

# fenix laser marker



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**operator's  
manual**

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An Excel Technology Company

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**Fenix™**  
**Operator's Manual**

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## Warranty information

This is to certify that the Fenix Laser Marker is guaranteed by SYNRAD, Inc. to be free of all defects in materials and workmanship for a period of one year from the date of purchase. This warranty does not apply to any defect caused by negligence, misuse (including environmental factors), accident, alteration, or improper maintenance.

If, within one year from the date of purchase, any part of the Fenix Laser Marker should fail to operate, contact the SYNRAD Customer Service department at 1.800.SYNRAD1 (outside the U.S. call 1.425.349.3500) and report the problem. When calling for support, please be prepared to provide the date of purchase, model number and serial number of the unit, and a brief description of the problem. When returning a unit for service, a Return Authorization (RA) number is required; this number must be clearly marked on the outside of the shipping container in order for the unit to be properly processed. If replacement parts are sent to you, then you are required to send the failed parts back to SYNRAD for evaluation unless otherwise instructed.

If your Fenix Laser Marker fails within the first 45 days after purchase, SYNRAD, Inc. will pay all shipping charges to and from SYNRAD when shipped as specified by SYNRAD Customer Service. After the first 45 days, SYNRAD will continue to pay for the costs of shipping the repaired unit or replacement parts back to the customer from SYNRAD. The customer, however, will be responsible for shipping charges incurred when sending the failed unit or parts back to SYNRAD or a SYNRAD Authorized Distributor. In order to maintain your product warranty and to ensure the safe and efficient operation of your Fenix Laser Marker, only authorized SYNRAD replacement parts can be used. This warranty is void if any parts other than those provided by SYNRAD, Inc. are used.

SYNRAD, Inc. and SYNRAD Authorized Distributors have the sole authority to make warranty statements regarding SYNRAD products. SYNRAD, Inc. and its Authorized Distributors neither assumes nor authorizes any representative or other person to assume for us any other warranties in connection with the sale, service, or shipment of our products. SYNRAD, Inc. reserves the right to make changes and improvements in the design of our products at any time without incurring any obligation to make equivalent changes in products previously manufactured or shipped. Buyer agrees to hold SYNRAD harmless from any and all damages, costs, and expenses relating to any claim arising from the design, manufacture, or use of the product, or arising from a claim that such product furnished Buyer by SYNRAD, or the use thereof, infringes upon any Patent, foreign or domestic.

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## Sales and Applications

SYNRAD's Regional Sales Managers work with customers to identify and develop the best CO<sub>2</sub> laser solution for a given application. Because they are familiar with you and your laser application, use them as a first point of contact when questions arise. Regional Sales Managers also serve as the liaison between you and our Applications Lab in processing material samples per your specifications. To speak to the Regional Sales Manager in your area, call SYNRAD at 1.800.SYNRAD1.

## Customer Service

For assistance with order or delivery status, service status, or to obtain a Return Authorization (RA) number, contact SYNRAD at 1.800.SYNRAD1 and ask to speak to a Customer Service representative.

## Technical Support

SYNRAD's Regional Sales Managers are able to answer many technical questions regarding the installation, use, troubleshooting, and maintenance of our products. In some cases, they may transfer your call to a Laser, Marking Head, or Software Support Specialist. You may also email questions to the Technical Support Group by sending your message to [support@synrad.com](mailto:support@synrad.com) or to [support@winmark.com](mailto:support@winmark.com).

## Reference materials

Your Regional Sales Manager can provide reference materials including Outline & Mounting drawings, Operator's Manuals, Technical Bulletins, and Application Newsletters. Most of these materials are also available directly from SYNRAD's web site at <http://www.synrad.com>.

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# laser safety


## Hazard information

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

## Terms

Certain terms are used throughout this manual or on the equipment labels. Please familiarize yourself with their definitions and significance.

 **Danger:** Hazards that could 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 equipment 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.

### **Danger**

possible  
personal  
injury

This product emits invisible infrared laser radiation at the 10.6  $\mu\text{m}$   $\text{CO}_2$  wavelength. Because direct or diffuse laser radiation can inflict severe corneal injuries, always wear eye protection when in the same area as an exposed laser beam. Eyewear protects against scattered energy and is not intended to protect against direct viewing of the beam or reflections from metallic surfaces. Protective eyewear that blocks 10.6  $\mu\text{m}$   $\text{CO}_2$  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.

U.S. customers should refer to and follow the laser safety precautions in ANSI Z136.1-1993, *American National Standard for Safe Use of Lasers*. Procedures listed under the Standard include the 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.

European customers should refer to and follow the laser safety precautions in EN60825-1, *Radiation Safety of Laser Products, Equipment Classification, Requirements, and User's Guide*.

# laser safety

## Hazard information

### **Warning**

possible  
personal  
injury

Materials processing can generate air contaminants such as vapors, fumes, and/or particles that may be noxious, toxic, or even fatal. Material Safety Data Sheets (MSDS) 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, *American National Standard for Safe Use of Lasers*, section 7.3.

U.S. Government's *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 the venting of processing 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.

## Other hazards

The following hazards would be typical for this product when incorporated for intended use: (A) risk of injury when lifting or moving the unit; (B) risk of exposure to hazardous laser energy through unauthorized removal of access panels, doors, or protective barriers; (C) 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; (D) generation of hazardous air contaminants that may be noxious, toxic, or even fatal.

## Additional laser safety information

The SYNRAD web site (<http://www.synrad.com/LaserFacts/lasersafety.html>) contains an online laser safety handbook that provides information on (1) Laser Safety Standards for OEM's/System Integrators; (2) Laser Safety Standards for End Users including Class I Installations, Class IV Installations, Laser Hazards, ANSI Standard, U.S. State Requirements, and OSHA; (3) References and Sources including CDRH, ANSI/OSHA; and (4) Assistance with Requirements.

In addition, the Occupational Safety and Health Administration (OSHA) has an online Technical Manual located at [http://www.osha-slc.gov/dts/osta/otm/otm\\_iii/otm\\_iii\\_6.html](http://www.osha-slc.gov/dts/osta/otm/otm_iii/otm_iii_6.html). Section III, Chapter 6 and Appendix III are good resources for laser safety information. Another excellent laser safety resource is the Laser Institute of America (LIA). Their comprehensive web site is located at <http://www.laserinstitute.org>.

# laser safety

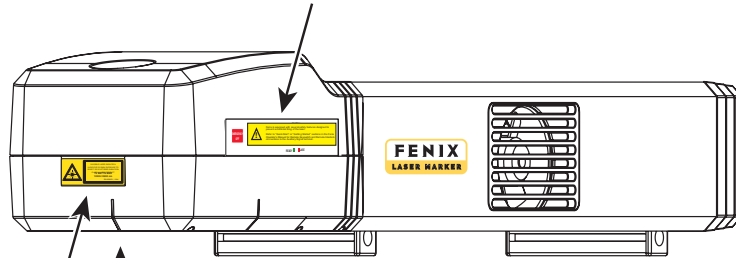
## Label locations



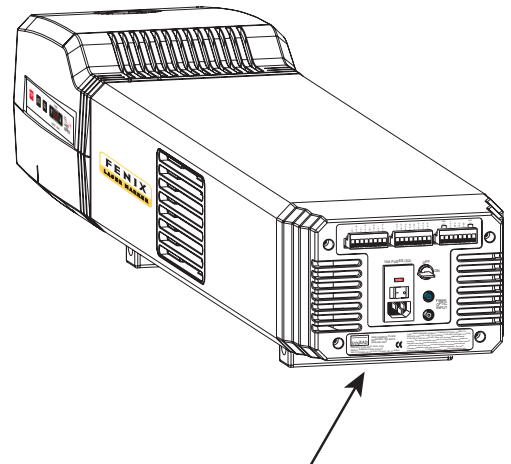
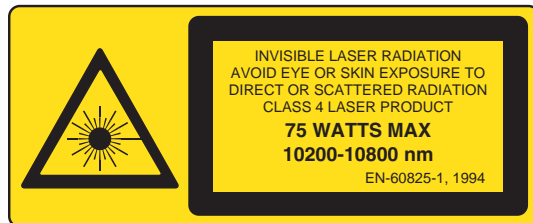
Fenix is equipped with several safety features designed to prevent accidental firing of the laser.

Refer to "Quick Start" or "Getting Started" sections in the Fenix Operator's Manual for Remote Keyswitch and Remote Interlock connections to the Auxiliary Signal terminal.

(Placed over membrane panel prior to initial shipment)



**AVOID EXPOSURE**  
Invisible laser radiation  
is emitted from  
this aperture.



	4600 CAMPUS PLACE		THIS LASER MARKING PRODUCT IS MANUFACTURED UNDER U.S. PATENTS: 4,805,182; 4,837,772; 5,008,984; 5,215,864; 5,602,865; 6,195,379; 6,198,758; 6,198,759; 5,065,405. Other U.S. and International Patents pending. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. This laser product complies with 21 CFR Subchapter J as of the manufacture date.
	MUKILTEO, WA 98275		
	(425)349-3500		
	MANUFACTURE DATE: XXXX XXXX		
SERIAL NUMBER: FENIX XXXXXX			
INPUT POWER: AC 85-132V/170-264V 1Ø, 47-440Hz			

**Figure 1** Fenix hazard label and CE label locations

# laser safety

## Agency compliance

The *Agency compliance* section includes subsections:

- Center for Devices and Radiological Health (CDRH) requirements
- Federal Communications Commission (FCC) requirements
- European Union (EU) requirements

The Fenix Laser Marker with its associated Fiber Link Controller Card has been tested and certified to comply with certain United States and European Union (EU) directives. These directives impose product performance requirements related to electromagnetic compatibility (EMC) and product safety characteristics for laser products. The associated directives and specific provisions to which Fenix must comply are identified and described in the following paragraphs.

## Center for Devices and Radiological Health (CDRH) requirements

Fenix™ is designed to comply with requirements for Class IV laser products imposed by the Radiation Control for Health and Safety Act of 1968. Under this act, the U.S. Food and Drug Administration (FDA) issued a performance standard in the *Code of Federal Regulations* (CFR) for laser products. This performance standard (21 CFR, Part 1040.10) was developed to protect public health and safety by imposing requirements upon manufacturers of laser products to provide an indication of the presence of laser radiation, to provide the user with certain means to control radiation, and to assure that all personnel are adequately warned of potential hazards through the use of product labels and instructions.

Federal regulations require that all laser products manufactured on or after August 2, 1976, be certified as complying with the performance standard. The manufacturer must demonstrate the product's compliance with the standard prior to certification or introduction into commerce by furnishing to the Center for Devices and Radiological Health (CDRH) reports pertaining to the radiation safety of the product and the associated quality control program. Failure to provide the required reports or product certification is a violation of Section 360B of the Radiation Control and Health and Safety Act of 1968.

Product features incorporated into the design of Fenix to comply with CDRH requirements are integrated as panel controls or indicators, internal circuit elements, or input/output signal interfaces. Specifically, these features include a keyswitch, Lase and Ready indicators, emergency off button, remote interlock, and a five-second delay between power on (*Ready* indicator) and lasing. Table 1 summarizes Fenix product features, indicating the type and description of features and whether those features are required by CDRH regulations.

Common safe operating practices should be exercised at all times when actively lasing. To prevent exposure to direct or scattered laser radiation, follow all safety precautions specified in this manual. The use of controls or adjustments or performance of procedures other than those specified herein may result in exposure to hazardous invisible laser radiation, damage to, or malfunction of the laser. Severe burns will result from exposure to the laser beam. Always wear safety glasses with side shields to reduce the risk of damage to the eyes when operating the laser.

Safe operation of the laser requires the use of an external beam block to safely block the beam from travelling beyond the desired work area. Use a firebrick or similar non-scattering, noncombustible material as the beam block. Never use organic material or metals as the beam blocker; organic materials, in general, are apt to combust or melt and metals act as specular reflectors that may create a hazard outside the immediate area.

# laser safety

## Agency compliance

### Federal Communications Commission (FCC) requirements

The United States Communication Act of 1934 vested the Federal Communications Commission (FCC) with the authority to regulate equipment that emits electromagnetic radiation in the radio frequency spectrum. The purpose of the Communication Act was to prevent harmful electromagnetic interference (EMI) from affecting authorized radio communication services in the frequency range above 9 kHz.

The FCC regulations that govern laser equipment are fully described in 47 CFR. Fenix has been tested and found to comply by demonstrating performance characteristics that have met or exceeded the requirements of 47 CFR, Part 15.

With respect to instances of electromagnetic interference by other devices, SYNRAD defines marking variations to be an “acceptable loss of performance” as long as the following criteria are met: (1) there is no damage to the marking equipment, or machinery into which it is integrated, (2) the marking variation does not cause a hazardous or unsafe condition, (3) the marking variation is apparent to the operator, and (4) normal operation is recovered after removal of the interfering signal.

### FCC information to the 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.

### FCC caution to the user

The Federal Communications Commission warns the user that changes or modifications of the unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### European Union (EU) requirements

The European Norm (EN) document EN60825-1 was developed to protect persons from laser radiation by imposing requirements upon manufacturers of laser products to provide an indication of laser radiation; to classify laser products according to the degree of hazard; to require both user and manufacturer to establish procedures so that proper precautions are adopted; to ensure adequate warning of the hazards associated with accessible radiation through signs, labels, and instructions; to improve control of laser radiation through protective features; and to provide safe usage of laser products by specifying user control measures.

Fenix is designed to comply with the requirements imposed by EN60825-1. Table 1 summarizes Fenix product features, indicating the type and description of features and whether those features are required by European Union regulations.

# laser safety

## Agency compliance

The Electromagnetic Compatibility (EMC) Directive 89/336/EEC is the sole Directive developed to address electromagnetic interference (EMI) issues in electronic equipment. In particular, the Directive calls out documents that define the emission and immunity standards for specific product categories. For Fenix, the standard EN55011 defines the radiated RF emissions limit. The generic standard EN50082-1 defines immunity requirements published by the International Electromechanical Commission (IEC).

Fenix has demonstrated performance characteristics that have met or exceeded the requirements of the EMC directive 89/336/EEC.

Fenix is designed to comply with the Low Voltage Directive 73/23/EEC that covers electrical equipment designed to operate at voltages between 50 and 1000 VAC. Because Fenix is intended for incorporation as a component of a laser marking system and is 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 and the Low Voltage Directive.

Fenix should be installed and operated in manufacturing or laboratory facilities by trained personnel only. Due to the considerable risks and hazards associated with the installation and operational use of this apparatus with the incorporated laser, the manufacturer has provided appropriate product warning labels and instructions to the user regarding laser safety. SYNRAD, Inc. assumes no responsibility for the compliance of the system into which Fenix is integrated, other than to supply and/or recommend components and apparatus that are CE marked for compliance with applicable European Directives.

# laser safety

## Agency compliance

**Table 1** Fenix safety features

Feature	Description	Required by:	
		CDRH	EN60825-1
Keyswitch	Rear panel control On/Off keyswitch controls power to laser electronics. Key cannot be removed from switch in the “On” position.	Yes	Yes
Emergency Off button	Side panel control Functions as a beam attenuator to disable RF driver/laser output when pressed. Operator must cycle the AC power switch and then the Keyswitch to restore operation.	Yes	Yes
Ready indicator	Side panel indicator (Green) Indicates that Fenix has power applied and is capable of lasing. Ready LED illuminates when the keyswitch is turned “On” and the remote keyswitch is closed.	Yes	Yes
Lase indicator	Side panel indicator (Red) Indicates that Fenix is actively lasing. Lase LED illuminates when laser beam is active. The brightness of the indicator is related to the laser’s duty cycle. Higher duty cycles (higher power output) produce brighter illumination.	Yes	Yes
Five Second Delay	Fenix circuit element Disables RF driver/laser output for five seconds after keyswitch is turned “On” and the remote keyswitch is closed.	Yes	No
Power Fail Lockout	Fenix circuit element Disables RF driver/laser output if input power is removed then later reapplied (AC power failure or remote interlock actuation) while the keyswitch and remote keyswitch are still closed. Operator must reset the keyswitch, or remote keyswitch, to restore operation.	Yes	No
Remote Interlock	Rear panel connection Disables RF driver/laser output when a remote interlock on an equipment door or panel is opened. Operator must reset the keyswitch, or remote keyswitch, to restore operation.	Yes	Yes
Over/Under Voltage Protection	Circuit element Fault shutdown will occur if the internal supply voltage falls below +15 VDC or rises above +36 VDC. Operator must reset the keyswitch, or remote keyswitch, to restore operation.	No	No
Over Temperature Protection	Circuit element Overtemperature shutdown occurs if temperature of the laser tube reaches 60°C ±2°C. Operator must reset the keyswitch, or remote keyswitch, to restore operation.	No	No
PWM Failure Protection	Circuit element Disables laser if output power exceeds commanded input by 20% or more because of an electronics failure. Operator must reset the keyswitch, or remote keyswitch, to restore operation.	No	No
Warning labels	Fenix exterior Labels attached to various external housing locations to warn personnel of potential hazards.	Yes	Yes

# laser safety

## Agency compliance

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

Table 2 contains a summary of EU performance requirements pertaining to Fenix.

**Table 2** European Union Directives

### Applicable Standards/Norms

---

89/336/EEC,	Electromagnetic Compatibility
EN55011:1991,	Emissions, Group I, Class A
EN50081-2,	Conducted Emissions
EN50082-2:1995,	Immunity
EN60204	Machinery Safety
EN60950,	Equipment Safety
EN61000-4-3,	Radiated Immunity
EN61000-4-6,	Conducted Immunity
EN61000-4-4,	Electrical Fast Transients, Burst Immunity
EN61000-4-2,	Electrostatic Discharge Immunity
73/23/EEC,	Low Voltage Directive
EN60825-1,	Safety of Laser Products

---

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 2.



MADE IN U.S.A.

**Figure 2** European compliance mark

# laser safety

## Declaration of Conformity

### Declaration of Conformity

**Applicable EU Directive(s):** 89/336/EEC Electromagnetic Compatibility

**Applicable Standards/Norms:** EN55011:1991 Radiated Emissions, Group I, Class A

EN50082-2: 1995 Immunity

ENV50140 RF Electromagnetic Fields

ENV50204 RF Electromagnetic Fields, Pulse Modulation

ENV50141 RF Common Mode

EN60204 Machinery Safety

EN60950 Equipment Safety

EN61000-4-2 Electrostatic Discharge

EN61000-4-4 Fast Transients

**Manufacturer:** SYNRAD, Inc.  
4600 Campus Place  
Mukilteo, WA 98275

**Model Number**

Fenix

**Serial Number  
(Compliant Unit)**

Beta 001

**Date of Compliance**

8 January 1999

We, SYNRAD, Inc., hereby declare under our sole responsibility that the equipment specified above conforms to the above Directive(s) and Standard(s).

**Corporate Officer:**



Dave Clarke, President of SYNRAD

8 February 1999

Date

**European Contact:**

Excel Technology Europe GmbH  
Münchner Str. 2a  
D-82152 Planegg  
Germany

# laser safety

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# quick start

This Quick Start section is provided as a service for those users who are experienced with Class IV laser marking systems. Fenix is very simple to setup and operate; however, if you are unfamiliar with either Class IV laser safety or laser marking concepts, we strongly recommend that you thoroughly read the instructions provided in this manual, beginning with the “Laser Safety” section.

This section covers only the initial connections required for stand-alone operation. See the “Getting Started” section for instructions on installing the Fiber Link Controller Card, which allows control of Fenix from a personal computer. The “Technical Reference” section contains information about interfacing Fenix with automated parts handling equipment.

 **Danger**

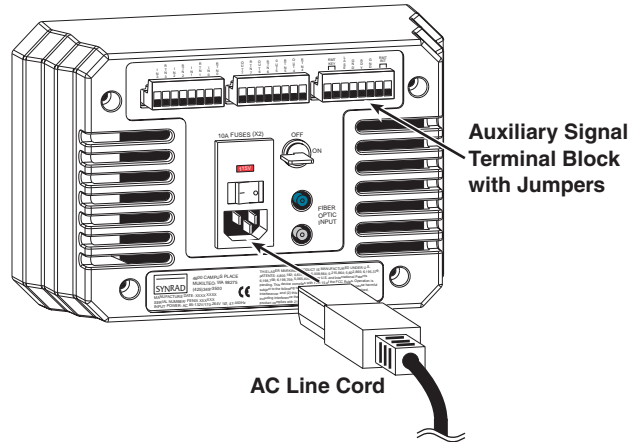
possible  
personal  
injury

This product emits invisible infrared laser radiation at the 10.6  $\mu\text{m}$   $\text{CO}_2$  wavelength. Since direct or diffuse laser radiation can inflict severe corneal injuries, always wear eye protection when in the same area as an exposed laser beam. Do not allow the laser beam to contact a person. This product emits an invisible laser beam that is capable of seriously burning human tissue.

Always be aware of the beam's path and always use a beam block while testing.

# quick start

**Important Note:** Failure to follow instructions and Danger, Warning, or Caution information described in the *Fenix Operator's Manual* may cause severe injury to personnel, damage to equipment, and may void the product warranty.



**Figure QS1** Fenix quick start connections

- 1 Fasten Fenix™ to a rigid mounting structure using the aluminum T-slot mounting rails. Refer to *Mounting* in the “Getting Started” section for further information.
- 2 Locate a terminal block in the shipping box and snap it into the *Auxiliary Signal* connector on the right side of the Fenix rear panel. Refer to Figure QS1.

## Caution

possible  
equipment  
damage

Do not ground Remote Keyswitch (RMT KEY) or Remote Interlock (REM INT) terminals. Damage to internal Fenix circuitry will result. Any external circuit connected to these terminals must be floating with respect to ground.

Because the current-carrying capability of these terminals is negligible (50 mA max. @ 30 VDC), “dry circuit”, zero voltage, switch or relay contact circuitry is recommended when connecting to REM KEY or REM INT terminals

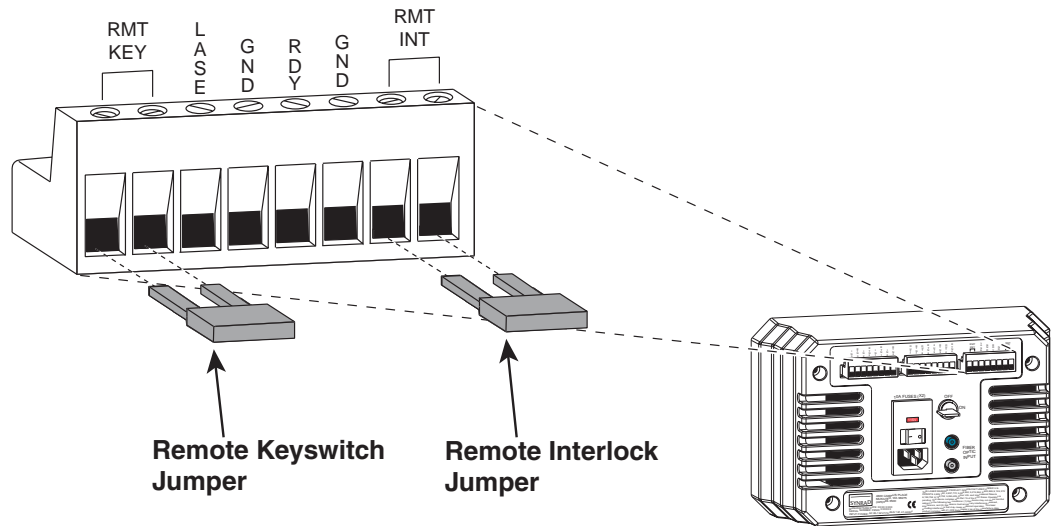
- 3 If your parts handling equipment requires a remote keyswitch connection, connect keyswitch wiring between the terminals marked RMT KEY (pins 1 and 2). See *Auxiliary Signal connections* in the “Technical Reference” section for details.

**Note:** If remote keyswitch wiring is not connected, a shorting jumper (supplied) must be installed between RMT KEY terminals (pins 1 and 2). See Figure QS2.

- 4 If your parts handling equipment requires a remote interlock connection, connect interlock wiring between the terminals marked RMT INT (pins 7 and 8). See *Auxiliary Signal connections* in the “Technical Reference” section for details.

**Note:** If external interlock wiring is not connected, a shorting jumper (supplied) must be installed between the RMT INT terminals (pins 7 and 8). See QS2.

# quick start



**Figure QS2** Auxiliary Signal jumpers

- 5 Connect the AC Line Cord to the AC power receptacle on the Fenix rear panel (Figure QS1). An AC line cord, with the appropriate AC plug for your country, is shipped with Fenix. If the plug does not fit your AC receptacle (within the range of 85–132 V, 170–264 V), locate a cable with the proper AC plug on one end and a standard IEC 320 female connector on the Fenix end.

After installing remote keyswitch and remote interlock connections (or jumpers), perform the following steps to initially test Fenix:

- 1 Remove the “Fenix is equipped with several safety feature...” labels from both Fenix membrane panels.
- 2 Remove the dust cap from the focusing lens.

## Caution

possible  
lens  
damage

Lens damage may result if the measuring device contacts the surface of the focusing lens.

- 3 Place the material to be marked (a sheet of anodized aluminum is ideal) on your marking surface in the field of the focusing lens.
- 4 Use a ruler marked in millimeters to set the working distance (Z-axis adjustment) from the bottom of the focusing lens mount to the surface of the part to be marked. See Figure 1-3, *Gauging Z-axis working distance*, in the “Getting Started” section. The nominal working distance is engraved on the bottom of the focusing lens mount. Because working distance is unique to each lens, consult the final test report shipped with your Fenix to determine the actual working distance of your lens.
- 5 Plug the AC Line Cord from Fenix into your wall outlet, then turn the AC Power Switch to “On” (1). You should hear the cooling fans start and the *Power %* display should show “00”.

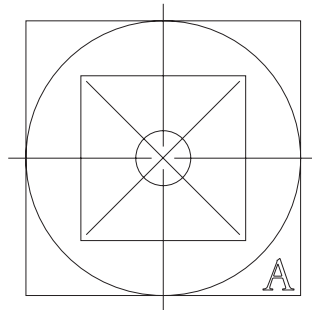
# quick start

- 6 Ensure that all personnel in the area are wearing appropriate protective eyewear.
- 7 Turn the *Keyswitch* “On” (clockwise). The *Ready* indicator illuminates green and the *Power %* display counts down a five-second delay. After five seconds, the *Lase* indicator turns red indicating that Fenix is ready to lase.

**Note:** During standby operation (*Ready* indicator on, but no Command signal applied), “tickle” pulses sent to the laser pre-ionize the gas to just below the lase threshold causing the *Lase* indicator to illuminate at its minimum brightness, a brightness level that may not be visible under all lighting conditions.

- 8 Press the *Test Mark* pushbutton. Fenix will mark a test pattern at a default speed of 40 inches per second using 50% power (approximately 12.5 W). See Figure QS3.

If Fenix fails to mark properly, refer to *Troubleshooting* in the “Maintenance/Troubleshooting” section.



**Figure QS3** Test mark pattern

To control Fenix with your computer, see *Connecting* in the “Getting Started” section for instructions on installing the Fiber Link Controller Card and fiber optic cables. Then see *Initial start-up* in the “Operation” section to test computer-controlled operation.

If you are integrating Fenix into an automated parts handling process, see *Marking automation* in the “Technical Reference” section.

# getting started

Use information in this section to prepare Fenix for operation. The order of information presented in this section is the same as the order of tasks that you need to perform. The best way to get Fenix ready for operation is to start at *Inventory* and work your way through *WinMark Pro software*.

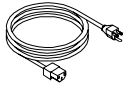
This section contains the following information:

- Inventory – describes all components shipped with your Fenix Laser Marker.
- Introduction – describes the features designed into Fenix.
- Mounting – explains Fenix mounting requirements .
- Connecting – explains how to connect cables and install the Fiber Link Controller Card (FLCC).
- WinMark Pro version 4 software – describes WinMark Pro software, which is used to create and mark laser graphics.

# getting started

## Inventory

AC Line Cord



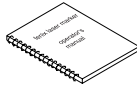
Terminals



T-Nuts



Fenix Operator's Manual



Fiber Link Controller Card



Fiber Optic Cable

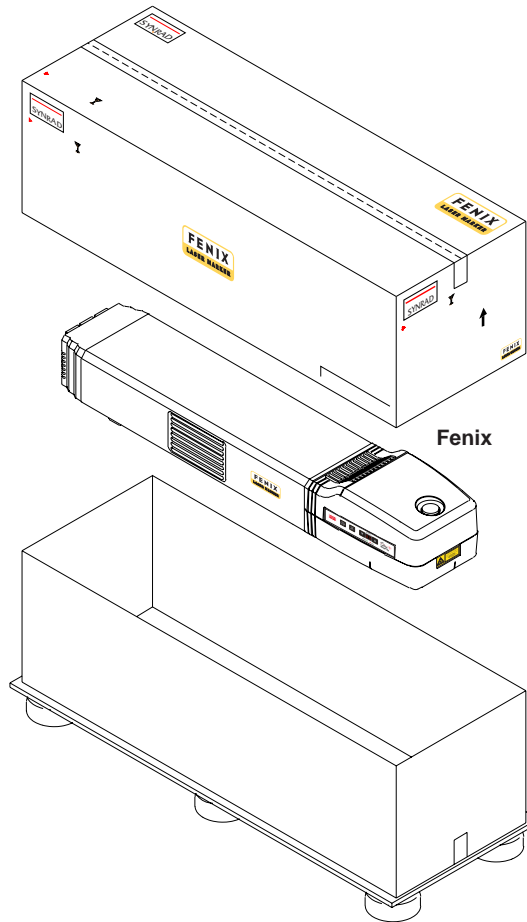


Figure 1-1 Shipping box contents

Table 1-1 Shipping box contents

Shipping Box Contents	Qty	Shipping Box Contents	Qty
Fenix Laser Marker .....	1	Fenix Operator's Manual .....	1
AC Line Cord .....	1	Magnetic Bubble Level (not shown) .....	1
I/O and Auxiliary Signal Terminals .....	3	Fiber Link Controller Card .....	1
Drop-in T-Nuts .....	4	Fiber Optic Cable .....	1
Spare 10 Ampere Fuses (not shown) .....	2		

# getting started

## Inventory

### Contents description

A description of each item listed in Table 1-1 follows:

SYNRAD Fenix Laser Marker – marks a variety of products and materials.

AC Line Cord – supplies AC line power to Fenix.

Input, Output, and *Auxiliary Signal* Terminal Blocks – allow you to connect I/O and *Auxiliary Signal* field wiring directly to Fenix. Two jumpers (for bypassing remote keyswitch and remote interlock functions) are also included.

Drop-in T-Nuts – fastens Fenix T-slot mounting rails to your mounting surface.

Spare 10 Ampere Fuses (not shown) – spare fuses for the AC power module.

*Fenix Laser Marker Operator's Manual* – provides Fenix setup, operation, and maintenance information.

Magnetic Bubble Level (not shown) – aids you in leveling Fenix to the marking surface. Mounts in the recessed holder on Fenix's top cover when not in use.

Fiber Link Controller Card (FLCC) – communicates with and allows remote computer control of the Fenix Laser Marker. The FLCC requires one open PCI-bus slot in your IBM-compatible computer.

Fiber Optic Cable – optically isolates your computer from Fenix while providing noise-free two-way communication.

# getting started

## Introduction

Fenix™ is SYNRAD's first fully integrated laser marking solution. Fenix has evolved from hundreds of SH and DH series Marking Heads currently being used in customer applications throughout the world. Fenix design features include: operation on line voltages from 85 to 264 VAC, completely air-cooled operation, an optically-isolated I/O interface, and digital control through a fiber optic interface.

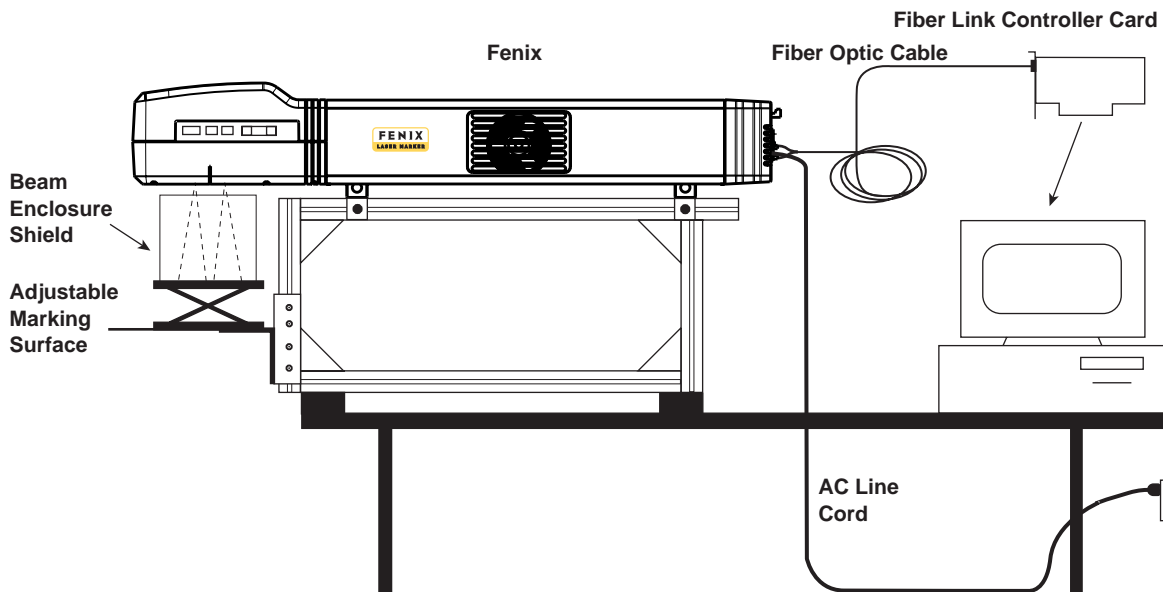
## Fenix marking setup

A typical Fenix Laser Marker setup is shown in Figure 1-2 and consists of the following components:

- SYNRAD's Fenix Laser Marker with Fiber Link Controller Card
- SYNRAD's WinMark Pro laser marking software

You will need to supply the following items:

- IBM-compatible computer with an open PCI bus slot  
(see *WinMark Pro software* later in this section for system requirements)
- Mounting platform for Fenix
- Adjustable marking surface (Z-axis)
- Beam enclosure shield



**Note:** To accurately focus the laser beam on the marking surface, a Z-axis adjustment should be provided on either the marking surface or on the mounting structure.

**Figure 1-2** Typical Fenix setup

# getting started

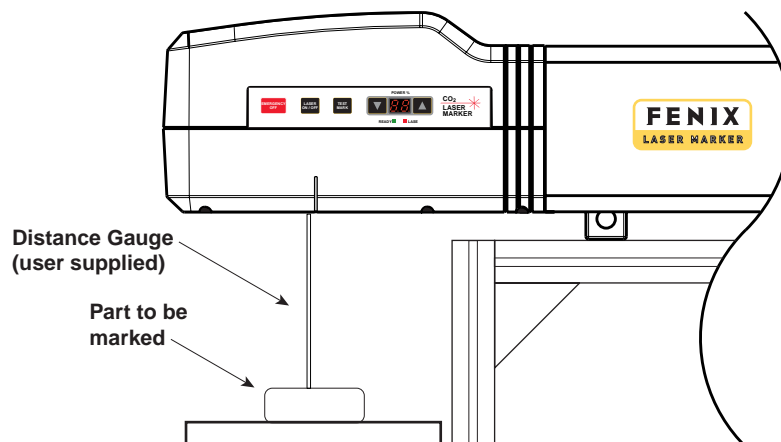
## 1 Mounting

When mounting Fenix, please ensure the following requirements are met:

- The side cooling fan intakes as well as the rear and top cooling fan exhausts must have six inches of unobstructed clearance to allow for proper airflow.
- Fenix should be rigidly affixed to a mounting structure by its mounting rails. Aluminum T-slot material, available under several trade names, makes an excellent mounting structure. Refer to Appendix A for a drawing and parts list for one type of mounting stand.
- Fenix can be mounted in any orientation; however, the marking surface must be parallel to the bottom of the Fenix housing.
- Position Fenix so that the working distance, measuring from the bottom of the focusing lens mount to the top of the marking surface, matches the distance specified on the lens mount (see Figure 1-3). A Z-axis adjustment for either the marking surface or the mounting surface is highly recommended.
- Whenever feasible, a beam enclosure shield should surround the beam path below the housing and around the marking area.

To fasten Fenix to your mounting structure using the aluminum T-slot rails attached to Fenix, perform the following steps:

- 1 Position T-nuts in the aluminum mounting rails then thread 5/16–18 bolts (not supplied) through the mounting structure into the T-nuts and tighten. For those customers with metric T-nuts, M8 × 1.25 bolts are required.
- 2 If mounting Fenix horizontally, you can use the built-in magnetic bubble level to level Fenix in both the X- and Y-axes during final mounting.
- 3 Adjust the marking surface as required to ensure that it is parallel to the Fenix focusing lens mount.



**Note:** The bottom of the focusing lens mount is recessed slightly and is not flush with the bottom of the Fenix chassis.

**Figure 1-3** Gauging Z-axis working distance

# getting started

## Connecting

The *Connecting* section includes subsections:

- AC Line Cord
- Fiber Link Controller Card
- Auxiliary Signal terminal

Refer to *Controls and indicators* in the “Operation” section for illustrations showing the placement and function of rear panel connections to Fenix.

### AC Line Cord

To install the AC Line Cord, perform the following steps:

- 1 Ensure that the AC Power Switch located on the Fenix rear panel is set to “Off” (0).
- 2 Locate the AC Line Cord and insert the female end of the line cord into the AC receptacle on the rear panel of Fenix.

**Note:** An AC line cord, with the appropriate AC plug for your country, is shipped with Fenix. If the plug does not fit available AC receptacles (within the range of 85–132 V, 170–264 V), you will need to provide a cable with the proper AC plug on one end and a standard IEC 320 female connector on the Fenix end.

#### Caution

possible  
equipment  
damage

Fenix control circuitry may be damaged if the AC line voltage drops below 85 VAC. Ensure that the AC line voltage remains at or above 85 VAC during marking operations.

### Fiber Link Controller Card

SYNRAD’s Fiber Link Controller Card (FLCC) accepts instructions from WinMark Pro® laser marking software and communicates data to Fenix through a digital fiber optic cable. The Fiber Link Card is very sensitive to static electricity discharges. Because it is possible to damage the FLCC or your computer through improper handling, please follow the installation directions carefully.

These instructions cover installation of SYNRAD’s PCI-bus Fiber Link Controller Card (FLCC) in IBM-compatible computers running Windows® 95, 98, NT4, 2000, or XP operating systems. Installation will vary slightly depending on the operating system and WinMark Pro version being used.

**Note:** WinMark Pro version 4.0.0.3773 and above supports PCI-bus FLCCs running on Windows 98, NT4, 2000, or XP operating systems.

Version 2.1.0.3468 and above supports either ISA- or PCI-bus FLCCs running on Windows 95/98 operating systems.

# getting started

## Connecting

### Caution

possible  
equipment  
damage

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

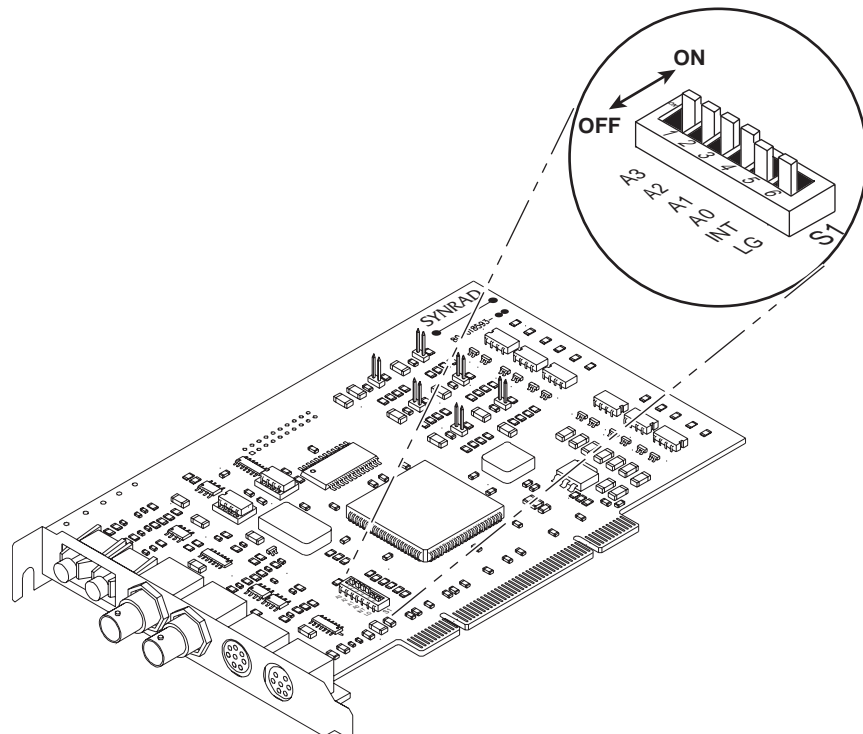
### Locate the FLCC device driver (WinMark Pro version 2.1 only)

**Note:** When installing WinMark Pro version 4.0.0.3773 or above, PCI Device Drivers are loaded during the WinMark Pro software installation. Proceed to the *Configure the FLCC* section.

Locate the FLCC's PCI Device Driver files (Synmarkh.inf and Synmarkh.vxd) before continuing the installation. On the WinMark Pro CD, driver files are located in the same folder as the WinMark Pro installation file. Version 2-compatible PCI drivers are also available from the WinMark Pro web site at <http://www.winmark.com/download.htm>.

### Configure the FLCC

We recommend that you configure DIP switches before installation. Figure 1-4 shows factory default DIP switch settings.



**Figure 1-4** PCI card DIP switch settings

# getting started

## Connecting

Table 1-2 lists FLCC DIP switch functions.

**Table 1-2** DIP switch functions

DIP SW#	Label	Default Position	Switch Function
1	A3	ON	Card ID# MSB
2	A2	ON	
3	A1	ON	
4	A0	ON	Card ID# LSB
5	INT	OFF	Fast Acting Safety Interlock (FASI) – ON enables the FASI function; OFF disables the Interlock function. When the FASI Interlock is enabled, a high level input must be present on Fenix Input # 3 (IN3) for marking to proceed.
6	LG	OFF	Used only with DH Series Marking Heads.

Because the Windows Plug and Play feature, not the user, assigns the PCI address, address switches are not important. The card identification set by the Card ID# DIP switches will support future improvements to WinMark Pro. Card ID switches use negative logic – for example when SW1–SW4 are set to ON, the Card ID# = 0; when SW1–SW4 are set to OFF the Card ID# = 15. If SW1, SW2, and SW3 = OFF and SW4 = ON, then the Card ID# = 7.

## Install the FLCC

To install the PCI-bus FLCC, perform the following steps:

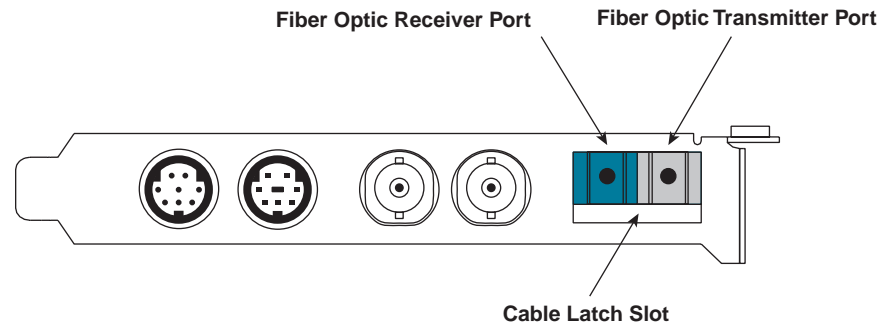
- 1 Turn off your computer, but leave it plugged into a properly grounded outlet. Leaving the computer plugged in means that the computer chassis will remain grounded, enabling you to discharge harmful static electricity before handling sensitive electronic components.
- 2 Remove the computer's case or cover to expose the expansion slots. Locate an empty PCI bus slot (the PCI-bus FLCC will not physically fit in an ISA slot).
- 3 If there is a "space filler" metal bracket covering the PCI slot, then remove the bracket. Save the screw.
- 4 Make sure you are grounded before handling the FLCC. While grounded, install the FLCC in the PCI slot. The gold contact fingers on the card should slide into the mating PCI bus slot without using excessive force.
- 5 When the card is properly seated, use the screw removed in step 3 to secure the card to the computer chassis.
- 6 Reinstall the computer's case or cover.

# getting started

## Connecting

### Connect the Fiber Optic cable

To install the *Fiber Optic* cable, refer to Figure 1-5 and perform the following steps:



**Figure 1-5** Fiber Link Controller Card connectors

- 1 With the back of the computer accessible, locate the *Fiber Optic Receiver/Transmitter* port on the FLCC and remove the rubber dust caps from the fiber optic ports.
- 2 Locate the *Fiber Optic* cable in the shipping box.
- 3 The end that attaches to the FLCC terminates into a single duplex connector. Insert the duplex connector into the *Fiber Optic Receiver/Transmitter* port on the FLCC. When properly connected, the latch on the connector should clip into the cable latch slot. You should not be able to remove the *Fiber Optic* cable without depressing the latch.
- 4 On the other end of the cable, connect the blue plug to the blue (upper) *Fiber Optic Control* port on the Fenix rear panel. Connect the gray plug to the gray (lower) port.

**Note:** The fiber optic connection is the only connection necessary to control Fenix or FH Series Marking Heads; no other connections are made to the FLCC.

### Load the PCI card driver (WinMark Pro version 2.1 only)

**Note:** When installing WinMark Pro version 4.0.0.3773 or above, PCI Device Drivers are loaded during the WinMark Pro software installation. Proceed to *Verify the FLCC's functionality* section.

To load the Fiber Link Controller Card's PCI Device Driver, perform the following steps:

- 1 Turn on your computer. During start-up, the Windows *New Hardware* wizard will guide you through the necessary steps to install the PCI card's Device Driver.
- 2 Windows will display a *New Hardware Found* dialog box. Wait until the *Building Information Database* progress bar completes its task.
- 3 The *Add New Hardware Wizard* dialog box appears. The wizard searches for new drivers for the PCI card labeled "PCI Co-processor CPU". Click the **Next** button.
- 4 Click the radio button next to "Search for the best driver for your device" and then click **Next**.

# getting started

## Connecting

- 5 Windows will search for new drivers on your hard drive and in any of the locations you select. Check “CD-ROM drive” or “specify a location” and uncheck all other choices. See Figure 1-6.



**Figure 1-6** Update Device Driver Wizard dialog box

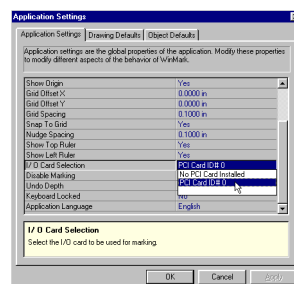
- 6 Insert the WinMark Pro CD into the CD-ROM drive or specify a location on your hard drive and click **Next**.
- 7 Windows will locate the “Fenix/FH Laser Marking Device” driver . Click **Next** to continue.
- 8 The wizard notifies you that it has installed the driver required by the FLCC. Click **Finish** to complete the start-up process.

## Verify the FLCC installation

After installing WinMark Pro, follow the steps below to verify that the PCI card is properly installed.

- 1 Restart your computer. This forces Windows to load the newly installed PCI Device Driver.
- 2 Double-click the *Shortcut to WinMark Pro* icon on your desktop.
- 3 When WinMark Pro opens, click *Tools* on the *Menu* bar and then click *General Settings....* On the *Application Settings* tab, locate the I/O Card Selection property and verify that the PCI card is properly identified. See Figure 1-7. If an ISA-bus FLCC is also installed in your computer, you will need to select the newly installed PCI card from the drop-down list.

This completes the installation of your PCI-bus Fiber Link Controller Card.



**Figure 1-7** Application Settings tab

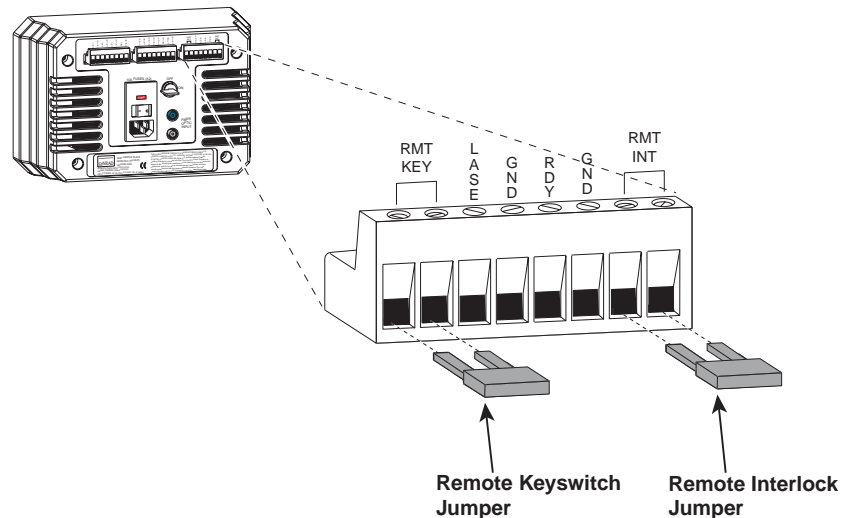
# getting started

## Connecting

### Auxiliary Signal terminal

For safety reasons, the *Auxiliary Signal* terminal block must be installed and the remote keyswitch (RMT KEY) and remote interlock (RMT INT) terminals must be wired to external parts handling equipment or be jumpered before Fenix can be operated.

To install and wire the *Auxiliary Signal* terminal block, refer to Figure 1-8 and perform the following steps:



**Figure 1-8** Auxiliary Signal terminals

- 1 Locate a terminal block in the shipping box and snap it into the Auxiliary Signal connector on the right side of the Fenix rear panel.
- 2 Install a shorting jumper (supplied) between the RMT KEY terminals (pins 1 and 2). If your parts handling equipment requires a remote keyswitch connection, connect external keyswitch wiring between the terminals marked RMT KEY. See *Auxiliary Signal connections* in the “Technical Reference” section for additional information.
- 3 Install a shorting jumper (supplied) between the RMT INT terminals (pins 7 and 8). If your parts handling equipment requires a remote interlock connection, connect your external interlock wiring between the terminals marked RMT INT. See *Auxiliary Signal connections* in the “Technical Reference” section for additional information.

The connections you have just completed are sufficient for manual operation and testing of Fenix. Refer to *Initial start-up* in the “Operation” section for start-up procedures. After completing the WinMark Pro software installation, you can control all marking actions directly from your computer.

If you plan to interface Fenix with automated parts handling equipment, read *Marking Automation* in the “Technical Reference” section for detailed information regarding I/O connections and electrical signals.

# getting started

## WinMark Pro® version 4 software

The *WinMark Pro version 4.0 software* section includes subsections:

- System requirements
- Installation

WinMark Pro® allows you to laser mark professional graphics and text from your Microsoft® Windows® 98, NT4, 2000, or XP operating system. WinMark Pro's ActiveMark™ technology is capable of controlling every aspect of the marking process from incrementing serial numbers to controlling laser parameters to interfacing with parts handling equipment. New features found in WinMark Pro version 4.0 include:

- PCI-bus FLCC support
- Extended character sets for stroke fonts
- Vector-style 2D codes
- Imported objects now “exploded” and grouped
- Multiple language support
- On-line link to SYNRAD's Laser Marking FAQ

## System requirements

To drive the Fenix Laser Marker, WinMark Pro version 4.0 requires a PCI-bus Fiber Link Controller Card (FLCC) . In order to install and run WinMark Pro software, your Windows computer system must meet the following minimum requirements:

**Note:** WinMark Pro version 4 software is not compatible with Windows 95 and is not compatible with Windows 98 operating systems using an ISA-bus FLCC.

### Windows 98

- 486DX, 66 MHz or faster (Pentium 90 MHz or faster recommended)
- 16-MB RAM (24 MB recommended)
- 20-MB available hard drive space
- One CD-ROM drive
- VGA or higher-resolution display adaptor (16- or 24-bit SVGA color monitor recommended)
- One open PCI-bus slot

### Windows NT4

- Pentium-compatible CPU, 90 MHz or faster
- 16-MB RAM (32 MB recommended)
- 20-MB available hard drive space
- One CD-ROM drive
- VGA or higher-resolution display adaptor (16- or 24-bit SVGA color monitor recommended)
- One open PCI-bus slot

# getting started

## WinMark Pro® version 4 software

### Windows 2000

- Pentium-compatible CPU, 133 MHz or faster
- 64-MB RAM
- 20-MB available hard drive space
- One CD-ROM drive
- VGA or higher-resolution display adaptor (16- or 24-bit SVGA color monitor recommended)
- One open PCI-bus slot

### Windows XP

- Pentium-compatible CPU, 233 MHz or faster (300 MHz recommended)
- 64-MB RAM (128 MB recommended)
- 20-MB available hard disk space
- One CD-ROM drive
- SVGA or higher-resolution display adaptor (16- or 24-bit SVGA color monitor recommended)
- One open PCI-bus slot

## Installation

### Hardlock

A Hardlock on the printer port prevents unauthorized use of WinMark software. If the Hardlock is not installed, WinMark can still be opened and files can be created, but marking will not be enabled.

Install the Hardlock by performing the following steps:

- 1 Disconnect the printer cable from the back of your computer.
- 2 Connect the Hardlock to the printer port.
- 3 Connect the printer cable to the Hardlock.

### WinMark Pro®

To install WinMark Pro, follow the installation directions in the *WinMark Pro User's Guide*. The User's Guide contains complete information for creating text, barcode, and graphic mark files as well as instructions for automating the marking process. Refer to the *Release Notes* for the latest information on any updates or changes to WinMark Pro.

After you have installed WinMark software on your computer, continue on to the "Operation" section of this manual to perform initial start-up and testing of your Fenix Laser Marker.

# getting started



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# operation

Use information in this section to familiarize yourself with Fenix controls and indicators and to begin marking operation.

This section contains the following information:

- Controls and indicators – displays and describes controls and indicators on Fenix.
- Initial start-up – explains how to start Fenix while verifying proper operation.

# operation

## Controls and indicators

### Membrane panel

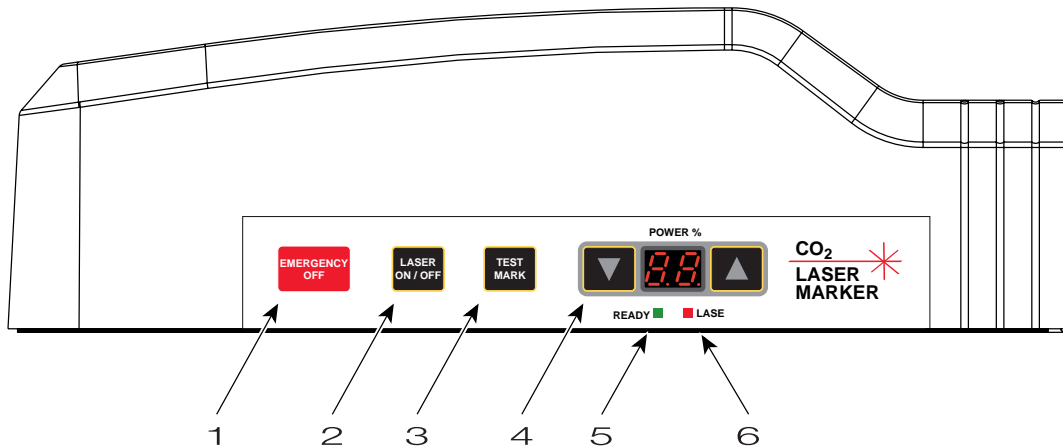


Figure 2-1 Membrane panel

**Note:** Membrane panels are located on either side of the Fenix head. Both panels are laid out identically from left to right.

- 1 *Emergency Off* Pushbutton – press to immediately stop lasing; the *Lase* indicator extinguishes and “EO” is shown on the *Power %* display. The AC power switch must be cycled “Off” (0) then “On” (1) and the *Keyswitch* must be reset (switched Off/On) to restart Fenix.
- 2 *Laser On/Off* Pushbutton – press to manually fire Fenix when the *Ready* indicator is illuminated. Pressing *Laser On/Off* centers the mirrors, toggles the laser on, and enables beam output at the power level shown on the *Power %* display. Use the ▼ or ▲ keys to set output power. Press *Laser On/Off* again to turn Fenix off.
- 3 *Test Mark* Pushbutton – press to mark a test pattern when the *Ready* indicator is illuminated. Use the ▼ or ▲ keys to set output power; if the displayed power level percentage is less than or equal to 4%, then beam output defaults to 50% power.
- 4 *Power %* Display – displays laser power level from 0 to 99%. Output power is set by the ▼ or ▲ keys. Press the ▼ key to decrease laser power; press the ▲ key to increase power. Holding in the ▼ or ▲ key will automatically decrease or increase the power setting until released. When Fenix is controlled by computer, output power is set by WinMark or Digital Scope software. Power output always resets to zero percent when Fenix is powered down.

The *Power %* display also shows fault codes if a problem should arise. Fault codes and their meanings are found in *Troubleshooting* in the “Maintenance/Troubleshooting” section.

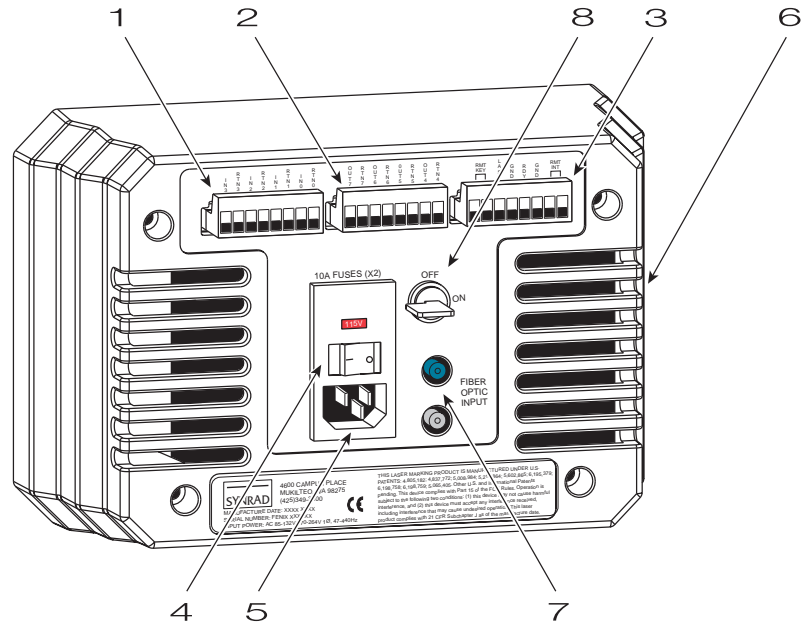
- 5 *Ready* Indicator – illuminates green indicating that lasing is possible after a five-second delay. The *Ready* indicator illuminates when remote interlocks are closed, the remote keyswitch is closed and the *Keyswitch* is turned from “Off” to “On”,
- 6 *Lase* Indicator – illuminates red to indicate that Fenix is active. The *Lase* indicator illuminates when a Command signal is applied and becomes brighter as laser output power is increased. “Tickle” pulses cause the *Lase* indicator to illuminate at minimum brightness, when Fenix is in the ready mode but not actively lasing.

# operation

## Controls and indicators

# 2

### Rear panel



**Figure 2-2** Fenix rear panel

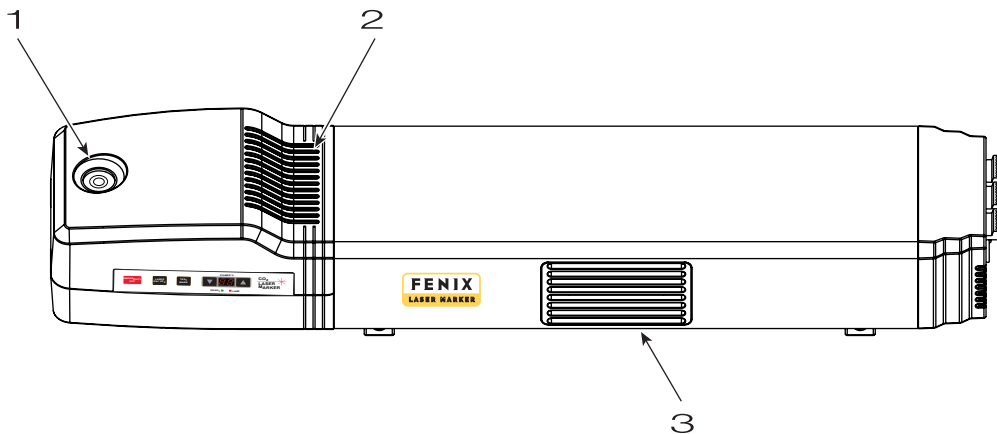
**Note:** When controlling Fenix from WinMark Pro, the only connections required are AC power, the fiber optic link, and *Auxiliary Signal* connections. *Input* and *Output* terminals are typically used only when connecting Fenix to automated parts handling equipment. See *Marking Automation* in the “Technical Reference” section for *Input* and *Output* pin and signal descriptions.

- 1 Input Terminals – provide four external inputs, IN0–IN3, for signals from your parts handling equipment. Each input has its own isolated ground, or return, line.
- 2 Output Terminals – provide four external outputs, OUT4–OUT7, for signals to your parts handling equipment. Each output has its own isolated ground, or return, line.
- 3 Auxiliary Signal Terminals – allow connection of remote keyswitch, interlock switches, and remote *Ready* and *Lase* indicators. Remote keyswitch and remote interlock connections to the *Auxiliary Signal* terminal must be completed, or jumpered, before Fenix will operate.
- 4 AC Power Switch – applies AC power to Fenix circuitry when switched to “On” (1). Two fast-acting fuses are also housed within the power module. See *Troubleshooting* in the “Maintenance/ Troubleshooting” section for fuse replacement information.
- 5 AC Power Receptacle – receives AC electrical power from your outlet through the AC Line Cord.
- 6 Rear Cooling Fan Exhaust – directs exhaust air out of the Fenix housing.
- 7 Fiber Optic Control Jacks – color-coded for connecting the digital fiber optic cable between Fenix and the Fiber Link Controller Card.
- 8 *Keyswitch* – provides On/Off control of Fenix. Rotate the key clockwise to enable Fenix. The key cannot be removed when the *Keyswitch* is switched to the “On” position.

# operation

## Controls and indicators

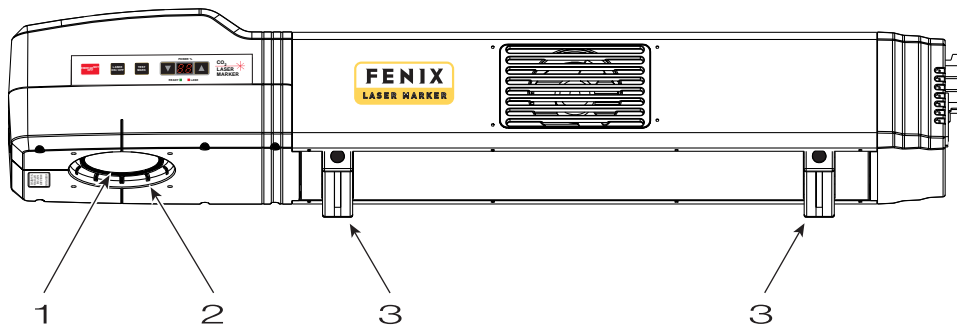
### Top cover



**Figure 2-3** Fenix top cover

- 1 Magnetic Bubble Level – used to level Fenix to the marking surface. The magnetic base level can also be removed from its holder and used to level the marking surface.
- 2 Top Cooling Fan Exhaust – directs exhaust air out of the Fenix housing.
- 3 Side Cooling Fan Intake – supplies intake air for the two variable-speed cooling fans located within the housing.

### Bottom/side panels



**Figure 2-4** Fenix bottom/side panels

- 1 Focusing Lens Mount – fastens your choice of lens to the housing.
- 2 Purge Air Exhaust – uses exhaust air from the cooling fans to blow smoke and vapors away from the focusing lens.
- 3 Aluminum T-slot Mounting Rails – fasten Fenix to your mounting surface.

# operation

## Initial start-up

# 2

The *Initial start-up* section includes subsections:

- Stand-alone operation
- Computer-controlled operation

## Stand-alone operation

To initially test Fenix™, perform the following steps:

- 1 Remove the “Fenix is equipped with several safety feature...” labels from both Fenix membrane panels.
- 2 Remove the dust cap from the focusing lens.

### Caution

possible  
lens  
damage

Lens damage may result if the measuring device contacts the surface of the focusing lens.

- 3 Place the material to be marked (a sheet of anodized aluminum is ideal) on your marking surface in the field of the focusing lens.
- 4 Use a ruler marked in millimeters to set the working distance (Z-axis adjustment) from the bottom of the focusing lens mount to the surface of the part to be marked. See Figure 1-3, *Gauging Z-axis working distance*, in the “Getting Started” section. The nominal working distance is engraved on the focusing lens mount. Because working distance is unique to each lens, consult the final test report shipped with your Fenix to determine the actual working distance of your lens.

### Caution

possible  
equipment  
damage

Fenix control circuitry may be damaged if the AC line voltage drops below 85 VAC. Ensure that the AC line voltage remains at or above 85 VAC during marking operations.

- 5 Plug the AC Line Cord from Fenix into your wall outlet, then turn the AC Power Switch to “On” (1). You should hear the cooling fans start and the *Power %* display should show “00”.
- 6 Ensure that all personnel in the area are wearing the appropriate protective eyewear.
- 7 Turn the *Keyswitch* from “Off” to “On” (clockwise). The *Ready* indicator should illuminate green and the *Power %* display counts down a five-second delay. After five seconds, the *Lase* indicator turns red indicating that Fenix is ready to lase.

# operation

## Initial start-up

**Note:** During standby operation (*Ready* indicator on, but no Command signal applied), “tickle” pulses sent to the laser pre-ionize the gas to just below the lase threshold causing the *Lase* indicator to illuminate at its minimum brightness, a brightness level that may not be visible under all lighting conditions. “Tickle” pulses allow Fenix to respond almost instantaneously to lase commands from WinMark Pro software as the beam is switched off and on during marking.

### **⚠ Danger**

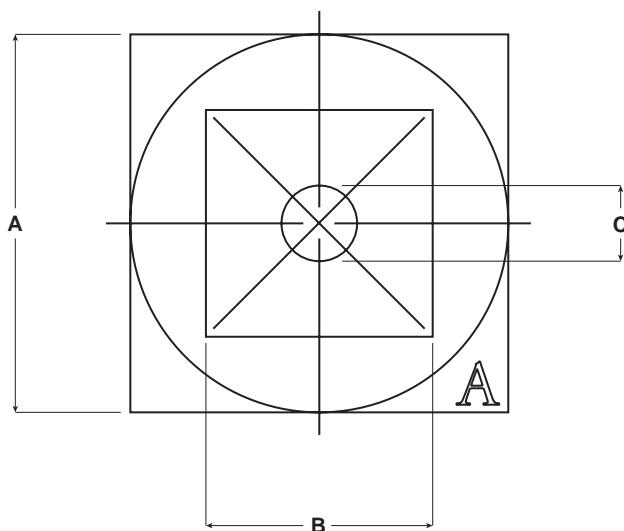
serious  
personal  
injury

This product emits invisible infrared laser radiation at the 10.6  $\mu\text{m}$   $\text{CO}_2$  wavelength. Since direct or diffuse laser radiation can inflict severe corneal injuries, always wear eye protection when in the same area as an exposed laser beam. Do not allow the laser beam to contact a person. This product emits an invisible laser beam that is capable of seriously burning human tissue.

Always be aware of the beam’s path and always use a beam block while testing.

- 7 Press the *Test Mark* pushbutton. Fenix will mark a test pattern at a default speed of 40 inches per second using 50% power (approximately 12.5 W). The test pattern, shown in Figure 2-5, locates the center of the marking field. Test pattern dimensions for Fenix lens are given in Table 2-1.

**Note:** If Fenix fails to mark, refer to *Troubleshooting* in the “Maintenance/Troubleshooting” section.



**Figure 2-5** Fenix test pattern

# operation

## Initial start-up

# 2

**Table 2-1** Test pattern dimensions

Lens Focal Length	Dimensions		
	A	B	C
370 mm	90.0 mm	54.0 mm	18.0 mm
200 mm	50.0 mm	30.0 mm	10.0 mm
125 mm	32.0 mm	19.2 mm	6.4 mm
80 mm	12.5 mm	7.5 mm	2.5 mm

## Computer-controlled operation

Once you have verified that Fenix is working properly, the FLCC is installed, and WinMark software is loaded, perform the following steps to begin controlling Fenix with your computer:

**Note:** Always power-up Fenix before starting WinMark Pro. This ensures that WinMark properly communicates with Fenix while launching.

- 1 Verify that the Hardlock is installed. If not, refer back to *WinMark Pro version 4 software* in the “Getting Started” section.
- 2 Start WinMark by double-clicking the Shortcut To WinMark Pro icon on your desktop.
- 3 Ensure that the lens size entered in WinMark is the same as the currently installed focusing lens:
  - a From the *Tools* menu in WinMark, select *General Settings...*
  - b In the *Application Settings* dialog box, click the *Application Settings* tab.
  - c Click *Lens*, and then click the ellipsis (...).
  - d In the *Lens Selection* dialog box, select the lens currently installed on your Fenix.
- 4 From the *File* menu, click *New* to open a new drawing.
- 5 Design a mark using WinMark or import a sample file from WinMark’s *Samples* folder.

**Note:** If WinMark Pro senses that it is communicating with a Fenix Tracker, a new tab, *Tracking*, appears in the Property List. If so, set *Track Marking Object* to *No* during this initial test.

### Caution

possible  
lens  
damage

Lens damage may result if the measuring device contacts the surface of the focusing lens.

# operation

## Initial start-up

### **Danger**

serious  
personal  
injury

This product emits invisible infrared laser radiation at the 10.6  $\mu\text{m}$   $\text{CO}_2$  wavelength. Since direct or diffuse laser radiation can inflict severe corneal injuries, always wear eye protection when in the same area as an exposed laser beam. Do not allow the laser beam to contact a person. This product emits an invisible laser beam that is capable of seriously burning human tissue.

Always be aware of the beam's path and always use a beam block while testing.

- 6 Place the material to be marked in the field of the focusing lens.
- 7 Use a ruler marked in millimeters to set the proper Z-axis working distance from the bottom of the focusing lens mount to the surface of the part to be marked.
- 8 Check that all safety precautions discussed earlier such as safety glasses and shielding around the beam area are being followed, then command WinMark to mark.

**Note:** If a membrane panel pushbutton is pressed while WinMark is laser marking, all or part of the mark may be lost. This can occur since Fenix accepts commands from both the membrane panel and WinMark. For safety reasons, if instructions arrive from both sources simultaneously, membrane panel inputs are programmed to take precedence.

**Note:** If Fenix fails to mark properly, refer to *Troubleshooting* in the “Maintenance/Troubleshooting” section or check the *WinMark Pro User's Guide* for information regarding WinMark Pro settings.

Use information in this section to setup your Fenix Tracker Laser Marker. The order of information presented in this section is the same as the order of tasks that you will need to perform. The best way to get Fenix Tracker ready for operation is to start at *Determining Line Speed* and work your way through *Marking*. You should have already completed the steps in the “Getting Started” and “Operation” sections of this manual.

This section contains the following information:

- Introduction – describes Fenix’s Tracker feature.
- Determining line speed – explains how to determine line speed for your application.
- WinMark Pro software – describes WinMark’s Tracker features.
- Additional hardware – explains how to connect the rotary position encoder, part sensor, and DC power supply required for Tracker operation.
- Marking – explains the concepts behind Tracker’s dynamic marking and demonstrates how to optimize Tracker marks for speed and quality.

**Note:** If you are installing a Fenix Tracker, please perform the tasks described in the “Getting Started” and “Operation” sections before proceeding to the “Tracker” section.

# tracker

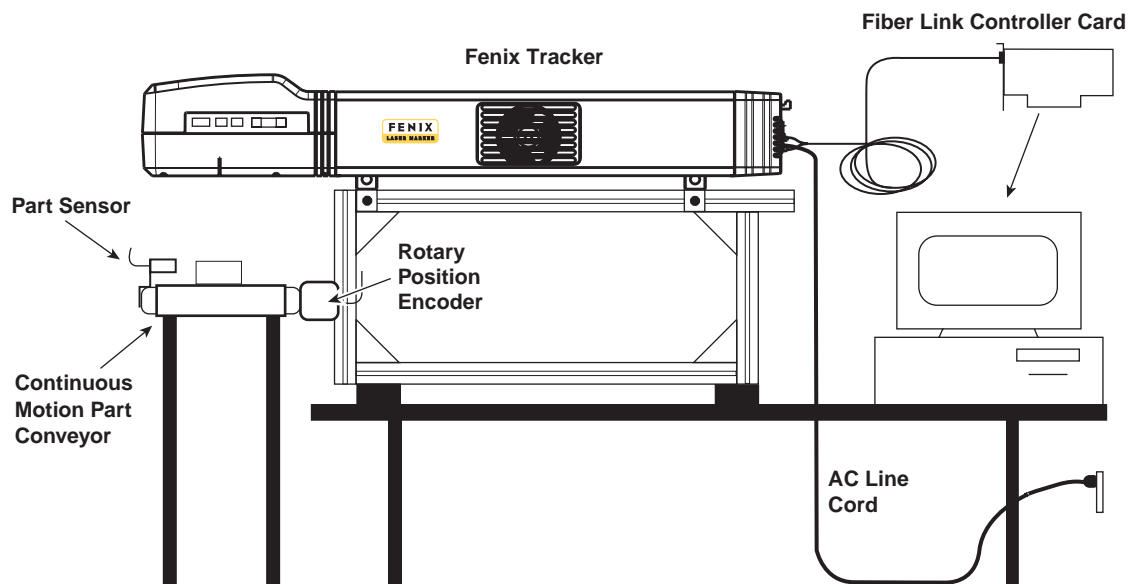
## Introduction

Unlike static laser marking systems that require parts to be at rest during marking, Fenix™ Tracker is capable of marking parts “on-the-fly” as they move through the marking field at line speeds up to 200 feet per minute. Initial material samples should be tested by SYNRAD’s Applications Lab to determine the optimum power, speed, and lens size settings for your application. This testing will lead to an approximate figure for expected line speed; however, line speed is greatly affected by the type of mark you decide to create. The fastest marks are generally alphanumeric text marks such as serial numbers, date codes, lot numbers, etc., but even then changes in font type or font size may make a significant difference in actual performance.

## Fenix Tracker setup

A typical Fenix Tracker setup is shown in Figure 3-1. In addition to the items listed under *Marking system components* in the “Getting Started” section, you will need to supply the following:

- Rotary position encoder
- Part sensor
- DC power supply for encoder and part sensor
- Part movement or conveyor system



**Note:** To accurately focus the laser beam on the marking surface, a Z-axis adjustment should be provided on either the marking surface or on the mounting structure.

**Figure 3-1** Typical Fenix Tracker setup

# tracker

## Determining line speed

# 3

The *Determining line speed* section includes subsections:

- Definitions
- Tracker marking criteria
- Line speed formula
- Sample calculations

## Definitions

Before calculating the approximate line speed for a Fenix Tracker in a given application, several terms must be defined. To obtain the highest possible line speed and mark quality, please review these definitions carefully before designing your Tracking application.

### Mark

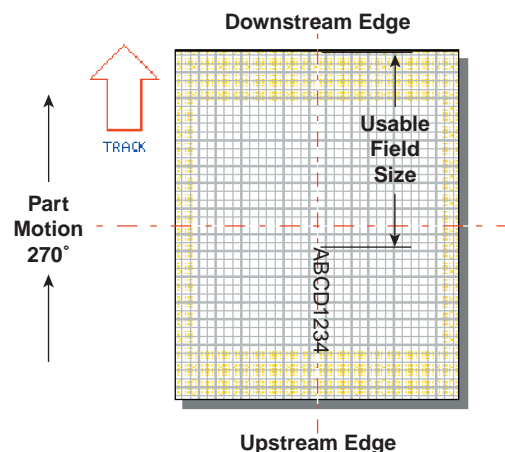
The *Mark* is the object, or collection of objects, defined by the bounding box when all marking objects are selected in your .mkh mark file.

### Marking Window

The *Marking Window* is best explained by visualizing WinMark Pro's *Drawing Canvas* superimposed on an actual part in the focal plane of the lens. The *Drawing Canvas* would exactly cover the maximum *Marking Window* for the selected lens. For example, with a 200 mm Fenix lens selected, the maximum *Marking Window* dimensions are 165 mm × 134 mm. When using a 125 mm Fenix lens, the *Marking Window* spans a 105.6 mm × 85.7 mm area.

### Usable Field Size

*Usable Field Size* is the distance, in millimeters, from the downstream edge of *Mark* placement in the *Marking Window* to the downstream edge of the *Marking Window* in the axis of part motion. Figure 3-2 illustrates *Usable Field Size*.



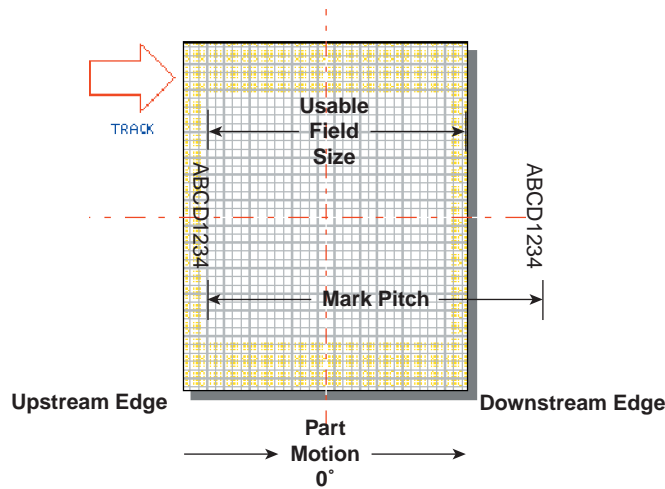
**Figure 3-2** Usable Field Size

# tracker

## Determining line speed

### Mark Pitch

*Mark Pitch* is the distance, in the axis of part motion, from the leading edge of the *Mark* on one part to the leading edge of the *Mark* on the following part. To achieve maximum line speed, *Mark Pitch* should be greater than the *Usable Field Size*. See Figure 3-3.



**Figure 3-3** Mark Pitch greater than Usable Field Size

### Cycle Time

The amount of time in seconds required to complete the *Mark* is the *Cycle Time*. Because cycle times for Index and Tracker marking are the same, marks are first tested and optimized for speed and mark quality in Index mode.

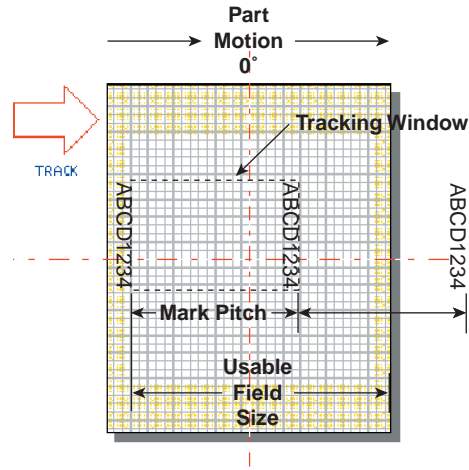
### Tracking Window

The *Tracking Window* is the fixed area beneath the Fenix Tracker in which marking may be completed without error. The *Tracking Window* is defined as the smaller of either *Usable Field Size* or *Mark Pitch*.

For example, Figure 3-4 shows an application using a 200 mm lens with a 0° Motion Vector. The *Marking Window* dimension, in the direction of part motion, is 134 mm. Mark placement creates a *Usable Field Size* measuring 128 mm and part spacing creates a *Mark Pitch* measuring 90 mm. By definition, the *Tracking Window* is the smaller of *Usable Field Size*, which is 128 mm, or *Mark Pitch*, which measures 90 mm. In this case the actual *Tracking Window* is limited to 90 mm.

# tracker

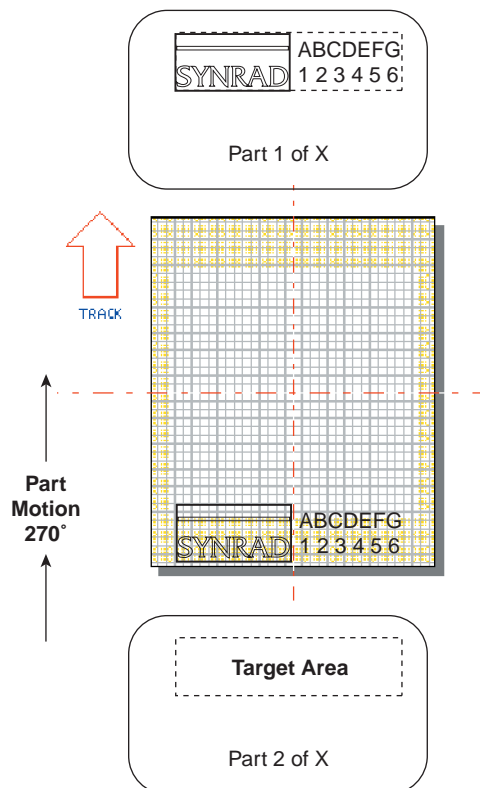
## Determining line speed



**Figure 3-4** Tracking Window

### Target Area

The *Target Area* is the area on the part, or array of parts, that will be lased with the *Mark* as parts move under the Fenix Tracker. See Figure 3-5.



**Figure 3-5** Target Area

# tracker

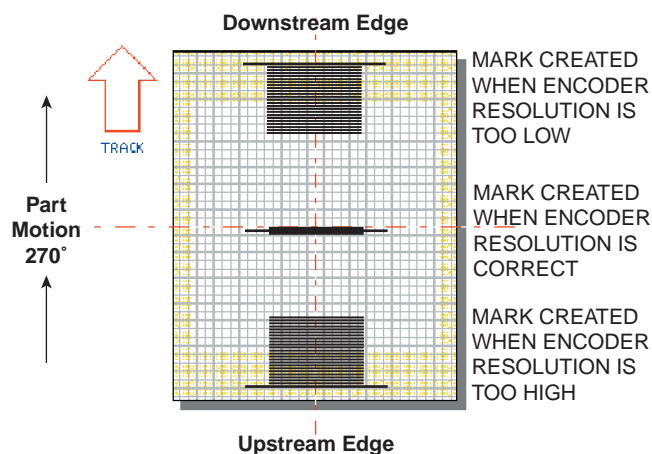
## Determining line speed

### Tracker marking criteria

- The entire *Target Area* of the part, or array of parts, to be marked must move completely within the *Tracking Window* before lasing will begin.
- Lasing must be completed on the part, or array of parts, before the *Target Area* of the next part, or array of parts, reaches the *Tracking Window*. If lasing is not complete before the *Target Area* of the next part reaches the *Tracking Window*, the next part, or array of parts, will not be marked and the mark log will display a “Line speed too fast – missed start” error.

Depending upon Sensor Distance and Mark Pitch, Fenix Tracker can buffer up to 16 “start mark” signals. The number of start signals buffered by the head equals the number of parts that pass the part sensor before the first part enters the *Tracking Window*. Note that when a “Line speed too fast – missed start” error occurs, the buffer is reset to zero. In cases where more than one “start mark” signal is buffered, more than one piece will not be marked when the buffer resets.

- The part sensor should be positioned so that it does not trigger while Fenix is marking a part. See Figures 3-14 and 3-15.
- Encoder Resolution, encoder pulses per millimeter of conveyor motion, must be properly set to prevent mark distortion or marking outside the *Target Area*. See *Additional hardware* later in this section for details on calculating Encoder Resolution. After determining the correct value, open and run the *Linestack200.mkh* or *Linestack370.mkh* mark file to verify the calculated value (for 80 mm and 125 mm lenses, copy the linestack objects and paste into a *New* drawing created with the correct lens setting). If Encoder Resolution is correct, then short and long lines will appear as one long line as shown in Figure 3-6.

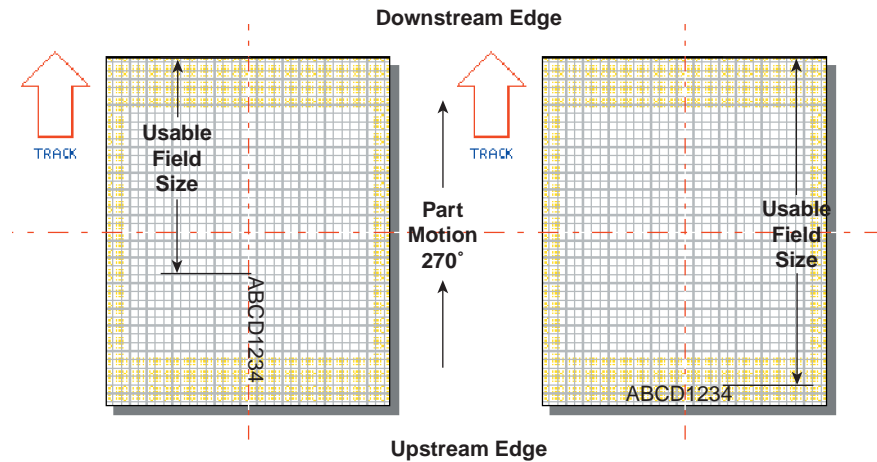


**Figure 3-6** Checking Encoder Resolution

If the long line is further downstream of the short lines in the direction of motion, then increase Encoder Resolution. If the long line is upstream of the short ones, decrease Encoder Resolution. Accuracy to the second decimal point may be required depending on the resolution of your encoder.

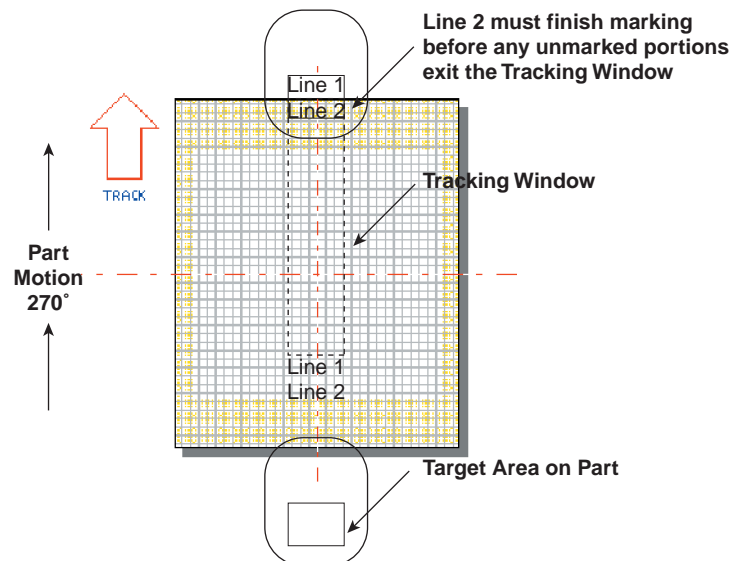
## Determining line speed

- Mark position and orientation make a substantial difference in Tracking speed because they change Usable Field Size. Maximum line speed is achieved when the Mark is positioned as close as possible to the upstream edge of the Marking Window. The entire Mark must be positioned on the Drawing Canvas so that it lies within the boundaries of the Marking Window. Figure 3-7 shows how the same text positioned differently can give two very different values for Usable Field Size.



**Figure 3-7** Usable Field Size comparisons

- Marked portions of the Target Area may move beyond the downstream edge of the Tracking Window as the mark is progressing; however, lasing is disabled when any unmarked microvectors move outside the Tracking Window. If this occurs, the mark may be missing or incomplete and the mark log will display a “Line speed too fast to finish” error. In Figure 3-8, “Line 2” will mark unless any unmarked portions of the text object move outside the Tracking Window.



**Figure 3-8** Maximum marking position in Tracking Window

# tracker

## Determining line speed

### Line speed formula

**Note:** Line speed calculations do not account for differences in computer speed or the time required for automation processes to complete their respective tasks between marks. These factors must be considered when determining the actual throughput of your production line. As with any factory automation proposal, proof-of-concept testing is highly recommended. The first step in achieving maximum line speed is to first optimize your mark file to meet mark speed and mark quality requirements for the specific material to be marked.

The formula below provides the approximate maximum line speed for a specific mark file using a Fenix Tracker Laser Marker:

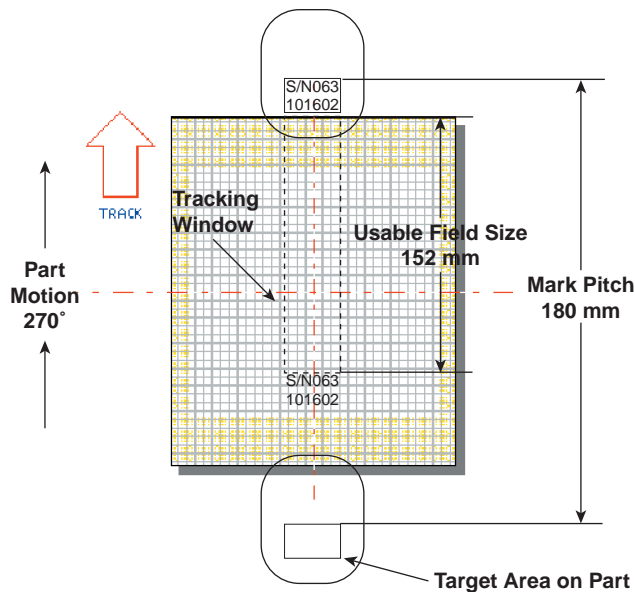
$$\text{Line Speed} = \text{Tracking Window} / \text{Cycle Time}$$

### Sample calculations

Sample calculation #1 and Sample calculation #2 guide you through the definitions described earlier so that the correct values for Tracking parameters can be determined and inserted into the Line Speed equation.

#### Sample calculation #1

Refer to Figure 3-9 and read through the following sample line speed calculation.



**Figure 3-9** Tracker line speed calculation # 1

The mark is being made by a Fenix Tracker using a 200 mm Fenix lens; maximum lens field dimensions are 165 mm × 134 mm. A Motion Vector of 270° is set in WinMark Pro on the *Tracking* tab due to the application's part motion requirements. Mark placement in the *Marking Window* is such that the *Usable Field Size* is 152 mm.

## Determining line speed

The *Tracking Window* is defined as the smaller of either *Usable Field Size* or *Mark Pitch*. *Usable Field Size* is 152 mm and *Mark Pitch* is 180 mm, so the *Tracking Window* is 152 mm.

*Cycle Time* for the mark (optimized in Index marking mode) is 0.32 seconds.

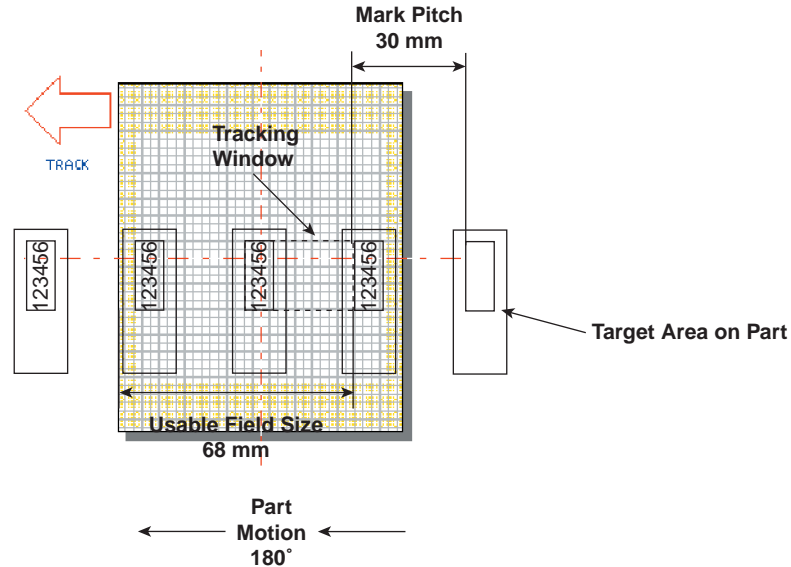
$$\text{Line Speed} = \text{Tracking Window} / \text{Cycle Time}$$

$$= 152 \text{ mm} / 0.32 \text{ sec}$$

$$\text{Line Speed} = 475 \text{ mm/sec} = 28.5 \text{ m/min} = 93.5 \text{ ft/min}$$

### Sample calculation #2

Refer to Figure 3-10 and the following sample line speed calculation.



**Figure 3-10** Tracker line speed calculation # 2

The mark is being made by a Fenix Tracker using a 125 mm Fenix lens. Maximum lens field dimensions are 105.6 mm × 85.7 mm. A Motion Vector of 180° is set in WinMark Pro on the *Tracking* tab due to the application's part motion requirements. *Usable Field Size* is 68 mm and *Mark Pitch* measures 30 mm. The *Tracking Window*, the smaller of either *Usable Field Size* or *Mark Pitch*, equals 30 mm.

*Cycle Time* for the mark is 0.20 seconds.

$$\text{Line Speed} = \text{Tracking Window} / \text{Cycle Time}$$

$$= 30 \text{ mm} / 0.20 \text{ sec}$$

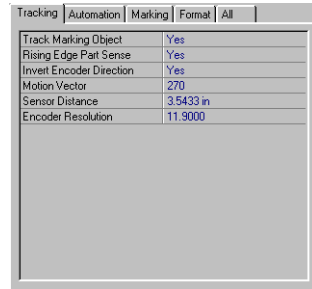
$$\text{Line Speed} = 150 \text{ mm/sec} = 9 \text{ m/min} = 29.5 \text{ ft/min}$$

# tracker

## WinMark Pro software

### Tracking tab

When WinMark Pro senses it is communicating with a Fenix Tracker it adds another tab to the Property List. This additional Drawing property tab, *Tracking* (shown in Figure 3-11), contains the tracking properties described below.



Property	Value
Track Marking Object	Yes
Rising Edge Part Sense	Yes
Invert Encoder Direction	Yes
Motion Vector	270
Sensor Distance	3.5433 in
Encoder Resolution	11.9000

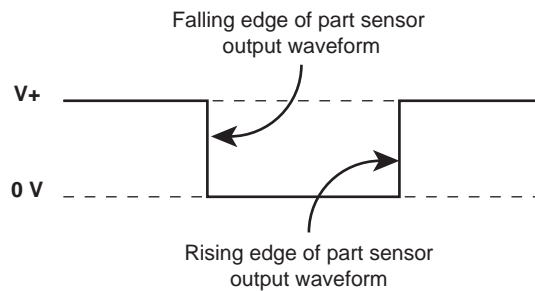
**Figure 3-11** Tracking tab

### Track Marking Object

Select *Yes* to track and mark moving parts with the Tracker feature. Choose *No* to mark stationary objects.

### Rising Edge Part Sense

Set Rising Edge Part Sense based on how the part sensor output should trigger the mark. Selecting *Yes* triggers marking on the rising edge of the sensor's output waveform while selecting *No* triggers marking on the falling edge of the signal. Figure 3-12 illustrates a typical waveform from a part sensor. For optimal results, Rising Edge Part Sense should always be set to *Yes*.



**Figure 3-12** Part sensor output waveform

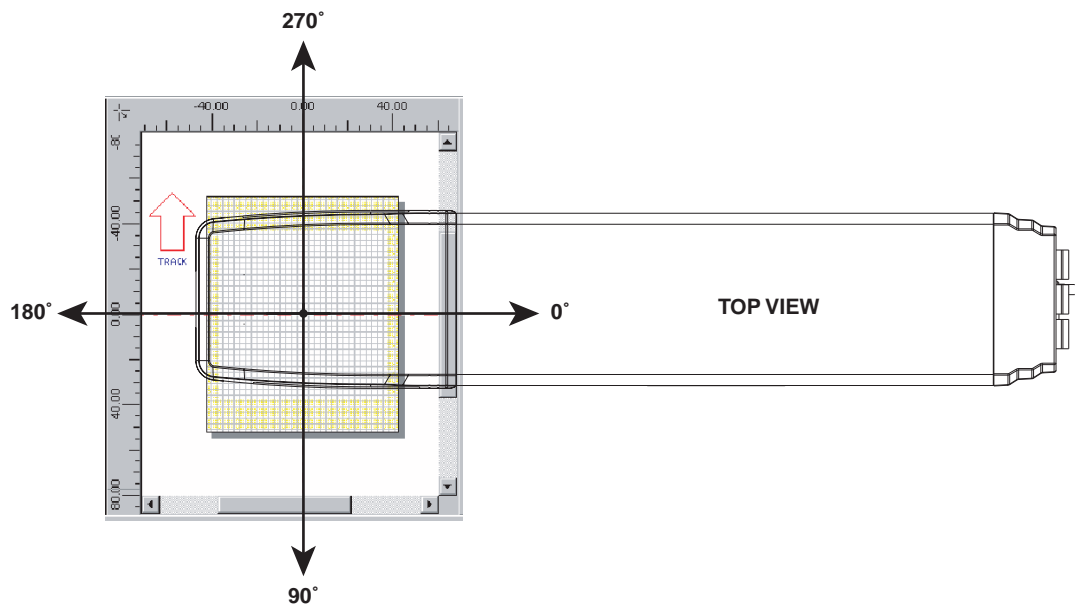
### Invert Encoder Direction

Invert Encoder Direction allows you to invert phasing of the encoder's output signal so that the actual direction of part movement through the marking field is correctly sensed as "forward". This feature eliminates the need to physically change input field wiring on the Fenix Tracker.

### Motion Vector

Set the direction of part movement through the marking field. When looking at WinMark's *Drawing Canvas* (shown in Figure 3-13), 0° is part movement towards the right, 90° is movement towards the bottom, 180° is towards the left, and 270° is part movement towards the top of the *Drawing Canvas*.

When Track Marking Object is Yes, a motion arrow displays to the left of the *Drawing Canvas* showing the direction of the currently entered Motion Vector.



**PART MOTION COORDINATE SYSTEM OF WINMARK DRAWING CANVAS RELATIVE TO FENIX TRACKER**

**Figure 3-13** Drawing Canvas coordinates relative to Fenix Tracker

**Note:** Part motions of 90° or 270° allow faster line speeds than 0° or 180° because part movement is through the long axis of the mark field, providing a larger *Tracking Window*.

### Sensor Distance

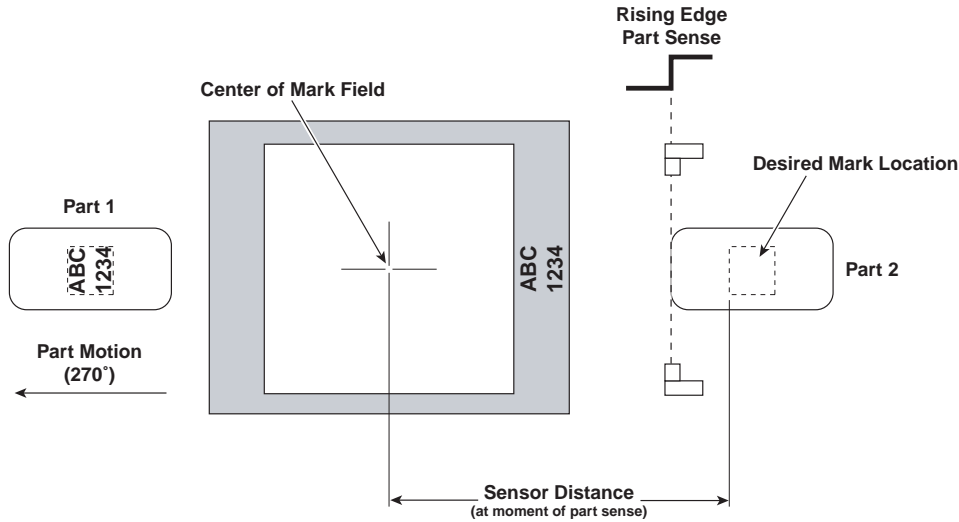
The term, Sensor Distance, is not entirely accurate because the value entered is not related to the physical part sensor location but rather Sensor Distance is defined as **the distance, at the moment of part sense, from the center of the Marking Window to the leading edge of the desired mark location**. Unlike other marking methods that are time-based, Fenix uses a distance-based marking scheme. This is because at the moment a part is sensed (on the rising or falling edge of the part sense signal), the Fenix Tracker begins counting rotary encoder pulses. When the number of encoder pulses counted by the head equals the Sensor Distance (calculated by the Encoder Resolution), marking begins. Because Fenix calculates marking vectors based on encoder pulses (distance), Fenix Tracker can continue to accurately mark an object even when it stops once the *Target Area* has fully entered the *Tracking Window*.

Units of measure for Sensor Distance are inches with a maximum value of 12.0 inches. Change Sensor Distance to move the location of the mark on the part in the axis of part motion. Moving the location of the mark object on the *Drawing Canvas* (in the axis of part motion) has no affect on part mark location.

# tracker

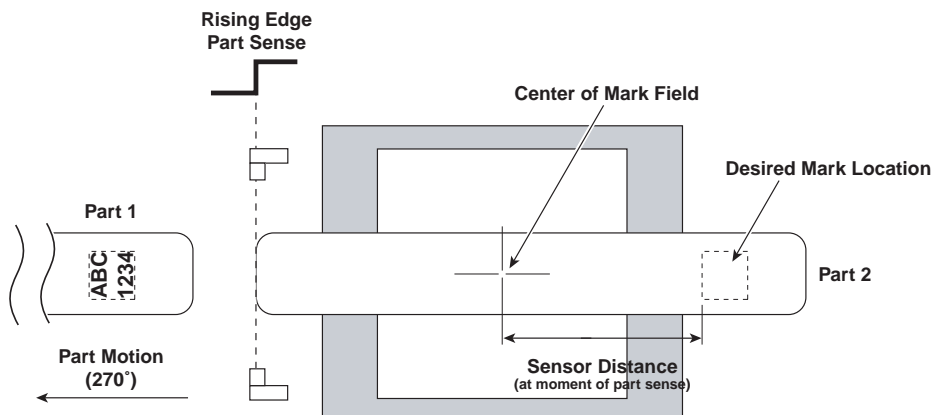
## WinMark Pro software

Figure 3-14 illustrates the Sensor Distance concept. In this case the part sensor is placed upstream of the mark field (parts are sensed before they reach the center of the mark field) and the sensor is set to trigger on a rising edge transition.



**Figure 3-14** Upstream part sensor, rising edge trigger

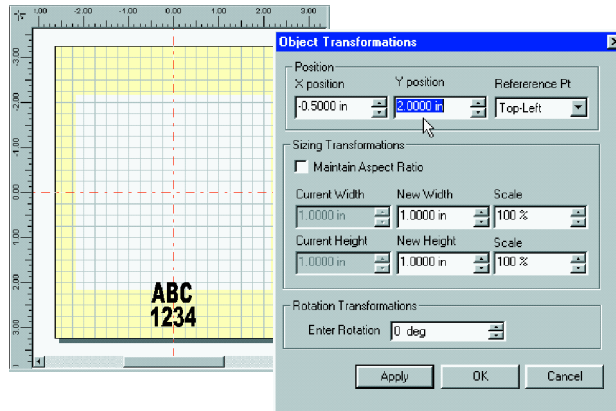
Figure 3-15 illustrates Sensor Distance when the part sensor is positioned downstream. Even though the leading edge of the part has traveled past the center of the mark field, the area where the part is to be marked must still be upstream of the centerline.



**Figure 3-15** Downstream part sensor

Maximum Tracker mark speeds are obtained when mark objects are positioned near the upstream edge of WinMark's *Drawing Canvas* (to provide the largest possible *Tracking Window*) and the Motion Vector (on the *Tracking* tab) is set to 90° or 270°, which takes advantage of Fenix's rectangular marking field.

Each object to be marked has an X-Y “start mark” point, which is the starting beam position. Sensor Distance must be greater than the value of the X or Y “start mark” coordinate, which is normally the object's top left corner (unless the object has been rotated). When the Tracking Motion Vector is 90° or 270°, the Sensor Distance must be greater than the Y “start mark” coordinate. When the Motion Vector is 0° or 180° then Sensor Distance must be greater than the X “start mark” coordinate. If the Sensor Distance minus the mark position on the *Drawing Canvas* is less than or equal to zero, this means that the part will be past the point of marking before the specified Sensor Distance has been traveled. If this error occurs, move the part sensor further upstream. If line speed (cycle time) is not an issue, you can instead move the object's location on the *Drawing Canvas*. In Figure 3-16, the text object's top left coordinate value is X = -0.5, Y = 2.0 (inches). If the drawing's Motion Vector is 270°, then the Sensor Distance entered must be greater than 2.0 inches.



**Figure 3-16** X-Y “start mark” coordinates

Rotating an object changes the X-Y coordinates of its “start mark” point, which may require you to reposition the mark object on the *Drawing Canvas* or change Sensor Distance (move the part sensor). Depending upon the Motion Vector selected, rotating an object 180° may allow the object to be placed closer to the upstream edge of the *Drawing Canvas*, thus increasing overall line speed.

## Encoder Resolution

Encoder Resolution is the number of encoder pulses received per millimeter of distance traveled by the conveyor. Encoder Resolution units are fixed as pulses/mm even when WinMark is set to display measurement units in inches or centimeters.

# tracker

## Additional hardware

The *Additional hardware* section includes subsections:

- Rotary position encoder
- Part sensor
- DC power supply

Fenix Tracker Markers require several additional components to coordinate marking with part motion. These components include a part sensor (capacitive, inductive, optical, mechanical, etc.) for part position information, a rotary position encoder (with quadrature signal output) for determining line speed, and a DC power supply to power both the part sensor and rotary encoder. Although the components listed above are not provided with your Fenix Tracker, some or all of them may already exist in the equipment that performs your automated parts handling.

## Rotary position encoder

A rotary position encoder is required to send position information to the Fenix Tracker. The tracking function senses the rising, or falling, edge of the encoder's "A" and "B" output signals to calculate part position and direction as parts travel through the mark field. If your parts handling equipment does not incorporate a rotary encoder that generates quadrature position signals, then you must add an encoder that produces a quadrature signal, a two channel output signal whose phase relationship distinguishes forward and reverse motion. Table 3-1 lists electrical specifications for choosing a rotary encoder.

**Table 3-1** Rotary position encoder specifications

Function	Specifications
Code	Incremental
Pulses Per Revolution	User determined (see <i>Encoder setup</i> for sample calculations)
Input Voltage	15.0–40.0 VDC
Output Signal	Open collector (PNP or NPN) or open drain (P-channel or N-channel) Low level output voltage: –0.6–5.0 VDC (0 V typ.) High level output voltage: 15.0–40.0 VDC (24 V typ.) On-state current: 15 mA minimum Quadrature ("A" and "B" phase) output

## Encoder connection

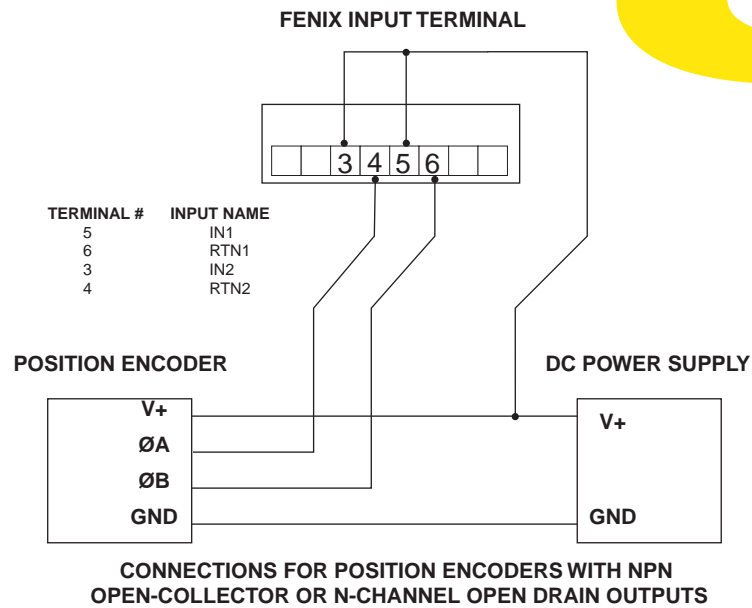
Encoder outputs are connected directly to the Fenix Tracker's input terminals (IN1, IN2). Fiber Link Controller Card (FLCC) inputs can not be used for tracking functions.

To connect the rotary position encoder, refer to the appropriate connection diagram. Use Figure 3-17 for NPN open collector or N-channel open drain encoders. Use Figure 3-18 for PNP or P-channel encoders.

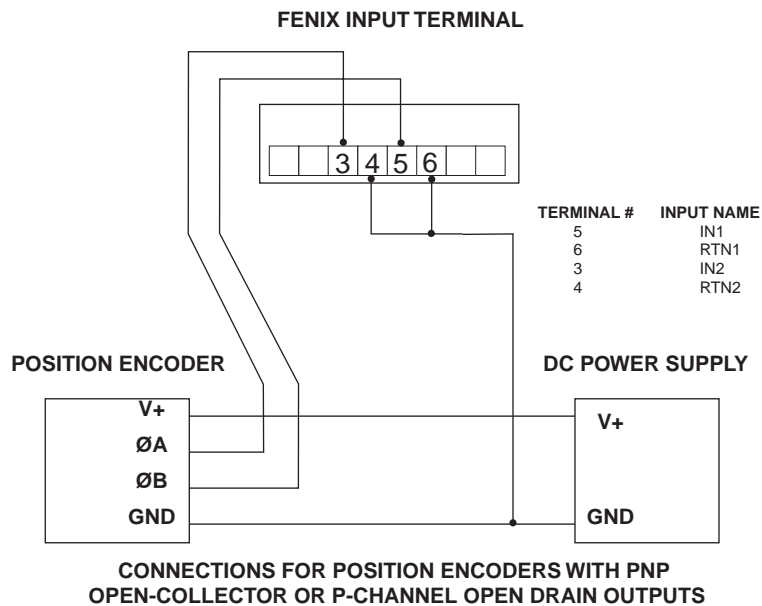
# tracker

## Additional hardware

# 3



**Figure 3-17** Wiring diagram for NPN or N-channel encoders



**Figure 3-18** Wiring diagram for PNP or P-channel encoders

Verify that field wiring is correct after encoder connections are completed. In the *WinMark* folder, open Digital Scope (*DigScope.exe*) and apply power to the encoder. If the encoder is properly connected, Input #1 (IN1) and Input #2 (IN2) should toggle as the position encoder rotates through its range of motion.

**Note:** To prevent I/O conflicts, Digital Scope and WinMark Pro should never be open at the same time. Always close one application before opening the other.

# tracker

## Additional hardware

### Encoder setup

Convert the encoder's "Pulses Per Revolution" (PPR) output to pulses per millimeter of motion by using the following equation:

$$\text{Encoder resolution (pulses per mm of motion)} = X (\text{pulses per rev}) \times Y (\text{coupling factor}) \times 1 \text{ m}/1000 \text{ mm}$$

Where: **X** is the number of encoder pulses per revolution (read from the encoder's data sheet),  
**Y** is the coupling factor; the number of encoder revolutions per meter of conveyor motion (calculated by the user). Multiply by 1 m/1000 mm (or divide by 1000 mm) to convert meters of motion to millimeters.

Example:

$$\begin{aligned} \text{Encoder resolution} &= X \times Y \times 1 \text{ m}/1000 \text{ mm} \\ &= 360 \text{ pulses/rev} \times 14.32 \text{ rev/m} \times 1 \text{ m}/1000 \text{ mm} \\ &= 5155.2 \text{ pulses/m} \times 1 \text{ m}/1000 \text{ mm} \end{aligned}$$

$$\text{Encoder resolution} = 5.1552 \text{ pulses per millimeter of conveyor motion}$$

An Encoder Resolution between 5–15 pulses per millimeter of conveyor motion provides adequate resolution for part conveyors that run smoothly at constant speeds. When marking very small objects or when part motion is variable, maintain mark quality by choosing an encoder with a higher PPR (pulses per revolution) output or increase the coupling factor so that the Encoder Resolution value is much larger.

Fenix Tracker's optically-isolated inputs have an electrical input frequency limitation of approximately 10 kHz. This means that the encoder's output (encoder pulses per revolution) and the coupling factor (encoder revolutions per meter of conveyor motion) should be chosen so that conveyor or line speed in mm/sec multiplied by the encoder's calculated pulses/mm of conveyor travel is less than 10,000. If line speed is set too fast, the message "Line speed too fast to finish" is displayed in the mark log file that appears on the right side of the Launcher (mark window) during a mark session.

Example:

The selected encoder provides 1000 pulses/rev and the coupling factor is determined to be 8 rev/meter of motion. Using the equation above, the calculated encoder resolution is 8 pulses/mm of conveyor motion. The required line speed is 144 ft/min (732 mm/s). Multiplying the line speed of 732 mm/s by the encoder's 8 pulses/mm of travel gives an input frequency of 5.856 kHz, which is within Tracker's frequency limit of 10 kHz.

Enter the calculated number of pulses per millimeter of motion in the Encoder Resolution field on WinMark Pro's *Tracking* tab.

If necessary, fine-tune encoder resolution using one of the *linestackXX.mkh* sample files included in the *WinMark* folder. These files consist of an array of 20 identical lines stacked on top each other. The last line marked is longer than the others and serves to indicate whether the actual encoder resolution is higher or lower than the currently entered Encoder Resolution.

# tracker

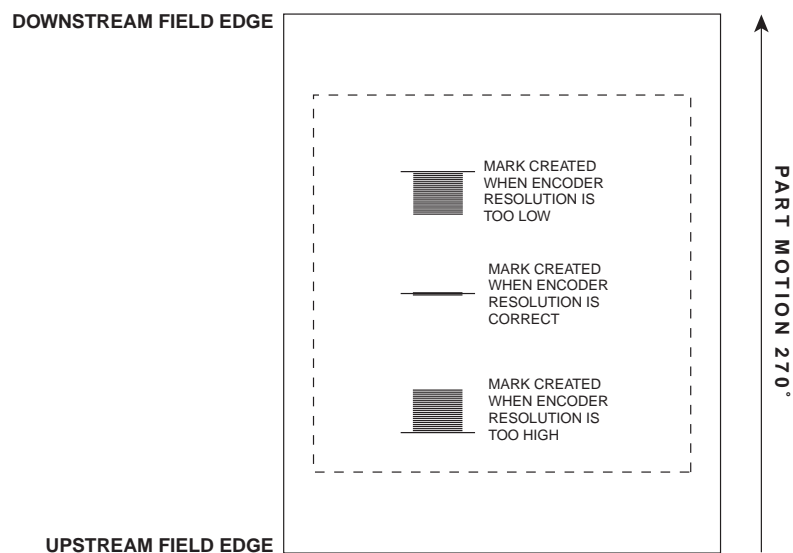
## Additional hardware

To fine-tune encoder resolution, follow the steps below:

- 1 In the *WinMark* folder, locate and open the appropriate *linestackXX.mkh* file where *XX* matches the lens installed on your marking head. For example, if a 200 mm focusing lens is installed, choose *linestack200.mkh*.
- 2 Click the *Marking* tab and set an appropriate *Power* for your test substrate.

**Note:** Your test substrate should be at the same height as the part to be marked. Minor differences in Z-axis adjustment (focal length) will affect performance as the mark may be too faint. Changing the Z-axis also affects the optimum Encoder Resolution value.

- 3 Ensure that all personnel in the area are wearing the appropriate protective eyewear.
- 4 Mark the file at the required line speed.
- 5 Examine the mark produced and compare with the drawing in Figure 3-19 below.



**Figure 3-19** Linestack mark

- 6 When Encoder Resolution is set accurately, the lines will appear as one long line. If the longer line is further downstream of the shorter lines, then increase Encoder Resolution. If the longer line is upstream of the shorter lines, then decrease resolution. Accuracy to the second decimal point may be required depending upon the resolution of your particular encoder.

# tracker

## Additional hardware

### Part sensor

A part sensor is required to send part position information to the Fenix Tracker. Any number of capacitive, inductive, photoelectric, or mechanical sensors currently on the market can be used depending on the part's material composition. Table 3-2 lists electrical specifications for choosing a part sensor.

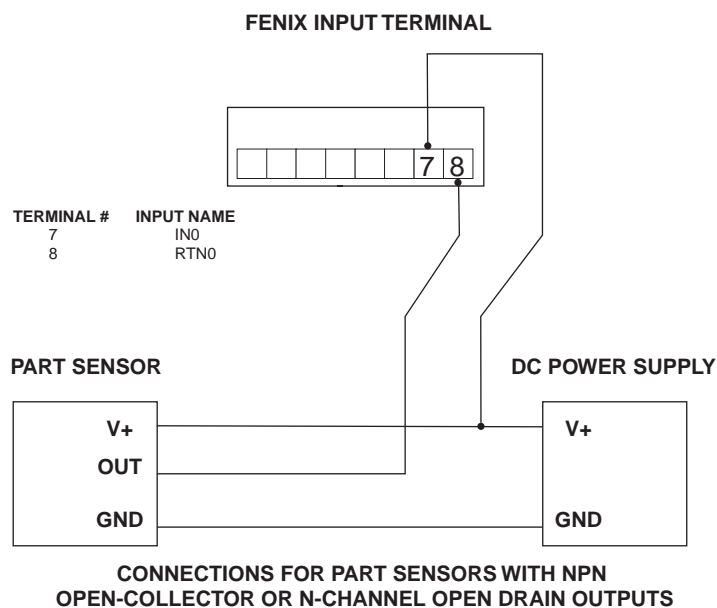
**Table 3-2** Part sensor specifications

Function	Specifications
Input Voltage	15.0–40.0 VDC
Output Signal	Open collector (PNP or NPN), open drain (P-channel or N-channel), or mechanical limit switch Low level output voltage: –0.6–5.0 VDC (0 V typ.) High level output voltage: 15.0–40.0 VDC (24 V typ.) On-state current: 15 mA minimum

### Part sensor connection

The part sensor output is connected directly to the Fenix Tracker's input terminal Input #0 (IN0). Fiber Link Controller Card (FLCC) inputs can not be used for tracking functions.

To connect the part sensor, refer to the appropriate connection diagram. Use Figure 3-20 for NPN open collector or N-channel open drain sensors. Use Figure 3-21 for PNP or P-channel sensors.

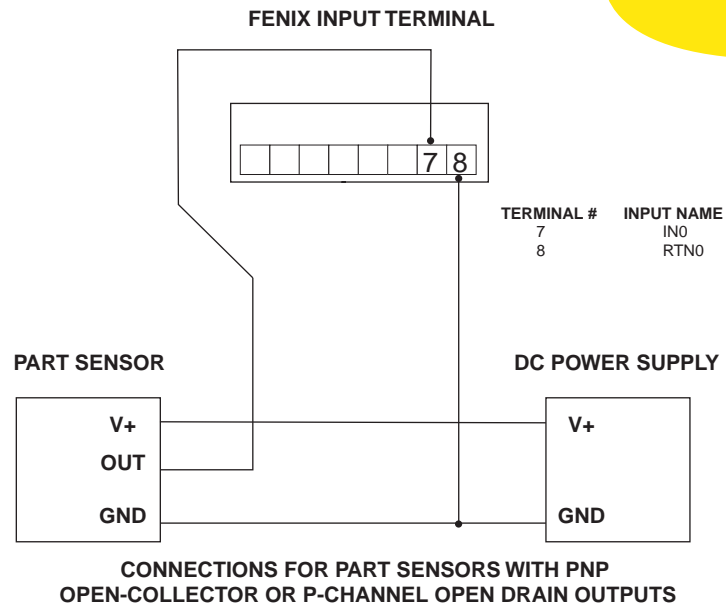


**Figure 3-20** Wiring diagram for NPN or N-channel sensors

# tracker

## Additional hardware

# 3



**Figure 3-21** Wiring diagram for PNP or P-channel sensors

Verify that field wiring is correct after all part sensor connections are complete. Locate and start Digital Scope (*DigScope.exe*) in the *WinMark* folder and then apply DC power to the sensor. If the part sensor is properly connected, Input #0 (IN0) should toggle only once when the part sensor activates.

**Note:** To prevent I/O conflicts, Digital Scope and WinMark Pro should never be open at the same time. Always close one application before opening the other.

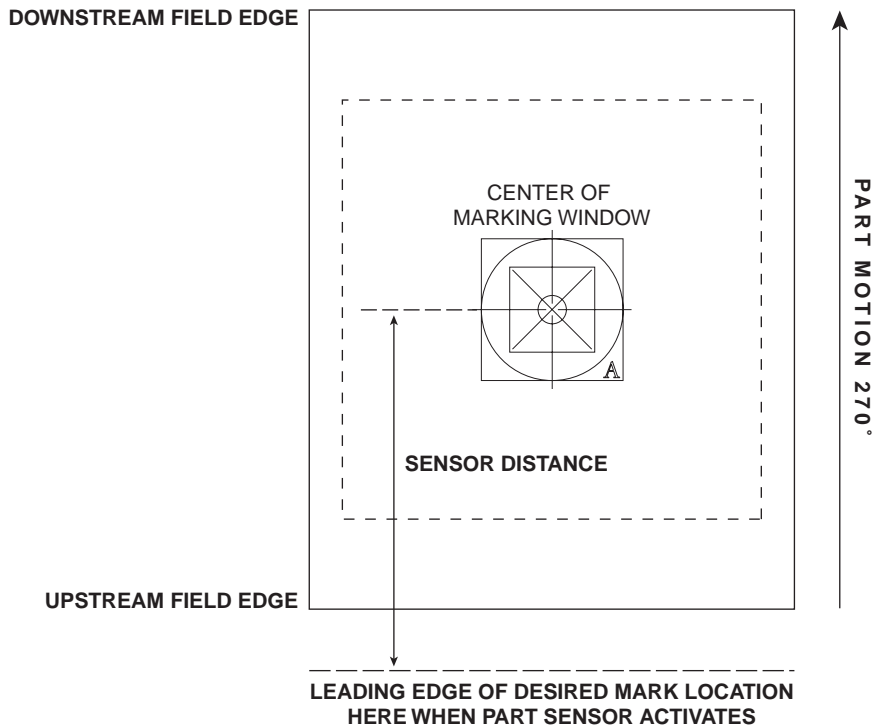
You may need to adjust the part sensor's optical sensitivity so that the sensor sends only a single output pulse for each individual part sense. Multiple part sense inputs for a single part causes Fenix to generate "Line speed too fast – missed start" errors. Mechanical or relay contact outputs may also provide part sense inputs, however the user must properly debounce the contacts to prevent multiple part sense inputs to the Fenix Tracker.

# tracker

## Additional hardware

### Part sensor setup

Set part sensor parameters by referring to Figure 3-22 and following the steps below:



**Figure 3-22** Part sensor setup

- 1 If you are using a photoelectric sensor, follow the manufacturer's instructions on selecting either a Light or Dark activation mode.
- 2 On WinMark's *Tracking* tab, click on Rising Edge Part Sense and select Yes. Ensure that your part sensor is configured to generate a rising edge output pulse.
- 3 Center a sheet of cardboard, anodized aluminum, or a scrap part on the conveyor under the focusing lens and press the *Test Mark* pushbutton on the Fenix Tracker.
- 4 Close WinMark Pro and open Digital Scope. Trigger the part sensor with the part to be marked and verify that IN0 toggles as the sensor is activated.
- 5 Measure the distance (at the instant the part sensor activates) from the center of the marking field indicated by the test mark target to the leading edge of the desired mark location on the part.
- 6 Enter this number in the Sensor Distance field on WinMark's *Tracking* tab.

## DC power supply

A DC power supply is required to power the part sensor and position encoder.

### Power supply specs

Table 3-3 lists electrical specifications for choosing a DC power supply.

**Table 3-3** Power supply specifications

<b>Function</b>	<b>Specifications</b>
Input Voltage	User determined
Output Voltage	Select output voltage based on encoder and part sensor requirements within the range of 15.0–40.0 VDC

# tracker

## Marking

The *Marking* section includes subsections:

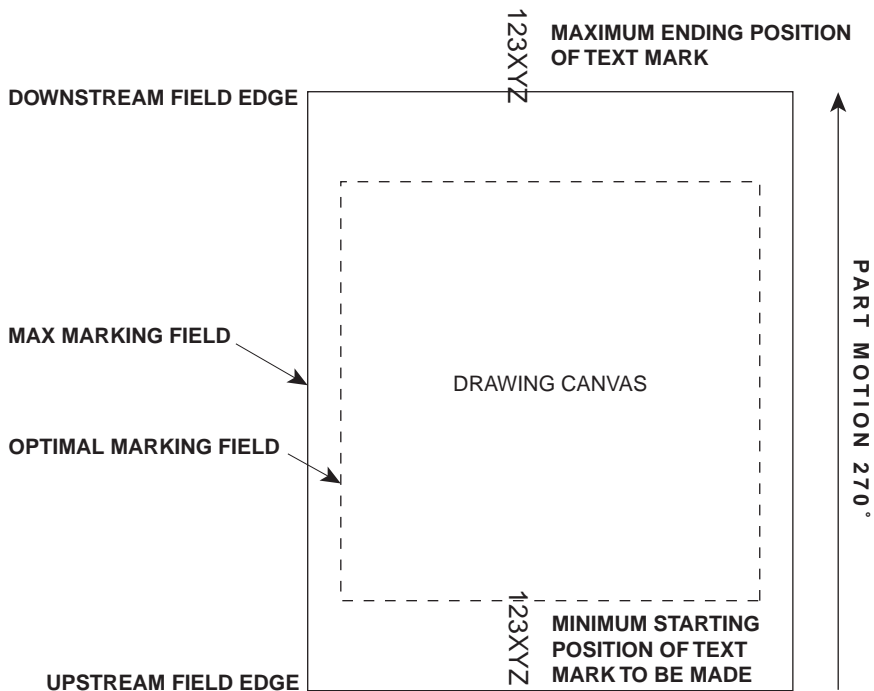
- Text
- Graphics
- Mark placement
- Optimization
- Summary

### Text

The best, and fastest, files to mark are those files containing only vector objects such as alphanumeric text using either a stroke font or an outlined TrueType font.

When marking a file containing only stroke text (such as “123XYZ”), Fenix Tracker starts marking only when the *Target Area* encompassing “123XYZ” is fully within the *Tracking Window*. Marking can continue up until the moment the last portion of text to be marked (the last part of the “Z”) exits the *Tracking Window*. Figure 3-23 illustrates placement of the text to be marked on the *Drawing Canvas*.

WinMark Pro marks text from left to right, just as you enter it in the *Text Caption Editor* dialog box; all the characters in line 1, followed by all the characters in line 2, etc. (refer back to Figure 3-8). When marking two or more lines of text, the *Mark* must not exit the *Tracking Window* before the last character on the *last* line, not the last character on the *first* line, is completed.



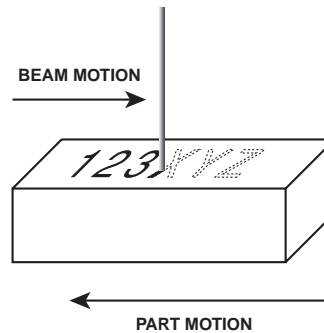
**Figure 3-23** Sample text mark

# tracker

## Marking

Because WinMark Pro marks text from left to right and top to bottom, use this feature to ensure that marking occurs at the fastest speed possible. To achieve optimum speeds, perform the following steps:

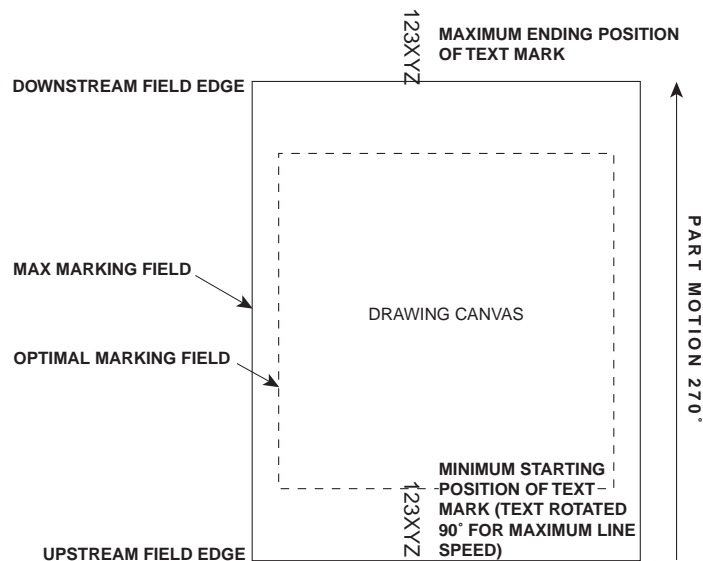
- 1 Orient either the text or the part to be marked as shown in Figure 3-24 so that the laser mark is made moving against, or counter to, the direction of part motion.



**Figure 3-24** Beam/mark motion

- 2 Position the mark on the *Drawing Canvas* so that the entire mark is placed near the upstream edge of the *Marking Window* (Figure 3-25).

**Note:** Because Sensor Distance must be greater than the X or Y “start mark” coordinate, you may need to move the physical placement of the part sensor to prevent an error when marking.



**Figure 3-25** Mark orientation

- 3 Begin marking at the desired speed. If line speed is set too fast, the message “Line speed too fast to finish” is displayed in the mark log (on the right side of the Launcher window). This error occurs when a *Target Area* containing any unmarked microvectors moves outside the *Tracking Window*.

# tracker

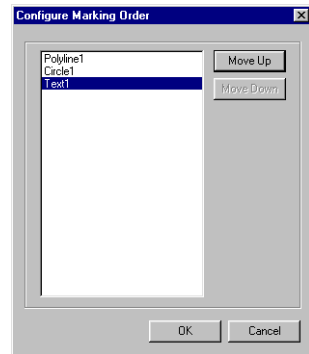
## Marking

## Graphics

The best graphics files to mark are simple drawings composed of unfilled vector-based artwork such as those created in drawing programs like AutoCAD®, Adobe® Illustrator®, CorelDRAW®, or Macromedia® Freehand™.

As with text objects, marking of graphic objects can continue up until the last portion of the object to be marked exits the *Tracking Window*. Be aware however, that starting points for objects such as circles and squares combined with the desired direction of part motion may not always allow the graphic to move outside the *Tracking Window* before marking is complete.

To optimize marking of files containing both text and graphics, set the mark order so that all graphic objects mark before any text objects. In WinMark, go to the *Objects* menu and click *Set Marking Order*. When the *Configure Marking Order* dialog box appears (Figure 3-26), arrange drawing objects as required.



**Figure 3-26** Configure Marking Order dialog box

**Note:** Bar codes, filled TrueType text, imported bitmap images, or other filled objects created in WinMark Pro are marked using a slower raster scanning method. These raster objects may not be appropriate for Fenix Tracker’s high-speed “on-the-fly” marking. Although 2D codes are also bitmap (raster scanned) objects, WinMark Pro versions 2.0.0.3087 and above support a “fast” spot-style 2D code. This “fast” code, created by marking very small unfilled vector circles, is a viable option for marking 2D codes with Fenix Tracker.

## Mark placement

To move the position of marking *along* the axis of part movement and achieve the highest potential line speed, position the mark near the upstream field edge of the *Marking Window* and then adjust *Sensor Distance* on WinMark’s *Tracking* tab to position the actual mark on the part.

To relocate the mark *across* the axis of part motion, select all mark objects on the *Drawing Canvas* and use your mouse or arrow keys to move the objects perpendicular to part motion.

**Note:** When positioning objects on the *Drawing Canvas*, never place any object beyond the edges of the maximum *Marking Window*.

## Optimization

### Tracking variables

There are several variables related to the *Tracking Window* that can be optimized to increase marking throughput:

- Lengthen *Usable Field Size* by reducing *Mark* size.
- Rotate the *Mark* (as shown in Figure 3-7).
- If the *Tracking Window* is smaller than *Usable Field Size*, increase the *Mark Pitch* so that it is equal to, or greater than, the *Usable Field Size*. If this is not possible then consider adding a second marking head so that each head marks every other part, which effectively doubles *Mark Pitch*.

### WinMark Pro property variables

Cycle times of mark files are usually optimized, even in Index applications, to obtain the highest throughput speeds. To increase Tracking lines speeds try the following:

- Increase Velocity and reduce Resolution.
- Increase Off Vector Velocity and reduce Off Vector Resolution.
- Use stroke text instead of TrueType fonts.
- When marking 2D codes, set 2D Barcode Bitmap (on the *Format* tab) to *No* and set Spot Marking Style (on the *Marking* tab) to *Yes*.
- Simplify line art.
- If possible, reduce the number of marking characters.
- Run WinMark Pro on a faster computer.

## Summary

Line speed calculations do not take into account the differences in computer speeds (for instance, if the mark's *Cycle Time* is optimized on a different computer system than the one running the actual marking application), or the time required for other automation processes (such as motion controllers or automation software) to complete their respective tasks between each mark. These factors must be accounted for when determining the actual throughput of your production line. As with any factory automation proposal, proof-of-concept testing is highly recommended.

# tracker 3

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# technical reference

Use information in this section as a technical reference for Fenix.

This sections contains the following information:

- Fenix technical overview – briefly describes SYNRAD’s Fenix technology.
- Upgrading firmware – describes how to upgrade the firmware in your Fenix.
- Custom test mark feature – explains how to implement the custom test mark feature using your Fenix Laser Marker and WinMark Pro.
- Auxiliary Signal connections – provides Auxiliary Signal pin locations and signal descriptions.
- Marking automation – explains how to interface Fenix to parts handling equipment.
- Fiber Link Controller Card features – describes the FLCC’s Fast Acting Safety Interlock function and illustrates DIP switch settings.
- General specifications – lists Fenix Laser Marker specifications.
- Fenix package outline – illustrates Fenix package outline and mounting dimensions.

# technical reference

## Fenix technical overview

The *Fenix technical overview* section includes subsections:

- Laser
- Control circuitry
- Fenix marking head
- Lens specifications

### Laser

At the heart of Fenix™ is a SYNRAD model 48-2 laser; a small but powerful 25 W laser based on SYNRAD's patented RF-excited, sealed CO<sub>2</sub> technology.

The laser's plasma tube consists of 2-inch square cross-section extruded aluminum tubing with welded end caps. A center extrusion within the tube creates a square bore region where the RF drive voltage causes the plasma to form. The tube's bore size, in conjunction with the mirror curvature, limits the output beam to TEM<sub>00</sub> modes when the optical resonator's curved total reflector and flat zinc selenide (ZnSe) output coupler are properly aligned. A CO<sub>2</sub> gas mixture provides an output wavelength at or near 10.6 μm (10.57 to 10.63 μm). Heat generated by the excited CO<sub>2</sub> molecules is transferred to the bore walls and then to the envelope by diffusion. Two variable-speed cooling fans provide sufficient cooling, which eliminates the need for expensive chillers.

A patented single MOSFET transistor power oscillator in a tuned feedback circuit provides RF power for the laser. From a 30 VDC input, the RF driver generates a striking voltage of over 500 V peak-to-peak to the discharge electrodes. The RF Drive module is shielded by integrating it and the plasma tube into a single assembly, eliminating the potential for interference with authorized communication services.

### Control circuitry

WinMark software sends commands to Fenix's control circuitry through a digital fiber optic link. Once received by the CPU board, these software commands are interpreted and sent to the proper control element. Digital power commands are converted into a 20 kHz pulse width modulated (PWM) Command signal sent to the laser. Position commands are digitally corrected to compensate for the optical properties of the head and then converted to analog signals that drive the galvanometer scanners. Position control of the galvanometers is maintained by analog servo electronics, which provide closed-loop feedback and control.

### Fenix marking head

The purpose of Fenix's marking head is to position and focus the laser beam onto the marking surface. This process begins as the laser's output beam enters the Fenix head through an expansion telescope. The beam is collimated and then deflected onto two lightweight X and Y mirrors mounted on separate high-speed galvanometer scanners. After being positioned by the mirrors, the beam is directed out through the focusing lens onto the marking surface. This focusing design, where the beam is focused after the steering optics, is called post-objective focus. The advantage of post-objective focus is that a flat-field lens can be used to achieve final focus. Flat-field lenses provide excellent mark quality because the focused spot is located in the same horizontal plane over the entire marking field.

# technical reference

## Fenix technical overview

### Lens specifications

To accommodate customers who need a slightly larger marking field at the same working distance, Fenix lenses are able to mark images beyond the standard field specification. Table 4-1 lists nominal and maximum field size, working distance, focused spot size, and depth of field specifications for Fenix lenses. This larger field can be seen in WinMark where the center area on the *Drawing Canvas* denotes the nominal mark area for the currently selected focusing lens. The outer border (shaded yellow) indicates the maximum marking field for that lens. Mark objects placed in the yellow shaded area, especially those objects placed near the outer corners, may exhibit a slight degradation in mark quality.

**Table 4-1** Lens specifications

<b>Lens Focal Length</b>	<b>Nominal Field H x W, mm</b>	<b>Max. Field H x W, mm</b>	<b>Working Distance* typical, mm</b>	<b>Spot Size (1/e<sup>2</sup>), μm</b>	<b>Depth of Field, mm</b>
370 mm	198 × 198 (7.8" × 7.8")	241.0 × 297.0 (9.5" × 11.7")	350 ± 5 (13.78")	540 (0.021")	± 10 (±0.394")
200 mm	110 × 110 (4.3" × 4.3")	134.0 × 165.0 (5.3" × 6.5")	190 ± 3 (7.48")	290 (0.011")	± 2.5 (±0.098")
125 mm	74 × 74 (2.9" × 2.9")	85.7 × 105.6 (3.4" × 4.2")	128 ± 2 (5.04")	180 (0.007")	± 1.5 (±0.059")
80 mm	27 × 27 (1.1" × 1.1")	33.5 × 41.2 (1.3" × 1.6")	74 ± 1 (2.91")	116 (0.005")	± 0.4 (±0.016")

\* for lenses with 19 mm (0.75") high lens mounts. The typical working distance is marked on each lens mount. Consult your marking head's final test report for the actual working distance.

# technical reference

## Upgrading firmware

The *Upgrading firmware* section includes subsections:

- Using WinMark Pro v4
- Using MarkLink.exe

The firmware in your Fenix Laser Marker is designed to be field-upgradeable\*. Upgrade Fenix firmware using either WinMark Pro version 4 or by using *MarkLink.exe* as described below.

**Note:** If you decide to reverse the firmware upgrade, you can do so by pressing and holding the *Test Mark* pushbutton while applying power to the Fenix Laser Marker. This causes the marking head to clear out the field upgrade and restart using the original factory-loaded firmware.

## Using WinMark Pro v4

To upgrade Fenix firmware using WinMark Pro version 4, perform the following steps:

- 1 Ensure that Fenix is powered up and is connected to the marking computer.
- 2 Open WinMark Pro and check that the digital fiber optic link is communicating with Fenix. Click the *Help\About Synrad WinMark ... \Head Info* button to check marking head status. The correct Head Type, Lens, and Firmware version should be displayed. Continue with the update only if your firmware version is 7 or greater.
- 3 From the *Help* menu, click *About Synrad WinMark ...*, and press the **Update F/W** button. A dialog box opens asking you to initiate the firmware update. Press **OK**.
- 4 In the *Open* dialog box, navigate to the *C:\Program Files\WinMark* folder, select the desired “*Update\_××.asc*” firmware file, where ×× is the firmware version, and press **Open**.
- 5 After downloading the new firmware file, remove power from Fenix, wait a few seconds, and then power up again to begin operation with the new firmware.

## Using MarkLink.exe

Prior to version 4, MarkLink was placed in the *WinMark* folder during installation. To upgrade Fenix firmware using WinMark Pro v2.1.X or v3.1.X with ISA-bus FLCCs, perform the following steps:

- 1 Ensure that Fenix is powered up and is connected to the marking computer.
- 2 Open WinMark Pro and check that it is communicating with the head. Click the *Help\About Synrad WinMark ... \Head Info* button to check head status. The correct Head Type, Lens, and Firmware version should be displayed. Update firmware only if the version number is 7 or greater.
- 3 Close WinMark and use Windows Explorer to open *MarkLink.exe* in *C:\Program Files\WinMark*.
- 4 Start *MarkLink.exe* and choose the **CODE DOWNLOAD** option when the dialog box opens.
- 5 Click the *Open File* tool and select the correct upgrade file. Files are formatted as “*Update\_××.asc*”, where ×× is the firmware version. MarkLink will download the selected file and indicate success.
- 6 Power down Fenix, wait a few seconds, and then reapply power to restart the new firmware. Open WinMark and click the **Head Info** button. It will display the upgraded firmware version.

\* Fenix Laser Markers running firmware version 7 or higher.

# technical reference

## Custom test mark feature

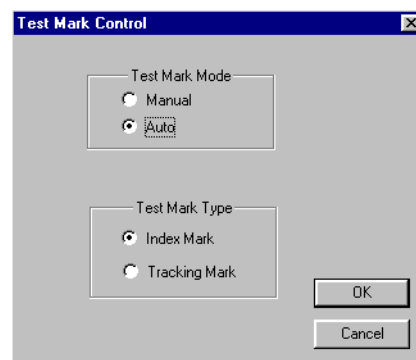
The *Custom test mark feature* section includes subsections:

- Overview
- Test Mark Control options
- Creating a custom test mark
- Setting Test Mark Control options
- Downloading a custom test mark file
- Custom test mark I/O

### Overview

Customers using Fenix Laser Markers (with firmware version 7 or higher) have the ability to download a custom test mark to their Fenix or Fenix Tracker. Like the standard test pattern shown in Figure 2-5 in the “Operation” section, a custom test mark downloaded into Fenix’s non-volatile memory is marked each time the *Test Mark* pushbutton is pressed. However, unlike the standard test pattern, the custom test mark command allows operators to: (1) create a custom mark file with specific object properties; (2) mark the custom test mark as an Index or Tracker mark; or (3) perform stand-alone Index or Tracker marking of the custom test mark without a computer connected to Fenix.

Access the custom test mark command in WinMark Pro by clicking *Tools* and then click *Custom Test Mark...* The *Test Mark Control* dialog box (shown in Figure 4-1) opens.



**Figure 4-1** Test Mark Control dialog box

**Note:** If Fenix is powered up and connected to your computer and *Custom Test Mark...* appears dimmed under the *Tools* menu, then under *Help*, click *About Synrad WinMark...* and then click *Head Info*. Custom test marking is supported if the Fenix *Firmware* version is 7.0 or greater, WinMark Pro version 2.0.0.3019 or greater is used, and the Fiber Link Controller Card firmware is 6.0 or greater.

# technical reference

## Custom test mark feature

### Test Mark Control options

The custom test mark feature is controlled by selecting one of two *Test Mark Modes* and one of two *Test Mark Types*. Each control option is described below.

#### Test Mark Mode

*Test Mark Mode* determines how the custom test mark is initiated. The options, *Manual* and *Auto*, are described below.

##### Manual

In *Manual Test Mark Mode*, the custom test mark simply replaces the factory default test pattern in memory. In this mode, the custom test mark is always marked as a static (Index) mark, firing only when the *Test Mark* pushbutton is pressed.

##### Auto

In *Auto Test Mark Mode*, the custom test mark replaces the factory test pattern in memory. Depending upon the setting of *Test Mark Type*, the stored custom test mark fires as an Index or Tracker mark when an input signal is sensed on input #0 (IN0).

#### Test Mark Type

*Test Mark Type* determines whether the custom test mark is marked as an Index or Tracker mark. *Test Mark Type* options, *Index Mark* and *Tracking Mark*, are described below. If *Manual Test Mark Mode* is selected, then *Test Mark Type* options do not apply and appear dimmed.

##### Index Mark

If *Test Mark Mode* is set to *Auto* and *Test Mark Type* is set to *Index* then a static custom test mark fires when the *Test Mark* pushbutton is pressed or when the rising edge of an input signal is detected on input #0 (IN0). *Index Mark* provides the ability to load a custom test mark file, disconnect the fiber optic cable and computer, and then automatically mark an Index file each time input #0 (IN0) goes active.

##### Tracking Mark

If *Test Mark Mode* is set to *Auto* and *Test Mark Type* is set to *Tracking* then a tracking custom test mark fires when an input (part sensor) signal is detected on input #0 (IN0), after encoder pulses satisfy the required *Sensor Distance*. When the *Test Mark* pushbutton is pressed, Fenix Tracker fires a static (Index) mark. *Tracking Mark* provides the ability to load a custom test mark file, disconnect the fiber optic cable and computer, and then automatically mark a tracking file each time a part moves through the marking field.

**Note:** The *Tracking Mark* option appears dimmed when WinMark Pro senses it is communicating with a standard Fenix Laser Marker.

# technical reference

## Custom test mark feature

### Creating a custom test mark

Use WinMark Pro to develop a custom test mark the same way you would create any other mark file for the appropriate Index or Tracker marking style. Create a drawing with properly positioned text or graphic objects and then set object properties such as Velocity, Power, Resolution, etc.

File size for custom test marks is limited by Fenix's non-volatile memory space. For example, the default test pattern (see Figure 2-5 in the "Operation" section) fills approximately half of the available memory. When a custom test mark file is too large to download, WinMark displays "The selected mark drawing does not fit in Test Mark Memory". If this happens, try the following options to reduce file size:

- A Reduce the Off Vector Resolution of mark objects in the drawing. Resolutions of 50–100 dpi are sufficient to obtain a quality mark.
- B Reduce the Resolution of mark objects. 300 dpi is adequate for most marking. For graphics with only horizontal or vertical straight lines (not diagonals), 100 dpi is sufficient.
- C Refine the mark. Use stroke text instead of TrueType fonts, mark fewer words, or simplify line art.

**Note:** Because it is a downloaded file stored in memory, a custom test mark file cannot perform serialization, real-time date and time stamp coding, Input/Output, or other automation functions as it could if run in WinMark Pro.

### Setting Test Mark Control options

Creation of a custom test mark can be done offline, but to set custom test mark options Fenix must be connected and communicating to a computer running WinMark Pro.

To setup custom test mark options, perform the following steps:

- 1 Open or create the desired file to be downloaded as a custom test mark.
- 2 From the *Tools* menu, click Custom Test Mark.... The *Test Mark Control* dialog box (Figure 4-1) opens.

**Note:** If your Fenix is already programmed with an Index or Tracker *Auto Test Mark*, then a dialog box appears indicating that auto test marking has been disabled. This prevents an input signal from commanding Fenix to mark while a new custom test mark file is being downloaded to memory.

- 3 Under *Test Mark Mode*, click *Manual* or *Auto*.
- 4 If *Auto Test Mark Mode* is selected, then under *Test Mark Type* choose *Index Mark* or *Tracking Mark*. The *Tracking Mark* option appears dimmed if the Fenix is not a Tracker model.

The type of mark selected should match the current marking method (Index or Tracking). If the *Test Mark Type* choice is not compatible with the currently selected marking mode, a dialog box reminds you to turn Track Marking Object (on the Drawing's *Tracking* tab) On or Off. After setting the desired marking mode, return to *Tools* and click Custom Test Mark... to reopen the *Test Mark Control* dialog box.

# technical reference

## Custom test mark feature

### Downloading a custom test mark file

- 1 Under *Tools*, click *Custom Test Mark...* and when the *Test Mark Control* dialog box opens, verify that the correct *Test Mark Mode* options are selected.

**Note:** The default *Test Mark Mode* is *Manual*. To enable *Auto Test Mark Mode* you must select the *Auto* option each time the *Test Mark Control* dialog box opens.

- 2 Click **OK** to download the currently active WinMark file to Fenix memory.
- 3 After file transfer is complete, a dialog box confirms a successful download.
- 4 If the data transmission fails, click **OK** to acknowledge the failure and then repeat Steps 1–3. If the custom test mark feature appears dimmed after a data transmission failure, then under *Help*, click *About Synrad WinMark...* and then click **Head Info**. After closing the dialog boxes, return to the *Tools* menu. The custom test mark command should be available.

Fenix memory can contain only one custom test mark at a time, but a new mark file can be downloaded at any time. A copy of the factory installed test pattern (*FactoryTestMark1.mkh*) is provided in the *Program Files\WinMark* folder so that the default test mark file can be reloaded into memory as required for lens testing or mark centering.

## Custom test mark I/O

It is possible for the Fenix Laser Marker to set or clear outputs (OUT4–OUT7) when marking a custom test mark. This output capability is only available when using *SetDigitalState* commands in WinMark Pro's Event Builder. Event Builder functions are available during these stages of the Automation loop:

On Before Mark Session – On Before Mark Piece – On After Mark Piece – On After Mark Session

Remember that in WinMark Pro's Automation loop, On Before Mark Session and On After Mark Session events run only once before/after a marking session while On Before Mark Piece and On After Mark Piece events run before/after each individual piece. In a custom test mark application however, each individual mark is considered a mark session meaning that On Before Mark Session / On After Mark Session events are run for each piece that is marked.

It is not possible for a custom test mark to perform non-Event Builder output functions (Set Digital Before Session, Set Digital Before Mark, or Set Digital After Mark) or to perform any type of input automation. Input signals are sensed in only three cases: (1) for the Fast Acting Safety Interlock (FASI) where input #3, IN3, must be active; (2) for Index marks where IN0, the part sensor input, is expected when *Test Mark Mode* is set to *Auto*; or (3) for Tracking where IN0 is the part sensor input and IN1/IN2 are position inputs from the rotary encoder.

### **Warning**

possible  
personal  
injury

Fenix or FLCC outputs may be set or cleared during a custom test mark download when the mark file contains Event Builder automation. The user must take steps to assure that this behavior does not compromise the integrity of the control system.

# technical reference

## Auxiliary Signal connections

Auxiliary Signal terminals located on the Fenix rear panel allow you to connect a remote keyswitch, *Lase*, or *Ready* indicators to a remote operator's station. Terminals are also provided to connect a *Remote Interlock*, a safety switch normally used to interlock equipment doors or panels. The *Auxiliary Signal* connector is shown in Figure 4-2. Signal descriptions are provided in Table 4-2.

Auxiliary Signal field wiring is connected to a removable-style terminal block. If Fenix must be moved or serviced, the terminal block can be pulled out of its mating socket without disconnecting external wiring.

**Note:** If a remote keyswitch circuit is not connected to the RMT KEY terminals (pins 1 and 2), then a shorting jumper must be installed between the terminals in order to operate Fenix. When connecting field wiring for a remote keyswitch, remove the jumper from the terminal block.

**Note:** If a remote interlock circuit is not connected to the RMT INT terminals (pins 7 and 8), then a shorting jumper must be installed between the terminals in order to operate Fenix. When connecting field wiring for a *Remote Interlock*, remove the jumper from the terminal block.

### Caution

possible  
equipment  
damage

Do not ground Remote Keyswitch (RMT KEY) or Remote Interlock (REM INT) terminals. Damage to internal Fenix circuitry will result. Any external circuit connected to these terminals must be floating with respect to ground.

Because the current-carrying capability of these terminals is negligible (50 mA max. @ 30 VDC), "dry circuit", zero voltage, switch or relay contact circuitry is recommended when connecting to REM KEY or REM INT terminals

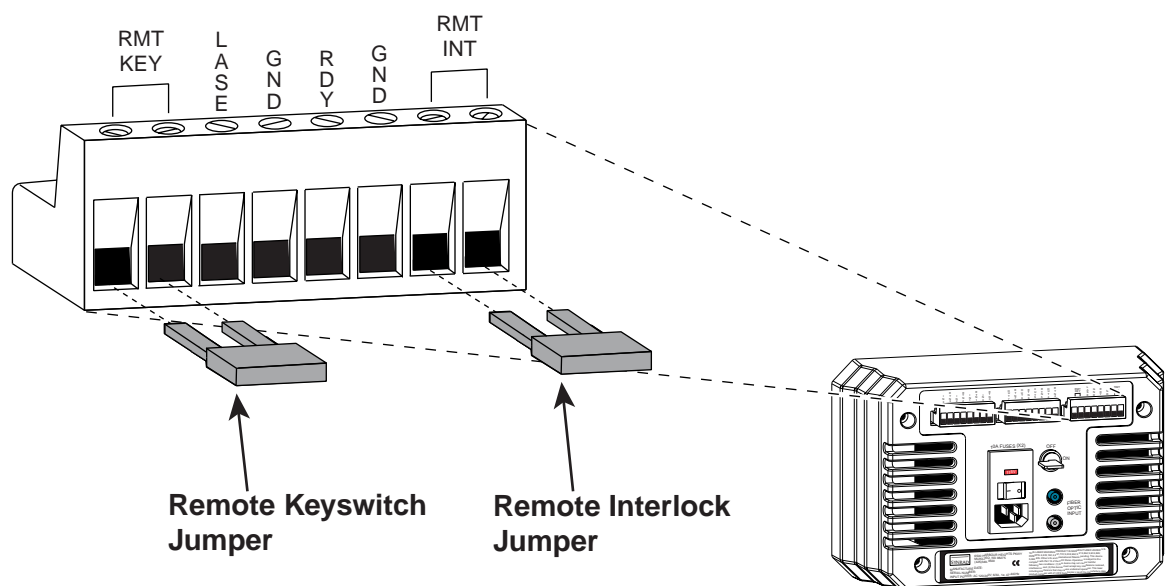


Figure 4-2 Auxiliary Signal connector

# technical reference

## Auxiliary Signal connections

Table 4-2 Auxiliary Signal descriptions

Terminal #	Description
1	RMT KEY  Remote Keyswitch Input – input point for connecting a remote relay or remote keyswitch in series with the Fenix keyswitch. Close a switch or contact wired between terminals 1 and 2 to remotely switch Fenix “On”; open terminals 1 and 2 to switch Fenix “Off” or to reset faults. If not wired to a remote keyswitch, terminals 1 and 2 must be jumpered. See note 1.
2	RMT KEY  Remote Keyswitch Output – output point for connecting a remote relay or remote keyswitch in series with the Fenix keyswitch. Terminal 2 is at DC line potential (+30 VDC) when the keyswitch is on. If not wired to a remote keyswitch, terminals 1 and 2 must be jumpered. This output is not individually current-limited or fused. If used as a voltage source, this output must be externally limited to less than 50 mA. See note 1.
3	LASE  Remote Lase Indicator – current-limited output signal for direct connection to the anode of a remote LED or LED-input optoisolator. The Lase signal is not a steady DC signal, but is a Pulse Width Modulated (PWM) signal that varies the apparent intensity of the indicator in proportion to optical output power. See note 2.
4	GND  Remote Lase Indicator Ground/Return – connection point for the cathode of a remote LED or LED input optoisolator.
5	RDY  Remote Ready Indicator – current- and voltage-limited output signal for direct connection to the anode of a remote LED or LED-input optoisolator. See note 3.
6	GND  Remote Ready Indicator Ground/Return – connection point for the cathode of a remote LED or LED input optoisolator.
7	RMT INT  Remote Interlock Input – input connection to disable Fenix when a safety interlock switch on an equipment door or panel is opened. An open switch between terminals 7 and 8 disables Fenix. If not wired to a remote interlock switch, terminals 7 and 8 must be jumpered. See note 1.
8	RMT INT  Remote Interlock Ground/Return – connection for the return path of remote safety interlocks. If not wired to a remote interlock switch, terminals 7 and 8 must be jumpered.

- (1) “Dry-circuit” external switches are recommended because current into *Remote Interlock* or debounced remote keyswitch terminals is negligible (50 mA @ 30 VDC).
- (2) PWM (30 VDC, 14 mA max.) output signal. Voltage level depends on the external load connected across terminals 3 and 4. This external load forms a voltage divider with an internal 2.2 K-ohm current-limiting resistor.
- (3) Current is limited to 20 mA, 3.3 VDC max.

# technical reference

## Marking automation



The *Marking automation* section includes subsections:

- Connecting to parts handling equipment
- Digital input circuitry
- Digital output circuitry

### Connecting to parts handling equipment

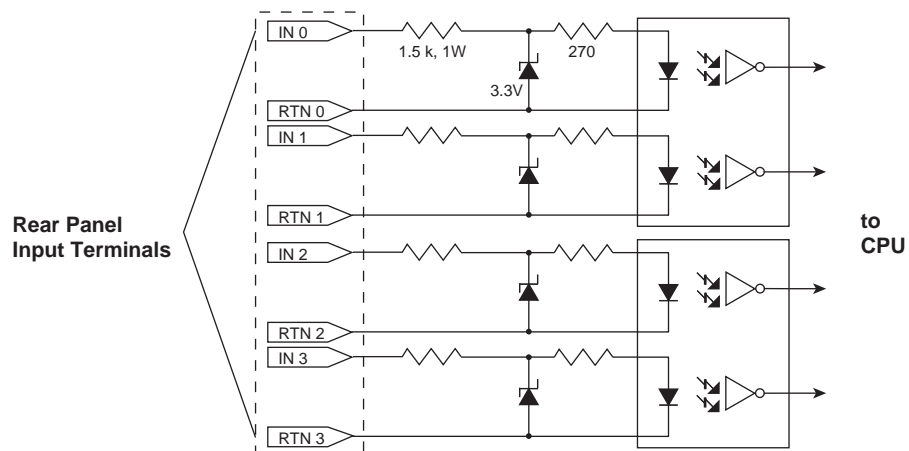
Fenix incorporates four input and four output circuits, each with a dedicated ground, that can be used to automate marking operation electronically in conjunction with WinMark Pro marking software.

A simple system utilizing Fenix digital I/O and WinMark Pro to control marking might operate like this: A conveyor stops with a new part positioned under Fenix and then delivers a “start mark” signal to a Fenix input. WinMark Pro software recognizes the input transition and marks the part. On completion of the mark, WinMark Pro commands Fenix to activate an output signaling “mark complete”, which starts the conveyor again. After the “mark complete” signal, WinMark Pro waits for the next “start mark” signal. The digital I/O capability of Fenix and the automation features of WinMark Pro enable this kind of process control.

Input and output field wiring is connected to removable-style terminal blocks; if Fenix must be moved or serviced, each terminal block can be pulled out of its mating socket without disconnecting external field wiring.

### Digital input circuitry

Figure 4-3 shows Fenix’s optically-isolated input circuitry.



**Figure 4-3** Input circuit

# technical reference

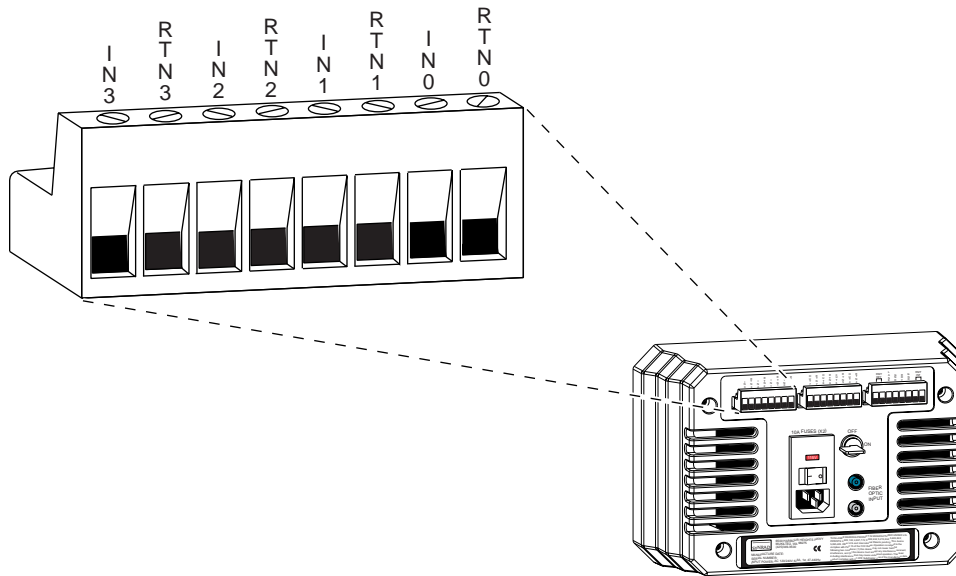
## Marking automation

Table 4-3 provides electrical signal parameters for inputs sent to Fenix.

**Table 4-3** Input signal parameters

Input Parameter	Min	Typ	Max
$V_{IL}$ – Low level input voltage	-0.6 V	0.0 V	5.0 V
$V_{IH}$ – High level input voltage	15.0 V	24.0 V	40.0 V
$I_F$ – LED forward current			26 mA @ 40 VDC 15 mA @ 24 VDC

Figure 4-4 shows the physical layout of Fenix's optically-isolated input terminals.



**Figure 4-4** Input terminal pinouts

**Note:** When the Fast Acting Safety Interlock (FASI) function is enabled, IN3 requires a high level input signal before the laser will fire. See page 4-16 for additional information on FASI.

## Sample input circuits

Optically-isolated Fenix inputs can be used to start a marking operation or perform other automation tasks. When an external device sinks current through an input, WinMark Pro software senses a “1”; when no current flows through the input, WinMark Pro senses a “0”.

Fenix inputs are designed to be compatible with standard industrial control circuit voltages and cannot be operated from 5 V TTL or CMOS logic signals. However Fenix inputs can be activated by a 5 V logic IC with open collector or open drain output as shown in Figure 4-5.

# technical reference

## Marking automation

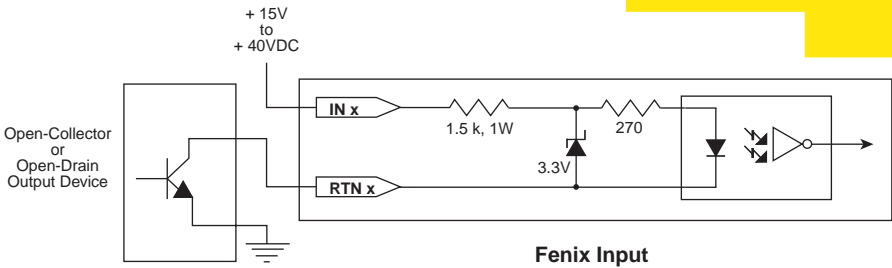


Figure 4-5 5 V logic IC input

Another common requirement in marking applications is for an operator to initiate each mark operation by closing a foot-operated switch. Figure 4-6 illustrates a simple input circuit for using a foot switch or relay contact to send an input signal to Fenix.

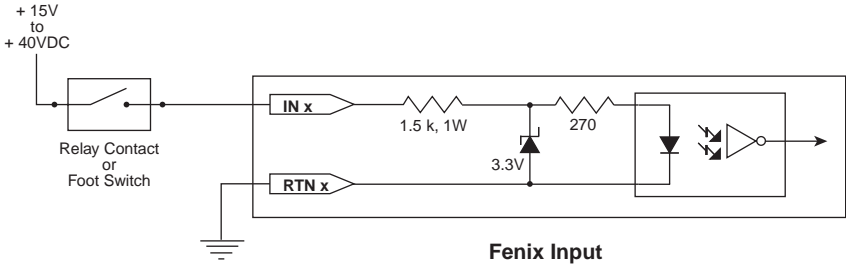


Figure 4-6 Relay or foot switch input

## Digital output circuitry

Digital outputs are designed to operate small relays or toggle inputs on parts handling equipment. Figure 4-7 shows Fenix's optically-isolated output circuitry.

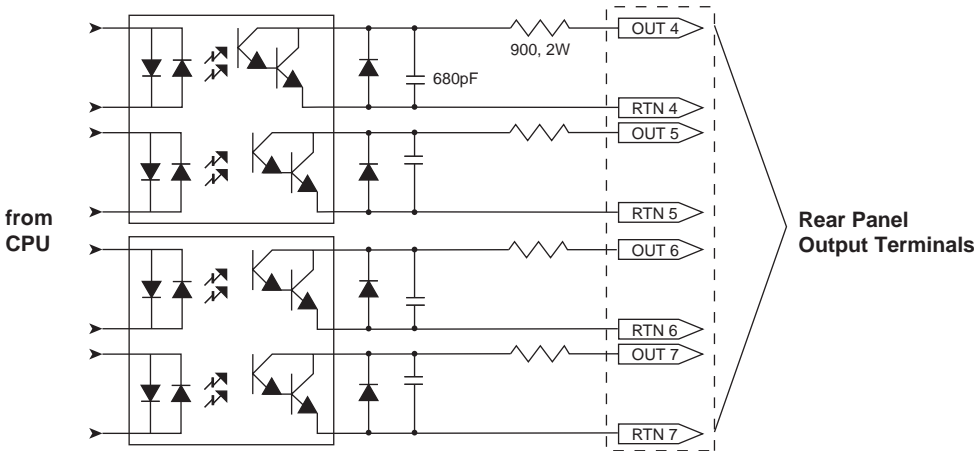


Figure 4-7 Output circuit

# technical reference

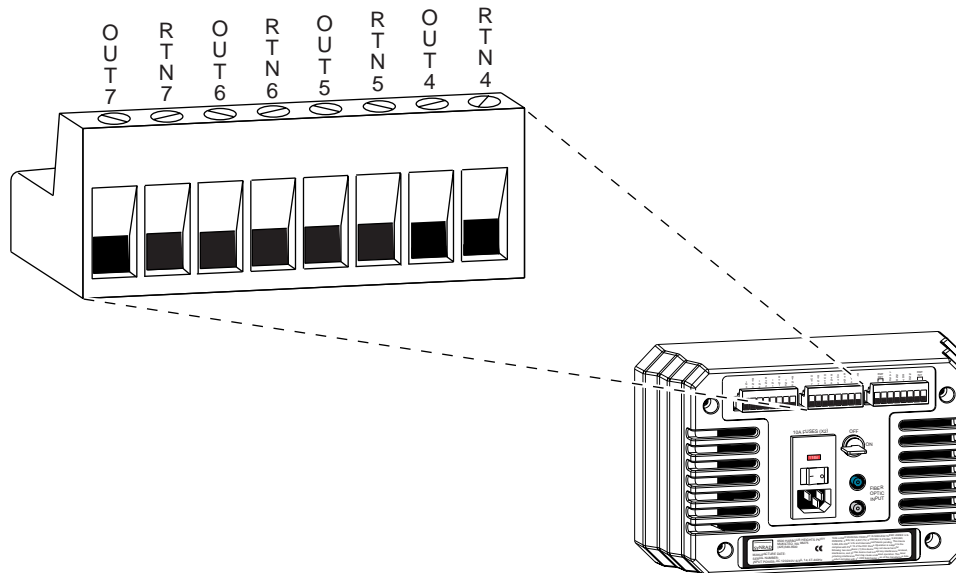
## Marking automation

Table 4-4 provides electrical signal parameters for Fenix outputs.

**Table 4-4** Output signal parameters

Output Parameter	Max
Sinking Current	40 mA
Darlington Breakdown Voltage	40 VDC
Darlington $V_{CE_{SAT}}$	1.0 VDC

Figure 4-8 shows the physical layout of Fenix's optically-isolated output terminals.



**Figure 4-8** Output terminal pinouts

### Sample output circuits

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

**Note:** When configuring your marking software, a “1” written to an output bit turns ON the output phototransistor. A “0” written to an output bit turns OFF the output phototransistor.

Figure 4-9 illustrates a simple output connection. In this configuration, the Fenix output is sinking current. When sizing  $V_{DC}$ , remember to account for the voltage drop across Fenix's 900-ohm output resistor.

# technical reference

## Marking automation

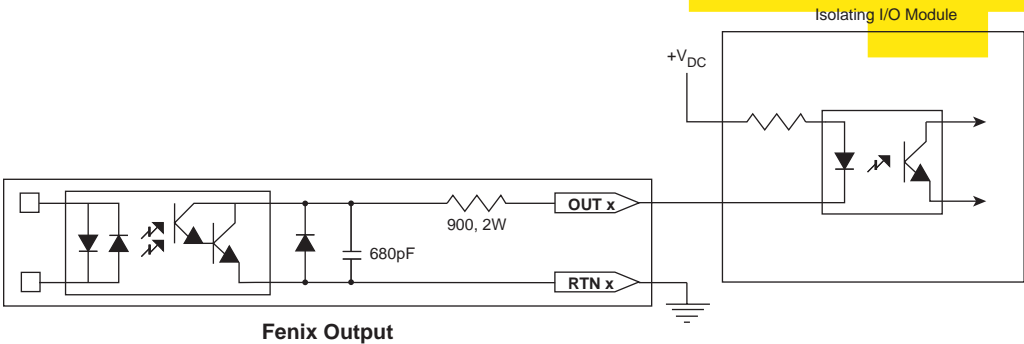


Figure 4-9 Output to isolated I/O module

Figure 4-10 illustrates a simple driver for a small signal relay. When the output from Fenix is ON, the relay is energized; the diode serves to clamp the inductive kick from the relay coil. Relay contacts can be used to drive higher current devices such as warning lights. Selection of the relay coil's operating voltage must account for the voltage drop across Fenix's 900-ohm output resistor.

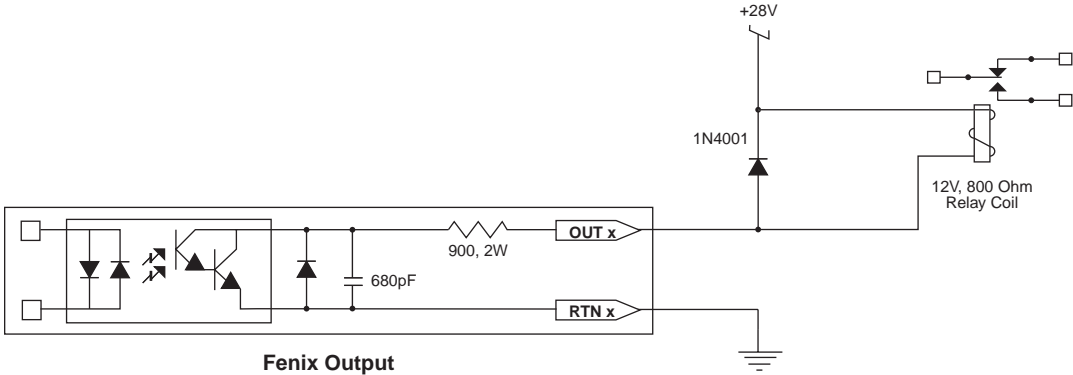


Figure 4-10 Output to relay driver

Figure 4-11 shows a simple logic interface circuit. When the Fenix output is ON, the logic input is High.

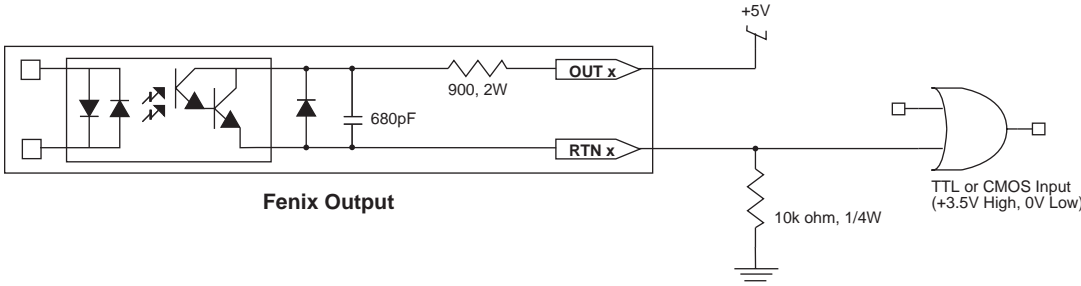


Figure 4-11 Output to TTL or CMOS logic interface

# technical reference

## Fiber Link Controller Card features

The *Fiber Link Controller Card features* section includes subsections:

- Fast Acting Safety Interlock (FASI)
- DIP switch settings

### Fast Acting Safety Interlock (FASI)

Many marking applications require a safety action to occur for each part that is marked. An example of this safety action would be a machine that lowers a shield over a part prior to marking, then raises the shield as soon as the mark is complete. Fenix is equipped with a *Remote Interlock* feature that disables laser firing, typically when a switch on an access door or safety enclosure is opened. However in marking applications where a safety interlock is frequently cycled, the *Remote Interlock* creates an unacceptable delay. This delay occurs because after the interlock is closed the *Keyswitch* or remote keyswitch must be cycled, which then invokes a built-in five-second delay prior to lasing. To address this issue, Fenix Laser Markers incorporate a Fast Acting Safety Interlock (FASI) function. The FASI function prevents the laser from firing unless a signal is present on Fenix input #3 (IN3). Fenix responds to this rising signal transition in less than 1 ms. To enable the FASI feature, perform the following steps:

- 1 Set DIP switch #5 on the FLCC to the “On” position. Refer to Figure 4-12 for switch locations.
- 2 Configure WinMark’s Wait Digital Before Piece command to wait for a “Set” state on input #3 (IN3) before marking begins. This synchronizes marking operations with the FASI safety feature.
- 3 Apply a signal in the range of 15–40 V (24 V typical) to Fenix input #3 (IN3).

When FASI is enabled, Fenix input #3 (IN3) must be active before the laser can fire (if the FASI feature is enabled and Fenix input #3 is inactive, no signal applied, then no marking will occur).

- 4 Command WinMark Pro to mark.

**Note:** Changes in the state of the FASI setting (DIP switch #5) are only sent to Fenix when WinMark Pro is commanded to mark. If you change the switch setting (to enable or disable the FASI function) you must send a mark command from WinMark Pro so that the new switch state is written into Fenix memory.

When the FASI function is enabled, this interlock state is set in Fenix’s non-volatile memory and so does not depend on WinMark Pro software or even the computer to be running. The FASI state is retained even when Fenix is powered down and then restarted. This means that even manual firing of the laser using the *Test Mark* or *Laser On/Off* pushbuttons requires an active signal on input #3 (IN3). Table 4-5 illustrates the relationship between DIP switch #5 and Fenix input #3 (IN3).

**Table 4-5** DIP switch / signal relationships

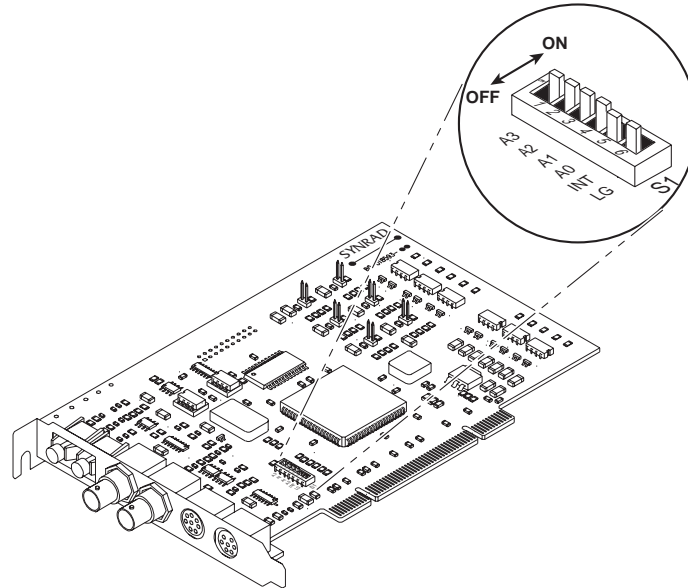
FLCC DIP SW 5	Fenix Input # 3	Laser Status
Off	Inactive (Low)	Enabled
Off	Active (High)	Enabled
On	Inactive (Low)	Disabled
On	Active (High)	Enabled

# technical reference

## Fiber Link Controller Card features

### DIP switch settings

Figure 4-12 shows the factory default settings of the FLCC's DIP switches.



**Figure 4-12** DIP switch settings

Table 4-6 lists the PCI-bus Fiber Link Controller Card's (FLCC) DIP switch functions. Note that the Fast Acting Safety Interlock (FASI) feature is controlled by DIP switch #5 on PCI-bus FLCCs. Previous ISA-bus FLCCs used DIP switch #6 to control FASI. Because the Windows Plug and Play feature, not the user, assigns the PCI address, address switches are not important. The card identification, set by the Card ID# DIP switches, will support future improvements to WinMark Pro. Card ID switches use negative logic – for example when SW1–SW4 are set to ON, the Card ID# = 0; when SW1–SW4 are set to OFF the Card ID# = 15. If SW1, SW2, and SW3 = OFF and SW4 = ON, then the Card ID# = 7.

**Table 4-6** Factory DIP switch settings

DIP SW#	Label	Default Position	Switch Function
1	A3	ON	Card ID# MSB
2	A2	ON	
3	A1	ON	
4	A0	ON	Card ID# LSB
5	INT	OFF	Fast Acting Safety Interlock (FASI) – ON enables the FASI function; OFF disables the Interlock function. When the FASI Interlock is enabled, a high level input must be present on Input # 3 (IN3) for marking to proceed.
6	LG	OFF	Used only with DH Series Marking Heads.

# technical reference

## General specifications

**Table 4-7** Fenix general specifications

Parameter	Focusing Lens Focal Lengths			
	370 mm	200 mm	125 mm	80 mm
<b>Marking Specifications</b>				
Field Size, optimum, mm (in.)	198 × 198 (7.8 × 7.8)	110 × 110 (4.3 × 4.3)	74 × 74 (2.9 × 2.9)	27 × 27 (1.0 × 1.0)
Spot Size, 1/e <sup>2</sup> , μm (in.)	540 (0.021)	290 (0.011)	180 (0.007)	116 (0.005)
Working Distance <sup>1</sup> , typical, mm (in.)	350 ± 5 (13.78)	190 ± 3 (7.48)	128 ± 2 (5.04)	74 ± 1 (2.91)
Depth of Field, typical, mm (in.)	±10 (± 0.394)	±2.5 (±0.098)	±1.5 (±0.059)	±0.4 (±0.016)
Incident Angle, degrees, max	19	16	11	5
Marking Speed <sup>2</sup> characters/sec, max	225	225	225	225
<b>Marking System Resolution</b>				
Position Accuracy, mm (in.)	0.05 (0.002)	0.03 (0.001)	0.02 (0.0007)	0.01 (0.0004)
Position Resolution, μm (in.)	< 15 (< 0.0006)	< 9 (< 0.0004)	< 6 (< 0.0002)	< 3 (< 0.0001)
Repeatability, mm (in.)	0.063 (0.0025)	0.038 (0.0015)	0.025 (0.0010)	0.015 (0.0006)
Settling Time, small step - 1% of field, ms	< 0.8	< 0.8	< 0.8	< 0.8
Orthogonality, any included angle of a square figure, degrees	90° 00' ±20' max			
<b>Input Specifications</b>				
Input Power	AC 85–132 V / 170–264 V, 12 A max, 47–440 Hz, 1Ø			
Input Fuse Rating	10 A, 250 VAC			
<b>Environmental Specifications</b>				
Operating Temperature	0° C–40° C			
Humidity	0–95%, non-condensing			
<b>Physical Specifications</b>				
Length	118.5 cm (46.67 in.)			
Width	24.5 cm (9.66 in.)			
Height with mounting rails	18.8 cm (7.39 in.) 21.4 cm (8.40 in.)			
Weight	28.1 kg (62.00 lbs)			

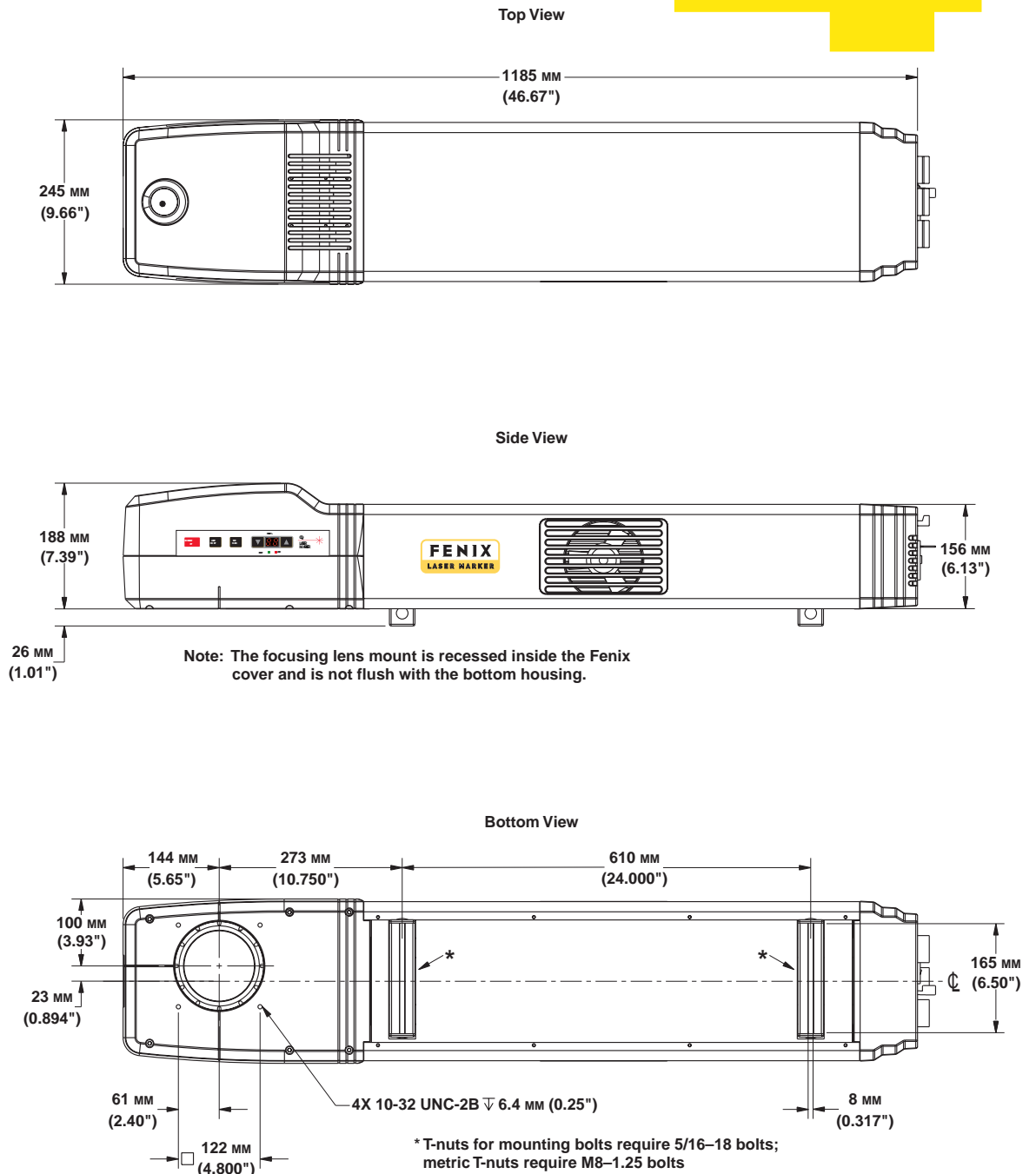
\* Specifications subject to change without notice.

1 For lenses with 19 mm (0.75") high lens mounts. The typical focal length (working distance) is marked on each lens mount since the actual working distance may vary from lens to lens. For this reason, it is important to provide a Z-axis adjustment between Fenix and the marking surface. Consult your Fenix's final test report for the actual measured working distance.

2 Based on a character height of ~3 mm, lens dependent.

# technical reference

## Fenix package outline



**Figure 4-13** Fenix package outline and mounting dimensions

# technical reference

# 4

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# **maintenance/ troubleshooting**

Use information in this section to perform maintenance and troubleshooting on your Fenix Laser Marker.

This section contains the following information:

- Maintenance – explains typical maintenance procedures for Fenix.
- Troubleshooting – describes built-in troubleshooting codes and explains how to troubleshoot common problems.

# maintenance/ troubleshooting

## Maintenance

The *Maintenance* section includes subsections:

- Disabling Fenix
- Daily inspections
- Cleaning the focusing lens

### Disabling Fenix

Before performing any maintenance, be sure to completely disable Fenix™ by disconnecting the AC Line Cord or by removing both fuses from the AC power module (Figure 5-2).

### Daily inspections

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

- 1 Ensure that power to Fenix is shut off and then remove the dust cap from the focusing lens.

#### **Warning**

possible  
personal  
injury

Ensure that power to Fenix is disconnected before inspecting the lens surface. Invisible CO<sub>2</sub> laser radiation is emitted through the lens. Corneal damage or blindness may result.

- 2 Visually inspect the exterior surface of the focusing lens for contaminants. If required, follow the cleaning instructions below.
- 3 Visually inspect the exterior of the Fenix housing to ensure that all warning labels are present. Refer to *Label locations* in the “Laser 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 5-1. Materials other than those listed are acceptable providing they meet or exceed the specified levels of quality or purity.

# maintenance/ troubleshooting

## Maintenance

**Table 5-1** Required cleaning materials

Cleaning Material	Requirements
Finger Cots or Rubber Gloves	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

## Passive cleaning

Passive cleaning of the focusing lens can be performed without removing the focusing lens from Fenix.

### **Caution**

possible  
lens  
damage

Do not allow the nozzle of the air bulb to touch the lens surface. Any contact 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.

Remove loose contaminants from the focusing lens surface by holding a clean air bulb at an angle to the lens and blow a stream of air at a glancing angle across the lens surface. Repeat as necessary until all loose particulates are blown off the lens surface.

## Aggressive cleaning

Aggressive cleaning involves the use of solvents and requires the removal of the focusing lens.

When handling or cleaning infrared optics, observe the following guidelines:

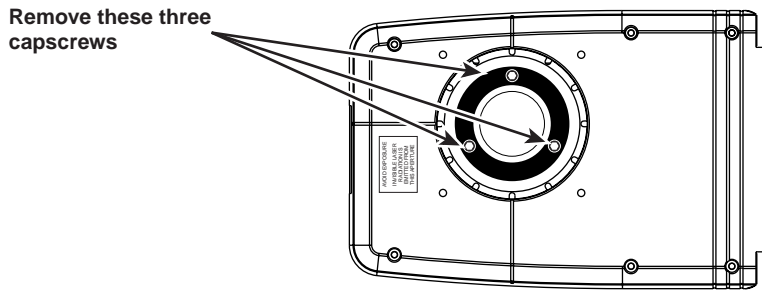
- Before beginning, read the entire cleaning process to ensure that all required materials are available.
- Use finger cots or rubber gloves to prevent contamination of the optics by dirt and skin oils.
- Always place optics on lens tissue for protection. Never place optics on hard or rough surfaces.
- 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.
- Before using cleaning agents, read Material Safety Data Sheets (MSDS) and observe all necessary safety precautions.

# maintenance/ troubleshooting

## Maintenance

To remove dust, oily residues, and plastics build-ups that have adhered to the surface of the focusing lens, perform the following steps:

- 1 Refer to Figure 5-1 and remove the three capscrews securing the focusing lens to Fenix. Do not remove the lens from its optical mount.



**Figure 5-1** Bottom view - Fenix focusing lens mount

- 2 Perform the passive cleaning procedure outlined earlier to remove any loose contaminants from the optical surface. Repeat as necessary until all loose particles are removed.
- 3 Refer to Table 5-2 and select the appropriate cleaning solvent based on the type of contamination that exists on the surface of the lens.

**Table 5-2** 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 during cleaning. The optical surface is very easily scratched by dislodged contaminants.

# maintenance/ troubleshooting

## Maintenance

- 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.* Drag the cotton ball or swab without applying any downward pressure.

**Note:** Use a clean cotton ball or swab on each pass. The cotton will pickup and carry surface contaminants that may 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 that the only remaining residue is around the outer edges and not in the center of the lens.
- 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.
- 9 Reinstall the focusing lens and replace the lens cap. If the cleaned optic will not be used immediately, wrap it in lens tissue and place in clean, dry storage.

# maintenance/ troubleshooting

## Troubleshooting

The *Troubleshooting* section includes subsections:

- Fenix
- Fenix Tracker
- Fiber Link Controller Card (FLCC)
- Automation I/O
- Laser Marking FAQ

## Fenix

### Fault codes

Fenix is equipped with on-board diagnostics capable of displaying fault codes in the event a problem occurs. If a fault occurs, fault codes are shown in the *Power %* display.

Fault codes and their meanings are listed below. Troubleshooting solutions for possible causes are also given.

#### Symptom:

- Fault code E0 appears.

#### Possible causes:

- E0 indicates *Emergency Off*.

When the *Emergency Off* pushbutton is pressed, the laser immediately shuts down, the *Lase* indicator extinguishes, and “E0” is displayed on the *Power %* display.

Cycle the AC power switch “Off” (0) then back “On” (1) and then reset the *Keyswitch* (or remote keyswitch) by switching “Off” then “On” to restart Fenix. Contact SYNRAD, Inc. or a SYNRAD Authorized Distributor if Fenix fails to respond.

#### Symptom:

- Fault code E1 appears.

#### Possible causes:

- E1 indicates an X-servo fault.

Cycle the AC power switch “Off” (0) then back “On” (1) to reset and restart Fenix. Contact SYNRAD, Inc. or a SYNRAD Authorized Distributor if Fenix fails to respond.

**Note:** Fenix may momentarily display fault code E1 or E2 during start-up.

# maintenance/ troubleshooting

## Troubleshooting

### Symptom:

- Fault code E2 appears.

### Possible causes:

- E2 indicates an Y-servo fault.

Cycle the AC power switch “Off” (0) then back “On” (1) to reset and restart Fenix. Contact SYNRAD, Inc. or a SYNRAD Authorized Distributor if Fenix fails to respond.

**Note:** Fenix may momentarily display fault code E1 or E2 during start-up.

### Symptom:

- Fault code E3 appears.

### Possible causes:

- E3 indicates a Fiber Link Parity fault.

A Fiber Link Parity fault indicates that some sort of interference is causing data transmission errors.

If a generator of strong electromagnetic fields (such as an arc welder or large motor) is located near Fenix, try turning it off or move Fenix further away from potential interference sources. Contact SYNRAD, Inc. or a SYNRAD Authorized Distributor if the problem persists.

### Symptom:

- Fault code E4 appears.

### Possible causes:

- E4 indicates a Fiber Link Communications fault.

A Fiber Link Communications fault can occur if the fiber optic cable is improperly connected or damaged.

Inspect the fiber optic cable for signs of damage and replace if necessary. See the Fiber Link Controller Card troubleshooting section later in this manual for step-by-step instructions to verify proper connection of the fiber optic cable.

### Symptom:

- Fault code E5 appears.

### Possible causes:

- E5 indicates a Keyboard Lockout fault.

A Keyboard Lockout fault can occur after the user has commanded WinMark to lockout the membrane panel pushbuttons and then a key is pressed. The *Emergency Off* pushbutton is always active; it cannot be disabled.

No action is necessary. The Fault code will clear when the next WinMark command is received.

To reactivate the membrane panel pushbuttons, go to the **Tools** menu and select General Settings. In the **WinMark Settings** dialog box, click the *Application Settings* tab and then click Fenix Keyboard Locked. Click the arrow and select **No**.

# maintenance/ troubleshooting

## Troubleshooting

### Symptom:

- Fault code E6 appears.

### Possible causes:

- E6 indicates a Fast Acting Safety Interlock (FASI) fault.

A Fast Acting Safety Interlock fault occurs when the Fiber Link Controller Card is set to the FASI mode (DIP switch #5 is “On”), Fenix Input #3 (IN3) is inactive (low), and Fenix is commanded to fire.

Enable the FASI function by applying a 15–40 V signal (24 V typical) to Fenix Input #3 (IN3). If you choose to disable the interlock function, set the FLCC’s DIP switch #5 to “Off” and then send a mark command to Fenix from WinMark Pro (Fenix retains the last state of the FASI switch setting until an update is sent by a WinMark “Mark” command).

### Symptom:

- Fault code E7 appears.

### Possible causes:

- E7 indicates an Invalid Lens Type fault.

An Invalid Lens Type fault occurs when Fenix fails to recognize the lens specified by the user in WinMark. There are two possible causes:

- 1 A lens type not supported by Fenix (such as an SH/DH series lens from previous SYNRAD marking heads) was specified in WinMark.

To specify a lens, open WinMark and perform the following procedure:

- a From the *Tools* menu, select *General Settings*....
- b In the *WinMark Settings* dialog box, click the *Application Settings* tab.
- c Click *Lens*, and then click the ellipsis (...).
- d In the *Lens Selection* dialog box, select a lens matching the one currently installed on your Fenix.

- 2 A new lens type designed after Fenix shipped was specified in WinMark.

Contact SYNRAD, Inc. about returning Fenix to the factory for a firmware upgrade (shipping and service charges may apply). You will need to provide the following information: (1) the serial number marked on the rear panel; (2) the lens you wish to use; and (3) the current Fenix firmware version installed (from the *Tools* menu, select *About Synrad WinMark*, and in the dialog box click the *Head Info* button).

# maintenance/ troubleshooting

## Troubleshooting

### Other faults

#### Symptom:

- The AC Line Cord is connected and the AC Power Switch is switched “On” (1) but the *Ready* indicator is not illuminated and the cooling fans are not running.

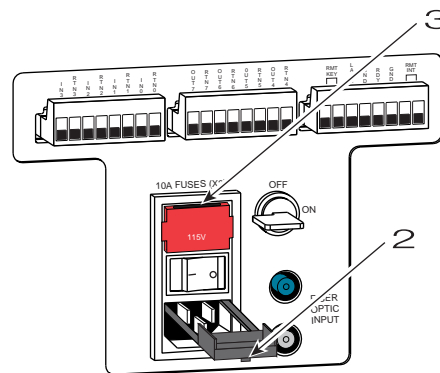
#### Possible causes:

- AC line voltage is not available from the outlet where Fenix is connected.

Ensure that the proper AC line voltage (85–132 V / 170–264 V, 1Ø) is available.

- One or both of the AC power module fuses have opened.

To check both fuses inside the Fenix AC power module, follow the steps below. The numbered items in Figure 5-2 correspond to step numbers 1 through 3 in the following procedure.



**Figure 5-2** AC line fuse location

#### **Warning**

possible  
personal  
injury

Warning – Double Pole/Neutral Fusing. AC power to this unit is double fused. Fuses are installed on both line and neutral conductors. A neutral line fuse failure may present a hazard to service personnel. Disconnect the AC Line Cord or remove both AC fuses before servicing the unit.

- 1 Unplug the AC Line Cord from the Fenix AC power module.
- 2 Insert a small thin-bladed screwdriver into the slot in the top center of the power module and carefully pry the black access door open.

# maintenance/ troubleshooting

## Troubleshooting

- 3 Insert a screwdriver into the slot in the top of the red fuse holder and carefully snap the fuse holder out of the module.
- 4 Inspect both fuses (one on each side of the AC line). If fuse replacement is required, use fast-blow fuses rated for 10 A at 250 VAC. Either 5×20 mm type GDA or 1¼" × 1¼" type AGC fuses will fit in the fuse holder.
- 5 Insert the fuse holder into the AC power module, snap it into position, and then close the access door.

### Symptom:

- The AC Line Cord is connected, the AC Power Switch is switched "On" (1), the *Keyswitch* is On and the cooling fans are running but *Ready* and *Lase* indicators are not illuminated and the left-hand display shows "88".

### Possible causes:

- The remote keyswitch is open.

If using a remote keyswitch, ensure that it is closed. If not using a remote keyswitch, check that a jumper is connected across the remote keyswitch terminals (RMT KEY) on the *Auxiliary Signal* connector.

- The remote interlock is open.

If using the *Remote Interlock* feature, ensure that all interlocked doors and panels are closed. If not using the interlock feature, check that a jumper is connected across the remote interlock terminals (RMT INT) on the *Auxiliary Signal* connector. Reset the *Keyswitch* (or remote keyswitch) by switching "Off" then "On" to reset and restart Fenix.

- A laser over-temperature condition exists.

An over-temperature shutdown of the laser will occur if laser tube temperature reaches 60° C ±2° C.

If Fenix seems unusually warm, allow it to cool and then cycle the AC power switch "Off" (0) then back "On" (1). Reset the *Keyswitch* (or remote keyswitch) by switching "Off" then "On" to restart Fenix.

### Symptom:

- Fenix's power output does not match the *POWER* setting commanded by the WinMark .mkh file.

### Possible causes:

- An I/O address conflict exists within the computer running WinMark Pro (ISA cards only).

Check your computer's I/O resources. Hex addresses 0330 through 033F must be unused by any hardware devices. If any devices are located within these 16 slots, then locate a contiguous 16-byte slot between 0300 and 03F0 and reset FLCC and WinMark addresses accordingly.

# maintenance/ troubleshooting

## Troubleshooting

### Symptom:

- The mark produced by Fenix is much larger or much smaller than drawn on the WinMark Drawing Canvas.

### Possible causes:

- The lens specified in WinMark does not match the lens installed on Fenix.

Check that the lens size specified in WinMark (from the *Tools* menu select *General Settings...*, and then click the *Application Settings* tab) matches the lens currently installed on Fenix. In addition to choosing the correct focal length, the lens must be selected from the FH/Fenix list.

- A data type mismatch has occurred.

Power down Fenix and close the WinMark application. Power-up Fenix first and then restart WinMark. This ensures that WinMark properly communicates with Fenix while launching.

### Symptom:

- Marked objects are elongated or elliptical in shape, but the test pattern produced by the *Test Mark* pushbutton is symmetrical.

### Possible causes:

- WinMark's Field Width, Field Height, Field Scale X, or Field Scale Y values are improperly set.

Unlike lenses for earlier SYNRAD marking heads, Fenix lenses have a rectangular marking field. Table 4-1, *Lens specifications*, in the "Technical Reference" section lists the maximum Field Width and Field Height dimensions for each Fenix lens. To check lens settings in WinMark, click *Drawing* and then click the *Format* tab. Field Width and Field Height dimensions should match those given in Table 4-1. Optimal Field Width and Optimal Field Height should match the nominal field sizes shown in the table.

Field Scale X and Field Scale Y dimensions are set to 100% by default. If these settings have been changed non-proportionally, then elongated marks will result. To check Field Scale X and Field Scale Y properties, click *Drawing* and then click the *Marking* tab. Also check field scale settings on the *Drawing Defaults* tab (from the *Tools* menu, select *General Settings...* and then click the *Drawing Defaults* tab).

### Symptom:

- No marks or very light marks appear on the part.

### Possible causes:

- The part is not positioned at the point of focus.

Locate the final test report shipped with Fenix to determine the actual working distance of the lens. Working distance is measured from the bottom of the focusing lens mount to the surface of the part to be marked.

# maintenance/ troubleshooting

## Troubleshooting

### Symptom:

- Mark quality deteriorates gradually over time and/or laser power must be increased to maintain quality.

### Possible causes:

- The focusing lens has become coated with marking debris or vapor.

Carefully inspect and clean the lens as described in *Maintenance* in the “Maintenance/Troubleshooting” section.

## Fenix Tracker

### Symptom:

- Fenix Tracker does not track moving parts.

### Possible Causes:

- Tracking is not enabled.

Check that Track Marking Object in WinMark Pro’s *Tracking* tab is set to *Yes*.

- Encoder pulses are not being read by the Fenix Tracker.

Close WinMark Pro and open Digital Scope (*DigScope.exe*). Rotate the conveyor or position encoder and verify that input #1 (IN1) and input #2 (IN2) toggle as the encoder rotates.

- The part sensor signal is not being read by the Fenix Tracker.

Close WinMark Pro and open Digital Scope. Trigger the part sensor and verify that input #0 (IN0) toggles.

- Part movement is not being sensed in the proper direction.

Toggle Invert Encoder Direction in WinMark Pro’s *Tracking* tab.

### Symptom:

- Characters or graphics within the mark are distorted or missing.

# maintenance/ troubleshooting

## Troubleshooting

### Possible Causes:

- The mark is not being completed within the marking field of the lens.

Ensure that the mark is positioned as close to the upstream edge of the *Drawing Canvas* as possible.

- Line speed is set too fast.

Lower line speed.

- The mark is being made too slowly for the required line speed.

Lower mark time by changing fonts, decreasing font size, or reducing line spacing. Simplify or eliminate graphic objects in the mark. Reduce graphic object size or resolution.

### Symptom:

- Tracker marks are skewed or distorted.

### Possible Causes:

- Encoder resolution is set improperly.

Load and mark the *linestack200.mkh* or *linestack370.mkh* file (located in the *WinMark* folder). Refer to *Rotary position encoder* in the “Tracker” section for instructions on how to fine-tune encoder resolution settings.

- Line speed is set too fast.

Lower line speed.

- The actual part motion vector is different than the value entered as the Motion Vector in WinMark's *Tracking* tab.

Check that actual part motion under the marking head equals the entered Motion Vector value.

## Fiber Link Controller Card (FLCC)

### Symptom:

- Fenix does not respond to WinMark commands.

### Possible causes:

- The fiber optic cable between Fenix and the Fiber Link Controller Card is improperly connected.

# maintenance/ troubleshooting

## Troubleshooting

The Fiber Link Controller Card's *Fiber Optic Receiver/Transmitter* port is color-coded. The gray half transmits to Fenix. The blue half receives from Fenix. The fiber optic control connections on Fenix are also color-coded. The blue connector receives from the FLCC; the gray plug transmits to the FLCC.

To verify proper connection of the fiber optic cable, follow the steps below:

- 1 Make sure that both Fenix and your computer are turned on.

### **Warning**

possible  
personal  
injury

Do not stare directly into the red laser diode light emitted from the transmitter port on the Fiber Link Controller Card or from Fenix. The light is potentially intense enough to injure the eye with prolonged exposure.

- 2 Disconnect the blue plug from the *Fiber Optic Control* connection on the Fenix rear panel; the blue plug attached to the fiber optic cable should emit a visible red glow.
- 3 If a visible red glow cannot be seen in the blue fiber optic plug, remove the duplex connector from the FLCC and verify that the card's gray (transmitter) port is emitting a visible red glow.
- 4 If there is no visible red glow from the *Fiber Optic Receiver/Transmitter* port on the FLCC, shut down the computer and check the FLCC to ensure it is properly seated in the computer's PCI bus slot. Remember to follow the same static discharge precautions that you followed when installing the card. If the card still fails to function properly, contact SYNRAD, Inc. or a SYNRAD Authorized Service Center for assistance.
- 5 Reconnect the duplex fiber optic connector to the FLCC so that the red glow from the gray transmitter port is visible in the blue plug on the other end of the cable. The connector latch should securely clip into the cable latch slot (see Figure 1-5 in the "Getting Started" section).
- 6 Reconnect the blue receiver plug to the blue *Fiber Optic Control* connection on the Fenix rear panel.
- 7 Disconnect the gray plug from the gray *Fiber Optic Control* connection on the Fenix rear panel. The gray bulkhead *Fiber Optic Control* connector on Fenix should emit a visible red glow; if not, contact SYNRAD, Inc. or a SYNRAD Authorized Service Center for assistance.
- 8 Reconnect the gray transmitter plug to the gray *Fiber Optic Control* connection on the Fenix rear panel.

- The Fiber Link Controller Card has failed or has been damaged.

If you determine that the FLCC is not operating correctly, contact SYNRAD, Inc. or a SYNRAD Authorized Distributor for assistance.

# maintenance/ troubleshooting

## Troubleshooting

### Automation I/O

#### Symptom:

- The Fenix Laser Marker or WinMark Pro are not responding to automation inputs or the automation controller is not “seeing” Fenix/WinMark Pro outputs.

#### Possible Causes:

- No Fiber Link Controller Card is selected.

In WinMark Pro, click the *Tools/General Settings.../Applications Settings* tab. Scroll down to I/O Card Selection and verify that a card is selected. If no card is shown on the drop-down list, verify that a fiber link card is installed in your computer, and then check that drivers for the PCI-bus FLCC are properly installed (refer to *Connecting* in the “Getting Started” section for information about installing PCI Device Driver files).

- I/O voltage levels are incorrect.

Review *Marking automation* in the “Technical Reference” section to verify that I/O signals are in the correct voltage range of 15–40 VDC.

- I/O wiring is not properly connected to Fenix.

Double-check field wiring to ensure that input/output signals are routed to the correct terminals on Fenix Input and Output connectors and that their respective ground paths are wired to the proper pins.

Use Digital Scope to verify proper I/O functionality between Fenix, the FLCC, and the automation controller. Digital Scope’s input “buttons” pop-in as each individual input is activated (when the correct voltage level is applied). Press an output “button” to activate an output.

**Note:** To prevent I/O conflicts, always close WinMark Pro or WinMark Launcher before opening Digital Scope. Close Digital Scope before operating the marking head membrane panel pushbuttons or before starting WinMark Pro or Launcher.

- The Fiber Link card is incorrectly addressed (ISA-bus FLCCs only).

Verify that any I/O address specified in WinMark Pro’s Event Builder matches the current ISA card address.

### Laser Marking FAQ

Our *Laser Marking FAQ*, available for downloading or browsing from the WinMark Pro web site at <http://www.winmark.com>, answers many common marking questions in categories including *General troubleshooting*, *WinMark Pro automation*, *Tracking operation*, *ActiveX*, and others. The *Laser Marking FAQ* also includes links to various SYNRAD technical bulletins.

# **maintenance/ troubleshooting**



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# appendix a

This appendix contains the following information:

- Mounting Stand – illustrates one way to mount your Fenix marking system.
- Parts List – provides a list of parts to build a Fenix mounting stand.

# appendix a

## Mounting stand

The mounting stand illustrated is built from pre-cut aluminum T-slot material available under several trade names. Callout numbers in the illustration refer to the item numbers listed in Tables A-1-A-3.

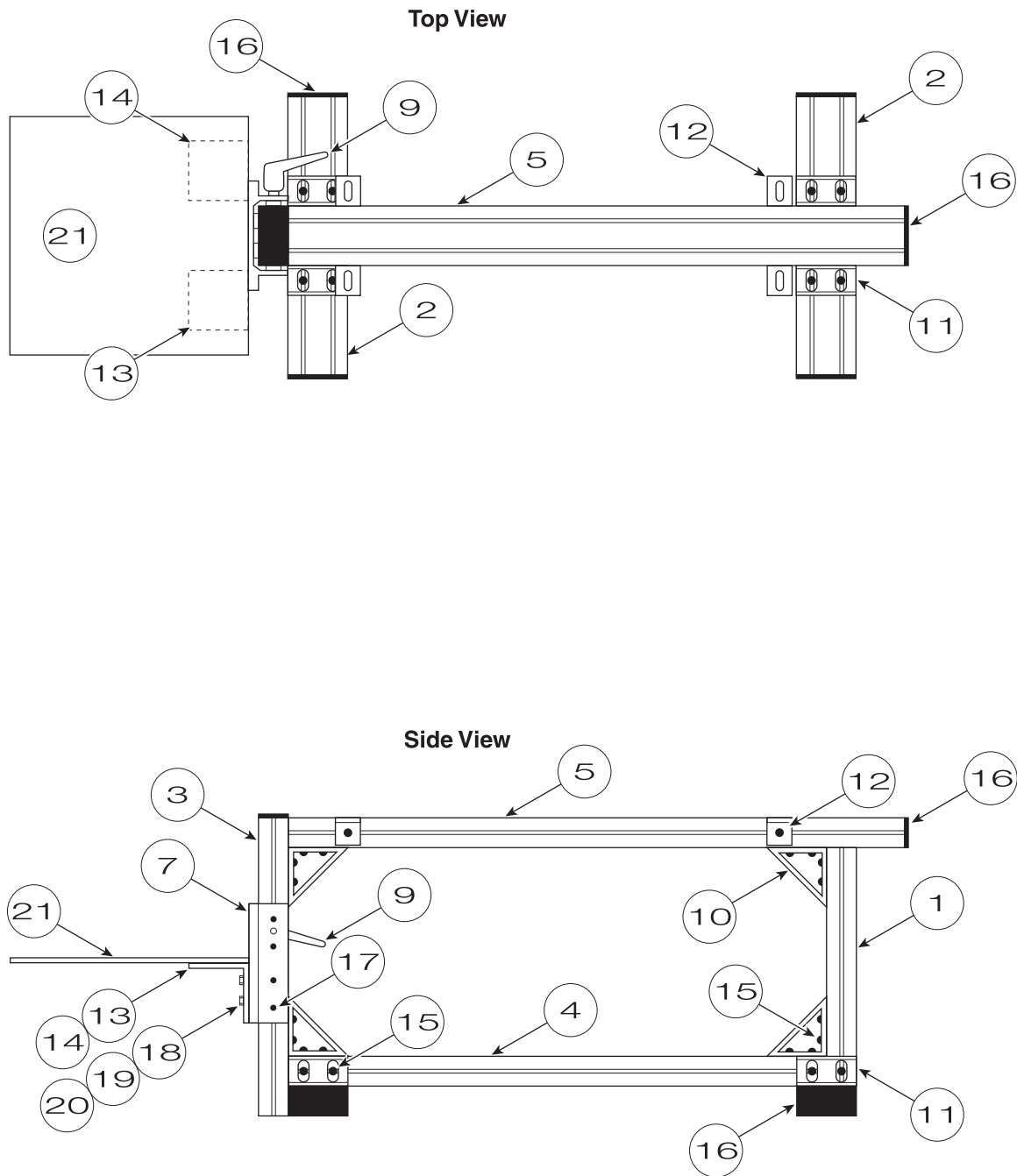


Figure A-1 Mounting stand

# appendix a

## Parts list

All components (and part numbers) necessary to build the mounting stand shown in Figure A-1 are listed in Tables A-1–A-3. Table A-1 lists part numbers for a “short” stand, meant for Fenix markers using 80 or 125 mm lenses. Table A-2 lists part numbers for a “medium” stand for markers using 80, 125, or 200 mm lenses. Table A-3 lists part numbers for a “tall” stand for 80, 125, 200, or 370 mm lenses.

The component manufacturer, 80/20 Inc. can be contacted directly at:

80/20 Inc.  
1701 S. 400 E.  
Columbia City, IN 46725  
Tel: (219) 248-8030  
Fax: (219) 248-8029  
Web site: <http://www.8020.net>

**Table A-1** Parts list for short mounting stand (for 80–125 mm lenses)

Item #	Part #	Qty	Description	Cut to Length
1	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	7"
2	1530-Lite	2	Extrusion, 1.5" × 3.0", medium duty	14"
3	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	10"
4	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	27"
5	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	31"
6	7020	6	1530-Lite cut to length (cutting charge)	—
7	6834	1	15 Series Double Flange Linear Bearing with #7400 @ LR and LU	—
8	7400	2	Brake Mounting Kit (machine charge)	—
9	6800	1	15 Series Ratcheting L-Handle	—
10	4338	4	15 Series 8 Hole Inside Gusset Corner Brkt	—
11	4334	4	15 Series 4 Hole Inside Gusset Corner Brkt	—
12	4295	4	15 Series 2 Hole Slotted Inside Corner Brkt	—
13	4308	1	15 Series 6 Hole RH Inside Corner Brkt	—
14	4309	1	15 Series 6 Hole LH Inside Corner Brkt	—
15	3320	52	5/16-18 × 5/8" Flanged Button Head Socket Cap Screw and Economy T-Nut	—
16	2045	6	1530-Lite End Cap	—
17	3340	8	5/16-18 × 1/2" Flanged BHSCS	—
18	3118	4	5/16-18 × 1" BHSCS	—
19	3260	4	5/16" Washer	—
20	3214	4	5/15-18 Hex Nut	—

Item #21 is not available from 80/20 Inc. We recommend using a 12" × 12" × 1/4" anodized aluminum plate.

**Note:** 80/20 Inc. stocks a complete line of metric fasteners for those customers who require them.

# appendix a

## Parts list

**Table A-2** Parts list for medium mounting stand (for 80–200 mm lenses)

Item #	Part #	Qty	Description	Cut to Length
1	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	12"
2	1530-Lite	2	Extrusion, 1.5" × 3.0", medium duty	14"
3	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	15"
4	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	27"
5	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	31"
6	7020	6	1530-Lite cut to length (cutting charge)	—
7	6834	1	15 Series Double Flange Linear Bearing with #7400 @ LR and LU	—
8	7400	2	Brake Mounting Kit (machine charge)	—
9	6800	1	15 Series Ratcheting L-Handle	—
10	4338	4	15 Series 8 Hole Inside Gusset Corner Brkt	—
11	4334	4	15 Series 4 Hole Inside Gusset Corner Brkt	—
12	4295	4	15 Series 2 Hole Slotted Inside Corner Brkt	—
13	4308	1	15 Series 6 Hole RH Inside Corner Brkt	—
14	4309	1	15 Series 6 Hole LH Inside Corner Brkt	—
15	3320	52	5/16-18 × 5/8" Flanged Button Head Socket Cap Screw and Economy T-Nut	—
16	2045	6	1530-Lite End Cap	—
17	3340	8	5/16-18 × 1/2" Flanged BHSCS	—
18	3118	4	5/16-18 × 1" BHSCS	—
19	3260	4	5/16" Washer	—
20	3214	4	5/15-18 Hex Nut	—

Item #21 is not available from 80/20 Inc. We recommend using a 12" × 12" × 1/4" anodized aluminum plate.

**Note:** 80/20 Inc. stocks a complete line of metric fasteners for those customers who require them.

# appendix a

## Parts list

**Table A-3** Parts list for tall mounting stand (for 80–370 mm lenses)

Item #	Part #	Qty	Description	Cut to Length
1	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	19"
2	1530-Lite	2	Extrusion, 1.5" × 3.0", medium duty	14"
3	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	22"
4	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	27"
5	1530-Lite	1	Extrusion, 1.5" × 3.0", medium duty	31"
6	7020	6	1530-Lite cut to length (cutting charge)	—
7	6834	1	15 Series Double Flange Linear Bearing with #7400 @ LR and LU	—
8	7400	2	Brake Mounting Kit (machine charge)	—
9	6800	1	15 Series Ratcheting L-Handle	—
10	4338	4	15 Series 8 Hole Inside Gusset Corner Brkt	—
11	4334	4	15 Series 4 Hole Inside Gusset Corner Brkt	—
12	4295	4	15 Series 2 Hole Slotted Inside Corner Brkt	—
13	4308	1	15 Series 6 Hole RH Inside Corner Brkt	—
14	4309	1	15 Series 6 Hole LH Inside Corner Brkt	—
15	3320	52	5/16-18 × 5/8" Flanged Button Head Socket Cap Screw and Economy T-Nut	—
16	2045	6	1530-Lite End Cap	—
17	3340	8	5/16-18 × 1/2" Flanged BHSCS	—
18	3118	4	5/16-18 × 1" BHSCS	—
19	3260	4	5/16" Washer	—
20	3214	4	5/15-18 Hex Nut	—

Item #21 is not available from 80/20 Inc. We recommend using a 12" × 12" × 1/4" anodized aluminum plate.

**Note:** 80/20 Inc. stocks a complete line of metric fasteners for those customers who require them.

# appendix a



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# appendix b

This appendix contains the following information:

- Power measurements – describes how to measure laser output power through a Fenix Laser Marker.

# appendix b

## Power measurements

The *Power measurements* section includes subsections:

■ Setup

■ Output measurements

This section describes how to measure laser output power through the Fenix™ Laser Marker using a SYNRAD Power Wizard® power meter. Use this procedure to verify that the Fenix laser is operating properly. Before beginning, read through each step in the *Setup* and *Output measurements* sections so that you understand the sequence and the purpose of each step.

### Caution

possible  
equipment  
damage

All power measurements must be taken on an unfocused beam. Never measure a focused laser beam at the point of focus. The Power Wizard power meter will be damaged.

## Setup

To prepare Fenix for power measurements, perform the following steps:

- 1 Place a beam block or other absorbent material on the marking surface in the field of the focusing lens.
- 2 Verify that the factory-supplied test mark file is loaded into Fenix test mark memory. If necessary reload this file, *FactoryTestMark1.mkh*, into memory. See *Custom test mark feature* in the “Technical Reference” section for instructions.
- 3 Check that all personnel in the area are wearing the appropriate protective eyewear.
- 4 With power applied to Fenix, press the *Test Mark* button to fire the test mark.  
This step centers the mirrors and marks a pattern to indicate the center of the marking field. As long as power remains applied to Fenix, the X-Y mirrors will remain centered on the marking surface.

**Note:** When WinMark Pro v4.0.0.4058 or higher is installed, Digital Scope automatically sends a command to center mirrors when it is opened.

- 5 Ensure that both WinMark Pro and WinMark Launcher are closed.

# appendix b

## Power measurements

### Output measurements

Output power is measured at the focusing optic (output aperture) of the Fenix Laser Marker.

**Note:** The steps below describe the use of a SYNRAD Power Wizard® PW-250 power meter to measure laser output power. Refer to the *Power Wizard® PW-250 Operation Instructions* for detailed operating instructions. Ensure that you are using the correct Power Wizard for the laser power you are checking. The Power Wizard PW-2 has a measurement range of 10–1999 mW; the Power Wizard PW-250 has a range of 1–250 W.

To begin output power measurements, perform the following steps:

- 1 Ensure that all personnel in the area are wearing the appropriate protective eyewear.
- 2 Locate and open Digital Scope (C:\Program Files\WinMark\DigScope.exe). Use the slider to set the desired PWM power percentage in the *Laser Duty Cycle* box.
- 3 Ensure that all personnel are clear of the beam path and then press the **Toggle Lase** button.
- 4 Push and hold the Power Wizard's *Reset* button for 2–3 seconds.
- 5 Release the *Reset* button and quickly verify that the display reads 0.0 W ( $\pm 0.3$  W).

#### Caution

possible  
equipment  
damage

All power measurements must be taken on an unfocused beam. Never measure a focused laser beam at the point of focus. The Power Wizard power meter will be damaged. Measure at a point on the beam several inches from the actual point of focus.

- 6 Immediately place the Power Wizard's target area in the output aperture's beam path centered on the *FactoryTestMark1.mkh* image marked earlier during the setup procedure.  
Hold the Power Wizard approximately one-half the distance from the bottom of the lens mount to the focal plane of the lens to ensure that the Power Wizard is in the path of a *defocused* beam.
- 7 Keep the unfocused beam centered on the Power Wizard's target area until you hear a series of beeps. This indicates the measurement cycle has ended. An automatic hold feature maintains the current reading for approximately 20 seconds or until the *Reset* button is pressed.
- 8 Press Digital Scope's **Toggle Lase** button to turn off the laser.
- 9 Repeat steps 3 through 8 two or three times to get a good average power reading.

If power loss through the Fenix seems too high, remove the focusing lens and take another set of output power measurements. If excessive power loss is seen when the focusing lens is installed, inspect the lens for contaminants. If required, carefully clean the lens as described in *Maintenance* in the "Maintenance/Troubleshooting" section.

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# B

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