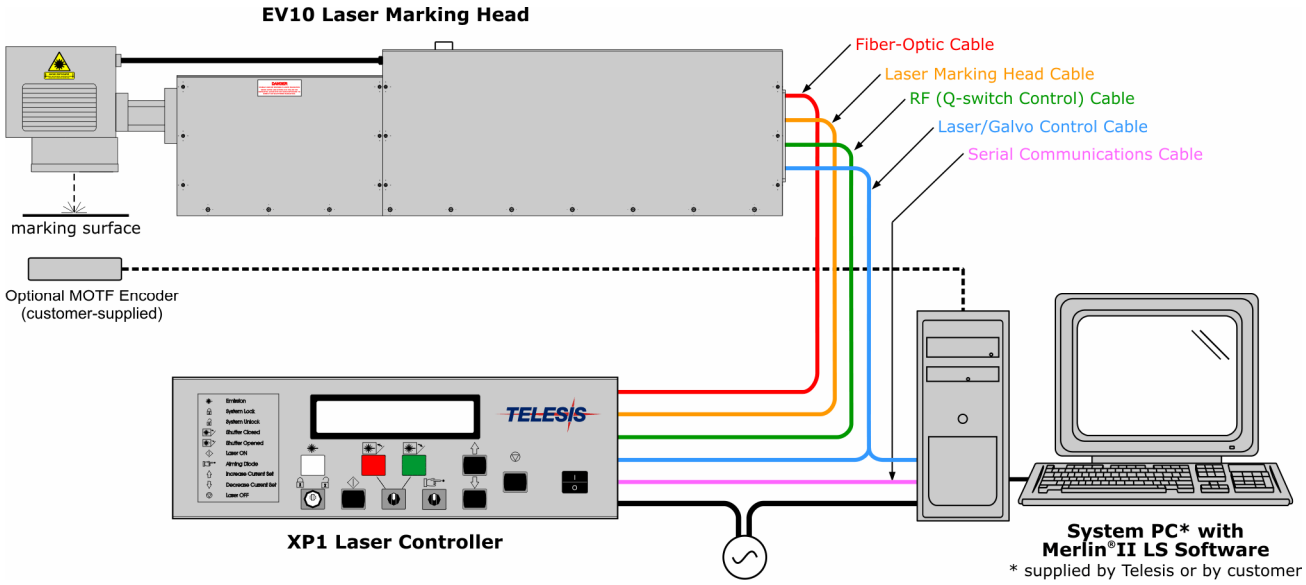


EV10 Laser Marking System General Arrangement

SYSTEM OVERVIEW

The Telesis® EV10 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 EV10 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 EV10 features a Q-switched Nd:YVO_4 diode-pumped laser with a remote fiber-coupled diode pump source. With average diode life of greater than 20,000 working hours the EV10 offers the user “best-in class” reliability.

The robust mechanical and optical design allows the Telesis EV10 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
- Large digital display for marker status, settings, and error condition monitoring
- Standard 115/230VAC operation
- DoD-compliant Unique Identification (UID) marking

SYSTEM CONFIGURATION

The EV10 is available in two configurations: one for marking only stationary objects, another for marking objects while they are moving (i.e., mark-on-the-fly operation). The basic laser marking system consists of the following components:

Laser Controller – contains pump diode, RF driver, and other electrical components

Fiber Optic Cable Assembly

Laser Marking Head – contains sealed resonator, beam expander, galvanometer assembly, visible red aiming diode

Software – Merlin®II LS Laser Marking Software

System Computer – supplied by Telesis or by customer

The modular design allows for major components to be easily replaced and returned to Telesis if required.

SYSTEM SPECIFICATIONS

Compliance	CDRH
Laser Type	fiber-coupled, diode-pumped, Q-switched, Nd:YVO_4
Wavelength	1064 nanometers (nm)
Mode	TEM_{00}
Average Power	10 watts at 1064 nm
Long Term Output Power Drift	< ± 2%
Max. Power Consumption	< 500 watts
Expected Diode Lifetime	> 20,000 hours
Input Power	95 to 250 VAC, 6 amps, 50/60 Hz single phase
Supply Voltage Fluctuation	< ± 10% with clean ground line
Operating 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

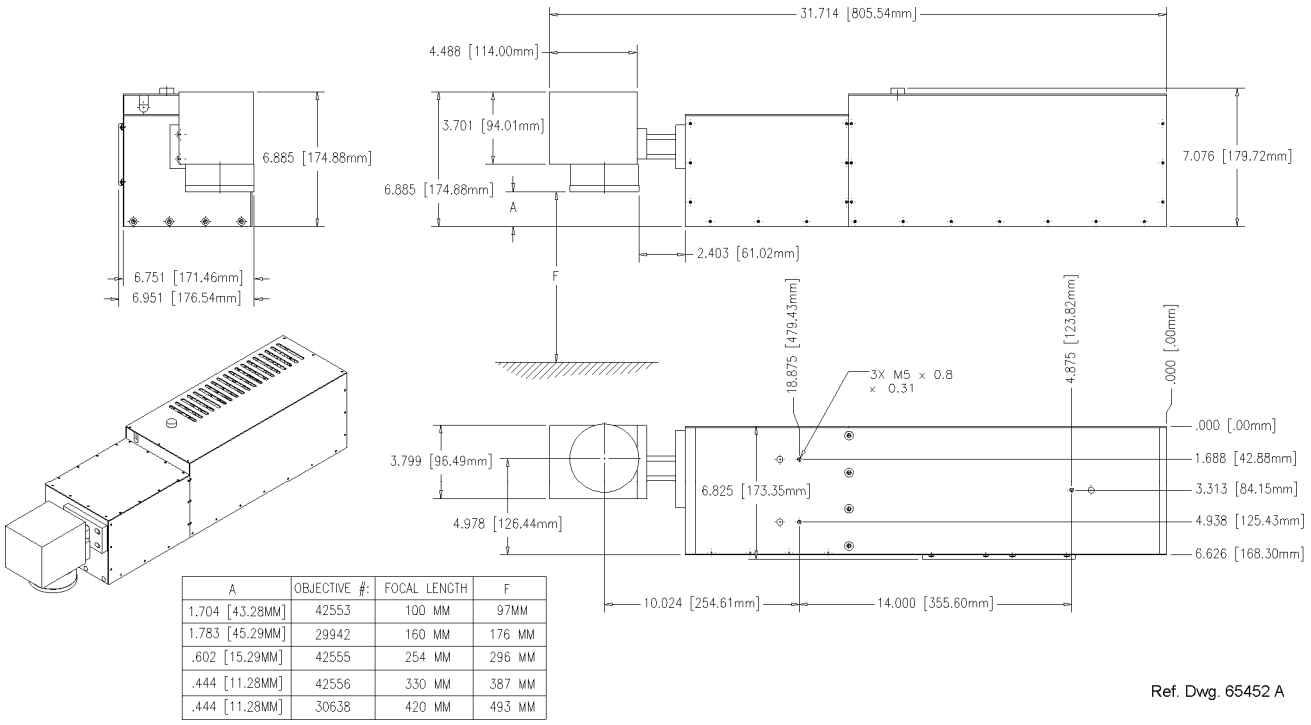
- Desktop computer or notebook computer with powered cardbus-to-PCI expansion enclosure
- Remote pushbutton station (start/abort)
- Externally-mounted focus-finder diode
- Mark-on-the-fly kit to interface with customer-supplied encoder for marking objects in motion (linear or circular)
- I/O options (see *Remote Communications* for details):
  TTL via PCI-DIO24 Board (Kit #53920)
  Opto-isolated via Merlin DCIO Module (Kit #53928)
  Two-axis Controller (for auxiliary axes; additional I/O)
- 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 *EV10 Installation & Maintenance Manual* for complete installation details.

Do not connect any power cable to power source until <u>all</u> system connections are made.

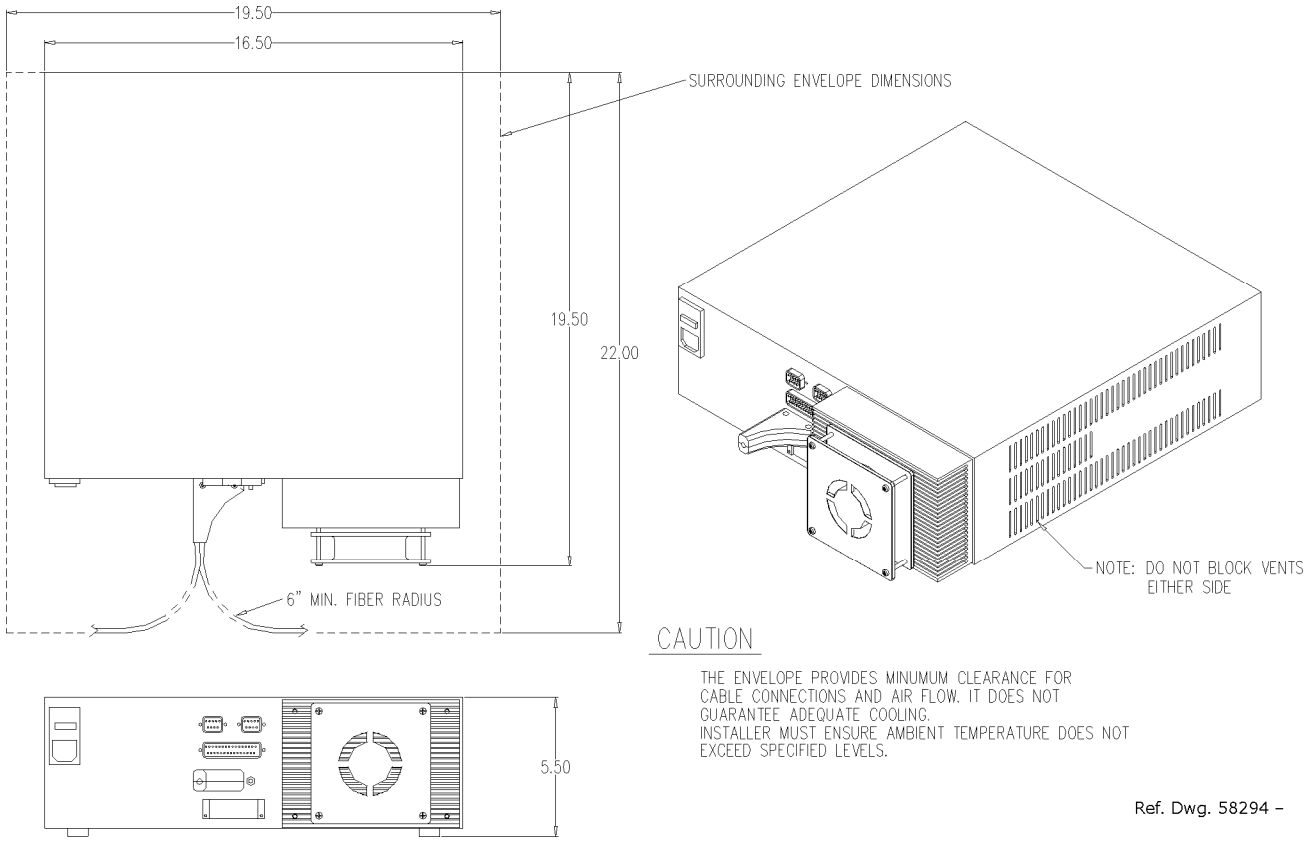
1. Equipment should remain powered down and in OFF position until mounting is complete.
2. Place computer, monitor, keyboard, and laser controller in desired location. Locate controller as close as practical to laser marking head – typically within 1.5m (5.0 ft.).
   - Ensure sufficient clearance on sides of laser controller (approx. 65 mm or 2.5 in.) to allow for air circulation.
3. Place the laser marking head on selected mounting.
   - **Do not bend or kink fiber optic cable.** The fiber optic cable will tolerate approximately 300 mm (12 in.) diameter bend without damage.
   - **Allow a minimum distance of 150 mm (6 in.) at rear of the laser marking head.** This will provide sufficient room for a proper bend radius of fiber optic cable.
   - **Do not block or obstruct exhaust vents or fans.** Note location of exhaust fans on right side of the laser marking head (as viewed from the connector panel) and the exhaust vents on the top and right sides. These vents and fans must have adequate clearance to ensure proper cooling.
   - Ensure sufficient clearance on all sides of laser marking head (approx. 65 mm or 2.5 in.) to allow for air circulation.
4. Mount laser marking head using three factory-tapped M5-0.8 mounting holes provided.
   - Locate the three pre-drilled M5-0.8 mounting holes.
   - Refer to the *Dimensions & Mounting* drawing for details.
   - **Mounting bolts must not extend into laser marking head more than 7.8 mm (.31 in.)** to avoid interference with internal components.
   - The leading edge of customer-supplied mounting fixture should extend no greater than 50 mm (2 in.) from forward edge of laser marking head rail assembly to allow clearance for beam output lens.
   - As viewed from front of the laser marking head in upright position, center of output beam is 254.61 mm (10.024 in.) forward of the front set of mounting holes in the laser rail assembly.
5. Secure the laser marking head to mounting fixture using three M5-0.80 bolts and lock washers. Torque to 47 in-lb (5.31 N-m). **Do not over tighten bolts.**
6. Select proper fuse arrangement for the laser controller. Refer to the *EV10 Installation & Maintenance Manual*. Connect power cable controller.
7. Connect fiber optic cable and all remaining cables, as applicable.
8. Refer to EV10 *Operation Supplement* for proper startup procedure. Refer to the *Merlin II LS Operating Instructions* for complete information on using system software.



A	OBJECTIVE #:	FOCAL LENGTH	F
1.704 [43.28MM]	42553	100 MM	97MM
1.783 [45.29MM]	29942	160 MM	176 MM
.602 [15.29MM]	42555	254 MM	296 MM
.444 [11.28MM]	42556	330 MM	387 MM
.444 [11.28MM]	30638	420 MM	493 MM

Ref. Dwg. 65452 A

EV10 Laser Marking Head Dimensions & Mounting Details



CAUTION

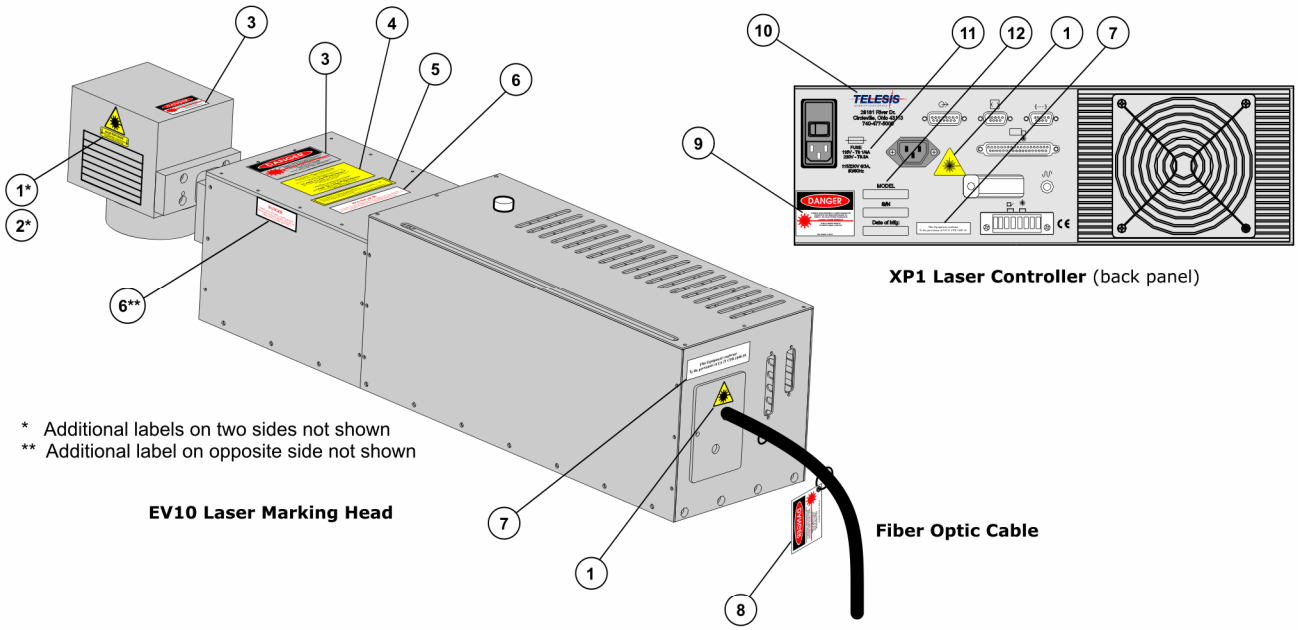
THE ENVELOPE PROVIDES MINUMUM CLEARANCE FOR CABLE CONNECTIONS AND AIR FLOW. IT DOES NOT GUARANTEE ADEQUATE COOLING.
INSTALLER MUST ENSURE AMBIENT TEMPERATURE DOES NOT EXCEED SPECIFIED LEVELS.

Ref. Dwg. 58294 –

XP1 Laser Controller Dimensions & Mounting Details

EV10 LASER MARKING SYSTEM LABELS

The following illustration shows the labels and their locations on the EV10 laser marking head and XP1 laser controller. Please familiarize yourself with the laser labels and their locations prior to operating the laser marking system.



1

2

AVOID EXPOSURE
VISIBLE AND INVISIBLE LASER RADIATION IS EMITTED FROM THIS APERTURE.

3

DANGER
VISIBLE AND INVISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
ND YVO, FIBER LASER, 1064nm WAVELENGTH
20 WATTS MAX. OUTPUT
2mJ per 20ns PULSE
DIODE LASER, 635-680nm WAVELENGTH
1 - 5 x CLASS I AEL CW OUTPUT
* PRACTICAL LIMIT
CLASS IV LASER PRODUCT

4

Classification to CRF Subch. J:Pt1040
INVISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
CLASS 4 LASER PRODUCT
ND YVO, FIBER LASER, 1064nm WAVELENGTH
20 WATTS MAX. OUTPUT
2mJ per 20ns PULSE
VISIBLE LASER RADIATION
DO NOT STARE INTO BEAM
CLASS 3R LASER PRODUCT
DIODE LASER, 635-680nm WAVELENGTH
1 - 5 x Class I AEL CW OUTPUT
IEC 60825-1-2001

5

INVISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
CLASS 4 LASER PRODUCT

6

DANGER
VISIBLE and/or INVISIBLE LASER RADIATION
WHEN OPEN AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION

7

This Equipment conforms To the provisions of US 21 CFR 1040.10.

8

DANGER
VISIBLE AND INVISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
DO NOT OPERATE LASER WITHOUT FIBER BEING CONNECTED TO HEAD
808nm WAVELENGTH
CLASS IV LASER PRODUCT

9

DANGER
VISIBLE AND INVISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
CLASS 4 LASER PRODUCT
808nm WAVELENGTH
50 WATTS MAX. OUTPUT
IEC 60825-1:2001

10

TELESIS
28181 River Dr.
Circleville, Ohio 43113
740-477-5000

11

Fuse
115V – T6 1/4A
230V – T6.3A
115/230V 6/3A
50/60 Hz

12

Model
S/N
Date of Mfg:

EV10 LASER MARKING HEAD

The E-series lasers are designed for easy maintenance. Heat exhaust fans are located on the right side of the unit (as viewed from the connector panel).

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

EV10 Laser Marking Head Specifications

Dimensions (L x D x H)	805.54 x 176.54 x 179.72 mm (31.714 x 6.951 x 7.076 in.)
Surrounding Envelope	875 x 245 x 245 mm (34.5 x 9.75 x 10 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
Cooling	air cooled, active thermo-electric

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 (mm)	Image Field (in.)	Working Clearance (mm)	Working Clearance (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

XP1 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.

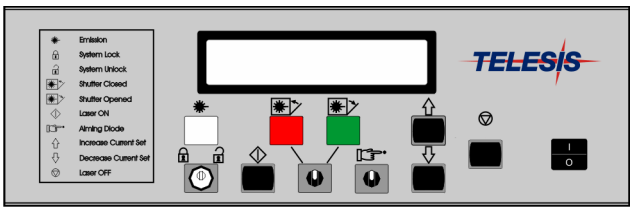
Engineered for the greatest reliability and for ease of maintenance, the pump diode within the laser controller is an easily replaceable sealed module with expected lifetime of greater than 20,000 operating hours.

XP1 Laser Controller Specifications

Dimensions (W x H x D)	419.1 x 139.7 x 495.3 mm (16.5 x 5.5 x 19.5 in.)
Surrounding Envelope	500 x 205 x 625 mm (19.5 x 8.0 x 24.5 in.)
Weight	approximately 10 Kg (22 lbs.)
Cooling	air cooled, active thermo-electric

Operator Control Panel

The front panel includes the system key switch, laser off push button, manual safety shutter control, function indicators, and LCD display. The display allows monitoring of the diode current, the crystal and diode temperatures, system status, and error conditions.



XP1 Laser Controller

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 for the EV10 is 2 meters (6.56 feet) long.

SYSTEM COMPUTER

The laser system requires an IBM-compatible computer for running the Merlin II LS Laser Marking Software. The system computer may be a desktop or a notebook computer and may be supplied by Telesis or by the customer.

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.

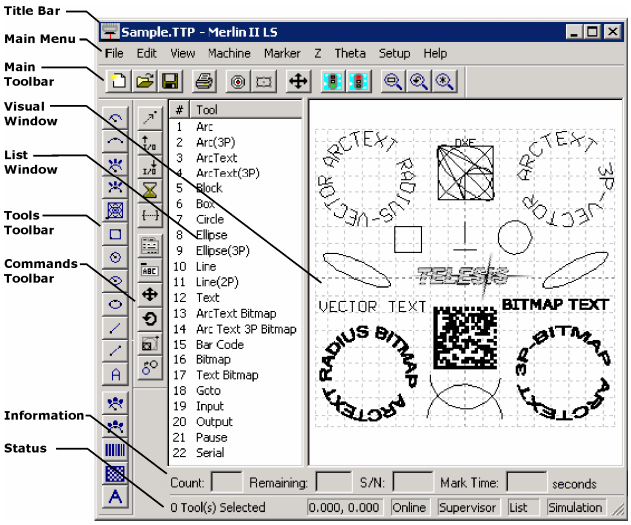
Operating System	Windows® 2000, Windows® XP, or Windows® Vista™ Business Edition
Operator Interface	Telesis Merlin II LS Laser Marking Software
Processor	Pentium® III with RAM as recommended per operating system
Hard Drive	2 GB Hard Disk Drive
External Drives	CD-ROM Drive
Peripherals	SVGA Color Monitor,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

** If the 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 remote I/O devices. Remote communications can be performed by connecting to a Host computer, an optional I/O kit, or an optional two-axis Auxiliary Controller.

The rear panel of the controller also provides a connector to monitor output signals that report the status of the shutter, laser emission, and fault conditions.

Host Communications. Remote communications may be executed from a host computer using RS-232 or Ethernet (TCP/IP) connections to the system computer (i.e., the PC 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*.

I/O Kits. 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** is available for all systems that use an *external computer*. It 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 <u>does not</u> 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** is available for all systems that use an *external computer*. It 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.

Two-axis Controller. Telesis offers an optional two-axis controller for all laser systems that use the Merlin-II LS Laser Marking 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.

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 ±n where ± 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 ±X.X,±Y.Y where ± 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.

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.