DL-10) target number, the laser mode (Pulsed or Fixed) and the PSD size (4x4 mm, 10x10 mm and 20x20 mm)
rEL_0	LocAL tArgt	Display is zeroed by the R-1307 Display can be zeroed by the UniTarget, using the Zero Button on the side of the Target (if so, equipped as an option).

Hidden menu items for any R-1307 model can be temporarily enabled by pressing and holding the UP arrow key while pressing the **MENU** key.

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.

For a complete chart of menu settings, see Page 23. To view the menu configurations for your specific readout, see *Configuring the R-1307 Readouts* beginning on Page 13.

Pulse/Continuous Modes (L-705, L-706 and L-708 Lasers)

The L-705, L-706 and L-708 Lasers are now equipped with a PULSE/CONTinuous switch, which manually switches the laser beam between *Pulsed* and *Fixed Beam Modes*. *Pulse Mode* automatically removes the effects of excess (ambient) background light for the R-1307 readouts, providing a more accurate reading. The R-1307 is capable of supporting both Pulse Mode and Continuous Mode as well as storing up to nine different target calibration factors for multiple target users. These capabilities must be specified when ordering a system.

The chart below indicates the operational modes for Readouts/Computer Interfaces that operate with the L-705/L-706/L-708 Lasers:

Mode	Readouts	Computer Interfaces
Pulse	R-1307B-2.4ZB, R-1307BC, R-1307C, R-1307-900/2.4, R-1307-2.4ZB, R-1307+R	A-910-900/2.4 (when used with R-1307-900 or R-1307-2.4) A-910-2.4ZB
CONTinuous	R-307, R-307V	R-358

Notes:

1. *The T-261A and T-266 Targets do not support the Pulsed-Beam Mode and the system purchased is factory-configured to operate in CONTinuous mode when using these targets.*
2. *When using the L-700 Laser with the R-1307 and a 2-Axis Target, the system is factory-configured to operate in CONTinuous mode.*

Configuring the R-1307 Readouts

Configuring the R-1307B-2.4ZB/XBE, R-1307C, R-1307-900/2.4 or R-1307-2.4ZB/XBE for a Cabled (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 Un it=. 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 Avg=. 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 Cabled (Local) Target**

   Press the MENU button until the upper display shows Funct=. Use the UP and DOWN arrow keys to select Funct= LOCAL.
6. **Select the PSD descriptor applicable to your target**

   Press the MENU button until the upper display shows tGt=nn, where nn designates the target number. Each R-1307 has three target descriptors:
   a. TGT=0 (for HLI use only. Do not use)
   b. TGT = nn, P.10.10 (pulsed beam mode)
   c. 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, tGt=02 F.10.10 or tGt=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 also returns to normal mode automatically after approximately four seconds of inactivity.

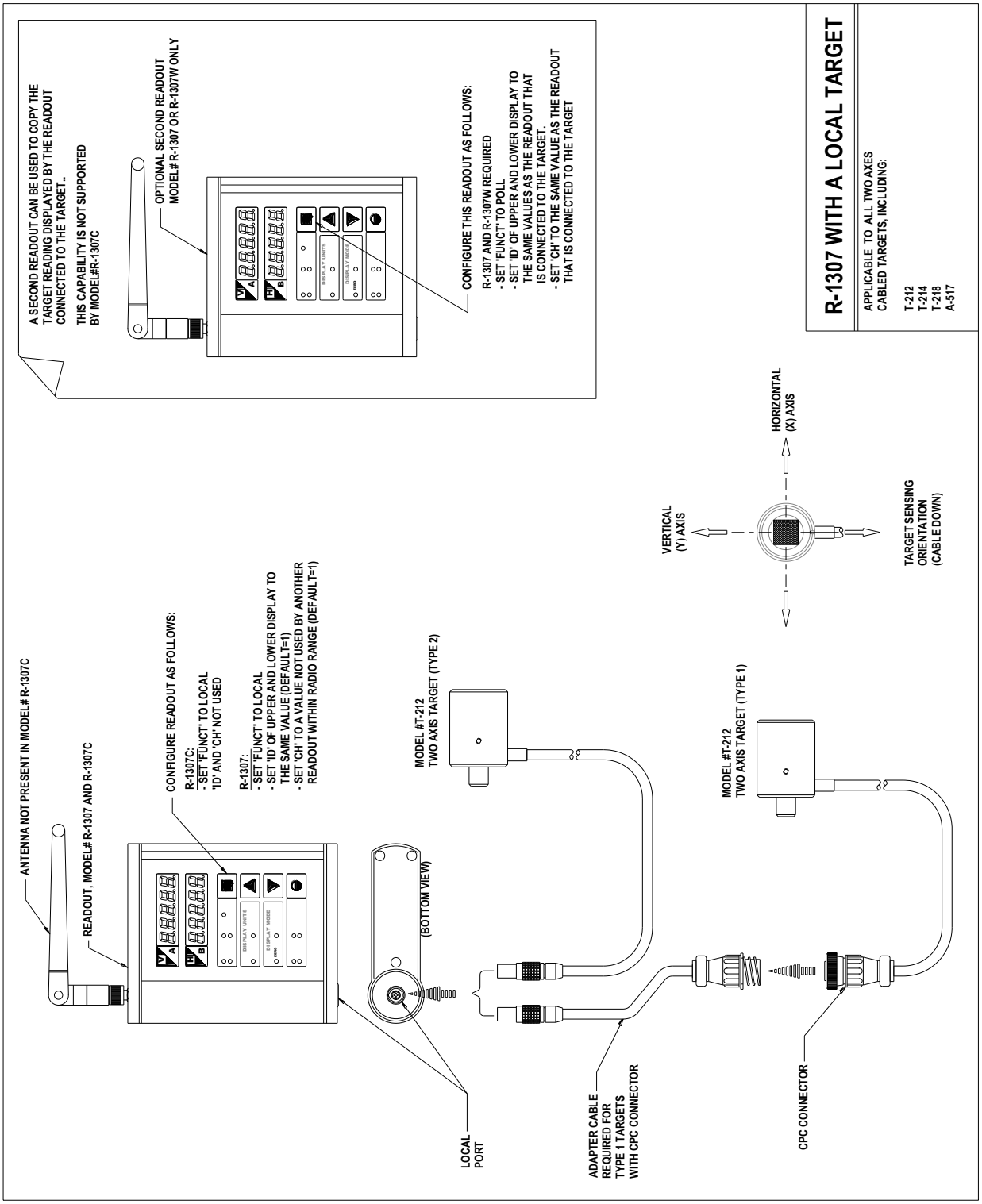


Figure 12 – *Connecting a Cabled (Local) Target to the R-1307*

Configuring the R-1307-900/2.4, R-1307W-900/2.4, R-1307W-2.4ZB/XBE or R-1307-2.4ZB/XBE as a Master Readout with up to Two Wireless Targets

Note: *Refer to* Figure 13 *for configuring the Readout to display data from one target in dual-axis (fixed beam) mode and* Figure 14 *for configuring the Readout to display data from two targets in single-axis (scanning beam) mode. Refer to* Figure 5 *or* Figure 6 *for descriptions of the control panel buttons and indicator function applicable to your unit and to* Figure 16 *for a list of Menu settings.*

1. **Set the Measurement Units**

   Press the MENU button until the upper display shows Un itS. Use the UP and DOWN arrow keys to select either inch for inches or mm for millimeters.

2. **Set the Dampening Level**

   Press the MENU button until the upper display shows AvG. Use the UP and DOWN arrow keys to set the number of averages. Four (4) is the default setting. Adjust this value as required to suit the application.

3. **Set the Readout Function to Master (poll) mode**

   Press the MENU button until the upper display shows FUnct. Use the UP and DOWN arrow keys to select FUnct PoLL.

4. **Set the Target Network ID for Target A, upper display**

   Press the MENU button until the upper display shows id nn with the current Target ID blinking.

   - Configure the upper display to show the position of the first scan target (A). Use the UP and DOWN arrow keys to set the Target ID to the TARGET NETWORK ID switch settings of the wireless target.

   --or—

   - Configure the upper display to show the vertical (Y) axis position of a dual-axis target. Use the UP and DOWN arrow keys to set the Target ID to the TARGET NETWORK ID switch settings of the wireless target.

5. **Set the Target Network ID for Target B, lower display**

   Press the MENU button until the lower display shows id nn with the current Target ID blinking.

   - Configure the lower display to show the position of the second scan target (B). Use the UP and DOWN arrow keys to set the Target ID to the TARGET NETWORK ID switch settings of the second wireless target.

   —or—

   - Configure the lower display to show the horizontal (X) axis position of a dual-axis target. Use the UP and DOWN arrow keys to set the Target ID to match the TARGET NETWORK ID of Target A.

6. **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 (the default is 01) to match the System ID switch setting common to all wireless targets that are part of a system.

   Note: *A "system" consists of one master readout, additional readouts in copy (listen) mode and up to two wireless targets. If you intend to use more than one system within radio range of each other, you must set each system to a different System ID (radio channel)*

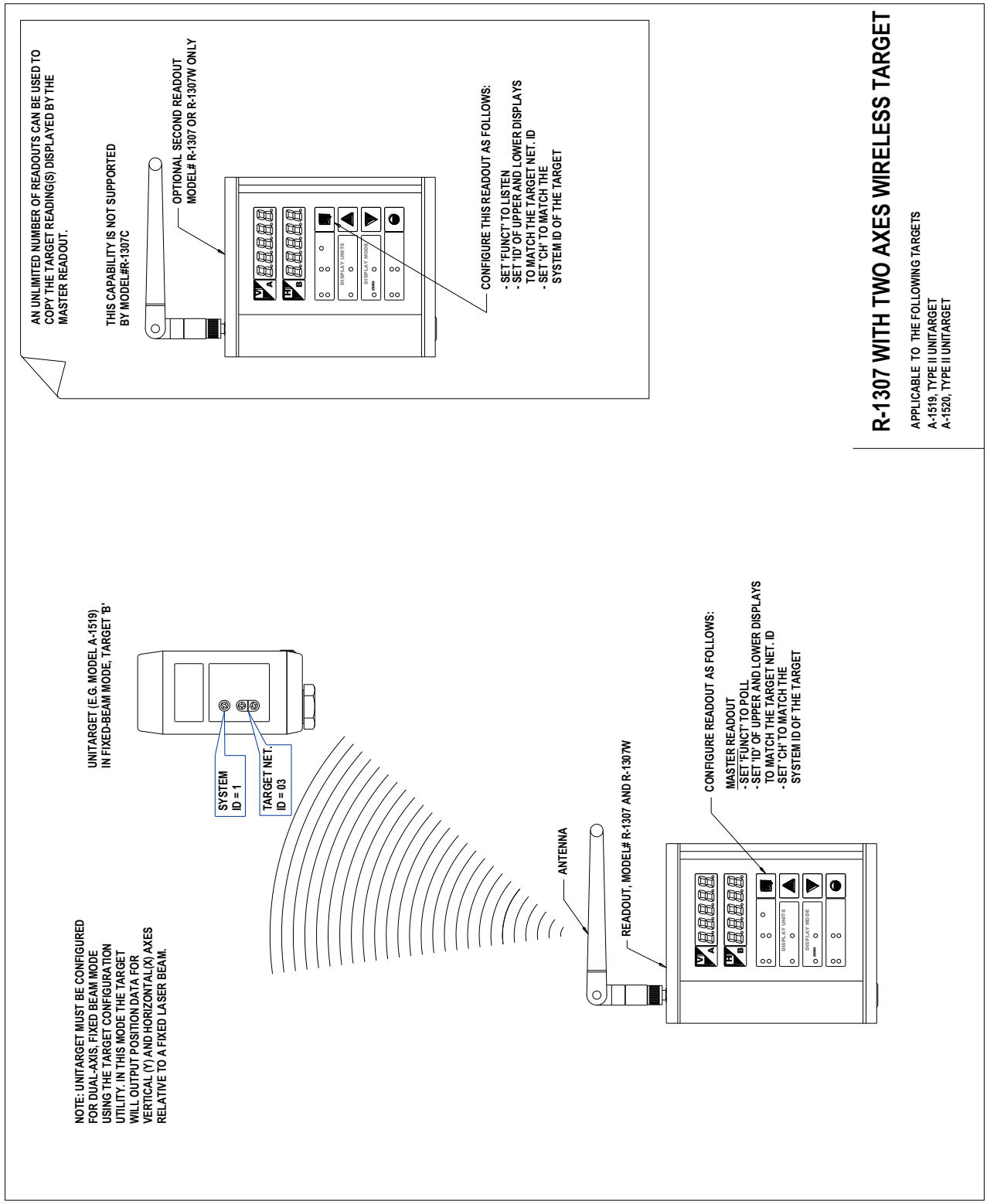


Figure 13 – *Using the R-1307 with one Unitarget in Dual-Axis (fixed beam) mode*

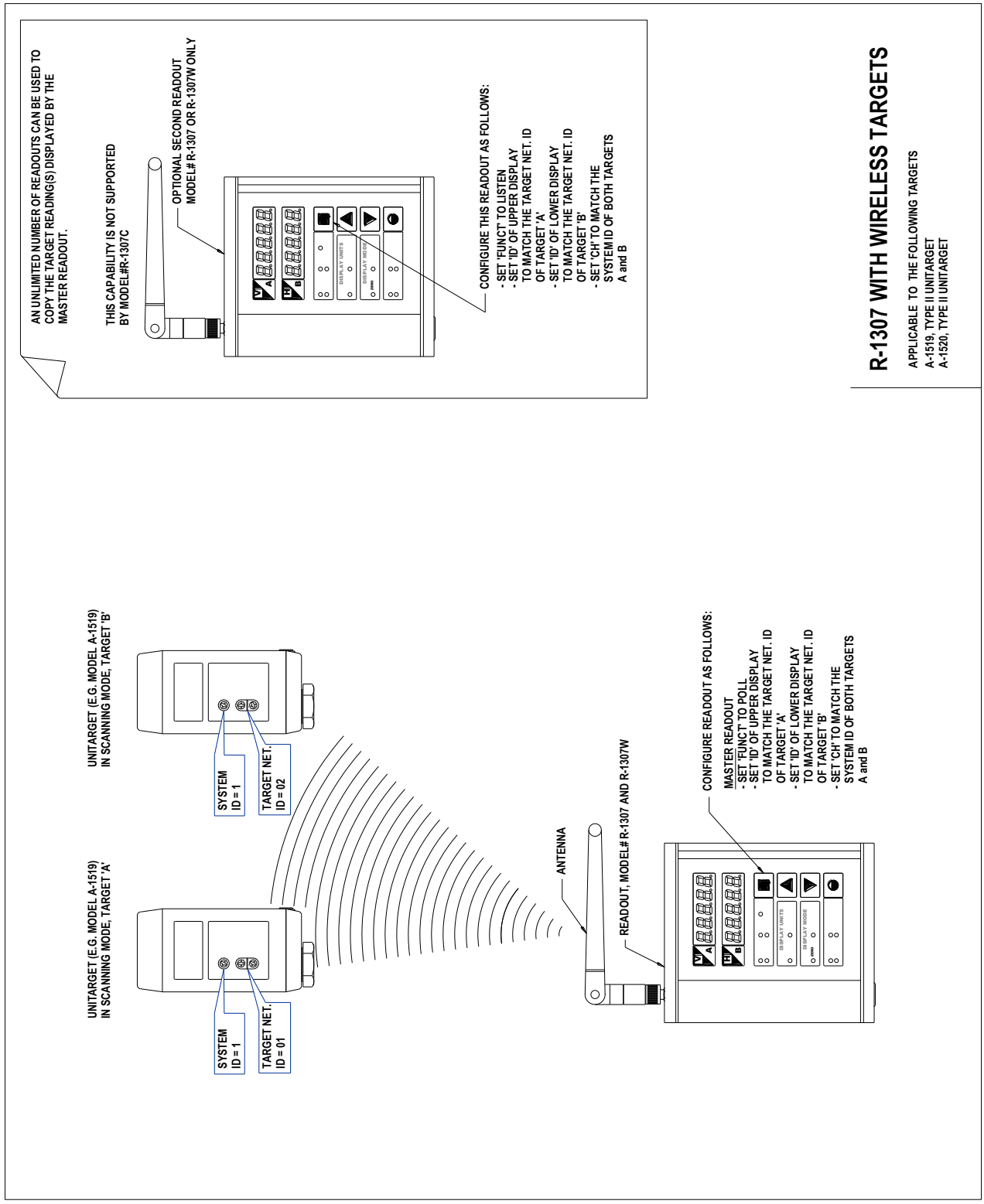


Figure 14 -- *Using the R-1307 with up to two Unitargets in Single-Axis (scanning) mode*

Configuring the R-1307W-900/2.4, R-1307-900/2.4, R-1307W-2.4ZB/XBE or R-1307-2.4ZB/XBE as a Backup Readout for Wireless Targets (Listen Mode)

Note: *Refer to* Figure 5 *or* Figure 6 *for descriptions of the control panel buttons and indicator function applicable to your unit and to* Figure 16 *for a list of Menu settings.*

1. **Set the Measurement Units to match the settings of the Master Readout**
   Press the MENU button until the upper display shows Un its. Use the UP and DOWN arrow keys to select either inch for inches or mm for millimeters.
2. **Set the Dampening Level to match the settings of the Master Readout**
   Press the MENU button until the upper display shows Avg. Use the UP and DOWN arrow keys to set the number of averages.
3. **Set the Readout Function to Copy (listen) mode**
   Press the MENU button until the upper display shows Funct. Use the UP and DOWN arrow keys to select Funct L ISTn.
4. **Set the Target Network ID for the upper and lower displays to match the settings of the Master Readout**
   Press the MENU button until the upper display shows id nn with the current Target ID blinking. Use the UP and DOWN arrow keys to set the Target ID to match the setting of the upper display ID of the Master Readout.

   Press the MENU button until the lower display shows id nn with the current Target ID blinking. Use the UP and DOWN arrow keys to set the Target ID to match the setting of the lower display ID of the Master Readout.
5. **Set the System ID (Radio Channel)**
   Press the MENU button until the upper display shows ch nn, with the current channel number (nn) blinking. Use the UP and DOWN arrow keys to set the channel of the Backup Readout to match the channel of the Master Readout.

   Notes:
   1. *Readouts configured in this mode will only display data if the Master Readout is present and polling one or more wireless targets.*
   2. *Backup Readouts must be within radio range of the targets and the Master Readout.*
   3. *There is no limit to the number of Backup Readouts configured to copy data for wireless targets.*

Configuring the R-1307W-900/2.4, R-1307-900/2.4, R-1307W-2.4ZB/XBE or R-1307-2.4ZB/XBE as a Backup Readout to an R-1307 Readout with a Cabled (Local) Target (Listen Mode)

Note: *Refer to* Figure 5 *or* Figure 6 *for a description of the control panel buttons and indicator functions applicable to your unit and to* Figure 16 *for a list of Menu settings.*

1. **Set the Measurement Units to match the settings of the Master Readout**
   Press the MENU button until the upper display shows Un it=_ Use the UP and DOWN arrow keys to select either inch for inches or mm for millimeters.
2. **Set the Dampening Level to match the settings of the Master Readout**
   Press the MENU button until the upper display shows Avg=. Use the UP and DOWN arrow keys to set the number of averages.
3. **Set the Readout Function to Master (poll) mode**
   Press the MENU button until the upper display shows Funct=. Use the UP and DOWN arrow keys to select Funct= PoLL.
4. **Set the Target Network ID for the upper and lower displays to match the settings of the Master Readout**
   Press the MENU button until the upper display shows id_= nn with the current Target ID (nn) blinking. Use the UP and DOWN arrow keys to set the Target ID to match the setting of the upper display ID of the Master Readout.

   Press the MENU button 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 match the setting of the lower display ID of the Master Readout.
5. **Set the System ID (Radio Channel)**
   Press the MENU button until the upper display shows ch_= nn, with the current channel number (nn) blinking. Use the UP and DOWN arrow keys to set the channel of the Backup Readout to match the channel of the Master Readout.

   Notes:
   1. *Backup Readouts must be within radio range of the Cabled (Local) Target Readout.*
   2. *There can only be one Backup Readout configured to copy data from a Cabled (Local) Target Readout.*

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 18, #5 in *Appendix B—The A-910 Radio Transceiver/Hub*).

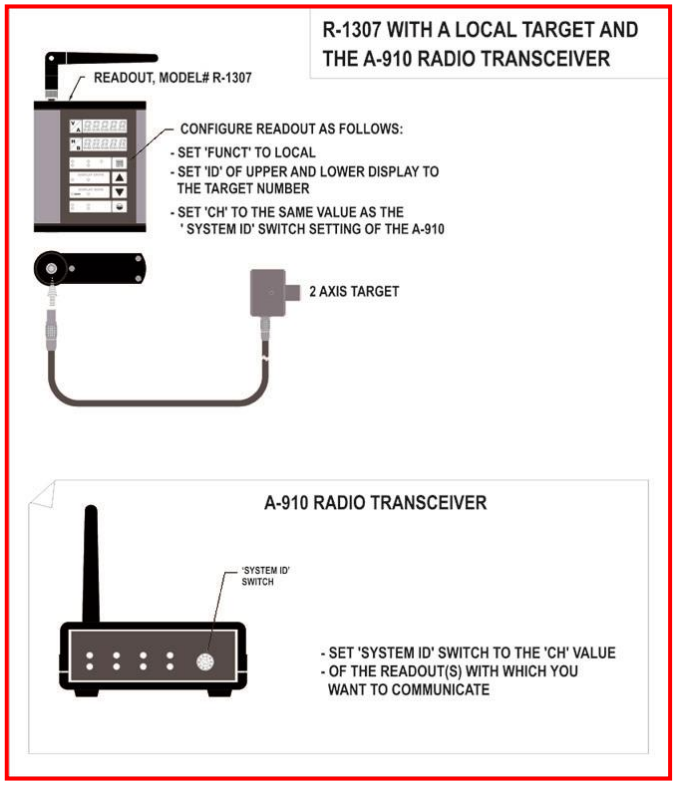


Figure 15– *R-1307 with Cabled (Local) Target and A-910 Radio Transceiver*

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. This is a standard message for the 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.

The A-910-2.4ZB/XBE and Utility Software

The A-910-2.4 ZB/XBE operates with the R-1307-2.4ZB/XBE models and plugs directly into any unused computer USB port to communicate directly with the targets. Utility software is provided for driver installation, setup and configuration. For detailed information, see Page 28.

Requirements for Radio Devices

As used in this manual, a s*ystem* is a collection of radio devices that have been assigned a set of common frequencies, grouped into a channel. The terms *channel* and *System ID* are functionally interchangeable.

All radio devices, for example the A-1519 and the R-1307W-2.4ZB/XBE, need to be configured for the same radio channel in order to communicate with each other. Set all devices that are part of a system to the same channel:

- Readout: ch= setting
- Wireless Target(s): System ID switch setting.

For example, if the System ID of an A-1519-900 is set to 02, then the Channel number of the R-1307 should be set to 02.

Within radio range, or for all practical purposes within the same facility, there can only be one Master Device in PoLL mode per system. This applies to *any* of the Hamar Laser radio devices.

There can only be one target with the same Target Network ID per system.

Frequently Asked Questions

Q *I need to read three targets simultaneously, requiring a second Master Readout. How can I read more than two targets within the same facility if there can only be one Master Device in PoLL mode per system?*

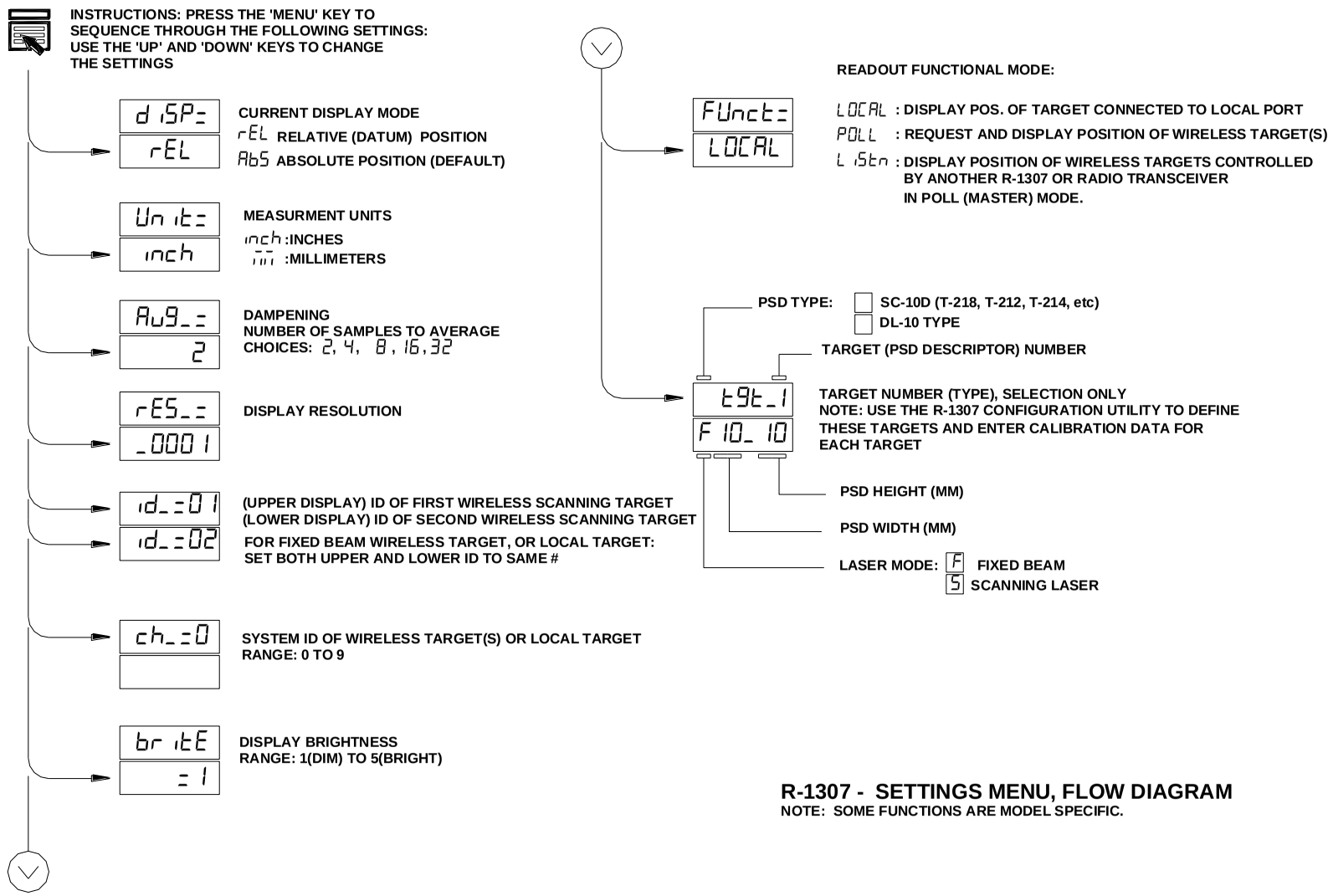
A The second Master Readout and the third target must be configured to operate on another Radio Channel or System ID. For every two targets, you will need an additional Master Readout configured to a different radio channel (see chart below).

Q *My position readings are noisy. What can I do to steady them?*

A First, determine *why* the readings are noisy. In most cases, reading noise is caused by vibration, air turbulence, or drift in the laser or target mounting structures. If possible, take steps to minimize external influences that cause reading instability. Experiment with the Dampening setting (Menu function AvG). Increase the number of samples to decrease reading fluctuations (note that higher number of samples results in slower response because reading takes longer to update after a change in position).

Set the display resolution to suit your requirements (Menu function rESJ). Don't set the display to .0001 in. resolution when you are working to tolerances of .001 in. or more. The extra digit will only add confusion if conditions are noisy.

Target Switch Settings			**R-1307 or R-1307W Readout Settings** (FUnct = PoLL)	
Target	**System ID (CH)**	**Target Net ID**	**Master Readout 1**	**Master Readout 2**
1	**01**	**01**	Upper id=01 , ch=01	--
2	**01**	**02**	Lower id=02 , ch=01	--
3	**02**	**03**		Upper id=03 , ch=02



R-1307 - SETTINGS MENU, FLOW DIAGRAM

NOTE: SOME FUNCTIONS ARE MODEL SPECIFIC.

Figure 16 -- *Settings Menu, Flow Diagram*

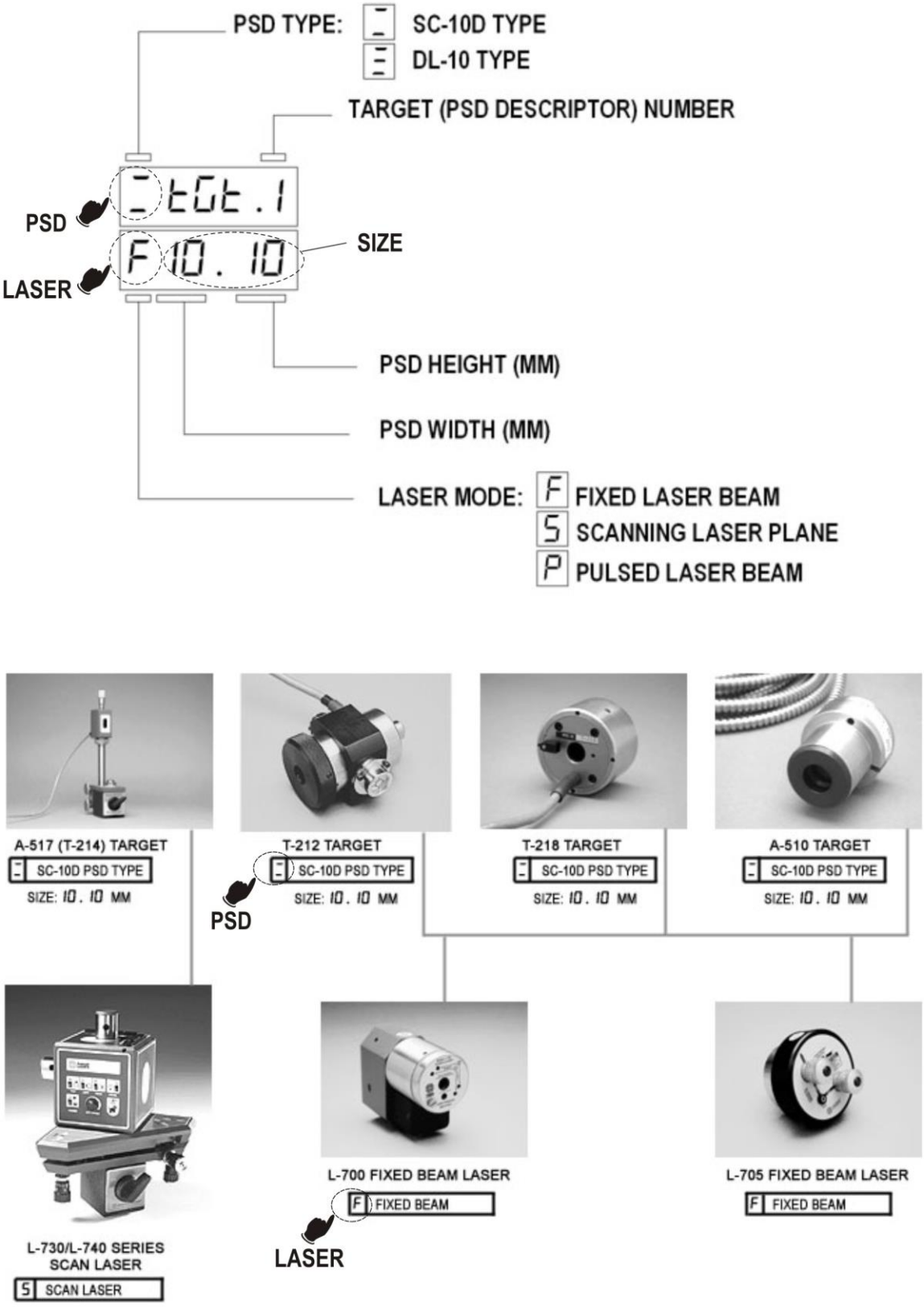
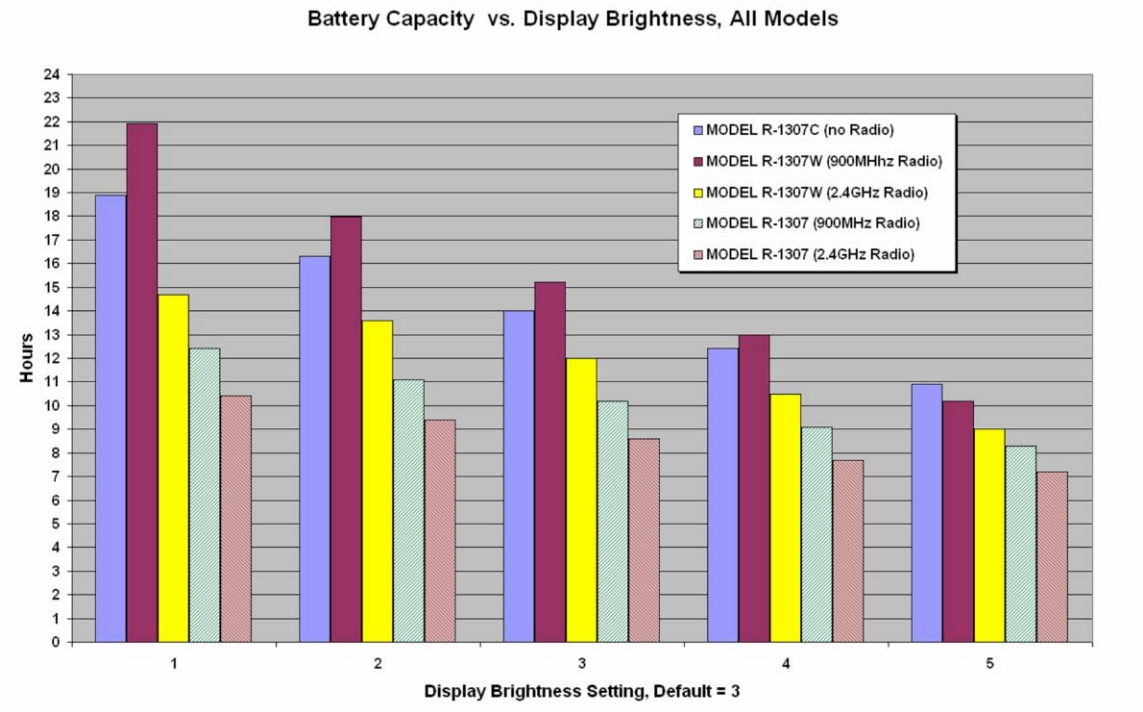


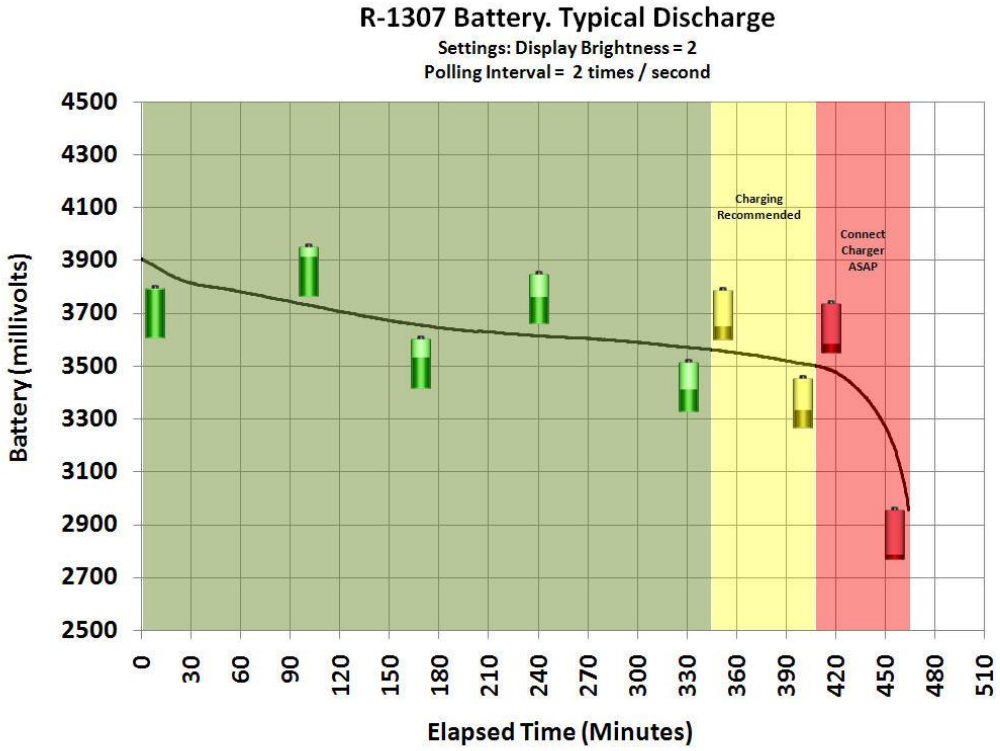
Figure 17 – *Target PSD Descriptor, Standard Targets and Lasers*

Appendix A – Equipment Specifications

Battery Type	2500mAh, Lithium-Polymer rechargeable battery
Battery Charging Time	5-8 hours typical. The CHARGING LED on the control panel remains lit until the battery is fully charged.
Battery Life Expectancy	800 charge/discharge cycles maximum. As is the case with all rechargeable batteries, the Lithium-Polymer internal battery will lose approximately 20% of the rated capacity after one year of normal daily usage (the battery will only last 8 out of the 10 hours that it lasted when it was new).
Battery Capacity (rated capacity of a new battery)	7-22 hours of continuous use. Varies by model, radio type and display brightness setting, as shown in the following chart. To optimize battery usage, set the display brightness to the lowest possible setting. A brightness setting of 2 is adequate for most room lighting conditions (see chart below).
Power Adapter/Charger	Input: 100-240V ac Output: 7.5V dc 1.2 A
Weight	1.2 lb. (0.55 Kg)
Housing Material	Aluminum
Physical Dimensions	5.45 in. x 4.63 in. x 1.45 in. (excluding antenna of R-1307 and R-1307W) 138 mm x 118 mm x 37 mm

Note: *The shelf life of lithium polymer batteries is 2-3 years under optimal conditions. Expect the battery capacity to drop to 80 percent after 500 charge/discharge cycles. To extend battery life, keep it away from heat (for example, inside a closed vehicle in full sun) and for best results, charge the battery to 100 percent of capacity and then allow it to discharge to 20 percent of capacity before recharging.*





Resolution and Accuracy – Cabled (Local) Target (R-1307-2.4ZB/XBE and R-1307C only)

PSD signal processor resolution: up to 0.25 microns with a 10x10mm sensor
LED Display resolution: up to .0001 in., 0.001mm

Cabled Target Position Sensor (PSD) accuracy:

PSD Type	Error[1] (Typical)	Error[2] (Maximum)
SC **A-517** **T-218** **T-212**	3% of displacement from PSD center *(.0008 in. error / .025 in. of displacement)* *(0.015mm error / 0.5mm displacement)*	5% of displacement from PSD center *(.0013 in. error / .025 in. of displacement)* *(0.025mm error / 0.5mm displacement)*
DL	1.5% of displacement from PSD center *(.0004 in. error / .025 in. of displacement)* *(0.008mm / 0.5mm displacement)*	3% of displacement from PSD center *(.0008 in. error / .025 in. of displacement)* *(0.015mm error / 0.5mm displacement)*

Resolution and Accuracy --Wireless Targets (R-1307-2.4ZB/XBE and R-1307W-2.4ZB/XBE only)

Position resolution and accuracy of wireless targets are not controlled by the R-1307. Wireless targets process and calibrate the position of the laser internally; therefore, the accuracy and resolution are device-dependent. Consult your wireless target documentation for more information.

[1] Based on Standard Calibration Method. PSD descriptor configuration required.
[2] Uncalibrated

Appendix B – The A-910 Radio Transceiver/Hub and the A-910-2.4ZB/XBE Radio

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 CH (Channel) number.

Figure 18 – *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 19 – *The A-910 Radio Transceiver/Hub REAR PANEL*

See Appendix D for radio specification details.

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

The A-910 Radio Utility for the A-910-24.ZB/XBE Dongle

Pre-installing the Common USB Port Driver

This driver is required for the A-910-2.4ZB/A-910-2.4XBE 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 flash drive into the target computer.
2. Open the flash drive and locate the driver installation executable (e.g., CP210xVCPInstaller.exe).
3. Double-click the executable to run the installer..
   Follow the on-screen instructions to complete the installation..

Figure 20 - *USB Common Driver Install*

Installing the A-910 Utility Software

1. Insert the flash drive into the target computer
2. Open the flash drive and locate the driver installation executable
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 dongle into any unused USB Port (see Figure 21). 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 22). If the utility does not automatically detect the COM port, it must be manually selected (see *Manually Selecting a COM Port* on Page 30).
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 23). Also see *Setting the Target System ID and Network ID* on Page 30 and *Setting the Target System ID and Network ID for the R-1307* on Page 20.

Figure 21 – *A-910-2.4ZB Dongle*

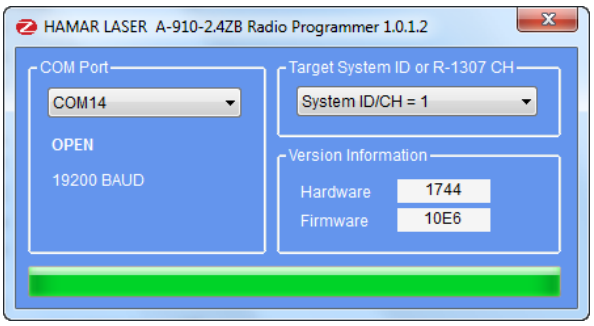


Figure 22 – *A-910 Utility showing the COM Port, System ID and Channel settings*

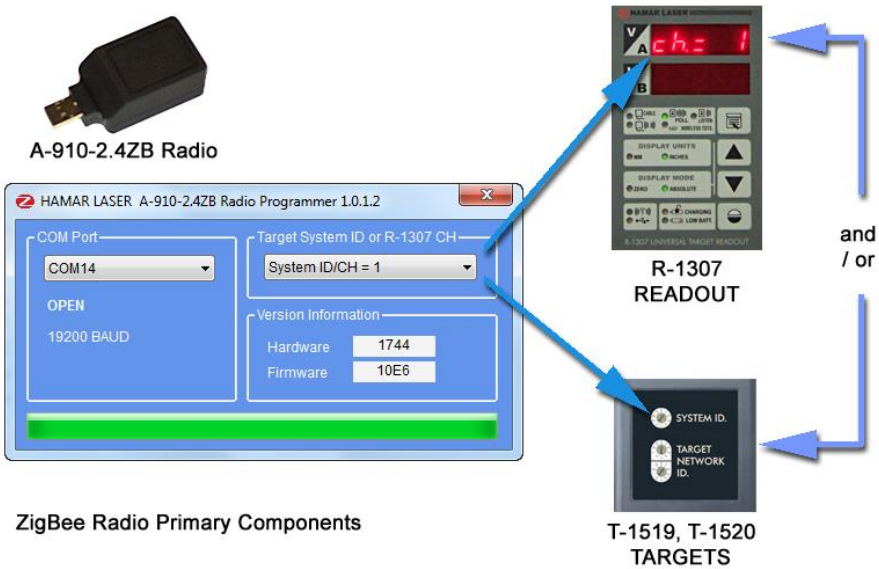


Figure 23 – *System ID Setup*

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.

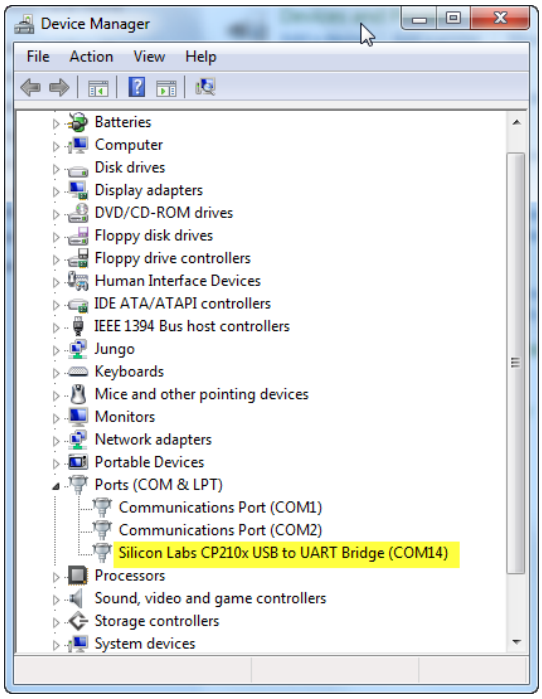


Figure 24 – *Device Manager showing COM Port for A-910 Dongle*

For Windows 10 and Windows 11:

1. **Open Device Manager:**
   - Press Win + X and select Device Manager from the menu.
   - Alternatively, you can search for "Device Manager" in the Start menu.
2. **Locate the Device:**
   - In the Device Manager window, expand the Ports (COM & LPT) section.
   - Find the device for which you want to change the COM port (e.g., "Silicon Labs CP210x USB to UART Bridge").
3. **Open Device Properties:**
   - Right-click the device and select Properties.
   - In the Properties window, go to the Port Settings tab.
4. **Advanced Settings:**
   - Click on the Advanced button.
   - In the Advanced Settings window, you'll see a section labeled COM Port Number.
5. **Change the COM Port:**
   - Click the drop-down menu next to COM Port Number and select an available COM port number from the list.
   - Click OK to save the changes.
6. **Apply and Close:**
   - Click OK in the Properties window to apply the changes.
   - Close the Device Manager.

Notes:

- Note the COM Port listed and select that COM Port in the A-910 Zigbee Utility software using the drop-down arrow (see **Figure 24**)

Setting the Target System ID and Target Network ID (A-1519/A-1520 Targets, A-910-900/2.4, A-910-2.4ZB/XBE)

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 25:

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

Figure 25 – *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 25 shows the System ID switch set to 1.

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

---

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

(1) 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

Agency Certifications for the 900 MHz Radio Transceiver

FCC (United States of America) Certification

Contains FCC ID: OUR-9XCITE
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 9XCite Radio (900 MHz), IC:4214A-9XCITE

Agency Certifications for the XBee® 802.15.4 Series 1

FCC (United States of America) Certification

Contains FCC ID: OUR-XBEE
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 XBee 902.14.4 IC:4214A-XBEE

CE ⓘ

Complies with ETSI (Europe), C-TICK (Australia) and Telec (Japan)

Appendix D – Care and Cleaning of Target Optics

The proper care and cleaning of optical windows and/or lenses of Hamar Laser's position-sensing devices (targets) assures optimum performance. Contaminants on an optical surface increase scatter, absorb laser energy, and eventually degrade the accuracy of the position-sensing devices. Because cleaning any precision optic risks damaging the surface, optics should only be cleaned when absolutely necessary. When cleaning is required, we recommend the following supplies and procedures.

Required Supplies

- **Optics Cleaning Tissue:** Soft, absorbent, lint-free lens tissue
- **Swabs:** Cotton swabs with wooden handles or polyester swabs with polypropylene handles
- **Dust Blower:** Filtered dry nitrogen blown through an antistatic nozzle is best. Canned dusters, such as Dust-Off, will also work.
- **Mild Soap solution:** Neutral soap, 1 percent in distilled water. Avoid scented, alkali, or colored soap such as liquid dishwashing detergents or hand soap. Ten drops of green soap (available at a pharmacies and optical cleaning suppliers) per 100 cc of distilled water is an acceptable alternative.
- **Isopropyl Alcohol:** Spectroscopic grade. Over-the-counter alcohol contains too much water and may have impurities.
- **Acetone:** Spectroscopic grade. Do not use over-the-counter Acetone, such as the type intended for nail polish removal.

Note: *When cleaning precision optics, even with the best quality optical cleaning tissue, use gentle pressure to avoid scratching the surface or damaging the optical coating(s). Always wipe using a figure-eight motion in one direction (begin at the top and work toward the bottom in a figure-eight motion).*
Use only moistened (not soaked) optical cleaning tissue, Swabs and Spectroscopic grade Acetone and Isopropyl Alcohol. ***Never spray any type of liquid directly on the device or submerge any part of the device.***

Removing Dust

Dust can bind to optics by static electricity. Blowing only removes some of the dirt. The remainder can be collected by using wet alcohol and Acetone swabs wrapped with optical lens tissue. Acetone dries rapidly and helps to eliminate streaks.

1. Blow off dust.
2. If any dust remains, twist lens tissue around a cotton swab moistened in alcohol and repeat as necessary.
3. Repeat using Acetone.

Cleaning Heavy Contamination

Fingerprints, oil, or water spots should be cleaned immediately. Skin acids attack coatings and glass and can leave permanent stains. Cleaning with solvents alone tends to redistribute grime.

1. Blow off dust.
2. Using a soap-saturated lens tissue around a swab, wipe the optic gently. Repeat as necessary.
3. Repeat using a distilled water-saturated lens tissue wrapped around a swab.
4. Repeat using an alcohol-saturated lens tissue wrapped around a swab.
5. Repeat using an acetone-saturated lens tissue wrapped around a swab.

Appendix E – Programmer's Reference

Polling the A-1519 and A-1520 Targets

The A-1519/A-1520 Targets do not transmit data until the Host Computer/Application transmits a polling request to each target that it needs to read. The polling request command consists of a Single Byte Code, equal to the Target Network ID.

For example: *To request a Data Packet from an A-1519 Target set to Target Network ID = 64, the host Application must transmit an ASCII 64 (40 hex).*

Polling interval by target data connection type:

- Wireless targets (ZigBee radio 2.4 GHz): 160 milliseconds or greater
- Cabled targets (RS-485 network): 70 milliseconds or greater.

Note: *The polling rate for scanning lasers (time interval between successive requests for data from the same target) should be greater than or equal to the scan rate. For most Hamar Laser scanners (for example the L-740) the recommended polling rate is 4 times/second (250 milliseconds interval). Polling the same target at a rate faster than the laser scan rate is pointless because the target will not reply with a new data packet until the position has been refreshed by a new laser scan.*

Standard procedure for polling a target:

a) Initialize the Active COM Port with the following Settings:
   - 19200 baud
   - No Parity
   - 8-bit word
   - 1 Stop Bit
b) Transmit the Single Byte Request Code = Target Network ID of the target that is being polled.
c) Set a timeout: Wait a minimum of 60 ms for a reply. Radio I/O may require up to 160 ms.
d) Process Data in the Input Buffer: Validate Checksum, Parse Data Packet, etc.
e) Check Validity of Device Type, Operational Status Code, on-target status, etc.
f) If polling another target, go to **Step a**.
g) If polling the same target, wait until the polling interval has elapsed since **Step a** was executed, then repeat **Step a**.

Normal Application Data Packet

Packet Length: 18 bytes (Including two Checksum bytes)

Byte 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SOM	LEN	DEV	SN		OPC	TNI	TST	WP		VCO		BAT		TEMP		CHK	

	DEC	**NOTES**
SOM = START OF MESSAGE	64	
LEN = LENGTH OF MESSAGE	18	
DEV = DEVICE TYPE	19,20	*A-1519 = 19 DEC*
SN= SERIAL NUMBER	00001TO 65535	
OPC=OPERATIONAL STATUS CODE	0,3	*0=UNCALIBRATED, 3=CALIBRATED*
TNI=TARGET NETWORK ID	1 TO 99	*FROM EXTERNAL DIP SWITCHES*
TST=TARGET STATUS	0 TO 255	(See TST Information, Page 39)
VP = VERTICAL POSITION, COUNTS	-32768 TO 32767	*1µm = 2 COUNTS (A-1519)*
	‘’	*1µm = 4 COUNTS (A-1520)*
VCO= SENSOR CENTER OFFSET	-4000 TO 4000	*1µm = 2 COUNTS (A-1519)*
	‘’	*1µm = 4 COUNTS (A-1520)*
BAT=BATTERY VOLTAGE	0 TO 5000	*MILLIVOLTS*
TEMP=INTERNAL TEMPERATURE (COUNTS)	-160 TO 800	*1 COUNT=1/16ºC*
CHK=PACKET CHECKSUM		

Notes:

1. Two byte (integer) values (for example, SN, CHK) are in least significant byte, most significant byte order. For example, Byte 4 = 57 (39 HEX), Byte 5 = 48 (30 HEX), then SN = 12345 (3039 HEX).
2. VCO = Mechanical offset between the sensor’s electrical center and the target’s mechanical center. For factory use only.
3. CHK (Checksum) = Two’s complement (negation) of the sum of bytes 1 to 16

Dual Axis Data Packet
(R-1307C, R-1307-2.4ZB/XBE Readouts or A-1519-2.4ZB, A-1520-2.4ZB/XBE targets)

BYTE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SOM	LEN	DEV	SN		OPC	TNI	TST	VP		VCO		BAT		TEMP		HP	

19	20	21	22
HCO		CHK	

Packet Length: 22 bytes (Including two Checksum bytes)

	DEC	NOTES
	-----	-------
SOM = START OF MESSAGE	64	
LEN = LENGTH OF MESSAGE	22	
DEV = DEVICE TYPE	19,20	*A-1519 = 19 DEC*
SN= SERIAL NUMBER	00001TO 65535	
OPC=OPERATIONAL STATUS CODE	0,3	*0=UNCALIBRATED,*
3=CALIBRATED		
TNI=TARGET NETWORK ID	1 TO 99	*FROM EXTERNAL DIP*
SWITCHES		
TST=TARGET STATUS	0 TO 255	(See Page 4)
VP = VERTICAL POSITION, COUNTS	-32768 TO 32767	*1µm = 2 COUNTS (A-1519)*
	‘’	*1µm = 4 COUNTS (A-1520)*
VCO= VERTICAL CENTER OFFSET	-4000 TO 4000	*1µm = 2 COUNTS (A-1519)*
	‘’	*1µm = 4 COUNTS (A-1520)*
BAT=BATTERY VOLTAGE	0 TO 5000	*MILLIVOLTS*
TEMP=INTERNAL TEMPERATURE (COUNTS)	-160 TO 800	*1 COUNT=1/16°C*
HP = HORIZONTAL POSITION, COUNTS	-32768 TO 32767	*1µm = 2 COUNTS (A-1519)*
	‘’	*1µm = 4 COUNTS (A-1520)*
HCO= HORIZONTAL CENTER OFFSET	-4000 TO 4000	*1µm = 2 COUNTS (A-1519)*
	‘’	*1µm = 4 COUNTS (A-1520)*

CHK=PACKET CHECKSUM

Notes:

1. Two byte (integer) values (for example, SN, CHK) are in lease significant byte, most significant byte order. For example, Byte 4 = 57 (39 HEX), Byte 5 = 48 (30 HEX), then SN = 12345 (3039 HEX).

2. VCO,HCO = Mechanical offsets between the sensor's electrical center and the target's mechanical center. For factory use only.
3. CHK (Checksum)) = Two's complement (negation) of the sum of the bytes 1 to 20.

TST – Target Status Byte (All Packet Types)

BIT ORDER
EXAMPLE: 116 DEC, (01110100 BINARY) =>

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
0	**1**	**1**	**1**	**0**	**1**	**0**	**0**

ILL:
(INCIDENT LIGHT LEVEL)
0 – 11 NORMAL RANGE
12–14 CAUTION. NEAR SATURATION
15 SATURATED

BIT 7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
BIT 6	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
BIT 5	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
BIT 4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
ILL =>	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**

BACKGROUND LIGHT PERIODICITY, SYNCRONIZATION MODE

PERIODICITY=>	**50/100Hz**	**60/120Hz**	**NONE**	**UNSTABLE**
BIT 3	0	0	1	1
BIT 2	0	1	0	1

USB PORT ACTIVITY INDICATOR

LASER DETECTION STATUS

BIT 1	1 = AUX. USB PORT ACTIVE	0 = RADIO/RS-485 ACTIVE
BIT 0	1 = LASER NOT DETECTED	0 = LASER DETECTED