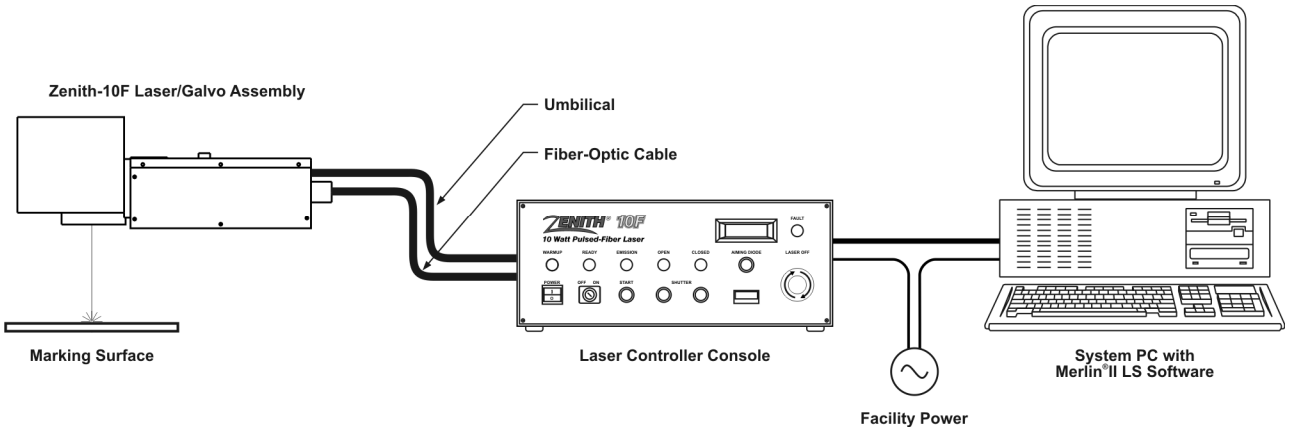


Zenith-10FQ Laser Marking System General Arrangment

System Overview

The Telesis ZENITH®10FQ is one laser in a family of maintenance-free, Q-switched pulsed, Ytterbium fiber lasers designed for marking applications. These lasers deliver a high power laser beam directly to the marking surface via a flexible, metal-sheathed fiber cable. The fiber based optical design and rugged mechanical design allows the Telesis ZENITH®10FQ to operate in industrial conditions with respect to shock, vibration, and dust, with relative humidity of 10 to 85% and a temperature range of 10 to 35°C.

The ZENITH®10FQ fiber laser offers these advantages:

- Standard 115/230 VAC wall plug operation
- External fiber delivery line
- High quality, easily focused beam
- High repetition rate
- Optimized pulse duration
- Exceptionally high reliability
- Self-calibrating/monitored power output
- Maintenance-free operation
- Air cooled
- DoD-compliant Unique Identification (UID) marking

Laser Specifications

Compliance.....CDRH and CE
Wavelength.....1,060 nm (± 10 nm)
Laser Type.....Ytterbium Q-switched Fiber Laser
Average Power .....10 W
Long Term Output Power....<5% Instability
Peak Power.....>4 KW
Beam Quality.....M2 < 2
Fiber Length .....5 meters (16 feet), Standard

System Configuration

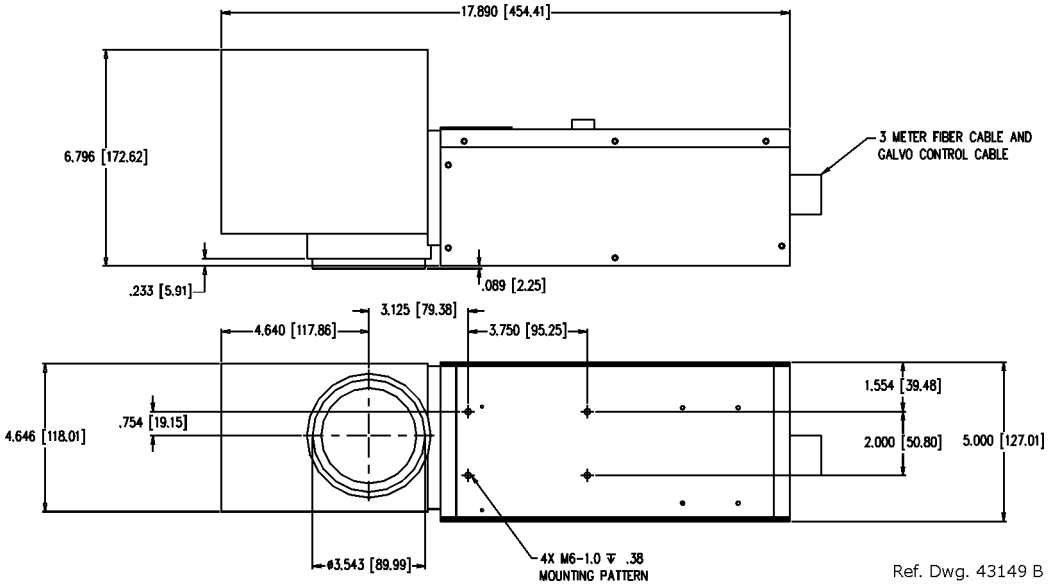
The ZENITH®10FQ unique design allows for a remote beam delivery system. The galvanometer package is attached to a fiber-optic delivery system from a remote laser engine. This allows the overall package to be very small and modular. The basic package consists of the following components.

- Laser Control Console
- Beam Delivery Assembly
- Galvanometer Package
- Software – Merlin II LS Laser Marking Software
- System PC – supplied by Telesis or by customer

The modular design allows for major components to be easily replaced and returned to Telesis if in need of repair. Replacing the entire modular unit eliminates the need for realignment. Depending on the level of integration of the laser into a workstation, module replacement can be completed in less than one (1) hour by an entry-level technician.

Laser Assembly System Options

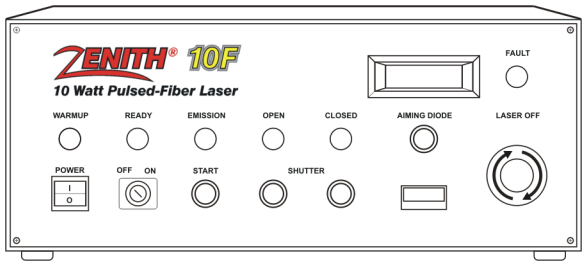
- Desktop computer or Notebook computer with powered CardBus-to-PCI expansion enclosure
- Externally mounted Focus-Finder Diode
- Tool post assembly with manual hand crank for Z-axis adjustment
- Pushbutton Station (Start/Abort)
- I/O Options:
  TTL via PCI-DIO24 Card (Kit #53920)
  Opto-isolated via Merlin DCIO Module (Kit #53928)
  TMC090 Controller (for auxiliary axes and additional I/O)
- Programmable X-Y or Z-axis (TMC090 required)
- Rotary Drive Fixture (TMC090 required)
- Vacuum System
- Workstation / Work area enclosures



Zenith-10FQ Dimensions and Mounting Details

Laser Control Console

The laser source is located in the control console enclosure. Designed to meet CDRH and CE standards, the control console enclosure also contains the galvo power supplies, driver control circuits, fusing, and the selectable 115/230 VAC, 50 Hz/60 Hz power jack. This unit includes the system key switch and laser off switch, a manual safety shutter control, function indicators, and digital displays. The enclosure is designed to fit in a standard 19-in. rack (48.3 x 20 x 60 cm) or it can be placed directly on a desktop.



ZENITH®10FQ Laser Controller Console

The solid-state laser source within the control enclosure does not contain the traditional laser crystal, front and rear mirrors and light amplifier arrangement known as the *laser resonator*.

Sometimes simply called the *laser engine*, this is a true solid state Ytterbium fiber light amplifier. The Ytterbium fiber laser design offers a modern and unique concept for laser beam generation; the optical fiber itself is the lasing medium. With no laser crystal or intra-resonator optics, the entire laser assembly is reduced to a compact, lightweight, easily replaceable sealed package.

Co-focal through the lens, red light diodes are available with Ytterbium fiber laser markers functioning primarily as a laser positioning / dry run feature.

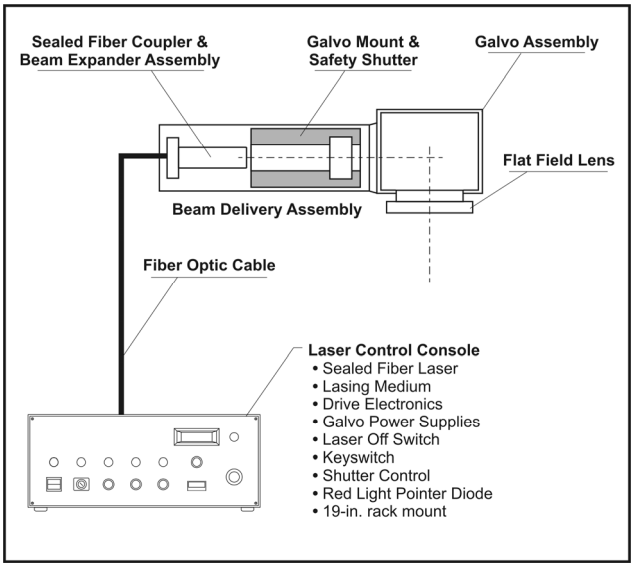
Laser Controller Specifications

Dimensions (W x H x L)	standard 19 in. rack mount: 43.2 x 19.1 x 59.7 cm 17.0 x 7.5 x 23.5 in.
Weight	24 Kg (53 lbs.)
Input Power (selectable)	115/230 VAC 50/60 Hz
Cooling	Air cooled, fan/filter
Avg. Power Consumption	350 Watts
Operating Range	10° to 35°C (50° to 95°F)
Humidity	10% to 85% non-condensing
Expected MTBF (diode)	Greater than 50,000 hours maintenance-free
Power Monitoring	LED display
Optical Isolator	Optional
Positioning	Visible Red Diode Light

Fiber Optic Beam Delivery Assembly

The beam is delivered from the laser source (in the laser control console) through a fiber optic cable to the galvo assembly. One end of the fiber optic cable is a permanently attached directly to the laser light source and cannot be removed. The standard cable for the ZENITH®10FQ is 5 meters (16 feet) long.

The output end of the fiber optic cable, which attaches to the galvo mounting block assembly, is fitted with a specially designed optical beam expander which is factory sealed into a machined steel housing. This is a very flexible, stainless steel armored, plastic sheathed, optically pure fiber cable designed for industrial applications. When properly mounted, this machined steel housing aligns the beam to the galvo assembly. The machined steel housing cannot be removed from the fiber cable without special tools and should not be attempted in the field without first contacting Telesis Service. Improper removal may expose optical lenses to outside contamination or, in extreme cases, expose personnel to active laser energy. Under no circumstances should the fiber optic cable be disconnected from the beam delivery assembly without taking proper safety precautions.



Beam Delivery

Galvanometer Package

The Galvanometer package consists of a galvo mounting block and electro-mechanical safety shutter. The galvo block is a machined aluminum component that allows for precision mounting and alignment of both the beam delivery assembly and the galvanometer beam steering assembly. The barrel of the beam delivery extends into the block and to a shoulder, creating the proper standoff from the first galvo mirror.

Between the sealed fiber coupler and the beam expander assembly is a safety shutter. Under power, a precision-drilled hole in the rotating drum is aligned with the beam path, allowing laser energy to pass through to the first galvanometer steering mirror. If the shutter is closed, or power is removed from the system (e.g., an emergency stop condition) the spring-loaded barrel will rotate to inhibit the beam.

The size of the ZENITH®10FQ fiber-to-fiber laser allows positioning of the laser galvo assembly in almost any angle. This provides an almost unlimited angle of attack for marking directly upon even the most difficult part configurations.

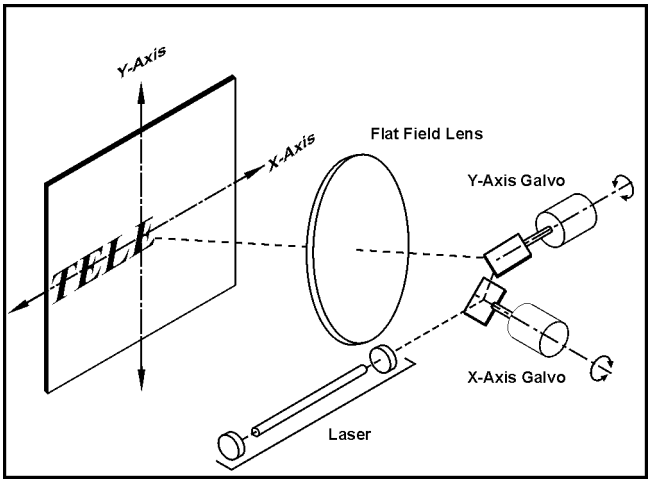
Galvanometer (Marking Head) Specifications

Dimensions (W x H x L) .....12.7 x 17.25 x 45.44 cm
5.0 x 6.79 x 17.89 in.

Weight.....5.45 Kg (12 lbs.)

Galvanometer Optical Scanners

Each galvo assembly has two optic scanning galvanometers, one each for controlling X-axis beam positioning and Y-axis beam positioning. Galvanometer scanners are computer-controlled high-performance precision closed-loop rotary motors. They consist of a motor section based on moving magnet technology and a high-precision closed-loop position detector. Attached to each motor shaft is an optically coated mirror assembly to deflect the beam. Each optically coated mirror assembly is factory balanced and bonded, then each combination of mirror and motor assembly are electronically equalized in the control circuitry.



Galvanometer Optical Scanners

Flat Field Lens, Final Objective Lens, (F-Theta Lens)

The final object 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. The final objective lens is sometimes called the F-Theta lens because the lens is optically corrected to provide an image height that is proportional to the scan angle (Theta), not the tangent of that angle, as is usually the case with traditional optical lenses. This lens is also 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 lens and protective cover is held in place by a threaded adapter ring called a bezel (mounting kit). The bezel threads directly into the machined galvo block. The lens and protective cover can be replaced in less than five (5) minutes. A properly maintained lens will remain functional indefinitely. Periodically, as a standard practice, the lens should be cleaned using an approved optical lens cleaner and soft optical tissue.

The following chart outlines the available lenses, their part numbers, the mounting kit (bezel) part numbers, and the resulting image field provided by the lens (in millimeters and inches).

Lens	Lens Part No.	Mount. Kit Part No.	Typical Image Field (mm)	Typical Image Field (in)
100 mm	42553	46846	45 x 45	1.77 x 1.77
160 mm	29942	46847	90 x 90	3.54 x 3.54
163 mm	42554	46848	110 x 110	4.33 x 4.33
254 mm	42555	46849	155 x 155	6.10 x 6.10

Marking Characteristics

Spot Size (line width). The laser spot size can be thought of as the line width of the image being marked. For all practical purposes, the laser-created text (or any machine-readable code) can be programmed to mark or engrave smaller than can be seen without magnification. In the opposite extreme, it can be marked so large as to cover the entire marking field.

In all cases, laser spot size is dependent on a variety of factors including lens selection, focus, and the material being marked. The following chart is provided for reference only.

Lens	Spot Size (line width)
100 mm	25 microns (.0010 in.)
160 mm	40 microns (.0015 in.)
163 mm	40 microns (.0015 in.)
254 mm	60 microns (.0025 in.)

Marking Field Size. The size of the marking field is dependent on lens type.

Lens	Marking Field (mm)	Marking Field (in.)	Working Clearance (mm)	Working Clearance (in.)
100 mm	45 x 45	1.77 x 1.77	97	3.82
160 mm	90 x 90	3.54 x 3.54	176	6.93
163 mm	110 x 110	4.33 x 4.33	185	7.28
254 mm	155 x 155	6.10 x 6.10	296	11.65

System PC

The laser system requires an IBM-compatible computer for running the Merlin®II LS Laser Marking Software. The PC may be a desktop or a notebook computer and may be supplied by Telesis or by the customer. If the PC is supplied by Telesis, warranty for the computer, computer keyboard, monitor, and peripherals default to the original equipment manufacturer.

Galvo control cards are included, along with interconnect cabling. The laser software is installed and the entire unit is tested as a laser marking system.

The minimum computer requirements are as follows:

- Windows® 2000 or Windows® XP
- Telesis Merlin® II LS Laser Marking Software
- Pentium® III, 128 MB RAM (minimum)
- Multi-gigabyte, HDD
- CD-ROM and 3.5 in. External Disk Drives
- SVGA Color Monitor, Mouse, and Keyboard
- Laser/Galvo Controller Board
- Video Card
- One available RS-232 Serial Port
- Two available USB Ports
- Two (minimum) full-height PCI Slots *

  Note: If a notebook computer is used, expansion must be used to provide the PCI slots.

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 marking system software (Programmable and Extended).

Programmable Protocol. This protocol is used where very simple one-way communications are required (such as with bar code scanners). Programmable Protocol provides no error checking or acknowledgment of transmitted data. Note that XON/XOFF Protocol applies even when Programmable Protocol is selected.

Extended Protocol. This protocol includes error checking and transmission acknowledgment. It should be used in applications where serial communication is a vital part of the marking operation.

Remote Communications

The communication capability of the marking system 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 card, or an optional TMC090 Auxiliary Controller.

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 *Operation Manual* supplied with the laser marking software.

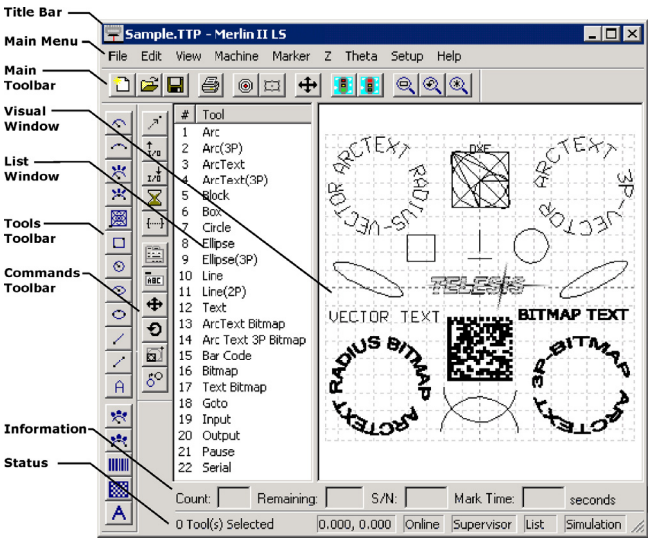
I/O Card. Telesis offers an optional I/O card that provides six input signals (Start Print, Abort, and four programmable inputs) and six output signals (Ready, Done, Paused, and three programmable outputs). The I/O card is available in kit #53928. For more information on using the optional I/O card, refer to the Telesis *Optional I/O Card Installation Supplement* supplied in each of these kits.

TMC090 Controller. Telesis offers an optional TMC090 Controller for all laser systems that use the Merlin-II LS Laser Marking Software. The TMC090 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. For details, refer to the *TMC090 Installation/ Maintenance Manual* supplied with the controller.

System Software

Telesis' powerful WIN32 Merlin®II LS Laser Marking Software is a PC-based operating 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 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 CAD files can also be imported for marking. Non-printable fields can be created to clearly display a graphical representation of the part being marked.



Overview of Merlin-II LS User Interface

Merlin®II LS Laser Marking Software Specifications

Operating System	Windows®2000 or Windows®XP Desktop PC or Notebook PC
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, PLT, DXF
Serialization	Automatic and Manual Input Host Interface Capable
Linear Marking	Scalable with Letter Spacing Control
Arc Text Marking	Scalable and Adjustable
Drawing Tools	Line, Rectangle, Circle, Ellipse

System Setup

Complete installation procedures are provided in the *Zenith-10FQ Installation/Maintenance Manual*. The following procedures are listed for reference only to provide a general overview of the installation process.

1. Equipment should remain powered down and in the OFF position until the mounting is complete.
2. Place the computer, monitor keyboard and laser control console in the desired location. Locate the controller as close as practical to the marking head. The standard cable length is 5 meters (16 feet).
3. Locate the galvo mounting block assembly to the mounting position taking care not to bend or kink the fiber optic cable. The fiber optic cable will take an approximately 305 mm (12 in.) diameter bend without damage.
4. Mount the laser galvo mounting block assembly by using four M6-1.0 bolts. **Mounting bolts must not extend into the galvo block as to interfere with the internal components.**
    a. Mounting holes are tapped for metric threads. The mounting pattern for the ZENITH®10FQ laser is a four (4) hole rectangular pattern 2.0 in. wide by 3.75 in. long (50.8 x 95.25 mm). The holes are tapped 3/8 in. deep for M6-1.00 bolts. Standard clearance holes (0.26 in.) for M6-1.00 bolts should be used for this pattern.
    b. The leading edge of the mounting plate should be no greater than .875 in. (22.23 mm) from the first set of holes to allow clearance for the beam output lens.
    c. As viewed from the front of the laser in the upright position, the center of the output beam is 3.125 in. (79.38 mm) forward of the first set of mounting holes and 0.754 in. (19.15 mm) inward from the right side set of mounting holes.
    d. A minimum distance of 6.0 in. (152.4 mm) should be allowed from the rear of the laser to allow for proper bend radius of the fiber optic cable
5. Ensure the laser control console power switch (on front panel) is OFF.
6. Select the proper voltage setting (either 115V or 230V), then connect the power cable.
7. Connect the remaining cables.
8. Refer to the *Zenith-10FQ Operation Supplement* for proper startup procedure of the complete system.
9. Refer to the laser marking system *Operation Manual* for complete information on using the system software.

General Mounting Procedures

If you chose to integrate the laser into a workstation that has not been designed by Telesis, you should keep in mind the following engineering considerations when integrating your system.

- **Design simple X-, Y-, and Z-axis adjustments.**
  When designing a mounting fixture for the laser marking head, allow for simple three-axis adjustment to aid in horizontal, vertical, and lateral alignment of the laser marking head. Experience has shown that a minimum adjustment value of 12.7 mm (0.50 in.) is a prudent design consideration if the intent is to integrate the laser into workstation not designed by Telesis.
- **Ensure the part and the part holding fixture are perpendicular to the final objective lens.**
  When designing a work piece holding fixture, ensure the fixture is flat relative to the final objective lens of the galvo block assembly and square to the centerline of the laser marking field.
- **Ensure the part is stable and will not move during marking.**
  Laser marking is a non-contact marking method. Typically all that is needed is simple fixturing pockets or X-axis, Y-axis datum rails.
- **Ensure the part width and length will fit in the marking area.**
  Double check that all the parts to be marked will fit within the laser marking field. Ensure the marking area is not obstructed and can be targeted by the laser beam .
- **Ensure the combined total height of the part and fixturing does not exceed the working clearance of the final objective lens selected.**
  Care should be taken to ensure that the laser can be placed into focus on the part. The total combination of the part and fixturing height must not exceed the adjustment capability of the customer-supplied Z-axis. The working clearance is the distance between the bottom of the lens and the top of the part to be marked. See *Marking Characteristics (Marking Field Size*) for details on working clearances for the available lenses.