

marking head

dh series



**operator's
manual**

SYNRAD

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DH series Marking Head Operator's Manual

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marking head safety

Hazard Information

Hazard Information includes terms and symbols used in this manual or on the equipment to alert both operating and service personnel of recommended precautions in care, use, and handling of laser equipment.

Terms

Certain terms are used in this manual or on the equipment labels. Familiarize yourself with their definitions and significance.

- Danger: Hazards that will result in serious personal injury or death.
- Warning: Hazards or unsafe practices that could result in serious personal injury or death.
- Caution: Hazards or unsafe practices that could result in minor personal injury or product damage.
- Note: Points of particular interest for more efficient or convenient instrument operation; additional information or explanation concerning the subject under discussion.

General Hazards

Following are descriptions of general hazards and unsafe practices that could result in death, severe injury, or product damage. Specific warning and cautions not appearing in this section are found throughout the manual.

Warning

possible
personal
injury

Always wear eye protection around an exposed laser beam. Direct or diffuse laser radiation can inflict corneal injuries. Select protective eyewear that blocks 10.6 μm , CO_2 laser radiation. Eyewear protects against scattered energy, and is not intended to protect against direct viewing of the beam or reflections from metallic surfaces. Protective eyewear for 10.6 μm , CO_2 laser radiation is available from SYNRAD, Inc.

Enclose the beam path whenever possible. Direct or diffuse laser radiation can seriously burn human or animal tissue.

Refer to and follow the laser safety precautions in ANSI Z136.1-1993, *American National Standard for the Safe Use of Lasers*. Procedures listed under the Standard include: appointment of a Laser Safety Officer, operation of the product in an area of limited access by trained personnel, servicing of equipment only by trained and authorized personnel, and posting of signs warning of the potential hazards.

marking head safety

Hazard Information

Warning

possible
personal
injury

Processing of materials can generate air contaminants such as vapors, fumes and/or particles that may be noxious, toxic or even fatal. Material Safety Data Sheets for materials being processed should be thoroughly evaluated and the adequacy of provisions for fume extraction, filtering, and venting should be carefully considered. Review the following references for further information on exposure criteria:

ANSI Z136.1-1993, *Standard for the Safe Use of Lasers*, section 7.3.

U.S. Government Code of Federal Regulations: 29 CFR 1910, subpart Z.

Threshold Limit Values (TLV's) published by the American Conference of Governmental Industrial Hygienists (ACGIH).

It may be necessary to consult with local governmental agencies regarding restrictions on venting of vapors.

Caution

possible
personal
injury

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

Note: The *Marking Head Safety*, *Getting Started*, *Operation*, *Technical Reference*, and *Maintenance/Troubleshooting Guide* sections of this manual refer specifically to SYNRAD's DH series Marking Head and Mounting Kit.

You must refer to the Operator's Manual provided with your laser and the User's Guide provided with your marking software for important safety and operational information. Failure to do so may expose personnel to hazardous laser radiation and/or result in equipment damage.

marking head safety

Label Locations

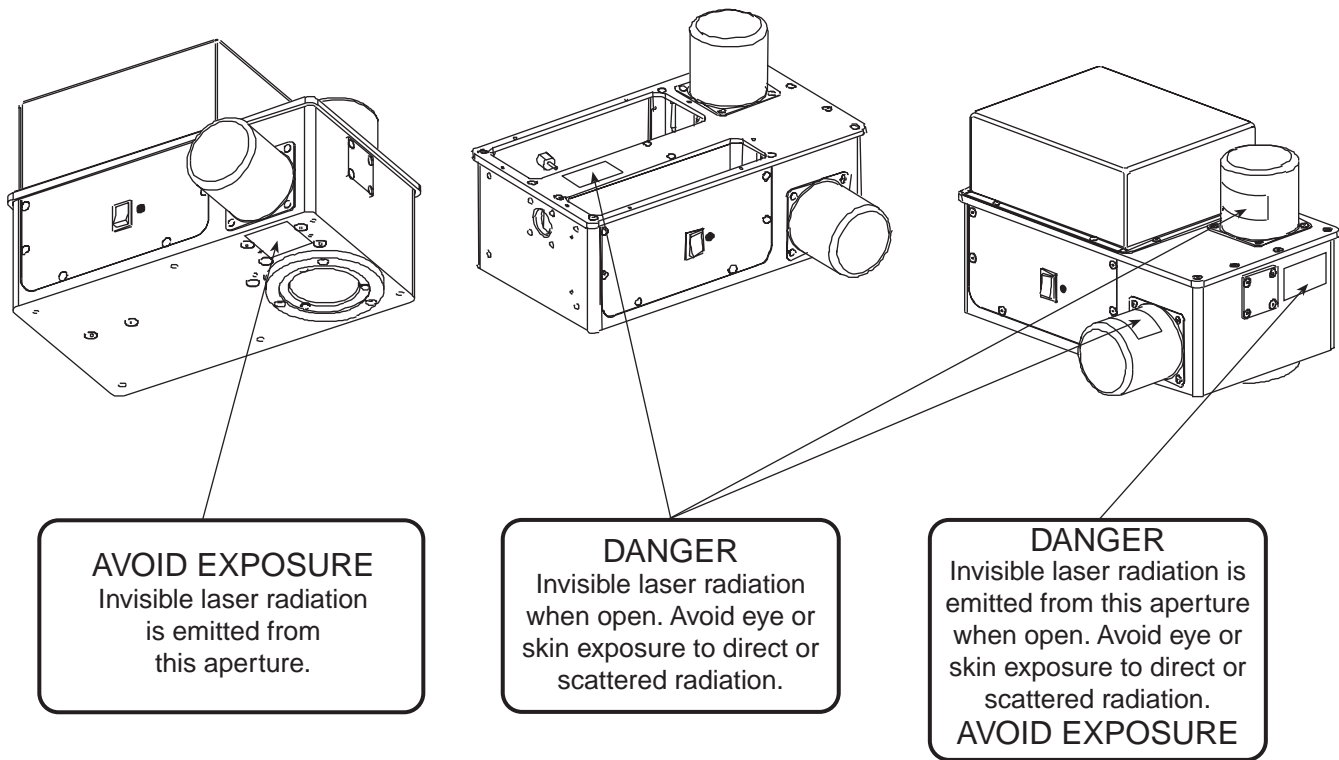


Figure i DH series Marking Head Hazard Label Locations

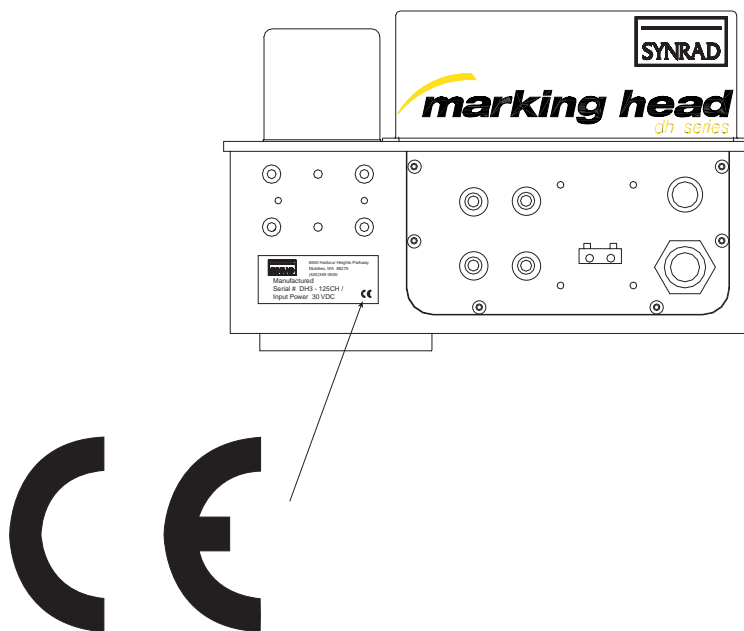


Figure ii DH series Marking Head CE Label Location

marking head safety

Agency Compliance

The DH series Marking Head™ with Fiber Link Card has been tested and certified to comply with certain Federal Communications Commission (FCC) and European Union (EU) directives. These impose product performance requirements relating to electromagnetic compatibility (EMC) and product safety characteristics for industrial, scientific, and medical (ISM) equipment. The associated directives and specific provisions to which compliance is mandatory for the DH series Marking Head are identified and described in the following paragraphs.

Federal Communications Commission (FCC) Requirements

The United States Communication Act of 1934 has vested the Federal Communications Commission (FCC) with the authority to regulate industrial, scientific, and medical (ISM) equipment that emit electromagnetic radiation in the radio frequency spectrum. The purpose of this regulation is to prevent harmful electromagnetic interference (EMI) from affecting authorized radio communication services in the frequency range from 30 MHz to 1 GHz.

The DH series Marking Head has demonstrated performance characteristics that have met or exceeded the requirements of CFR 47, Chapter 1, Part 2, Subpart J, Emissions.

European Union (EU) Requirements

The European Union's electromagnetic compliance (EMC) directive 89/336/EEC is the sole directive developed to address EMI issues in electronic equipment. In particular, the directive calls out European Norm (EN) documents that define the emission and immunity standards for specific product categories.

The DH series Marking Head has demonstrated performance characteristics that have met or exceeded the following requirements:

EN 55011:1991, Emissions, Group I, Class A

EN 50082-2:1995, Immunity

ENV 50140, RF Electromagnetic Fields

ENV 50204, RF Electromagnetic Fields, Pulse Modulation

ENV 50141, RF Common Mode

EN 61000-4-2, Electrostatic Discharge

EN 61000-4-4, Fast Transients

marking head safety

Agency Compliance

After a product has met the requirements of all applicable EU directives, the product can bear the official compliance mark of the European Union as shown in Figure iii.



MADE IN USA

Figure iii European Compliance Mark

DH series Marking Heads have demonstrated performance characteristics that have met or exceeded the requirements of the EMC directive 89/336/EEC.

Declaration of Conformity

Applicable EU Directive(s):	89/336/EEC	(EMC Directive)
Applicable Standards/Norms:	EN55011:1991	Emissions, Group 1, Class A
	EN50082-2:1995	Immunity
	ENV50140	RF Electromagnetic Fields
	ENV50204	RF Electromagnetic Fields, Pulse Modulation
	ENV50141	RF Common Mode
	EN61000-4-2	Electrostatic Discharge
	EN61000-4-4	Fast Transients

Manufacturer: Synrad, Inc.
6500 Harbour Heights Parkway
Mukilteo, WA 98275

Model Number	Serial Number (Compliant Unit)	Date of Compliance
DH3X - 125CH	0322	02/02/98

Synrad, Inc. hereby declares that the equipment specified above conforms to the above Directive(s) and Standard(s).

marking head safety

Agency Compliance

The operational input power requirements of the DH series Marking Head are 30 VDC @ 3 Amps (max.). In accordance with the Low Voltage Directive 72/23/EEC Article 1, the Low Voltage Directive would not apply to this family of devices. However, due to the considerable risks and hazards associated with the installation and operational use of this apparatus, when incorporated with associated laser equipment, the manufacturer has provided appropriate product warning labels and instructions to the user regarding laser safety. Laser Safety instructions and warnings are included in this manual.

The DH series Marking Head is intended for incorporation as a component of a laser marking system. When incorporated as a part of a laser marking system, and dependent upon the user application and installation, additional warning labels and safety barriers may be required to protect the operator of the system. The final system and installation should be evaluated to meet the requirements of EN60825-1 under the Low Voltage Directive 72/23/EEC.

SYNRAD assumes no responsibility for the compliance of the system into which the DH series Marking Head is integrated, other than to supply and/or recommend components and apparatus that are CE marked for compliance with applicable European Directives.

In accordance with the Machinery Directive, 89/392/EEC, Article 1, para. 4 and 5, the Machinery Directive does not apply to this device. In consideration of the incorporation of the DH series Marking Head into devices that may fall under the definition of a “machine”, SYNRAD, Inc. considers the application of the EMC directive as sufficient evidence that the DH series Marking Head product family will not compromise the compliance of the “machine” into which it is incorporated.

The DH series Marking Head systems are intended for installation and use in laboratory or manufacturing facilities by trained personnel only.

The following hazards would be typical for this product family when incorporated for intended use:

- A. Normal hazards associated with high potential DC supply voltages.
- B. Risk of injury when lifting or moving the unit.
- C. Risk of exposure to hazardous laser energy through unauthorized removal of access panels, doors, or protective barriers.
- D. Risk of exposure to hazardous laser energy and injury due to failure of personnel to use proper eye protection and/or failure to adhere to applicable laser safety procedures.

US FCC Information to User

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

marking head safety

Trademarks

DH series Marking Head is a registered trademark of SYNRAD, Inc.

WinMark Pro is a registered trademark of SYNRAD, Inc.

ActiveMark is a registered trademark of SYNRAD, Inc.

Windows 95 and Windows 98 are registered trademarks of Microsoft Corporation

getting started

Use information in this section to prepare your DH series Marking Head for operation. The order of information in this section is the same as the order of tasks that you need to perform. The best way to get your Marking Head ready for operation is to start at Inventory and work your way through Alignment.

This section contains the following information:

- Introduction – describes benefits of the digital DH series Marking Head and the Mounting Kit.
- Inventory – describes all components shipped with your Marking Head. Also describes components shipped with the Mounting Kit which is purchased separately.
- Mounting – explains how to attach the Marking Head and your laser to the Mounting Kit.
- Connecting – explains how to connect the required cards and cables.
- Software – describes the software required to control the Marking Head.
- Alignment – explains the step-by-step procedure for accurately aligning your Marking Head to the laser.

Note: Your DH series Marking Head may have been purchased separately from the laser and mounting kit or may have been purchased as a fully integrated 10W or 25W marking solution. Our fully integrated marking packages, consisting of a SYNRAD 10 or 25W laser, DH series Marking Head, and Mounting Kit, are delivered fully assembled and factory aligned.

The best way to get your integrated marking system ready for operation is to start at *Inventory* then review the *Mounting* section. Even though your Marking Head is pre-assembled and aligned, please review the *Mounting Requirements* to ensure the system is properly mounted in relation to your marking surface. Finish your installation by working through the *Connecting* and *Software* sections. For critical applications, you should review the *Alignment* section and verify beam alignment before operation.

getting started

Introduction

The DH series Marking Head is SYNRAD's second generation marking product. Its design benefits from our experience with hundreds of our popular SH series Marking Heads in customer applications around the world. Improved features of our DH series includes:

- Digital commands for improved resolution and noise immunity.
- Fiber optic control for electrical isolation of the Marking Head from the computer.
- Optically isolated I/O interface for parts handling equipment.
- Lower profile for easier system integration.

We've tried to develop a comprehensive manual that provides all the information required to get your marking system up and running as quickly as possible. If you encounter problems, or have questions unanswered by this manual, please contact us at 1-800-SYNRAD1 or by e-mail to synrad@synrad.com.

Required System Components

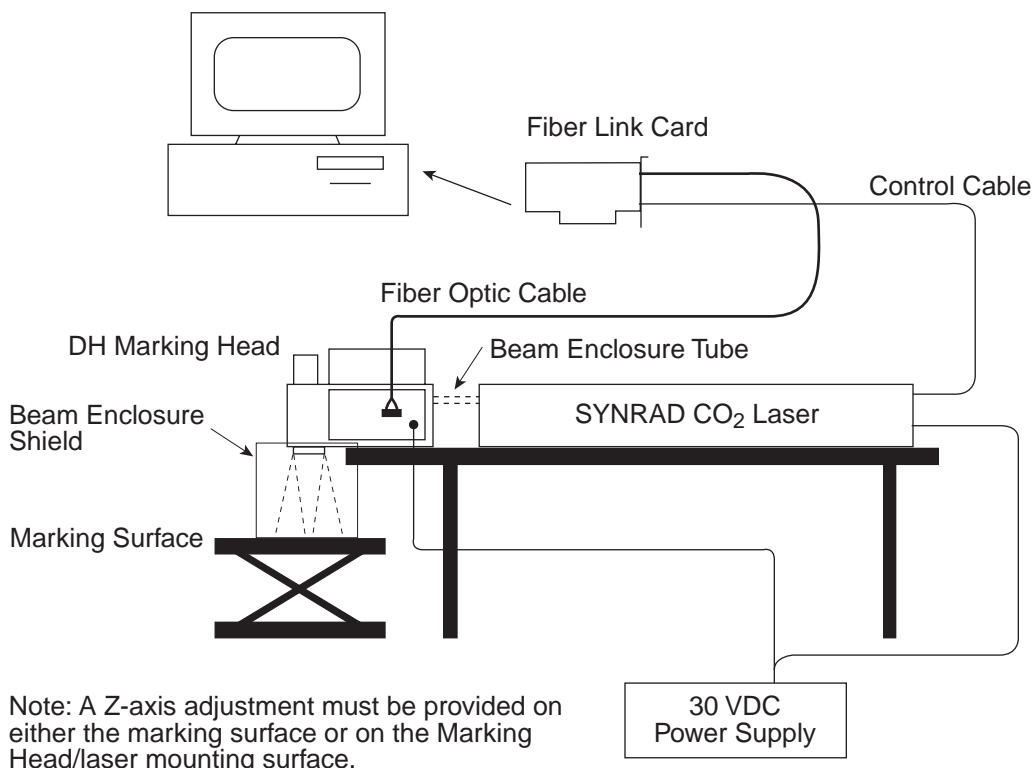


Figure 1-1 Complete Laser Marking System

getting started

Introduction

A complete laser marking system is shown in Figure 1-1 and will consist of the following components:

- SYNRAD CO₂ laser (10W – 125W).
- SYNRAD DH series Marking Head.
- Pentium computer with an open ISA Bus slot (customer-supplied).
- SYNRAD's WinMark Pro laser marking software.
- SYNRAD Fiber Link interface card.
- 30 VDC power supply.
- Beam Enclosure Tube (available from SYNRAD).
- Beam enclosure shield (customer-supplied).
- SYNRAD Mounting Kit.

Note: The detailed instructions and safety precautions contained within this manual were developed using the DH series Marking Head in conjunction with a SYNRAD CO₂ laser, SYNRAD Mounting Kit, and WinMark Pro marking software. You may need to contact SYNRAD for assistance prior to using a non-SYNRAD laser with the Marking Head.

DH series Marking Head specifications listed under “General Specifications” in the Technical Reference section are only guaranteed when the Marking Head is used with a SYNRAD CO₂ laser and WinMark Pro software.

getting started

Inventory

Marking Head

In addition to your DH series Marking Head, you should find the items listed in Table 1-1 included in the shipping box.

Table 1-1 Shipping Box Contents

Shipping Box Contents	Qty	Shipping Box Contents	Qty
SYNRAD DH series Marking Head	1	Laser Safety Information Bulletin	1
Accessory Kit	1	DH series Operator's Manual	1
Warranty Registration Card	1	SYNRAD Mouse Pad	1
SYNRAD Laser Safety Handbook	1		

Table 1-2 lists the items packaged in the Accessory Kit box.

Table 1-2 Accessory Kit Contents

Accessory Kit Contents	Qty	Accessory Kit Contents	Qty
Beam Alignment Tool	1	8-32 x 1/4 Flathead Screws	1
Mode Screen	2	Focusing Lens Cover	2
Power Cable	1	Output Aperture Cover	1

Contents Description

A description of each item listed in Table 1-1 and Table 1-2 follows.

SYNRAD DH series Marking Head – for marking a variety of products and materials.

Warranty Registration Card – notifies SYNRAD to put your warranty into effect.

SYNRAD *Laser Safety Handbook* – summarizes laser safety requirements and provides sources for obtaining additional information and assistance.

Laser Safety Information Bulletin – prepared by the Laser Institute of America to educate new laser users on issues and concerns related to laser safety.

DH series Operator's Manual – provides setup and operator information.

SYNRAD Mouse Pad – provides state-of-the-art control of your DH series Marking Head when used in conjunction with your mouse and WinMark Pro laser marking software.

Accessory Kit – contains the following DH series Marking Head accessories:

Beam Alignment Tool – aids the alignment of the DH series Marking Head to your SYNRAD CO₂ laser.

Mode Screen – spare mode screens for the Beam Alignment Tool.

Power Cable – carries DC power from your DC power source to the DH series Marking Head.

Screws – fasten the Marking Head to its mounting surface.

Focusing Lens Cover – protects your *Focusing Lens* from damage.

Output Aperture Cover – protects internal mechanisms when the *Focusing Lens* is removed.

getting started

Inventory

Fiber Link Card

In addition to the Fiber Link Card, you should find the items listed in Table 1-3 included in the shipping box.

Table 1-3 Fiber Link Card Accessories

Fiber Link Card Accessories	Qty
Fiber Link Card	1
Fiber Optic Cable	1
Power Control BNC Cable	1
Digital Input Cable	1
Digital Output Cable	1
Input Voltage Level Jumpers	7

Contents Description

A description of each item listed in Table 1-3 follows.

Fiber Link Card – communicates with parts handling equipment and controls the DH series Marking Head.

Fiber Optic Cable – electrically isolates your computer from the Marking Head while providing two-way communications.

Power Control BNC Cable – provides a laser power control connection from the Fiber Link Card.

Digital Input Cable – transfers input information from your parts handling equipment to the optically isolated Fiber Link Card I/O.

Digital Output Cable – transfers optically isolated output information from the Fiber Link Card to your parts handling equipment.

Input Voltage Level Jumpers – allow you to select either a high or low voltage level to trigger Fiber Link Card input circuitry.

getting started

Inventory

Marking Head Mounting Kit

You should find the items listed in Table 1-4 included in the Mounting Kit shipping box.

Table 1-4 Shipping Box Contents

Shipping Box Contents	Qty
Mounting Rail	1
Adjuster Plate	1
Beam Enclosure Tube w/ mounting screws	1
Spacers	2
Marking Head Attachment Screws (8-32 x ¼)	4
Spacer Attachment Screws*	4
Laser Mounting Screws**	4

- * 6-32 x ½ Flathead for Model 48-1, 48-2 lasers
10-32 x ½ Flathead for Model 48-5 lasers
¼-20 x ¾ Capscrew for Model 57-1, 60-1, and Evolution 100/125 lasers

- ** 10-32 x ½ Flathead for Model 48-1, 48-2, and 48-5 lasers
¼-20 x ½ Capscrew for Model 57-1, 60-1, and Evolution 100/125 lasers

Contents Description

A description of each item listed in Table 1-4 follows.

Mounting Rail – for mounting and maintaining alignment of your laser to the DH series Marking Head.

Adjuster Plate – provides horizontal and lateral adjustment of Marking Head to the laser. Once the alignment procedure is complete, the Marking Head can be removed from the *Adjuster Plate* then reinstalled without disturbing beam alignment.

Beam Enclosure Tube – encloses the beam path between laser and Marking Head to ensure operator safety.

Spacers – raise the laser to the correct mounting height.

Marking Head Attachment Screws –fasten your Marking Head to the *Adjuster Plate*.

Spacer Attachment Screws – fasten *Spacers* to your SYNRAD laser.

Laser Mounting Screws – fasten the laser/Spacer assembly to the *Mounting Rail*.

getting started

Mounting

The Marking Head must be properly mounted to allow alignment to both the laser and the marking surface. To mount your SYNRAD laser and DH series Marking Head, refer to the appropriate mounting diagram (page 3-6, 3-7, or 3-8) in the Technical Reference section and perform the following steps:

Note: If you purchased a 10W or 25W pre-assembled marking package then mounting and alignment are complete. You should, however, review the bulleted Mounting Requirements for fastening your Marking Head/laser/mounting kit package to the mounting surface of the application.

- 1 Place your laser upside down on a work surface and remove the rubber feet from the bottom side of the laser.
 - 2 For laser models 48-1 and 48-2 only, remove four cover screws from the bottom of the laser as required to expose the mounting holes used for attachment of the *Spacers*. Mounting holes are exposed on the other laser models.
 - 3 Orient both *Spacers* over the mounting holes on the bottom of the laser.
 - 4 Install and tighten the *Spacer Attachment Screws* to fasten *Spacers* to the laser.
 - 5 Turn the laser right-side up and orient it on the *Mounting Rail* with the output aperture facing the *Adjuster Plate*. Place the laser so that screw holes on the ends of the *Spacers* are aligned over the forward set of mounting holes on the *Mounting Rail*.
- Note:** When mounting a laser with no optical accessories attached, the *Spacers* are fastened to the forward set of mounting holes on the *Mounting Rail*. If your laser uses a Diode Pointer, Closed Loop Kit, or other optical accessory then the *Spacers* are attached to the *Mounting Rail* using the rear set of mounting holes.
- 6 Install and tighten the *Laser Mounting Screws*, securing the laser to the *Mounting Rail*.
 - 7 Connect power and water hookups to your laser according to instructions in the laser's Operator's Manual.
 - 8 Place your Marking Head on the *Adjuster Plate* with the *Entrance Aperture* facing the laser's output aperture.
 - 9 Install and tighten the four flathead *Marking Head Attachment Screws* through the bottom of both the *Mounting Rail* and *Adjuster Plate* into the bottom of the Marking Head housing.

Mounting Requirements

For customers who have not purchased SYNRAD's Mounting Kit, ensure the following requirements are met when fabricating your own mounting:

- The Marking Head and laser must be rigidly affixed to a mounting structure.
- The mounting structure must allow alignment of the Marking Head to the axis of the laser beam.
- IMPORTANT – The Marking Head Mounting Kit, or mounting structure, must be securely fastened so that the marking surface is parallel to the bottom of the Marking Head housing.
- Use 8–32 flathead screws to fasten the Marking Head to its mount. Ensure the screws do not extend more than 3/16 of an inch into the Marking Head.
- Position the Marking Head so that the lens to marking surface distance, the Working Distance, matches the distance specified on the lens mount. A Z-axis adjustment for either the marking surface or the mounting surface is highly recommended.
- The Beam Enclosure Tube between your laser and the Marking Head must be securely affixed.
- A beam enclosure shield should surround the beam path below the Marking Head and around the marking area wherever feasible.

getting started

Marking Head Removal

If it becomes necessary to remove your Marking Head from the *Mounting Rail*, remove only the four 8-32 x 1/4 flathead attachment screws that secure the *Marking Head* to its *Adjuster Plate*. The *Marking Head* can then be reinstalled on the *Adjuster Plate* without disturbing beam alignment with the laser.

Note: If the *Adjuster Plate* is removed from the *Mounting Rail*, the alignment procedure will have to be repeated.

getting started

Connecting

The Connecting instructions include subsections:

- Power Cable
- Fiber Link Card and Cables

Power Cable

To install the *Power Cable*, perform the following steps:

- 1 Locate the *Power Cable* in the Accessory Kit.
- 2 Verify the DC power supply is disconnected from its power source.
- 3 Connect one end of the *Power Cable* to the *Power Input* connector on the Marking Head.
- 4 Attach the white wire on the other end of the *Power Cable* to the positive (+) terminal on the power supply.
- 5 Attach the black wire of the *Power Cable* to the negative (-) terminal on the power supply.
- 6 Attach the green wire of the *Power Cable* to earth ground.

Note: *Power Cable* wires supplied prior to August 1998 were color-coded as blue (+), brown (-), and green.

Fiber Link Card and Cables

A computer-controlled digital fiber optic link operates the DH series Marking Head. SYNRAD's Fiber Link Card accepts instructions from the marking software and communicates X-Y position data to the Marking Head via fiber optic cable. The Fiber Link Card also supplies the pulse-width modulated (PWM) laser control signal that adjusts laser output power and turns the beam on and off. During laser off periods, the control signal generates "Tickle" pulses required to keep the laser ready to fire at the next "on" command. Finally, the Fiber Link Card provides input and output (I/O) connections that can be used to interface to parts handling equipment. All communication with the Fiber Link Card is optically isolated to minimize susceptibility to electrical noise.

Installing the Fiber Link Card

The Fiber Link Card is designed for an ISA Bus slot in an IBM-compatible computer. It is possible to damage the Fiber Link Card or your computer through improper installation; please follow the directions carefully.

- 1 Turn off your computer, but leave it plugged into a properly grounded wall outlet. Leaving the computer plugged in means that the computer chassis will be grounded, enabling you to discharge harmful static electricity before handling sensitive electronics.
- 2 Remove the computer's case or cover to expose the expansion slots. Locate an empty ISA Bus slot (don't worry, the Fiber Link Card will not physically fit in a PCI slot). If there is a "space filler" metal bracket on the rear of the computer adjacent to the ISA slot, remove it.

getting started

1 Connecting

Caution

possible
equipment
damage

Static sensitive components on the Fiber Link Card may be damaged if exposed to static electricity discharges. Always wear a static control wrist strap when handling the Fiber Link Card. If a static control wrist strap is not available, follow the instructions in step 3 carefully to avoid damaging the card.

- 3 When handling the Fiber Link Card, use a static control wrist strap if one is available. If a wrist strap is not available, you will need to ground yourself by maintaining continuous contact with the grounded metal computer chassis. While grounded, remove the card from the static bag and install it in the ISA slot. The gold fingers on the card should slide into the mating ISA Bus slot without using excessive force. The BNC connectors (coaxial cable connectors on the card) should be accessible from the back of your computer. When the card is properly seated, screw the bracket into place.
- 4 Reinstall the case or cover on your computer. Do not apply power until cable connections in the next section have been completed.

Fiber Link Card Cable Connections

To install the Fiber Link cables, refer to Figure 1-2 and perform the following steps:

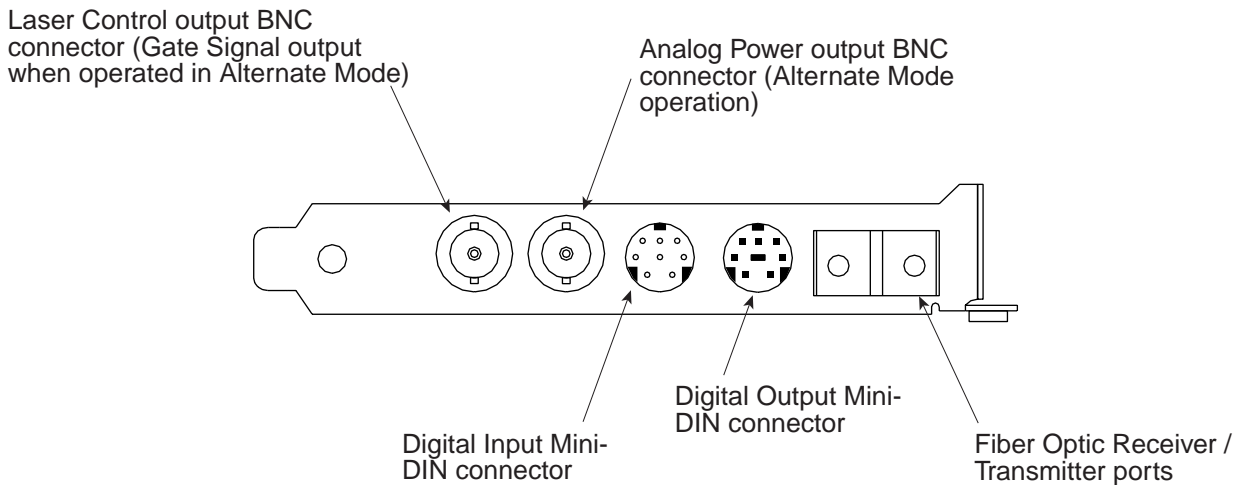


Figure 1-2 Fiber Link Card Connectors

- 1 Ensure the computer is still turned off from step 4 above. With the back of the computer accessible, locate the connectors on the Fiber Link Card.
- 2 Complete the control connection from the Fiber Link Card to your laser according to its type.

Series 48-1, 48-2 laser:

Attach one end of the supplied coaxial control cable to the *Laser Control* output BNC connector on the Fiber Link Card. Attach the other end of the cable to the control input, labeled *CTRL* located on the rear of the laser.

getting started

Connecting

Series 48-5 laser:

Attach the long “leg” of the supplied “Y” coaxial control cable to the *Laser Control* output BNC connector on the Fiber Link Card. Attach the short “legs” of the cable to the control inputs, labeled *CTRL1* and *CTRL2* located on the rear of the laser.

Series 57-1, 60-1, and Evolution 100/125 laser:

Attach one end of the supplied coaxial control cable to the *Laser Control* output BNC connector on the Fiber Link Card. Attach the other end of the cable to the control input, labeled *CTRL IN* (*CONTROL IN* connector on Evolution lasers) located on the front or rear panel of the RF power supply.

- 3 Remove the gray rubber dust plugs from the fiber optic ports on the Fiber Link Card and the DH series Marking Head.
- 4 Connect one end of the duplex fiber optic cable to the fiber optic receiver/transmitter port on the Fiber Link Card. When connected properly, the latch on the cable end should clip into the connector on the card. You should not be able to pull the fiber optic cable out of the connector without depressing the latch.
- 5 Connect the other end of the duplex fiber optic cable to the *Digital Control RX/TX* (receiver/transmitter) port on the DH series Marking Head. When connected properly, the latch on the cable end should be facing up and clip into the connector on the Marking Head. You should not be able to pull the fiber optic cable out of the connector without depressing the latch.
- 6 Since it is possible to partially install the fiber optic cable upside down, check the connection to ensure it is properly connected.
 - a Apply power to your computer and the Marking Head.

Warning

Do not stare directly into the red LED light from the transmitter port on the Fiber Link Card or the Marking Head. The light is potentially intense enough to injure the eye with prolonged exposure.

Note: When looking at either the Marking Head or Fiber Link Card with the fiber optic cable removed, the gray half of the fiber optic port is the transmitter and should emit an easily visible red glow.

- b Remove the cable from the fiber optic port on the Fiber Link Card. The cable half connected to the Marking Head *Digital Control TX* (gray) port should emit a visible red glow. This cable half should connect to the black half (RX – Receiver port) of the Fiber Link Card’s fiber optic port. The red illuminated cable half should not connect to the red transmitter port, if so, then one of the cable ends is improperly connected.

Note: Marking Head *Analog Control Inputs* are not enabled when the fiber optic cable is connected to the *Digital Control RX/TX* port. While it’s possible to drive the Marking Head using the *Analog Control Inputs X* and *Y* connectors, SYNRAD recommends fiber optic cable control. The fiber optic cable and Fiber Link Card provide superior noise immunity between your computer and the DH series Marking Head.

The connections you have completed are sufficient for basic operation and testing of the marking system. With these basic connections, all marking actions can be controlled directly from the keyboard. Automated applications will require electrical signals from parts handling equipment to initiate laser marking. See “Controlling the Marking Head” in the Operation section for detailed information on interfacing your parts handling system to the Fiber Link Card I/O connectors.

getting started

Software

SYNRAD's WinMark Pro™ laser marking software with ActiveMark™ Technology gives you the power to create or import professional graphics and text images that can then be laser marked on your product from a Windows 95 or Windows 98 desktop. WinMark Pro is also capable of controlling every aspect of the laser marking process from incrementing serial numbers to changing laser parameters to interfacing with parts handling equipment.

Software Installation

WinMark Pro

SYNRAD's WinMark Pro and Fiber Link Card were designed to operate together. To install WinMark Pro, follow directions in the WinMark Pro User's Guide. To complete a laser mark, WinMark Pro requires that a hardware key device be attached to the parallel port of your computer.

The WinMark Pro User's Guide contains complete information for importing graphics as well as creating text and barcode images. The User's Guide also explains how to automate your marking process by configuring WinMark Pro to read from and write to Fiber Link Card I/O connected to your parts handling equipment.

DigScope is a stand-alone program included with WinMark Pro software. Use DigScope to configure and monitor the status of the Fiber Link Card's inputs and outputs. DigScope is also capable of manually commanding the laser beam on and off and can adjust the laser's output power level. Manual control is useful while aligning the Marking Head to the laser or when troubleshooting.

getting started

Alignment

READ THIS SECTION THOROUGHLY BEFORE BEGINNING. This will familiarize you with the steps and adjustments you will be making. The alignment procedure is an iterative process that may require several cycles to complete.

Proper alignment is achieved by precisely positioning the Marking Head relative to the laser, ensuring that the laser beam passes through the centers of both the *Entrance Aperture* and *Expander Mirror Aperture*. Since the laser's position is fixed by the *Mounting Rail* and the Marking Head is securely fastened to the *Adjuster Plate*, this process relies on the moveable *Adjuster Plate* to properly align the Marking Head to the laser. The *Adjuster Plate* has five adjustment screws that position the Marking Head. Two are located on the side of the *Adjuster Plate* for lateral positioning and three are located beneath the *Mounting Plate* (directly below the Marking Head) for vertical positioning.

DH series Marking Heads are shipped with a beam alignment tool, Figure 1-3 to ease the alignment process.

Note: If you purchased a SYNRAD fully integrated 10W or 25W marking solution, you will not need to perform the alignment procedure described below although for critical applications you should verify beam alignment before operation.

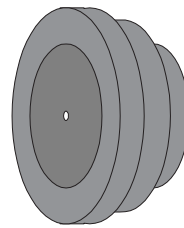


Figure 1-3 Beam Alignment Tool

To align the Marking Head, perform the following steps:

Danger

serious
personal
injury

Aligning the Marking Head will require operation of the laser. All personnel working in an area where a CO₂ laser is operating should wear protective eyewear that blocks 10.6 μm, CO₂ laser radiation. Protective eyewear for 10.6 μm, CO₂ laser radiation is available from SYNRAD, Inc.

Do not allow the laser beam to contact personnel. The Expander Mirror Mount is removed from the Marking Head during the alignment procedure allowing the beam to travel in an abnormal path through the Marking Head Entrance Aperture and exiting through the Expander Mirror aperture. The exposed invisible laser beam is capable of seriously burning human tissue and/or inflicting corneal injuries.

In addition to being a serious burn hazard, the unfocused laser beam can present a fire hazard over a range of several hundred feet. Erect a beam block to stop the beam and absorb its heat energy. The beam block should measure at least two feet by two feet (60 cm x 60 cm) and be placed no further than three feet (1 m) from the Expander Mirror aperture. The beam block should be a masonry material such as concrete block, brick, or preferably, firebrick.

getting started

Alignment

- 1 Verify that power to both the laser and Marking Head is off. Close the laser's shutter, if one is available.

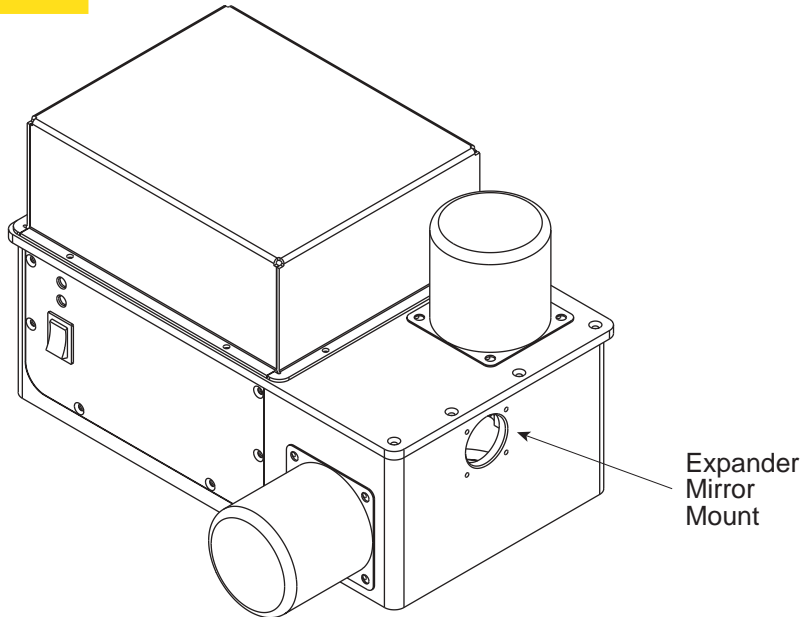


Figure 1-4 Expander Mirror Mount Location

- 2 Remove the four screws securing the *Expander Mirror Mount* to the Marking Head. Refer to Figure 1-4 for the *Expander Mirror Mount* location.

Caution

possible
equipment
damage

Do not touch the reflective surface of the mirror. Fingerprint residue on the mirror will burn when exposed to the laser beam, damaging the reflective surface.

- 3 Carefully remove the *Expander Mirror Mount* from the Marking Head and place it mirror side down on a flat, clean surface to keep dust off the mirror.
- Note:** Do not adjust the three button head screws that secure the *Expander Mirror* to the *Mirror Mount*. The *Expander Mirror Mount* is an integral part of the internal optics and is precisely aligned at the factory for optimal performance.
- 4 Ensure that all system connections for the Marking Head and laser are complete.
 - 5 Position your computer monitor and keyboard so you can operate your marking software while adjusting Marking Head alignment.
 - 6 Remove the *Entrance Aperture* cover and the *Focusing Lens* cover from the Marking Head and remove the *Beam Enclosure Tube* if one is installed.
 - 7 Insert the beam alignment tool into the beam *Entrance Aperture* of the Marking Head. Refer to Figure 1-5 for the *Entrance Aperture* location. Make certain the tool is seated flush against the Marking Head housing and is not cocked sideways in the bore.

getting started

Alignment

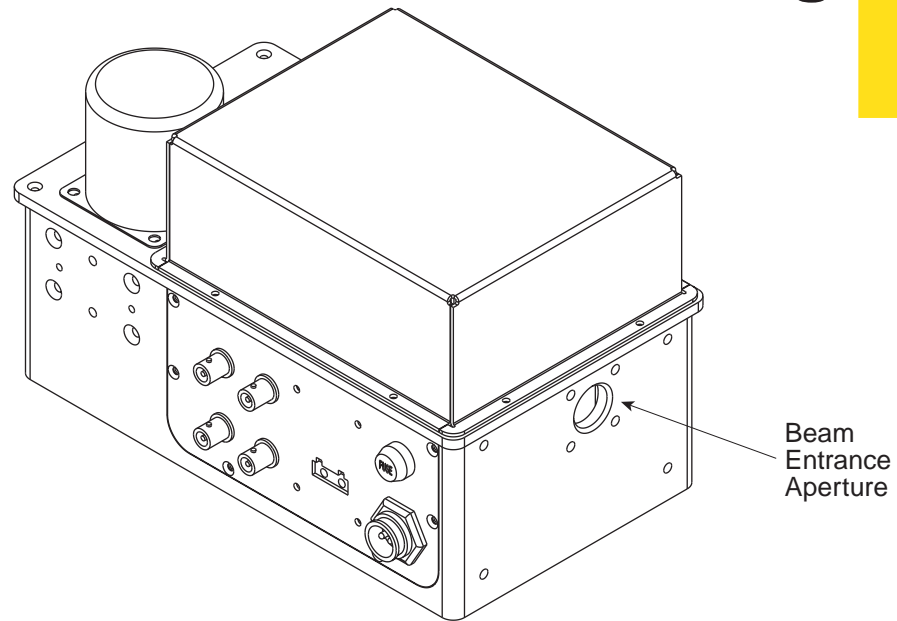


Figure 1-5 Beam Entrance Aperture Location

- 8 Ensure that personnel in the area are wearing appropriate protective eyewear. Turn on the laser's power supply (the Marking Head does not need to be on for this operation). Using your marking software (DigScope is particularly useful), set laser output power to minimum and open the laser's shutter.
- 9 Gradually increase laser power until a faint orange spot appears on the screen of the alignment tool. If the beam is centered on the alignment hole, the *Entrance Aperture* is aligned, proceed to Step 14. If the beam is not centered, adjustment is required, continue with Step 10 below.
- 10 Turn laser off and close the shutter. Verify that the beam is off.
- 11 Loosen the three *Locking Setscrews* located beneath the *Mounting Plate*. Refer to the mounting diagram for your laser (page 3-6, 3-7, or 3-8) in the Technical reference section for *Locking Setscrew* and *Adjustment Screw* locations.

Caution

possible
equipment
damage

The three *Locking Setscrews* must be loosened prior to adjusting either the *Lateral* or *Vertical Adjustment Screws*.

- 12 Turn the laser on and open the shutter.
- 13 Adjust the one *Lateral* and/or one *Vertical Adjustment Screw(s)* positioned closest to the laser as required to center the laser beam through the alignment hole in the beam alignment tool.
- 14 Lower laser power to minimum, turn the laser off and close the shutter. Verify that the beam is off.
- 15 Move the beam alignment tool from the *Entrance Aperture* to the *Expander Mirror Aperture*. Refer to Figure 1-4 for the *Expander Mirror Aperture* location. Make certain the tool is seated flush against the Marking Head housing and is not cocked sideways in the bore.

getting started

Alignment

- 16 Reset laser output power to minimum, turn the laser on and open the shutter.
 - 17 Gradually increase laser power until a faint orange spot appears on the screen of the alignment tool. If the beam is centered on the alignment hole, the *Expander Mirror Aperture* is aligned, proceed to Step 19. If beam is not centered, adjustment is required, continue with Step 18 below.
 - 18 Adjust the one *Lateral* and/or two *Vertical Adjustment Screw(s)* positioned farthest from the laser as required to center the laser beam through the alignment hole in the beam alignment tool. Adjustments to the *Vertical Adjustment Screws* should be performed in equal amounts.
 - 19 Turn laser off and close the shutter. Verify that the beam is off.
 - 20 Tighten all the *Locking Setscrews*. Do not exceed 50 in-lbs of torque when tightening the setscrews.
- Note:** Tightening the *Locking Setscrews* may affect alignment, you may need to compensate for this slight movement during the alignment process.
- 21 Remove the beam alignment tool.
 - 22 Repeat Step 7 through Step 20 to verify the Marking Head/laser system is properly aligned. If necessary, repeat the alignment procedure.
 - 23 Turn off the laser power supply. Reinstall the *Expander Mirror Mount* and tighten the four mounting screws.
 - 24 Install the *Beam Enclosure Tube*, provided in the Marking Head Mounting Kit, between the Marking Head and laser using the 8–32 x 1/4 mounting screws provided.

operation

2

Use information in this section to familiarize yourself with DH series Marking Head controls and indicators and begin operating the Marking Head.

This section contains the following information:

- Controls and Indicators – displays and describes exterior controls and indicators on the DH series Marking Head.
- Initial Turn-On – explains how to turn on the Marking Head while verifying proper operation.
- Controlling the Marking Head – explains how to interface the Marking Head to your parts handling equipment.

operation

Controls and Indicators

Interconnect Panel

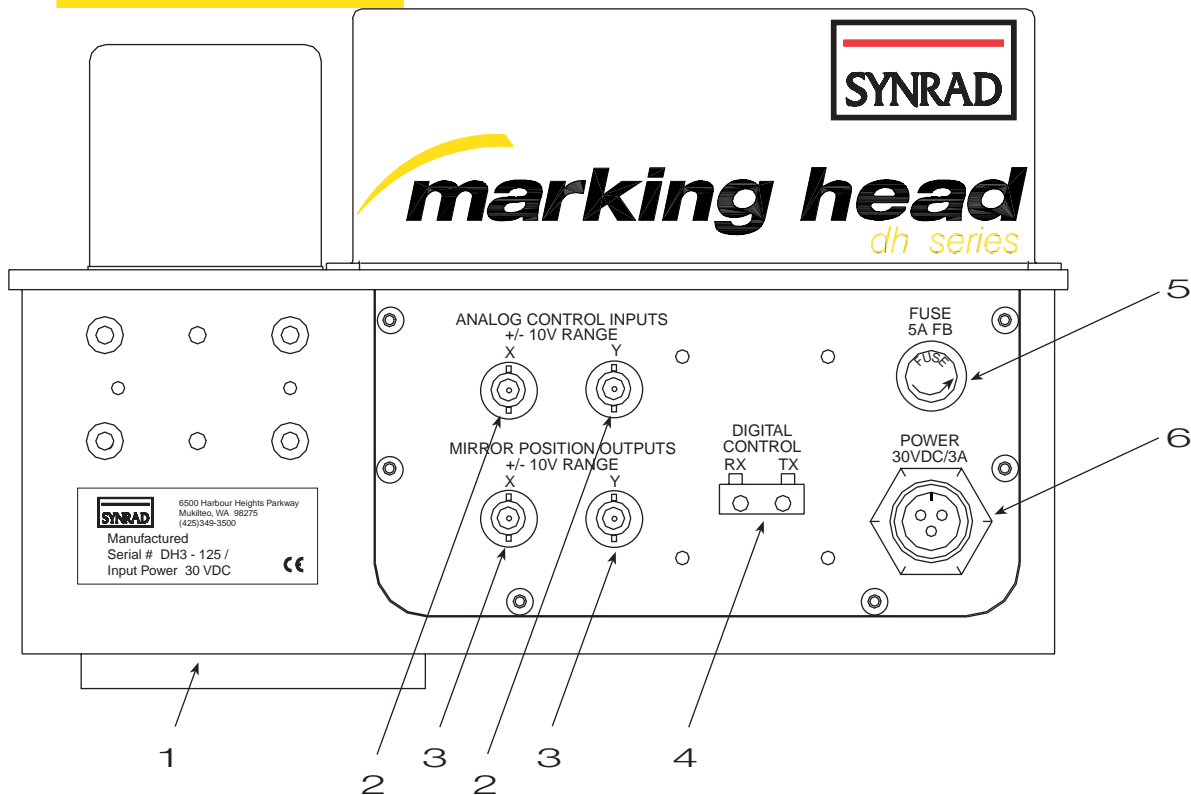


Figure 2-1 Interconnect Panel Controls and Indicators

- 1 Focusing Lens Mount – fastens your choice of lens to the Marking Head.
- 2 Analog Control Inputs BNC Connectors – accept customer-supplied analog voltage inputs to drive the “X” and “Y” mirror galvanometers. The allowable input voltage range is from –10 V to +10 V.
- 3 Mirror Position Outputs BNC Connectors – provide analog voltage feedback signals proportional to “X” and “Y” mirror positions. The output voltage range is from –10 V to +10 V. These connectors are provided for troubleshooting purposes only.
- 4 Digital Control RX/TX Fiber Optic Port – carries digital information via a fiber optic cable between the Marking Head and the Fiber Link Card. The fiber optic cable provides noise immunity for the digitally generated control signals.
- 5 Fuse Holder – protects Marking Head circuitry with a 5 ampere FB (Fast Blow) fuse.
- 6 Power Input Connector – receives 30 VDC, 3 amp input power from your power supply. The DH series Marking Head can be powered in parallel from the same 30 V supply as your laser.

operation

Controls and Indicators

Switch Panel

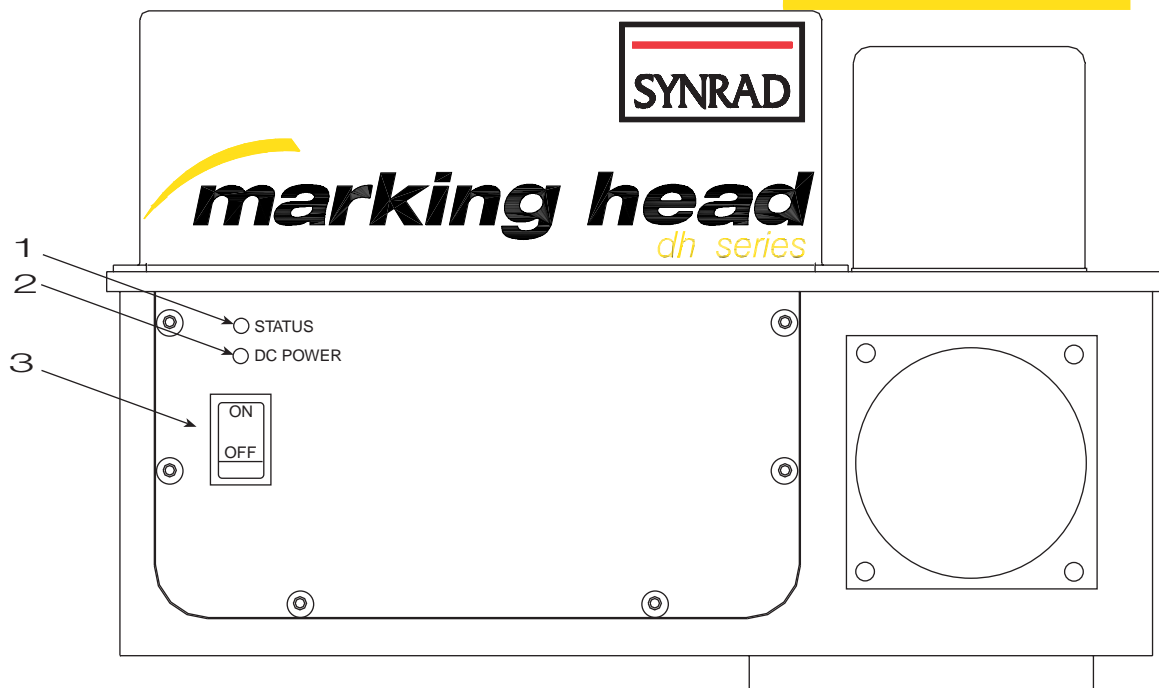


Figure 2-2 Switch Panel Controls and Indicators

- 1 *Status* Indicator – illuminates to indicate Marking Head status. The indicator is red during power-up, changing to green when the system is ready to mark. A fault is indicated if the lamp remains red.
- 2 *DC Power* Indicator – illuminates green when 30 VDC is applied to the Marking Head and the power switch is in the On position.
- 3 Power Switch – activates the Marking Head.

operation

Initial Turn-On

Once the Fiber Link Card is installed in your computer, your marking software is running, and the Marking Head is aligned, you are ready to test the installation by performing the following steps:

- 1 Design a simple mark using your marking software.
- 2 Ensure that personnel in the area are wearing the appropriate protective eyewear. Turn on the 30 VDC power supply to the Marking Head.
- 3 Turn on the Marking Head. Verify that both the *Status* and *DC Power* indicators above the Marking Head power switch are green. A red *Status* light indicates a fault. It is normal to see the *Status* light illuminate red then change to green when the Marking Head is first turned on.
- 4 Place the material to be marked in the field of the marking lens. Check that the surface of your material is the proper distance from the lens. The required distance is marked on the lens mount as the Working Distance.
- 5 Check that all safety precautions discussed earlier such as safety glasses and shielding around the beam area are being met, then execute the mark.

Note: If the Marking Head fails to mark properly, refer to “Troubleshooting” in the Maintenance/Troubleshooting Guide section.

Controlling the Marking Head

The Controlling the Marking Head section includes subsections:

- Connecting to Parts Handling Equipment
- Fiber Link Card Optional Features
- Using Fiber Link Card Outputs

Connecting to Parts Handling Equipment

The Fiber Link Card incorporates several input and output lines which can be used to control marking operation electronically. A simple system utilizing the card's digital I/O to control marking electronically might operate as follows. A conveyor stops with a new part under the Marking Head and delivers a "start mark" signal to an input on the Fiber Link Card. WinMark Pro software recognizes the transition on an input, and marks a serial number. On completion of the mark, WinMark Pro activates an output pin "mark complete", starting the conveyor again. After the mark complete signal, WinMark Pro increments the serial number and waits for the next "start mark" signal. The digital I/O capability of the Fiber Link Card enables this kind of system.

Digital Input Circuitry

Use the optically isolated digital inputs to carry information (for example: a part is in position, ready for marking) from the parts handling equipment to your computer and marking software. The input circuit is shown in Figure 2-3.

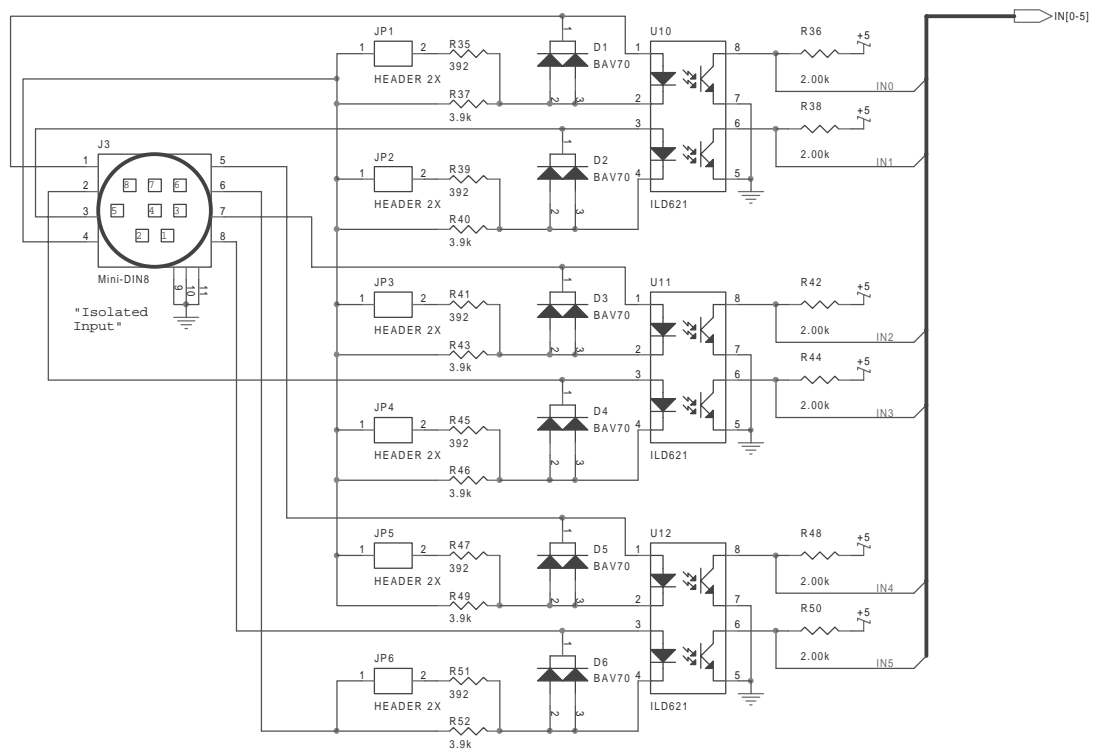


Figure 2-3 Digital Input Circuit

operation

Controlling the Marking Head

There are 6 digital input lines, 5 of which share a common ground or return line. The sixth input line is referenced to an independent ground, or return line.

The voltage level required to activate, or turn on, inputs is individually user-selectable by jumpers. The factory default enables the high voltage (28 V nominal) input voltage setting. No shorting jumpers are installed. Placing a shorting jumper across any jumper, JP1 through JP6, changes that input to accept a low voltage (5 V nominal) CMOS or TTL input signal. Refer to Table 2-1 for input signal parameters.

Table 2-1 Input Signal Parameters

Parameter	Min	Typ	Max
Low Voltage Inputs (TTL/CMOS compatible)			
V_{IL} – Low level input voltage	-0.6 V	0 V	1.0 V
V_{IH} – High level input voltage	2.0 V	5.0 V	6.0 V
I_F – LED forward current			15 mA
High Voltage Inputs			
V_{IL} – Low level input voltage	-0.6 V	0 V	5.0 V
V_{IH} – High level input voltage	15.0 V	28.0 V	40.0 V
I_F – LED forward current			15 mA

A pre-assembled digital input cable with connector and pigtail is shipped with each Fiber Link Card to ease system development. No power is available on the input connector; power required to operate digital inputs must be supplied by your equipment. Refer to Table 2-2 for connector pin numbers and wire color-coding.

Table 2-2 Input Connector Pinouts

Pin #	Pin Description	Wire Color
1	Input 0	Brown
2	Input 3	Red
3	Input 1	Orange
4	Common Ground (Return) for Inputs 0-4	Yellow
5	Input 4	Green
6	Isolated Ground (Return) for Input 5	Blue
7	Input 2	Violet
8	Isolated Input 5	Grey

Controlling the Marking Head

The digital input connector shown in Figure 2-3 is a Mini-DIN 8 type, available from the following source. Be sure to request assembly instructions.

Kycon, Inc.
1810 Little Orchard St.
San Jose, CA 95125
USA
1-800-544-6941

Input Cable part number KMDLA-8P.
Output Cable part number KMDLA-7P.

Digital Output Circuitry

Use the optically isolated digital outputs to carry information from the computer (for example: the mark is complete, move the next part into position) to your parts handling equipment. The output circuit is shown in Figure 2-4.

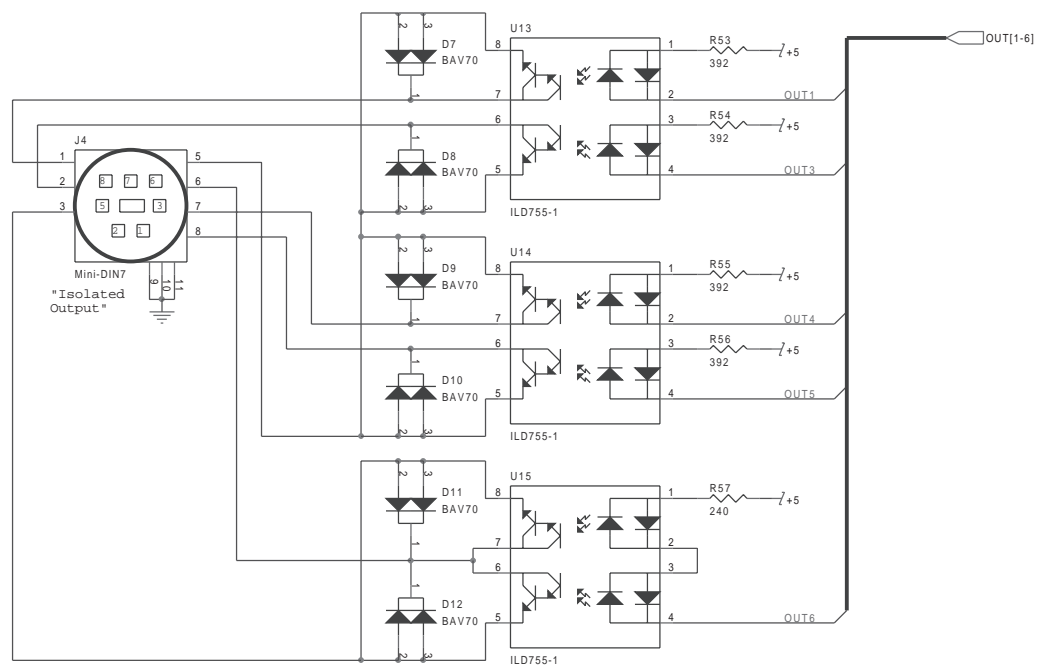


Figure 2-4 Digital Output Circuit

There are 5 digital output lines, 4 of which are designed to sink 50 mA of current. The fifth output line is designed to sink 100 mA. Breakdown voltage of the photo-Darlington is 60 V, and $V_{CE_{SAT}}$ is 1 V. These outputs are only meant to operate small relays, or toggle inputs on parts handling equipment.

A pre-assembled digital output cable with connector and pigtail is shipped with each Fiber Link Card to ease system development. Refer to Table 2-3 for connector pin numbers and wire color-coding.

operation

Controlling the Marking Head

Table 2-3 Output Connector Pinouts

Pin #	Pin Description	Wire Color
1	Output 1	Brown
2	Output 3	Red
3	Isolated Ground (Return) for Output 6	Orange
4	No Connection	
5	Common Ground (Return) for Outputs 1, 3, 4, 5	Green
6	Output 6	Blue
7	Output 4	Violet
8	Output 5	Grey

The digital output connector shown in Figure 2-4 is a Mini-DIN 7 type available from the source listed in the Input Circuitry section. The part number is KMDLA-7P. Be sure to request assembly instructions.

Fiber Link Card Optional Features

The Fiber Link Card is factory configured for the most commonly used mode. The standard mode described above requires no changes to the DIP switch settings on the card.

Alternate Mode

Configuring the Fiber Link Card to Alternate Mode allows the Marking Head laser to be operated with a Closed Loop Kit installed. A Closed Loop Kit in conjunction with a UC-1000 Laser Controller maintains highly stable control of laser power by real-time sampling of the beam and internal adjustment of the PWM control signal sent to the laser.

To configure your system for the Alternate Mode, refer to Figure 2-5 and perform the following steps:

- 1 Connect the Closed Loop Kit's Mini-DIN connector to the UC-1000's *CL Adaptor* connection.
- 2 Connect the coaxial control cable from the laser's *CTRL* or *Control In* BNC connector to the UC-1000's *Output* BNC connection.
- 3 Connect a coaxial cable from the Fiber Link Card's *Analog Power* output BNC connector to the UC-1000's *ANV/C* BNC connection.
- 4 Connect a coaxial cable from the Fiber Link Card's *Laser Control (Gate Signal)* output BNC connector to the UC-1000's *Gate* BNC connection.
- 5 Remove the gray rubber dust plugs from the fiber optic ports on the Fiber Link Card and the Marking Head.
- 6 Connect the duplex fiber optic cable from the Fiber Link Card's fiber optic receiver/transmitter port to the *Digital Control RX/TX* fiber optic port on the DH series Marking Head.
- 7 Set the UC-1000's Mode switch to *CLL* or *CLH* (refer to the UC-1000 Operation Manual or 48-CL Closed Loop Kit Manual for detailed information about Closed Loop operation).

Controlling the Marking Head

- 8 Set DIP switch # 5 on the Fiber Link Card to the “0” or “off” position.

In Alternate Mode, the Fiber Link Card delivers a Gate signal to the UC-1000 through the *Laser Control (Gate Signal)* output BNC connector. The card also generates an analog signal for the UC-1000 through its *Analog Power* BNC connector. The analog power signal is a voltage ranging from 0 V (“Tickle” signal only) to 10 V (maximum power output).

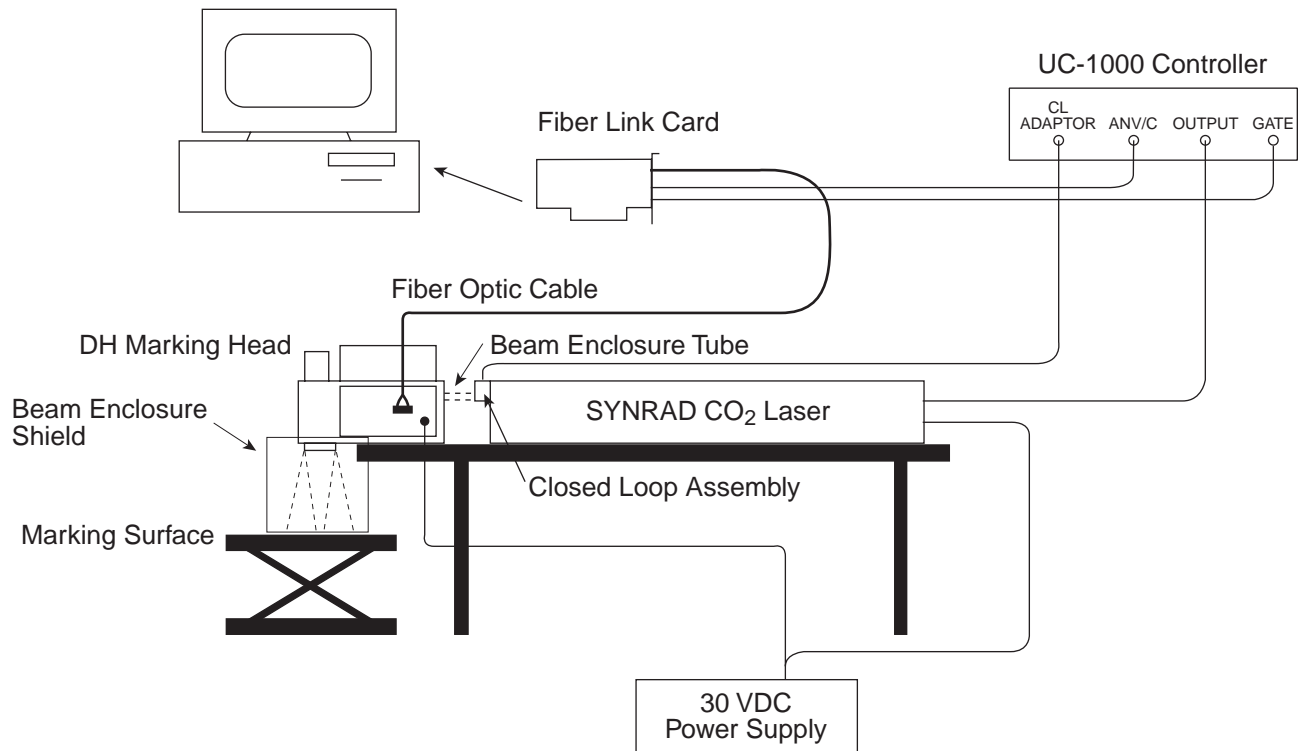


Figure 2-5 Alternate Mode Connections

Fast Acting Safety (FAS) Interlock

SYNRAD lasers are equipped with a safety interlock feature that disables laser firing, typically when an access door or safety enclosure is opened. Many marking applications require a safety action to occur for each part that is marked. An example would be the lowering of a shield over a part prior to marking, then raising it and removing the part as soon as the mark was complete. In these types of applications the laser safety interlock does not react quickly enough. This led to the development of a Fast Acting Safety (FAS) Interlock feature in the Fiber Link Card.

Enable the FAS Interlock by setting DIP switch # 6 on the Fiber Link Card to the “1” or “on” position. When the FAS Interlock is enabled, a high voltage input must be present on digital Input # 5 for the laser to fire and the mark to proceed. When the Interlock is enabled and Input # 5 is low, a “Tickle” pulse is delivered through the *Laser Control* output BNC connection. “Tickle” keeps the laser gases ionized without producing laser beam emission. When Input # 5 goes high, the PWM control signal from the Fiber Link Card allows the laser to fire at the programmed power level.

The FAS Interlock function is implemented in the Fiber Link Card’s digital circuitry and does not depend on the WinMark Pro software. Interlock circuitry on the Card overrides instructions from the marking software. The state of Input # 5 is available to the marking software whether the FAS Interlock feature is enabled or disabled. To synchronize marking software with FAS Interlock circuitry, program the software to require the “safe” (high) input on Input # 5 before executing a mark. Reaction time using the FAS Interlock (laser firing after a high level is sensed on Input # 5) is less than 1 ms.

operation

Controlling the Marking Head

DIP Switch Settings

Figure 2-6 shows the factory default positions of the DIP switches.

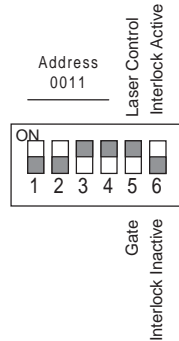


Figure 2-6 DIP Switch Default Settings

The Fiber Link Card address is 3x0 hex, where the first four DIP switches set the x value. Leave the address set to 330 unless your computer configuration forces you to change it. If you must change the board address, make the corresponding change in WinMark Pro. The Fiber Link Card does not use interrupts.

Table 2-4 illustrates the relationships between DIP switches # 5 and # 6, Input # 5 and the signal generated to the *Laser Control* output BNC connection.

Table 2-4 Switch / Signal Settings

DIP SW 5	DIP SW 6	Input # 5	Signal Sent to Laser Control Connection
ON (Laser Control)	OFF (Inactive)	High	Laser Control (PWM power signal)
ON (Laser Control)	OFF (Inactive)	Low	Laser Control (PWM power signal)
ON (Laser Control)	ON (Active)	High	Laser Control (PWM power signal)
ON (Laser Control)	ON (Active)	Low	“Tickle” signal
OFF (Gate)	OFF (Inactive)	High	Gate (Beam On)
OFF (Gate)	OFF (Inactive)	Low	Gate (Beam On)
OFF (Gate)	ON (Active)	High	Gate (Beam On)
OFF (Gate)	ON (Active)	Low	Low (Gate Off) (Beam Off)

Using Fiber Link Card Outputs

The optically isolated outputs on the Fiber Link Card can be used to create very flexible automated systems. Typically, one of these outputs will be used to indicate the completion of a mark. Another might be used to drive a warning light when the laser beam is active, or to increment a parts counter. Several circuits for interfacing to Fiber Link Card outputs are shown on the following pages.

Controlling the Marking Head

Note: When configuring your marking software, a “1” written to an output bit turns an output photo-transistor ON. A “0” written to an output bit turns an output photo-transistor OFF. An exception to this rule exists for customers whose DH series Marking Heads have serial numbers lower than 280. For those units, a “0” written to an output bit turns an output photo-transistor ON, a “1” turns the output OFF.

Logic High Output to PLC Input

Figure 2-7 illustrates the simplest connection to a PLC input. The circuit is most appropriate for digital Output # 6 which doesn't share a common ground (return) line with the other outputs. Output transistor ON means the PLC input is High.

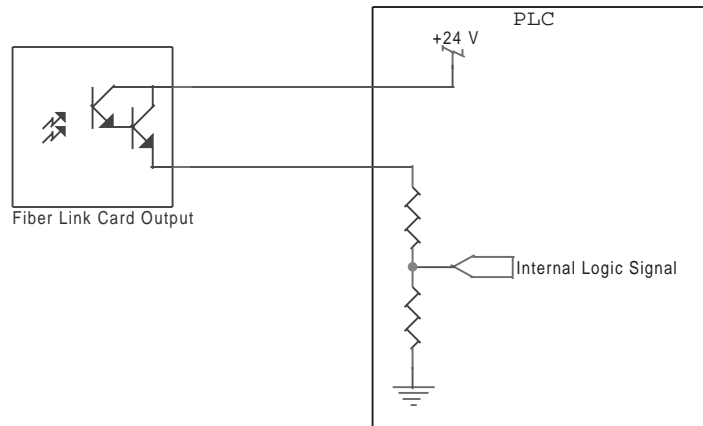


Figure 2-7 Logic High Output to PLC

Logic Low Output to PLC Input

Figure 2-8 illustrates an alternate connection to a PLC input. Output transistor ON means the PLC input is Low. Check that the resistance and power rating of the pull-up resistor are acceptable for your system.

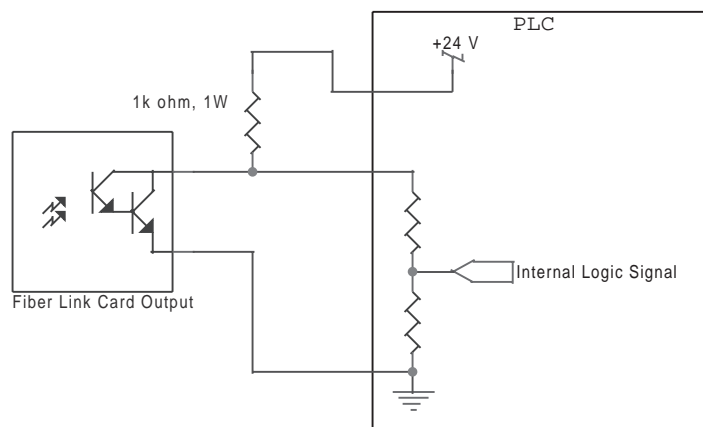


Figure 2-8 Logic Low Output to PLC

operation

Controlling the Marking Head

Relay Driver Output

Figure 2-9 illustrates a simple relay driver circuit. The diode serves to clamp the inductive kick from the relay coil. Output transistor ON means the relay is energized.

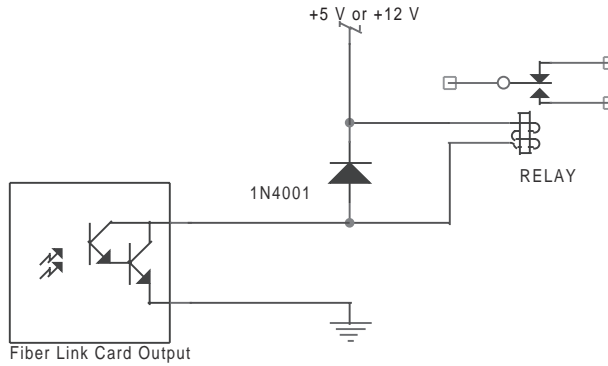


Figure 2-9 Relay Driver Output

Logic Interface Output

Figure 2-10 illustrates a sample logic interface circuit. This circuit is appropriate for digital Output # 6 which doesn't share a common ground (return) line with the other outputs. Output transistor ON means the logic input is High. A logic interface can also be implemented with a pull-up resistor using one of the outputs that share a common ground.

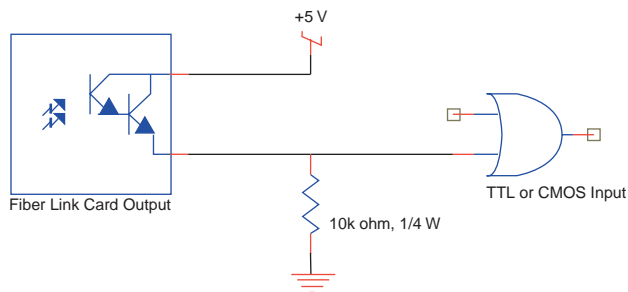


Figure 2-10 Logic Interface Output

technical reference



Use information in this section as a technical reference for your DH series Marking Head.

This section contains the following information:

- Programming the Fiber Link Card – provides a technical description of the software interface to the Fiber Link Card.
- General Specifications – provides specifications for DH series Marking Heads.
- Marking Head Package Outline – illustrates Marking Head package and mounting dimensions.
- Marking Head / Laser Mounting – diagrams for attaching specific laser models and a DH series Marking Head to SYNRAD's Mounting Kit.

technical reference

Programming the Fiber Link Card

The Programming the Fiber Link Card section includes subsections:

- Basic Functions
- Addressing the Fiber Link Card

The following information is provided for users who wish to design custom software to operate the SYNRAD DH series Marking Head and laser via the Fiber Link Card. Before beginning a project of this scope, remember that SYNRAD's WinMark Pro software is the result of our extensive experience with hundreds of marking applications around the world. WinMark Pro incorporates tremendous flexibility of I/O and control with a highly refined engine for driving the marking system. SYNRAD engineers would be happy to discuss the particular requirements of your application, and explain how WinMark Pro may be able to meet your needs.

Basic Functions

In order to execute a mark, the following actions must occur:

- Set laser output power level.

000 hex is minimum laser power ("Tickle" signal only). FFF hex is maximum laser output power. For backward compatibility with earlier SYNRAD marking products, 12 bits are written, but only the 7 MSB's are actually used. The duty cycle of the laser control signal during marking should track the power level written to the Fiber Link Card. When the card is set to Alternate Mode (DIP Switch 5 off), a 0-10 V analog power output signal proportional to the code can be read with a voltmeter at the *Analog Power* output BNC connector on the Fiber Link Card.

- Write (x, y) coordinate pairs to move the beam spot to the beginning of the mark.

Coordinate pair data writes must occur in the following sequence: low byte of x, high byte of x, low byte of y, high byte of y. 000 hex is the minimum X-axis value, 800 hex is the center of the X-axis. FFF hex is the maximum X value. This data is transmitted to the Marking Head via the fiber optic link. Use the mirror position outputs on the Marking Head to debug these writes. Mirror position outputs are analog voltages, proportional to the programmed hex value, ranging from -10 V to +10 V.

- Turn the laser on.

Two bits of the digital output byte are used to control the laser Gate function. To turn the laser on, the digital output byte must be xxxx x1x0. To turn the laser off, set the output byte to xxxx x0x1. The logic state of the Gate signal can be read at Test Point 1 (TP1) on the Fiber Link Card. A "1" (logic high) at TP1 indicates laser firing.

- Move the beam through the mark by writing a stream of (x, y) coordinate pairs.

Laser power incident on the marking surface is proportional to the laser power setting and inversely proportional to the speed of motion of the beam spot. Speed of the beam spot is simply the distance between successive coordinate pairs divided by the time interval between the coordinate pairs. The minimum time interval between successive coordinate pairs should be $\geq 25 \mu\text{s}$, meaning x, y coordinate pairs should be updated no faster than 40 kHz.

- Turn the laser off.

technical reference

Programming the Fiber Link Card

Addressing the Fiber Link Card

The Fiber Link Card resides in the I/O space of the computer at base address 3x0 hex, where x is set by four DIP switches on the card. The factory default address is 330 hex, try this one first. The Fiber Link Card does not generate any interrupts. All I/O is polled. Since the Fiber Link Card uses the 8 bit ISA Bus, communication is a byte at a time. There are 16 byte-wide addresses decoded on the card. Eight are used for general control of the marking system. The remaining addresses are reserved by SYNRAD for future developments, and should not be read from or written to. All data written to the laser power, X, and Y registers should be right aligned 12 bit values. See Table 3-1 for specific register addresses.

Table 3-1 Register Addresses

Address	Register Function
3x0, 3x1	Low and high bytes for laser power control. Write only.
3x4, 3x5	Low and high bytes for X-axis beam position. Write only.
3x6, 3x7	Low and high bytes for Y-axis beam position. Write only.
3xC	Digital input port. Bits 0-5 are supported by the hardware. Read only.
3xD	Digital output port. Bits 0 and 2 are reserved for the Gate function. Bits 1, 3, 4, 5, 6, are supported by the hardware. Only writes are recommended, but reads are supported by the hardware.

technical reference

General Specifications

Table 3-2 DH series Marking Head General Specifications

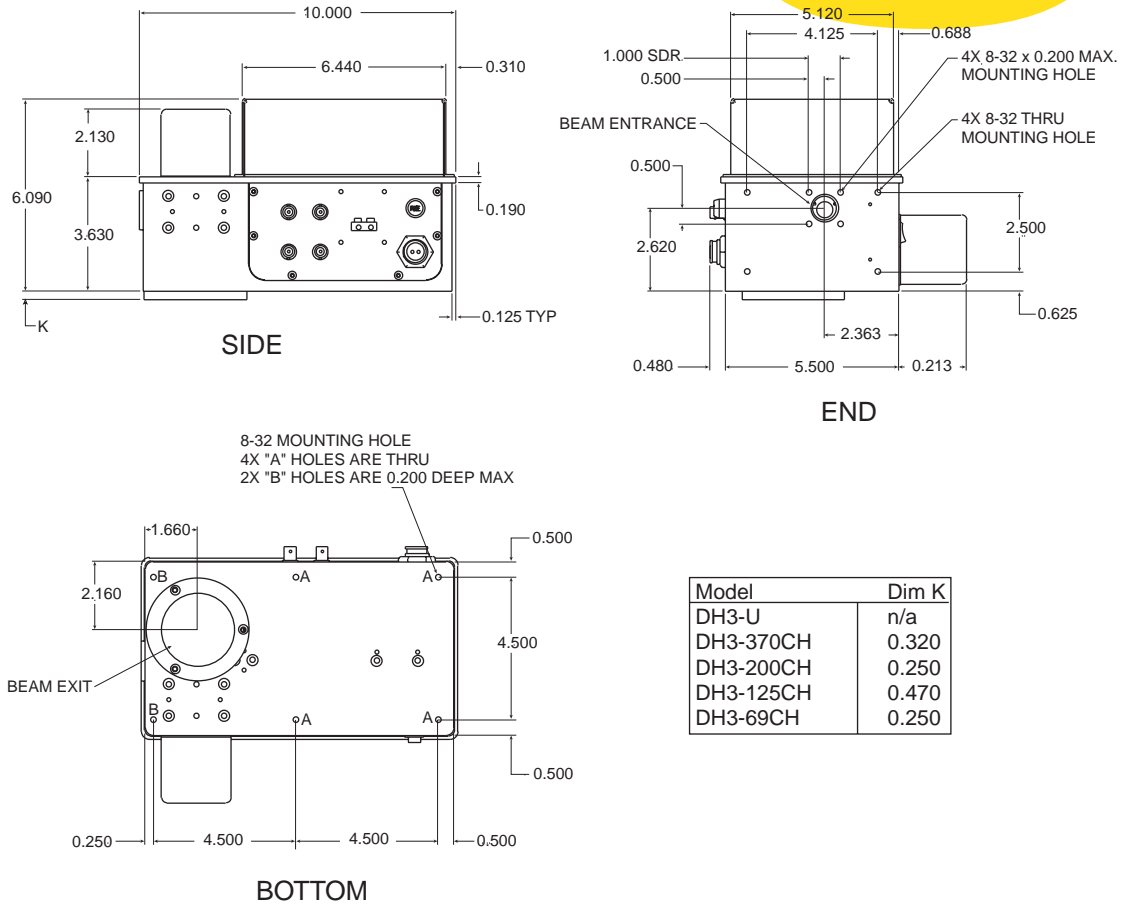
Parameter	Marking Head Model Numbers DH3-			
	370CH	200CH	125CH	69CH
Marking Specifications				
Field Size, typical (mm)	200 x 200	110 x 110	70 x 70	38 x 38
Field Size, typical (in)	7.874 x 7.874	4.331 x 4.331	2.556 x 2.556	1.496 x 1.496
Spot Size, typical at Working Distance (µm)	530 (.021")	290 (.011")	180 (.007")	100 (.004")
Working Distance ¹ , (mm)	455 (17.91")	240 (9.45")	148 (5.83")	70 (2.76")
Depth of Field, typical (mm)	±10 (.394")	±2.5 (.098")	±1.5 (.059")	±0.5 (.020")
Beam Angle to Surface Normal, max (degrees)	15	14	13	10
Marking System Resolution				
Position Accuracy (mm)	.05 (.002")	.03 (.001")	.02 (.0007")	.01 (.0004")
Position Resolution	lens field size/2 ¹²			
Repeatability	lens field size x 5x10 ⁻⁶			
Scanning Aperture (mm)	15 (.591")			
Input Beam Diameter at 1/e ² (mm)	3–4			
Settling Time (ms)				
Full Field	< 5			
Small Step (10% of field)	< 1.4			
Input Specifications				
Input Power	30 VDC @ 3 A max			
Continuous Beam Input Power, max (W)	140			
Drive Signals				
Fiber Optic Control	16 bit digital code			
Analog Control	±10 V analog signal			
Physical Specifications				
Length	10.00 in (25.4 cm)			
Width	8.11 in (20.6 cm)			
Height ²	6.09 in (15.5 cm)			
Weight	10 lbs, 14 oz (4.9 kg)			

1 The exact distance is marked on the Focusing Lens mount since the Working Distance may vary from lens to lens within ±10mm (.39"). For this reason, it is important to provide a Z-axis adjustment between the Marking Head and the marking surface.

2 Height measured without Focusing Lens installed. Refer to Figure 3-1, "DH series Marking Head Package Outline and Mounting Hole Dimensions" for a table which provides dimension "K", the Focusing Lens height.

technical reference

Marking Head Package Outline



ALL DIMENSIONS ARE IN INCHES

Figure 3-1 DH series Marking Head Package Outline and Mounting Hole Dimensions

technical reference

Model 48-1/48-2 Mounting

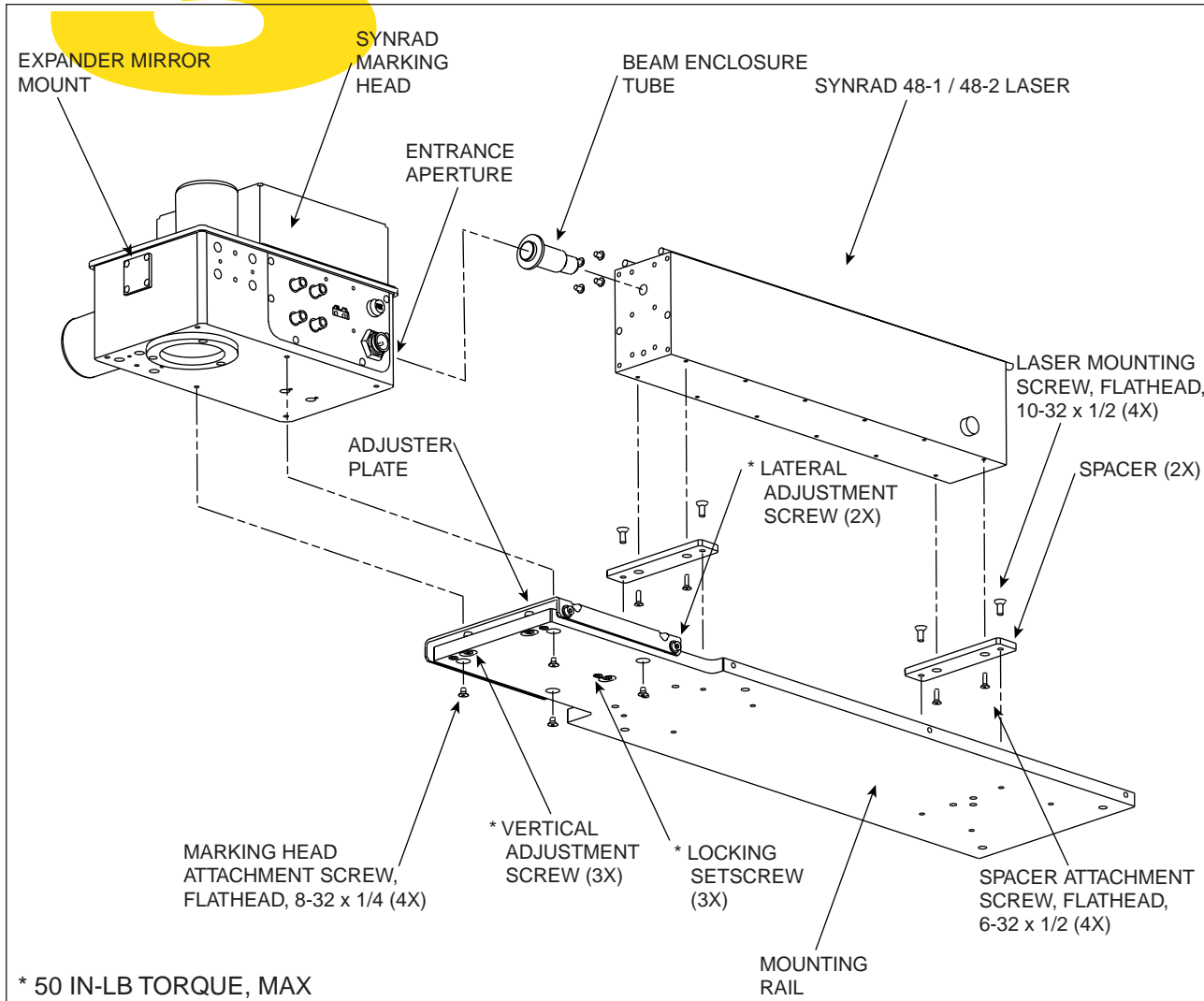


Figure 3-2 Model 48-1 / 48-2 Mounting Diagram

Table 3-3 Model 48-1 / 48-2 Mounting Kit Parts

Mounting Kit Parts	Qty
Mounting Rail	1
Adjuster Plate	1
Beam Enclosure Tube w/ mounting screws	1
Spacers	2
Marking Head Attachment Screws, 8-32 x 1/4 Flathead ..	4
Spacer Attachment Screws, 6-32 x 1/2 Flathead	4
Laser Mounting Screws, 10-32 x 1/2 Flathead	4

Table 3-4 Required Tools

Required Tools

Socket Head Wrenches:

1/16"

5/64"

3/32"

1/8"

5/32"

technical reference

Model 48-5 Mounting

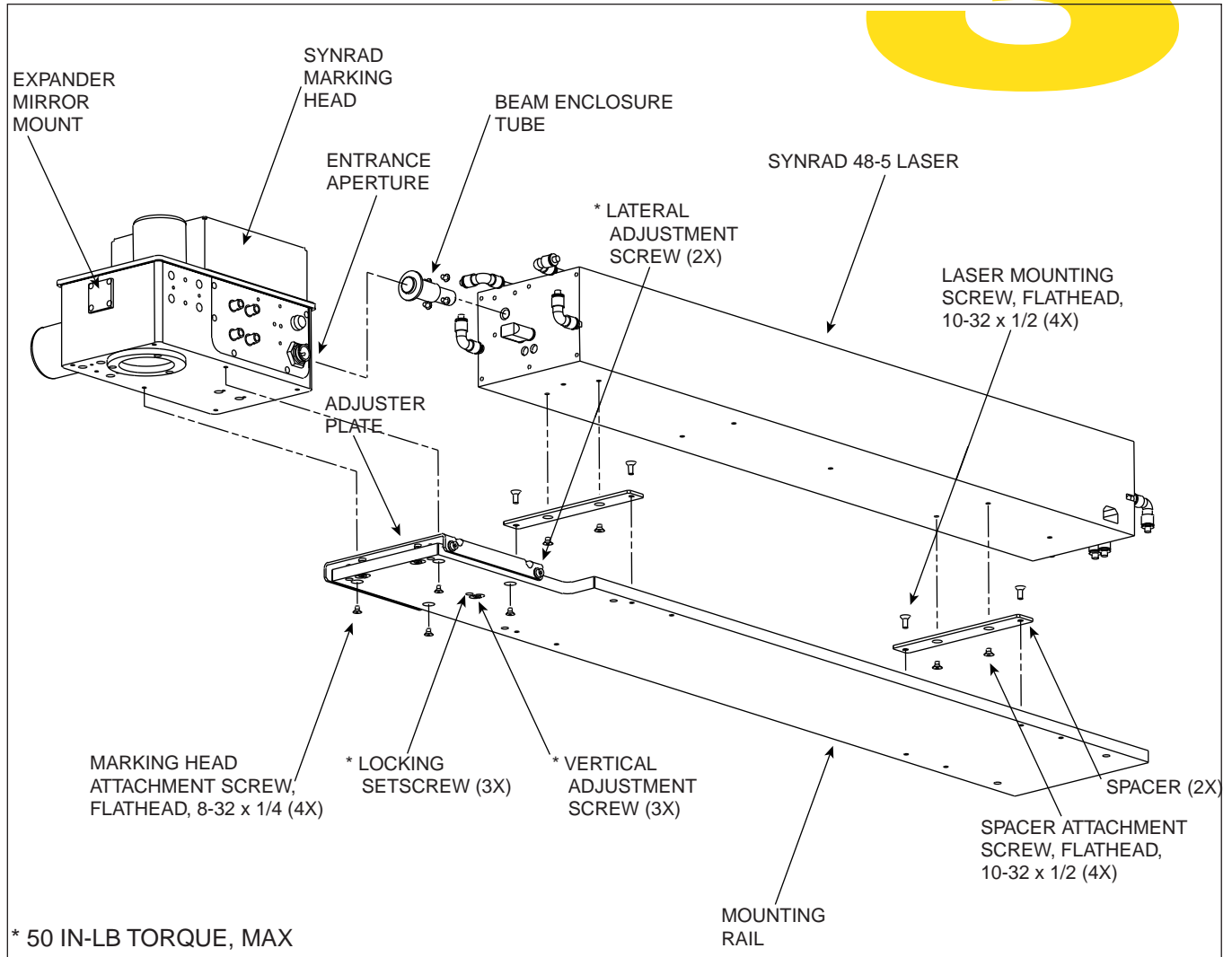


Figure 3-3 Model 48-5 Mounting Diagram

Table 3-5 Model 48-5 Mounting Kit Parts

Mounting Kit Parts	Qty
Mounting Rail	1
Adjuster Plate	1
Beam Enclosure Tube w/ mounting screws	1
Spacers	2
Marking Head Attachment Screws, 8-32 x 1/4 Flathead ..	4
Spacer Attachment Screws, 10-32 x 1/2 Flathead	4
Laser Mounting Screws, 10-32 x 1/2 Flathead	4

Table 3-6 Required Tools

Required Tools
Socket Head Wrenches:
1/16"
5/64"
3/32"
1/8"
5/32"

technical reference

Model 57-1, 60-1, and Evolution 100/125 Mounting

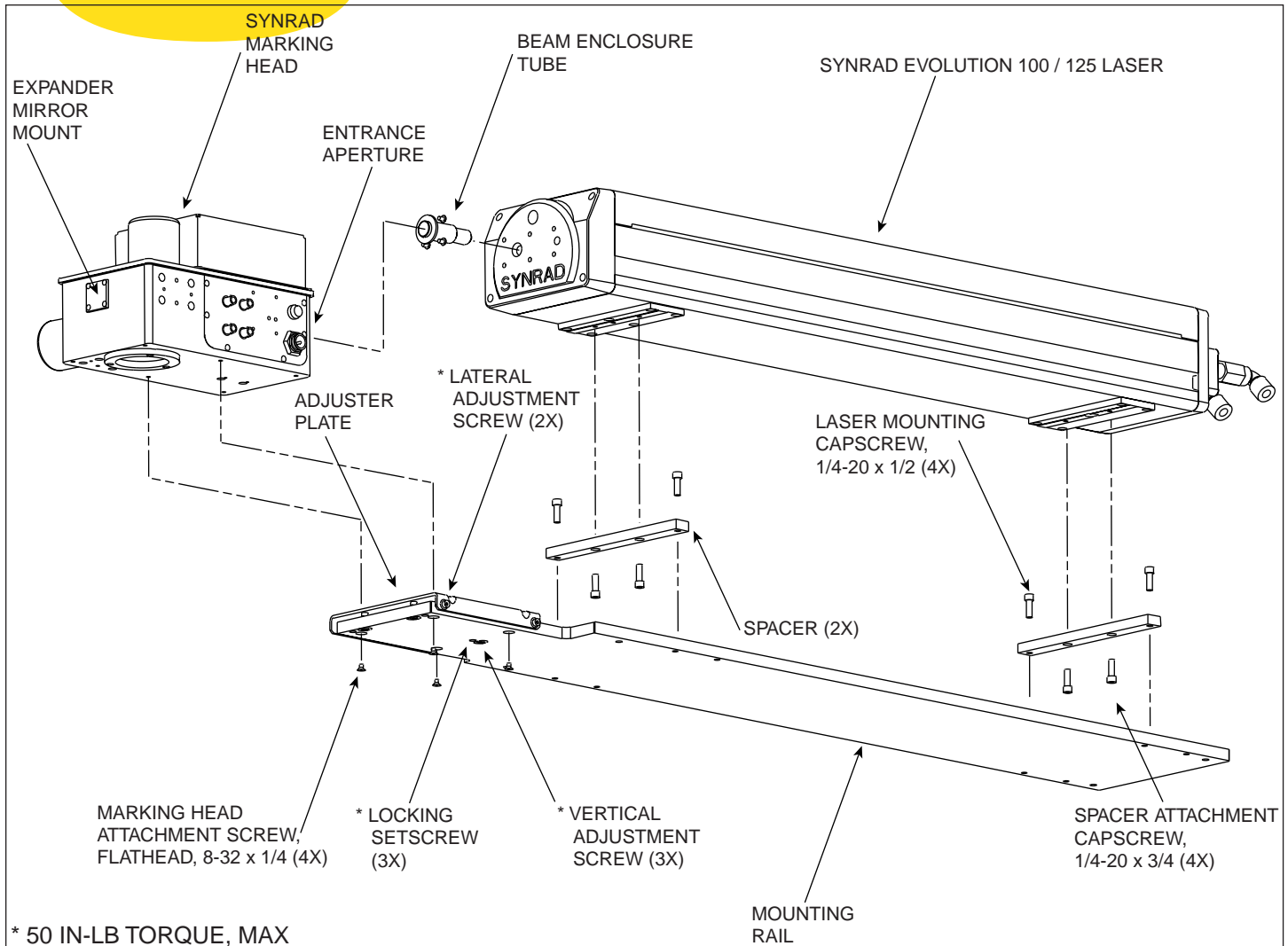


Figure 3-4 Model 57-1, 60-1, and Evolution 100/125 Mounting Diagram

Table 3-7 Model 57-1, 60-1, and Evolution 100/125 Mounting Kit Parts

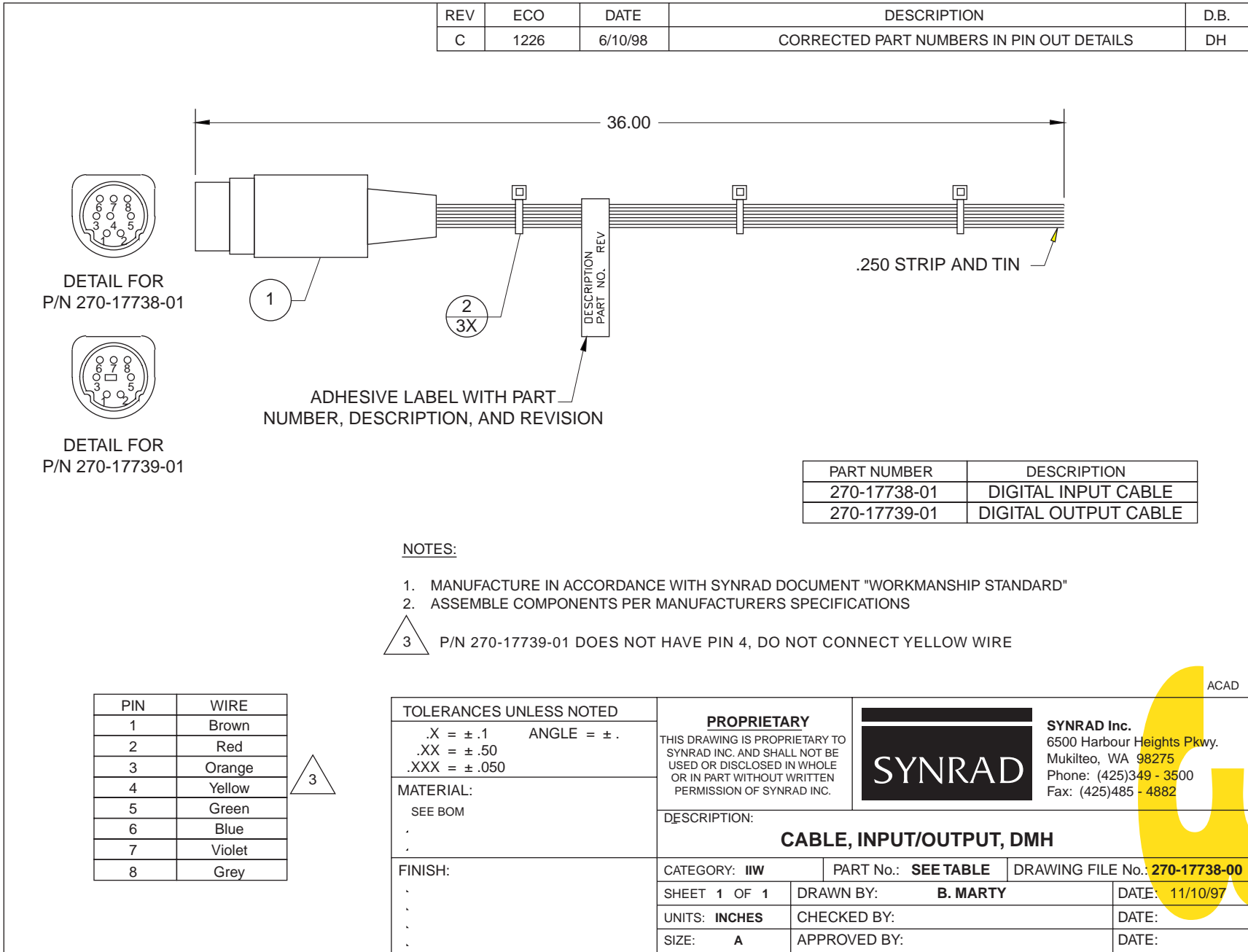
Mounting Kit Parts	Qty
Mounting Rail	1
Adjuster Plate	1
Beam Enclosure Tube w/ mounting screws	1
Spacers	2
Marking Head Attachment Screws, 8-32 x 1/4 Flathead	4
Spacer Attachment Screws, 1/4-20 x 3/4 Socket Hd Capscrew ..	4
Laser Mounting Screws, 1/4-20 x 1/2 Socket Hd Capscrew	4

Table 3-8 Required Tools

Required Tools
Socket Head Wrenches:
1/16"
5/64"
3/32"
5/32"
3/16"

Figure 3-5 DH series Marking Head Input/Output Cable

Synrad DH series Marking Head™ operator's manual



maintenance/ troubleshooting guide

Use information in this section to perform maintenance and troubleshooting on your DH series Marking Head.

This section contains the following information:

- Maintenance – explains procedures for performing maintenance on your Marking Head.
- Troubleshooting – describes common problems and explains how to troubleshoot them.

maintenance/ troubleshooting guide

Maintenance

The Maintenance section includes subsections:

- Daily Inspections
- Cleaning the Focusing Lens

Daily Inspections

Perform the following steps daily to keep your Marking Head in optimum operating condition. Except for the procedures described below, no other service is required or should be attempted.

- 1 Ensure that power to the laser and Marking Head is off. Close the laser's shutter if it is equipped with one.

Warning

possible
personal
injury

Ensure laser power is off before inspecting the lens surface. Invisible CO₂ laser radiation is emitted through the lens which can cause eye damage or blindness.

- 2 Remove the *Focusing Lens* cover.
- 3 Visually inspect the exterior surface of the *Focusing Lens* for contaminants. Perform the lens cleaning instructions detailed below as necessary.
- 4 Visually inspect the Marking Head housing for loose panels or covers and tighten as necessary.
- 5 Visually inspect the exterior of the Marking Head housing to ensure all warning labels are present. Refer to Figure i - "DH series Marking Head Hazard Label Locations" in the Marking Head Safety section for label types and locations.

Cleaning the Focusing Lens

Great care must be used when handling infrared optics since they are much more fragile than glass. For this reason, do not remove optics from their mounts. Carefully follow the cleaning procedures below, using the materials listed in Table 4-1. Materials other than those listed are acceptable providing they meet or exceed the specified levels of quality or purity.

Table 4-1 Required Cleaning Materials

Cleaning Material	Requirements
Rubber Gloves or Finger Cots	Powder Free
Air Bulb	Clean Air Bulb
Ethyl Alcohol	Spectroscopic or Reagent Grade
Acetone	Spectroscopic or Reagent Grade
Lens Tissue	Optical Quality
Cotton Balls or Cotton Swabs	High-Quality Surgical Cotton High-Quality Paper-Bodied

maintenance/ troubleshooting guide

Maintenance



Passive Cleaning

Passive cleaning of the *Focusing Lens* can be performed without removing the lens from the Marking Head. This involves the use of air to remove particulate contamination from the lens surface.

To remove loose contaminants from the *Focusing Lens* surface, perform the following steps:

Caution

possible
lens
damage

Do not allow the nozzle of the air bulb to come in contact with the lens surface. This may damage the lens by scratching the surface.

Do not use compressed (shop) air to blow contamination from the lens. Compressed air contains significant amounts of water and oil that form absorbing films on the optical surface.

- 1 Hold a clean air bulb at an angle to the lens and blow a stream of air at a glancing angle across the surface.
- 2 Repeat as necessary.

Aggressive Cleaning

Aggressive cleaning involves the use of solvents and requires the removal of the *Focusing Lens* from the Marking Head.

Observe the following guidelines when handling/cleaning infrared optics:

- Before beginning, read the entire cleaning process outlined below to ensure that all required materials are available.
- Use finger cots or rubber gloves to prevent contamination of the optics by dirt and skin oils.
- Always place optics on lens tissue for protection. Never place optics on hard or rough surfaces.
- It may be necessary to use a fluffed cotton swab instead of a cotton ball to uniformly clean the entire surface of small diameter mounted optics.
- Observe all necessary safety precautions when using cleaning agents.

To remove dust, oily residues, plastics, and oxide buildups that have adhered to the surface of the *Focusing Lens*, perform the following steps:

- 1 Remove the *Focusing Lens* from the Marking Head. Do not remove the lens from its optical mount.
- 2 Follow the Passive Cleaning procedure above to remove loose contaminants from the optical surface. Repeat as necessary until all loose particles are removed.
- 3 Refer to Table 4-2 and select the appropriate cleaning solvent based on the type of contamination that exists on the surface of the lens.

maintenance/ troubleshooting guide

Maintenance

Table 4-2 Cleaning Solvent Selection

Solvent Type	Classification	Application
Ethyl Alcohol	Least Aggressive	Initial Dust Cleaning
Acetone	Moderately Aggressive	Oily Residues Minor Baked-On Plastics

Note: If acetone is used as the cleaning solvent, a second follow-up cleaning of the optical surface using ethyl alcohol is required. Repeat steps 4 through 7 using the ethyl alcohol.

4 Dampen a cotton ball or fluffed cotton swab with the selected cleaning agent.

Caution

possible
lens
damage

Do not exert pressure on the surface of the optical lens when cleaning. The optical surface is very easily scratched by dislodged contaminants. Read through and follow directions carefully before cleaning; use only the highest quality cleaning materials.

5 Gently wipe the lens surface with the damp cotton beginning in the center of the optic and working outward in a spiral pattern. *Do Not Rub Hard or Apply Pressure, Especially When Using a Cotton Swab!*

Note: Use a clean cotton ball or swab on each pass. The cotton will pickup and carry surface contaminants that will scratch the optical surface.

To prevent streaking during the final ethyl alcohol cleaning, drag the cotton slowly across the surface so that the cleaning liquid evaporates right behind the cotton.

6 It may be impossible to remove all traces of contaminants from the lens surface especially near the edges. Ensure the only remaining residue is around the outer edges and not in the center.

7 Carefully examine the optical surface under a good light in front of a black background. Certain contaminants or damage such as metal splatter or pitting cannot be removed. In these cases the optic will require replacement.

8 Repeat steps 4 through 7 as required, removing all possible contaminants and deposits. See the Note above if you used acetone as the cleaning agent.

9 Reinstall the *Focusing Lens* in the Marking Head and replace the lens cap. If the cleaned optic will not be used immediately, wrap in lens tissue and place in clean, dry storage.

maintenance/ troubleshooting guide

Troubleshooting



The Troubleshooting section includes subsections:

- Fiber Link Card
- Marking Head

Fiber Link Card

Perform the following steps to verify proper operation of the Fiber Link Card:

Warning

possible
personal
injury

Do not stare directly into the red LED light from the transmitter port on the Fiber Link Card or the Marking Head. The light is potentially intense enough to injure the eye with prolonged exposure.

- 1 When looking at the Fiber Link Card, the gray half of the fiber optic port is the transmitter. When the fiber optic cable is removed from the connector, the transmitter port should emit an easily visible red glow. Replace the fiber optic cable. When connected properly, the latch on the cable end should clip into the connector on the card. You should not be able to pull the fiber optic cable out of the connector without depressing the latch.
- 2 When there is no marking operation occurring, the laser is maintained in a ready-to-fire state by “Tickle” pulses generated by the Fiber Link Card. You can verify operation by connecting an oscilloscope to the *Laser Control* output BNC connector on the card. You should see 1 μ s wide pulses generated at a frequency of approximately 5 kHz at an amplitude of +5 V. Reconnect the coaxial control cable between the *Laser Control* connector and the laser.
- 3 If the installed Fiber Link Card does not pass these tests, power off the computer and check for proper seating of the card in the computer’s ISA Bus slot. Remember to follow the static discharge precautions discussed earlier. If the card still fails to function properly, contact SYNRAD at 1-800-SYNRAD1 or by e-mail to synrad@synrad.com.

maintenance/ troubleshooting guide

Troubleshooting 4 Marking Head

Symptom:

- The Marking Head does not communicate with the Fiber Link Card.

Possible Cause:

- The fiber optic cable between the Marking Head and the Fiber Link Card is installed improperly.

Warning

possible
personal
injury

Do not stare directly into the red LED light from the transmitter port on the Fiber Link Card or the Marking Head. The light is potentially intense enough to injure the eye with prolonged exposure.

It is possible to partially install the fiber optic cable upside down. When properly oriented, the cable connector should be flush against the housing with the latch facing up. You should not be able to pull the fiber optic cable out of the connector without depressing the latch.

When looking at either the Marking Head or Fiber Link Card, the gray half of the fiber optic port is the transmitter. When the fiber optic cable is removed from the connector, the transmitter port should emit an easily visible red glow. Once the fiber optic cable is properly connected to the Marking Head, the cable half connected to the *Digital Control TX* port should emit a visible red glow. This cable should connect to the black half (RX - Receiver port) of the Fiber Link Card's fiber optic port. Again, the cable connector should be flush against the housing with the latch facing up and you should not be able to pull the fiber optic cable out of the connector without depressing the latch.

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