SYSTEM OVERVIEW

The Telesis® CO10A is a 10-watt, RF-excited, continuous wave, sealed-tube, CO2 laser marking system that provides a galvo-steered beam designed for marking. The CO10A laser marking system is excellent for marking substrates like wood, glass, Plexiglas®, quartz, ceramics, fabrics, and other organic materials.

The CO10A laser offers these advantages:

• Air-cooling – no external water or refrigerant needed
• Compact laser marking head and simple mounting system
• Detachable laser head cable assembly for easy integration
• Visible red aiming diode
• Standard 115/230VAC operation
• Key switch, Laser Off button, interlocked safety shutter, and emission indicators
• DoD-compliant Unique Identification (UID) marking

SYSTEM CONFIGURATION

The CO10A is available in several configurations. The system computer, required for running the Merlin® II LS software, may be 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 for marking objects while they are moving (i.e., mark-on-the-fly operation).

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** – includes the laser tube, optics, shutter assembly, galvanometer assembly, and flat-field lens. A coaxial red aiming diode is included for pin-point marking alignment.
• **Laser Controller** – contains circuit boards, electrical components, and the operator console
• **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** – supplied by Telesis for systems with embedded computers; may be supplied by Telesis or by the customer for systems with external computers.
SYSTEM SPECIFICATIONS

Compliance..............................  CDRH
Laser Type................................ RF-excited, continuous wave,
sealed-tube, carbon dioxide laser
Wavelength..............................  10.6 micrometers (µm)
Long Term Output
Power Drift..............................  < ±5%
Power Requirements..............  115 VAC, single-phase,
9.0A, 50/60Hz
230 VAC, single-phase,
4.5A, 50/60Hz
System Power (total)..............  approx. 480W,
4.2A at 115 VAC
Maximum Supply Voltage .........  264 VAC
Supply Voltage Fluctuation ..........  < ±10% with clean ground
Operational Temp...............  15° to 30°C  (59° to 86°F)
Recommended Temp..............  16° to 24°C  (61° to 75°F)
Ambient Relative Humidity ...  10% to 90% 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 laser controller to run
Merlin II LS Laser Marking Software
- Laser Controller Fuse/Connector Kit
- 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 z-axis adjustment
- Programmable tool post for z-axis adjustment (requires
two-axis controller)
- Programmable rotary drive fixture for 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 CO10A
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 connection 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 and to permit
   proper installation of applicable cables. Refer to the C1030
   Laser Controller Dimensions 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 and to
   permit proper installation of applicable cables.
6. Mount the laser marking head with three M8-1.25 bolts and
   lock washers using the factory-tapped mounting holes
   provided. Refer to the CO10A Laser Marking Head
   Dimensions drawing for details.
   Caution: Maximum mounting bolt penetration into
   the laser marking head is 7.8 mm (.31 in.).
   Note: Optionally, three M6 locating pins may be
   used at the 0.2362 P6 hole locations for more
   precise marking head alignment.
7. Connect all cables remaining cables, as applicable.
8. Connect any optional or customer-supplied devices or
   interface circuits as applicable.
9. Refer to the CO10A Operation Supplement for proper
   startup procedure. Refer to the Merlin II LS Operating
   Instructions for complete information on using the system
   software.
CO10A Laser Marking System

**CO10A Laser Marking Head Dimensions**

**C1030 Laser Controller Dimensions**

(external computer configuration shown – embedded computer configuration similar)
CO10A LASER MARKING HEAD SAFETY LABELS

The following illustration shows the labels and their locations on the CO10A laser marking head. Please familiarize yourself with the laser labels and their locations prior to operating the laser marking system.

This Equipment conforms To the provisions of US 21 CFR 1040.10 and 1040.11(b)
**C1030 LASER CONTROLLER SAFETY LABELS**

The following illustration shows the labels and their locations on the C1030 laser controller. Please familiarize yourself with the laser labels and their locations prior to operating the laser marking system.

---

**TELESIS**

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

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1. QF

CB: 15A

115-230V 11-5.5A, 50/60Hz

2. Model

Date of Mfg

S/N

3. This Equipment conforms To the provisions of US 21 CFR 1040.10 and 1040.11(b)
CO10A Laser Marking System

CO10A LASER MARKING HEAD
The laser marking head incorporates the latest technology in sealed-tube, RF-excited, continuous wave, carbon dioxide lasers, providing excellent output power, stability, and reliability in a rugged compact modular package.

CO10A Laser Marking Head Specifications
- Dimensions (L x W x H) ....... 857.07 x 165.13 x 221.07 mm (33.743 x 6.501 x 8.704 in.)
- Surrounding Envelope .......... see CO10A Laser Marking Head Dimensions drawing
- Electrical Power ............... 330 watts (approximate)
- Mounting Weight ............... 19.1 Kg (42 lbs.)
- Mounting ....................... three factory-tapped M8-1.25 holes
- Positioning ...................... visible red aiming diode
- Field Resolution ............... 16 bit (65535 data points)
- Galvanometer
  - Repeatability .................. < 22 micro radian
- Marking Field Size ........... lens-dependent, see chart
- Laser Marking Head Cable ..... 1.8 m (6 ft.), detachable
- Laser/Galvo Control Cable .... 3.6 m (12 ft.), detachable
- Cooling ........................ air cooled, fans

Dual-Sensor Shutter Circuit
The CO10A 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.

Visible Red Aiming Diode
Laser marking head includes a visible red diode that can be viewed on the work surface without the need for protective safety goggles.

The aiming diode provides a safe and convenient aid for laser setup and part programming. Since the red beam is located after the shutter, the aiming beam 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.

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) to properly focus the laser for marking.

<table>
<thead>
<tr>
<th>Lens</th>
<th>Image Field Marking Window (mm)</th>
<th>Working Clearance (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 mm</td>
<td>50 x 50</td>
<td>1.97 x 1.97</td>
</tr>
<tr>
<td>100 mm</td>
<td>70 x 70</td>
<td>2.76 x 2.76</td>
</tr>
<tr>
<td>150 mm</td>
<td>100 x 100</td>
<td>3.94 x 3.94</td>
</tr>
<tr>
<td>200 mm</td>
<td>140 x 140</td>
<td>5.51 x 5.51</td>
</tr>
<tr>
<td>250 mm</td>
<td>170 x 170</td>
<td>6.69 x 6.69</td>
</tr>
<tr>
<td>300 mm</td>
<td>205 x 205</td>
<td>8.07 x 8.07</td>
</tr>
<tr>
<td>360 mm</td>
<td>250 x 250</td>
<td>9.84 x 9.84</td>
</tr>
</tbody>
</table>
C1030 LASER CONTROLLER
The laser controller is remotely connected to the laser marking head by the laser marking head cable assembly. The cable assembly carries power and control signals to the laser marking head.

The laser controller provides the electrical control of the laser marking system. The controller connects to the facility electrical supply to provide power to the laser marking system. The laser controller is also the electrical interface between the laser marking software (installed on the system computer) and the laser marking head. It provides buttons and indicators to control and monitor the laser marking process.

C1030 Laser Controller Specifications
- Dimensions (W x H x D) ...... 425.20 x 140.21 x 504.44 mm (16.74 x 5.52 x 19.86 in.)
- Surrounding Envelope .......... see C1030 Laser Controller Dimensions drawing
- Weight......................... approx. 8.14 Kg (17.9 lbs.)
- Cooling......................... air cooled, fan/filter

Operator (Front) Panel
The laser control panel 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, and a laser on (emission) indicator.

Connector (Back) Panel for External Computer Usage
The rear panel of the controller provides a power entry module with circuit breaker and connectors for the laser marking head cable and the laser/galvo control cable. It also provides a remote interlock connector and a remote pendant connector. An output connector allows you monitor output signals reporting the status of the shutter, laser emission, and fault conditions.

Connector (Back) Panel with Embedded Computer
The rear panel of the controller provides a power entry module with circuit breaker and connectors for the laser marking head cable and the laser/galvo control 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 with Telesis software.
CO10A 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.

NOTICE
Merlin II LS software and associated applications are pre-installed on the embedded computer. The embedded system supports Telesis-installed software only and does not support user-installed programs.

All system computers supplied by Telesis (external and embedded) have the laser/galvo controller board and the Merlin II LS software installed prior to shipment so the entire assembly is tested as a laser marking system. Warranties for the computer, keyboard, monitor, and peripherals default to the original equipment manufacturer.

If the external system computer is supplied by anyone other than Telesis it must use the following software:

- Operating System: Windows®2000, XP, Vista® (Business), 7 (professional), or 8 (Professional)
- Operator Interface: Telesis Merlin II LS Laser Marking Software

Additionally the system computer must, at a minimum, meet the following specifications:

- 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 Ethernet 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 the system computer is a notebook, expansion must be used to provide the PCI slots.
‡ Telesis recommends a USB mouse and a USB keyboard for system computers that are embedded in the laser controller.

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 Laser Marking Software Specifications

- 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 auxiliary controller for all laser marking systems that use the Merlin II LS laser marking software. The Auxiliary Controller provides an interface for connecting the optional vertical (Z) axis and the optional rotary (Theta) axis. The Auxiliary Controller may be configured with additional board to support two additional linear axes (L1 and L2). For installation details, refer to the Auxiliary Controller Installation & Maintenance Manual supplied with the controller.

I/O Kits for Systems with External Computers. Telesis offers optional I/O kits that provide up to 12 additional, programmable I/O signals (6 inputs and 6 outputs). All kits provide an I/O card, pre-installed SIPs resistor packs, and software driver CD. For details on connecting and using the additional I/O signals, refer to the Installation Supplement provided in each of the kits.

- **Kit 53920** provides a PCI-DIO24 card.
- **Kit 53928** provides a PCI-DIO24 card, the Merlin I/O Interface Module, and two cable assemblies.
- **Kit 74445** provides a PCIe-DIO24 card (PCIe x1).
- **Kit 53928** provides a PCIe-DIO24 card (PCIe x1), the Merlin I/O Interface Module, and two cable assemblies.

1) 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.

2) When using the Merlin I/O Interface Module in this kit, 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 CO30AF 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 (ASCII 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 (ASCII 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 (ASCII 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 (ASCII P) indicates the data extracted from the host message name of the pattern to be loaded.

81 Message type 81 (ASCII Q) updates the text in the first query text buffer (buffer 0) with the data extracted from the host message.

86 Message type 86 (ASCII uppercase 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 (ASCII lowercase v) updates the first text field encountered in the pattern that contains a variable text flag that matches the specified string length.

0 Message type 0 (zero) indicates that host will provide message type, field number (if applicable), and data.; This delegates message type selection to the host on message-by-message basis. The host message must use the format:

\[ \text{Tnn<\textit{string}>} \]

where:

- **T** = the message type (1, A, H, P, Q, V, or v)
- **nn** = the two-digit field number or query text buffer where data will be placed.

Note: Not used with Message Types A, H, P.

\(<\textit{string}>\) = the pattern name to load (Message Type P), or the data to be inserted into the field or the query text buffer, as applicable (Message Types 1, Q, V, or v).
Communications Protocol (continued)

Extended Protocol. Extended protocol provides two-way communication with error checking and transmission acknowledgment. It is designed to provide secure communications with an intelligent host device using pre-defined message formats and response formats where serial communication is a vital part of the marking operation. All communications are carried out in a parent/child relationship with the host being the parent. Only the host has the ability to initiate communications. The following describes the Extended Protocol message format as sent from the host to the Merlin II LS software.

SOH TYPE [##] STX [DATA] ETX BCC CR
where:

SOH ASCII Start of Header character (001H). The system ignores all characters received prior to the SOH.

TYPE A single, printable ASCII character that defines the meaning (type) and content of the message downloaded from the host, where:

1 Message Type 1 provides data to a text string in the pattern or polls the pattern for data. See [DATA] for details.

A Message Type A provides data to the system Offset Angle parameter for the marking window or polls the system for data. See [DATA] for details.

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. See [DATA] for details.

G Message Type G initiates a print cycle.

H Message Type H provides data to the system X/Y Offset parameters or polls the system for data. See [DATA] for details.

I Message Type I polls the system for the I/O status.

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.

P Message Type P loads a pattern or polls the system for the current pattern name. See [DATA] for details.

Q Message Type Q provides data to the system query text buffer or polls the system for data. See [DATA] for details.

S Message Type S polls the system for the machine status. The machine status is returned to the host in an eight-character hexadecimal mask.

V Message Type V provides data to a variable text string in the pattern or polls the pattern for data. See [DATA] for details.

[##] Optional two-digit ASCII number that specifies the Station ID of the system in multi-drop network applications. The ID may range from 00-31. Note that “00” is reserved for applications where only one controller is used. In such applications, this field may be eliminated and “00” will be assumed.

STX ASCII Start of Text Character (002H).

[DATA] Character string that may be required for certain message types (e.g., Type 1, A, E, H, P, Q, or V). Typically, data is sent in the format:

nn<string>
where:

nn = the two-digit field number or query text buffer where data will be placed. (Message Types 1, Q, or V).

<string> = the data to be inserted into the field or the query text buffer, as applicable (Message Types 1, Q, or V).

or the pattern name to load (Message Type P).

or the value of the X/Y Offset (Message Type H).

or the value of the Offset Angle (Message Type A).

ETX ASCII end of text character (003H).

BCC Optional Block Check Code that is generated and sent to improve link reliability by providing fault detection. The BCC is calculated by taking an eight bit addition of the TYPE and DATA TEXT characters and transmitting them as a three digit ASCII decimal number in the range from 000 to 255. If the sum is greater than 255, the most significant bit overflows and is discarded.

CR ASCII Carriage Return Character (00DH).

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