

SYSTEM OVERVIEW

The Telesis® EV15DS is an advanced, fiber-coupled diode pumped solid state (DPSS) laser marking system. The laser beam and Q-switched pulse characteristics are optimized for applications that require high beam quality and stability. In addition, the EV15DS offers extra power and speed for precision marking and material processing applications. Its short pulse width and extremely small spot size provide high resolution marking with minimal heat impact to surrounding areas. These characteristics make it an ideal choice for general-purpose laser marking, scribing, trimming, and other material processing applications.

The EV15DS design features a Q-switched Nd:YVO₄ end-pumped laser with a remote fiber-coupled diode pump source. With average diode life of greater than 20,000 working hours the EV15DS offers the user “best-in class” reliability.

The robust mechanical and optical design allows the Telesis EV15DS to operate in an industrial environment where shock, vibration, and dust are a concern.

The laser marking system offers these advantages:

- Reliable, long, maintenance-free performance
- Compact size and modular construction
- Remote, fiber-coupled pump diode
- Exceptional beam quality and stable output power
- Visible red aiming diode
- Air cooling
- Thermo-electrical temperature control of the laser crystal and pump diode
- Active AO Q-switching
- Standard 115/230VAC operation
- Large digital display for marker status, settings, and error condition monitoring
- Key switch, Laser Off button, interlocked safety shutter, and emission indicators
- DoD-compliant Unique Identification (UID) marking

SYSTEM CONFIGURATION

The EV15DS is available in several configurations. The system computer, required for running the Merlin® II LS software, may be an external device connected to the laser controller, or embedded within the laser controller itself. Additionally, the system may be configured to mark only stationary objects or to mark objects while they are moving (i.e., mark-on-the-fly).

The modular design allows for major components to be easily replaced and returned to Telesis if required. The basic laser system consists of the following components.

- **Laser Marking Head** – contains sealed resonator, beam expander, galvanometer assembly, visible red aiming diode.
- **Laser Controller** – contains pump diode, RF driver, and other electrical components
- **Laser Controller Connector/Fuse Kit** – contains mating connectors for back panel interfaces and spare fuses
- **Fiber Optic Cable**
- **Cable Assemblies** – power, control, and data cables
- **Software** – Merlin II LS Laser Marking Software
- **System Computer** – may be an external device connected to the laser controller or embedded within the laser controller itself. If external, the computer may be supplied by Telesis or by the customer.
- **Monitor, Keyboard, and Mouse** – may be supplied by Telesis or by the customer.

EV15DS Laser Marking System

SYSTEM SPECIFICATIONS

Compliance	CDRH
Laser Type	fiber-coupled, diode-pumped, Q-switched, Nd:YVO ₄
Wavelength	1064 nanometers (nm)
Mode.....	TEM ₀₀
Average Power	15 watts at 1064 nm
Long Term Output Power Drift...	< ± 2%
Max. Power Consumption.....	< 500 watts
Expected Diode Lifetime	> 20,000 hours
Input Power	115 VAC, single-phase, 9.0A, 50/60Hz 230 VAC, single-phase, 4.5A, 50/60Hz
Supply Voltage Fluctuation	< ± 10% with clean ground line
Operational Temperature.....	18° to 35°C (65° to 95°F)
Recommended Temperature....	20° to 25°C (68° to 77°F)
Ambient Relative Humidity	10% to 85% non-condensing

SYSTEM OPTIONS

- External computer (desktop or notebook with powered cardbus-to-PCI expansion enclosure) to run the Merlin II LS Laser Marking Software
- Embedded computer within the laser controller to run the Merlin II LS Laser Marking Software
- Remote pushbutton station (start/abort)
- Externally-mounted focus-finder diode
- Mark-on-the-fly kit to interface with customer-supplied encoder for marking objects in motion (linear or circular)
- I/O options (see *Remote Communications* for details):
 - TTL via PCI-DIO24 Board
 - Opto-isolated via Merlin DCIO Module
 - Two-axis Controller
- Manually operated tool post for vertical (z-axis) adjustment
- Programmable tool post for vertical (z-axis) adjustment (requires two-axis controller)
- Rotary drive fixture for rotational (theta-axis) adjustment (requires two-axis controller)
- Workstation / work area enclosure
- Fume extraction systems

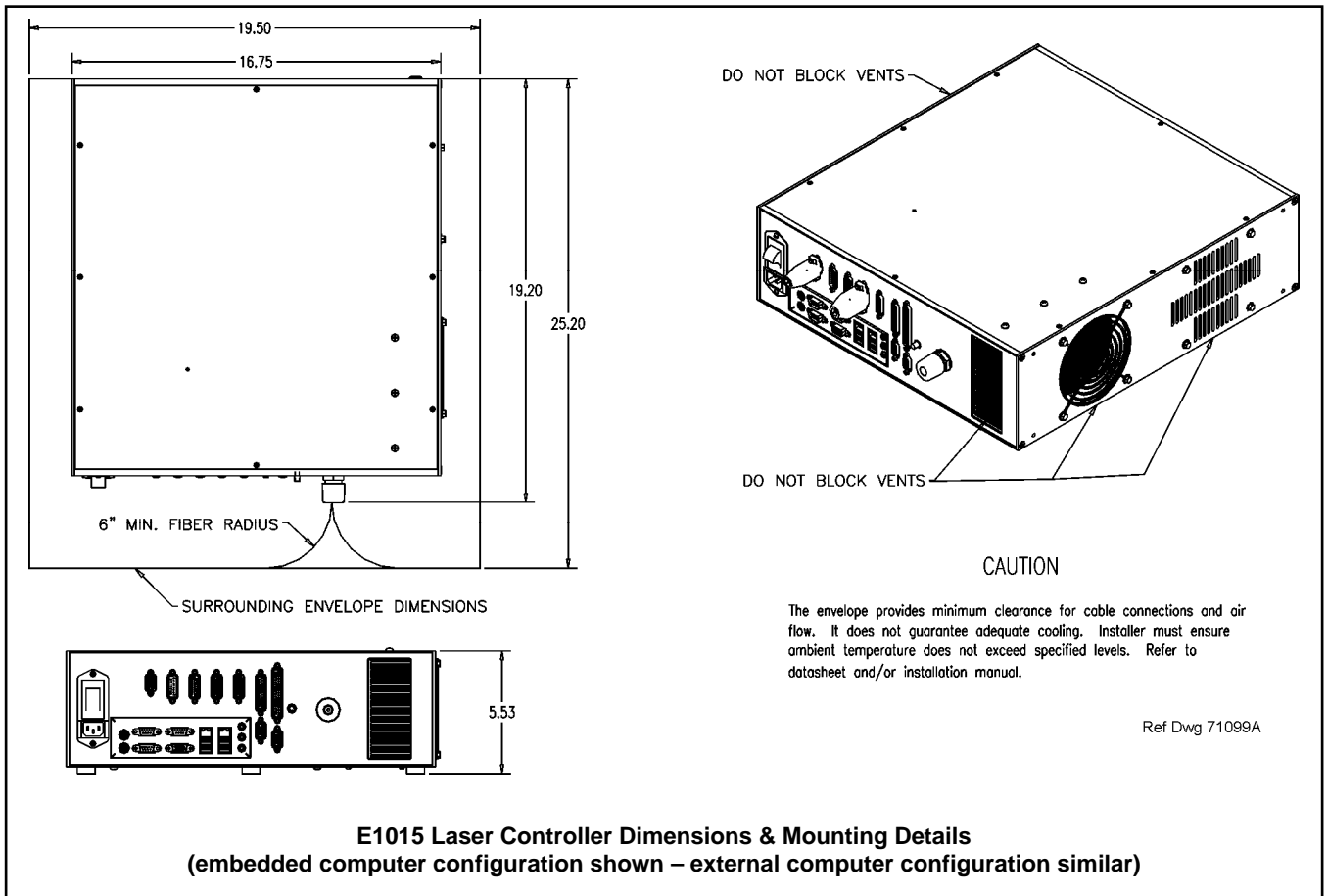
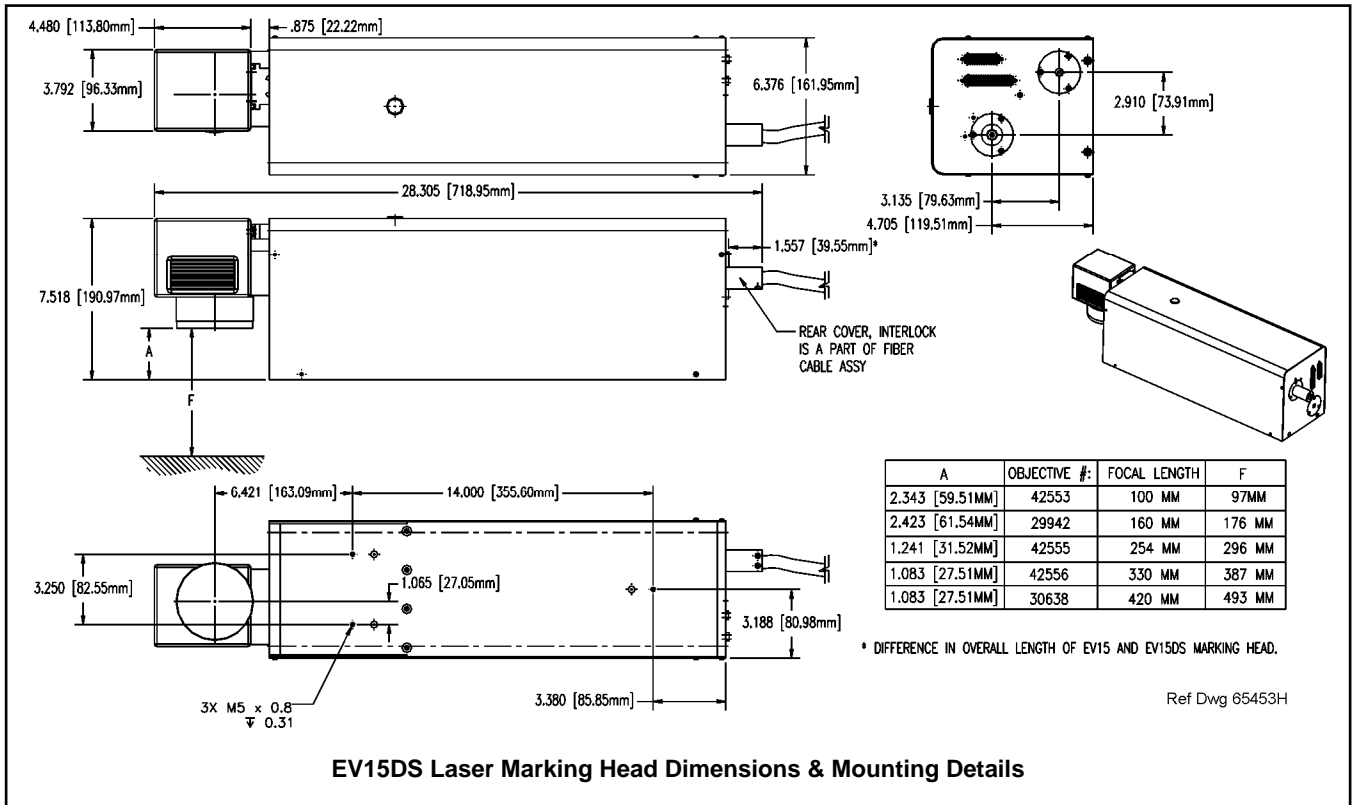
SYSTEM SETUP

The following procedures are listed for reference only to provide a general overview of the installation process. Refer to the *EV15DS Installation & Maintenance Manual* for complete installation details.

Do not connect any power cable to power source until all system connections are made.

1. All equipment must remain powered down and in the OFF position until mounting and connections are complete.
2. Place the laser controller, monitor, keyboard, mouse, and if applicable, the external system computer, in the desired locations. Locate the laser controller as close as practical to the laser marking head.
3. Ensure sufficient clearance exists on all sides of the laser controller to allow for proper air circulation. Allow sufficient space *behind* the laser controller to prevent excessive bending of the fiber optic cable. Refer to the *E1015 Dimensions & Mounting* drawings for details.
4. Place the laser marking head on a suitable mounting surface.
5. Ensure sufficient clearance exists on all sides of the laser marking head to allow for proper air circulation. Allow sufficient space *behind* the laser marking head to prevent excessive bending of the fiber optic cable.
6. Mount the laser marking head with three M5-0.80 bolts and lock washers using the factory-tapped mounting holes provided. Refer to the *EV15DS Dimensions & Mounting* drawing for details.
7. Connect all cables as applicable (fiber optic cable, laser marking head cable, RF cable, galvo control cable, computer monitor, keyboard, and mouse).
8. Connect any optional or customer-supplied devices or interface circuits as applicable.
9. Refer to the *EV15DS Operation Supplement* for proper startup procedure. Refer to the *Merlin II LS Operating Instructions* for complete information on using the system software.

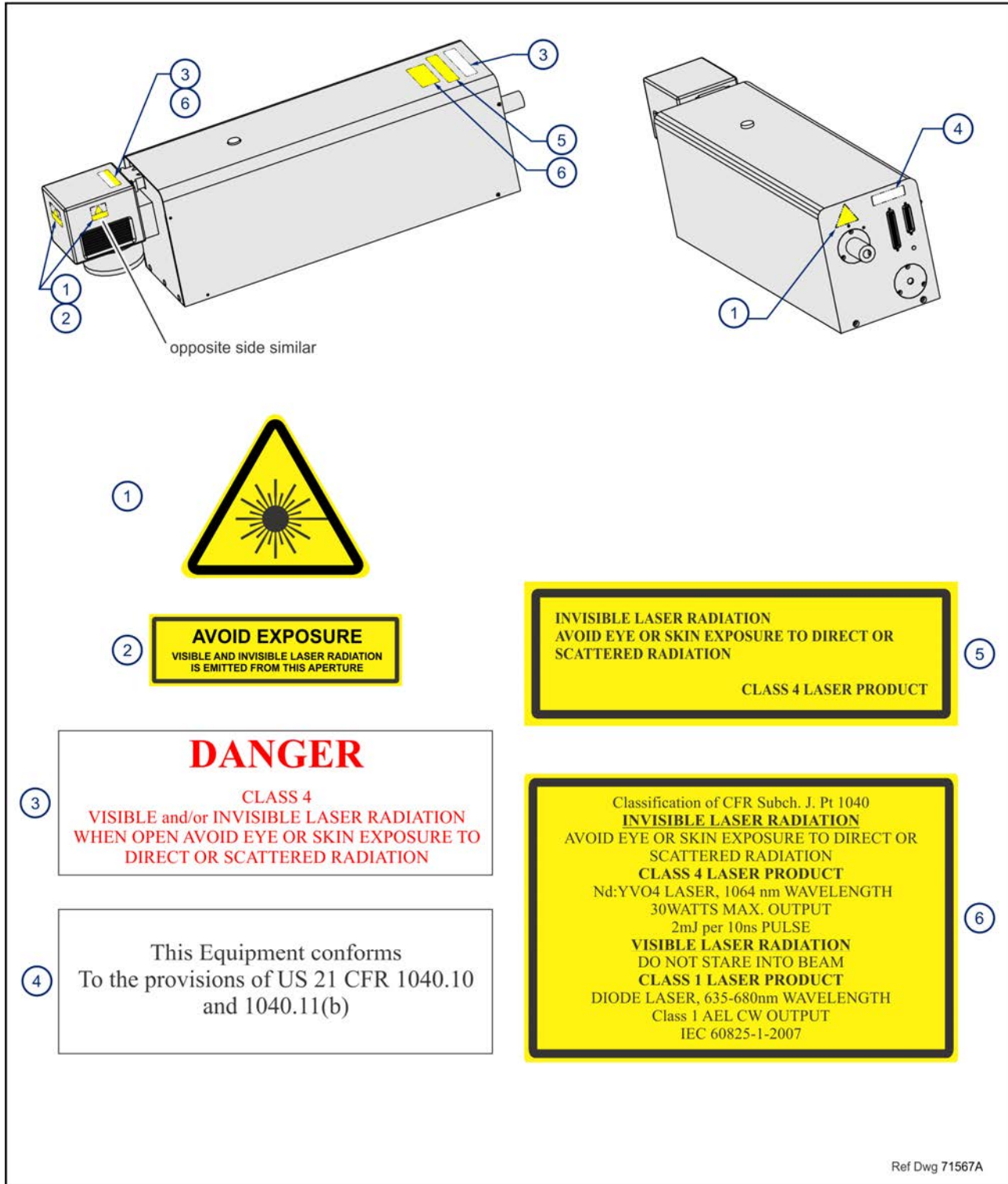
EV15DS Laser Marking System



EV15DS Laser Marking System

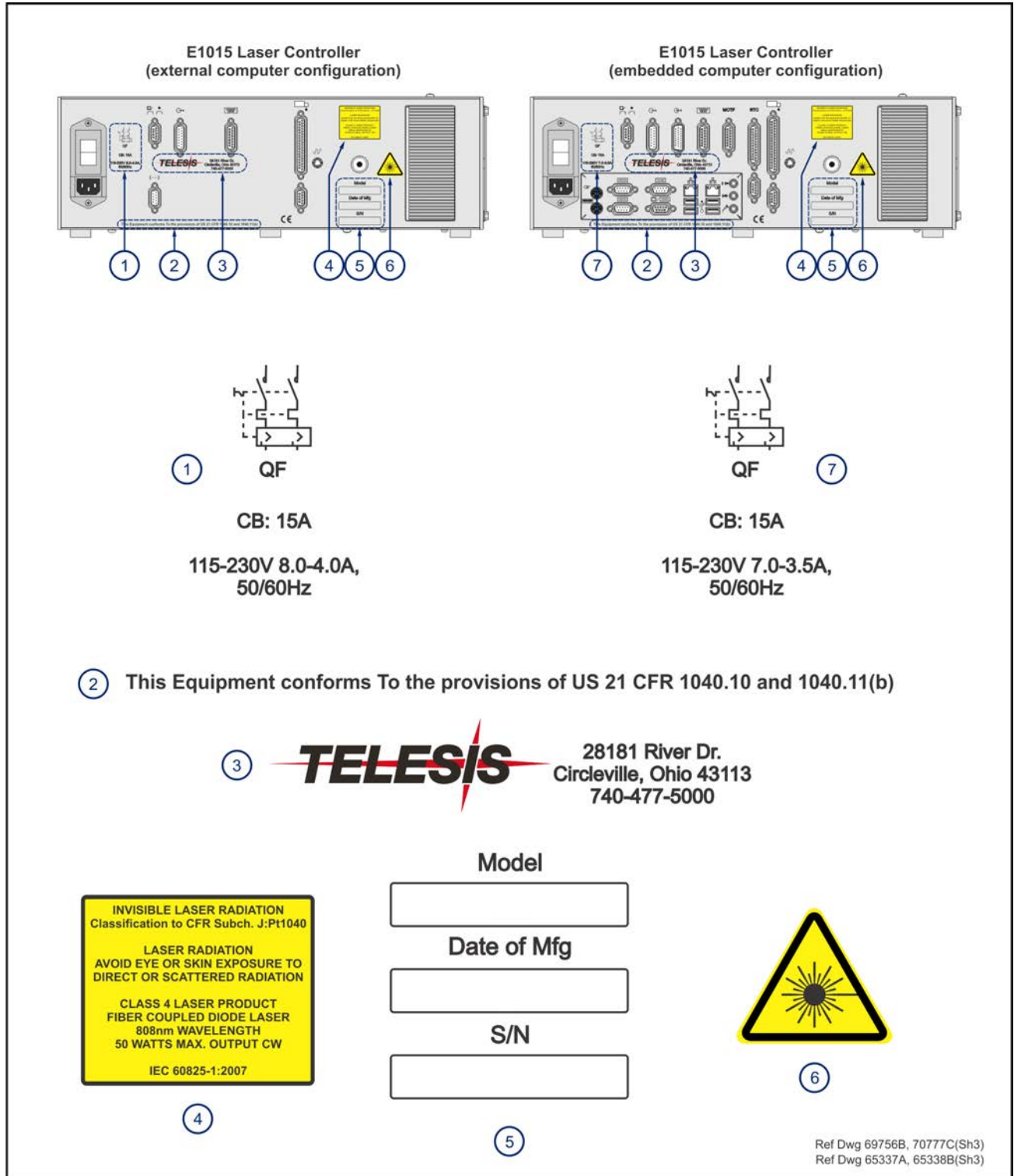
EV15DS LASER MARKING HEAD SAFETY LABELS

The following illustration shows the labels and their locations on the EV15DS laser marking head. Please familiarize yourself with the laser labels and their locations prior to operating the laser marking system.



E1015 LASER CONTROLLER SAFETY LABELS

The following illustration shows the labels and their locations on the E1015 laser controller. Please familiarize yourself with the laser labels and their locations prior to operating the laser marking system.



EV15DS Laser Marking System

EV15DS LASER MARKING HEAD

EV15DS lasers are designed for easy maintenance. Heat exhaust fans are located on the right side of the unit.

The laser marking head encloses the sealed laser resonator, the beam expander, the red aiming diode, and the galvanometer assembly.

EV15DS Laser Marking Head Specifications

Dimensions (L x W x H).....	718.95* x 161.95 x 190.97 mm (28.305* x 6.376 x 7.518 in.)
Surrounding Envelope.....	790 x 230 x 260 mm (31.0 x 9.0 x 10.5 in.)
Mounting Weight.....	approximately 20 Kg (45 lbs.)
Mounting Holes	three factory-tapped M5-0.80
Positioning.....	visible (red) aiming diode
Field Resolution	16 bit (65535 data points)
Galvanometer Repeatability....	< 22 micro radian
Marking Field Size	lens-dependent, see chart
Fiber Optic Cable Length	1.75 m (5.74 ft.) – standard 4.75 m (15.58 ft.) – optional
Cooling	air cooled, active thermo-electric

* Length includes rear panel interlock switch (part of fiber cable)

Dual-Sensor Shutter Circuit

The EV15DS laser marking head employs two separate sensors to detect the closed-state of the laser shutter mechanism. The sensor signals can be monitored at the Outputs Connector on the back panel of the laser controller. When the shutter is open, the sensor feedback signals are OFF. When the shutter is closed, the sensor feedback signals are ON.

Sealed Laser Resonator

The laser resonator is assembled and sealed in the clean room environment to prevent contamination. The laser marking head contains an electro-mechanical safety shutter. Under power, the safety shutter allows 1064nm laser beam to pass through the galvanometer steering mirrors. If the shutter is closed during normal operation (or power is removed from the system via a power off/stop condition) it will block the 1064nm laser beam.

Visible Red Aiming Diode

The laser marking head produces a visible red diode that may be viewed on the work surface without the need for protective safety goggles. This provides a safe and convenient aid for laser setup and part programming. Since the red beam is located *after* the shutter, the aiming diode may be used with the shutter opened or closed. Additionally, the visible red beam may be used with the lasing beam *during* the marking cycle. **Note that protective eyewear must always be worn when the laser is in operation.**

Marking Field Size

The size of the marking field is dependent on type of lens installed on the laser marking head. See *Flat-Field Lens*.

Marking Depth

Simple laser parameters can be operator programmed to create depths ranging from simple surface discoloration, shallow laser etching, or deep laser engraving. Marking depth is dependent on several factors including material, lens type selected, and laser marking parameters. Please contact Telesis for the proper setting for your specific application.

Flat-Field Lens

The flat-field lens is key to the marking performance of the system. This is the final coated optical lens that the beam will pass through before it strikes the marking target. This lens is called a flat field lens because when the beam is focused, the focus lies in a plane perpendicular to the optical axis of the lens. To protect the final objective lens from dust and debris, a clear protective cover is inserted between the work area and the lens.

The following chart outlines the available lenses, the resulting image field (marking window) provided by the lens, and the working clearance (in millimeters and inches).

Lens	Image Field		Working Clearance	
	(mm)	(in.)	(mm)	(in.)
100 mm	65 x 65	2.56 x 2.56	97	3.82
160 mm	110 x 110	4.33 x 4.33	176	6.93
254 mm	175 x 175	6.89 x 6.89	296	11.65
330 mm	230 x 230	9.06 x 9.06	387	15.24
420 mm	290 x 290	11.42 x 11.42	493	19.41

E1015 LASER CONTROLLER

The pump diode is enclosed in the laser controller, while the laser resonator with the crystal is located in the laser marking head. The pump beam from the diode (approx. 808nm) is delivered through a fiber optic cable directly into the laser resonator. This compact laser controller can be fitted to any standard-rack mount or it can be placed directly upon a desktop.

The laser controller also contains the active thermo-electrical cooling system for the pump diode, the RF driver, galvanometer power supply, driver control circuits, appropriate fusing, and a 115/230VAC IEC320 connector, and a front panel control module.

Engineered for the greatest reliability and for ease of maintenance, the pump diode within the laser controller is an easily replaceable sealed module with expected lifetime of greater than 20,000 operating hours.

Fiber Optic Cable Assembly

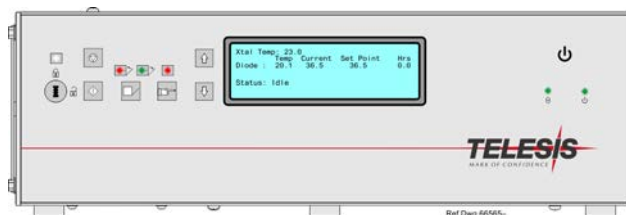
The fiber optic cable is permanently attached to the pump diode within the laser controller and cannot be removed. The standard optical fiber is 1.75 meters (5.74 feet) long. An optional 4.75 meter (15.58 ft.) fiber optic cable is also available.

E1015 Laser Controller Specifications

Dimensions (W x H x D)	425.45 x 140.46 x 487.68 mm (16.75 x 5.53 x 19.20 in.)
Surrounding Envelope	500 x 205 x 640 mm (19.5 x 8.0 x 25.20 in.)
Weight.....	approximately 15 Kg (33 lbs.)
Cooling.....	air cooled, active thermo-electric

Operator (Front) Panel

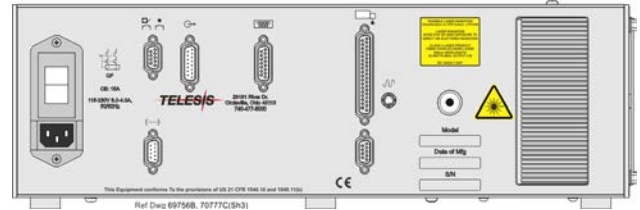
The front panel of the laser controller includes the system enable key switch, a soft power on/off button, green power indicator, laser start push button, laser off push button, safety shutter open and close controls, a laser on (emission) indicator, function indicators, and a liquid crystal display screen. The LCD screen allows monitoring of the diode current, the crystal and diode temperatures, the system status, and error conditions.



E1015 Laser Controller – Front Panel

Connector (Back) Panel for External Computer Usage

The rear panel of the laser controller provides a power entry module with circuit breaker and connectors for the fiber optic cable, laser marking head cable, galvo control cable, and RF cable. It also provides a remote interlock connector, a remote pendant connector, and an outputs connector. The outputs connector allows you monitor output signals reporting the status of the shutter, laser emission, and fault conditions.



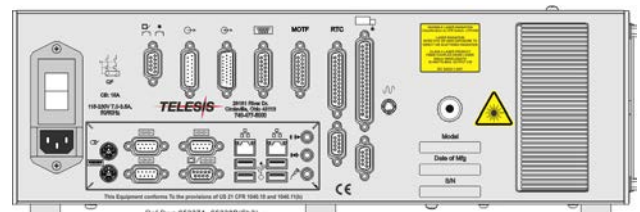
**E1015 Laser Controller
Back Panel – External Computer**

Connector (Back) Panel with Embedded Computer

The rear panel of the laser controller provides a power entry module with circuit breaker and connectors for the fiber optic cable, laser marking head cable, galvo control cable, and RF cable. It also provides a remote interlock connector and a remote pendant connector. An output connector allows you to monitor output signals reporting the status of the shutter, laser emission, and fault conditions.

An opto-isolated I/O connector and an I/O cable is provided for connection to the remote I/O devices. Refer to *Remote Communications* for more information.

Connections for the embedded system computer are mounted on a sub-panel. The separate panel allows you to connect a monitor, keyboard and mouse directly to the laser controller. Additional RS-232, Ethernet, and USB ports are provide for other optional connections and usage.



**E1015 Laser Controller
Back Panel – Embedded Computer**

EV15DS Laser Marking System

SYSTEM COMPUTER

The laser system requires an IBM-compatible computer for running the Merlin II LS Laser Marking Software. The system computer may be an external device connected to the laser controller, or it may be embedded within the controller itself.

If supplied by Telesis, the Laser/Galvo Controller board and the Merlin II LS is installed in the system computer prior to shipment and the entire unit is tested as a laser marking system. Warranty for the computer, keyboard, monitor, and peripherals default to the original equipment manufacturer.

If the system computer is supplied by anyone other than Telesis it must, at a minimum, meet the following specifications.

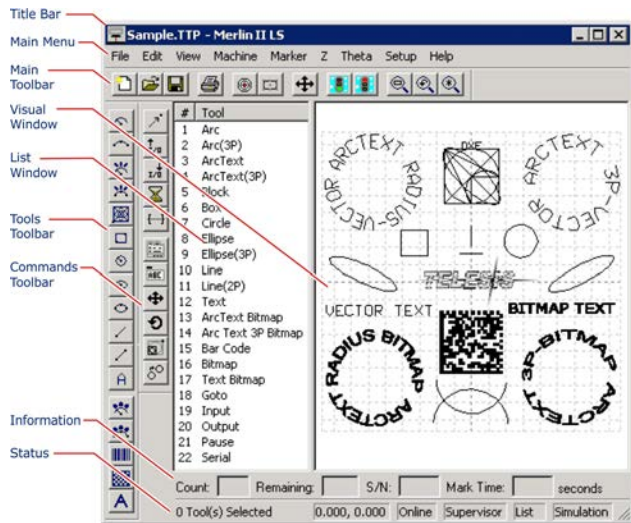
- Operating System Windows® 2000, Windows® XP, or Windows® Vista™ Business Edition
- Operator Interface Telesis Merlin II LS Laser Marking Software
- Processor Pentium® III with RAM as recommended per operating system
- Hard Drive 2 GB Hard Disk Drive
- External Drives CD-ROM Drive
- Comm Ports One available RS-232 Serial Port, Two available USB Ports, Two available full-height PCI Slots *
- Circuit Cards Laser/Galvo Controller Board, Video Board
- Peripherals SVGA Color Monitor, Mouse, Keyboard,

* One additional PCI slot required if system is configured for mark-on-the-fly operation.
If system computer is a notebook, expansion must be used to provide the PCI slots.

SYSTEM SOFTWARE

The powerful Telesis Merlin II LS Laser Marking Software is a Windows® based software package that comes standard with the laser marking system. It is a graphical user interface that makes marking pattern design quick and easy. The WYSIWYG (what-you-see-is-what-you-get) interface provides a to-scale image of the pattern as it is created. Just “click and drag” for immediate adjustment to field size, location, or orientation.

The Merlin II LS software includes tools to create and edit text at any angle, arc text, rectangles, circles, ellipses, and lines. Multiple fields may be grouped and saved as a block to form a logo. Existing DXF files can also be imported for marking. Non-printable fields can be created to clearly display a graphical representation of the part being marked.



Merlin II LS User Interface

Merlin II LS Laser Marking Software Specifications

- Operating System Windows® 2000, Windows® XP, or Windows® Vista™ Business Edition
- Font Generation True Type Fonts
- Barcodes and Matrix 2D Data Matrix, PDF417, BC 39, Interleaved 2 of 5, UPCA/UPCE BC 128, Maxi Code, Code 93, QR Code and others
- Graphic Formats Raster and Vector: BMP, GIF, JPG, WMF, EMF, DXF, CUR, ICO
- Serialization Automatic and Manual Input Host Interface Capable
- Linear Marking Scalable w/ Letter Spacing Control
- Arc Text Marking Scalable and Adjustable
- Drawing Tools Line, Rectangle, Circle, Ellipse

Remote Communications

The communication capability of the laser marking software allows you to control the laser from a remote source. Remote communications can be performed by connecting to a Host computer, an optional two-axis Auxiliary Controller, or to remote I/O devices.

Host Communications. Remote communications may be executed from a host computer using RS-232 or Ethernet (TCP/IP) connections to the system computer running the Telesis laser marking software. The software provides parameters to define the data transmitted to and from the host. For more information on using and configuring these parameters, refer to the *Merlin II LS Operating Instructions*.

Two-axis Controller. Telesis offers an optional two-axis controller for all systems that use the Merlin-II LS software. The auxiliary controller provides an interface for connecting six input and six output signals to and from the laser marking system, and for connecting the optional auxiliary axes: vertical (Z) axis, rotational (Theta) axis, and linear (L1 and L2) axes.

Environmental considerations must be taken into account when installing the auxiliary controller concerning contaminants and EMI susceptibility. For details, refer to the *Auxiliary Controller Installation & Maintenance Manual* supplied with the controller.

I/O Kits for Systems with External Computers. Telesis offers optional kits that provide programmable I/O signals in addition to the standard input signals (Go, Abort, Input 1 through Input 4) and standard output signals (Done, Ready, Paused, Output 1 through Output 3). For more information on connecting and using the additional I/O signals, refer to the *I/O Installation Supplement* provided in each of the kits.

Kit #53920 provides an additional 6 inputs and 6 outputs. It includes the I/O board, pre-installed SIPs resistor packs, software driver CD, and installation documentation. **This kit does not provide opto-isolated signals. Telesis does not endorse direct connection of I/O signals to the I/O board. Direct connections to high current/high voltage devices will damage the board.** The installer/integrator must provide opto-isolation between remote I/O devices and the I/O board.

Kit #53928 provides an additional 6 inputs and 6 outputs. It includes the I/O board, pre-installed SIPs resistor packs, software driver CD, Telesis Interface Module (#53423), two cable assemblies, and installation documentation. This kit provides opto-isolated signals between remote I/O devices and the I/O board using a Telesis interface module so additional I/O racks or opto-isolated board assemblies are not required.

I/O Connector for Systems with Embedded Computers.

Controllers configured with an embedded computer provide an opto-isolated DB26P I/O connector. Separate I/O racks or opto-isolated board assemblies are not required. In addition to the standard input signals (Go, Abort, Input 1 through Input 4) and standard output signals (Done, Ready, Paused, Output 1 through Output 3), this connector provides two programmable inputs and two programmable outputs. For more information on connecting and using the opto-isolated I/O connector, refer to the *EV15DS Installation & Maintenance Manual*.

Communications Protocol

Two types of host interface are supported (RS-232 or TCP/IP) and two communication protocols are provided through the Merlin II LS laser marking software: Programmable and Extended.

Programmable Protocol. Programmable protocol provides one-way (receive only) communication with no error checking or acknowledgment of the transmitted data. You may use Programmable protocol to extract a continuous portion of a message string to print. This can be used with a host computer or a bar code scanner. Note that XON/XOFF Protocol applies even when Programmable Protocol is selected.

The Programmable Protocol Message Type identifies the type of message sent from the host. It determines how the marker uses the data it extracts from the host message string when Programmable Protocol is used.

- 49 Message type 49 ("1")** overwrites the content of the first text-based field in the pattern with the data extracted from the host message. Note that if the field contains message flags, they will be overwritten, not updated.
- 65 Message type 65 ("A")** updates the Offset Angle parameter with the data extracted from the host message. Syntax for the transmitted string is $\pm n$ where \pm is a positive or negative sign and n is an integer that represents the offset angle for the marking window.
- 72 Message type 72 ("H")** updates the Offset X/Y parameters with the data extracted from the host message. Syntax for the transmitted string is $\pm X.X, \pm Y.Y$ where \pm is a positive or negative sign, $X.X$ represents the X-axis offset distance, and $Y.Y$ represents the Y-axis offset distance.
- 80 Message type 80 ("P")** indicates the data extracted from the host message is the name of the pattern to be loaded.
- 81 Message type 81 ("Q")** updates the text in the first query text buffer (buffer 0) with the data extracted from the host message.
- 86 Message type 86 ("V")** updates the text in the first variable text field in the pattern with the data extracted from the host message.
- 118 Message type 118 ("v")** updates the first text field encountered in the pattern that contains a variable text flag that matches the specified string length.

If the host provides the message type within the transmitted text string, set the Programmable Protocol Message Type (on the software Host/Setup window) to Message Type 0 (zero).

- 0 Message type 0 (zero)** indicates that the host will provide the message type, field number (if applicable), and data (if applicable). This option allows more flexibility by delegating the message type selection to the host on a message-by-message basis. It also allows you to direct data to specific fields and/or query text buffers.

The host can use Message Type 0 to provide data to the marking system. The marking system will insert data transmitted with the message into the appropriate location.

EV15DS Laser Marking System

Communications Protocol *(continued)*

Extended Protocol. Extended protocol provides two-way communication with error checking. It is designed to provide secure communications with an intelligent host device using pre-defined message formats and response formats. It also provides error checking using a block check code to detect faults in the transmitted messages and to verify the data is properly received.

The Extended Protocol Message Type determines how the marker uses the data it extracts from the host message string or from the laser marking system software, as applicable.

- 1 Message Type 1** can provide data to a text string in the pattern or poll the pattern for data.
- A Message Type A** can provide data to the system Offset Angle parameter for the marking window or poll the system for data.
- E Message Type E** allows the host to take the machine offline. It also provides the option of displaying an error message box with the provided data string.
- V Message Type V** can provide data to a variable text string in the pattern or poll the pattern for data.
- P Message Type P** can load a pattern or poll the system for the current pattern name.
- O Message Type O** places the marker online. This allows a host computer to reset. For example, this may be used to recover from a power outage when the marker is unattended.
- G Message Type G** initiates a print cycle.
- Q Message Type Q** can provide data to the system query text buffer or poll the system for data.
- H Message Type H** can provide data to the system X/Y Offset parameters or poll the system for data.
- S Message Type S** is used to poll the system for the machine status. The machine status is returned to the host in an eight-character hexadecimal mask.
- I Message Type I** is used to poll the system for the I/O status.

TRADEMARKS

Telesis and **Merlin** are registered trademarks of Telesis Technologies, Inc. in the United States and/or other countries.

Pentium is a registered trademark of Intel Corporation in the United States and other countries.

Vista is a trademark of Microsoft Corporation in the United States and other countries.

Windows is a registered trademark of Microsoft Corporation in the United States and other countries.