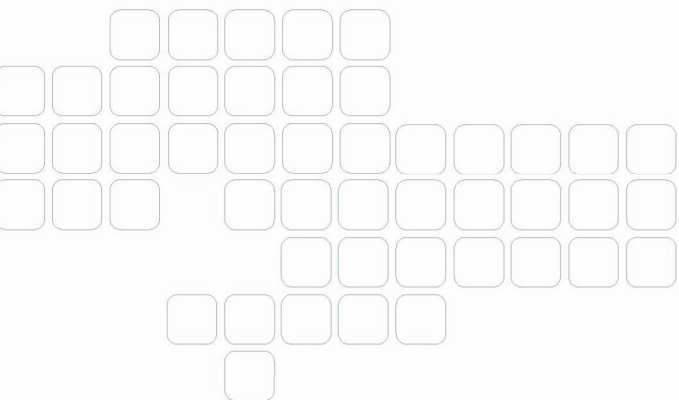
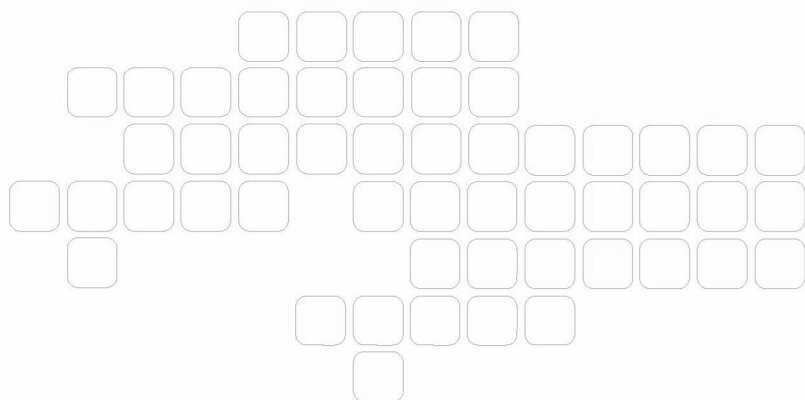




USER'S MANUAL

B-Series B900 Sensor

Version 5.1.4.4



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This product is designated for use solely as a component and as such it does not comply with the standards relating to laser products specified in U.S. FDA CFR Title 21 Part 1040.

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Table of Contents

1	Overview	5
2	Laser Safety.....	7
2.1	General Information	7
2.2	Laser Classification	8
2.2.1	Laser Classes	8
2.2.2	User Precautions & OEM Responsibilities	9
2.2.3	Class 3B/IIIb OEM Responsibilities	9
2.3	Requirements on laser systems sold or used in the USA	11
2.4	B900 laser safety specification	11
3	Sensor Description	12
3.1	General	12
3.2	Performance Specifications.....	12
3.3	Electrical Power Requirements	12
3.4	Dimensions	13
4	Maintenance	14
4.1	Preventative Maintenance Procedures.....	14
4.2	Welding and the Scanner Frame	14
5	Connecting the Hardware	15
5.1	Connection Overview	15
5.2	Mounting	16
5.2.1	Sensor Positioning	16
5.2.1.1	<i>Relative to the Target.....</i>	<i>16</i>
5.2.2	Chain Spacing.....	17
5.3	Cabling/Power.....	19
5.3.1	Connector and Cable Part Numbers.....	20
6	OEM Design.....	21
6.1	Design Requirements.....	21
6.1.1	System Calibration.....	21
6.1.1.1	<i>Determine Laser Alignment Offset/Delay.....</i>	<i>21</i>
6.1.1.2	<i>Determine Range Offset</i>	<i>21</i>
6.2	Design Recommendations	22
6.2.1	Sensor Mounting	22
6.2.2	Photocells	22
6.2.3	Scanner Frame	22
6.2.4	Baffle Plates.....	23
6.3	B900 Sensor and Baffle Plate Configuration	28
6.3.1	Sensor Alignment.....	28
6.3.2	Baffle Plate Alignment.....	30
7	Getting Started	31
7.1	Powering Up	31
7.2	Connecting.....	32
7.3	Sensor Diagnostics	33
7.4	Application Development.....	33
7.5	Ranges	34
7.6	Light Curtain Processing Considerations.....	35
7.7	Sensor Position Configuration	36
8	Warranty	37

8.1	Warranty Policies	37
8.2	Return Policy.....	37
9	Getting Help.....	38

1 Overview

The DynaVision® B900 sensor by LMI Technologies Inc. is designed for use in a lumber profile scanner to supply a 3 dimensional profile for lumber recovery optimization. B900 based scanning systems are primarily designed to provide true shape, 3D measurements of lumber to enable computerized optimization of lumber processing centres such as edgers, trimmers, and sorters.

Raw boards are fed through the scanner using cross-transfer mechanism such as chains equipped with lugs. Each set of lugs "pushes" a raw board (flitch) through the scanner. Travel distance is measured using an opto-mechanical encoder attached to the motor. While the flitch is traveling under the scanner, each encoder pulse triggers the sensor to take range measurements at intervals of 3.00" along the length of the target and supplies a light curtain profile to provide board length to a resolution of 1/8". These measurements are retrieved by a NetPowerHub interface module, stored in it's internal data buffers and made available to the scanner computer once the target board completely passes through.



Access to the sensor data is based on standard TCP/IP and UDP Ethernet network protocol allowing the DynaVision® B900 to be interfaced to many hardware and OS platforms.

Each B900 sensor provides data for a 2 foot (610 mm) section (the length of each B900 sensor) of the material to be scanned.

The sensors may be mounted above and below the target (Top/Bottom scanning) or above the target only (Top only scanning). Top/Bottom scanning allows true thickness measurements at each laser beam. Top only scanning provides thickness profiles at each laser beam relative to an arbitrary fixed reference point.

The sensors are designed to be used in conjunction with the NetPowerHub (NPH) and the MB Station, which collects measurements from all, installed heads and stores them for use by the client's computer. A fully populated NetPowerHub permits top/bottom scanner designs of up to 24 feet (6.1 m) and 48 feet (12.2 m) for top only systems. The B900 sensor generates measurement samples at 2 kHz. Each pulse generated by an encoder connected to the NetPowerHub/MB Station, causes the current range and light curtain readings for all heads on the frame (scan line) to be collected.

B900 sensors are kept in synch with one another via a synchronization signal that is transmitted from the NetPowerHub/MB Station to each sensor. This insures that the range data sampled at the same point in time across the board.

The following components are available from LMI Technologies Inc.:

B900 Sensors	Laser-based distance and length sensors.
NetPowerHub/MB Station	Distributes individually fused power and serial communications to the B900 heads.
B-series Software CD	CD-ROM containing software libraries, system installation, diagnostic and demonstration programs, and software documentation.

The following may be ordered directly from DNA Cables of Burnaby, BC, Canada (ph: 604-439-1099) or LMI :

Integrated Power Cable	Connectorized cable for power and serial communications.
-------------------------------	--

2 Laser Safety

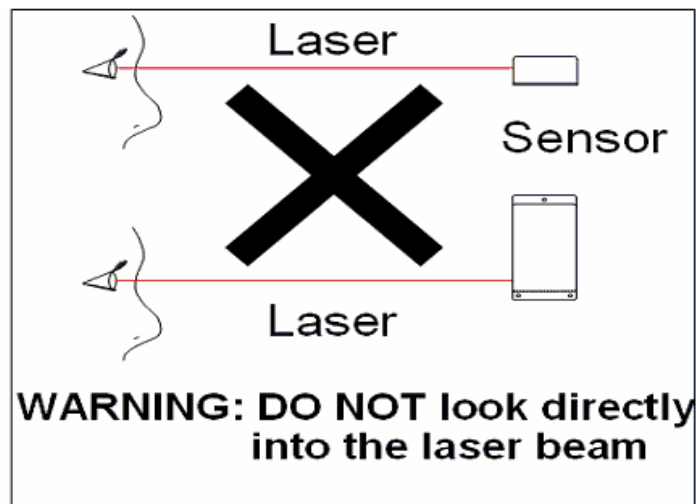
2.1 General Information

The laser light sources used in LMI Sensors are semiconductor lasers emitting visible light.

LMI Laser Sensors have a 2/II, 3R/IIIa or 3B/IIIb classification depending on model.

Class 2/II and 3R/IIIa sensors are referred to as “products” indicating that they fully comply with the standards relating to laser products specified in IEC 60825-1 and U.S. FDA CFR Title 21 Part 1040 except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001.

Class 3B/IIIb sensors are sold only to qualified OEM’s as “components” for incorporation into their own equipment. The sensors do not incorporate safety items which the OEM is required to provide in their own equipment (e.g. remote interlocks, key control). As such these sensors do not fully comply with the standards relating to laser products specified in IEC 60825-1 and FDA CFR Title 21 Part 1040.



Caution! Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

1. **International Standard IEC 60825-1 (2001-08) Consolidated edition**, Safety of laser products – Part 1: Equipment classification, requirements and user's guide
2. **Technical Report TR 60825-10**, safety of laser products – Part 10. Application guidelines and explanatory notes to IEC 60825-1
3. **Laser Notice No. 50**, FDA and CDRH <http://www.fda.gov/cdrh/rad-health.html>

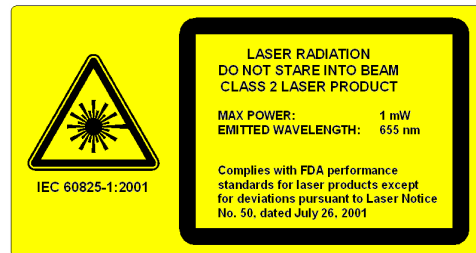
2.2 Laser Classification

2.2.1 Laser Classes

Class 2/II laser products:

Class 2/II laser products would not cause permanent damage to the eye under reasonably foreseeable conditions of operation, provided that any exposure can be terminated by the blink reflex (assumed to take 0.25 sec). Because classification assumes the blink reflex, the wavelength of light must be in the visible range (400 nm to 700 nm). The Maximum Permissible Exposure (MPE) for visible radiation for 0.25 second is 25 Watt per square meter, which is equivalent to 1 mW entering an aperture of 7 mm diameter (the assumed size of the pupil).

Labels reprinted here are examples relevant to the laser classes. For detailed specifications observe the label on your laser sensor



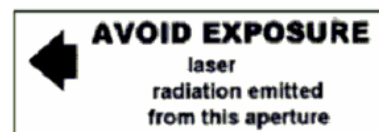
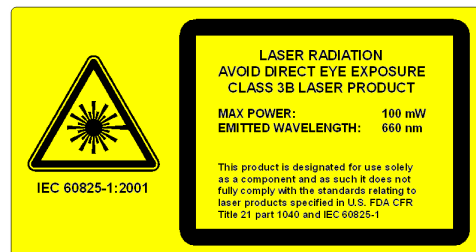
Class 3R/IIIa laser products:

Class 3R/IIIa laser products emit radiation where direct intrabeam viewing is potentially hazardous, but the risk is lower than for 3B/IIIb lasers. Fewer manufacturing requirements and control measures for users apply than for 3B/IIIb lasers.



Class 3B/IIIb laser components:

Class 3B/IIIb components are unsafe for eye exposure. Usually only ocular protection would be required. Diffuse reflections are safe if viewed for less than 10 seconds.



2.2.2 User Precautions & OEM Responsibilities

The specific user precautions as specified in IEC 60825-1 and FDA CFR Title 21 Part 1040 are:

Requirements	Class 2/II	Class 3R/3a	Class 3B/3b
Laser safety officer	Not required	Not required	Required
Remote interlock	Not required	Not required	Required**
Key control	Not required	Not required	Required** Cannot remove key when in use
Beam attenuator	Not required	Not required	Required**
Emission indicator	Not required	Not required	Required**
Warning signs	Not required	Not required	Required**
Beam path	Not required	Terminate beam at useful length	Terminate beam at useful length
Specular reflection	Not required	Prevent unintentional reflections	Prevent unintentional reflections
Power-On delays	Not required	Not required	Required**
Eye protection	Not required	Not required	Required under special conditions
Training	Not required	Required for operator and maintenance personnel	Required for operator and maintenance personnel

LMI Class 3B/IIIb laser components do not incorporate the safety items indicated by an asterisk ** in the table above. These items must be added and completed by the OEM in the system design.

2.2.3 Class 3B/IIIb OEM Responsibilities

LMI Technologies has filed reports with the FDA to assist the OEM in achieving certification of their laser products. The OEM can reference these reports by an accession number that will be provided upon request.

A detailed description of the safety items that must be added to the OEM design is listed below:

Remote Interlock

A remote interlock connection must be present in Class IIIB laser systems. This permits remote switches to be attached in serial with the keylock switch on the controls. The deactivation of any remote switches must prevent power from being supplied to any lasers.

Key Control

A key operated master control to the lasers that prevents any power from being supplied to the lasers while in the OFF position. The key can be removable in the OFF position but the switch must not allow the key to be removed from the lock while in the ON position.

Beam Attenuators

A permanently attached method of preventing human access to the laser radiation other than switches, power connectors or key control must be employed. On some LMI laser sensors, the beam attenuator is supplied with the sensor as an integrated mechanical shutter.

Emission Indicator

It is required that the controls that operate the sensors incorporate a visible or audible indicator when power is applied and the lasers are operating. If distance (>2 m between sensor and controls) or mounting of sensors intervenes with observation of these indicators, a second power-on indicator should be mounted at some readily observable position. When mounting the warning indicators, it is important not to mount them in a location that would require human exposure to the laser emissions.

Power-On Delays

A delay circuit is required that illuminates warning indicators for a short period of time prior to supplying power to the lasers.

Warning Signs

Laser warning signs must be located in the vicinity of the sensor such that they will be readily observed. Examples of laser warning signs are:



FDA Example



IEC Example

2.3 Requirements on laser systems sold or used in the USA

The OEM's laser system which incorporates laser components or laser products manufactured by LMI Technologies requires certification by the FDA.

It is the responsibility of the OEM to achieve and maintain this certification.

OEM's are recommended to obtain the information booklet *Regulations for the Administration and Enforcement of the Radiation Control for Health and Safety Act of 1968*: HHS Publication FDA 88-8035.

This publication, containing the full details of laser safety requirements, can be obtained directly from the FDA, or downloaded from their website at <http://www.fda.gov/cdrh>.

2.4 B900 laser safety specification

Laser Classification: 3B/IIIb laser component

Peak Power: 130mW

Emitted Wavelength: 660nm

3 Sensor Description

3.1 General

Each sensor projects 8 laser beams onto a target surface at 3" (76.2 mm) spacing. Each beam produces a laser spot that is detected by one or both integrated CCD line cameras and the respective target range is calculated using the triangulation method. The arrangement of the cameras allows ranges to be calculated for all lasers at the actual scan rate of the CCD without overlapping spots.

The B900 sensor uses only solid-state components including solid-state lasers. Reliability is improved by avoiding the use of beam splitters, spinning mirrors, or other mechanical devices. All components are mounted in a solid aluminum CNC machined package that can be installed directly in the sawmill environment.

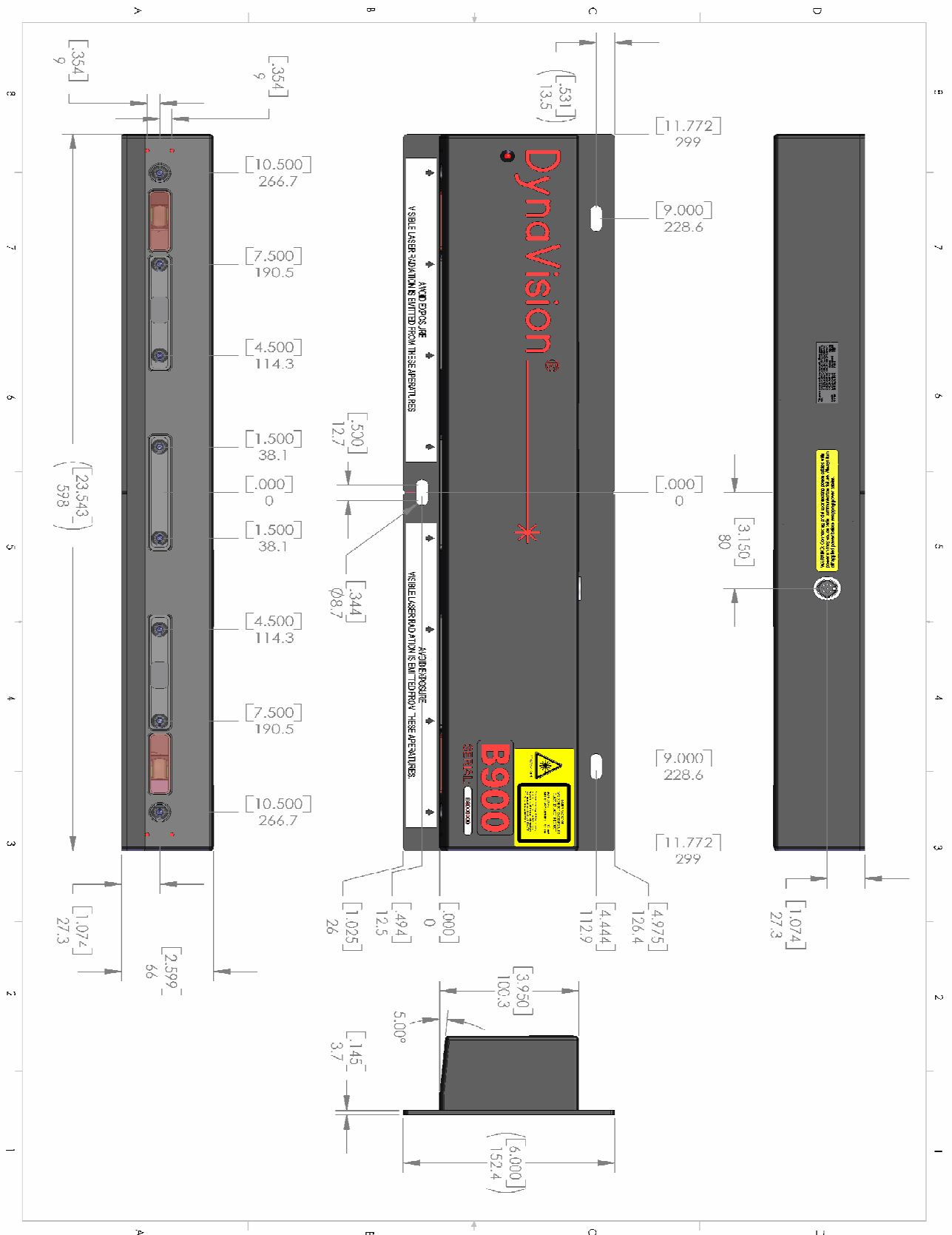
3.2 Performance Specifications

Standoff Distance	17" (432mm)
Measurement Range	14" (356mm)
Measurement Resolution	$\pm 0.008"$ (0.20mm)
Line Accuracy	$\pm 0.125"$ (3mm)

3.3 Electrical Power Requirements

B900 sensor - +15 to +24 VDC (650mA @ 24VDC)

3.4 Dimensions



4 Maintenance

The sensor does not contain any user serviceable parts! Any attempt to open the unit may damage it and will void the warranty.

As an optical apparatus, it is critical that the internal space within the sensor remains clean and moisture free. Therefore, all servicing of the sensor must be performed at LMI's manufacturing facility in a controlled environment.

4.1 Preventative Maintenance Procedures

Since the DynaVision® sensors operate optically, the primary maintenance procedure is keeping the heads clean of sawdust, oil and pitch. The following maintenance tasks should be performed regularly to keep the system in good working order.

- Using clean air, blow off the top and bottom head baffle plates and sensors. Do not use any air, which may contain water or oil as it may coat the glass lenses on the sensors, resulting in scanning errors.
- Clean the glass windows on each sensor using a soft, lint free cloth and isopropyl alcohol.

Do not pressure wash the sensors as this can cause severe damage.

4.2 Welding and the Scanner Frame

DynaVision® sensors are optical apparatus, and care must be taken to ensure that nothing affects their optical performance.

The camera used inside each sensor can be damaged by very intense light.

Additionally, the debris generated while welding is normally hot enough to mar or imbed itself in the surface of the glass lenses covering the lasers and camera. Therefore, it is recommended that the sensor heads are shielded before any welding takes place in a close proximity of the scanner frame

5 Connecting the Hardware

5.1 Connection Overview

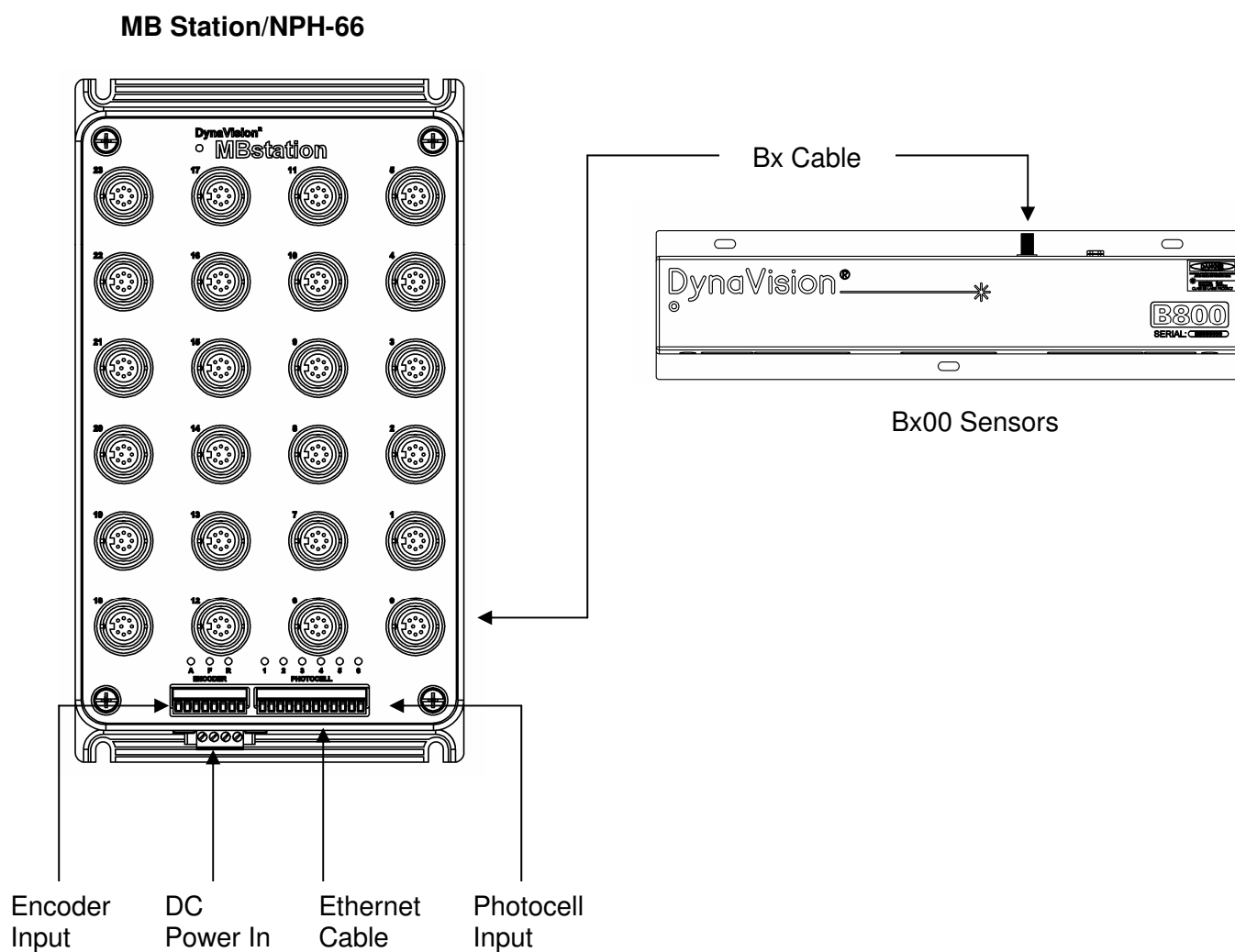


Figure 5.1 – BX00 to MB Station connection

5.2 Mounting

The sensors are held in place at three points (mounting holes). It's suggested that the sensors be mounted onto studs attached to the frame rather than bolted directly to the frame itself. This allows the installation of shims to aim the scan head in case the frame is not aligned correctly. You should be able to pivot all sensors so that they can be aligned such that the top and bottom pairs have their lasers shining directly into each others windows.

5.2.1 Sensor Positioning

5.2.1.1 Relative to the Target

The B900 sensor field of view for taking measurements starts at a distance of 17" from the face of the sensor (Measurement Offset) and extends 14" (Measurement Range). Depending on the possible sizes of the target material and whether or not the system will be a Top-only or Top-Bottom scanner, this will influence the distance to place the sensors above and/or below the material transfer. Keep in mind that the closer the sensors are placed to the transfer, the greater the opportunity for objects to occlude the view of one or more of the sensor's cameras.

For many applications, the sensors are positioned about 23 inches away from the top of the transfer chain. This reduces the chance of an occlusion occurring and places the target in the middle of the scanning range of the sensor. For Top-Bottom scan systems, this creates an overlapping scan area

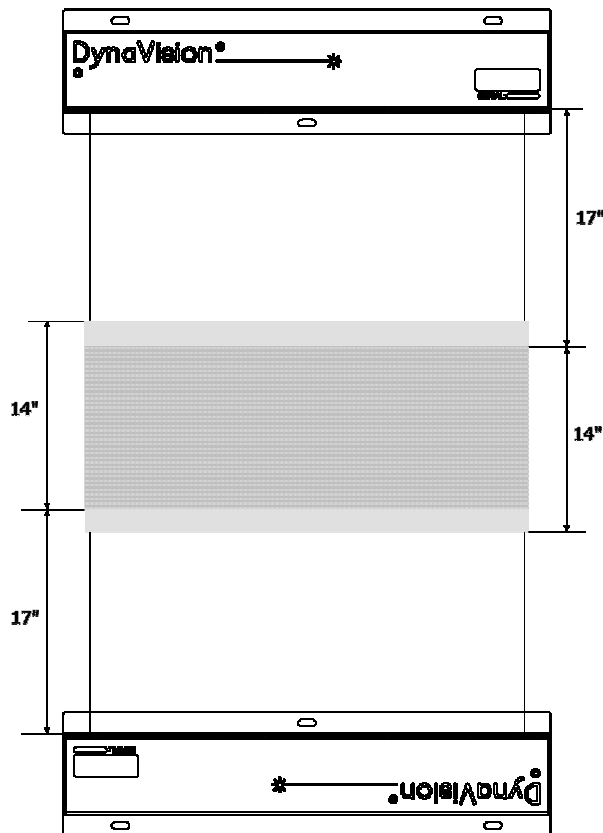


Figure 5.2 – Top-Bottom sensor showing the overlapping scan area

5.2.2 Chain Spacing

Any chains that run between B900 sensors (2 foot centers) must have chain guides as narrow as possible. This may be achieved by eliminating the side rails at the point that the laser would strike it and let the chain only travel on the bottom center guide. It is mandatory to keep each sensor's field-of-view unobstructed and to prevent lasers from hitting the chain.

The figure below shows a B900 sensor mounted on the bottom of a frame with the chain run through its field of view. This is an example of improper chain spacing. In this case lasers 3 and 5 are occluded from one camera and laser 4 is hitting the chain. No range data will be reported for lasers 3 and 5 in this example because they are not seen by both cameras. Both cameras must have a clear view of each laser in order to provide range information. Due to the highly reflective nature of metal, laser 4 may appear highly distorted and scattered on the chain surface, interfering with the sensor's ability to give accurate range data for other lasers. In addition, this may cause the sensor to give range data while no board is present in the scanner.

Important! Both cameras must have a clear view of each laser in order to provide range information.

The highly reflective surface and constant movement of the chain hit by laser 4 will interfere with the sensor's ability to give accurate range data at that point. It will also cause the sensor to give range data while no board is present in the scanner.

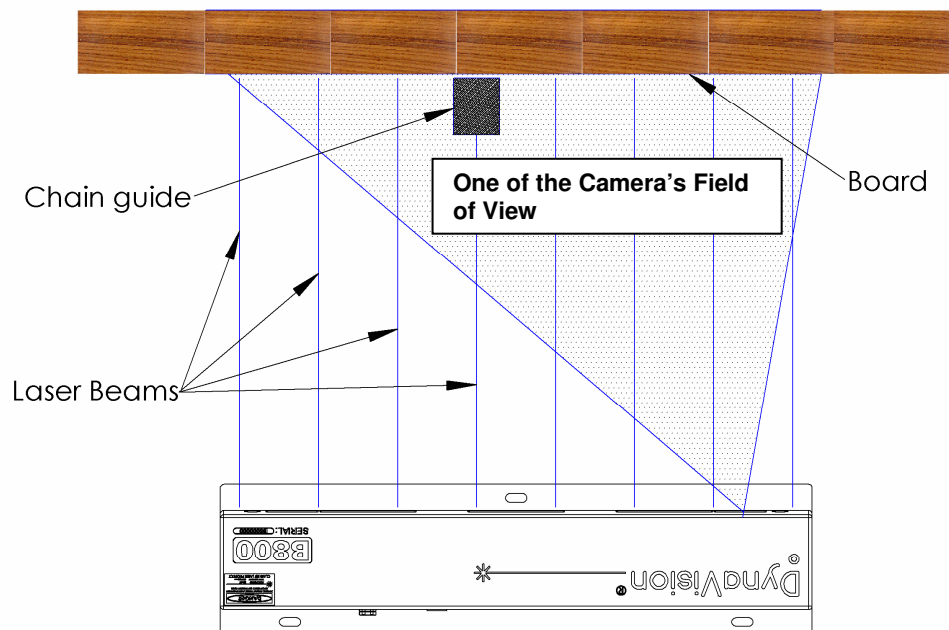


Figure 5.3 - Improper Chain Spacing

The illustration below shows an example of proper chain spacing. The chains are run between sensors giving both cameras on each sensor a clear view of every laser throughout the sensor's measurement range. In addition, no lasers are hitting the chain or other metal objects.

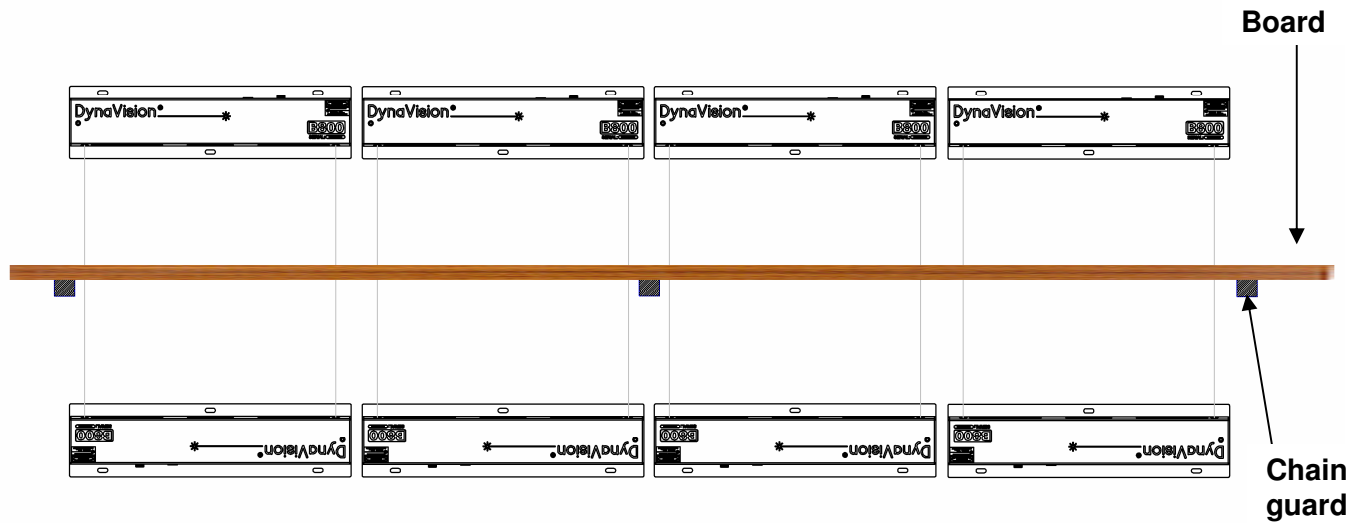


Figure 5.4 – Proper Chain Spacing

5.3 Cabling/Power

With all power OFF, plug the integrated power cable into each sensor. Ensure that the cables are fully pushed into place and the hold down sleeve is screwed on hand tight.

Warning! Ensure the power is off when installing or removing a power cable from a scan head.

A single four pair plenum grade (i.e. industrial) shielded CAT5 cable is run to each head from the MBStation. The power cable connector used is a DIN 41 326 Standard 8 pin circular connector. Pin outs are below as viewed from the solder side:

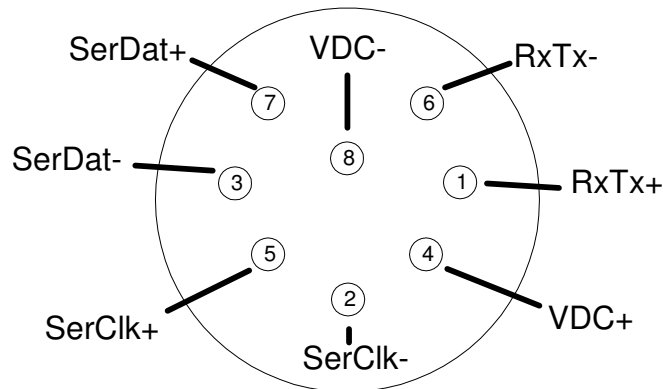


Figure 5.5 – Pin out of Connector from the soldering side

Name	Description
VDC+/-	DC power (VDC+) and Ground return (VDC-)
RxTx+/-	Asynchronous 19.4 Kbaud serial bi-directional pair (RS-485)
SerClk+/-	High speed Serial Clock pair
SerDat+/-	High Speed Serial Data pair

Each of the four twisted pairs in the CAT5 cable are connected to one of the RS-485 differential or power/ground (+/-) pairs.

The B900 sensor has been specially designed to work with high source resistance power supplies, thus allowing more inexpensive power cabling to be used (such as CAT5 cable).

Note!

Use of CAT5 cable assumes a 24V supply, and a maximum cable length of 90-meters. The CAT5 cable DC resistance is about 25 ohms per thousand feet, or about 2.5 ohms for the 100 foot round trip on a 50 foot cable. The B900 draws about 600 mA at 24 volts, so a 1.5V drop occurs on the cable. Lower voltages (such as 15V) cause the switching power supplies in the B900 sensor to draw more current, and will make the voltage drop on the cable larger.

5.3.1 Connector and Cable Part Numbers

The manufacturer and part number for the cable end of the power cable is Amphenol C091 31H008 101 2. The cable is 4 pair shielded CAT5 Ethernet stranded cable.

6 OEM Design

6.1 Design Requirements

6.1.1 System Calibration

Once all the sensors have been mounted in the scanner frame, two calibration calculations need to be performed. While the two calculations are described separately below, the recommended procedures for each calculation are the same and may be combined into one calibration sequence. The purpose of these calculations is to provide the necessary data for optimizers to transform individual range readings into a global frame of reference.

6.1.1.1 Determine Laser Alignment Offset/Delay

The first of the two calibration calculations compensates for the variations in laser placement that result from sensor mounting and manufacturing variations of the frame in the direction of a target transfer. These alignment variations need to be taken into account in order to align the data obtained during a target scan in time (z – axis). The calibration routine needs to determine the offset/delay values in encoder pulse resolution for all the lasers on the scanner frame referenced to a common 'zero' plane in the direction of travel. The recommended method, which guarantees that the readings are taken from the same location, is to run a straight 2"x4" profile bar through the scanner and then examine the scan buffers.

During the calibration process, an offset value of 0 is used when reading the scan buffers. The number of blank (out of range) entries in each of the buffers corresponds to the offset value for that buffer. It is crucial that the profile bar used for calibration is straight; this ensures that the buffer offsets determined here will properly align the data obtained in subsequent board scans.

Later, the application software applies these offset values while reading spot buffers resulting in proper data alignment at every laser position.

6.1.1.2 Determine Range Offset

The second of the two calibration calculations addresses the variations in range above or below the item being scanned. It also determines how the top and bottom halves of the model data join together when the viewing areas of opposing sensors overlap.

The recommended method for determining range offsets requires a few steps:

- a) Measure the distances of the entire top mounted sensors to the top of the transfer chain, then average the results to determine a 'preset' value. For our example we'll say that the average distance from the face of the top mounted sensors to the top of the transfer chain, or 'Top Preset' value is 23".

-
- b) Repeat the process for all the sensors mounted below the transfer chain. For our example we'll say the average distance, or 'Bottom Preset' value is 22".
 - c) Pass a calibration profile bar of known thickness through the scanner.
 - d) For each top mounted sensor, read the spot buffers of each laser and calculate the average range reading for the entire width of the calibration bar. Compare the result with the 'Top Preset' value less the calibration bar's known thickness to determine the range-offset necessary for that spot.
 - d) Repeat the same process for each spot of lower mounted sensors except that the comparison is only between the 'Bottom Preset' value and the range reading.

For example using a calibration bar that is 1.875" thick, if average reading for a top sensor laser spot is 21.00" then the range offset for that laser spot would be calculated as:

$$\begin{array}{rclclcl} \text{Top 'Preset'} & - & \text{Calibration Thickness} & - & \text{Average Spot Reading} & = & \text{Range Offset} \\ 23.000" & - & 1.875" & - & 21.000" & = & 0.125" \end{array}$$

If the bottom sensor laser spot's average readings were 22.125, then it's offset would be:

$$\begin{array}{rclclcl} \text{Bottom 'Preset'} & - & \text{Average Spot Reading} & = & \text{Range Offset} \\ 22.000" & - & 22.125" & = & -0.125" \end{array}$$

6.2 Design Recommendations

A generic scanner frame design with dimensions is included for a guide to the critical dimensions. This is the basis for a frame design and it is recommended that the OEM individualize the design to match their application and existing equipment. Some points to consider are:

6.2.1 Sensor Mounting

When designing the scanner frame, it is preferable that the design mounts the sensors on the downstream side of the frame so that any debris travels away from the sensors. Sensors are generally mounted with the first laser line 1" to 3" inside the 'zero lumber line' to ensure that the first laser spot will always see a target.

For edger and cant optimizer applications where pins are used to skew and offset the piece, the skew pins should be aligned as close as possible to a laser spot to measure board/cant edges at the pin location guaranteeing skew and offset position.

6.2.3 If any of the lasers are detected on a chain or support structure then make note of which laser and which sensor this occurs on. Any lasers hitting chains must be physically blocked at the laser windows otherwise they will generate data errors.

6.2.2 Photocells

6.2.4 If you are designing a system that requires exact width measurements then consider using photocells in conjunction with the sensor data. The sensors are intended for range measurement and wane detection. Photocells can give better width accuracy especially for 'square' material.

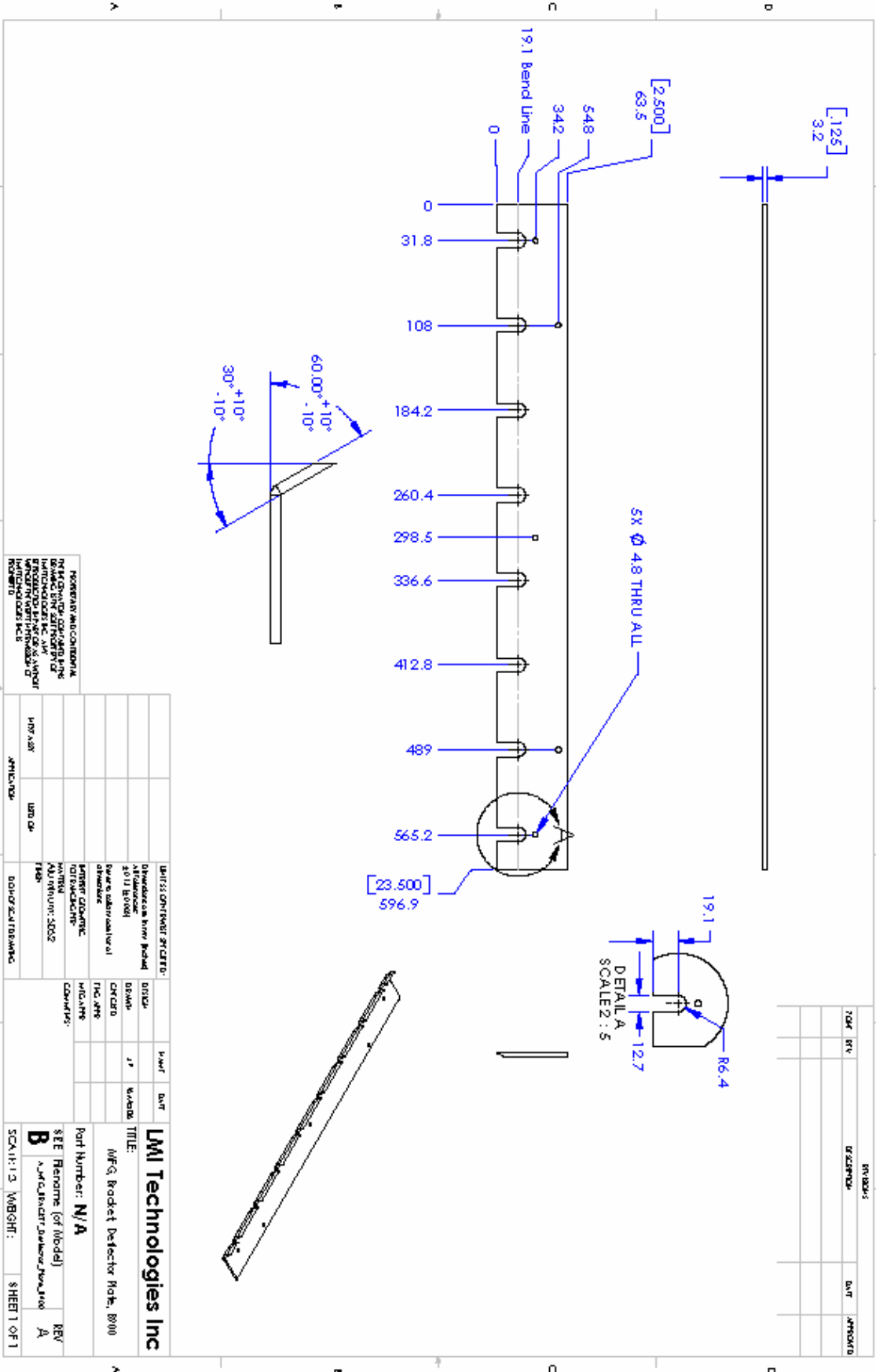
6.2.3 Scanner Frame

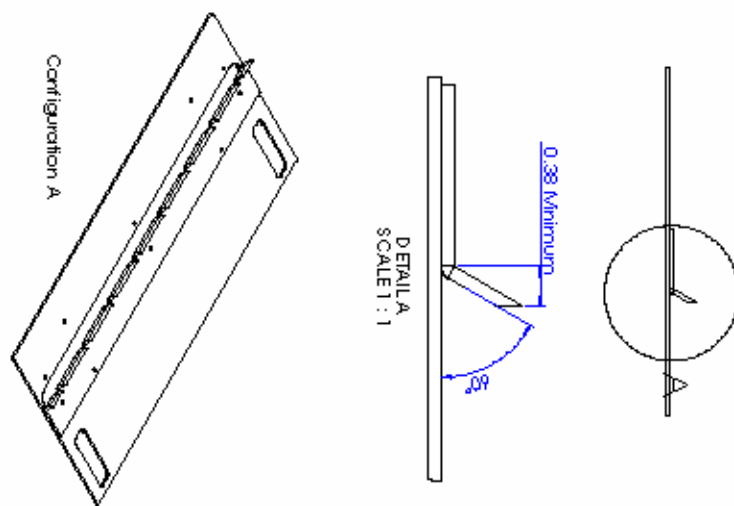
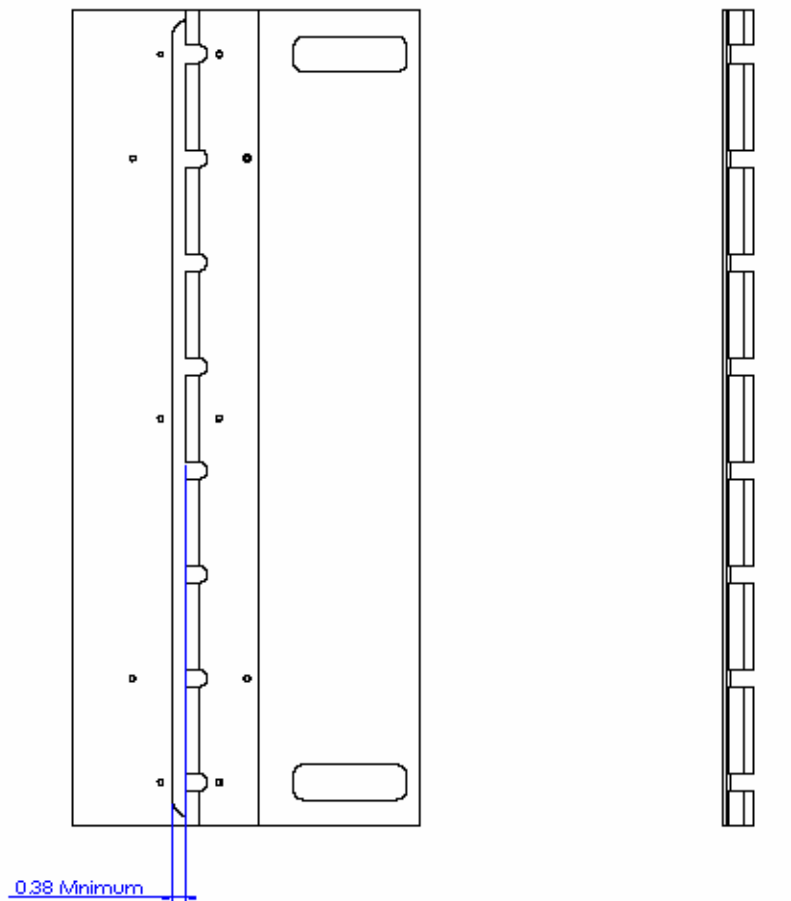
To protect the cabling from damage, run the cabling for the sensors inside the frame support beam to one end of the frame where power supplies and conduits to computer room are located.

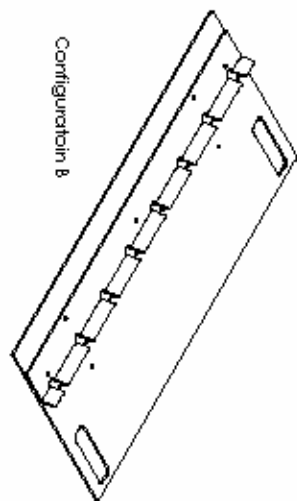
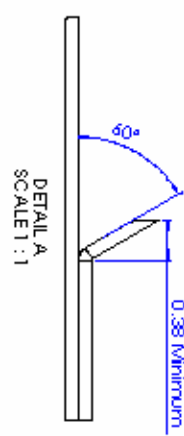
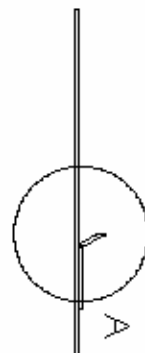
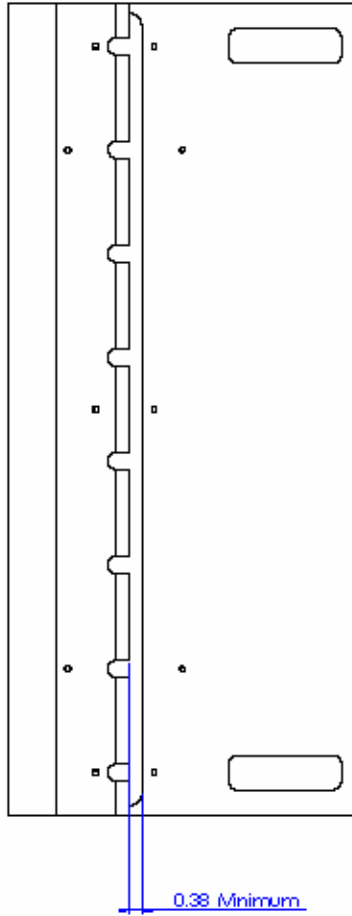
Having a design, which incorporates a positive air pressure blower/purge, system built into the frame helps in keeping the bottom sensors clear of debris. On installations without air purge, if the bottom sensors are cleaned every 2 to 4 hours things still run fine. However, performance can be degraded if the heads are running dirty. When installing an air purge using mill air, make sure to filter the air to remove oil and water.

6.2.4 Baffle Plates

Baffle Plate designs are included on next pages:







6.3 B900 Sensor and Baffle Plate Configuration

Proper setup and alignment of B900 sensors and baffle plates are critical to achieving quality measurement data. Length accuracy from light curtain data will be diminished if setup requirements are not met.

6.3.1 Sensor Alignment

B900 sensors are to be aligned co-planar (no stagger) side-to-side and staggered 9mm top-to-bottom. Each sensor should be mounted on a three-point gimbal mount in order to allow precise alignment and positioning. The laser lines must be staggered 9mm top-to-bottom in order to not strike the CCD window of the opposing sensors.

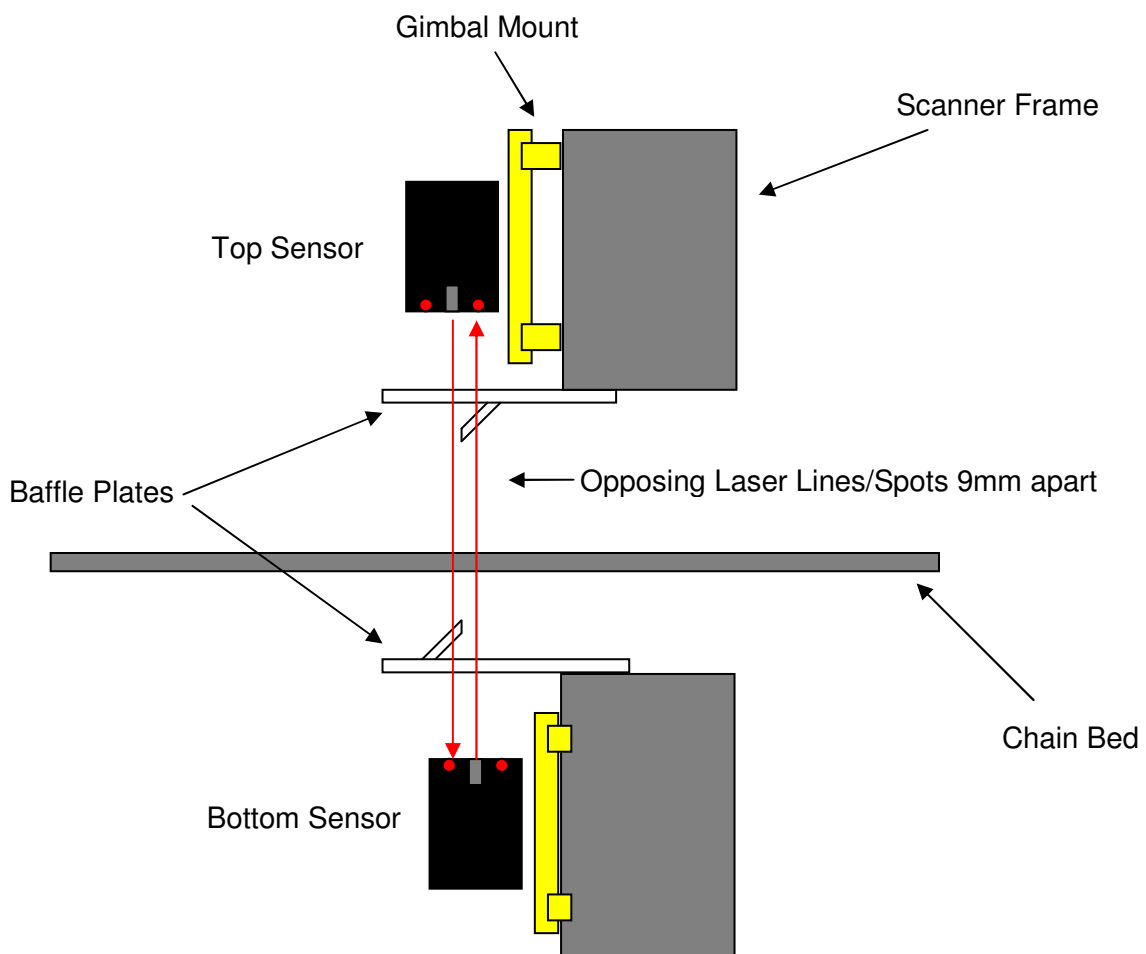


Figure 6.1 - Sensor and Baffle Plate Configuration

Each sensor has alignment markers on its face to aid in the process of aligning sensors on the frame. The sensors should be aligned so that their laser lines pass through the alignment markers on the face of the opposing sensors. **The set of markers to use depends on if the row is staggered upstream or downstream of the opposing row.** Note that if a laser line is allowed to strike the CCD window of an opposing sensor, the

opposing sensor will not function properly. Aligning laser lines to the alignment markers of the opposing heads ensures that the 9mm stagger is achieved and that the laser lines are clear of all CCD windows.

Correct sensor operation also requires that both rows of sensors are aligned such that their laser lines overlap completely, creating one solid laser line down the length of the frame. **It is critical that this overlap is maintained throughout the sensors operating range.** Once the first pair is aligned as shown in the above diagram, the adjacent and the opposing laser lines can be used as reference to align the remaining sensors.

6.3.2 Baffle Plate Alignment

The purpose of the B900 baffle plates is to trap laser light beyond the scan deck in order to prevent sensors from detecting laser light when no board is present in the scanner. Mechanical drawings of the B900 baffle plate are provided on the following pages. The light trapping is accomplished differently for the spots and lines. The laser spots are trapped by allowing them to pass through gaps in the plate and strike the face of the opposing sensor, occluding them from the CCD cameras. The laser lines are trapped by projecting them onto a steeply angled portion of the baffle plate (deflector plate), causing the laser light to be deflected away from the CCD cameras.

The B900 baffle plates consist of two separate pieces, a baffle plate and deflector plate. The design allows the deflector plate to be mounted on either side of the slot of the baffle plate depending on if the plate is to be mounted on the top of the frame or the bottom.

The baffle plates should be mounted above each sensor (see diagrams above and below) such that the sensors lasers can emit unobstructed through the slot in the plate and the incoming laser lines hit the angled portion of the deflector plate.

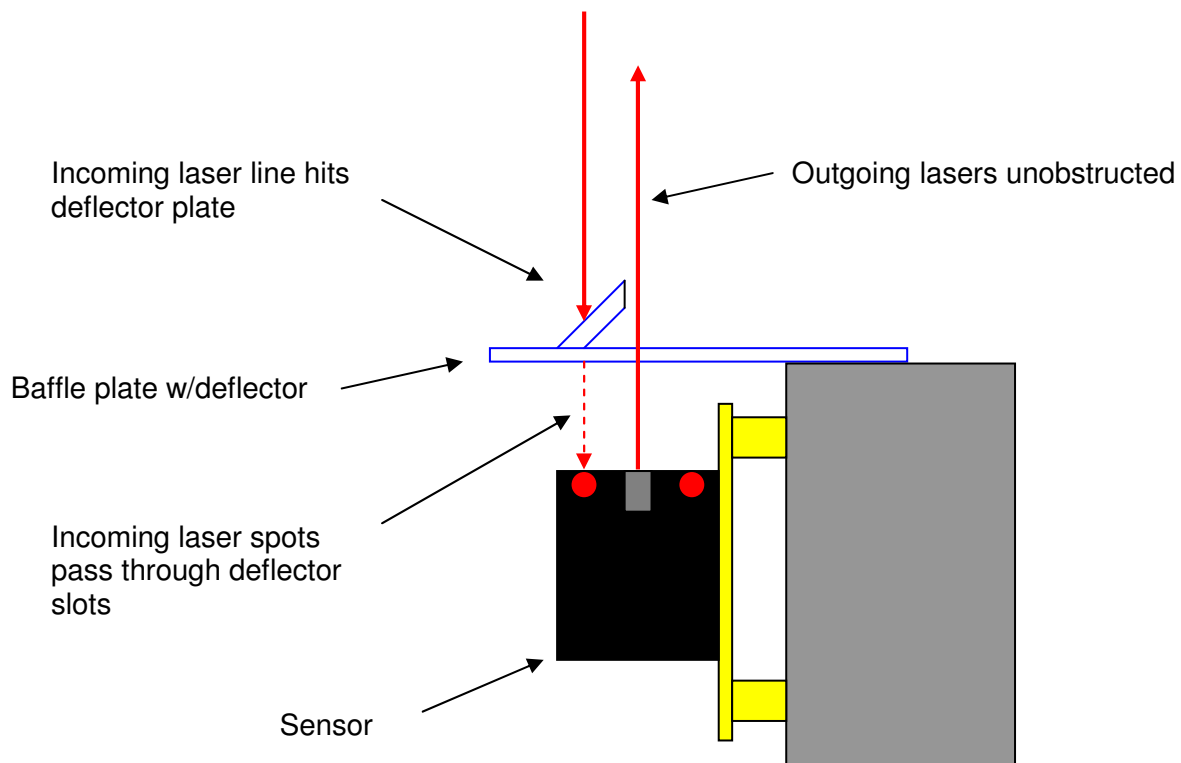


Figure 6.2 - Baffle Plate Alignment

7 Getting Started

For sensors connecting via MB Station, you may require the MB Station User's Manual where you will find the following information:

- Connecting to the MB Station
- How to Set the IP address using IPConfig
- Update Firmware using kUpdate
- How to use the Software tools NbTest and BxLoad



Figure 7.1 – MB Station

7.1 Powering Up

2. Verify that the power supply is switched off and connect it to the MBStation.
3. Connect the PC to the MBStation via Ethernet port. If connecting directly a crossover cable is required.
4. Connect each sensor to the MBStation.
5. Switch on the power supply.
6. Verify that all the sensors LEDs are lit.

7.2 Connecting

1. Insert the B-Series OEM CD into the CD-ROM and copy the contents to a local folder (ex. C:\B-Series OEM CD)
2. Confirm that the PC subnet address is set to **192.168.0.xxx** with the subnet mask **255.255.255.0**. By default MBStation ships with the address **192.168.0.151**. Please refer to the MBStation user manual for instructions on modifying the IP address or the mask.
3. Start **NBTest** application and select 'Scanner Parameters' tab.
4. Fill the 'NPH-66 IP Address' box with the correct IP address.
5. Select 'System' tab and press 'Connect'
6. Verify that the 'Heads' tab at the top of the application window shows the connected heads in green color.

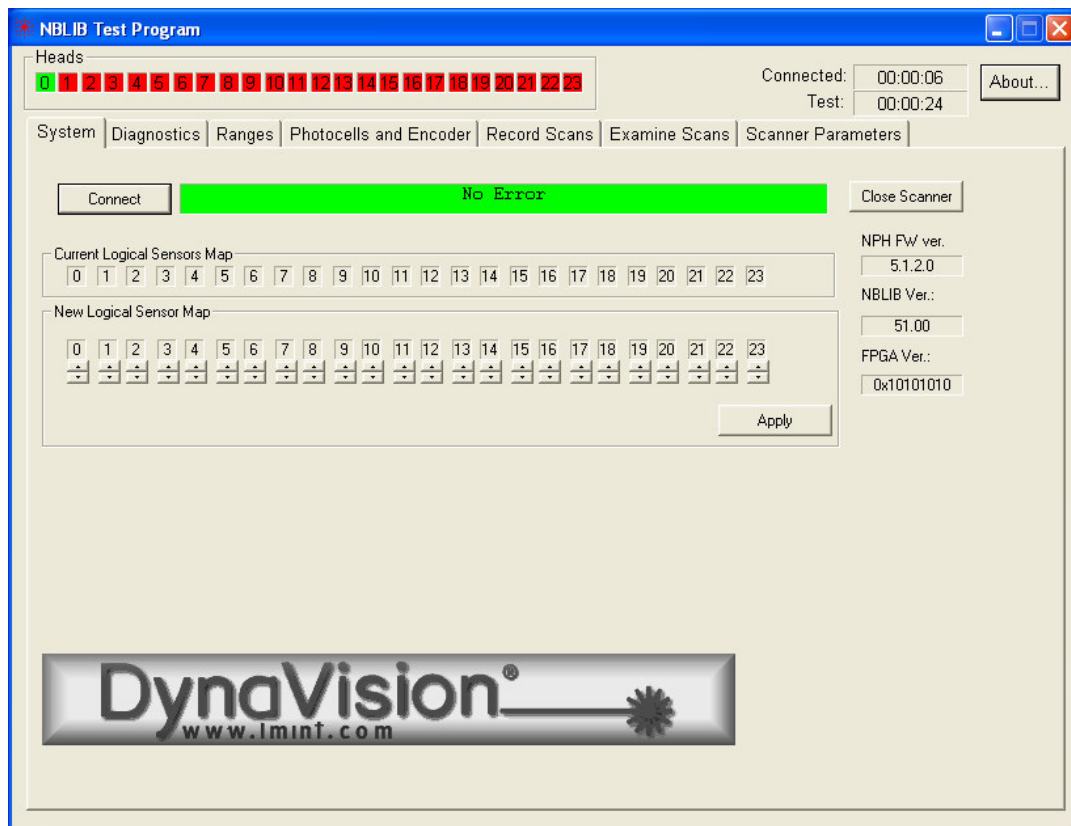


Figure 7.2 – NbTest Program

7.3 Sensor Diagnostics

1. Position the connected sensors such that they are facing a target in their operating range.
2. Select 'Diagnostics' tab, see below. Select desired MBStation port by using 'Head' slider on the right side of the application window.
3. Confirm that the 'Serial #' (bottom right of the window) entry matches the serial number of the selected sensor and the 'Ranges' column reports distance from the face of the sensor to the target.

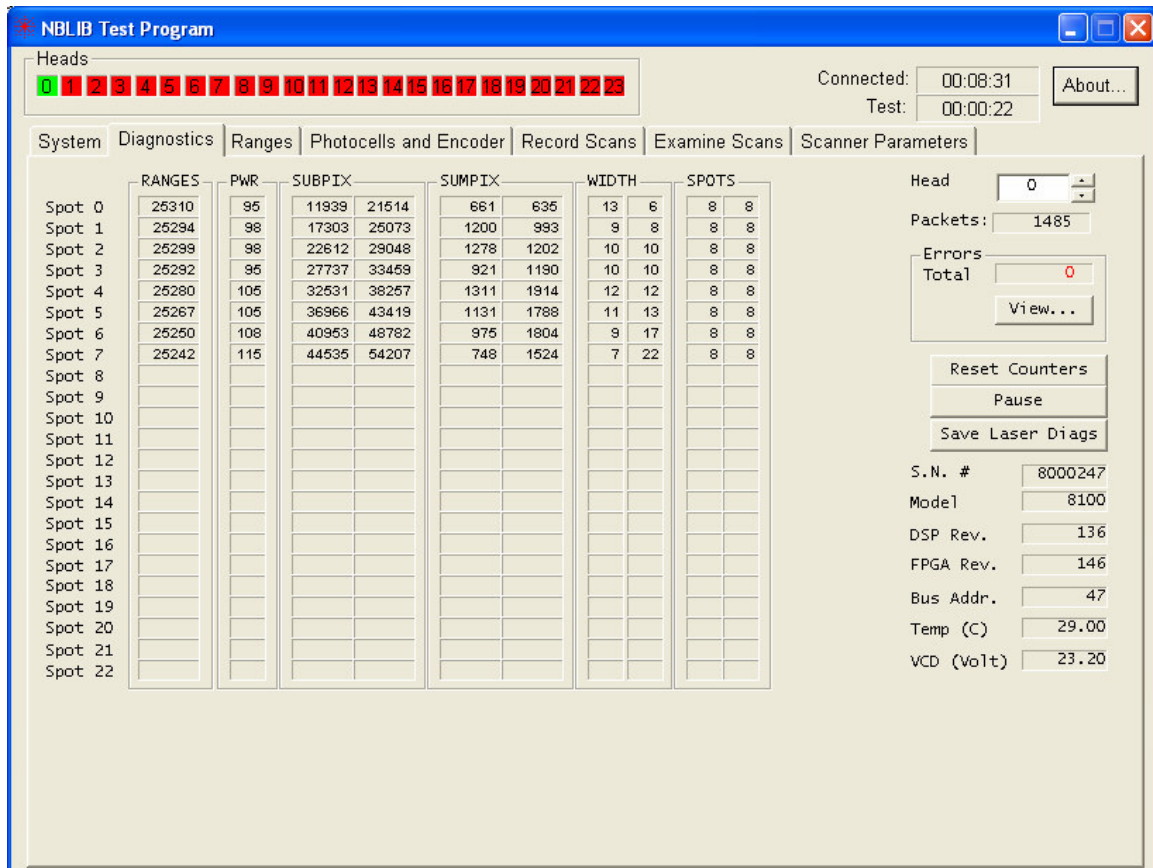


Figure 7.3 – NbTest: Diagnostics Tab

For further information on the use of NbTest application please refer to the MBStation OEM manual.

7.4 Application Development

Please refer to the MBStation OEM manual for the information on the supplied libraries and tools. The B-Series OEM CD also provides source code for two `mt_test` and `curtain_test` as examples of the use of provided API.

7.5 Ranges

Ranges Tab windows displays both numerical and a bar graph representation of current range readings (within the operational range). The range tab also displays the light curtain data.

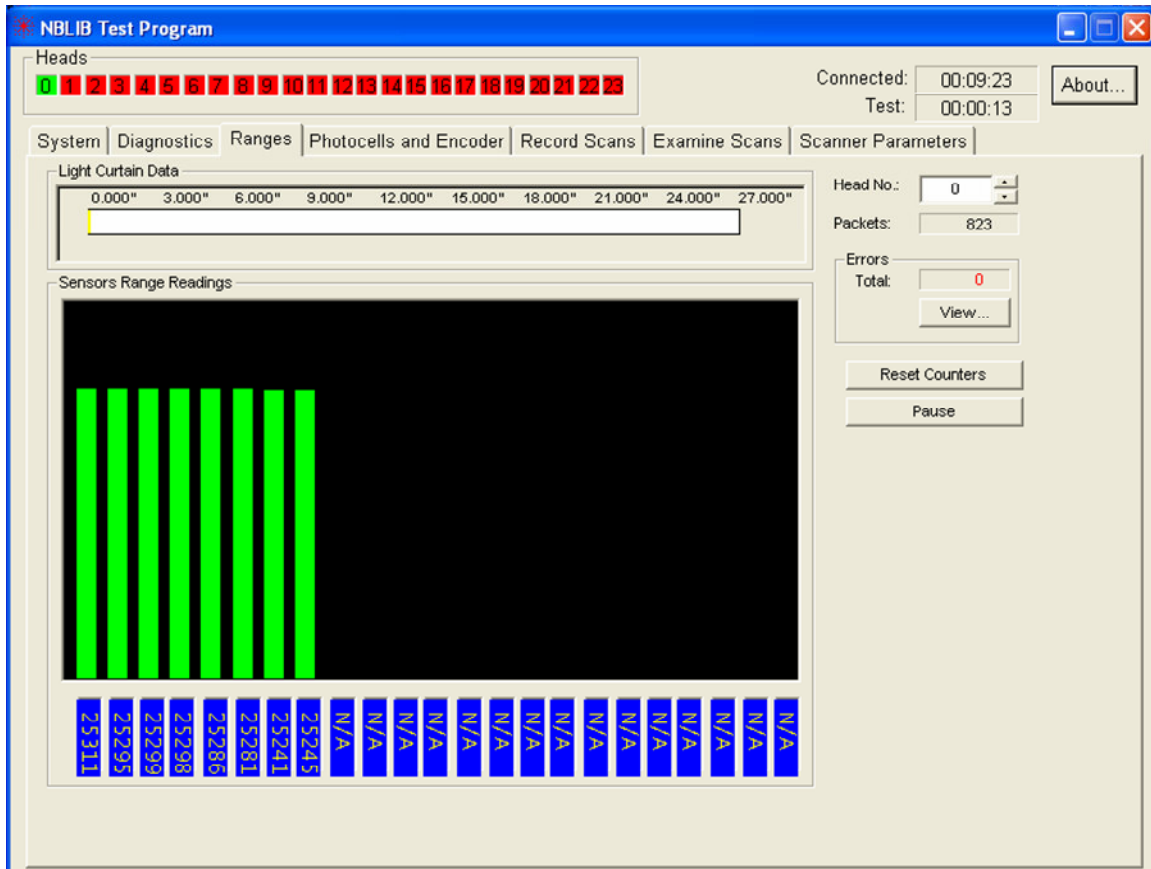


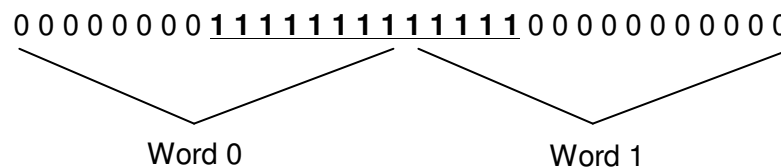
Figure 7.4 – NbTest: Ranges Tab

7.6 Light Curtain Processing Considerations

To achieve 1/8" accuracy, the length calculation should be primarily based on light curtain data taken from the non waning side of the board. Flat surfaces provide a better view of the target's edge to the sensor.

B900 outputs light curtain data as an array of 16 bit words. The size of the output is 14 words, totaling 224 bits. The first 216 of these bits specify whether an object is present (1) or not present (0). The remaining 8 bits are unused. The light curtain data allows the user to calculate edges of the scanned object as well as its length. Each bit represents a 1/8" section of the target.

The following diagram is an example of the light curtain output for the first two words of sensor data. According to the data the target starts at (1/8" X 8 bits= 1") from the zero mark and is (1/8" X 13 bits = 1.625") long.



**Figure 7.5 – B900 Light Curtain,
Example of two words of the sensor**

Since each bit represents a 1/8" interval, the total length of reported region is (1/8" X 216 = 27").

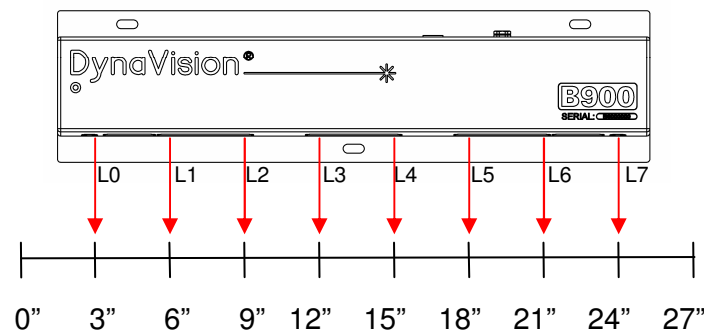
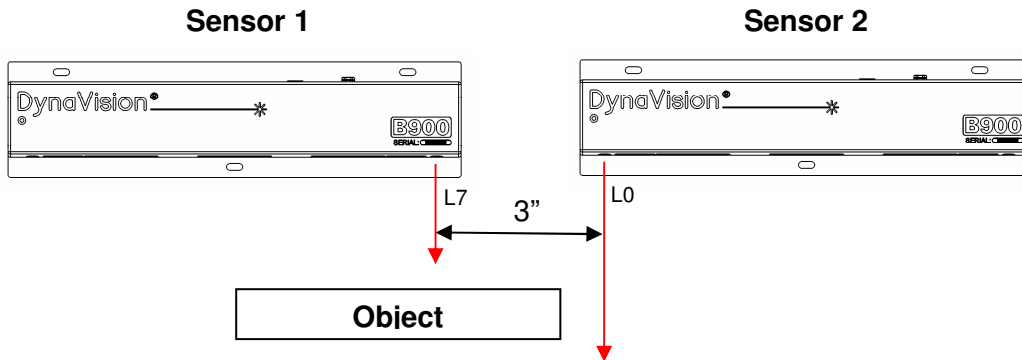


Figure 7.6 – B900 Light Curtain Range Data

Notice that the 3" mark of the light curtain aligns with laser 0 of the sensor and the 24" mark aligns with laser 7. This relationship is intentional and should be used for combining the range data with the light curtain data.

It is critical to position B900 sensors such that neighboring lasers of adjacent sensors are 3" apart. Positioning them further apart will result in less than full coverage of the

target. This is due to the fact that B900 sensors require at least a single range laser to hit the target before any light curtain data can be reported.

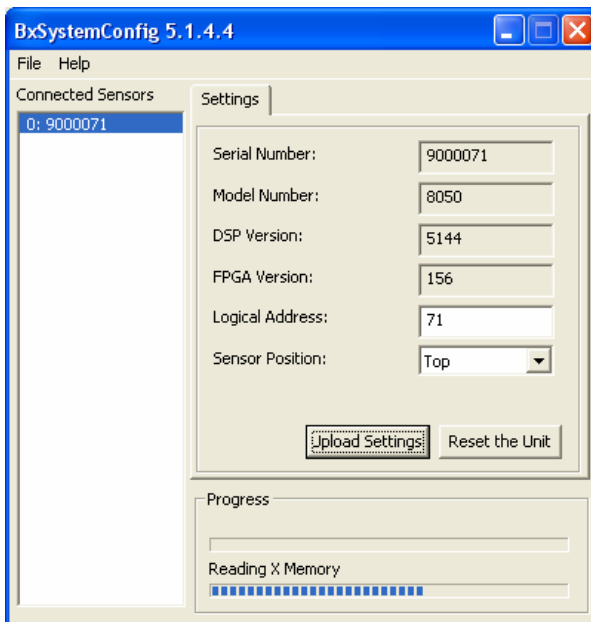


**Figure 7.7 – B900 Light Curtain, only
Sensor 1 is able to report light curtain data**

In the above diagram none of the **Sensor 2** range lasers are hitting the target. Because of this, only **Sensor 1** will be able to report light curtain data from L7 to L0 of **Sensor 2**. The data for that region reported by **Sensor 2** will be zero. The entire light curtain scan line can be assembled by applying binary OR to the corresponding bits of adjacent sensors.

7.7 Sensor Position Configuration

Due to potential interference between two opposing sensors during the light curtain acquisition period each data acquisition period of each sensor is accomplished in its own time slice (ranges top, light curtain bottom, ranges bottom, light curtain top). To facilitate this, one of the sensors must be designated as 'Top' and the other as 'Bottom'. This setting must be configured for each sensor in the system using BxLoad or BxSystemConfig applications.



As BxSystemConfig does not contain expert level settings it is more suitable for end user environment than BxLoad. Please refer to the MBStation user manual for details on using BxSystemConfig.

Figure 7.8 – BxSystemConfig application

8 Warranty

8.1 Warranty Policies

The sensor is warranted for two years from the date of purchase from LMI Technologies Inc.. Products that are found to be non-conforming during there warranty period are to be returned to LMI Technologies Inc. The shipper is responsible for covering all duties and freight for returning the sensor to LMI. It is at LMI's discretion to repair or replace sensors that are returned for warranty work. LMI Technologies Inc. warranty covers parts, labor and the return shipping charges. If the warranty stickers on the sensors are removed or appear to be tampered with, LMI will void the warranty of the sensor.

8.2 Return Policy

Before returning the product for repair (warranty or non-warranty) a return material authorization (RMA) number must be obtained from LMI. Please call LMI to obtain this RMA number. Carefully package the sensor in its original shipping materials (or equivalent) and ship the sensor prepaid to your designated LMI location. Please insure that the RMA number is clearly written on the outside of the package. With the sensors include the address you wish this shipment returned to, the name, email and telephone number of a technical contact should we need to discuss this repair and details of the nature of the malfunction. For non-warranty repairs, a purchase order for the repair charges must accompany the returning sensor. LMI Technologies Inc. is not responsible for damages to a sensor that is the result of improper packaging or damage during transit by the courier.

9 Getting Help

If you wish further help on the component or product contact your distributor or LMI directly. Visit our website at www.sensorsthatsee.com for the agent nearest you.

For more information on Safety and Laser classifications, contact:

Center for Devices and Radiological Health, FDA
Office of Compliance (HFZ-305)
Attn: Electronic Product Reports
2098 Gaither Road
Rockville, Maryland 20850