



B16 SENSOR USER MANUAL

by

LMI Technologies Inc.



PROPRIETARY

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Table of Contents

	Page
1. Overview	5
1.1. Specifications	5
1.2. Scanner System Components	6
2. Safety Requirements	7
2.1. LMI DynaVision® B16 Sensor Head	7
2.2. Laser Safety Requirements	8
2.2.1. OEM Safety Responsibilities	9
2.2.2. Scanner Frame Laser Warning Signs	9
2.2.3. Laser Emission Warning Indicators	9
2.2.4. Beam Attenuators	10
2.2.5. Power-On Delays	10
2.2.6. Keylock Switch	10
2.2.7. Remote Interlock Connector	10
2.2.8. Location of Controls	10
2.3. Electronics Handling Procedures	11
2.4. Welding and the Scanner Frame	11
3. Functional Description	12
3.1. B16 Sensor Head	12
3.2. B16 Net Power Hub NPH-66	12
4. Maintenance	13
4.1. Preventative Maintenance Procedures	13
5. Scanner Hardware	14
5.1. Encoder	14
5.2. Connecting the B16 Sensor to the Net Power Hub Unit	14
5.3. Power Requirements	15
5.4. Connecting the B16 Sensor Heads	15
5.5. Connector and Cable Part Numbers	16
6. Mechanical Dimensions for the B16	17
7. B16 Software	18
7.1. What's on the Disk?	18
8. Optimization Implementation	19
8.1. Non-Intel Based Systems	19
9. Scanner Frame Design	20
9.1. Overview	20

10. Scanner Installation	21
10.1. Frame Considerations	21
10.2. Power Supply Cabinet Considerations	21
10.3. Suggested Mounting Pattern for the Net Power Hub	21
10.4. DC Power Checkout	21
10.5. Install Integrated Power Cabling	22
10.6. Installing Scan Heads	22
10.7. Install Computer Cabinet	23
10.8. Installing the Encoder	23
11. System Check	24
11.1. Use NBTEST.EXE Diagnostics Program to Check System Operation	24
12. Getting Help	25
12.1. List of Agents	25

1. Overview

The DynaVision® B16 optical scanner by LMI Technologies Inc. is a general purpose lumber profile scanner capable of supplying a 3 dimensional profile for lumber recovery optimization.

The DynaVision® B16 scanner can be interfaced to many hardware platforms (ISA bus, VME, VAX, etc.) through the industry standard IndustryPack® interface. IndustryPack carriers are supported by several 3rd party vendors for different computer platforms.

1.1. Specifications

Mechanical

Housing	Anodized cast/milled solid aluminum block with plate cover.
Dimensions	6.0" x 2.75" x 27.0"
Mounting	Three point mount to eliminate twist of enclosure, compatible with 5/16" mounting hardware.

Power

CAT-5 shielded cable	24V
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Environmental

Enclosure Rating	NEMA 4
Operating Temperature	0° C - +50° C
Humidity	10 – 95% non-condensing @ 40° C

Performance

Laser Type	655 nm @ max. 7 mW output
Laser Beam Spacing	0.985" / 25 mm
Scan Rate	190 Hz
B16 15-26	
Measurement Range	15" / 380 mm to 41" / 1040 mm measured from the face of the sensor.
Resolution	± 0.040" / 1.0 mm across the calibrated range

1.2. Scanner System Components

LMI Technologies Inc. delivers the following components:

B16 Sensor Heads	(P/N 30080) laser distance sensors.
Net Power Hub	(NPH-66 P/N 30083) Distributes individually fused power and serial communications to all B16 heads.
NPH Software CD	A CD-ROM containing software libraries, system installation, diagnostic and demonstration programs, and software documentation.

The OEM must supply the following components:

Scanner Frame	A scanner frame to mount the B16 sensor heads. Guidelines to the design of the scanner frame are outlined in the chapter on "Frame Design Considerations".
Power Supply	Power supply to provide DC power to the B16 sensor heads (24V power supply recommended, although the heads accept 14.5 to 26 Volts). Each head consumes about 15 watts of power.
Power Supply Cabinet	Cabinet to house the DC power supply and the Concentrator enclosure.
Quadrature Differential Encoder	Quadrature differential encoder coupled mechanically to the chain to produce pulses in proportion to the chain travel.
Encoder Cable	Cable to connect the encoder to the PCI/ATC IP Carrier card.
Host Computer	A computer to run application software using the B16 scanner 3D data.
UPS	Uninterruptible power supply to provide 120 VAC to the host computer and the power supply cabinet.

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

Integrated Power Cable	(P/N 11374-xx) Connectorized cable for power and serial communications. Note: xx denotes the desired length of the cable, in feet.
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2. Safety Requirements

The DynaVision® B16 sensor head uses lasers for measuring ranges. This requires that specific safety precautions are taken when interacting with the B16 scanner system.

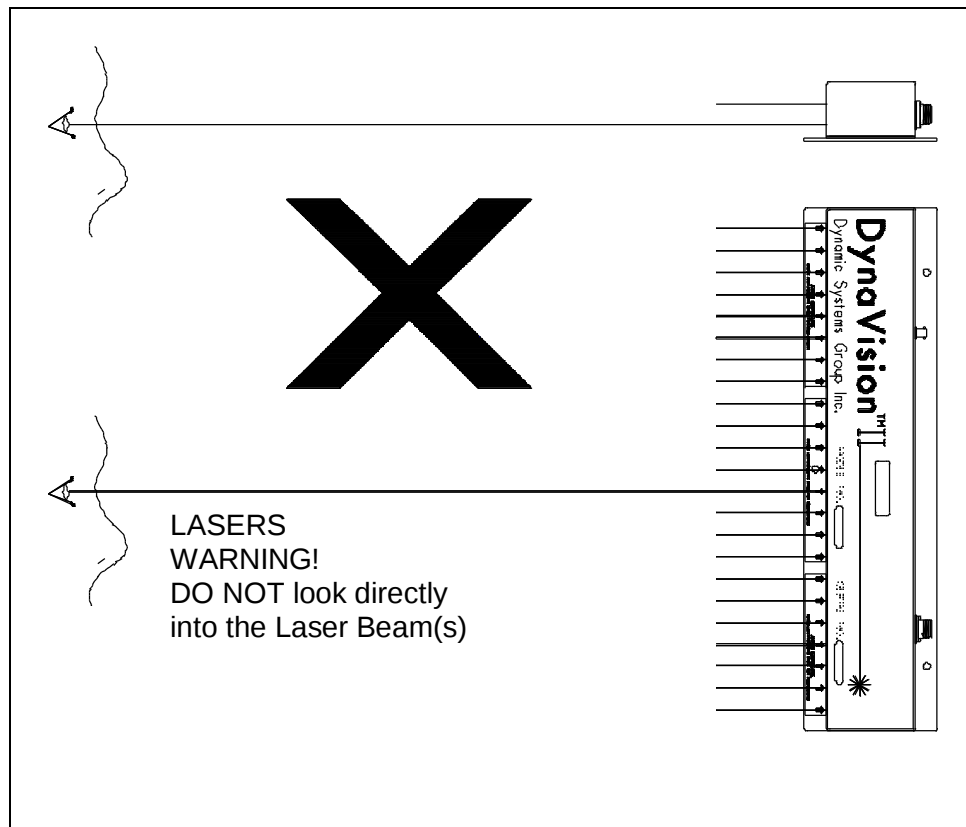
Caution! Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Additional precautions need to be taken when handling sensitive electronic components to ensure the long life and reliability of these parts.

2.1. LMI DynaVision® B16 Sensor Head

The lasers used in the LMI DynaVision® sensor heads are visible red (class IIIB) units. These operate inside the visible range of the eye (655 nm). The laser's intensity is high enough to damage the eyes if viewed directly.

Each DynaVision® sensor head uses 16 low power visible red lasers to measure a 15 inch section of material. The laser light is emitted from the 16 round windows on each sensor head. During normal operation, the lasers do not pose any hazard to the mill personnel. The only situation in which the lasers could be viewed directly would occur when personnel are working inside the throat of the scanner frame with the lasers turned on.

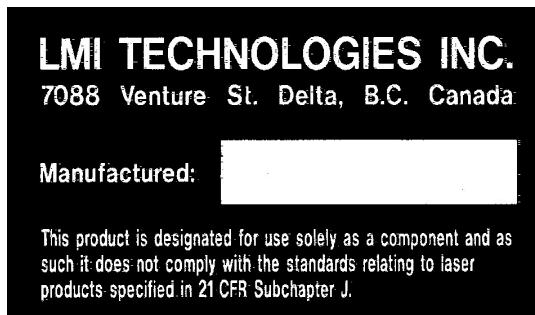


2.2. Laser Safety Requirements

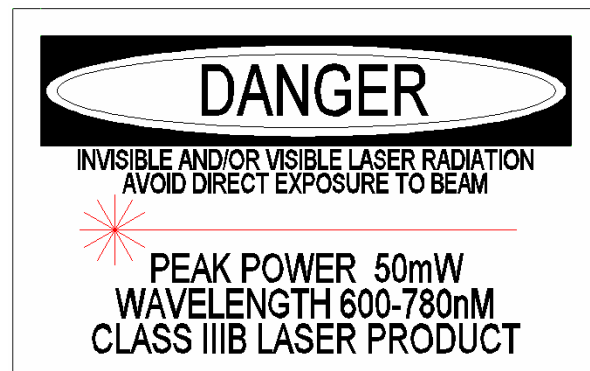
For systems which will be sold or used in the United States, the Department of Health and Human Services specifies that a number of laser safety requirements be maintained. Full details of these requirements are specified in the booklet "Regulations for the Administration and Enforcement of the Radiation Control for Health and Safety Act of 1968": HHS Publication FDA 88-8035. This publication can be obtained directly from the FDA. LMI Wood Products Division has filed a report with the FDA to assist OEM's in achieving certification of their own applications. These reports can be referenced by their accession number which will be provided upon request.

It is recommend that the information packet be obtained from the FDA for full details on what the OEM requires to meet FDA certification. With reference to the FDA specifications, the following items should be noted:

1. In accordance with the HHS standards under the Radiation Control for Health and Safety Act of 1968, the following safety labels are affixed to each individual sensor head:



Manufacturer ID/Certification Label



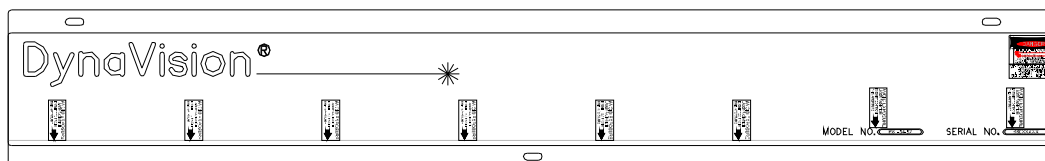
Warning Label



VISIBLE LASER RADIATION IS EMITTED FROM THESE APERTURES

Aperture Label

Warning labels should also be attached to the scan frame where they are clearly visible. The location of the labels on each individual sensor head is indicated in the illustration below:



2. Operators and maintenance personnel should be aware of the potentially dangerous laser radiation and the precautions required.
3. Always wear proper laser safety glasses if there is a chance of being exposed to the lasers.
4. **Never intentionally look into the laser beam!** Even when wearing laser safety glasses, damage to the eyes can result.
5. When servicing the B16 scanner frame the power to the B16 sensor heads should be removed so that the laser emission-warning indicator is OFF.

The laser emission-warning indicator comes on prior to the power being applied to the lasers to warn personnel that the lasers are about to be activated. A timer module in the scan frame power supply cabinet allows the warning duration to be adjusted to the desired amount (Refer to section 2.2.5 “Power-On Delays”).

The warning light should always be maintained to ensure personnel are warned when the B16 sensor head lasers are on.

2.2.1. OEM Safety Responsibilities

LMI Wood Products Division has filed a report with the FDA to assist OEM's in achieving certification of their own applications by referencing the report accession number. However, the following paragraphs outline areas which are not covered by LMI Wood Products Division submission and need to be addressed by the OEM.

2.2.2. Scanner Frame Laser Warning Signs

Laser warning signs must be located in the vicinity of the scanner frame such that they will be readily observed. Refer to the following diagram for an example of the laser warning sign.



2.2.3. Laser Emission Warning Indicators

As specified by the U.S. Department of Health and Human Services under the Radiation Control for Health and Safety Act of 1968, it is required that the controls which operate

the scanners incorporate a visible or audible signal when the lasers of the sensors are active.

Typically this consists of a warning lamp on top of the power supply cabinet which is illuminated when power is supplied to the scan frame. However, if the distance between the scanner frame and the power supply cabinet exceeds 2 meters, a second power-on indicator should be mounted on the scanner frame. When mounting the warning indicator it is important not to mount it in a location which would require human exposure to the laser emissions.

Additionally, CDRH standards require that the indicator be clearly visible through protective eyewear designed specifically for the wavelengths of the emitted laser radiation.

2.2.4. Beam Attenuators

CDRH standards also specify that a permanently attached method of preventing human access to the laser radiation other than switches, power connectors, or key control must be employed.

2.2.5. Power-On Delays

For Class IIIB laser systems, a delay circuit is required that delays the power-on of the lasers after the visual or audible indicators have been turned on. This is to ensure that sufficient warning is given prior to emission of laser radiation.

2.2.6. Keylock Switch

For Class IIIB laser systems the power supply cabinets require a keylock switch which, when in the OFF position, prevents any power from being applied to the lasers. The key shall be removable when in the OFF position, but not removable when in the ON position.

2.2.7. Remote Interlock Connector

For Class IIIB laser systems, a readily available remote interlock connector having an electrical potential difference of no greater than 130 root-mean-square volts between terminals is required. When the terminals of the connector are not electrically joined, human access to all laser and collateral radiation from the laser product shall be prevented.

2.2.8. Location of Controls

Class IIIB laser product shall have operational and adjustment controls located so that human exposure to laser or collateral radiation is unnecessary for operation or adjustment of such controls.

2.3. *Electronics Handling Procedures*

The DynaVision® B16 optical scanner consists of several electronic components that can be easily damaged by electrostatic discharge (ESD). ESD damage normally occurs as a result of handling electronic circuit boards and components without 'grounding' the body. 'Grounding' the body of the person handling the components discharges any static to ground instead of through the components themselves.

The DynaVision® optical scanner consists of several printed circuit boards and components that could be damaged without the following handling precautions:

1. Always ground your body using a wrist strap in contact with bare skin attached to a solid ground such as a chassis etc. Do not handle any components unless grounded first.
2. Printed circuit boards are usually stored and shipped in plastic conductive bags. The boards should only be removed from or placed in these bags when your body is completely grounded. Make sure spare boards are always replaced in these bags before storage.
3. Only after completing service replacement should the ground strap be removed.

2.4. *Welding and the Scanner Frame*

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

The camera used inside each B8L sensor head 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 close proximity of the scanner frame.

3. Functional Description

The B16 log scanning system consists of up to 8 sensors typically arranged around the log cross section for longitudinal infeed, covering 360° view. Each sensor head projects 16 laser beams on the target surface at 0.985" (25mm) spacing. Each B16 sensor head generates measurement samples at 190Hz. As the target is rotated 360°, the distance readings are calculated by the sensor at the sensor's scan rate.

When an encoder is mechanically coupled with the drive mechanism to rotate the log and electrically connected to the encoder port on the NPH-66, one along-frame scan line (the current range readings for all heads on the frame) is stored for each pulse generated by the encoder. This data is then returned to the host PC, where 3 dimensional profiles of the target are created.

3.1. B16 Sensor Head

Each head projects 16 laser beams onto a target surface at 0.985" (25 mm) spacing. Each laser spot is detected by a CCD line camera and the target range is calculated using the triangulation method.

There is a DIN type connector for the DC power, RS-485 providing bi-directional communication to and from a sensor and a proprietary high speed real-time data broadcast to the Net Power Hub unit.

Overall specifications of the B16 head are provided in the B16 specification sheet. Mechanical details may be found on the drawing on the following page.

The B16 scanner head uses only solid state components including solid 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 which can be installed directly in the sawmill environment.

3.2. B16 Net Power Hub NPH-66

The Net Power Hub distributes individually fused DC power to each head and provides Ethernet communication link with the client CPU. It also converts a single RS-232 serial port to multiple individually buffered RS-485 links for each B16 head.



4. Maintenance

4.1. Preventative Maintenance Procedures

Since the DynaVision® scanner heads 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 scanner heads. **Do not use any air which may contain water or oil as it may coat the glass lenses on the scanner heads, resulting in scanning errors.**
- Clean the glass windows on each scanner head using a soft, lint free cloth and isopropyl alcohol. **Do not pressure wash the sensors as this can cause severe damage.**
- Inspect the timing belts and sprockets to the encoder and clean them if required to ensure there is no build up of material which may affect the encoder's proper operation.
- Check the system calibration.
- Back up files from the hard drive.
- Check the scanner infeed chains and lugs for lodged debris. Ensure that the lugs are correctly aligned and that the chains haven't slipped on the sprockets.

5. Scanner Hardware

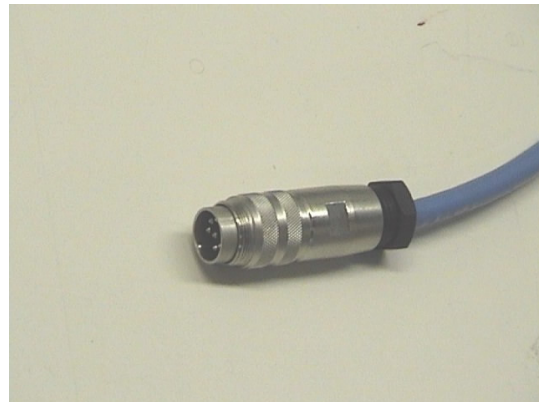
5.1. Encoder

The pulse output from the rotary encoder is input to the NetPowerHub unit. The rotary encoder is mechanically coupled to the scanner transfer mechanism (chain) to produce pulses in proportion to the chain travel. The encoder pulses are received from the encoder using differential RS-485 signaling. LMI Technologies recommends quadrature differential opto-mechanical encoders – DO NOT USE SINGLE ENDED ENCODERS OR THEY WILL PRODUCE ERRATIC RESULTS.

5.2. Connecting the B16 Sensor to the Net Power Hub Unit



New Power Hub



Power Cable

The Net Power Hub has several important functions:

- To distribute fused power to each connected sensor.
- To enable upload of new code and operational parameters to each connected sensor.
- To capture real time range readings synchronized to the encoder from all connected sensors.
- To synchronize up to 8 photocells with the encoder.
- To format all data and send it to the host PC via Ethernet as a complete board scan.

The Net Power Hub interfaces each sensor on the scanner frame with the host computer. One Net Power Hub is capable of operating up to 24 sensors. Additional Net Power Hubs may be utilized to increase the total number of sensors in the system beyond 24.

The Net Power Hub's principal function is to process commands sent from the host and collect profiles from each of the sensors plugged into the Net Power Hub and transmit them back to the host computer.

A bi-directional encoder that is driven by the transfer chain through the scanner is connected to the Net Power Hub through a DB9 connector. The encoder generates pulses that trigger a transfer of range data along the length of the frame for each laser location.

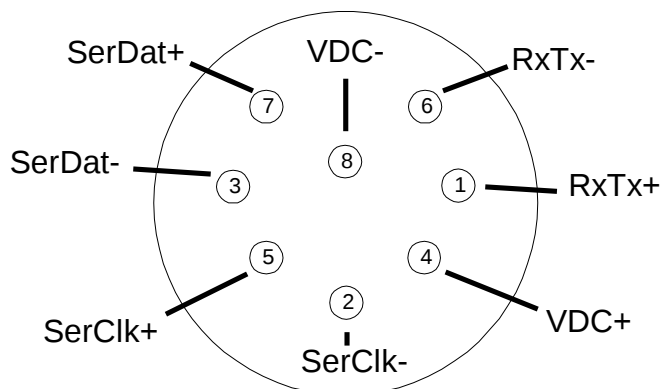
5.3. Power Requirements

The Net power Hub requires an external power supply capable of supplying between 15Vdc@1.4A to 24Vdc@0.875A per sensor. Example: If a 24Vdc system were to run 8 sensors, the required power supply would have to be capable of supplying 7 amps.

The power supply to operate the Net Power Hub and sensor heads should be mounted in a cabinet on or near the scanner frame to reduce voltage drops to each head.

5.4. Connecting the B16 Sensor Heads

A single four pair plenum grade (i.e. industrial) shielded CAT5 cable is run to each head from the B16 Net Power Hub concentrator. The power cable connector used is a DIN 41326 Standard 8 pin circular connector. Pin outs are below as viewed from the solder 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 B16 head 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 that the use of CAT5 cable assumes a 24V supply, and a maximum cable length of 50 feet. The CAT5 cable DC resistance is about 25 ohms per thousand feet, or about 2.5 ohms for the 100 foot round trip on the 50 foot cable. The B16 head draws about 750 mA at 24 volts, so a 1.9V drop occurs on the cable. Lower voltages (such as

15V) cause the switching power supplies in the B16 head to draw more current, and will make the voltage drop on the cable larger.

5.5. 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 cable, and can be either solid core or stranded, and has a variety of manufacturers.

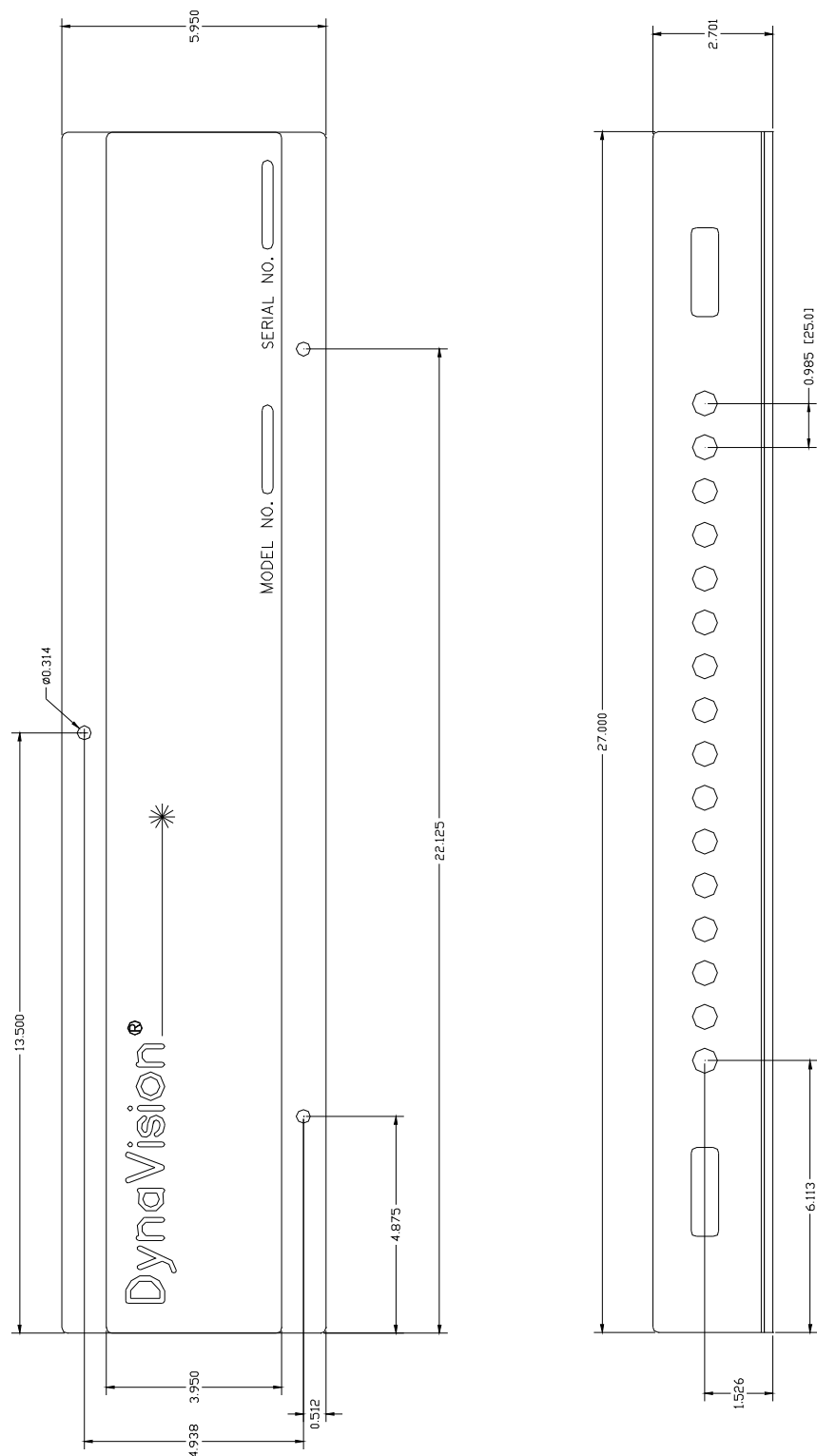
The manufacturer and part number for the cable end of the fiber optic cable is Amp 504566-1 or Amphenol 905-150-5001. The cable is 62.5/125 micron single mode fiber, and has a variety of manufacturers.



C091 31H008 101 2 Cable Connector

6. Mechanical Dimensions for the B16

The physical dimensions for the B16 can be found on the following diagram:



7. B16 Software

7.1. What's on the Disk?

Component	Requirements	Description
B16 Software Tools	• Pentium-class processor • Windows® 9x / NT 4.0 / 2000 / XP	The B16 Software Tools include the Win32 API library as well as diagnostic and display applications.
B16 OEM Manual	• Adobe® Acrobat® Reader	Electronic version of this document.
HTML Help Viewer	• Windows 9x/NT 4.0 • Internet Explorer, version 3.02 or higher.	The HTML Help Viewer is required to view the compiled HTML help files included on the installation CD. Installing this component will update an older version of the HTML Help Viewer if one exists. NOTE: this component comes pre-installed on Windows 2000 and XP systems.

Documentation and sample code for the NB16LIB API are included on the installation CD. A help guide for the B16net.exe and Nbtest.exe diagnostics applications is also included. All help documents are supplied in compiled HTML format and require the HTML Help Viewer.

8. Optimization Implementation

The optimization procedures using the profile information are performed in the host computer. The DynaVision® B16 scanner can be interfaced to many hardware platforms (ISA bus, VME, PCI, etc.) through the Ethernet interface.

8.1. *Non-Intel Based Systems*

When transferring data from one system to the next it is important to remember that the method of storing data in memory differs in the Intel processors from the method employed by Motorola and other manufacturers. As a result, it may be necessary to swap the MSB and LSB 16 bit segments of data before, or after transferring the data streams from one machine to the next.

9. Scanner Frame Design

9.1. Overview

A general 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 user individualize the design to match existing user equipment. Some points to consider are:

- Cabling for the heads is run inside the frame support beam to one end of the frame where power supplies and conduits to computer room are located.
- Each head is mounted at three points on standoffs to prevent distortion. Generally we have put studs in the frame for the connector side of the head to make it easier to mount the head in the field (head is heavy). The laser side of the head should use a cap head socket screw that is below the window (out of the field of view) when tightened.

10. Scanner Installation

The procedure describes the step by step instructions to install the DynaVision® B16 scanner system.

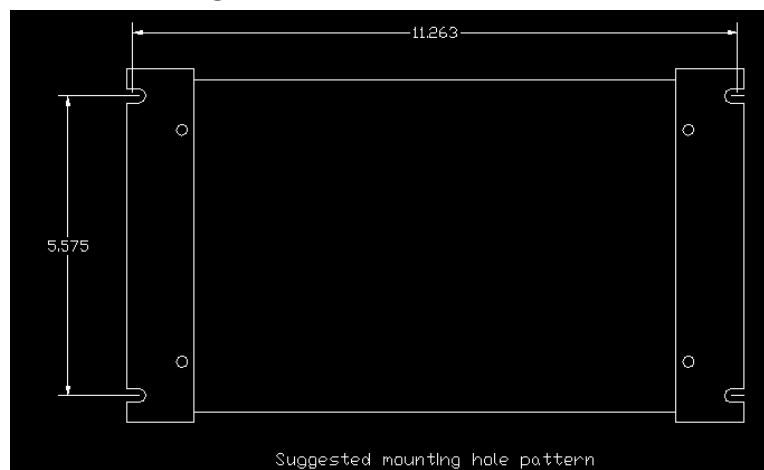
10.1. Frame Considerations

- To isolate the scanner from mill vibration, the frame should be mounted on an independent sub-base to the mill foundation. Shock mounts should be used to mount the scanner frame to the sub-base.
- The frame height should ensure the level of the transfer chain is within active (calibrated) area of sensor(s) scope.

10.2. Power Supply Cabinet Considerations

- Mount the power supply cabinet on one end of the scan frame to allow proper access from the mill floor for installation and service.
- Position the cabinet on the end of the frame so there is proper clearance from the bottom access plate on the frame into the power supply cabinet to run the power cables.
- Ensure that any warning bulbs mounted on the scanner frame or power supply cabinet are not positioned where they are in direct view of any of the sensor heads cameras.

10.3. Suggested Mounting Pattern for the Net Power Hub



Suggested bolt size: #8 to #10

10.4. DC Power Checkout

Connect DC power to B16 Net Power Hub concentrator. Turn on the DC power and verify the DC power is correct at the DC power studs, Net Power Hub red LED lights up.

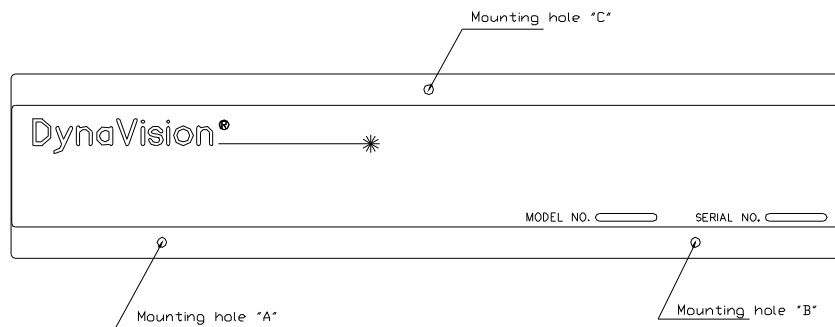
NOTE: Both the Bx Wiring Concentrator and the B16 heads include reverse and over voltage protection. This is a severe condition, however, and should not be deliberately tested.

10.5. Install Integrated Power Cabling

- Fish the integrated power cabling through the hole in the scanner frame (adjacent to each scan head), and out of the access cutout up into the power supply cabinet.
- There is one power cable per scan head.
- Label each power cable as sensor index so you know where to wire them in the cabinet. Any excess cable length should be inside the frame tubing.
- Connect Integrated Power cable to the B16 NetPowerHub with power to the NPH OFF. **Under no circumstances disconnect or connect B16 power cables to a powered NPH unit as it may result in damage to the sensor and / or NPH unit.** Sensor vs. connector is not significant (any cable can go to any available connector) as its logical address can be re-mapped using software tools.

10.6. Installing Scan Heads

- The scan heads are held in place at three points (mounting holes).



The X, Y, location of holes A B relative to the center of the coordinate system will be required to allow the host computer to reconstruct the log profile properly.

- Studs are installed on the frame in the same three point pattern as the mounting holes on the sensor.
- The shims can be used to correct any miss-alignment in the frame.
- The studs should be installed in the frame with loctite and left to set to ensure studs are tight.
- With the AC power **OFF** to the scanner frame cabinet, plug the integrated power cable into each scan head. Ensure that the cables are fully pushed into place and the hold down sleeve screwed on hand tight.
- Turn on the AC power to the scanner frame cabinet. After a delay the DC power will be supplied to the scan heads.

Warning!

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

- If any of the lasers are detected on a chain or support structure then make note of which laser and which head this is occurring on. Software can be used to disable the spot detection using the API command. The beam can also be physically blocked yet using software to disable the spot is the recommended method.

10.7. Install Computer Cabinet

Both the scanner frame junction box and the computer cabinet power should be supplied by the same UPS (uninterruptible power supply).

10.8. Installing the Encoder

The encoder is wired to the NetPowerHub unit with a shielded cable in separate conduit well away from all other AC and DC power cables. The cable must be terminated using male DB-9 connector matching NetPowerHub's connector.

11. System Check

11.1. Use NBTEST.EXE Diagnostics Program to Check System Operation

Scanner

Scanner system check is performed after the entire scanner is connected and cabled to the host computer.

Ensure that 120 VAC power is ON to both the computer and scanning equipment.

Start the NBTEST.EXE Diagnostics.

Once NBTEST program starts press 'Connect' dialog box button, the graphical display showing all elements of the scanner system should show up as green without any error messages.

Encoder

Switch to the Photocells and Encoder Tab window. If the encoder counter decrements when the chain is moving forward correct the encoder wiring. If the counter continues to decrement regardless of the wiring orientation, then inspect the encoder cable for damage. This occurrence is typically related to 'electrical noise'.

Photocells

Only the first 8 photocell indicators, 0 through 7 are functional at this time. Indicators 8..15 are used for LMI's diagnostics purposes requiring special firmware (not distributed). Unblocked photocell is indicated by a green box, blocked one by a red box. Test individual photocells, if connected by blocking them and observing change of corresponding PC indicator.

12. Getting Help

If you wish further help on the B16 contact your distributor.

For more information of 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

12.1. List of Agents

Canada and the United States

Call our offices at 604-636-1011 for the agent nearest you, or visit our web site at www.lmint.com.

International

LMI Selcom Inc. (Sweden)
Box 250, S-433 25
Ogardesvagen 19A
Partille, Sweden
Telephone: 46-31-336-25-10
Fax: 46-31-44-61-79