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FH SERIES MARKING HEAD



operator's manual

SYNRAD®

An Excel Technology Company

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FH SERIES MARKING HEAD

FH Series Marking Head

Operator's Manual

for

Index and Tracker models

Version 2.0

Released June 2000

Part number 900-17922-01

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table of contents

Laser Safety

Hazard information 1
- Terms 1
- General hazards 1

Label locations 3

Agency compliance 4
- Federal Communications Commission requirements 4
- Center for Devices and Radiological Health requirements 4
- European Union requirements 5

Declaration of Conformity 7

Getting Started 1

Inventory 1-2
- FH Series Marking Head 1-3
- Mounting Rail 1-4
- Laser 1-4

Introduction 1-5
- Marking system components 1-5

Mounting 1-6
- Mounting Rail 1-6
- L-bracket 1-6
- FH Head 1-6
- Laser 1-7

Connecting 1-8
- DC Power cable 1-8
- Fiber Link Controller Card 1-9
- Laser Control cable 1-11

WinMark Pro software 1-12
- System requirements 1-12
- Installation 1-12

Operation 2

Controls and indicators 2-2
- Control panel 2-2

Initial start-up 2-3
- Stand-alone operation 2-3
- Computer-controlled operation 2-5

Tracker 3

Introduction 3-2
- Tracker system components 3-2

Determining line speed 3-3

WinMark Pro software 3-5
- Tracking tab 3-5

Additional hardware 3-7
- Rotary position encoder 3-7
- Part sensor 3-11
- DC power supply 3-14

Marking 3-15
- Text 3-15

table of contents

Tracker (cont.)

Graphics 3-17
Repositioning marks 3-17
Positioning for best quality 3-18

Technical Reference 4

FH Head technical overview 4-2
Control circuitry 4-2
Marking head 4-2
Lens specifications 4-2
Custom test mark feature 4-3
Overview 4-3
Test Mark Control options 4-3
Creating a custom test mark 4-4
Setting Test Mark Control options 4-5
Downloading a custom test mark file 4-5
Marking automation 4-6
Connecting to parts handling equipment 4-6
Digital input circuitry 4-7
Digital output circuitry 4-9
Optional FLCC features 4-11
Fast Acting Safety Interlock (FASI) 4-11
DIP switch settings 4-12
General specifications 4-13
FH package outline drawing 4-14
FH Head / Model 48-1/48-2 package outline drawings 4-15
FH Head / Model 48-5/Evolution 100 package outline drawing 4-17
FH Head / Evolution 125 package outline drawing 4-18
FH Head / Model 48-1/48-2 mounting 4-19
FH Head / Model 48-5/Evolution 100/125 mounting 4-20

Maintenance/Troubleshooting 5

Maintenance 5-2
Daily inspections 5-2
Cleaning the focusing lens 5-2
Troubleshooting 5-5
FH Series Marking Head 5-5
FH Series Tracker Marking Head 5-5
Fiber Link Controller Card (FLCC) 5-7

Appendix A

Mounting stand A-2
Parts list A-3

Appendix B

Tracker Motion Sensing Kit B-2
Component suppliers B-3

Index

table of contents

List of Figures

Figure i FH Marking Head hazard label and CE label locations 3
Figure ii European compliance mark 6

Figure 1-1 Shipping box contents 1-2
Figure 1-2 Typical FH Series marking system 1-5
Figure 1-3 Power Input connector polarity 1-8
Figure 1-4 Fiber optic connectors 1-10

Figure 2-1 Control panel 2-2
Figure 2-2 Test pattern 2-4

Figure 3-1 Typical FH Series Tracker marking system 3-2
Figure 3-2a Part pitch greater than (lens field size - part length) 3-3
Figure 3-2b Part pitch equal to (lens field size - part length) 3-3
Figure 3-2c Part pitch less than (lens field size - part length) 3-4
Figure 3-3 Tracking tab 3-5
Figure 3-4 Part sensor output waveform 3-5
Figure 3-5 Drawing Canvas coordinates relative to Tracker 3-6
Figure 3-6 Wiring diagram for NPN or N-channel encoders 3-8
Figure 3-7 Wiring diagram for PNP or P-channel encoders 3-8
Figure 3-8 Linestack mark 3-10
Figure 3-9 Wiring diagram for NPN or N-channel sensors 3-12
Figure 3-10 Wiring diagram for PNP or P-channel sensors 3-12
Figure 3-11 Part sensor setup 3-13
Figure 3-12 Sample text mark 3-15
Figure 3-13 Beam/mark motion 3-16
Figure 3-14 Marking orientation 3-16
Figure 3-15 Configure Marking Order dialog box 3-17
Figure 3-16 Positioning mark across axis of motion 3-18
Figure 3-17 Positioning mark for best quality 3-18

Figure 4-1 Test Mark Control dialog box 4-3
Figure 4-2 Physical layout of Parts Handling Control connector 4-6
Figure 4-3 Input circuit 4-7
Figure 4-4 5 V logic IC input 4-8
Figure 4-5 Relay or foot switch input 4-8
Figure 4-6 Output circuit 4-9
Figure 4-7 Output to isolated I/O module 4-10
Figure 4-8 Output to relay driver 4-10
Figure 4-9 Output to TTL or CMOS logic interface 4-10
Figure 4-10 DIP switch settings 4-12
Figure 4-11 FH Marking Head package outline and mounting dimensions 4-14
Figure 4-12 FH Head / Model 48-1/48-2 package outline and mounting dimensions 4-15

table of contents

List of Figures (cont.)

Figure 4-13 FH Head / Model 48-1/48-2 package outline and mounting dimensions 4-16
Figure 4-14 FH Head / Model 48-5/Evo 100 package outline and mounting dimensions 4-17
Figure 4-15 FH Head / Evolution 125 package outline and mounting dimensions 4-18
Figure 4-16 FH Head / Model 48-1/48-2 mounting drawing 4-19
Figure 4-17 FH Head / Model 48-5/Evolution 100/125 mounting drawing 4-20

Figure A-1 Mounting stand A-2

List of Tables

Table i European Union Directives 6

Table 1-1 Shipping box contents 1-3
Table 1-2 Shipping box contents 1-4
Table 1-3 Shipping box contents 1-4

Table 2-1 Test pattern dimensions 2-4

Table 3-1 Rotary position encoder specifications 3-7
Table 3-2 Part sensor specifications 3-11
Table 3-3 Power supply specifications 3-14

Table 4-1 FH lens specifications 4-2
Table 4-2 Parts Handling Control connector pin assignments 4-7
Table 4-3 Input signal parameters 4-8
Table 4-4 Output signal parameters 4-9
Table 4-5 DIP switch / signal relationships 4-11
Table 4-6 Factory DIP switch settings 4-12
Table 4-7 FH Series Marking Head general specifications 4-13

Table 5-1 Required cleaning materials 5-2
Table 5-2 Cleaning solvent selection 5-4

Table A-1 Parts list for short mounting stand A-3
Table A-2 Parts list for medium mounting stand A-4
Table A-3 Parts list for tall mounting stand A-5

Table B-1 SYNRAD Tracker Motion Sensing Kit part numbers B-2
Table B-2 SYNRAD Tracker Motion Sensing Kit contents B-2

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ActiveMark, Evolution, and Fenix are trademarks of SYNRAD, Inc.

All other trademarks or registered trademarks are the property of their respective owners.

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Warranty information

This is to certify that the FH Series Marking Head is warranted 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 FH Series Marking Head should fail to operate, contact the SYNRAD Customer Service department at 1-800-SYNRAD1 (outside the U.S. call 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.

If the FH Series Marking Head 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 FH Series Marking Head, 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.

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 will result in serious personal injury or death.

⚠ Warning: Hazards or unsafe practices that could result in serious personal injury or death.

Caution: Hazards or unsafe practices that could result in minor personal injury or product damage.

Note: Points of particular interest for more efficient or convenient 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.

⚠ Warning

possible personal injury

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 µm CO_2 laser radiation is available from SYNRAD, Inc.

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

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 EN 60825-1, *Radiation Safety of Laser Products, Equipment Classification, Requirements, and User 92s 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 family when incorporated for intended use: (A) normal hazards associated with high potential DC supply voltages; (B) risk of injury when lifting or moving the unit; (C) risk of exposure to hazardous laser energy through unauthorized removal of access panels, doors, or protective barriers; (D) risk of exposure to hazardous laser energy and injury due to failure of personnel to use proper eye protection and/or failure to adhere to applicable laser safety procedures; (E) generation of hazardous air contaminants that may be noxious, toxic, or even fatal.

Additional laser safety information

The SYNRAD web site contains an online laser safety handbook (http://www.synrad.com/LaserFacts/lasersafety.html) that provides information on (1) Laser Safety Standards for OEM's/System Integrators including Product Classification, Product Housing, Product features, and Other CDRH Requirements; (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.

laser safety

Label locations

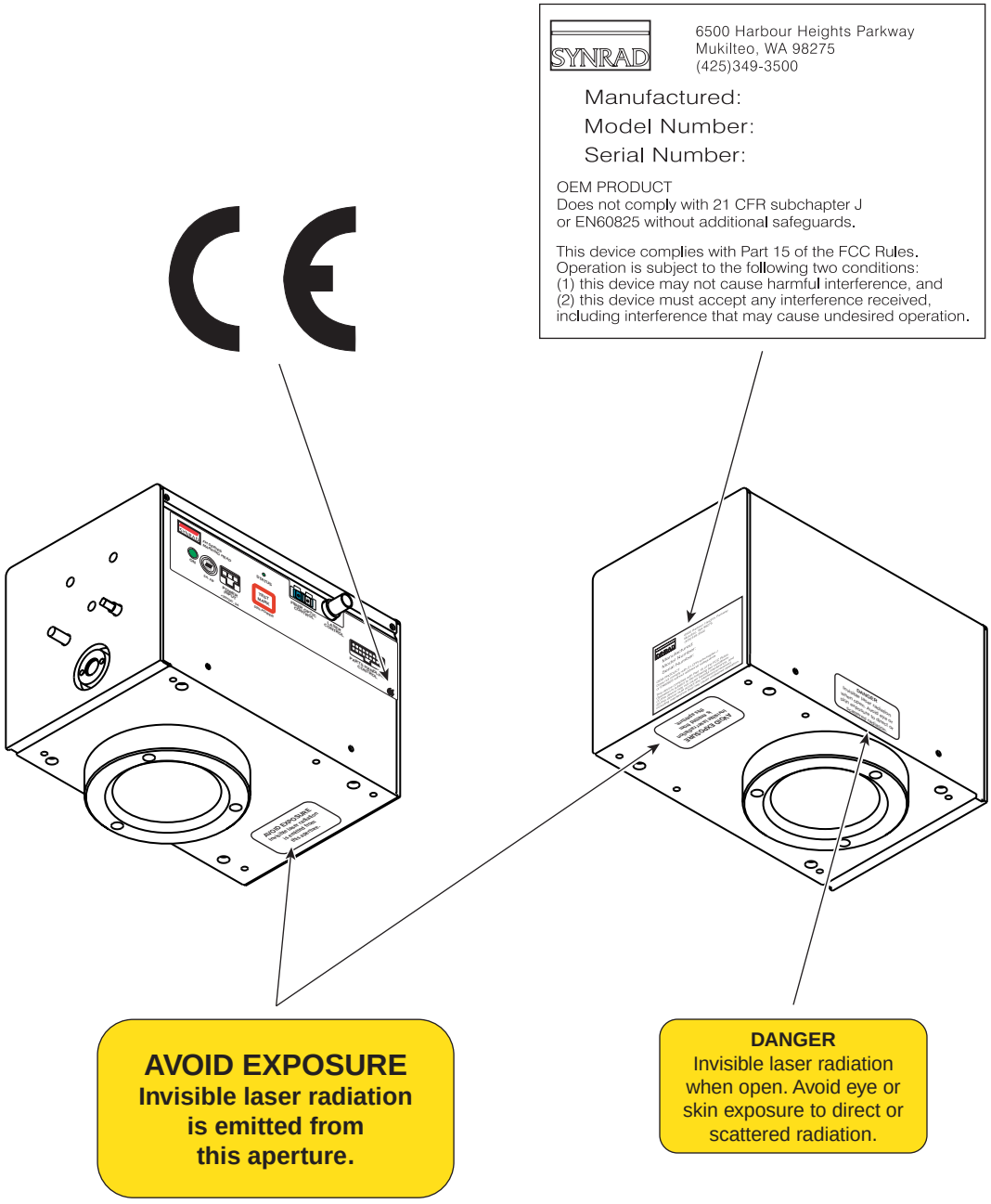


Figure i FH Marking Head hazard label and CE label locations

laser safety

Agency compliance

The FH Series Marking Head 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 the FH Series Marking Head must comply are identified and described in the following paragraphs.

Federal Communications Commission 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.

SYNRAD's FH Series Marking Head has been tested and found to comply by demonstrating performance characteristics that have met or exceeded the requirements of CFR 47, Chapter 1, Part 2, Subpart J.

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.

Center for Devices and Radiological Health requirements

Under the Radiation Control for Health and Safety Act of 1968, 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.

SYNRAD's FH Series Marking Head is an OEM product intended for incorporation as a component of a laser marking system and as such does not comply with 21 CFR, Subchapter J without additional safeguards. Additional safeguards required to meet the standard depend on the system in which the FH Series Marking Head is to be incorporated. For instance, if the system is intended to be a Class 1 laser system, the OEM integrator will have to provide guarding to prevent laser emission in excess of the Accessible Emission Limits (AEL) for Class 1 devices. For incorporation in a Class IV laser system, the integrated system must include a beam attenuator, a keyswitch, a remote interlock, and other safety features as required under the standard.

laser safety

Agency compliance

European Union requirements

The European Union's 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 the FH Series Marking Head, the standard EN55011 defines the radiated RF emissions limit. The generic standard EN50082-1 defines immunity requirements published by the International Electromechanical Commission (IEC). FH Series Marking Heads have demonstrated performance characteristics that have met or exceeded the requirements of EMC directive 89/336/EEC.

Operational requirements of the FH Series Marking Head are 30 VDC @ 3 amps (max). In accordance with Low Voltage Directive 73/23/EEC Article 1, the Low Voltage Directive would not apply to this family of devices. However, due to the considerable risks and hazards associated with the installation and operational use of this apparatus when incorporated with associated laser equipment, the manufacturer has provided appropriate product warning labels and instructions to the user regarding laser safety. Laser safety instructions and warnings are included in this manual.

The FH Series Marking Head is intended for incorporation as a component of a laser marking system. When incorporated as a part of a laser marking system, and dependent upon the user application and installation, additional warning labels and safety barriers may be required to protect the operator of the system. The final system and installation should be evaluated to meet the requirements of EN60825-1 under Low Voltage Directive 73/23/EEC.

SYNRAD, Inc. assumes no responsibility for the compliance of the system into which the FH Series Marking Head is integrated, other than to supply and/or recommend components and apparatus that are CE marked for compliance with applicable European Directives. FH Series Marking Head systems are intended for installation and use in laboratory or manufacturing facilities by trained personnel only.

In accordance with 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 the FH Series Marking Head into devices that may fall under the definition of a "machine", SYNRAD, Inc. considers the application of the EMC Directive as sufficient evidence that the FH Series Marking Head product family will not compromise the compliance of the "machine" into which it is incorporated.

laser safety

Agency compliance

Table i contains a summary of EU performance requirements pertaining to the FH Series Marking Head.

Table i European Union Directives

Applicable Standards/Norms	
89/336/EEC	Electromagnetic Compatibility
EN 55011:1991	Radiated and Conducted Emissions
EN 50082-2: 1995	Immunity
ENV 50140	RF Electromagnetic Fields
ENV 50204:1995	RF Electromagnetic Fields, Pulse Modulation
ENV 50141	RF Common Mode
EN 60950	Equipment Safety
EN 61000-4-2:1995	Electrostatic Discharge Immunity
EN 61000-4-4:1995	Electrical Fast Transient/Burst Immunity

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 ii.



Figure ii European compliance mark

laser safety

Declaration of Conformity

Declaration of Conformity

Applicable EU Directive(s):	89/336/EEC	Electromagnetic Compatibility
Applicable Standards/Norms:	EN 55011:1991	Radiated and Conducted Emissions, Class A, Group II
	EN 50082-2: 1995	Immunity
	ENV 50140	RF Electromagnetic Fields
	ENV 50204:1995	RF Electromagnetic Fields, Pulse Modulation
	ENV 50141	RF Common Mode
	EN 60950	Equipment Safety
	EN 61000-4-2:1995	Electrostatic Discharge Immunity
	EN 61000-4-4:1995	Electrical Fast Transient/Burst Immunity

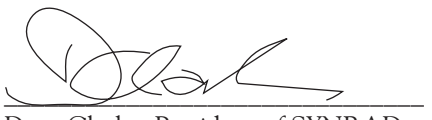
Manufacturer:

SYNRAD, Inc.
6500 Harbour Heights Parkway
Mukilteo, WA 98275

Model Number	Serial Number (Compliant Unit)	Date of Compliance
FH Marking Head	Beta 001	20 December 1999
FH Tracker Marking Head	Beta 001	20 December 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:

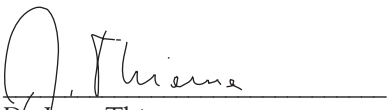


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20 December 1999
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laser safety

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getting started

Use information in this section to prepare your FH Series Marking Head for operation. 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 the marking head 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 FH Series Marking Head.
- Introduction – describes the history of the FH Head.
- Mounting – explains marking head mounting requirements.
- Connecting – explains how to connect cables and install the Fiber Link Controller Card.
- WinMark Pro software – describes WinMark Pro software, which is used to create and mark laser graphics.

Note: If you are installing an FH Tracker Marking Head, please perform the tasks described in the "Getting Started" and "Operation" sections before proceeding to the "Tracker" section.

getting started

Inventory

Your FH Series Marking Head may have been purchased separately from the laser and mounting kit or may have been purchased as a component in a complete marking solution. The components in a typical marking package include a SYNRAD FH Series Marking Head; a Fiber Link Controller Card; a SYNRAD 10, 25, 50, 100, or 125 W laser; an L-bracket; and a Mounting Rail. If you ordered all the components listed above as a complete package, they are delivered factory aligned and only require the assembly of major components. If you ordered a SYNRAD 10 W or 25 W air-cooled marking system, it is shipped completely assembled—ready to use out-of-the-box after making power and control connections. Figure 1-1 below illustrates all the components (except laser) shipped with a complete marking system.

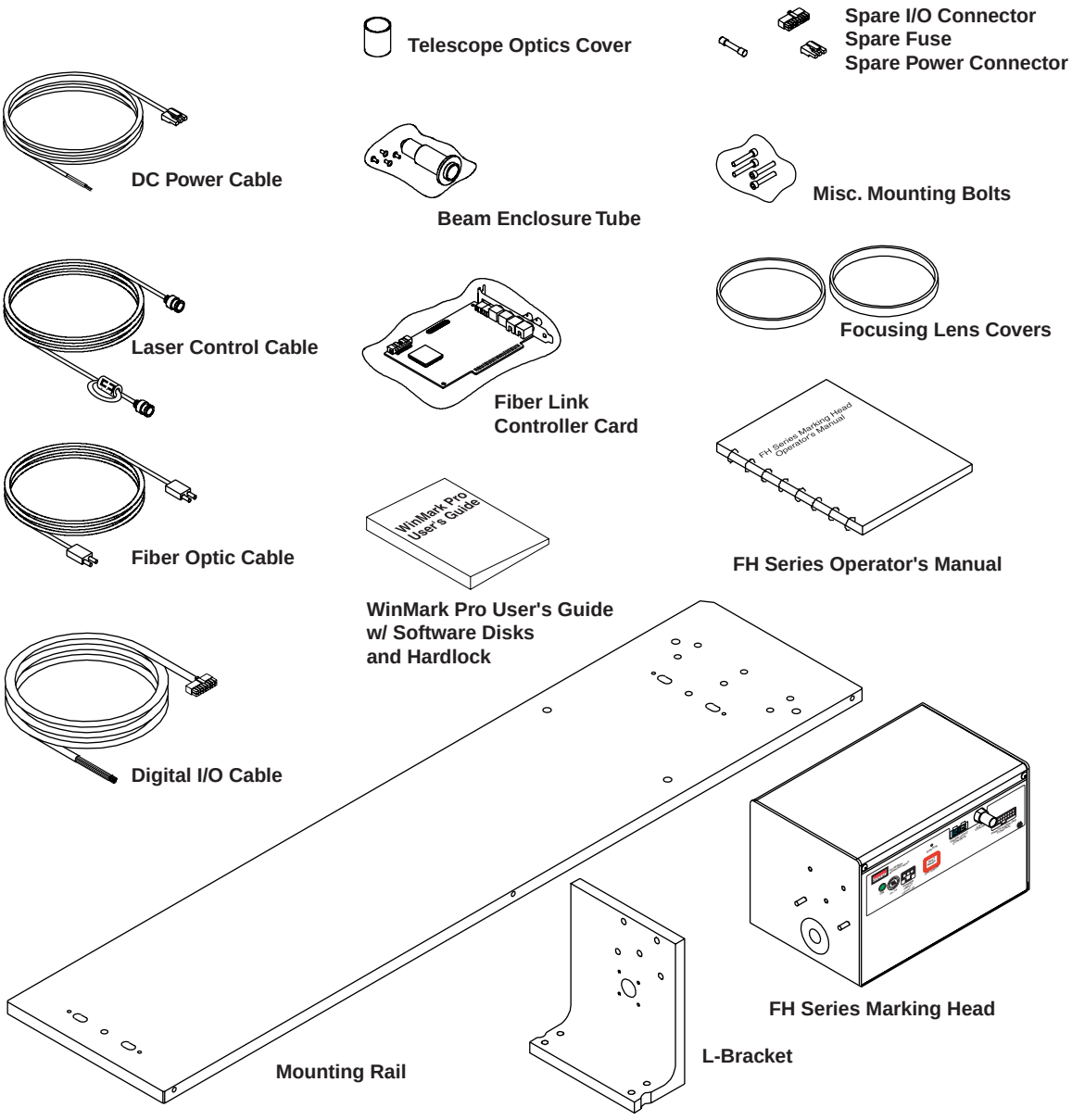


Figure 1-1 Shipping box contents

getting started

1 Inventory

FH Series Marking Head

Table 1-1 Shipping box contents

Shipping Box Contents	Qty	Shipping Box Contents	Qty
SYNRAD FH Series Marking Head	1	Accessory Kit (cont.)	
FH Series Operator's Manual	1	Laser Control Cable	1
*L-Bracket	1	Digital I/O Cable	1
*WinMark Pro Software	1	Focusing Lens Covers	2
WinMark Pro User's Guide	1	Telescope Optics Cover	1
WinMark Pro Hardlock	1	Beam Enclosure Tube	1
*Fiber Link Controller Card (FLCC)	1	Misc. Mounting Bolts	1
Fiber Optic Cable	1	Spare 5 Ampere (A) Fuse	1
Accessory Kit		Spare Power Connector	1
DC Power Cable	1	Spare Digital I/O Connector	1

Contents description

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

SYNRAD FH Series Marking Head – marks a variety of products and materials.

FH Series Marking Head Operator's Manual – provides setup, operation, and maintenance information.

*L-Bracket – serves to position the FH Head in alignment with the laser when using the Mounting Rail.

*WinMark Pro Laser Marking Software – allows you to easily create text and graphics, or import graphics files to be laser marked by the FH Series Marking Head.

WinMark Pro User's Guide – describes WinMark Pro's marking and object commands. Also covered are automation basics (using WinMark Pro in conjunction with automated parts handling equipment) and ActiveMark technology, WinMark's implementation of ActiveX control.

WinMark Pro Hardlock – installs on your computer's printer port to prevent unauthorized use of WinMark Pro software.

*Fiber Link Controller Card (FLCC) – communicates with and allows remote computer control of the FH Series Marking Head.

Fiber Optic Cable – optically isolates your computer from the FH Marking Head while providing noise-free, two-way communication.

* when ordered

getting started

Inventory

Accessory Kit Contents –

DC Power Cable – supplies power to the FH Marking Head.

Laser Control Cable – sends Command signals from the marking head to the laser.

Digital I/O Cable – allows you to connect I/O field wiring directly to the FH Marking Head.

**Focusing Lens Covers – protects the *Focusing Lens* from damage.

**Telescope Optics Cover – protects telescope input optics from damage.

Beam Enclosure Tube – encloses the beam path between the laser's output aperture and the marking head's input aperture.

Misc. Mounting Bolts – fastens the FH Head, laser, *L-bracket* and *Mounting Rail* assemblies together.

Spare 5 Ampere (A) Fuse – spare fuse for the FH Head.

Spare Power Connector with Crimp Pins – allows you to build a custom length *DC Power* cable.

Spare Digital I/O Connector with Crimp Pins – allows you to build a custom length I/O cable.

Mounting Rail

Table 1-2 Shipping box contents

Shipping Box Contents	Qty
*Mounting Rail	1

Contents description

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

*Mounting Rail – serves as a mounting base for the FH Marking Head and laser.

Laser

Table 1-3 Shipping box contents

Shipping Box Contents	Qty
*SYNRAD 10, 25, 50, 100, or 125 W laser	1

Contents description

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

*SYNRAD laser – the world's most popular sealed CO_2 laser. Evolution™ 100 and 125 W lasers include a second box containing the RF-3000 RF power supply and laser accessories.

* when ordered

** installed over optics to prevent damage during shipment

getting started

Introduction

The FH Series Marking Head family is SYNRAD's third generation marking product, evolving from our years of experience with SH and DH Series Marking Heads currently being used in hundreds of applications at customer sites throughout the world. The FH Series Index Marking Head is designed to mark stationary parts in manual, indexed, or intermittent motion applications while our newest head, the FH Tracker, marks moving parts "on-the-fly" at line speeds up to 200 feet per minute.

Marking system components

A typical FH Index laser marking system is shown in Figure 1-2 and consists of the following components available from SYNRAD:

- SYNRAD FH Series Marking Head
- Fiber Link Controller Card
- SYNRAD CO_2 laser (10 W–125 W)
- Marking head mounting kit
- 30 VDC power supply
- SYNRAD's WinMark Pro marking software

You will need to supply the following items:

- IBM-compatible computer with an open ISA bus slot (see *WinMark Pro software* later in this section for system requirements)
- Marking surface with an adjustable Z-axis
- Beam enclosure shield

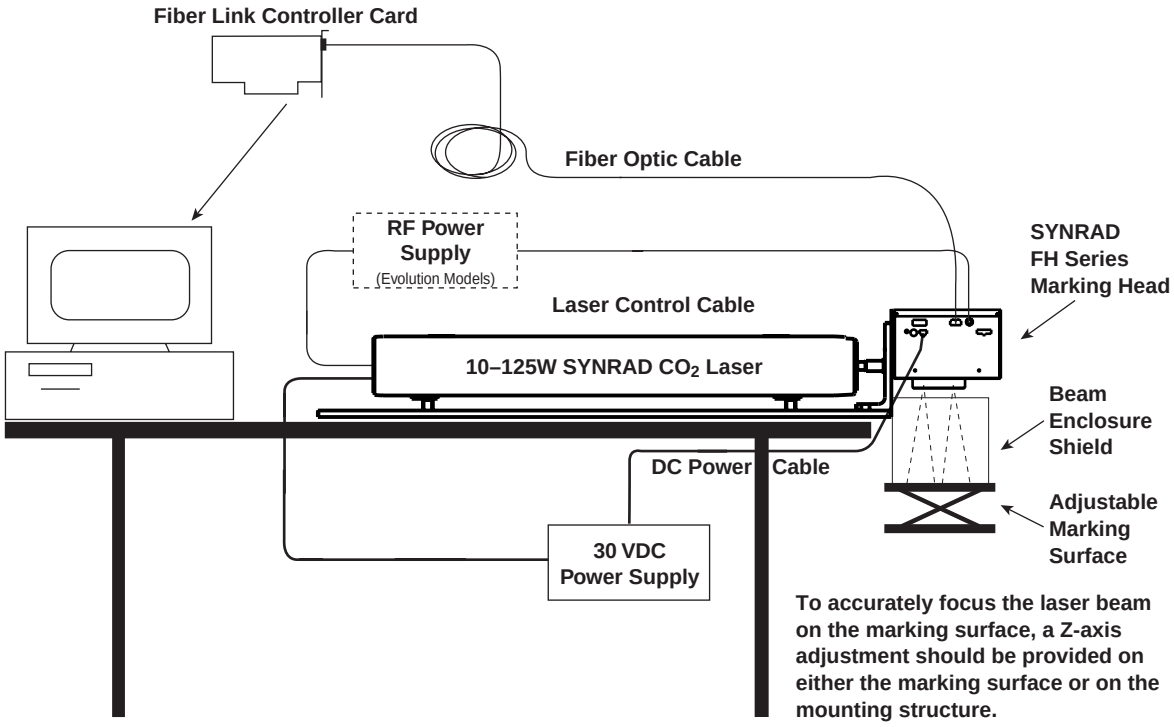


Figure 1-2 Typical FH Series marking system

getting started

Mounting

The Mounting instructions include subsections:

- Mounting Rail
- L-bracket
- FH Head
- Laser

Before mounting your FH Series Marking Head to the appropriate Mounting Rail, please ensure the following requirements are met:

- The mounting rail must be securely positioned so that the marking surface is parallel to the bottom of the marking head housing.
- Position the marking head so that the lens to marking surface distance, the working distance, matches the distance specified on the lens mount. A Z-axis adjustment for either the marking surface or the mounting rail is highly recommended.
- A beam enclosure shield should surround the beam path below the marking head and around the marking area wherever feasible.
- An Alignment Kit, SYNRAD part number 130-18184-01, may be required if you are not mounting the FH Head to an L-bracket/Mounting Rail assembly.

SYNRAD's integrated component design eliminates the need for FH Head alignment. To mount your FH Series Marking Head simply follow the steps listed in each section below.

Mounting Rail

Refer to the appropriate mounting diagram (Figure 4-16 or Figure 4-17) in the "Technical Reference" section for the proper orientation of the bevel on the *Mounting Rail* and then securely fasten the *Mounting Rail* to a rigid structure. Appendix A provides information about a mounting stand that you can build.

L-bracket

The FH Head is positioned by dowel pins on the *L-bracket*, which in turn is dowel pinned to the *Mounting Rail*. To mount the *L-bracket* to the *Mounting Rail*, perform the following steps:

1. Orient the *L-bracket* as shown in the appropriate mounting diagram, then place the bracket so that the dowel pins protruding from the bottom engage the dowel holes in the *Mounting Rail*.
2. Bolt the *L-bracket* to the *Mounting Rail* using four 1/4–20 × 3/4" socket head capscrews.

FH Head

To mount your FH Head to the *L-bracket*, perform the following steps:

1. Remove the *Telescope Optics Cover* from the rear (beam input end) of the FH Head.
2. Place the FH Series Marking Head on the *L-bracket* so that the dowel pins protruding from the rear of the head engage the dowel holes in the *L-bracket*.

3 Install and tighten three 1/4–20 × 3/4" socket head capscrews through the *L-bracket* into the marking head housing.

4 Fasten the *Beam Enclosure Tube* to the *L-bracket* using four 8–32 × 1/4" button head socket screws.

Laser

To mount the laser, perform the following steps:

Note: The laser's mounting feet are precisely aligned and shimmed at the factory to ensure alignment between the FH Series Marking Head and the *Mounting Rail*. Do not remove the calibration stickers or the mounting feet from the laser.

1 Orient the laser on the *Mounting Rail* with the output aperture facing the *L-bracket*.

2 Ease the laser forward against the *Beam Enclosure Tube* until the dowel pins on the mounting feet drop into the dowel pin holes drilled into the *Mounting Rail*. The screw holes on the ends of the feet should be positioned over the appropriate mounting holes shown in Figure 4-16 or 4-17 in the "Technical Reference" section.

3 Install and tighten four capscrews to secure the laser to the *Mounting Rail*.

48-1/48-2 lasers use 6–32 × 1" socket head capscrews (SHCS).
48-5 lasers use 10–32 × 3/4" SHCS.
Evolution 100/125 lasers use 1/4–20 × 1" SHCS.

4 Connect water and power hookups to your laser according to instructions in the laser's *Operator's Manual*.

getting started

Connecting

The Connecting instructions include subsections:

- DC Power cable
- Fiber Link Controller Card (FLCC)
- Laser Control cable

Refer to *Controls and indicators* in the "Operation" section for illustrations showing the placement and function of connections to the FH Series Marking Head.

DC Power cable

To install the *DC Power* cable, perform the following steps:

1 Locate the *DC Power* cable in the Accessory Kit.

2 Verify that the DC power supply is disconnected from its power source.

Note: The marking head can share the same 30 VDC power supply as the laser head.

3 Connect the 3-pin keyed connector on the end of the *DC Power* cable to the *Power Input* connector on the FH Head.

4 Attach the red wire on the other end of the power cable to the positive (+) terminal on the DC power supply.

5 Attach the black wire of the power cable to the negative (-) terminal on the DC power supply.

6 Attach the green wire of the power cable to earth ground.

Note: If your installation requires the use of a *DC Power* cable longer than six feet in length, a spare power connector with crimp pins for 18–24 AWG wire is included in the Accessory Kit. When wiring the spare connector, refer to Figure 1-3 below for the polarity of the FH Head's male *Power Input* connector.

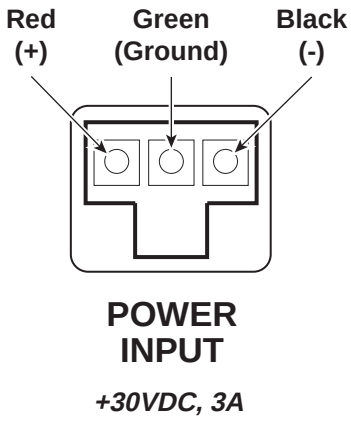


Figure 1-3 Power Input connector polarity

Fiber Link Controller Card

SYNRAD's Fiber Link Controller Card (FLCC) accepts instructions from marking software and communicates data to the FH Marking Head through a digital fiber optic cable.

Installing the FLCC

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

To install the FLCC, perform the following steps:

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

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 in Step 3 carefully to avoid damaging the card.

3. Make sure you are grounded before handling the FLCC. If a static control wrist strap is not available then ground yourself by maintaining continuous contact with your computer's grounded metal chassis. While grounded, remove the card from its static control bag and install it in the ISA slot. The gold fingers on the card should slide into the mating ISA bus slot without using excessive force. When the card is properly seated, screw the bracket into place to secure it.
4. Reinstall the cover on your computer.

getting started

Connecting

Fiber Optic cable connections

To install the *Fiber Optic* cable, refer to Figure 1-4 and perform the following steps:

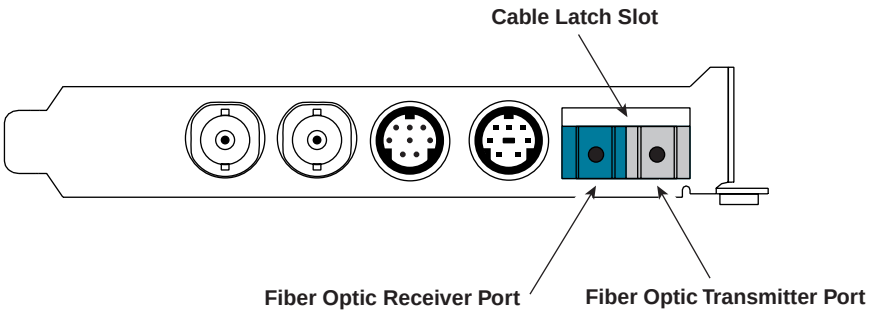


Figure 1-4 Fiber optic connectors

1. With the back of the computer accessible, locate the *Fiber Optic Receiver/Transmitter* port on the FLCC.
2. Remove the rubber dust caps from the fiber optic ports.
3. Locate the *Fiber Optic* cable in the shipping box.
4. Insert the duplex cable connector into the fiber optic port on the FLCC. When properly connected, the latch on the connector should snap into the cable latch slot. You should not be able to remove the *Fiber Optic* cable without depressing the latch.
5. With the latch facing up, insert the connector on the other end of the cable into the *Fiber Optic Control* port on the FH Head until it snaps into place. You should not be able to remove the cable without depressing the latch.

Note: The *Fiber Optic* cable is the only connection necessary to control the FH Series Marking Head; no other connections are made to the FLCC.

Laser Control cable

Install the *Laser Control* cable from the FH Series Marking Head to your laser according to its type.

Important Note: To aid electrical noise suppression, one end of the *Laser Control* cable is looped through a snap-on ferrite bead. This end of the cable should be connected to the FH Series Marking Head.

Series 48-1, 48-2 laser:

Attach the end of the coaxial control cable with the ferrite bead to the *Laser Control* BNC connector on the FH Series Marking Head. Attach the other end of the cable to the control input, labeled *CTRL*, located on the rear of the laser.

Series 48-5 laser:

Attach the long "leg" of the "Y" coaxial control cable, the end with the ferrite bead, to the *Laser Control* BNC connector on the FH Series Marking Head. Attach the short "legs" of the cable to the control inputs, labeled *CTRL1* and *CTRL2*, located on the rear of the laser.

Evolution 100/125 laser:

Attach the end of the coaxial control cable with the ferrite bead to the *Laser Control* BNC connector on the FH Series Marking Head. Attach the other end of the cable to the control input, labeled *Control In*, located on the front or rear panel of the RF-3000 RF power supply.

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

If you plan to interface the FH Series Marking Head with automated parts handling equipment, then read *Marking automation* in the "Technical Reference" section for detailed information regarding I/O connections and electrical signals.

getting started

WinMark Pro® software

SYNRAD's WinMark Pro laser marking software gives you the power to create or import professional graphics and text that can then be laser marked on your product. WinMark Pro with ActiveMark™ technology is capable of controlling every aspect of the laser marking process from incrementing serial numbers to controlling laser parameters to interfacing with parts handling equipment. A few of WinMark Pro's capabilities include:

- TrueType font support
- High speed stroke fonts
- Powerful property-driven user interface
- WYSIWYG drawing editor
- Velocity control by object
- Numerous file import filters
- Process automation
- Event Builder I/O capability
- Serial number marking
- Bar code marking
- 2D Data Matrix code marking
- ActiveMark (ActiveX / OLE) automation

System requirements

- Windows 95 / Windows 98 operating system
- 16 megabytes (MB) of RAM
- SVGA Display (800 × 600 min. resolution)
- Pentium 90 MHz or faster
- 10-MB free hard drive space

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 also contains complete information for importing graphics as well as creating text and barcode images. In addition, the manual also explains how to automate your marking process by configuring WinMark Pro to read from and write to parts handling I/O.

Note: WinMark Pro version 1.0.5.2699 or later must be used with the FH Series Index Marking Head. Version 1.0.6.2931 or later must be used with FH Tracker Heads.

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 FH Series Marking Head.

operation 2

Use information in this section to familiarize yourself with FH Series Marking Head controls and indicators and to begin marking operation.

This section contains the following information:

- Controls and indicators – displays and describes FH Marking Head controls, indicators, and connections.
- Initial start-up – explains how to start the FH Head and verify proper operation.

operation 2

Controls and indicators

Control panel

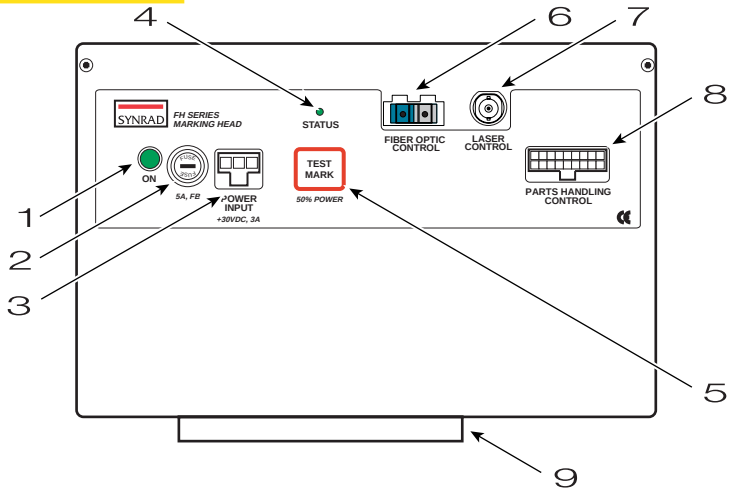


Figure 2-1 Control panel

1 *ON* Indicator – illuminates green when 30 VDC is applied to the FH Marking Head.

2 Fuse Holder – protects marking head circuitry with a 5 ampere, 125 V fast blow (FB) fuse.

3 *Power Input* Connector – receives 30 VDC from the power supply through the *DC Power* cable. The FH Head can be powered in parallel from the same 30 VDC supply as the laser.

4 *Status* Indicator – illuminates to indicate FH Head status. The indicator may be red during power-up, changing to green when the system is ready to mark. A fault condition is indicated if the lamp remains, or turns, red.

5 *Test Mark* Pushbutton – press to mark a test pattern when the *Status* indicator is illuminated green. *Test Mark* power output is 50% of the laser's rated output power with a marking speed of 40 inches per second (ips).

6 *Fiber Optic Control* Port – carries digital information via the *Fiber Optic* cable between the FH Head and the Fiber Link Controller Card (FLCC). The *Fiber Optic* cable provides noise immunity for the digitally-generated control signals.

7 *Laser Control* BNC Connector – outputs 5 kHz tickle and 20 kHz PWM Command signals to the laser.

8 *Parts Handling Control* Connector – provides four external inputs, IN0–IN3, and four external outputs, OUT4–OUT7, for signals to and from parts handling equipment through the *Digital I/O* cable. Each input or output has its own isolated ground, or return, line.

Note: When controlling the FH Series Marking Head with WinMark software, the only connections required are *DC Power*, *Laser Control*, and *Fiber Optic* cables. *Parts Handling Control* connections through the *Digital I/O* cable are typically used only when connecting the FH Head to automated parts handling equipment.

9 Focusing Lens Mount – focuses the laser beam onto the material to be marked. Each lens has a nominal working distance engraved on the bottom face of the lens mount. The actual working distance is noted on the final test report shipped with each FH Head.

Stand-alone operation

To initially test your FH Series Marking Head, perform the following steps:

1 Remove the dust cap from the focusing lens.

2 Place the material to be marked (a sheet of anodized aluminum is ideal) on your marking surface in the field of the focusing lens.

Caution

possible lens damage

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

3 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. 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 FH Head to determine the actual working distance of your lens. Refer to Table 4-1 in the "Technical Reference" section for FH focusing lens specifications.

4 Ensure that all personnel in the area are wearing the appropriate protective eyewear.

5 Apply power to the FH Head and the laser.

6 If your laser is equipped with a *Keyswitch*, turn it "On" (clockwise). The laser's green *PWR* indicator (Series 48 laser) or yellow *Laser Ready* (Evolution laser) indicator illuminates and after a five-second delay, the *Lase* indicator turns red indicating that the laser is ready to lase.

Note: During standby operation (*PWR* or *Laser Ready* indicator on, but no Command signal applied), "tickle" pulses sent to SYNRAD lasers 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 the laser to respond almost instantaneously to Command signals from WinMark Pro software as the beam is switched off and on during marking.

7 Press the *Test Mark* pushbutton. The FH Head will mark a test pattern at a default speed of 40 inches per second (ips) using 50% of the laser's rated output power.

The test pattern, shown in Figure 2-2, locates the center of the marking field. Test pattern dimensions for each lens are provided in Table 2-1. Adjust the Z-axis up and down in 1 mm increments to find the exact working distance for your specific head/lens combination.

Note: If the FH Head fails to mark properly, refer to *Troubleshooting* in the "Maintenance/Troubleshooting" section.

operation 2

Initial start-up

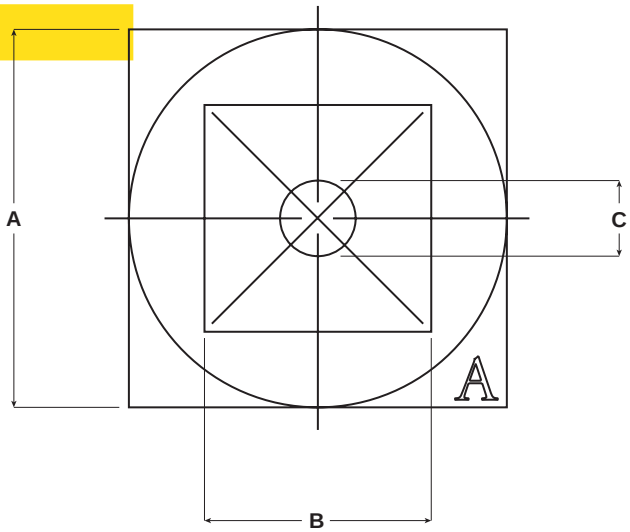


Figure 2-2 Test pattern

Table 2-1 Test pattern dimensions

Lens Size	Dim A	Dim B	Dim 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
125HP*	30.0 mm	18.0 mm	6.0 mm
80 mm	12.5 mm	7.5 mm	2.5 mm

* 125 mm lens for use with lasers 50 W and higher.

See *Custom test mark feature* in the "Technical Reference" section for information about creating a custom test mark. This feature allows a WinMark Pro mark file to be downloaded into FH memory and then marked manually via the *Test Mark* pushbutton or automatically upon receipt of an input, or part sense, signal even without a computer connected to the Marking Head!

Computer-controlled operation

Once you have verified that the FH Series Marking Head is working properly, the FLCC is installed, and WinMark software is loaded, perform the following steps to begin marking through your computer:

1 Refer to the *WinMark Pro User's Guide* and install the Hardlock.

2 Ensure that the lens size entered in WinMark is the same as the currently installed focusing lens:

- a From the ***Tools*** menu in WinMark Pro, 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 the lens currently installed on your FH Head.

3 From the ***File*** menu, open a New drawing.

4 Design a mark using WinMark or import a sample file from WinMark's *Samples* folder.

5 Place the material to be marked in the field of the focusing lens.

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

6 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.

7 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 the *Test Mark* pushbutton is pressed while WinMark Pro is marking a part, all or part of the mark may be lost. This can occur since the FH Marking Head accepts commands from both the *Test Mark* pushbutton on the control panel and WinMark Pro software. For safety reasons, if instructions arrive from both sources simultaneously, control panel inputs are programmed to take precedence.

Note: If the FH Head fails to mark properly under computer control, refer to *Troubleshooting* in the "Maintenance/Troubleshooting" section for information about the FLCC or check the *WinMark Pro User's Guide* for information regarding WinMark Pro settings.

operation 2

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tracker 3

Use information in this section to setup your FH Series Tracker Marking Head. 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 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 the FH Head'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 an FH Tracker Marking Head, please perform the tasks described in the "Getting Started" and "Operation" sections before proceeding to the "Tracker" section.

tracker 3

Introduction

Unlike static laser marking systems that require parts to be at rest during marking, the FH 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 based on a static (FH Index) sample test. 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.

Tracker system components

A typical FH Tracker marking system 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

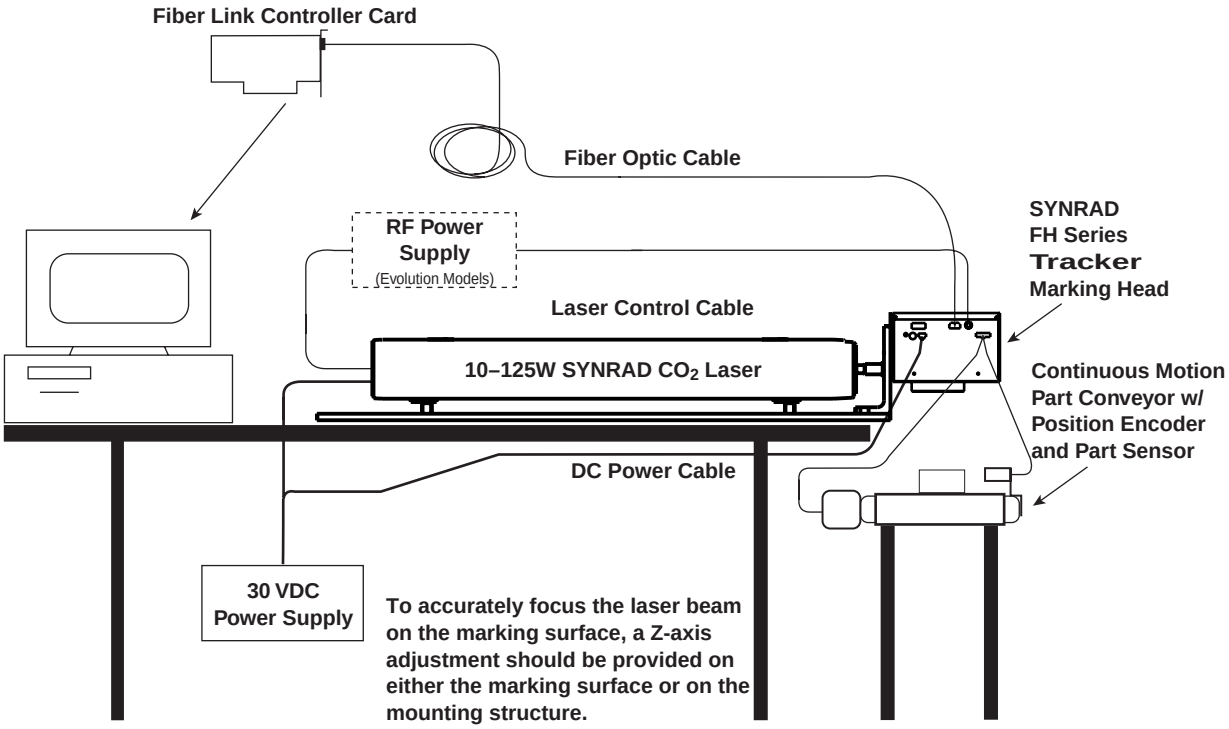


Figure 3-1 Typical FH Series Tracker marking system

Determining line speed

A general formula for determining approximate maximum line speed is to subtract the size of the mark from the size of the available marking field and divide that number by the time required to make a static mark. For example, if Tracker requires 0.2 seconds to create a 13 mm long mark using a 200 mm lens with a maximum marking field of 165 mm, then the maximum line speed would equal (165 mm - 13 mm) / 0.2 seconds = 760 mm/s = 45.6 m/min (about 150 ft/min). To achieve maximum line speed, the pitch of the parts to be marked—the distance from the leading edge of one part (or mark) to the leading edge of the next part (or mark)—should not be less than the dimension of the marking field. For the example above, the pitch of the parts should be greater than or equal to 165 mm (see Figures 3-2a and 3-2b). If your part pitch is fixed at less than the maximum marking field, then line speed equals part pitch divided by the time required to make the mark (Figure 3-2c). In this case a 13 mm mark made in 0.2 seconds with a part pitch of 130 mm provides a line speed of 130 mm / 0.2 s = 650 mm/s = 39 m/min or about 128 ft/min.

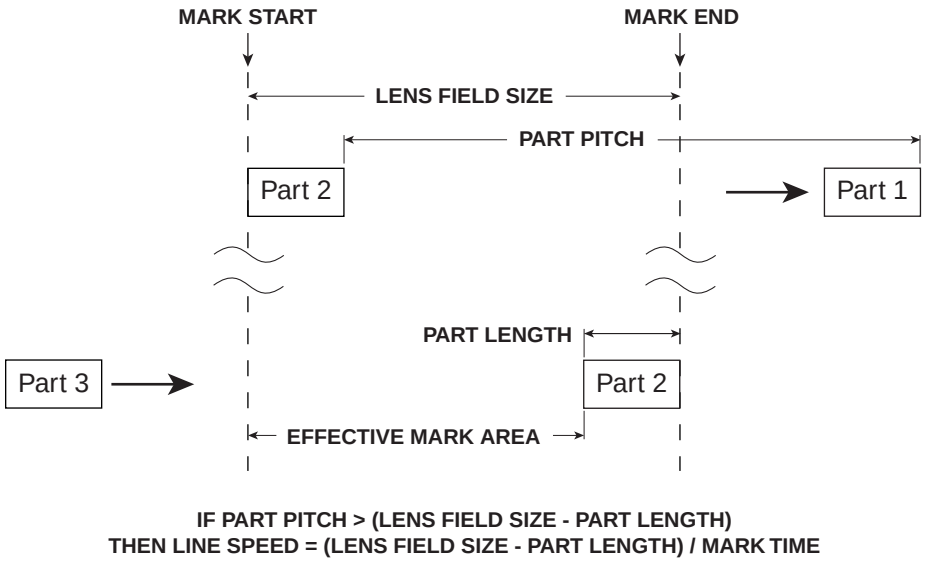


Figure 3-2a Part pitch greater than (lens field size - part length)

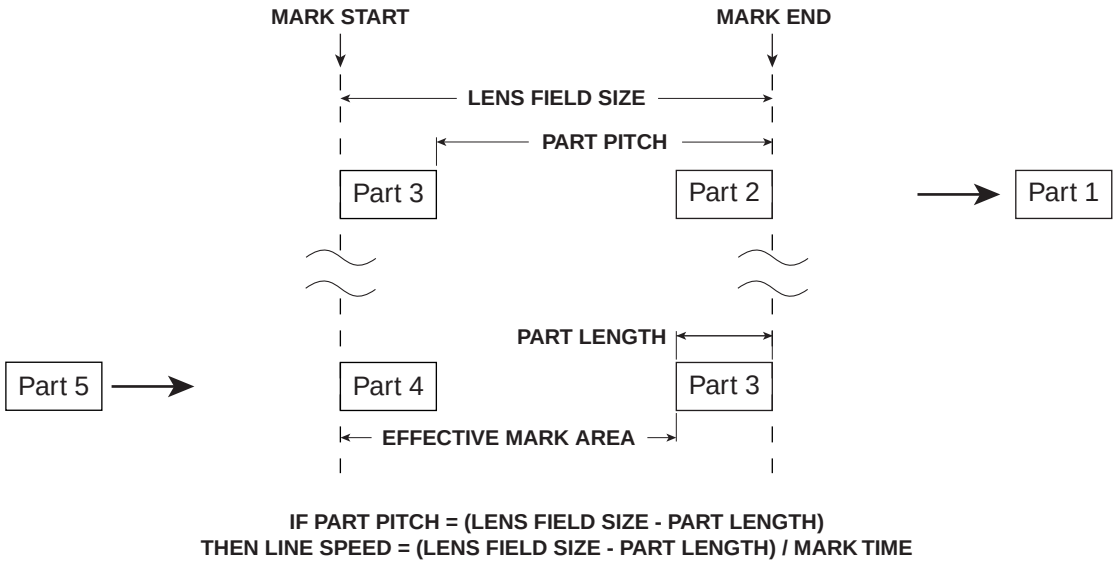


Figure 3-2b Part pitch equal to (lens field size - part length)

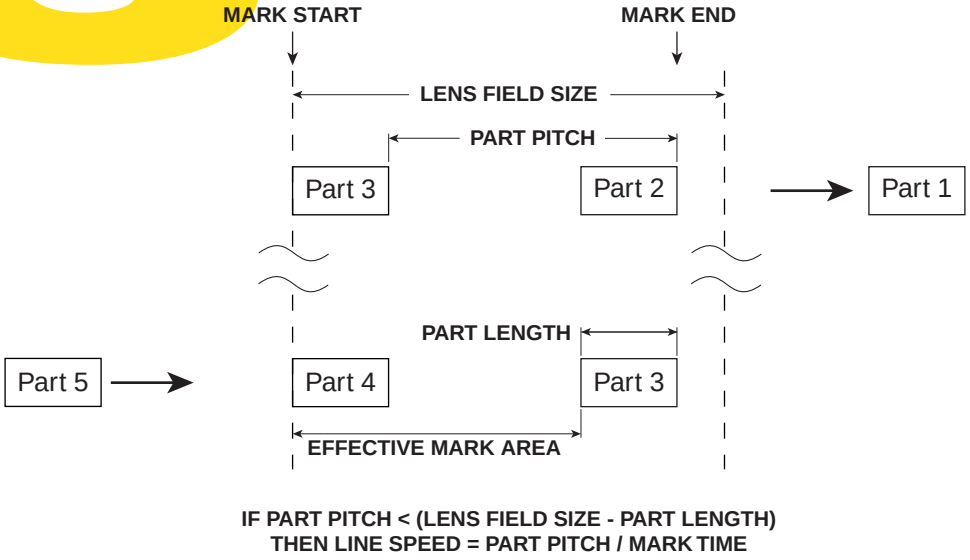


Figure 3-2c Part pitch less than (lens field size - part length)

Tracking tab

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

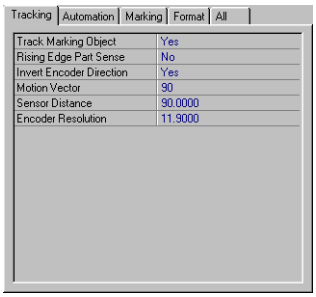


Figure 3-3 Tracking tab

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 3-4 illustrates a typical waveform from a part sensor.

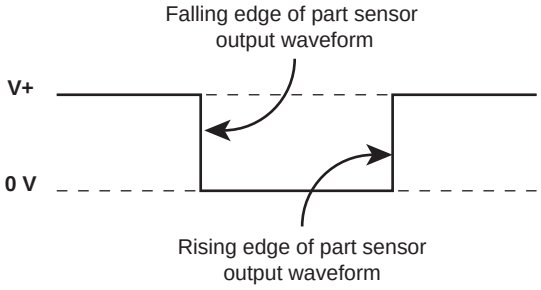


Figure 3-4 Part sensor output waveform

Invert Encoder Direction

Invert Encoder Direction allows you to invert phasing of the encoder's quadrature 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 FH Head.

Motion Vector

Set the direction of part movement through the marking field. When looking at WinMark's Drawing Canvas (shown in Figure 3-5), 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.

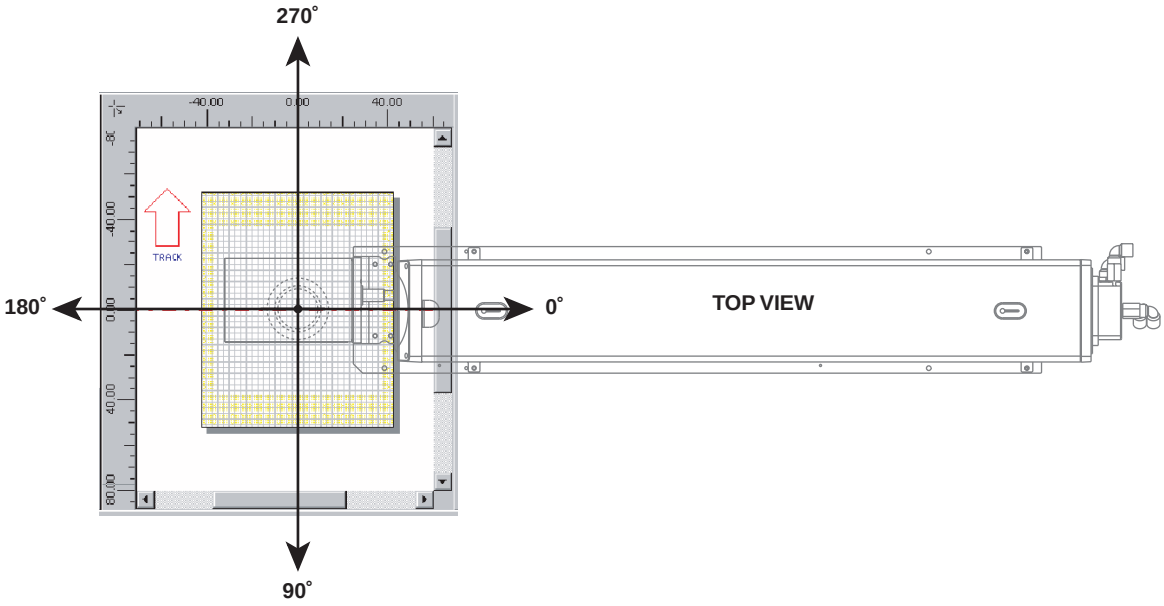


Figure 3-5 Drawing Canvas coordinates relative to Tracker

Note: Part motions of either 90° or 270° provide the fastest line speeds because part movement is along the long axis of the marking field; 0° or 180° part movement will be slightly slower. Although non-cardinal motion vectors (like 70° or 125°) are supported by Tracker, it is simpler to setup and achieve expected results using the cardinal motion vectors of 0°, 90°, 180°, or 270°.

Sensor Distance

Set the distance from the point of part sense to the centerline of the marking field. The maximum distance is limited to 305 mm (12 in.).

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 3

Additional hardware

FH Tracker Heads 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 bidirectional or 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 FH Tracker, some or all of them may already exist in the equipment that performs your automated parts handling. *Appendix B* provides information on a Tracker Motion Sensing Kit for those customers who prefer to buy motion detection components from SYNRAD.

Rotary position encoder

A rotary position encoder is required to send position information to the FH Tracker. 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 "bidirectional" or "quadrature" output signal, a two channel signal whose phase relationship distinguishes forward and reverse motion. Do not use an absolute position encoder.

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 *Encoder setup* for sample calculations)
Input Voltage	15.0–40.0 VDC
Output Signal	Open collector Low level output voltage: -0.6–5.0 VDC (0 V typ.) High level output voltage: 15.0–40.0 VDC (24 V typ.) Maximum current: 15 mA Quadrature or bi-directional

Encoder connection

Position encoder outputs are connected directly to the FH Tracker's *Parts Handling Connector*. 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 3-6 for NPN open collector or N-channel open drain encoders. Use Figure 3-7 for PNP or P-channel encoders.

Note: If using SYNRAD's Tracker Motion Sensing Kit, connect the encoder's five-pin DIN jack to the five-pin DIN plug on the end of Tracker's *Parts Handling Control* cable. Plug the 18-pin *Parts Handling Control* connector into the *Parts Handling Control* port on the FH Head.

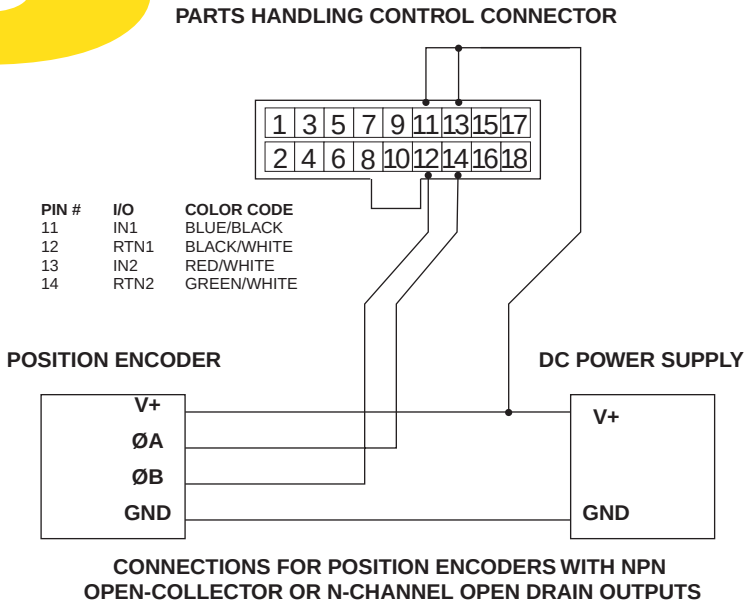


Figure 3-6 Wiring diagram for NPN or N-channel encoders

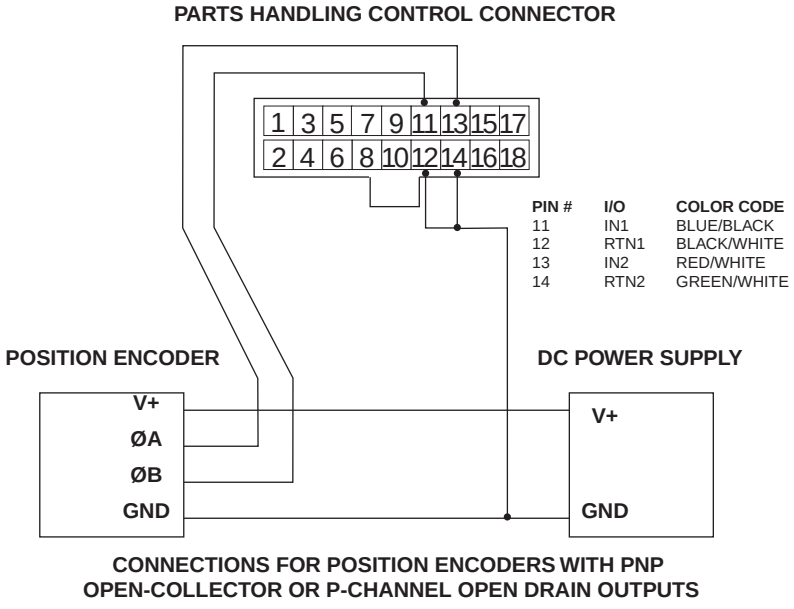


Figure 3-7 Wiring diagram for PNP or P-channel encoders

Verify that field wiring is correct after all encoder connections are complete. Locate and start Digital Scope (*DigScope.exe*) in the *WinMark* folder and then apply DC power to the encoder. If the encoder is properly connected, input bits 1 and 2 should toggle as the position encoder rotates through its range of motion.

Note: To prevent I/O conflicts, always close Digital Scope before starting WinMark Pro.

Encoder setup

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

Encoder resolution (pulses per mm of motion) = X (pulses per rev) × Y (coupling factor) × 1 m/1000 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:

Encoder resolution = **X** × **Y** × 1 m/1000 mm

= 360 pulses/rev × 14.32 rev/m × 1 m/1000 mm

= 5155.2 pulses/m × 1 m/1000 mm

Encoder resolution = 5.1552 pulses per millimeter of conveyor motion

An encoder resolution between 5–15 pulses per millimeter of conveyor motion should provide adequate resolution for conveyors that start and stop, briefly reverse, move at variable speeds, or encounter some jerkiness during operation. Use lower resolutions (1–5 pulses per millimeter) for lines that move very smoothly at constant speeds.

Tracker's optically-isolated inputs have an electrical input frequency limitation of 13–15 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 outputs 1000 pulses/rev and the coupling factor is determined to be 8 rev/m 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 practical input 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 the *linestack200.mkh* or *linestack370.mkh* sample file included in the *WinMark* folder. This file consists 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.

To fine tune encoder resolution, follow the steps below:

1 In the *WinMark* folder, locate and load *linestack200.mkh* or *linestack370.mkh*.

2 Click the *Marking* tab and set an appropriate Power for your test substrate.

Note: If your test substrate is a different height than the part to be marked, remember to adjust the Z-axis of the part conveyor or marking head in order to maintain the proper lens focal length.

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 3-8 below.

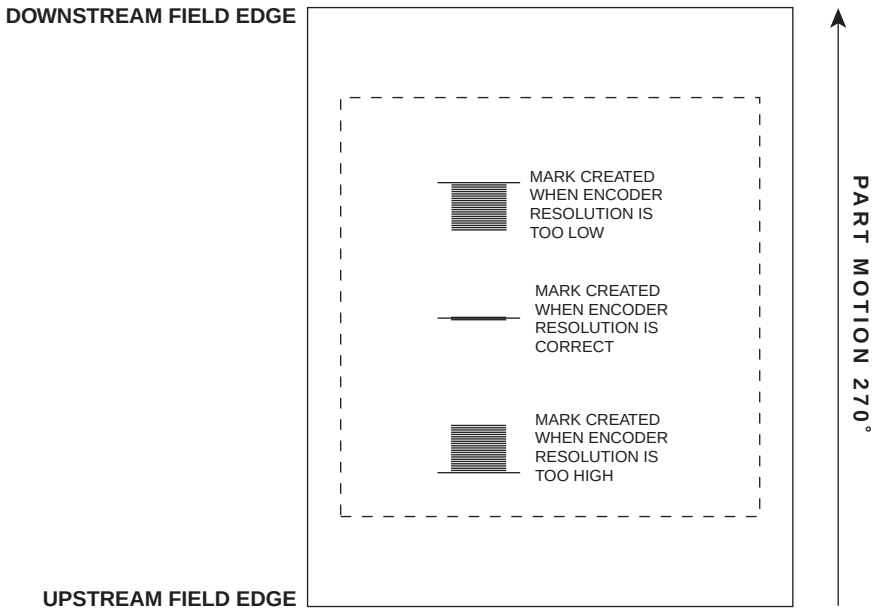


Figure 3-8 Linestack mark

6 When Encoder Resolution is set accurately, the lines will appear as one long line. If the longer line is ahead of the others in the direction of motion, then increase Encoder Resolution. If the longer line lags the others, then decrease resolution. Accuracy to the second decimal point may be required depending upon the resolution of your particular encoder.

Part sensor

A part sensor is required to send part position information to the FH Tracker. Any number of capacitive, inductive, photoelectric, or mechanical sensors currently on the market can be used depending on the part's material composition and your marking environment.

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 (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.) Maximum current: 15 mA

Part sensor connection

The part sensor output is connected directly to the FH Tracker's *Parts Handling Connector*. 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 3-9 for NPN open collector or N-channel open drain sensors. Use Figure 3-10 for PNP or P-channel sensors.

Note: If using SYNRAD's Tracker Motion Sensing Kit, connect the sensor's four-pin DIN jack to the four-pin DIN plug on the end of Tracker's *Parts Handling Control* cable. Plug the 18-pin *Parts Handling Control* connector into the *Parts Handling Control* port on the FH Head.

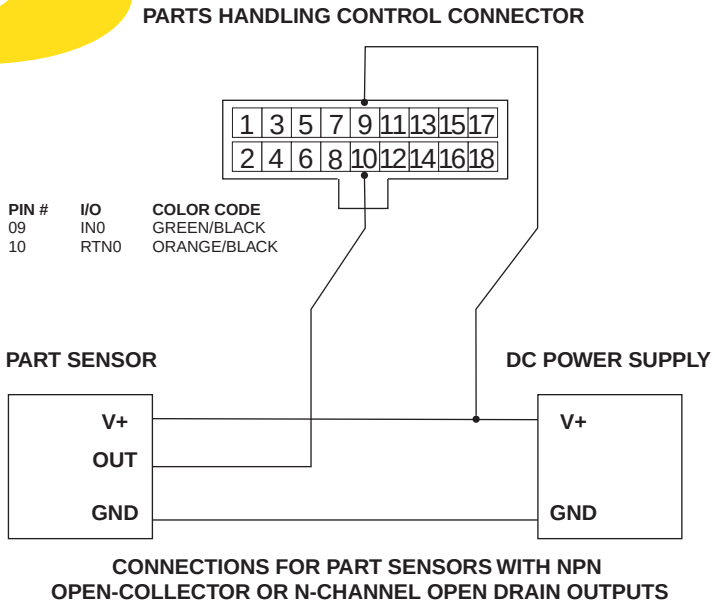


Figure 3-9 Wiring diagram for NPN or N-channel sensors

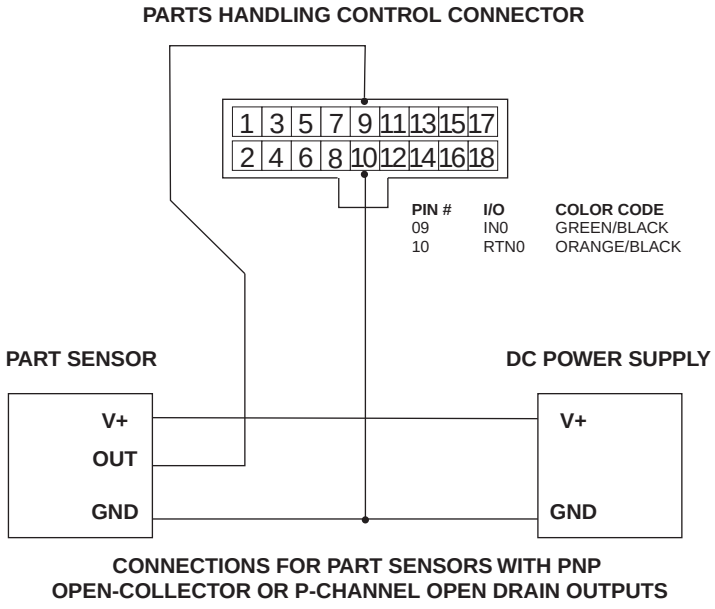


Figure 3-10 Wiring diagram for PNP or P-channel sensors

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 bit 0 should toggle when the part sensor activates.

Note: To prevent I/O conflicts, always close Digital Scope before starting WinMark Pro.

Part sensor setup

Set part sensor parameters by referring to Figure 3-11 and following the steps below:

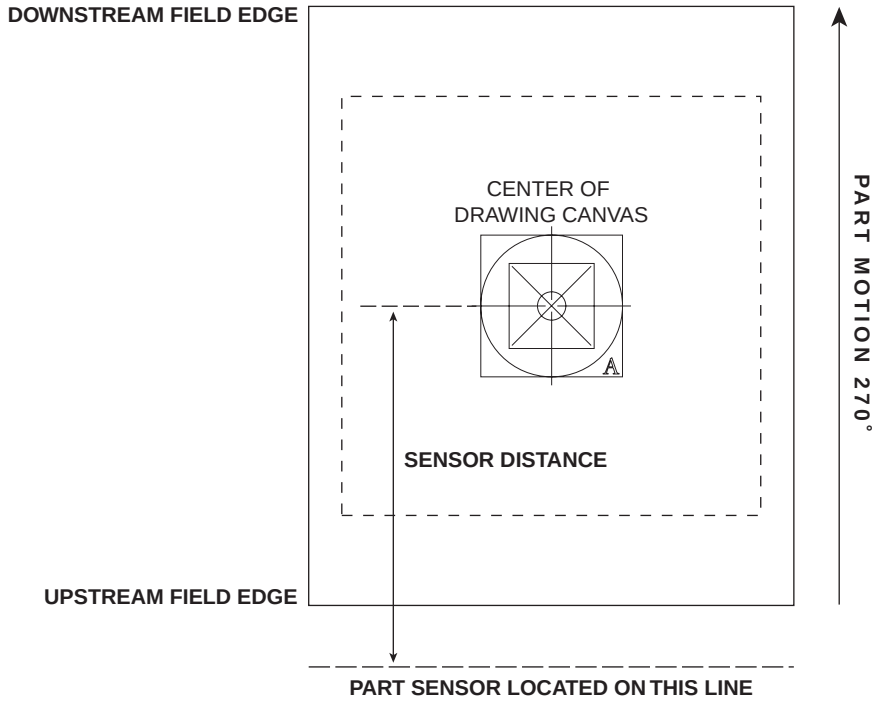


Figure 3-11 Part sensor setup

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* or *No* depending on which edge of the output signal triggers the mark. Refer back to Figure 3-4.
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 FH Tracker Head.
4. Measure the distance between the point of part sensing (the point when the sensor activates) and the center of the marking field indicated by the test mark target.
5. 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

Function	Specifications
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

Text

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

When marking a file containing just non-filled text (such as "123XYZ"), start marking only when the mark area encompassed by "123XYZ" is fully within the marking field of the lens. Marking can continue up until the moment the last portion of text to be marked (the last part of the "Z") exits the marking field. Figure 3-12 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.). When marking two or more lines of text, the mark must not exit the marking field before the last character on the *last* line, not the last character on the *first* line, is completed.

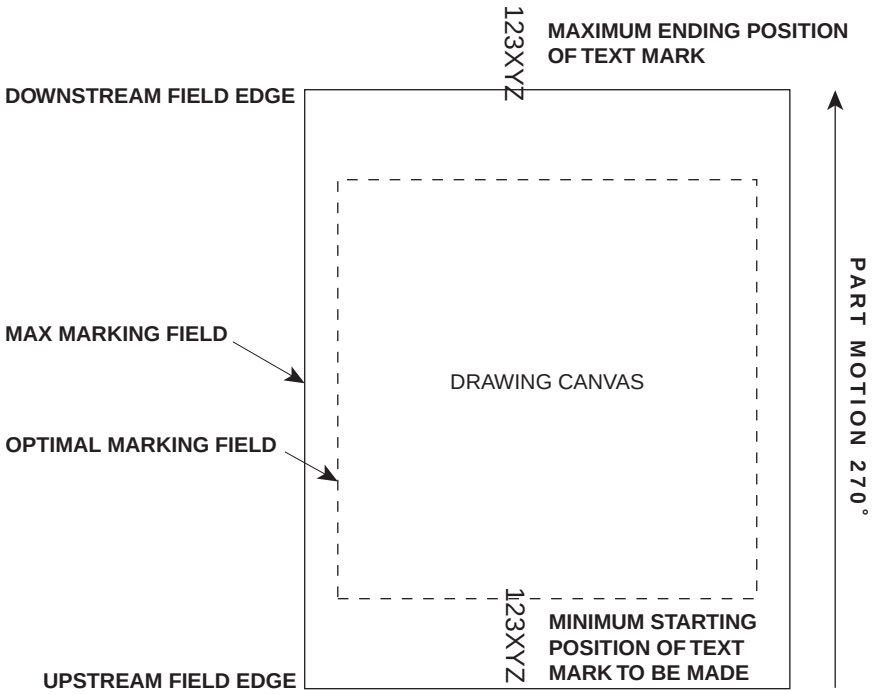


Figure 3-12 Sample text mark

Because WinMark Pro marks text just as you type it in (from left to right), this feature can be used to ensure your mark is made at the fastest speed possible. To achieve the highest line speeds, perform the following steps:

1 Orient either the text or the part to be marked as shown in Figure 3-13 so that the laser mark is made moving against, or counter to, the direction of part motion.

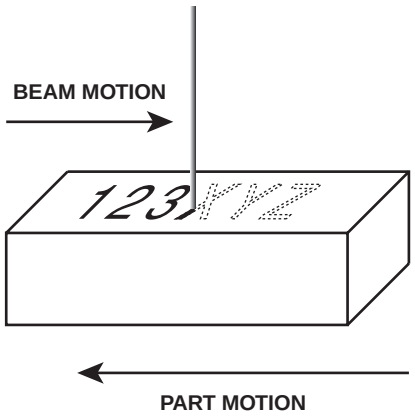


Figure 3-13 Beam/mark motion

2 Position the mark on the Drawing Canvas so that the entire mark is placed near the upstream edge of the marking field (Figure 3-14).

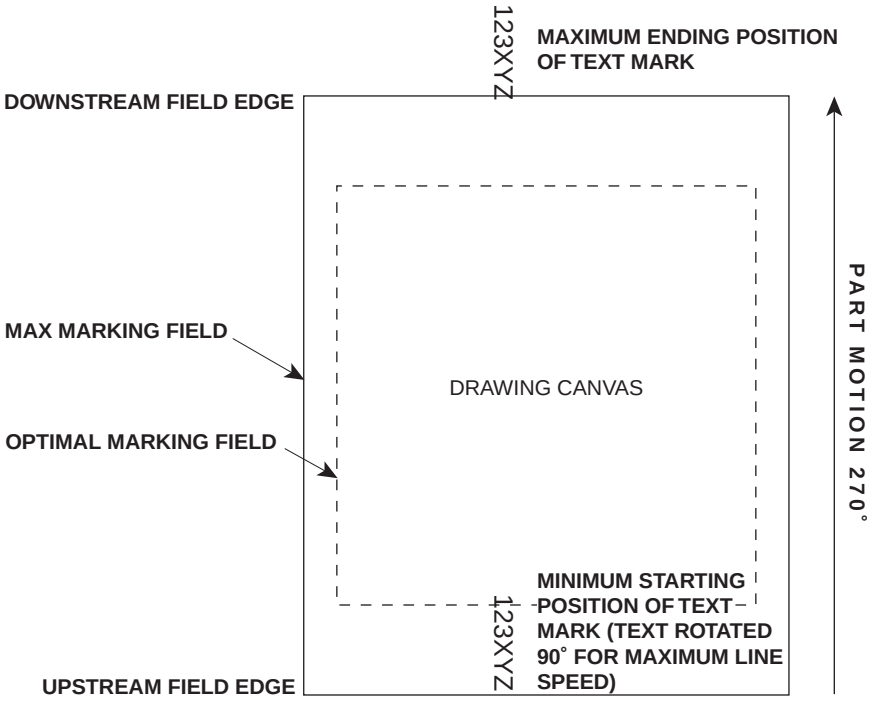


Figure 3-14 Marking orientation

3 Make the mark at the desired line speed. 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.

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 marking field. 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 marking field 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 3-15), arrange drawing objects as required.

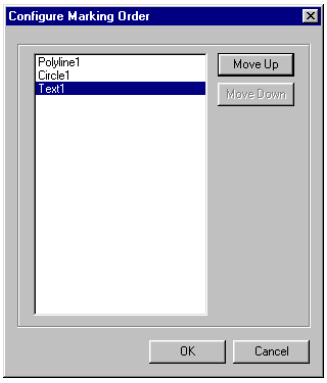


Figure 3-15 Configure Marking Order dialog box

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 Tracker's high-speed "on-the-fly" marking. Although 2D Data Matrix codes are also bitmap (raster scanned) objects, WinMark Pro version 2.0 now supports a "fast" 2D Data Matrix code using vector circles. This "fast" code, marked by creating small circles at the spot size of the lens, is a viable option for marking 2D Data Matrix codes with Tracker.

Repositioning marks

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 Drawing Canvas and then adjust Sensor Distance on WinMark's *Tracking* tab to center the actual mark on the part.

To relocate the position of marking *across* the axis of part motion, select mark objects on the Drawing Canvas and use your mouse or arrow keys to move the objects perpendicular to part motion as shown in Figure 3-16.

Note: When positioning objects on the Drawing Canvas, never place any object beyond the edges of the maximum marking field.

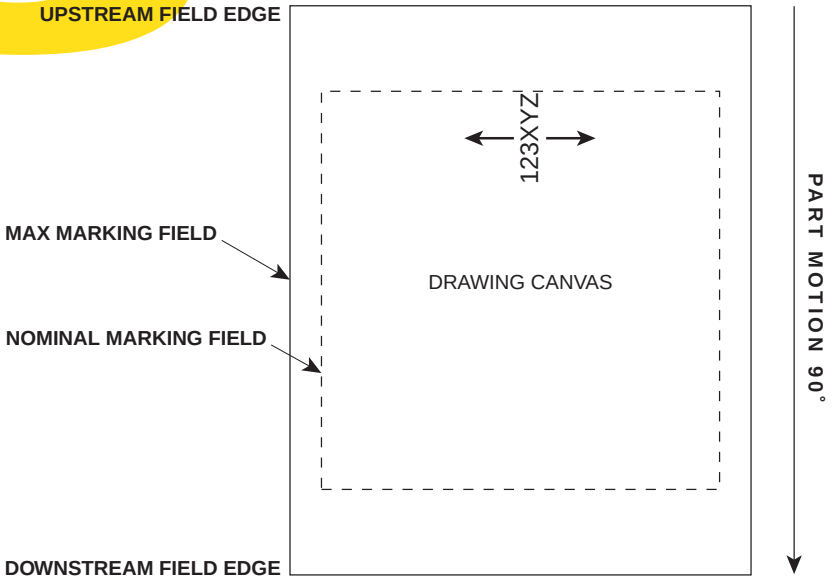


Figure 3-16 Positioning mark across axis of motion

Positioning for best quality

Objects placed near the corners of the maximum marking field on the Drawing Canvas may exhibit a slight degradation in mark quality. If the best marking quality is important, then position the mark so that the entire mark is completed while the part is within the optimal marking field of the lens (Figure 3-17). Because of this smaller marking area, maximum line speed will be reduced.

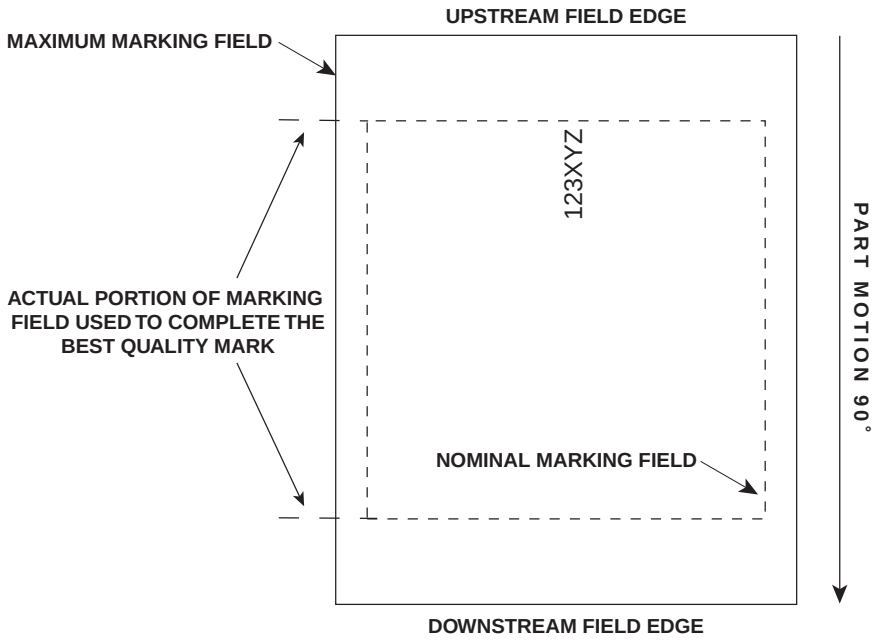


Figure 3-17 Positioning mark for best quality

technical reference 4

Use information in this section as a technical reference for your FH Series Marking Head.

This sections contains the following information:

- FH Head technical overview – briefly describes SYNRAD's FH Series Marking Head technology.
- Custom test mark feature – explains how to implement the custom test mark feature with your FH Head and WinMark Pro.
- Marking automation – explains how to interface the FH Head to parts handling equipment.
- Optional Fiber Link Controller Card features – describes the FLCC's Fast Acting Safety Interlock function and illustrates DIP switch settings.
- General specifications – lists FH Series Marking Head specifications.
- FH package outline drawing – illustrates FH Series Marking Head package outline and mounting dimensions.
- FH Head / Model 48-1/48-2 package outline drawings – illustrates package outline and mounting dimensions for an FH Head with a 10 or 25 W laser.
- FH Head / Model 48-5/Evolution 100 package outline drawing – illustrates package outline and mounting dimensions for an FH Head with a 50 or 100 W laser.
- FH Head / Evolution 125 package outline drawing – illustrates package outline and mounting dimensions for an FH Head with a 125 W laser.
- FH Head / Model 48-1/48-2 mounting – illustrates an exploded assembly drawing for an FH Head with a 10 or 25 W laser.
- FH Head / Model 48-5/Evolution 100/125 mounting – illustrates an exploded assembly drawing for an FH Head with a 50, 100, or 125 W laser.

technical reference

4 FH Head technical overview

Control circuitry

WinMark Pro software sends commands to FH control circuitry through a digital fiber optic link. Once received by the control board, these software commands are interpreted and sent to the proper control element. Digital laser power commands are converted into a 20 kHz pulse width modulated (PWM) Command signal sent to the laser (the tickle signal is sent at a 5 kHz clock rate). 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.

Marking head

The purpose of the 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 head through an expansion telescope. One of two expansion ratios is used depending upon the laser's beam diameter: 3X for Series 48 lasers, 2.5X for Evolution lasers. 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 a single-element 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, providing excellent mark quality since the focused spot is located in the same horizontal plane over the entire marking field.

Lens specifications

To accommodate customers who need a slightly larger marking field at the same working distance, FH lenses are able to mark images beyond the standard field specification. Table 4-1 lists nominal and max field size, working distance, focused spot size, and depth of field specifications for FH lenses. In WinMark Pro, the white center area on the Drawing Canvas denotes the nominal (standard) imageable area for the currently installed focusing lens. The outer border (shaded yellow) indicates the maximum marking field for that lens. Objects or text placed in the yellow shaded area, especially those objects placed near the corners, may exhibit a slight degradation in mark quality.

Table 4-1 FH lens specifications

Lens Focal Length	Nominal Field H × W, mm	Max. Field H × W, mm	Working Distance* typical, mm	Spot Size (1/e²), µm	Depth of Field, mm
370 mm	198 × 198 (7.79" × 7.79")	241.0 × 297.0 (9.49" × 11.69")	350 ±5 (13.78")	540 (0.021")	± 10 (±0.394")
200 mm	110 × 110 (4.33" × 4.33")	134.0 × 165.0 (5.28" × 6.50")	190 ±3 (7.48")	290 (0.011")	± 2.5 (±0.098")
125 mm	74 × 74 (2.91" × 2.91")	85.7 × 105.6 (3.37" × 4.16")	128 ±2 (5.04")	180 (0.007")	± 1.5 (±0.059")
125HP**	66 × 66 (2.60" × 2.60")	80.4 × 99 (3.16" × 3.90")	126 ±2 (4.96")	180 (0.007")	± 1.5 (±0.059")
80 mm	27 × 27 (1.06" × 1.06")	33.5 × 41.2 (1.32" × 1.62")	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.

** 125 mm lens for use with lasers 50 W and higher.

technical reference

4 Custom test mark feature

Overview

With the introduction of the Tracker model, customers with FH Series Marking Heads (firmware version 7 or greater) using WinMark Pro (version 2.0.0.3019 or later) have the ability to download a custom test mark to their FH Index or Tracker Head. Like the standard test pattern shown in Figure 2-2 in the "Operation" section, a custom test mark loaded into the FH Head'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 the FH Head.

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.

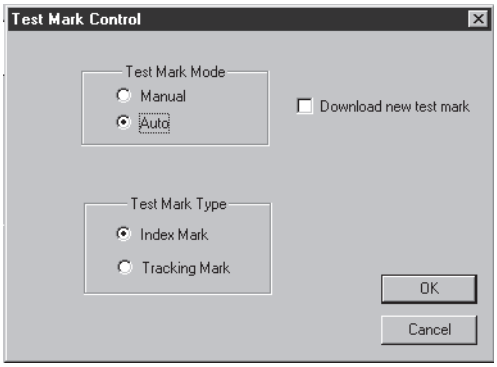


Figure 4-1 Test Mark Control dialog box

Note: If the FH Head 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 *Firmware* version is 7 or greater.

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 on the FH Head is pressed.

technical reference

4 Custom test mark feature

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 on the FH Head 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 an input signal is sensed.

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 received equal the specified Sensor Distance. When the *Test Mark* pushbutton on the FH Head is pressed, Tracker makes 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 an FH Index Marking Head.

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 the FH Head's non-volatile memory. For example, the default test pattern (see Figure 2-2 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 the FH Head 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 2-3) opens.

Note: If Index or Tracker *Auto* **Test Mark Mode** is currently enabled, then a dialog box appears indicating that auto test marking has been disabled. This prevents an input signal from commanding the FH Head 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 marking head is an Index 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 *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.

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. Select the *Download new test mark* check box to download the currently active WinMark file to FH Head memory.
3. Click **OK**. 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.

The marking head 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 can be reloaded into FH memory for lens testing or mark centering.

technical reference

4 Marking automation

The Marking automation section includes subsections:

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

Connecting to parts handling equipment

FH Series Marking Heads incorporate 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 software.

Important Note: The installation of a network card in the computer running WinMark Pro software may, in some cases, cause unintended laser firing. Because WinMark software must be in full control of the computer when firing the laser, SYNRAD strongly recommends that WinMark be installed in a stand-alone computer, separate from any networking, motion control, or parts handling systems. A second computer or programmable logic controller (PLC) is ideal for controlling parts handling or networking functions.

A simple system utilizing FH Series Marking Head digital I/O and WinMark Pro to control marking might operate like this: A conveyor stops with a new part positioned under the marking head and then delivers a "start mark" signal to an FH input. WinMark Pro recognizes the input transition and marks the part. On completion of the mark, WinMark Pro signals the FH Head 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 SYNRAD's FH Series Marking Head and the automation features of WinMark Pro enable this kind of process control.

Figure 4-2 shows the physical layout of the FH Head's optically-isolated output terminals. Table 4-2 lists pin assignments for the *Parts Handling Control* connector.

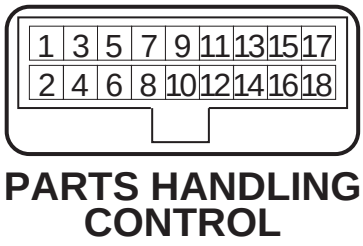


Figure 4-2 Physical layout of Parts Handling Control connector

Note: If your installation requires the use of a *Digital I/O* cable longer than six feet in length, a spare 18 pin I/O connector with crimp pins for 20–24 AWG wire is included in the Accessory Kit. When wiring the connector, refer to Figure 4-2 and Table 4-2 for the position and description of I/O connections.

Table 4-2 Parts Handling Control connector pin assignments

Pin #	Signal	Wire Color
1	RTN4	Black
2	OUT4	White
3	OUT5	Red
4	RTN5	Green
5	RTN6	Orange
6	OUT6	Blue
7	OUT7	White/Black
8	RTN7	Red/Black
9	IN0	Green/Black
10	RTN0	Orange/Black
11	IN1	Blue/Black
12	RTN1	Black/White
13	IN2	Red/White
14	RTN2	Green/White
15	IN3	Blue/White
16	RTN3	Black/Red
17	DO NOT CONNECT	
18	DO NOT CONNECT	

Digital input circuitry

Figure 4-3 shows the FH Head's optically-isolated input circuitry.

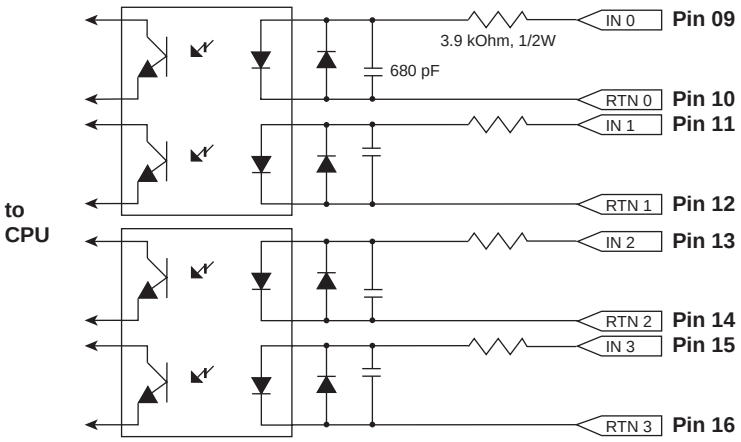


Figure 4-3 Input circuit

Table 4-3 provides electrical signal parameters for inputs sent to the FH Head.

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			15 mA

Sample input circuits

The FH Head's optically-isolated inputs can be used to start a marking operation or choose among multiple marks. 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".

FH 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 FH inputs can be activated by a 5 V logic IC with an open collector or open drain outputs a shown in Figure 4-4.

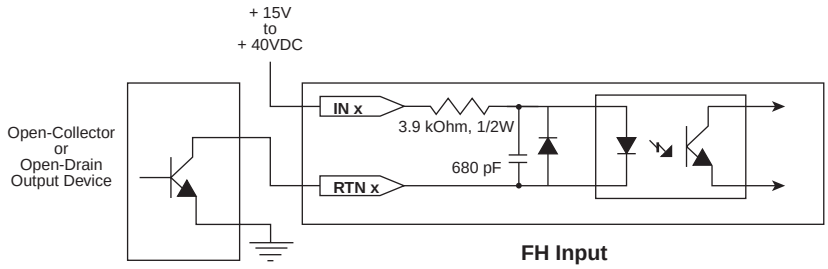


Figure 4-4 5 V logic IC input

Another common requirement in marking applications is for an operator to initiate each mark operation by closing a foot-operated switch. Figure 4-5 illustrates a simple input circuit for using a foot switch or relay contact to send an input signal to the FH Head.

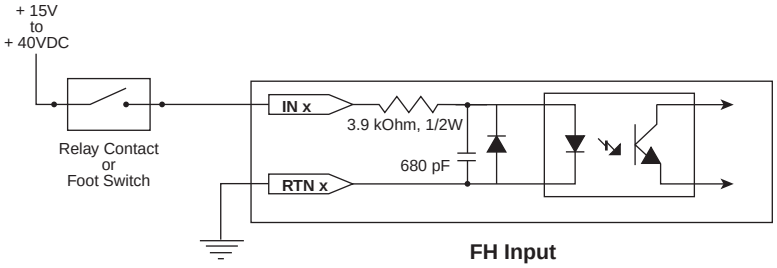


Figure 4-5 Relay or foot switch input

Digital output circuitry

Digital outputs are designed to operate small relays or toggle inputs on parts handling equipment. Figure 4-6 shows the FH Head's optically-isolated output circuitry.

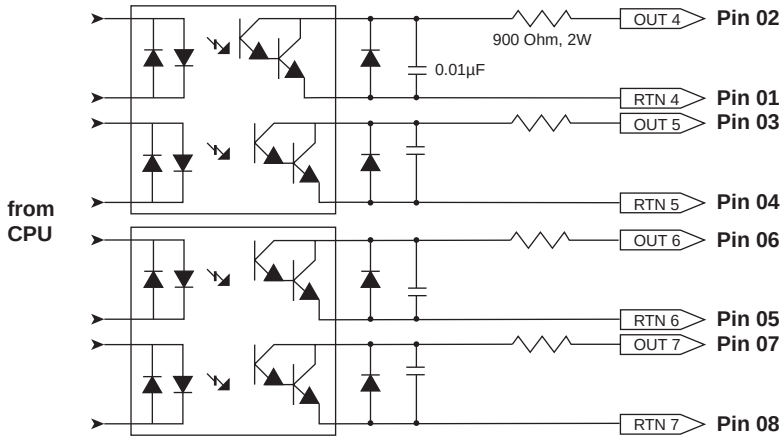


Figure 4-6 Output circuit

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

Table 4-4 Output signal parameters

Output Parameter	Max
Sinking Current	40 mA
Darlington Breakdown Voltage	40 V
Darlington VCE_{SAT}	1.0 V

Sample output circuits

FH Head optically-isolated outputs 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 FH 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 4-7 illustrates a simple output connection. In this configuration, the output is sinking current. When sizing V_{DC} remember to account for the voltage drop across the output's 900 Ω output resistor.

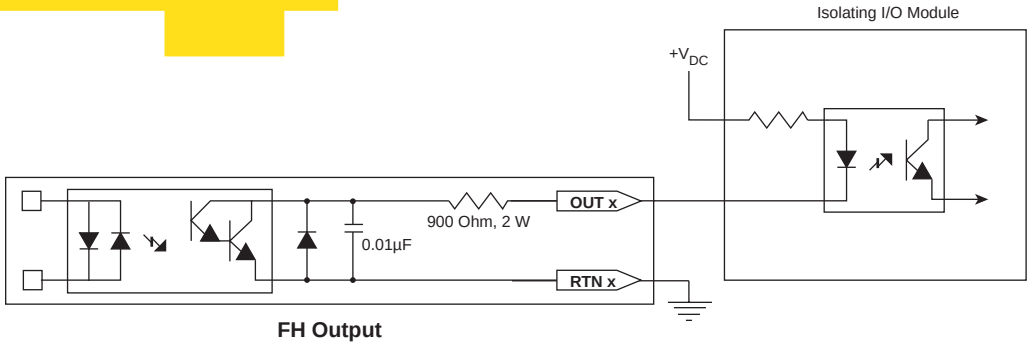


Figure 4-7 Output to isolated I/O module

Figure 4-8 illustrates a simple driver for a small signal relay. When the output 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.

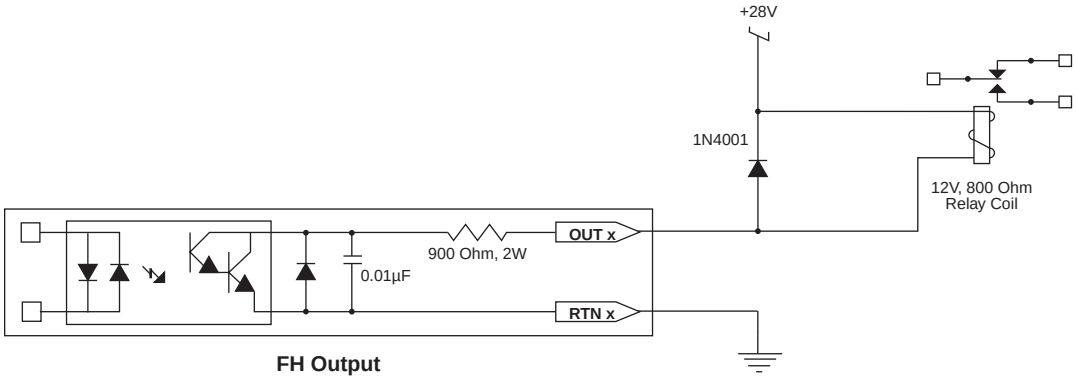


Figure 4-8 Output to relay driver

Figure 4-9 illustrates a simple logic interface circuit. When the output is ON, the logic input is High.

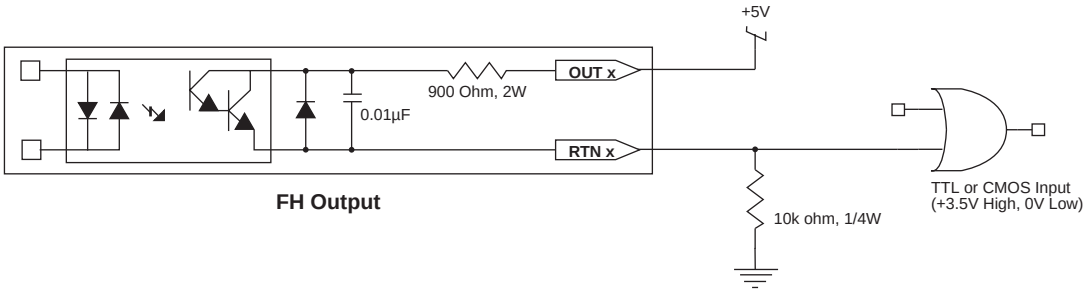


Figure 4-9 Output to TTL or CMOS logic interface

4 Optional FLCC features

Fast Acting Safety Interlock (FASI)

Many marking applications require a safety action to occur for each part that is marked. An example of this kind of action would be a machine that lowers a shield over a part prior to marking, then raises the shield to advance the part as soon as the mark is complete. SYNRAD lasers are 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, the FH Marking Head incorporates a Fast Acting Safety Interlock (FASI) function. The FASI function prevents the laser from firing unless a signal is present on FH input #3 (pin 15 of the *Parts Handling Control* connector). The FH Head responds to this rising signal transition in less than 1 ms.

To enable the FASI feature, perform the following steps:

1. Set DIP switch #6 on the FLCC to the "On" position. Refer to Figure 4-10 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 FH input #3.

   When the FASI feature is enabled, FH input #3 must be active before the laser can fire (if the FASI feature is enabled and FH 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 #6) on the FLCC are only sent to the FH Marking Head when WinMark Pro or Digital Scope 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 (or Digital Scope) so that the new state is written into FH memory.

When the FASI function is enabled, this interlock state is placed in the FH Head's non-volatile memory and so does not depend on WinMark Pro software or even the computer to be running. This means that even manual firing of the laser using the *Test Mark* pushbutton requires an active signal on input #3.

Table 4-5 illustrates the relationship between DIP switch #6 and FH input #3.

Table 4-5 DIP switch / signal relationships

FLCC DIP SW 6	FH Marking Head Input # 3	Laser Status
Off	Inactive (Low)	Enabled
Off	Active (High)	Enabled
On	Inactive (Low)	Disabled
On	Active (High)	Enabled

technical reference

4 Optional FLCC features

DIP switch settings

Figure 4-10 shows the factory default settings of the FLCC's DIP switches.

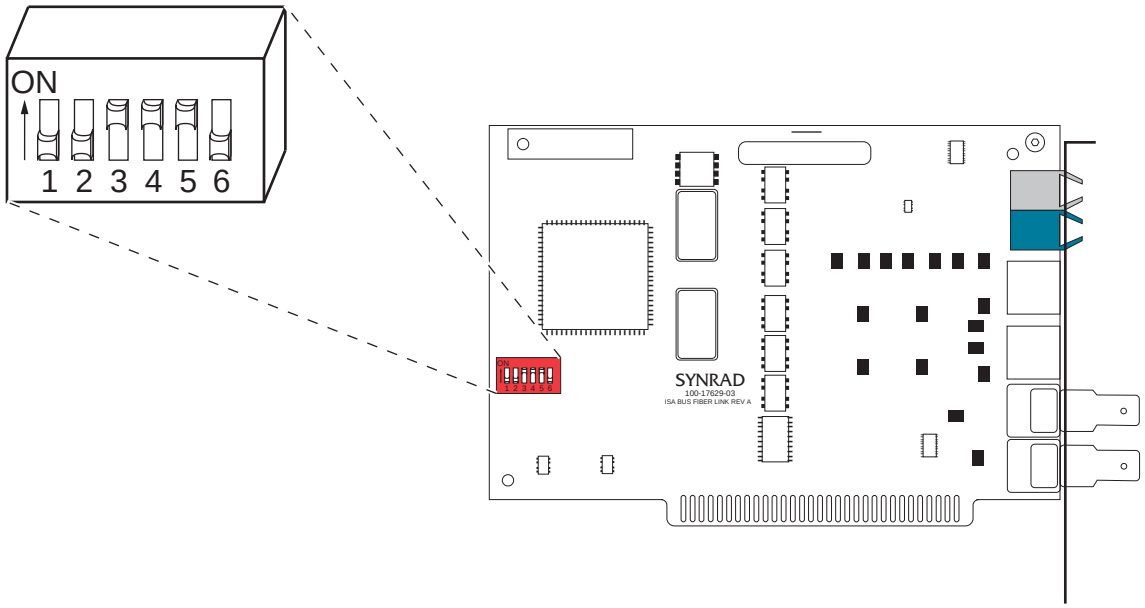


Figure 4-10 DIP switch settings

The FLCC address is 3x0 hex, where the first four DIP switches set the x value. Leave the address set to the default address of 330 unless your computer configuration forces you to change it. If you must change the board address, remember to make the corresponding change in WinMark Pro also (From the ***Tools*** menu, select General Settings. In the ***WinMark Settings*** dialog box, click the *Application Settings* tab and then click DA Card Address. Enter the decimal equivalent of the board's newly selected hexadecimal address). Table 4-6 explains FLCC DIP switch functions.

Note: WinMark Pro's default decimal address, 816, is the equivalent of the FLCC's base hexadecimal address, 330.

Table 4-6 Factory DIP switch settings

DIP SW#	Default Switch Position	Switch Function
1	OFF	FLCC address MSB
2	OFF	(Binary address 0011 equals a decimal address of 3)
3	ON	
4	ON	FLCC address LSB
5	ON	Used only with SYNRAD DH Series Marking Heads
6	OFF	Fast Acting Safety Interlock – "On" enables the FASI function; "Off" disables it. When the FASI function is enabled, a high level input must be present at FH input # 3 for the mark to proceed.

Table 4-7 FH Series Marking Head general specifications

Parameter	Marking Head Model Number FH-30-xxx[1]				
Lens Focal Length	**370 mm**	**200 mm**	**125 mm**	**125 HP***	**80 mm**
Marking Specifications					
Field Size, nominal, mm (in.)	198 × 198 (7.79 × 7.79)	110 × 110 (4.33 × 4.33)	74 × 74 (2.91 × 2.91)	66 × 66 (2.60 × 2.60)	27 × 27 (1.06 × 1.06)
Spot Size, $1/e^2$, µm (in.)	540 (0.021)	290 (0.011)	180 (0.007)	180 (0.007)	116 (0.005)
Working Distance[2], typical, mm (in.)	350 ±5 (13.78)	190 ±3 (7.48)	128 ±2 (5.04)	126 ±2 (4.96)	74 ±1 (2.91)
Depth of Field, typical, mm (in.)	±10 (±0.394)	±2.5 (±0.098)	±1.5 (±0.059)	±1.5 (±0.059)	±0.4 (±0.016)
Incident Angle, degrees, max	19	16	11	10	5
Marking Speed[3] characters/sec, max	225	225	225	225	225
Marking System Resolution					
Position Accuracy, mm (in.)	0.05 (0.002)	0.03 (0.001)	0.02 (0.0007)	0.02 (0.0007)	0.01 (0.0004)
Position Resolution, µm (in.)	<15 (<0.0006)	<9 (<0.0004)	<6 (<0.0002)	<6 (<0.0002)	<3 (<0.0001)
Repeatability, mm (in.)	0.063 (0.0025)	0.038 (0.0015)	0.025 (0.0010)	0.025 (0.0010)	0.015 (0.0006)
Settling Time, Small Step - 1% of field, ms	<0.8	<0.8	<0.8	<0.8	<0.8
Orthogonality (any included angle of a square figure), degrees	90°00' ±20' max				
Input Specifications					
Input Power	30 VDC @ 3 A max, 6 A inrush				
Continuous Beam Input Power, max (W)	125 mm lens–40, all other lenses–140				
Environmental Specifications					
Operating Temperature	0°C–40°C				
Humidity	0–95%, non-condensing				
Physical Specifications					
Length	21.29 cm	(8.38 in.)			
Width	13.72 cm	(5.40 in.)			
Height	13.72 cm	(6.15 in.)			
with Mounting Rail	21.21 cm	(8.35 in.)			
Weight, max	4.54 kg	(10 lbs)			

1 FH-30-xxx designates an FH Head with expander optics for 48-1/-2/-5 lasers. FH-25-xxx designates an FH Head with expander optics for Evolution 100/125 lasers.

2 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 the FH Series Marking Head and the marking surface. Consult your marking head's final test report for the actual measured working distance.

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

* 125 mm lens for use with lasers 50 W and higher.

FH package outline drawing

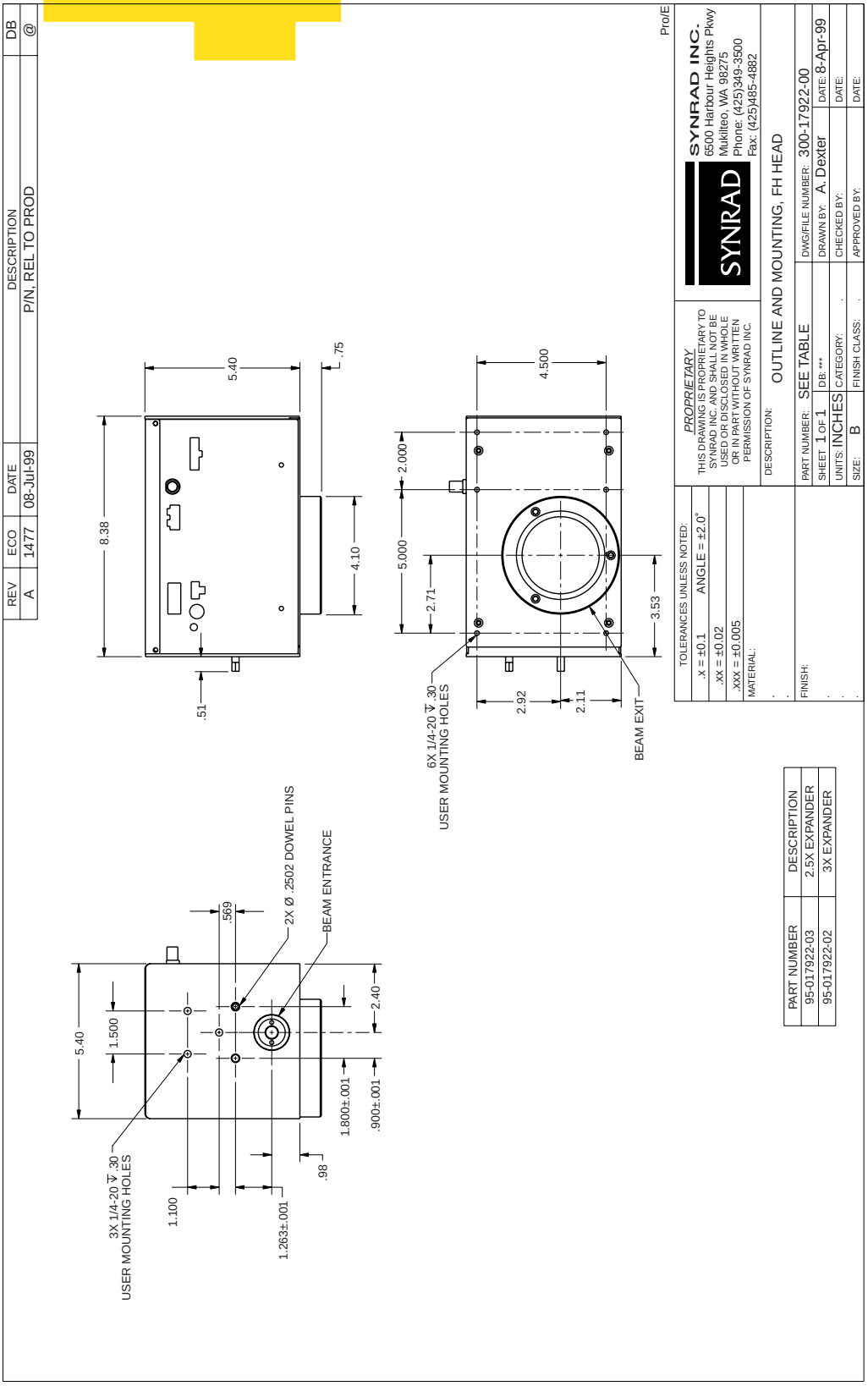
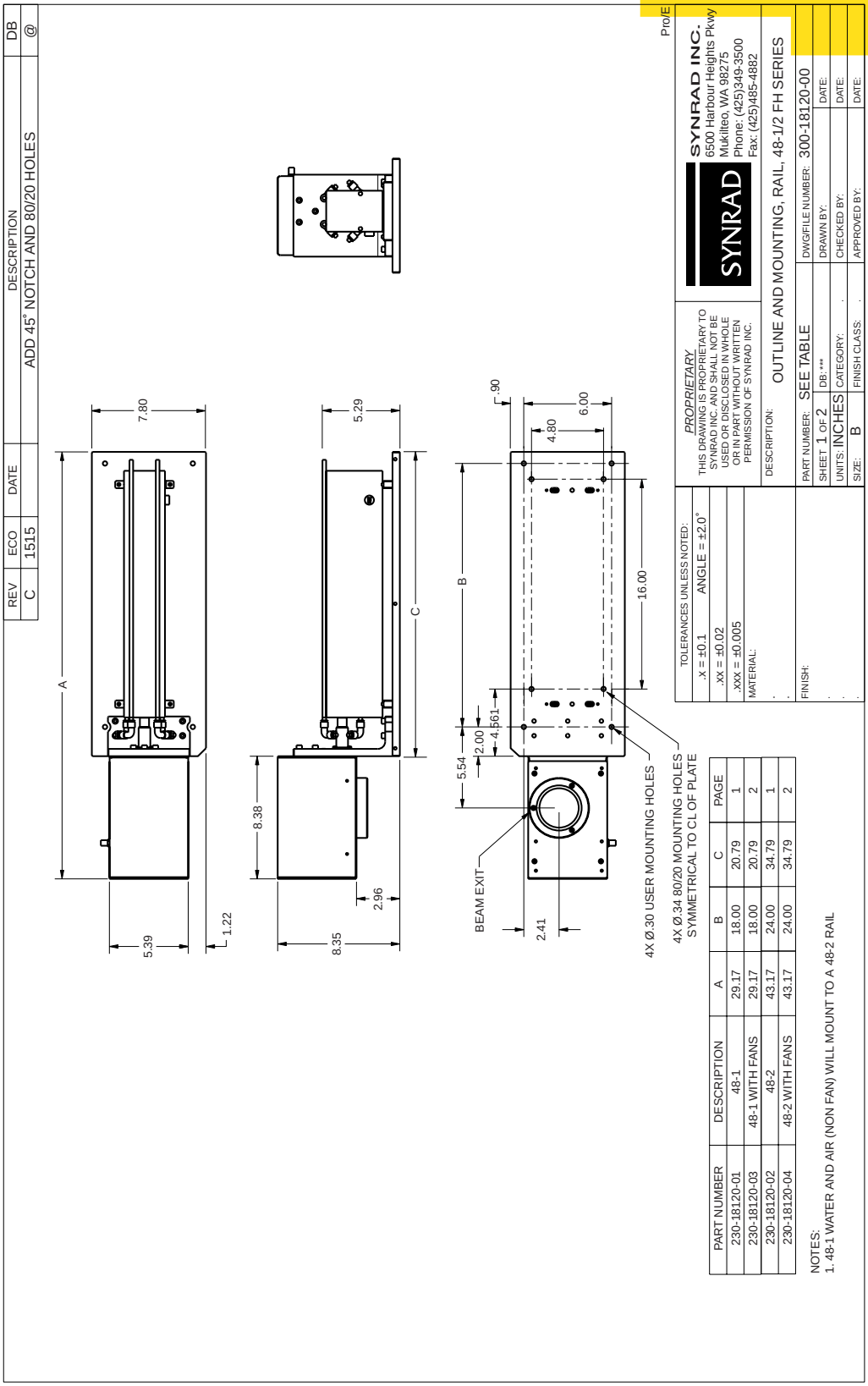


Figure 4-11 FH Marking Head package outline and mounting dimensions

FH Head / Model 48-1/48-2 package outline drawings



PART NUMBER	DESCRIPTION	A	B	C	PAGE
230-18120-01	48-1	29.17	18.00	20.79	1
230-18120-03	48-1 WITH FANS	29.17	18.00	20.79	2
230-18120-02	48-2	43.17	24.00	34.79	1
230-18120-04	48-2 WITH FANS	43.17	24.00	34.79	2

NOTES:
1. 48-1 WATER AND AIR (NON FAN) WILL MOUNT TO A 48-2 RAIL

Figure 4-12 FH Head / Model 48-1/48-2 package outline and mounting dimensions

FH Head / Model 48-1/48-2 package outline drawings

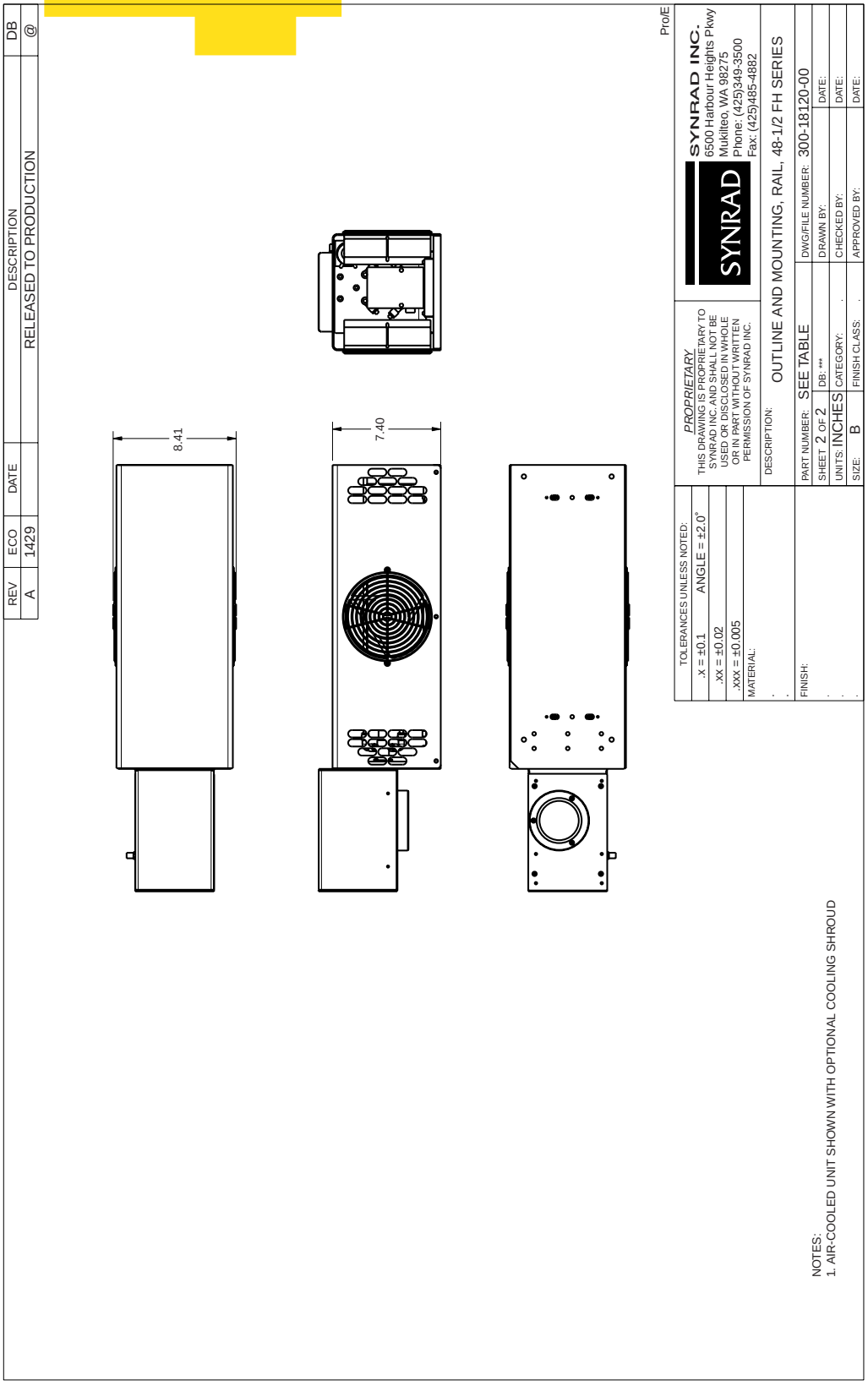


Figure 4-13 FH Head / Model 48-1/48-2 package outline and mounting dimensions

FH Head / Model 48-5/Evolution 100 package outline drawing

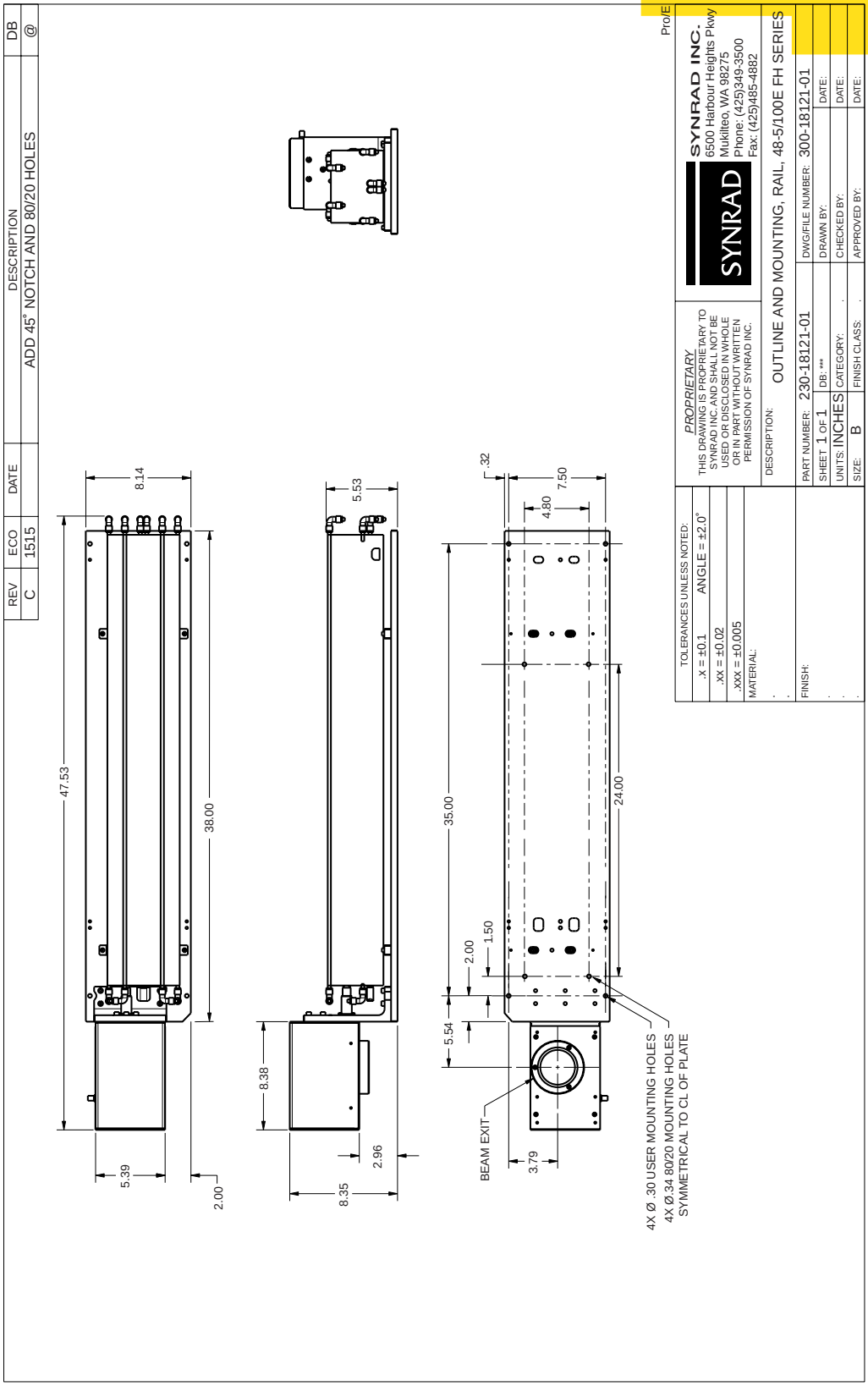


Figure 4-14 FH Head / Model 48-5/Evo 100 package outline and mounting dimensions

FH Head / Evolution 125 package outline drawing

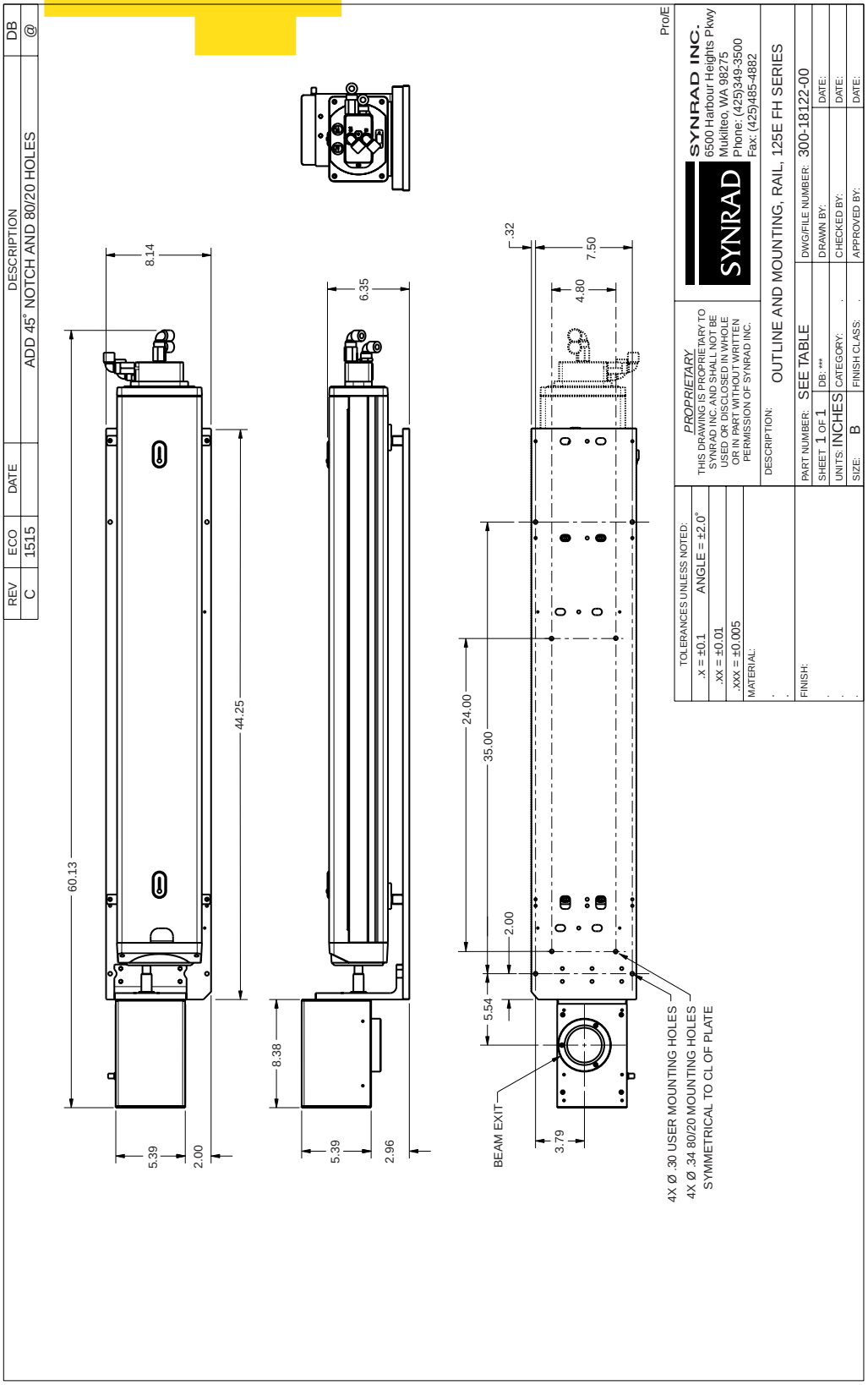


Figure 4-15 FH Head / Evolution 125 package outline and mounting dimensions

FH Head / Model 48-1/48-2 mounting

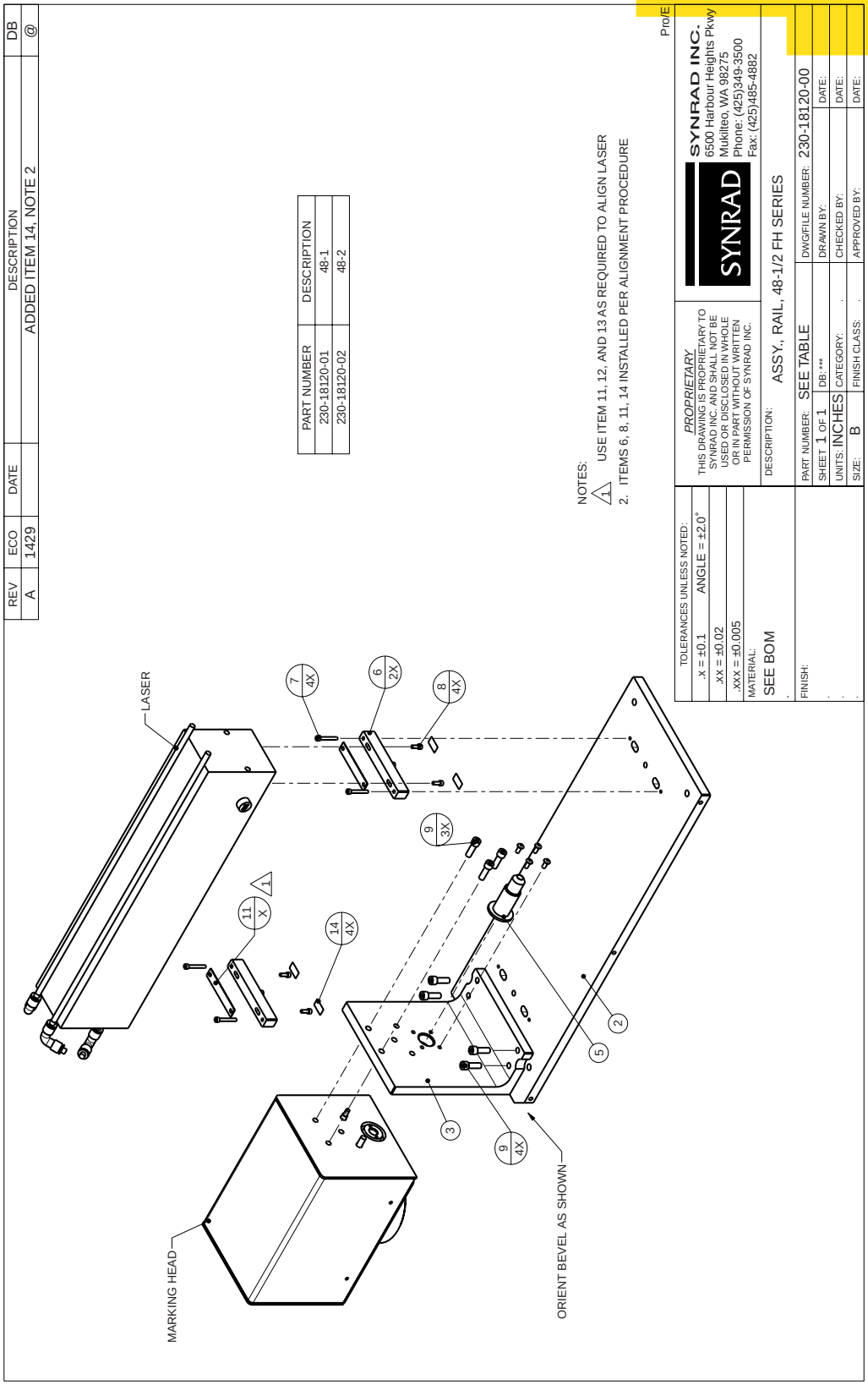


Figure 4-16 FH Head / Model 48-1/48-2 mounting drawing

FH Head / Model 48-5/Evolution 100/125 mounting

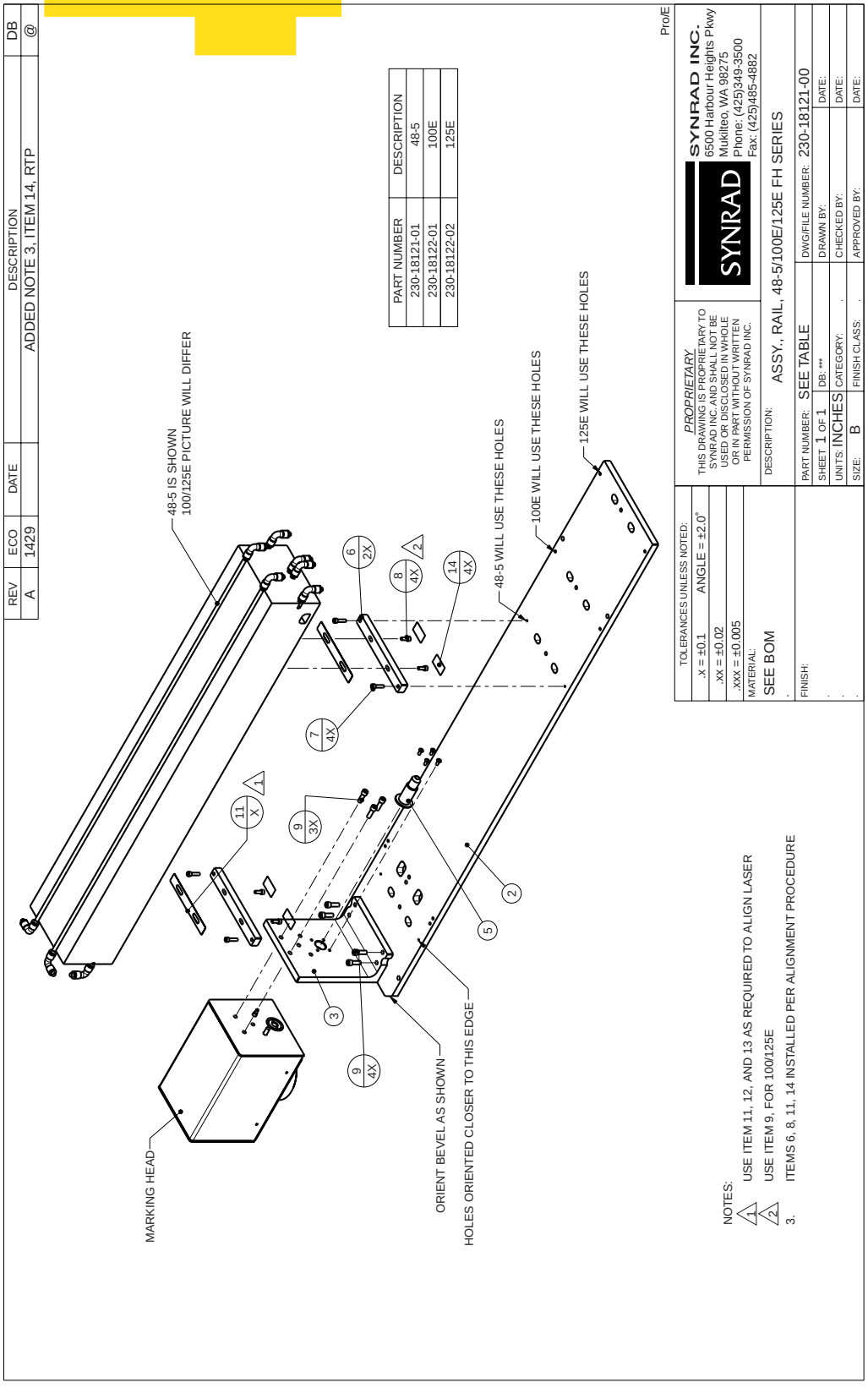


Figure 4-17 FH Head / Model 48-5/Evolution 100/125 mounting drawing

5 maintenance/ troubleshooting

Use information in this section to perform maintenance and troubleshooting of the FH Series Marking Head.

This section contains the following information:

- Maintenance – explains typical maintenance procedures for the FH Marking Head.
- Troubleshooting – describes how to troubleshoot common problems.

5 maintenance/ troubleshooting

Maintenance

Daily inspections

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

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

⚠ Warning

possible personal injury

Ensure that laser power is turned off before inspecting the lens surface. Invisible CO_2 laser radiation is emitted through the lens. Corneal damage or blindness may result from exposure to laser radiation.

2 Remove the dust cap from the focusing lens and 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 marking head housing to ensure that all warning labels are present. Refer to Figure i *- FH Marking Head hazard label and CE 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.

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 the marking head.

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 from the marking head.

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.

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

1. Remove the three capscrews securing the focusing lens to the marking head. Do not remove the lens from its optical mount.
2. Perform the passive cleaning procedure discussed 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 easily scratched by dislodged contaminants.

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

5

Troubleshooting

The Troubleshooting section includes subsections:

- FH Series Marking Head
- FH Series Tracker Marking Head
- Fiber Link Controller Card (FLCC)

FH Series Marking Head

Symptom:

- The *DC Power* cable is connected but the *ON* indicator is not illuminated.

Possible Causes:

- DC voltage is not available from the DC power supply.

Ensure that the proper DC voltage (30 VDC) is available.

- The fuse has blown.

Turn the fuse holder cover counterclockwise and remove the fuse. Inspect or test the fuse, replacing as necessary with the correct 5 A, 125 V fast blow fuse.

FH Series Tracker Marking Head

Symptom:

- Tracker does not track moving parts.

Possible Causes:

- Tracking is not enabled.

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

- Encoder pulses are not being read by the FH Tracker Head.

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

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

Close WinMark Pro and open Digital Scope. Trigger the part sensor and verify that input bit 0 toggles.

Troubleshooting

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

Toggle Invert Encoder Direction in WinMark's *Tracking* tab.

Symptom:

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

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 *Encoder setup* 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:

- The laser's *Ready* indicator is On and the Marking Head's *ON* indicator is illuminated, but the laser will not fire when commanded by WinMark Pro or Digital Scope.

Possible Causes:

- The *Fiber Optic* cable between the FH Head and the FLCC is improperly connected.

To verify proper connection of the *Fiber Optic* cable, follow the steps below:

1 Make sure that both the FH Marking Head and your computer are turned on.

⚠ Warning

possible personal injury

Do not stare directly into the red laser diode light emitted from the transmitter ports on the FLCC or from the marking head. The light is potentially intense enough to injure the eye with prolonged exposure.

2 Remove the duplex connector from the *Fiber Optic Receiver/Transmitter* port on the FLCC and verify that the card's gray (transmitter) port is emitting a visible red glow. The FLCC's fiber optic port is color-coded. The gray half transmits to the FH Marking Head. The blue half receives from the head.

Note: If there is no visible red glow from the transmitter port on the FLCC, shut down the computer and check the FLCC to ensure it is properly seated in the computer's ISA 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 Distributor for assistance.

3 Reconnect the duplex fiber optic connector to the FLCC. When properly connected, the latch on the connector should snap into the cable latch slot (see Figure 1-4 in the "Getting Started" section). You should not be able to remove the *Fiber Optic* cable without depressing the latch.

4 Disconnect the duplex fiber optic connector from the *Fiber Optic Control* port on the FH Head's Control panel. The transmitter (TX) port on the FH Head should emit a visible red glow; if not, contact SYNRAD, Inc. or a SYNRAD Authorized Distributor for assistance.

5 Reconnect the duplex fiber optic connector to the *Fiber Optic Control* port so that the half that is emitting a visible red glow connects to the receiver (RX) port on the FH Head. When properly connected, the latch on the connector should snap into the cable latch slot. You should not be able to remove the *Fiber Optic* cable without depressing the latch.

Troubleshooting

- The FLCC's Fast Acting Safety Interlock (FASI) function is enabled.

If the FASI function is enabled, IN3 requires an active (high) input signal before the laser will fire.

- The FLCC 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.

appendix a

This appendix contains the following information:

- Mounting stand – illustrates one way to mount your FH marking system.
- Parts list – provides a list of parts to build an FH Series 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.

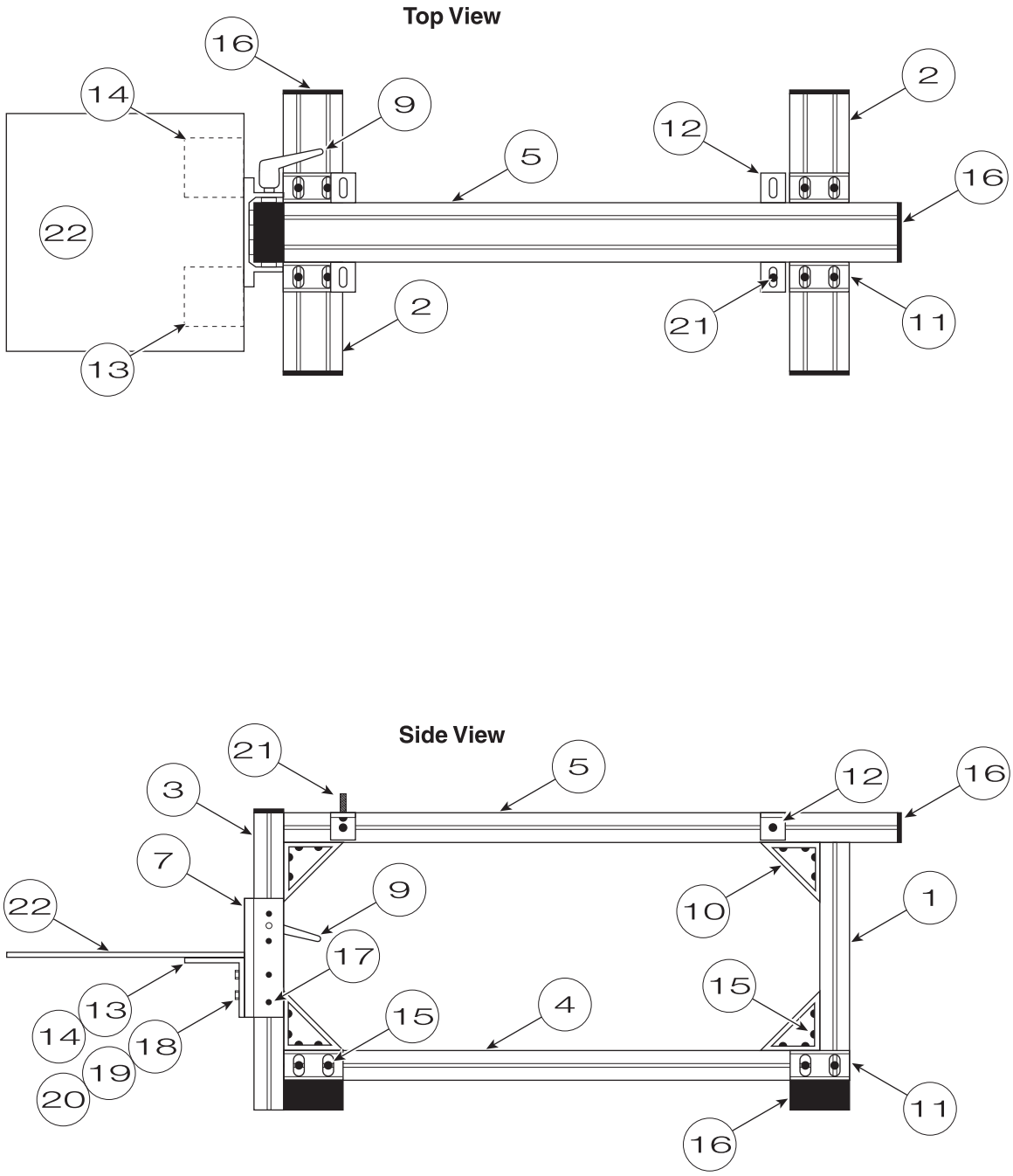


Figure A-1 Mounting stand

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 FH systems using 80 or 125 mm lenses. Table A-2 lists part numbers for a "medium" stand for systems using 80, 125, or 200 mm lenses. Table A-3 lists part number for a "tall" stand for systems using 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	8	5/16" Washer	—
20	3214	8	5/15-18 Hex Nut	—
21	3123	4	5/16-18 × 1 1/4" SHCS	—

Item #22 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	8	5/16" Washer	—
20	3214	8	5/15-18 Hex Nut	—
21	3123	4	5/16-18 × 1 1/4" SHCS	—

Item #22 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	8	5/16" Washer	—
20	3214	8	5/15-18 Hex Nut	—
21	3123	4	5/16-18 × 1 1/4" SHCS	—

Item #22 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

A

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appendix b

This appendix contains the following information:

- FH Tracker Motion Sensing Kit – lists descriptions of items contained in the Tracker Motion Sensing Kit available from SYNRAD.
- Component suppliers – lists suppliers of items contained in the Tracker Motion Sensing Kit.

appendix b

Tracker Motion Sensing Kit

FH Tracker Heads require several additional components to coordinate marking on-the-fly with part motion. These components include a part sensor (capacitive, inductive, optical, mechanical, etc.) for part position information, a rotary position encoder (with bi-directional or quadrature signal output) for determining line speed, and a DC power supply to power both the part sensor and rotary encoder. Although these components are not provided with the FH Tracker, some or all of them may already exist as part of the equipment performing your automated parts handling. For those customers who prefer to buy motion detection components from a single source, SYNRAD offers the Tracker Motion Sensing Kit described in Table B-1 below.

Table B-1 SYNRAD Tracker Motion Sensing Kit part numbers

Item Description	SYNRAD Part Number
Tracker Motion Sensing Kit w/ US power plug	250-18200-01
Tracker Motion Sensing Kit w/ UK power plug	250-18200-02
Tracker Motion Sensing Kit w/ European power plug	250-18200-03

Table B-2 lists components contained in the Tracker Motion Sensing Kit. Please note that kit components are ***not*** available separately from SYNRAD.

Table B-2 SYNRAD Tracker Motion Sensing Kit contents

Item Name	Description / Notes
Rotary position encoder	1000 PPR, quadrature output Dynapar H22100011420H 5-pin DIN jack added by SYNRAD
Friction drive wheel (for encoder)	2-5/8" O.D. Stock Drive Products A6Z10-1342408
Optical part sensor (w/ reflective or thru-beam capability)	NAiS/Aromat UZF301 sensor NAiS/Aromat UZFTF8 fiber optic pair 4-pin DIN jack added by SYNRAD
Custom FH Tracker I/O cable	Standard FH I/O cable 5-pin DIN plug added by SYNRAD 4-pin DIN plug added by SYNRAD Power jack added by SYNRAD
Power supply (choose one by location)	120 VAC/24 VDC, North American power plug Condor D12-10-03-206IP 230 VAC/24 VDC, United Kingdom power plug Condor PSD-24750-230/BSI-206IP 230 VAC/24 VDC, European power plug Condor PSD-24750-230-206IP

appendix b

Component suppliers

SYNRAD has successfully used Dynapar H20 Series rotary position encoders available from:

Danaher Controls
1675 Delany Road
Gurnee, IL 60031-1282
USA
Phone: 1-800-873-8731 or 847-662-2666
Fax: 847-662-6633

SYNRAD has successfully used NAiS UZF3 and UZC Series photoelectric sensors available from:

Aromat Corporation
Phone: 1-800-228-2350
Internet: http://www.aromat.com

appendix b

B

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index

A

Agency compliance
see Compliance

Automation
marking, **4**-6–**4**-10

B

Beam Enclosure Tube **1**-4
installing, **1**-7

C

Caution
lens damage, **2**-3, **2**-5, **5**-3, **5**-4
radiation exposure, 2
static sensitive components, **1**-9

CDRH requirements 4

CE mark 6
label location, 3

Compliance
CDRH, 4
EU, 5
FCC, 4

Connecting
DC Power cable, **1**-8
Fiber Optic cable, **1**-10
FLCC, **1**-9
Laser Control cable, **1**-11
to parts handling equipment, **4**-6

Control panel **2**-2

Copyright information vii

Custom test mark feature **2**-4, **4**-3–**4**-5
creating, **4**-4–**4**-5
downloading, **4**-5
options, **4**-3–**4**-4, **4**-5
overview, **4**-3

D

DC Power cable **1**-4
connecting, **1**-8

DC power supply **3**-14, B-2
specifications, **3**-14

Declaration of Conformity 7

Digital I/O cable **1**-4, **4**-6

Digital I/O connector
spare, **1**-4, **4**-6

Digital input circuit
diagram, **4**-7
sample input circuits, **4**-8
signal parameters, **4**-8

Digital output circuit
diagram, **4**-9
sample output circuits, **4**-9–**4**-10
signal parameters, **4**-9

Digital Scope **3**-8, **3**-12, **5**-5

E

EU requirements 5

Encoder
see Rotary position encoder

Encoder Resolution
calculating, **3**-9
fine-tuning, **3**-9–**3**-10
property, **3**-6

F

Fast Acting Safety Interlock **4**-11, **5**-8

FCC requirements 4

FH Head
automation, **4**-6–**4**-10
control circuitry, **4**-2
mounting dimensions, **4**-14
specifications, **4**-13
technical overview, **4**-2
troubleshooting, **5**-5–**5**-6

FH Series Operator's Manual **1**-3

Fiber Optic cable **1**-3
connecting, **1**-10

Fiber Optic Control port **1**-10, **2**-2, **5**-7

FLCC **1**-3, **1**-9, **4**-11–**4**-12
address, **4**-12
DIP switch settings, **4**-12
DIP switch/signal relationships, **4**-11
installing, **1**-9
troubleshooting, **5**-7–**5**-8

Focusing lens
cleaning, **5**-2–**5**-4
selection, **2**-5

index

Focusing lens covers **1**-4

Focusing lens mount **2**-2

Fuse **5**-5
  spare, **1**-4

Fuse holder **2**-2, **5**-5

G

General specifications
  see Specifications

Graphics
  marking, **3**-17

H

Hardlock **1**-3, **1**–12

Hazard information 1

Hazard label locations 3

I

I/O connector
  see Digital I/O connector

Initial start-up **2**-3–**2**-5

Input circuit
  see Digital input circuit

Input circuits
  samples, **4**-8

Inspections
  daily, **5**-2

Inventory **1**–2

Invert Encoder Direction
  property, **3**-5

L

L-Bracket **1**-3
  mounting, **1**-6

Label locations 3

Laser Control BNC connector **1**-11, **2**-2

Laser Control cable **1**-4
  connecting, **1**-11

Laser
  mounting, **1**-7

Laser safety information 2

Lens size
  setting in WinMark Pro, **2**-5

Lens specifications **4**-2

Line speed
  determining, **3**-3–**3**-4
  too fast, **3**-16, **5**-6

M

Maintenance **5**-2–**5**-4

Marking
  best quality, **3**-18
  graphics, **3**-17
  positioning marks, **3**-17–**3**-18
  text, **3**-15–**3**-16

Marking automation **4**-6–**4**-10

Material Safety Data Sheets 2, **5**-3

Motion Vector **5**-6
  property, **3**-6

Mounting
  drawings, **4**-19, **4**-20
  FH Head, **1**-6–**1**-7
  L-Bracket, **1**-6
  laser, **1**-7
  Mounting Rail, **1**-6
  requirements, **1**-6

Mounting bolts
  misc., **1**-4

Mounting Rail **1**-4, **1**-6

Mounting stand **A**-2
  drawing, **A**-2
  parts list, **A**-3, **A**-4, **A**-5
  supplier, **A**-3

N

Noise suppression
  electrical, **1**-11

O

ON indicator **2**-2, **5**-5, **5**-7

Outline and mounting dimensions **4**-14–**4**-18

Output circuit
  see Digital output circuit

Output circuits
  samples, **4**-9–**4**-10

index

P

Part pitch **3**-3, **3**-4

Part sensor **3**-11, **4**-4, **B**-2
  connection, **3**-11–**3**-12
  setup, **3**-13
  specifications, **3**-11
  suppliers, **B**-3
  wiring diagrams, **3**-12

Parts Handling Control connector **2**-2, **3**-8, **3**-12, **4**-6
  physical layout, **4**-6
  pinout, **4**-7

Position encoder
  see Rotary position encoder

Power connector
  spare, **1**-4, **1**-8

Power Input connector **1**-8, **2**-2

R

Rising Edge Part Sense
  property, **3**-5
  setting, **3**-13
  waveform, **3**-5

Rotary position encoder **3**-7, **B**-2
  connection, **3**-7–**3**-8
  setup, **3**-9–**3**-10
  specifications, **3**-7
  suppliers, **B**-3
  wiring diagrams, **3**-8

S

Safety precautions
  laser, 1

Sensor Distance
  property, **3**-6
  setting, **3**-13, **3**-17

Shipping box contents
  FH Series Marking Head, **1**-3–**1**-4
  illustration, **1**-2
  Laser, **1**-4
  Mounting Rail **1**-4

Specifications **4**-13

Status indicator **2**-2

T

Technical overview **4**-2

Telescope optics cover **1**-4

Test Mark pushbutton **2**-2, **2**-3, **2**-5, **4**-3, **4**-4, **4**-11

Test pattern **2**-3, **4**-3, **4**-4, **4**-5
  illustration, **2**-4

Test pattern dimensions **2**-4

Text
  marking, **3**-15–**3**-16

Track Marking Object **5**-5
  property, **3**-5

Tracker
  introduction, **3**-2
  system components, **3**-2

Tracker Motion Sensing Kit **3**-7, **3**-11, **B**-2
  part numbers, **B**-2
  kit contents, **B**-2

Tracking tab **3**-5
  properties, **3**-5–**3**-6

Trademark information vii

Troubleshooting **5**-5–**5**-8
  FH Head, **5**-5
  FLCC, **5**-7–**5**-8
  Tracker, **5**-5–**5**-6

W

Warning
  air contaminants, 2
  eye damage, **5**-2, **5**-7
  eye protection, 1

Warranty information viii

WinMark Pro **1**-3, **1**-12
  installation, **1**-12
  system requirements, **1**-12
  Tracking tab **3**-5
  WinMark Pro User's Guide, **1**-3

Working distance **2**-3, **2**-5, **4**-2, **4**-13
  chart, **4**-2

Z

Z-axis adjustment **1**-6, **2**-3, **2**-5, **4**-13

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