

SQ-30 Laser

CO₂ Laser Marking System User Guide



SQUID INK

SQ-30 Laser

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Abbreviations & Terminology

The following abbreviations and terminology are used throughout this User Guide:

Abbreviation	Meaning	Abbreviation	Meaning
A	Amperes	mm	millimeters
AC	Alternating Current	m/min	meters/minute
AEL	Accessible Emission Limits	MPE	Maximum Permissible Exposure
ANSI	American National Standards Institute	MRK	a file format
ASC	Accredited Standards Committee	mW	milliwatts
ASTM	American Society for Testing and Materials	NC	No Connection
BD	Bold	NHZ	Nominal Hazard Zone
C	Celsius	NIOSH	National Institute for Occupational Safety and Health
CAD	Computer-Aided Design and Drafting	NPN	Negative-Positive-Negative
CDRH	Center for Devices and Radiological Health	OSHA	Occupational Safety and Health Administration
CE		PC	Windows-based computer
CFR	Code of Federal Regulations	PLC	Programmable Logic Controller
char/sec	characters/second	PLT	a file format
cm	centimeters	PNP	Positive-Negative-Positive
CW	Continuous Wave	PPE	Personal Protective Equipment
DE9	D-Subminiature Electrical Connector	PVC	Polyvinyl Chloride
E/C	English/Chinese	QR	Quick Response
F	Fahrenheit	RCode	Barcodes that print with black and white inverted
FDA	Food and Drug Administration	RF	Radio Frequency
feet/min	feet per minute	RS-232	Recommended Standard 232
FLPPS	Federal Laser Product Performance Standards	RX	Receive
GND	Ground	TTL	Transistor-Transistor Logic
HMI	Human Machine Interface	TX	Transmit
Hz	Hertz	USB	Universal Serial Bus
ID	Identification	UV	Ultraviolet
IEC	International Electrotechnical Commission	V	Volts

Terminology

Accessible Emission Limits (AEL):

The maximum accessible level of laser radiation permitted within a particular laser class.

Aversion Response:

Blinking of the eye, or movement of the head to avoid exposure to a bright light.

Continuous Wave (CW):

Continuous emission of radiation as opposed to short bursts.

Controlled Area:

An area where the occupancy and activity of those within is subject to control and supervision for the purpose of protection from radiation hazards.

Diffuse Reflection:

Change of the spatial distribution of a laser beam when it is reflected in multiple directions by a rough or matte surface.

Intrabeam Viewing:

Exposing the eye to all or part of a laser beam.

Maximum Permissible Exposure (MPE):

The level of laser radiation to which a person may be exposed without hazardous effect or adverse biological changes in the eye or skin.

Nanometer (nm)

A unit of electromagnetic radiation.

Nominal Hazard Zone (NHZ):

The space within which the level of the direct, reflected, or scattered radiation during normal operation exceeds the applicable MPE.

Safety Interlock System

On the SQ-30, a system typically involving a simple electrical circuit connected to the Protective Cover for the Laser Head. When the Protective Cover is lifted, the circuit is broken, shutting the laser off and preventing injury from the laser beam.

Specular Reflection:

A mirror-like reflection of a laser beam.

Safety

The Squid Ink SQ-30 CO₂ Laser Marking System is designed to be easy to install, operate and maintain. However, incorrect installation, operation, maintenance or repair of the equipment can result in serious injury or damage to the equipment. Please follow these safety steps to ensure smooth and safe operation:

Warnings

- The marking system is fairly heavy. While unpacking and setting up the unit, always use proper lifting techniques. Avoid over-reaching and twisting while handling the marking system and accessories. If necessary, use more than one person to lift and move the marking system.
- Make sure the electrical power source is properly wired and grounded. The power source should comply with all safety regulations and codes applicable to the installation location.
- The marking system generates heat and potentially fumes. Ensure that the area is properly ventilated.
- Do not use the system without a sufficient Protective Cover and Safety Interlock System (see “Protective Cover and Safety Interlock System” on page [20](#)) and proper protective clothing (see “Protective Clothing” on page [23](#)).

Understanding Safety Notifications

	DANGER: Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING: Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION: Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	ATTENTION: Indicates a hazardous situation which, if not avoided, could result in property damage only.

General Precautions

When installing, operating, and maintaining the SQ-30 CO₂ Laser Marking System, observe the following precautions.

	DANGER: Invisible Output Emissions Do not look at or into beam.
	DANGER: Burn Hazard The laser can cause burns to the skin. Do not contact laser beam with any parts of the body.
	WARNING: Health Hazard PVC marking will cause the production of hydrochloric gas. Ensure proper ventilation and filtering.
	WARNING: Wear Safety Equipment Wear necessary Personal Protective Equipment (PPE) when using or operating near the SQ-30 CO ₂ Marking System.
	WARNING: Electrical Hazard Do not use equipment in any way other than instructed in this manual. Do not open the SQ-30. No user-serviceable parts inside. Dedicated circuit recommended. Check polarity.
	WARNING: Electrical Ground Hazard Ensure that unit is properly grounded.
	WARNING: Keep Dry Keep the equipment dry and indoors.
	CAUTION: Fire Hazard Flammable or combustible materials may ignite if exposed to the direct laser beam.

Laser Classifications

Lasers and laser systems are divided into four major classifications per their potential to cause biological damage to the eye or skin. The purpose of these classifications is to warn users of the hazards associated with the laser relative to the Accessible Emission Limits (AEL). These limits are based on laser output energy or power, radiation wavelengths, exposure duration, and cross-sectional area of the laser beam at the point of interest.

Class IV lasers are high power lasers which are hazardous to view under any condition (directly or diffusely scattered) and are a potential fire hazard and a skin hazard. Significant controls are required of Class IV laser facilities.

Warning: Class IV Laser

ALL PRECAUTIONS RELEVANT TO THIS PRODUCT MUST BE FIRMLY HEEDDED.

The installer hereby accepts to establish the requirements of its Local Factory Inspector, Laser Safety, and Country Regulations for the proper guarding of the Laser Marking System supplied by Squid Ink, and ensures that guarding is installed and properly connected to the Laser Interlock System (see “Protective Cover and Safety Interlock System” on page 20). Safety apparatus are to be properly operated and used.

If safety devices and guards are supplied by Squid Ink, they will not necessarily meet requirements of the Customer’s Local Factory Inspector, Laser Safety and Country Regulations. No warranty or representation is given or made that such guards supplied by Squid Ink comply with any statutory or other requirement, and no liability is accepted by Squid Ink.

The SQ-30 CO₂ Laser Marking System involves a possibility of hazard to the user if not used correctly. Read this entire manual meticulously before installing and starting the system.



WARNING: Because this system is classified as a Class IV Laser, all distances should be considered a Nominal Hazard Zone (NHZ). Therefore, all installations must include a Safety Interlock System.



CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Firm compliance with the safety measures set out and referred to in this manual and extreme care when using the system are vital to minimize the chance of damage to the equipment or personal injury.

Squid Ink recognizes that there may be errors or omissions in this manual. Squid Ink does not accept responsibility for any loss, damage, or injury resulting from the use of information, errors, or omissions.

Precautions for Class IV High Power Lasers

The SQ Laser Marking System is a Class IV type laser per power considerations and energy content. It is a high-power device exceeding the AEL of class IIIB, wherein, it exceeds 0.5W and emission exposure is more than 105 J/m².

2. Establish a controlled area for laser operation. Limit access to those trained in the principles of laser safety.
3. Post warning signs prominently near entrances to the laser operation area.
4. Set up shields to prevent the beam from escaping the laser operation area.
5. Set up a target to block the beam after it passes through the operating area.
6. Keep the Protective Cover on the Laser Head during operation.
7. Beam path must be covered.
8. Keep the laser beam either above or below eye level.
9. Do not look at the beam directly or as reflected by a mirror or polished surface. When working with a Class IV laser, do not expose skin to beam.
10. Safety glasses must be worn at all times when working with a Class IV laser.
11. Environmental Health and Safety Office. When working with a Class IV laser, contact your Laser Safety Officer for operation of the laser activation warning system.

Cautions

CLASS 4 (Class IV) High powered lasers (CW >500mW, pulsed >10J/cm²) are capable of causing severe eye damage with short-duration exposure to the direct, specularly-reflected, or diffusely-reflected beam. They are also capable of producing severe skin damage. Flammable or combustible materials may ignite if exposed to the direct beam.



DANGER: When the SQ-30 is in marking mode, the laser is operating at a frequency that is invisible to the human eye. Not seeing the beam does not mean that the beam is not there or that it cannot cause severe damage.

Damage to Skin:

Skin damage can occur from less than a second of exposure to infrared or ultraviolet light. For infrared exposure, the results can be thermal burns or excessively dry skin depending on the intensity of the radiation. In the 230 - 380 µm range of ultraviolet light, erythema (sunburn), skin cancer, or accelerated skin aging are possible. The most damaging region of ultraviolet is 280 – 315 µm, also known as UV-B. Gloves, long sleeves, and face shields should be worn when manipulating class ultraviolet lasers.

Damage to Eyes:

Different structures of the eye can be damaged by laser light depending on the wavelength. Retinal burns, resulting in partial or complete blindness are possible in the visible (400 - 700 µm) and near-infrared (700 - 1400 µm) regions. At these wavelengths, the eye will focus the beam or specular reflection on a tiny spot on the retina. This focusing increases the irradiance of the beam by a factor of about 100,000. Corrective lenses will further focus the beam. Laser emissions in the ultraviolet (< 400 µm) and far infrared (> 1400 µm) regions are primarily absorbed by and cause damage to the cornea. In the near-ultraviolet range (315 - 400 µm), some of the radiation reaches the lens of the eye. Eye damage may be painless and instantaneous.

Laser Eye Surveillance Program

Eye exams are no longer required for laser users per ANSI Z136.12007. An exam is required after an exposure.

FDA Requirements

The U.S. Food & Drug Administration's Center for Devices and Radiological Health (CDRH) mandates are released as federal code in Title 21 of the Code of Federal Regulations (21CFR). The subsections of this title list the required elements to which manufacturers must comply if they are offering a product for sale in the United States.

A summary of 21CFR chapters related to laser products:

21CFR1000-1005

Broad scope list of devices regulated the records and reports that must be produced and retained by a manufacturer, and the import / export requirements.

21CFR1010

General performance standards, certifications, and variances.

21CFR1040.10

Performance standards for manufacture of laser products. This is where one will find the information pertaining to the laser housing interlocks, remote electrical interlocks, labeling, and power classification. In addition to providing the required information for manufacturers, this standard is a useful reference for the end user in situations where the user is building their own Class 1 enclosure around Class IIIB or Class IV laser systems.

The chapters above are collectively known by the acronym FLPPS, which stands for **Federal Laser Product Performance Standards**.

All Class III, Class IIIB and Class IV lasers are registered with the Environmental Health and Safety Office.

ANSI Requirements

ANSI Z136.1 is the American National Standard for Safe Use of Lasers. Z136.1 is the parent document referenced by all other Z136 standards. The standards are developed by the ANSI Accredited Standards Committee (ASC) Z136, a collaboration of the leading experts in the field, and are considered to be the authoritative standard in the United States for safe laser operation and practices. Although the standards are not "law," compliance with the standard is often mandated by federal entities. 10CFR851.23(11) requires all Department of Energy contractors to comply with ANSI Z136.1-2000see: <http://ecfr.gpoaccess.gov>.

A facility that fully adopts the ANSI Z136.1 standard is effectively adopting FLPPS. A majority of the FLPPS requirements are repeated (almost verbatim) in section 4.3 of the ANSI Z136.1 standard. This repeat of the FLPPS requirements within the ANSI standard provides beneficial safety information but can lead to confusion when trying to implement end user engineered safety controls. ANSI Z136.1-2014 sections 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5.1, 4.3.7, 4.3.8, and 4.3.14 are FLPPS specifications that are expected to already exist as a performance feature in a commercially certified product. These items should be verified to exist upon receipt of a laser and should be checked periodically to verify their functionality. If the laser or laser system is built in-house, full compliance is an expectation.

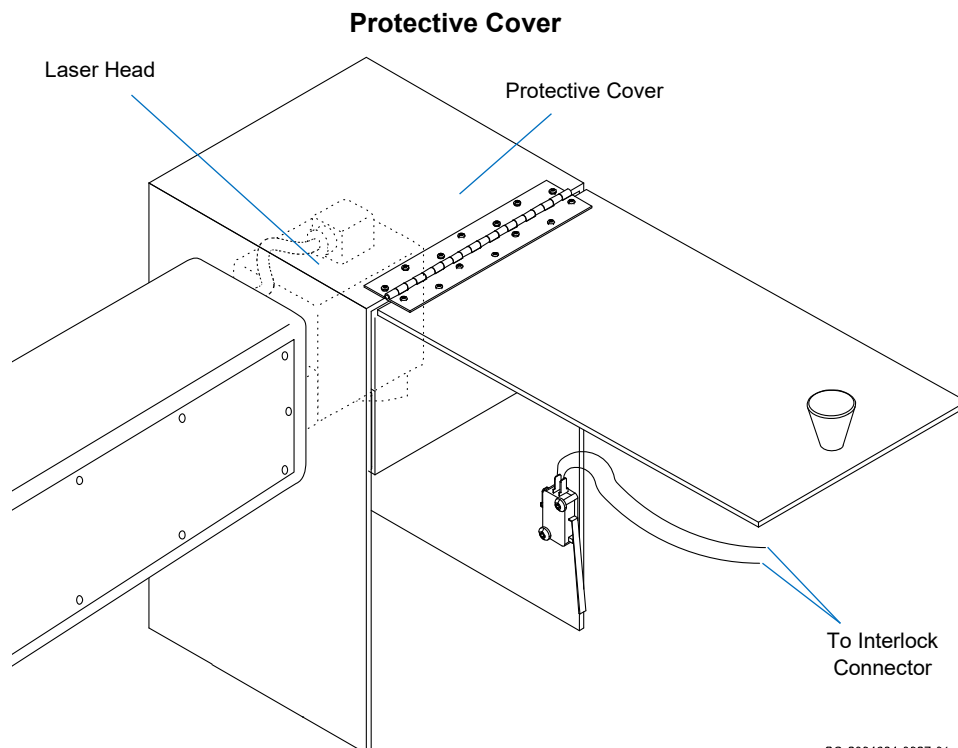
The ANSI Z136.1-2014 standard is a copyrighted publication available for purchase from several commercial sources. The ANSI Z136 secretariat and publisher is the Laser Institute of America (LIA), whose web address is: <http://www.laserinstitute.org>.

Protective Cover and Safety Interlock System

A vital component for the safety and legal compliance of a Class IV laser marking system is the proper installation and maintenance of a Protective Cover – equipped with a Safety Interlock System – for the Laser Head. The size and shape of the Protective Cover will vary depending on the unique needs of the customer, and preferred method of safety interlock will also vary. It is the responsibility of the customer to provide, install, and maintain the Protective Cover and the Safety Interlock System.

Protective Cover

The customer is expected to provide the necessary protection for their system that will eliminate all possible human access to direct or reflected laser radiation paths. This should include a Protective Cover that shields the entire laser field between the marking head and the object being marked, as demonstrated in the example below:



SQ-2004684-0027-01

This example shows a hinged access. Any hinged or removable access must be secured by an appropriate sensor to detect situations that can allow human access to the laser or its reflections. This sensor must be connected to the Safety Interlock System to ensure the laser is instantly disabled whenever the access panel is utilized. FDA code 21CFR 1040.10 provides guidance on the proper standards for such enclosures.

Further info is available at:

<https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcr/CFRSearch.cfm?fr=1040.10>

Safety Interlock System

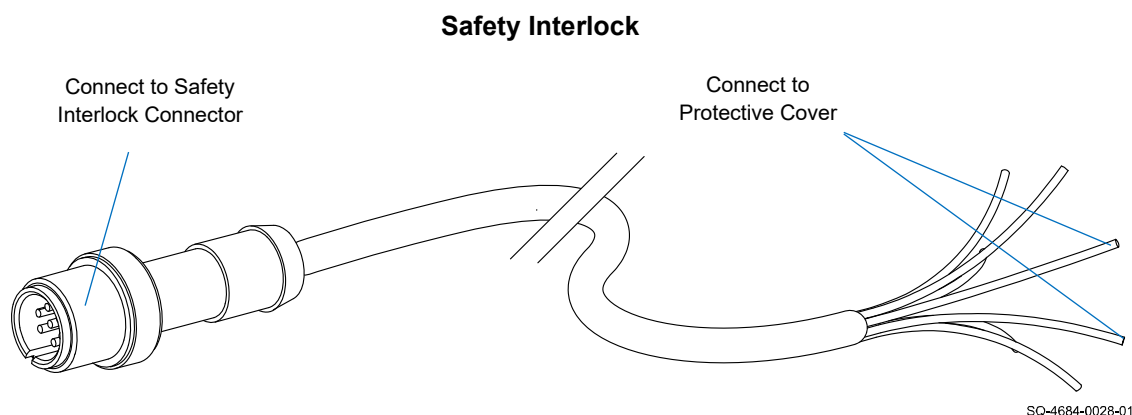
The Protective Cover for every commercial Class IIIB and Class IV laser sold in the United States is legally required to have a remote Safety Interlock System. This system is composed of a sensor that detects when the laser's beam or radiation field have become accessible (ie, the Protective Cover has been opened or removed), triggering immediate shutdown of the system. The laser must then remain off until it has been restarted by an operator, even if the safety circuit trip was momentary.

The customer is responsible for ensuring that this or any other legally compliant Safety Interlock System is properly installed before use. FDA code 21CFR 1040.10 provides guidance on the proper standards for Safety Interlock Systems.

Further info is available at:

<https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=1040.10>

The SQ-30 CO₂ Laser Marking System ships with a Safety Interlock System. The trigger is an electrical connection between two terminals whose circuit is only completed when the Protective Cover is closed, and whose completed circuit is physically necessary for the laser to operate. If the Protective Cover opens, the circuit is broken, and the laser will not emit any radiation above the MPE threshold.



If multiple access panels are used, the triggers/sensors must be wired in series. Additional safety interlock options may include a switch activated by the door of the room of the laser or similar safety measures. Multiple safety switches or options can also be employed by connecting these devices in series with one of the safety interlock connections.

Fume Extraction System

A Fume Extraction System should always be used when laser marking to ensure the operator and other employees are not exposed to any possible harmful vapors. It is especially critical to use the appropriate Fume Extraction System when laser marking PVC or similar materials due to the potential creation of hydrochloric vapors. The following two fume extractors have been approved for use with the SQ-30 CO₂ Laser Marking System:

Part Number	Product Name	Description
2004670	SQ-LFX Fume Extraction Kit	Fume Extractor for non-PVC laser marking applications
2004671	SQ-LFX-PVC Fume Extraction Kit	Fume Extractor for PVC laser marking applications

Protective Clothing

When using or working around Class IV ultraviolet lasers, the following protective clothing must be worn:

- Laser Protective Eyewear
- Safety Gloves
- Face Shields/Respiratory Protection
- Long sleeves

Additional protective clothing specific to maintenance of the system:

- Safety (steel toe capped) Shoes/Boots
- Overalls with long sleeves to prevent contact with arms

Laser Protective Eyewear

Laser Protective Eyewear with wraparound or side pieces must be available and worn by laser operators, incident personnel and visitors in facilities where a Class IIIB or Class IV laser is present and there is a potential exposure to the beam or reflected beams at levels above the MPE. This is to protect eyes from damage by the laser beam and to prevent particle or droplet eye contamination: retinal injury can be thermal, acoustic, or photochemical.

The customer is responsible for ensuring that appropriate Laser Protective Eyewear is always available and worn, organized, and stored. Scratched or damaged eyewear must not be used.

OSHA requires the wavelength filtered, optical density, and visible light transmission to be printed on the eyewear in accordance with the standard set by the ANSI / ISEA, which is Z87.1 – 2015. In the U.K/Europe, the standard for safety glasses is En 166:2001.

A pair of Laser Protective Eyewear is shipped with every SQ Laser. Additional pairs of Laser Protective Eyewear are available from Squid Ink (Part Number 2004612).

Safety Gloves

Safety gloves must provide UV protection and should have extended wrists.

In the UK / Europe, the standard for gloves used for chemical and biological protection is BS En 374-1 to 4 (2004) expected to be replaced/revised in 2017.

According to OSHA, there is no specific standard for gloves to be used for chemical protection (there are standards for cut protection). The recommendation is that the gloves should be matched to the chemical being handled using the manufacturers guide. This means the end user approaches their industrial glove supplier and asks for the gloves that meet their requirements including:

- Resistance to hydrochloric acid
- Short term usage (less than 30 mins)
- Single-use only
- Extended wrist to cover approximately half the forearm
- Ease of removal

Face Shields/Respiratory Protection

In the US, the most common face mask approved by NIOSH is the N95. The N is for non-oil and the 95 refers to the removal of 95% of dust particles. Masks to this standard should be adequate for use when changing filters because any oil in the filters should not become airborne.

The N95 should only be where one or a small number of filters is being changed, and the particular chemical vapors involved should be considered. Spending more than a few minutes changing PVC filters while wearing an N95 mask may result in exposure to a higher level of fumes from the contaminated filter than is safe.

The European standard for the dust face mask is EN 149: 2001 and the classification can be FFP 1, 2 or 3.

Protective Footwear

In the US, the previous standard ANSI Z41 class 75 has been replaced by ASTM F 2412 - 05 class 75 for protective footwear.

In the UK and Europe, protective footwear should be to the standards En 345 / En ISO 20345: 2011.

Please refer to the Fume Extractor manual for further questions.

Safety Labels

Observe the following safety labels on the SQ-30 CO₂ Laser Marking System:

Label	Label Type	Location
	Danger	Side of Controller
	Power	Side of Controller
	ID and Certification	Side of Controller
	ID and Certification	Side of Controller
	Aperture	Side of Laser Head
	IEC Warning	Side of Laser Head
	IEC Warning	Top of Laser Head

Introduction

The SQ-30 CO₂ Laser Marking System is designed for high-speed food and beverage, pharmaceutical, cosmetic, and other primary coding applications. The SQ-30 can permanently mark onto paper, cardboard, plastic, glass, wood, coated metal, leather, and more.

Application Versatility

- Permanent coding of text, time and date, bar codes, serial numbering and more.
- Quick and easy installation for both stationary and moving products.
- Easily fits into production environments where space is limited.
- Laser head can be rotated 90° in less than 5 minutes.

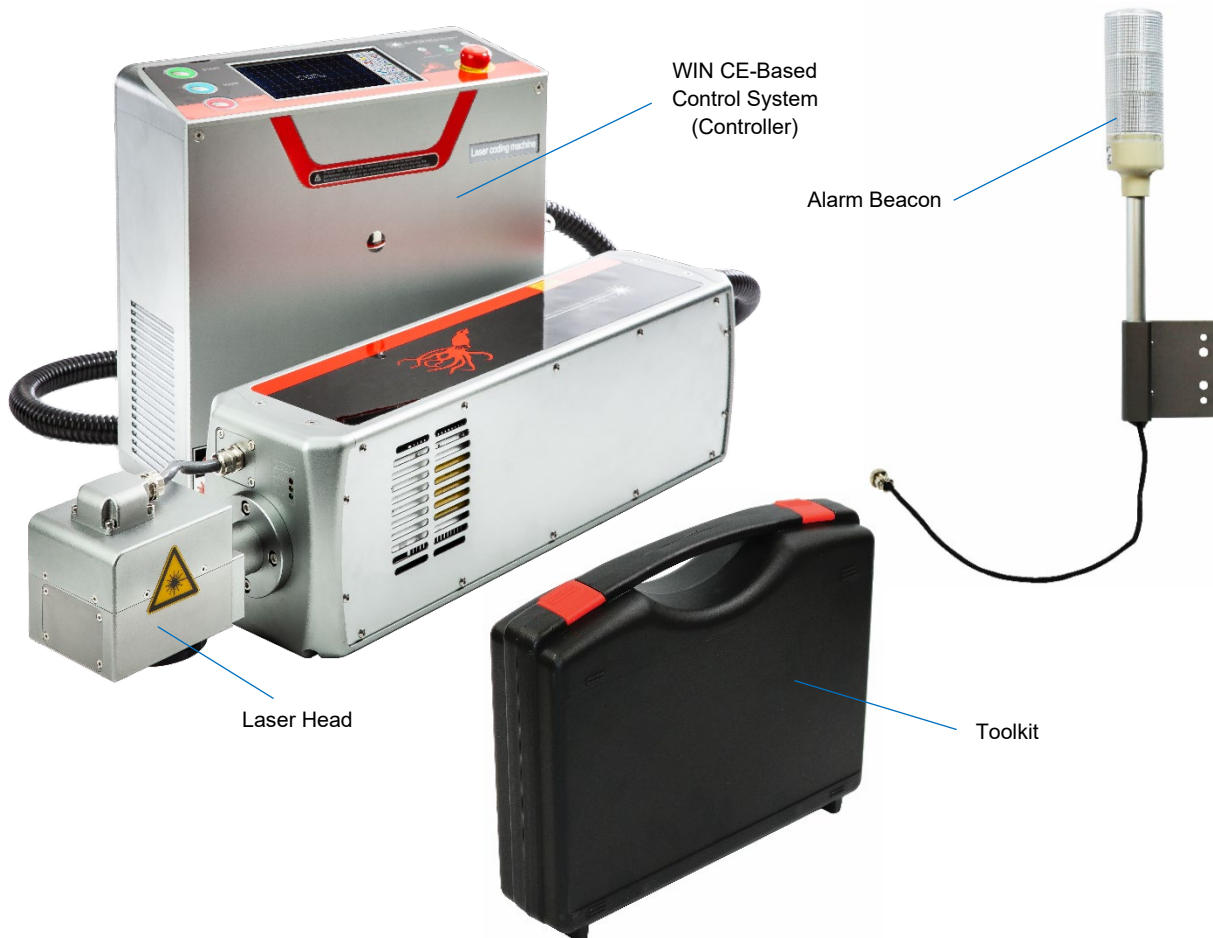
Reliable & Economical

- No ink/consumables for lower cost of ownership.
- Clean and eco-friendly coding system.
- Rugged cast aluminum controller body.
- IP54 rating ensures maximum reliability and uptime in demanding applications.
- Integrated key switch and interlock relay for increased safety on the production floor.

SQ-30 Equipment

Standard Equipment

The SQ-30 ships with the following items:



Toolkit includes:

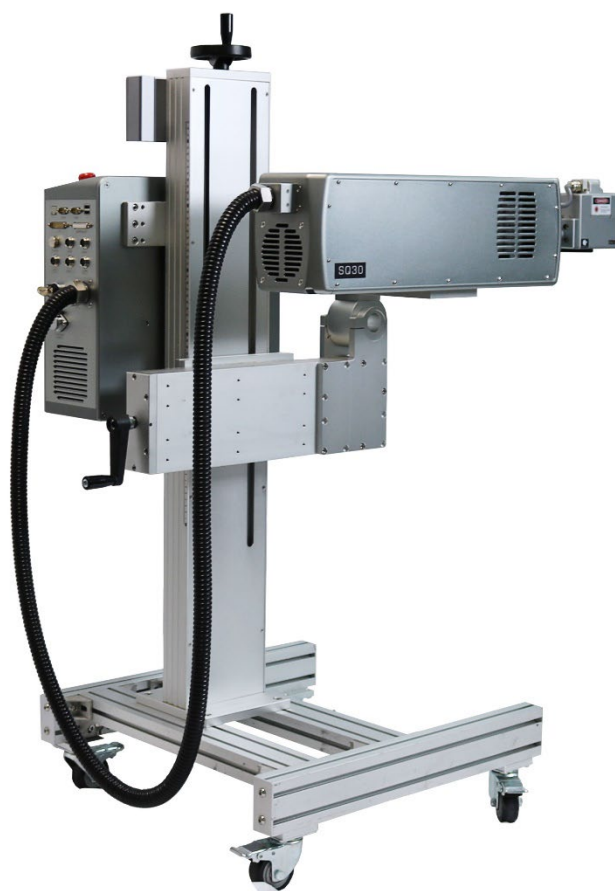


- A. Laser Safety Glasses
- B. Alarm Beacon
- C. Electrical Cord
- D. Phillips Screwdriver
- E. Stylus for Touchscreen
- F. Stand Hardware (optional)
- G. Screen Protectors
- H. Additional Socket Head Cap Screws
- I. Metric Allen Head Wrench Set
- J. Safety Interlock Cable

Optional Equipment

Stand

Squid Ink offers a sturdy, heavy duty cast aluminum Stand (Part Number 2004605) that is ideal for precise and steady positioning of the SQ-30, providing easy portability and adjustability. The Stand is designed specifically for systems like the SQ-30. It allows users to get the most out of the system and facilitates safe and effective operation of the equipment.



Stand
(Part Number 2004605)

Sensor or Photocell

A Photocell is often an essential part of an SQ-30 CO₂ Laser Marking System. It detects the edge of a passing product and triggers the SQ-30 to mark the item. The Photocell can be mounted directly to the Stand Assembly, to the conveyor, or to its own separate stand. Mounting the Photocell upstream from the Laser Head allows it to detect the leading edge of the product/substrate and trigger marking. Due to issues such as surface reflectiveness, different Photocells are appropriate for different situations. Squid Ink offers optical, fiber optic, ultrasonic, laser, metal proximity, and capacitive proximity Photocells. Please contact Squid Ink Sales Support at 800-877-5658 to determine the best option for your needs.

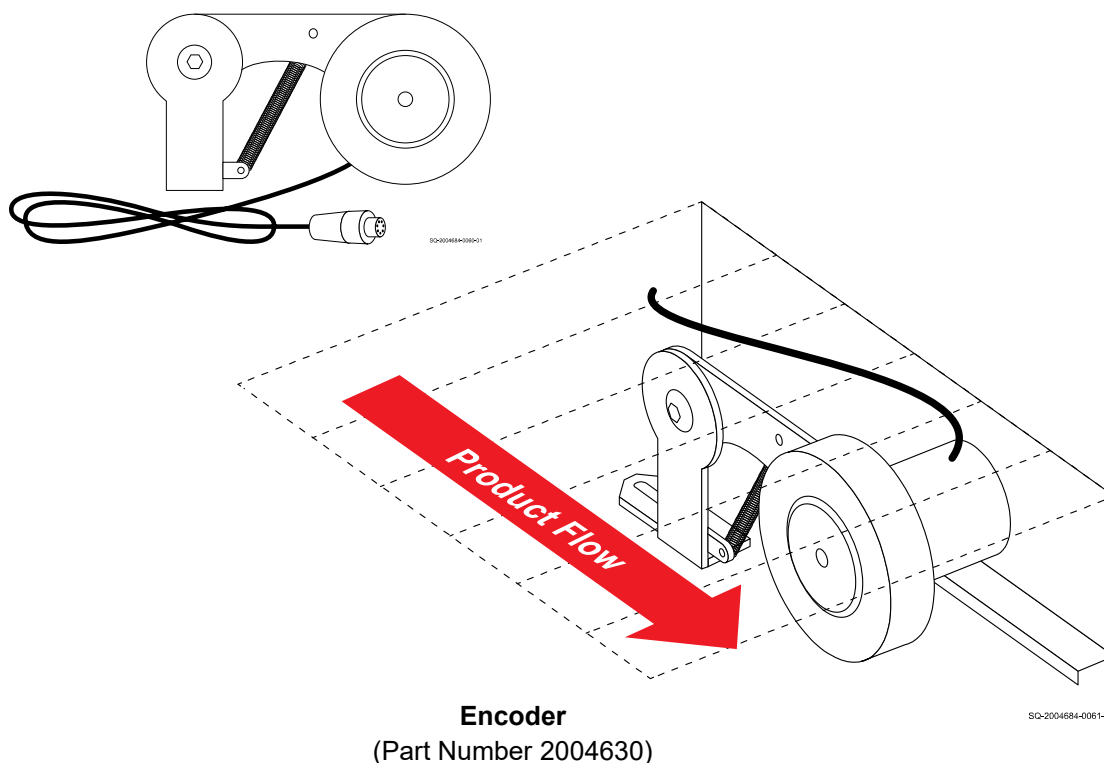


Photocell

(Part Number: Varies based on substrate
and other issues)

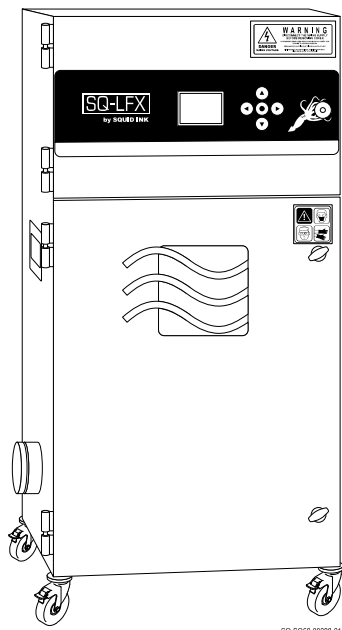
Encoder

An Encoder sends the SQ-30 continuous information about the speed of the conveyor. When using a variable speed conveyor (for example, a conveyor that starts and stops while moving products under the Laser Head), an Encoder is needed to coordinate the timing of marking with the timing of the passing products. An Encoder is essentially a wheel that touches the conveyor belt and sends electronic pulses to the SQ-30 with real time information on the distance that the conveyor has moved at any given instant, regardless of changes in conveyor speed. Squid Ink offers a high-resolution Encoder that sends 2,000 pulses per revolution to the SQ-30 and is highly recommended for this application.

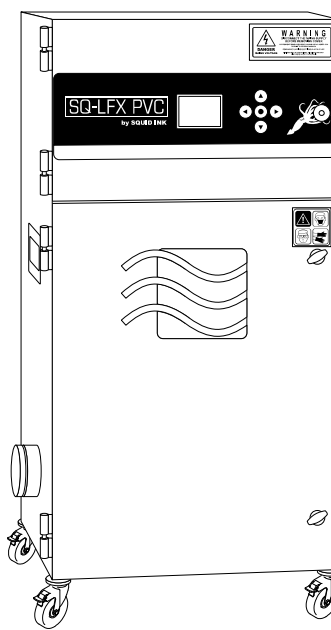


Fume Extraction System

The laser marking process often results in the marked item emitting harmful vapors. To limit the effects of these vapors, Squid Ink offers two Fume Extraction Systems that have been approved for use with the SQ-30 CO₂ Laser Marking System:



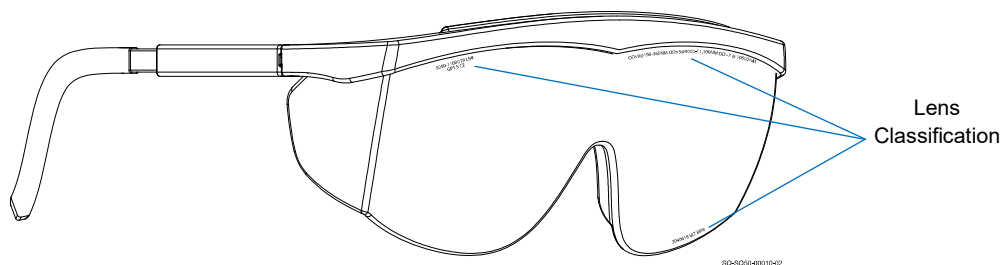
SQ-LFX Fume Extraction Kit
(Part Number 2004670)



SQ-LFX-PVC Fume Extraction Kit
(Part Number 2004671)

Additional Laser Protective Eyewear

Additional Laser Protective Eyewear is available from Squid Ink and must be worn by all laser operators, incident personnel and visitors in facilities where a Class IIIB or Class IV laser is present and there is a potential exposure to the beam or reflected beams at levels above the MPE.



Laser Protective Eyewear
(Part Number 2004612)

Customer-Supplied Equipment

The customer is responsible for providing additional materials necessary for the safe operation of a Class IV laser system, including:

- Protective Cover with integrated Safety Interlock System
- Fire extinguisher
- Appropriate laser-related signage
- All necessary safety precautions

For further details on the requirements for these items, see

<https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcr/CFRSearch.cfm?fr=1040.10>

System Components

The SQ-30 CO₂ Laser Marking System consists of two main parts:

Laser Head

The Laser Head is the source of the marking beam. It has an aluminum alloy shell, and its main parts consist of:

Laser Marking Head:

Contains the Laser Marking Control, Galvanometers, and Galvanometer Control Card.



ATTENTION The Galvanometers are high-precision parts and should not be handled. The Galvanometers are not serviceable parts, nor are any other parts in this laser system.

Laser Tube:

The fully sealed RF-excited tube.

F-Theta Lens:

One of the key optical components in the laser marking system, used to focus the beam.

WIN CE-Based Control System (Controller)

WIN CE is a highly integrated industrial computer system used in forming marking information input, editing, and fast and precise control of the laser and galvanometers. Care must be taken with the Touchscreen. Do not use hard, sharp objects to operate the unit: it will damage the Touchscreen and affect touch sensitivity. Piercing the Touchscreen voids the warranty.

Controller parts include:

- Standard I/O Interface
- Built-in Marking Control System
- 7" LCD Touchscreen
- Connections for external keyboard, mouse, sensors, and USB devices

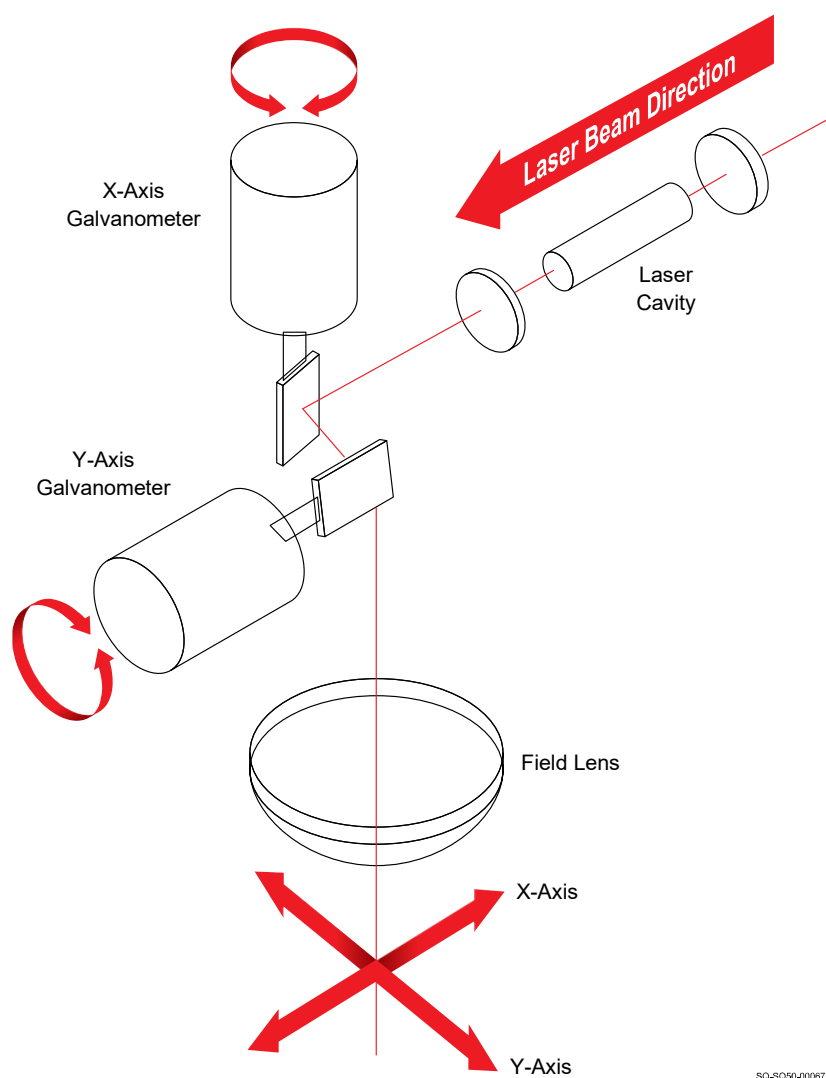
How the SQ-30 Works

Laser marking is a technique used for creating permanent surface engraving on a variety of different substances. Laser marking is caused by:

- Evaporation of the surface material, leading to chemical and physical changes that create a “carving” effect, or
- Light energy burning off part of the material, showing the etched patterns and text

The accepted principle of “Thermal Processing” involves having the higher energy density of the laser beam (a centralized energy flow) irradiating the surface of the material to be marked. The material surface absorbs the laser energy, thermal excitation of molecules results in the irradiated regions, and the material surface (or coating) temperature is raised.

Laser Marking System Diagram



SQ-SQ50-00067-03

In the case of the SQ-30, the laser beam is emitted down the length of the Laser Head. At the end of the Laser Head are two Galvanometers which move rapidly and precisely based on input from the Controller. The mirrors on the Galvanometers redirect the beam in the pattern of the desired text or designs. The beam is then focused through the Field Lens onto the passing substrate and etches the markings into the item.

NOTE: When marking on PVC, the chemical reaction between the laser and the PVC results in a pale orange marking color.

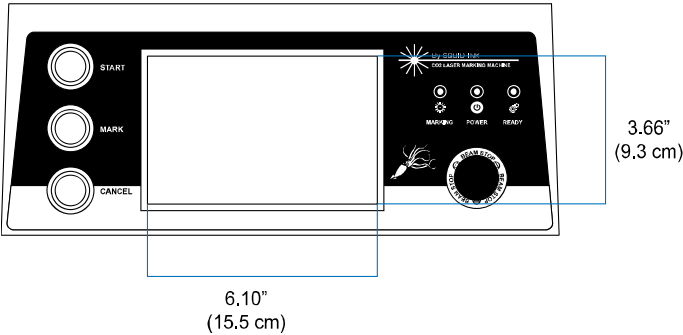


ATTENTION: When marking on white PVC, the marking color is also pale orange. However, when exposed to UV light (eg, sunlight), a further chemical reaction takes place that causes the marking to fade to white, making it no longer visible.

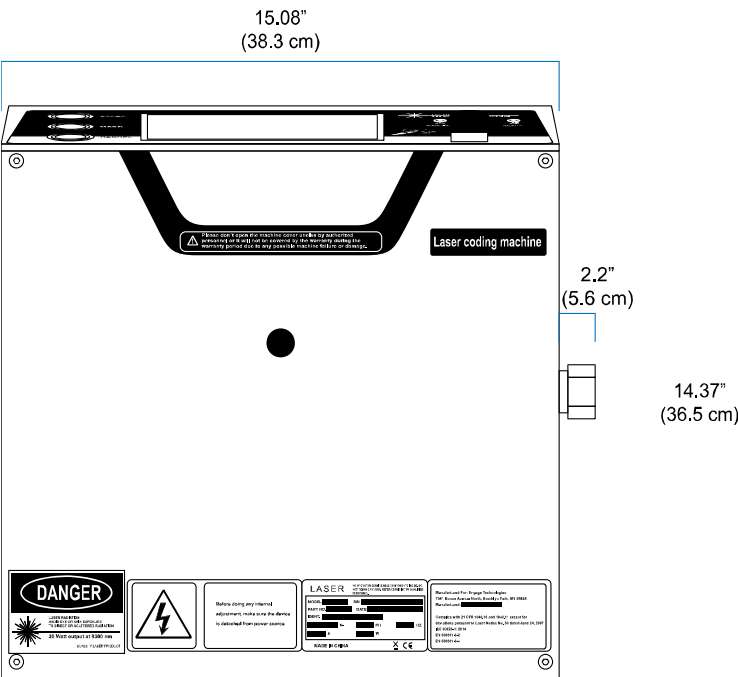
System Dimensions

Controller Dimensions:

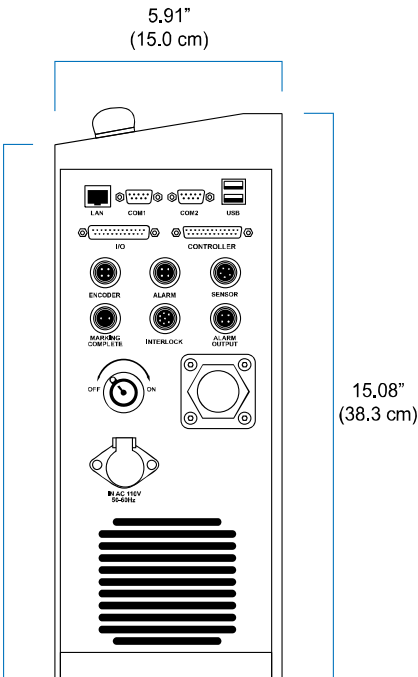
Top View



Side View

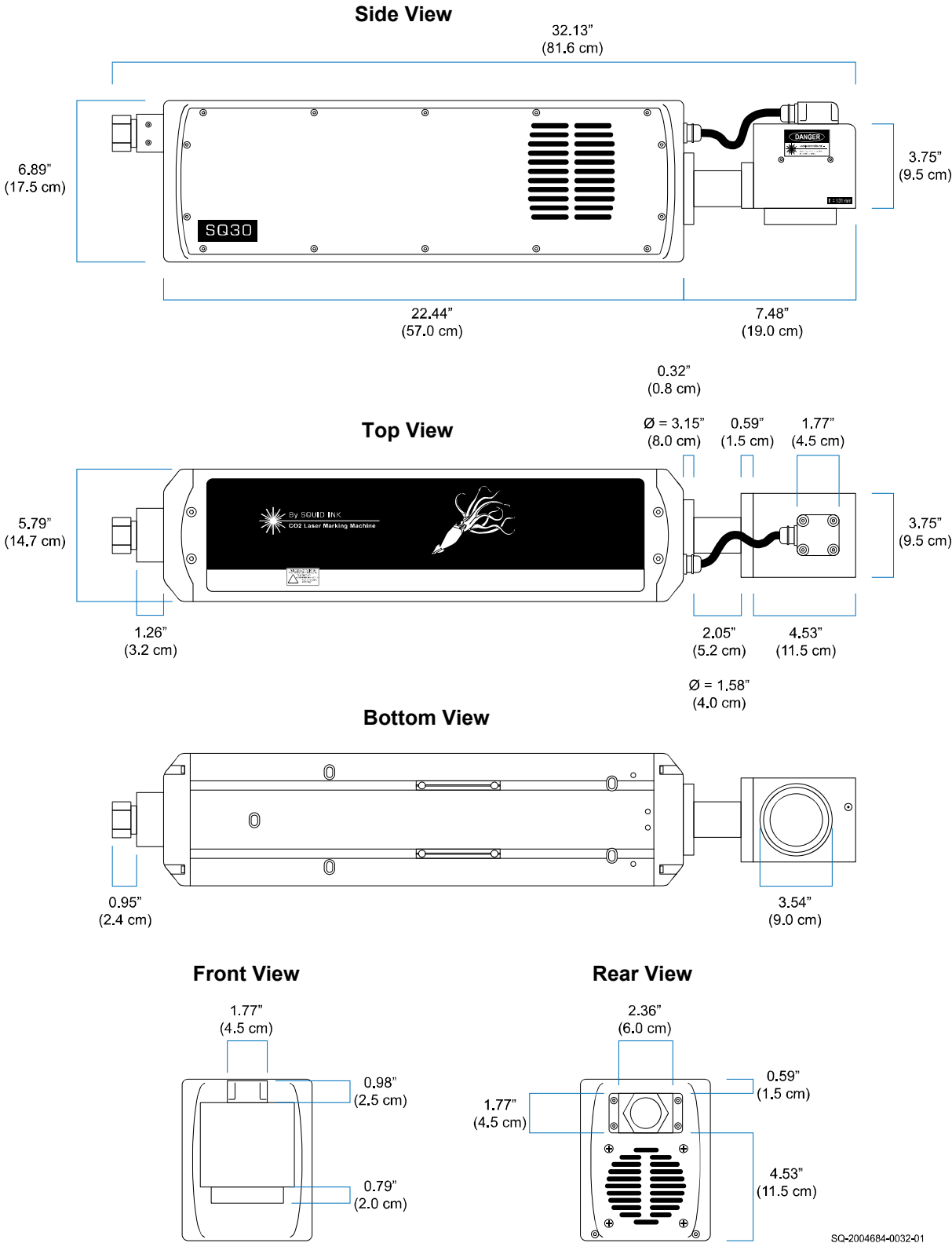


Rear View

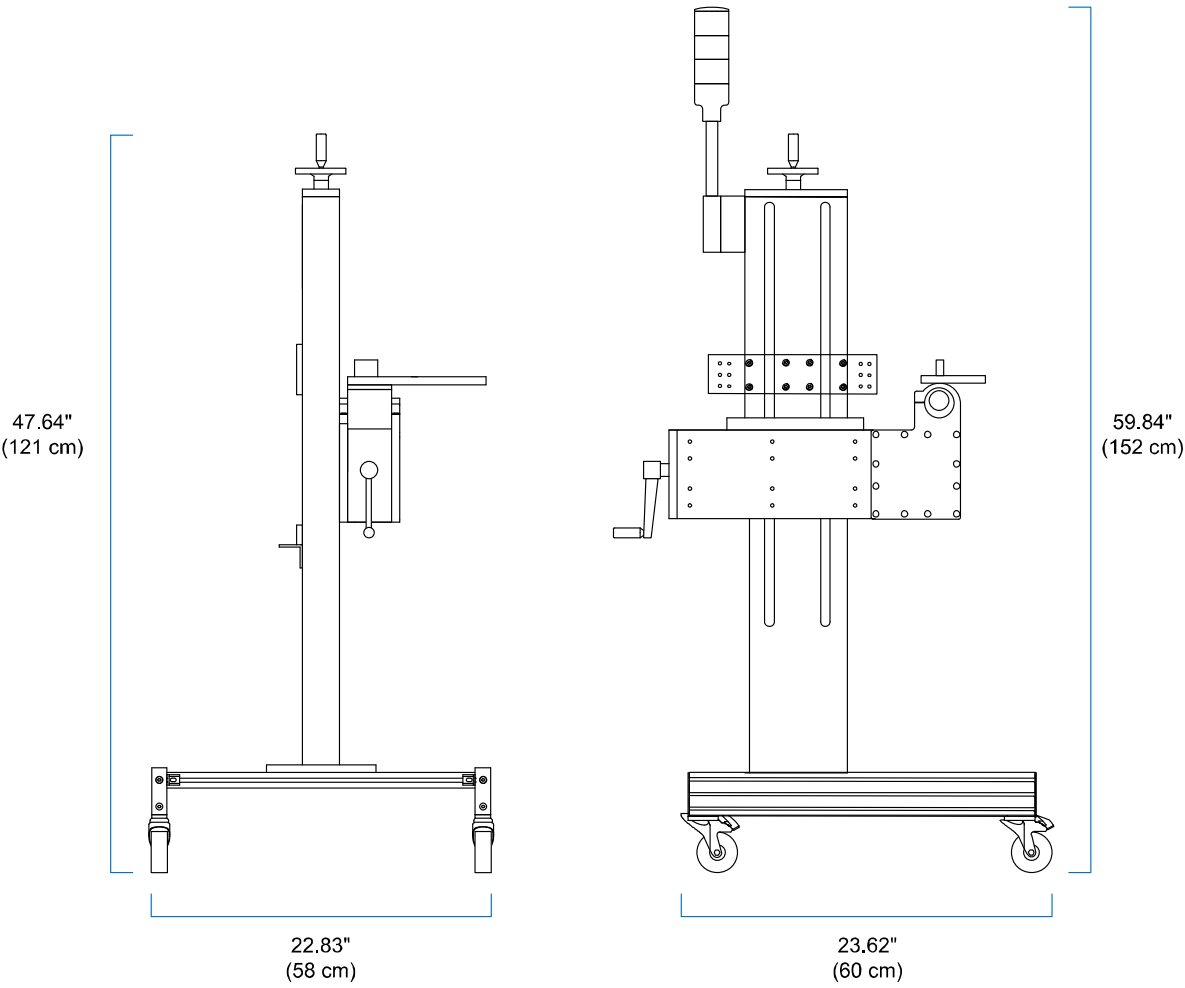


SQ-2004684-0031-01

Laser Head Dimensions:



Stand Dimensions



SQ-SQ50-00092-02

System Specifications

Laser Type	CO ₂ Laser (Full sealed RF-excited metal tube)	
Laser Wavelength	9.3 or 10.6 μ m	
Laser Power	30 W	
Laser Galvanometer	High-precision 2D high-speed scanning galvanometers	
Cooling Method	Atmospheric air-cooled	
Dust Way	Sealed	
Power Consumption	500 – 1,000 W	
Marking Focal Length Range	3.94 – 12.00"	100 mm – 305 mm
Positioning Accuracy	0.0004"	0.01 mm
Minimum Line Width	0.004"	0.1 mm
Marking Area Range	3.94" x 3.94" to 8.07" x 8.07" depending on focal length of lens	100 mm x 100 mm to 205 mm x 205 mm depending on focal length of lens
Assembly Line Speed Support	<393.7 feet/min	<120 m/min
Marking Speed	800 ~ 1,000 char/sec	
Character Size	Adjustable in marking range	
Marking Line Number	Adjustable in marking range	
Marking Content	Chinese and English characters / numbers / graphics / dates / times / serial numbers, etc.	
Marking Font	Many standard CAD geometric fonts. Also can be user-defined and extended	
Laser Head Dimensions	Length: 29.92"	(76.0 cm)
	Width: 5.79"	(14.7 cm)
	Height: 6.89"	(17.5 cm)
Controller Dimensions	Length: 15.06"	(38.3 cm)
	Width: 15.06"	(38.3 cm)
	Height: 5.91"	(15.0 cm)
Umbilical Length	72.00"	(182.9 cm)
Laser Head Weight	37.9 lbs	(17.19 kg)
Controller Weight	30.0 lbs	(13.61 kg)
Operating Temperature	32° ~ 115° F	(0° ~ 45° C)
Environmental Humidity	45% ~ 75%	
Atmospheric Pressure	<Altitude 2,000 m	
Electrical Requirements	90 – 220 VAC, 10 A and 60 HZ	

* Technical parameters and other information varies per specific application conditions and materials, and are subject to change without notice.

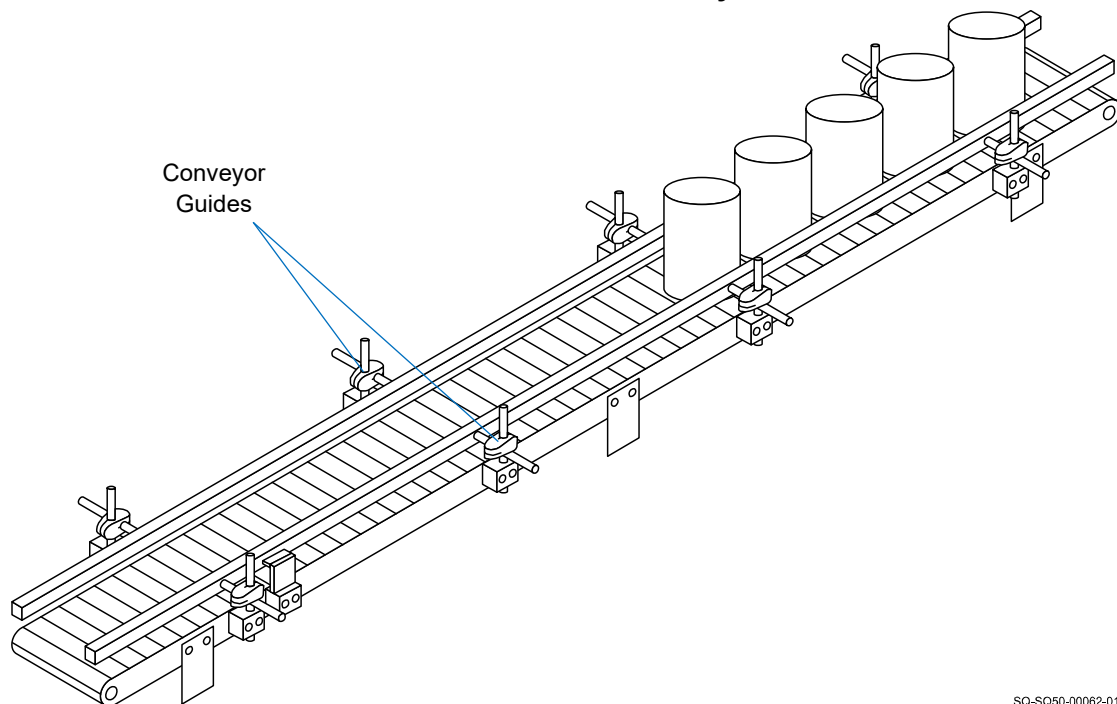
Setup and Installation

General Setup Considerations

Material Handling

The most critical factor for consistently achieving superior quality laser marking is material handling. Adequate conveyor product guides must be provided, correctly installed, and properly maintained, so that the product consistently passes by at the correct distance from the Laser Head, and unpredictable movements are minimized. Incorrect or inconsistent product handling will cause marking quality problems, maintenance problems, and could lead to damage to the Laser Head. The customer is responsible for maintaining proper material handling equipment.

Product Guides on Conveyor



SQ-SQ50-00062-01

AC Power

Experience has shown that the AC power in locations where the SQ-30 is installed can be subject to line noise, brownouts, and blackouts. If line noise, brownouts, or blackouts occur on a regular basis, install a good quality line conditioner. In many cases, these devices may not be necessary; it is acceptable to start an installation without them. However, if marking issues occur, the first corrective measure should be to isolate and clean up the AC power.

Work Area

The SQ-30 uses a Class IV laser. All precautions and safety measures described earlier in this User Guide must be strictly observed. Failure to do so can result in serious injury or damage to the equipment, and can void the warranty. If unsure, review the entire safety section (see “Safety” section, starting on page [11](#)).

Maintenance Access

When planning the installation, allow for easy access to all external parts of the SQ-30 so that setup, operation, and maintenance can be done conveniently.

Ventilation

The SQ-30 CO₂ Laser Marking System can produce hazardous fumes when marking. A Fume Extraction System (Part Number 2004670 or 2004671) should be installed before use, and the operating area should have adequate ventilation. The air vents on the front and back of the Controller should also have at least 8" (20.32 cm) of clearance to allow proper cooling and air flow.

Mounting and Portability

Each installation is unique. Squid Ink Manufacturing cannot anticipate customer requirements for mounting the SQ-30 to the customer's production line. Squid Ink Manufacturing offers a portable Stand Assembly (Part Number 2004605) that ensures stable positioning during operation and also allows the unit to be moved easily to other locations when needed.

Laser Head Position

The SQ-30 can print in any direction, including straight up, so there is almost no limitation on Laser Head orientation. However, because the laser can cause eye damage and burns, the Laser Head should always be pointed in a direction that will ensure that people in the vicinity are not exposed directly to the beam, that the beam will not reflect off of any surface and cause human exposure, and that people in the vicinity cannot see the beam. Further, a Protective Cover connected to a Safety Interlock System is required for all Class IV laser systems (see “Protective Cover and Safety Interlock System” on page [20](#))

Traffic Patterns

Careless positioning can result in damage to the SQ-30. An example would be locating the SQ-30 where it can be accidentally knocked by a forklift, or similar placement of the system in an area of predictable traffic. Keep the SQ-30 away from known traffic paths.

Assembling the Stand

The Laser Head of the SQ-30 needs to be securely mounted to ensure predictable marking results and limit accidents. This section describes how to assemble the recommended Stand Assembly (Part Number 2004605), which can securely and compactly hold the Controller, Laser Head, and Alarm Beacon, and enables easy portability of the system when needed.

Items Needed to Assemble the Stand:

- At least two people
- 5 mm Allen Wrench
- 6 mm Allen Wrench
- Six (6) 5 mm socket head cap screws
- Four (4) 6 mm socket head cap screws

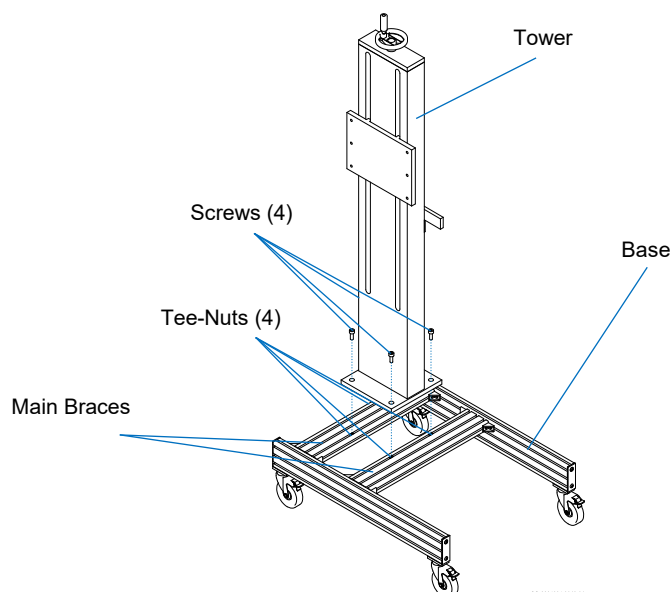
To Assemble the Stand:

Assemble the Stand using the included hardware.

1. Attach the Tower to the Base:

- a. Hold the Tower upright over the main braces of the Base as shown below.
- b. Align the screw holes at the bottom of the Tower with the tee-nuts in the inner “tracks” of the braces. If necessary, slide the tee-nuts into position to allow the tower to be centered on the Base.
- c. Attach the Tower to the main braces of the Base using the four (4) 6 mm socket head cap screws. Tighten the screws securely with a 6 mm Allen wrench.

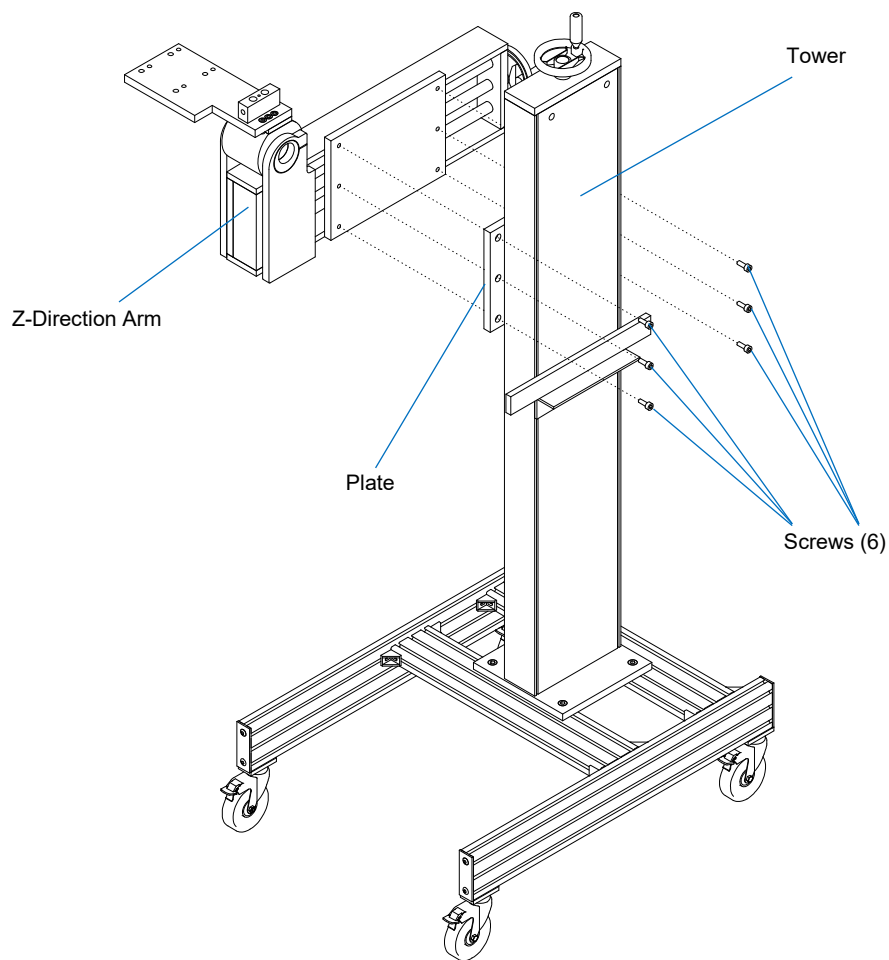
Mounting the Tower to the Base



2. Attach the Z-Direction Arm to the Tower:

- Lock the casters on the Base.
- Hold the Z-Direction Arm flush with the rectangular plate on the side of the Tower as shown.
- Attach the Z-Direction Arm to the Tower using the six (6) 5 mm socket head cap screws included. Tighten the screws securely with a 5 mm Allen wrench.

Mounting the Z-Direction Arm to the Tower



SQ-SQ50-00069-01

Mounting the Controller and Beacon

Once the Stand has been assembled, the SQ-30 Controller and Beacon can be attached to it.

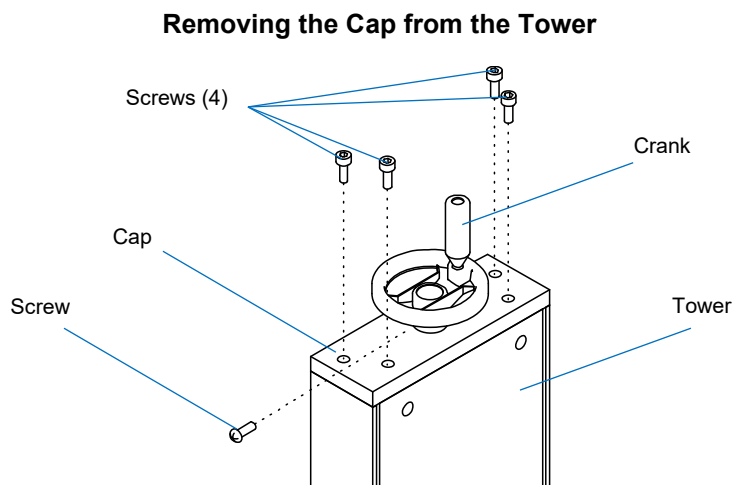
Items Needed to Mount the Controller and Beacon:

- At least two people
- 5 mm Allen wrench
- Eight (8) 5 mm socket head cap screws
- 6 mm Allen wrench
- Phillips head screwdriver

To Mount the Controller and Beacon:

To attach the Controller and Beacon to the Stand, do the following:

1. **Remove the Cap from the top of the Stand Tower:**
 - a. With a Phillips head screwdriver, remove the screw in the side of the Crank.
 - b. Lift the Crank off the top of the Tower.
 - c. With a 6 mm Allen wrench, remove the four socket head screws holding the Cap onto the top of the Tower and save them.
 - d. Lift the Cap off the top of the Tower.



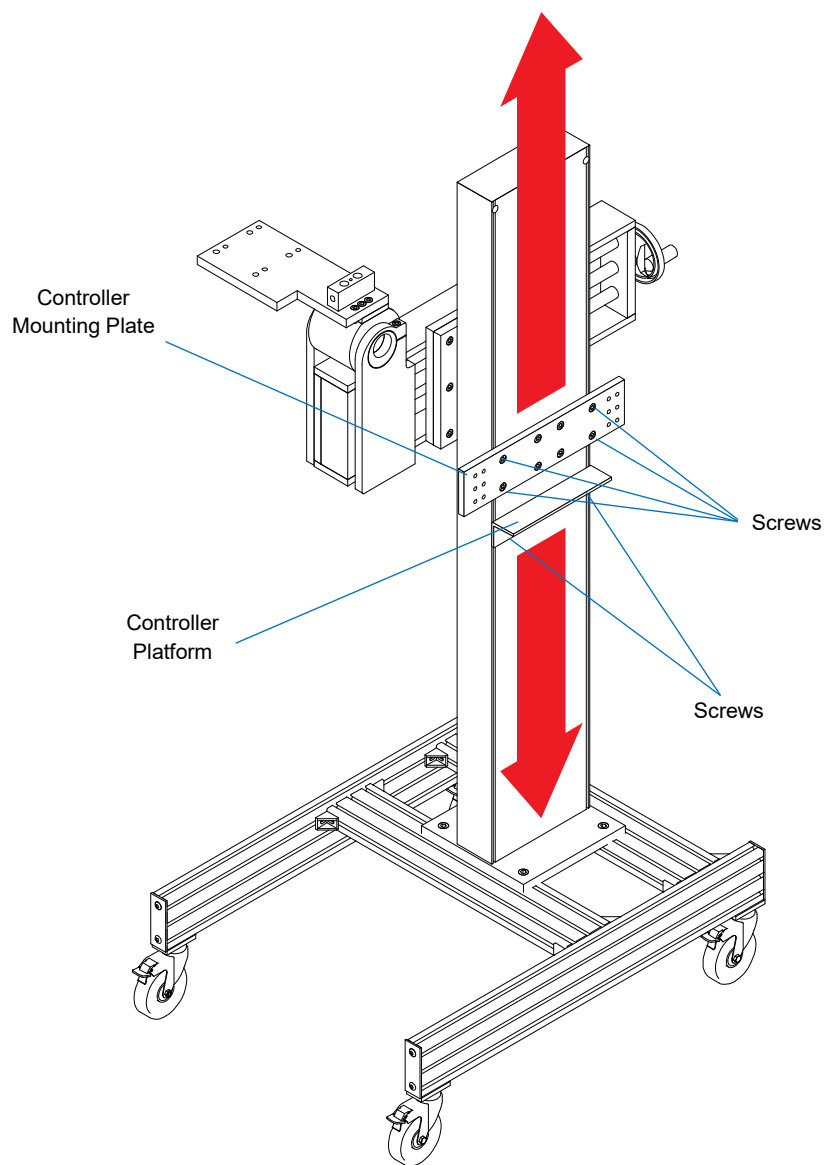
2. **Attach the Controller to the Tower:**

- a. With a 5 mm Allen wrench, slightly loosen (but do not remove) the screws holding the Controller Platform and Controller Mounting Plate to the Tower. The platform and mounting plate should slide easily up and down the Tower.



CAUTION: The Controller Platform and Controller Mounting Plate may weigh more than expected. Use caution to avoid fingers being pinched.

Loosening the Controller Mounting Plate and Controller Platform



SQ-SQ50-00071-02

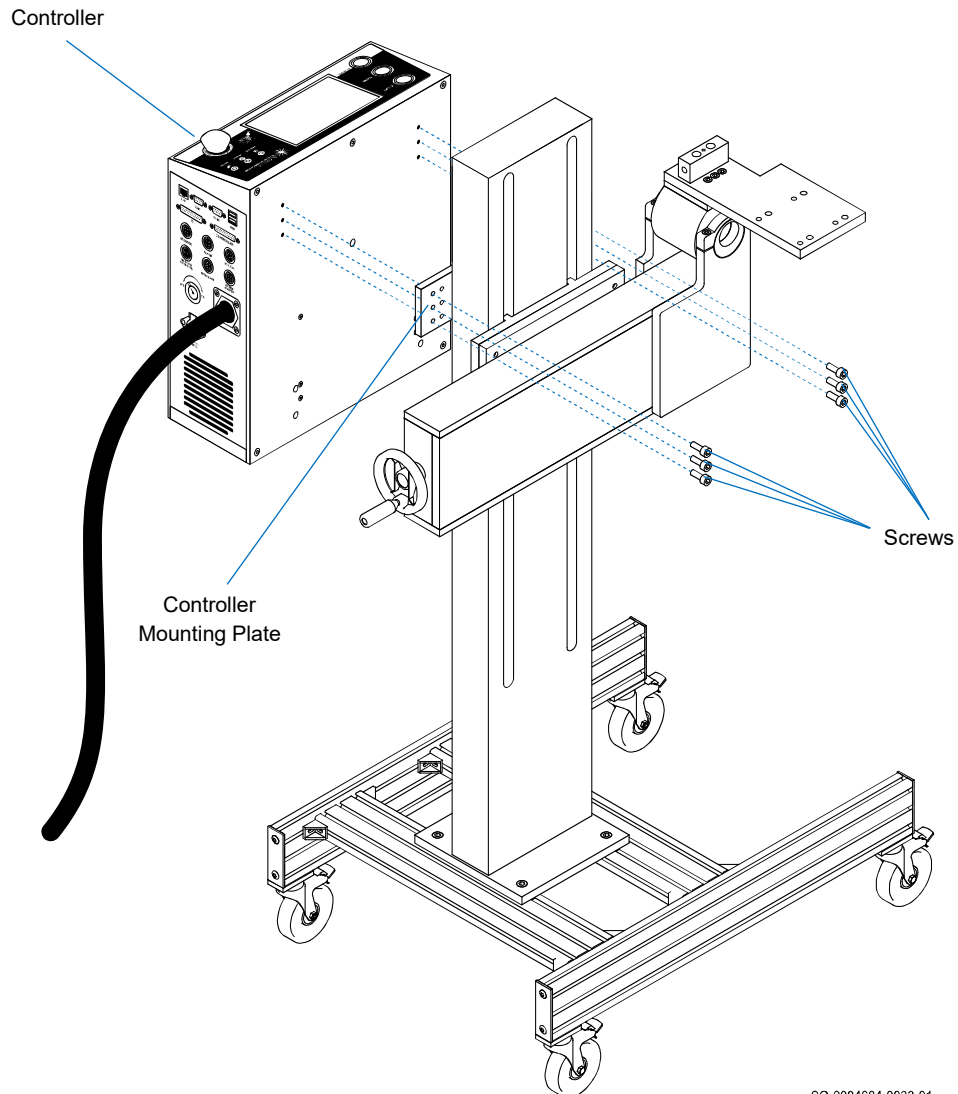
- b. Allow the Controller Platform to slide to the base of the Tower.

3. Attach the Controller to the Tower:

- a. Slide the Controller Mounting Plate upward on the Tower, and position it no less than 6" (15 mm) from the top of the Tower.

- b. With a 5 mm Allen wrench, tighten the screws in the Controller Mounting Plate to secure it in position on the Tower.
- c. With the assistance of at least one other person, hold the Controller against the Controller Mounting Plate so that the screw holes align.

Attaching the Controller

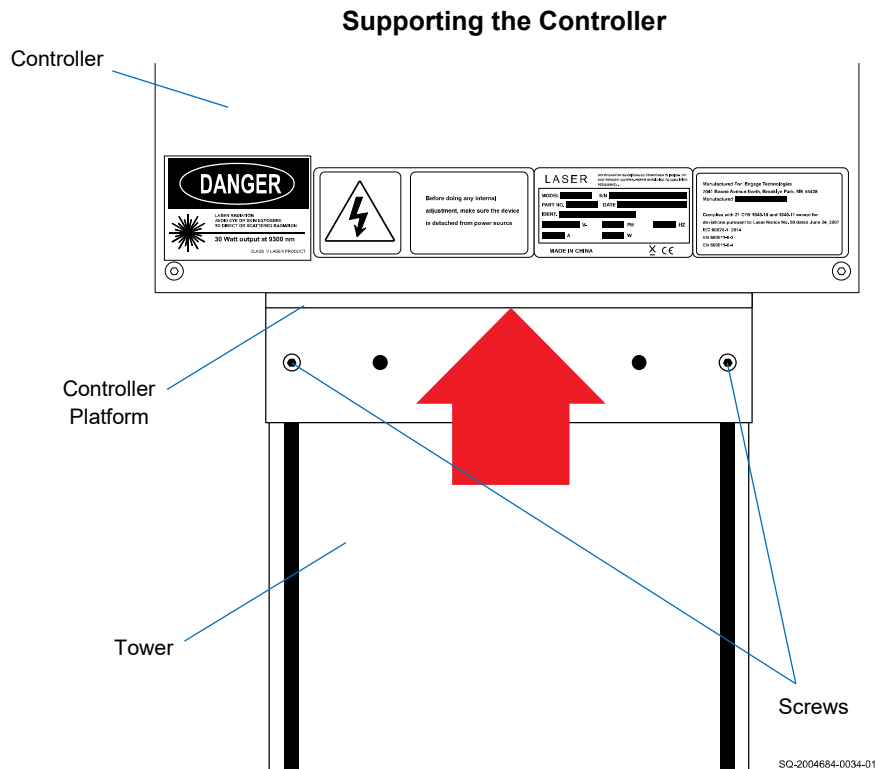


- d. Insert six (6) 5 mm socket head cap screws into the holes, and with a 5 mm Allen wrench, tighten them firmly to secure the Controller to the Controller Mounting Plate.

NOTE: It may be easiest to first secure the Controller to the Mounting Plate using just one screw on each side, and then insert and tighten the rest of the screws with the Controller already secured in position.

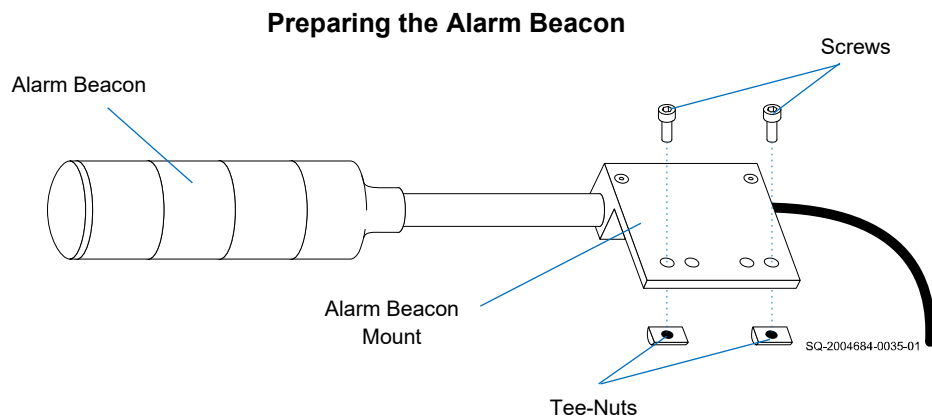
4. Support the Controller:

- Slide the Controller Platform up the Tower so that it is snug against the bottom of the Controller, as shown below.
- Insert a 5 mm socket head cap screw on either side of the Controller Platform, and tighten it firmly to lock the Controller Platform in place.



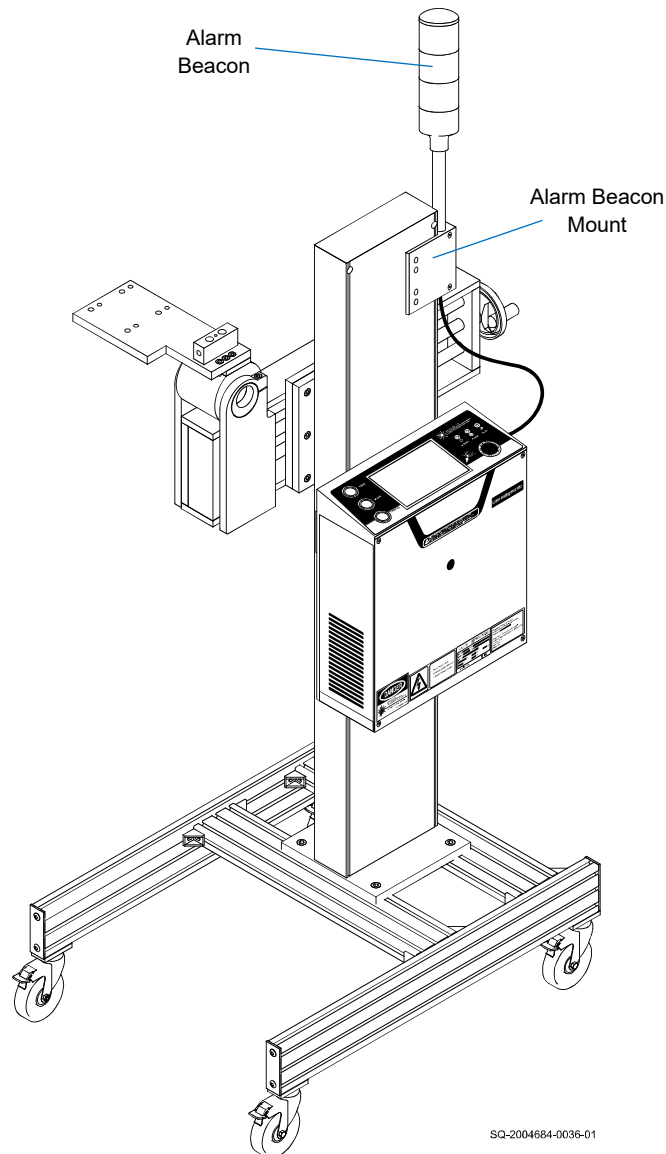
5. Attach the Alarm Beacon to the Tower:

- Connect two (2) 5 mm socket head cap screws loosely to two (2) tee-nuts by going through two holes in the Alarm Beacon Mount, as shown below.



- b. Slide the Alarm Beacon Mount down over the top of the Stand Tower, with the tee-nuts in one of the “tracks” on the Tower, as shown below.

Attaching the Alarm Beacon



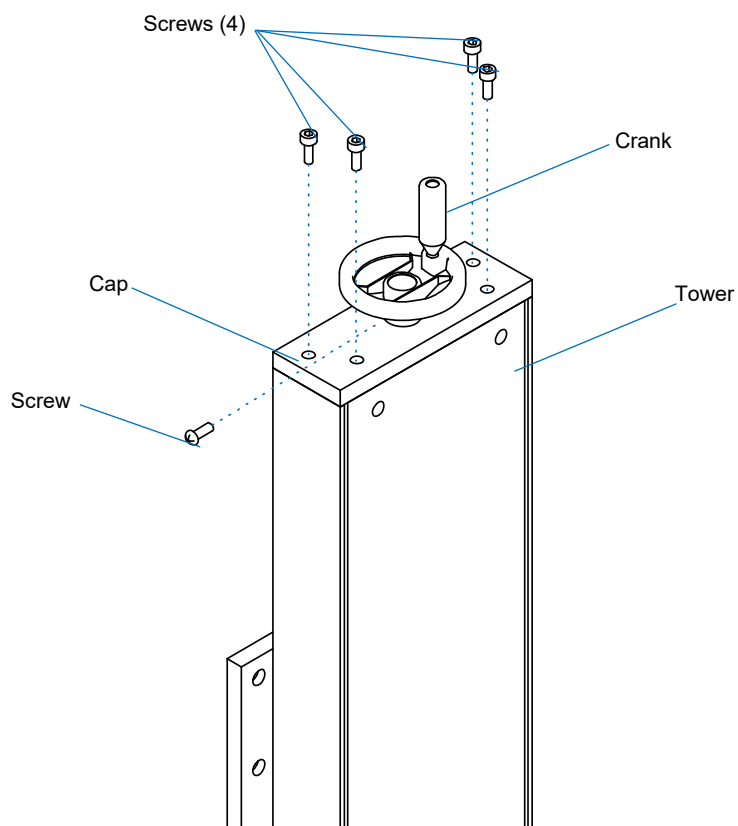
- c. Using a 5 mm Allen wrench, tighten the two screws firmly to hold the Alarm Beacon securely in place.

6. Replace the Cap on the top of the Stand Tower

- a. Place the Cap on the top of the Tower.
- b. Insert the four socket head screws into the top of the Cap, and use a 6 mm Allen wrench to tighten them, securing the Cap to the top of the Tower.

- c. Place the Crank on the stem protruding above the Cap.
- d. Insert the screw into the side of the Crank and tighten it with a Phillips head screwdriver to secure the Crank in place.

Replacing the Cap on the Tower



Mounting the Laser Head – Aimed Downward

For most operations, the beam of the SQ-30 Laser Head will be pointing downward to mark the tops of products. This section describes how to mount the Laser Head pointing downward.

Items Needed to Mount the Laser Head Aimed Downward:

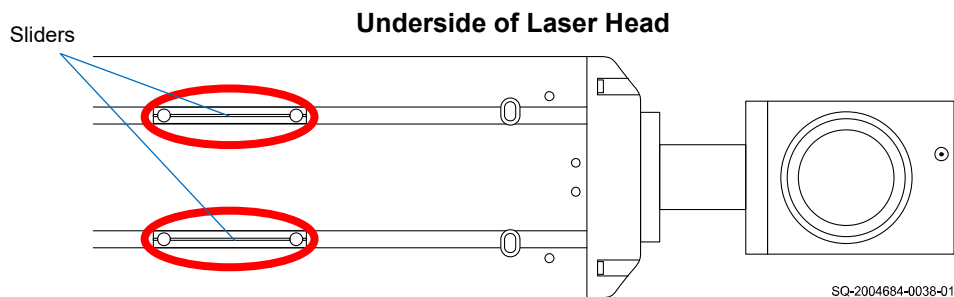
- 5 mm Allen wrench
- Four (4) 5 mm socket head cap screws

To Mount the Laser Head Aimed Downward:

To attach the Laser Head to the Stand pointing downward, do the following:

1. Position the Sliders:

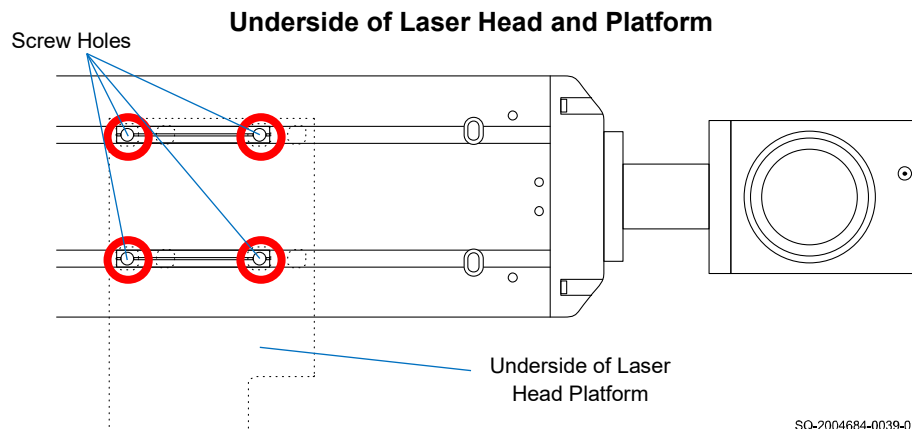
- On the underside of the Laser Head, locate the Sliders.



- Move the Sliders to be even with each other.

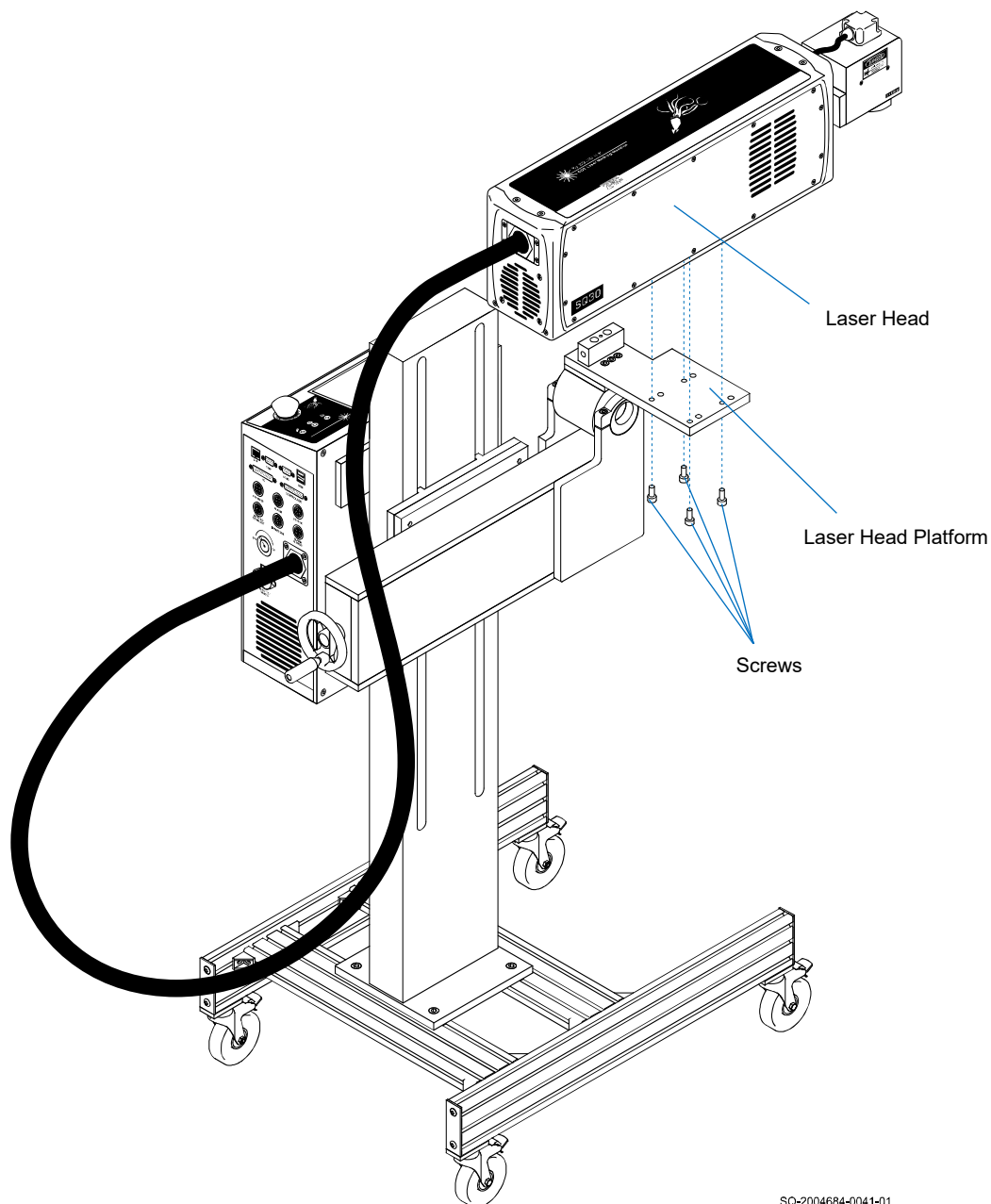
2. Mount the Laser Head to the Platform:

- Place the Laser Head on the Laser Head Platform, aligning the screw holes in the Sliders with the screw holes in the platform, as shown:



- b. Insert four (4) 5mm socket head cap screws into the aligned screw holes and tighten them firmly with a 5 mm Allen wrench.

Securing the Laser Head to the Platform

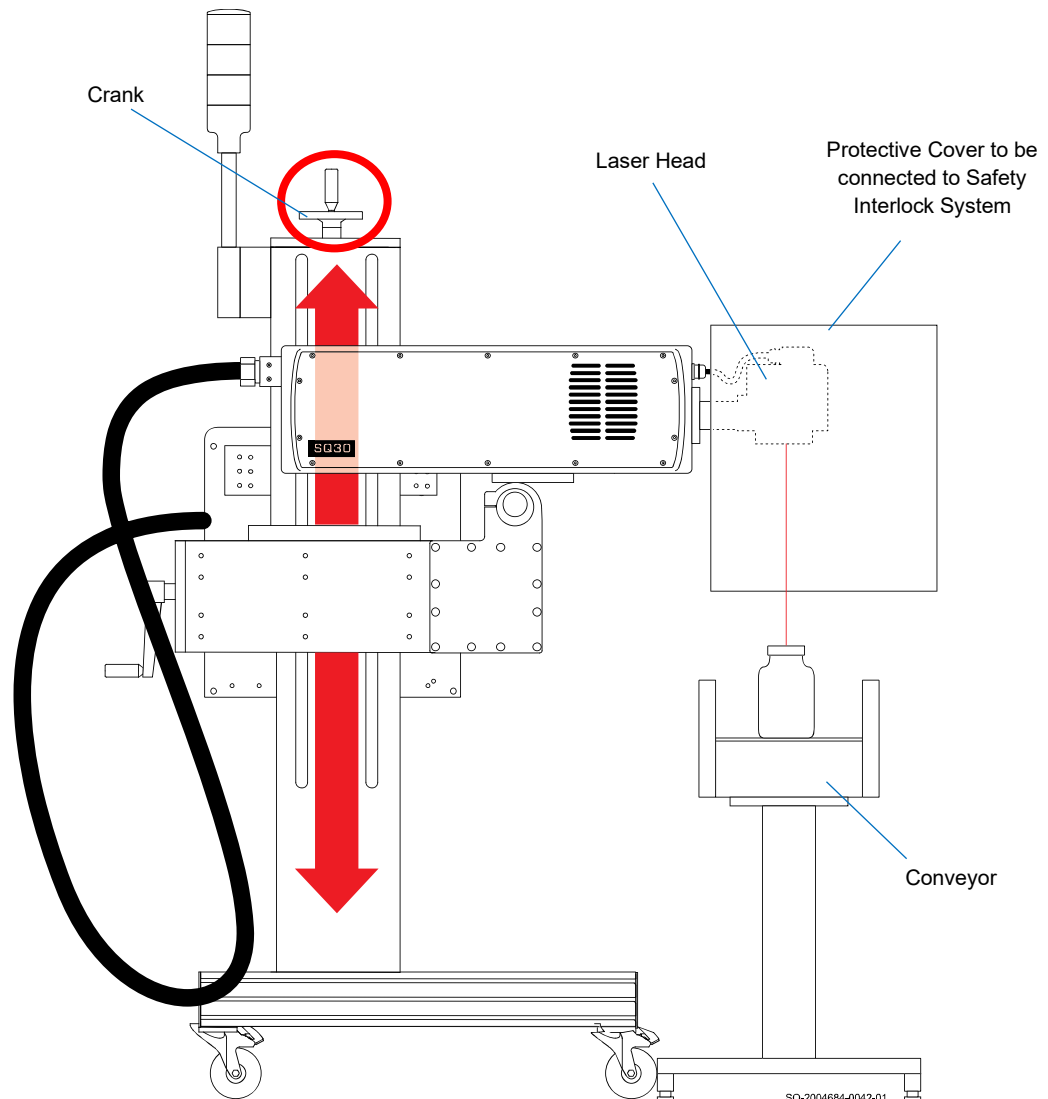


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3. Adjust the Position of the Laser Head:

- a. Rotate the Crank on the top of the Stand to adjust the vertical position of the Laser Head, as shown below.

Adjusting the Vertical Position of the Laser Head



Mounting the Laser Head – Aimed Forward

The SQ-30 Laser Head can be oriented to aim the beam forward to mark the sides of products. This section describes how to mount the Laser Head pointing forward.

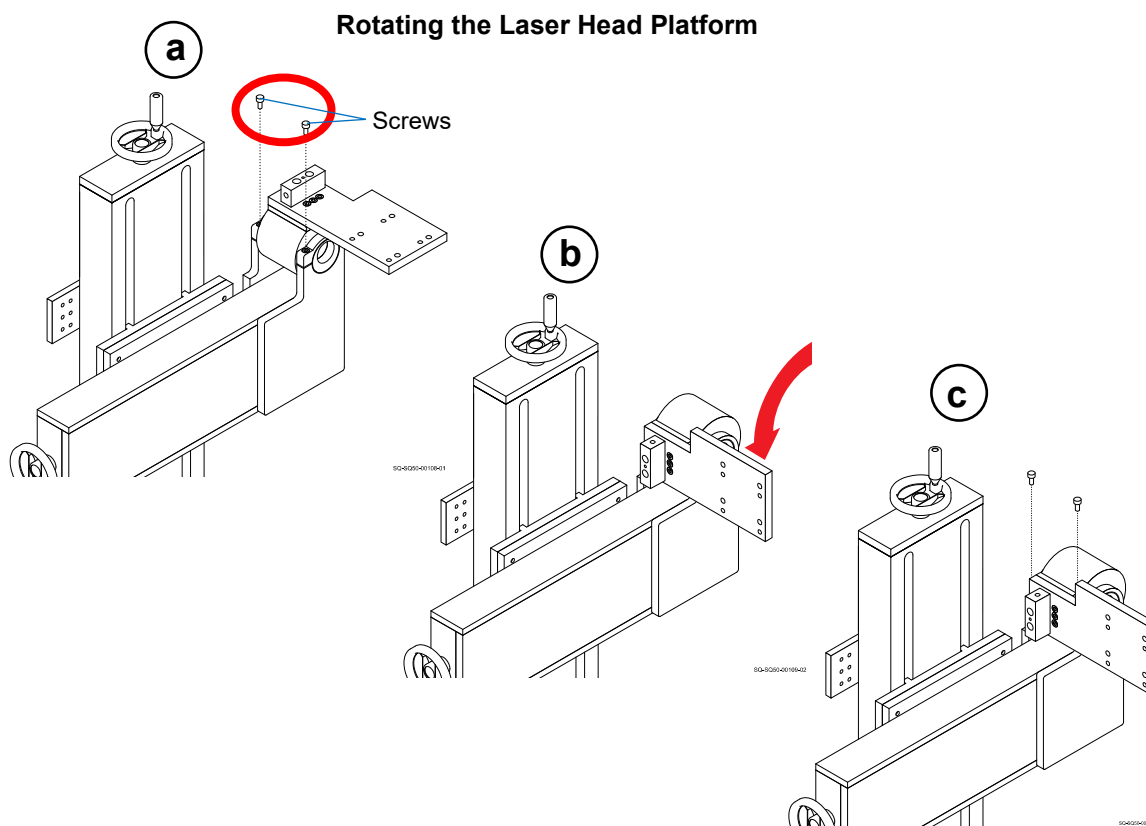
Items Needed to Mount the Laser Head Aimed Forward:

- 5 mm Allen wrench
- Four (4) 5 mm socket head cap screws
- 2 Q-Tips or other objects that are similar size/length

Mounting the Laser Head Aimed Forward:

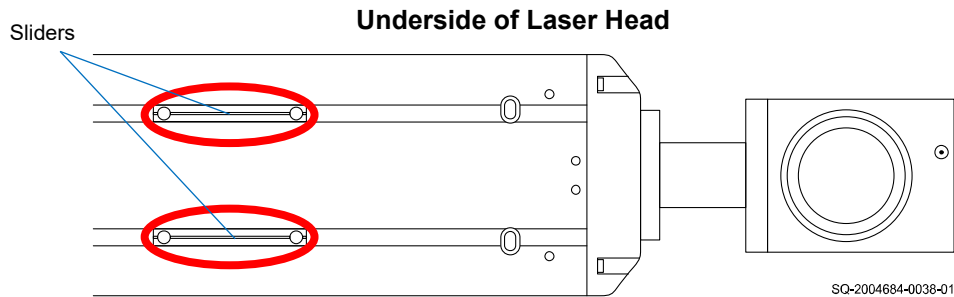
To attach the Laser Head to the Stand pointing forward, do the following:

1. **Rotate the Laser Head Platform 90°:**
 - a. Use the 5 mm Allen wrench to remove the two 5mm socket head cap screws that hold the Laser Head Platform in place.
 - b. Rotate the Laser Head Platform 90° toward the Stand Tower.
 - c. Use the 5 mm Allen wrench to replace the two 5mm socket head cap screws, tightening them firmly to secure the Laser Head Platform in place.



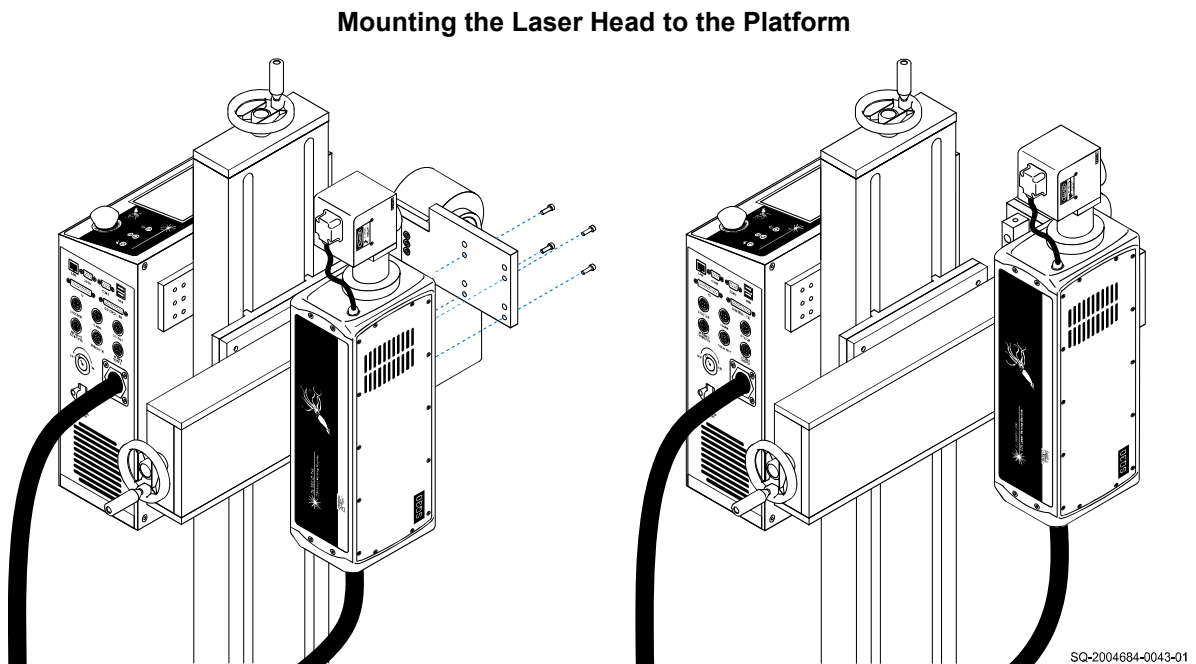
2. Position the Sliders:

- a. Locate the Sliders on the underside of the Laser Head.



3. Mount the Laser Head to the Platform:

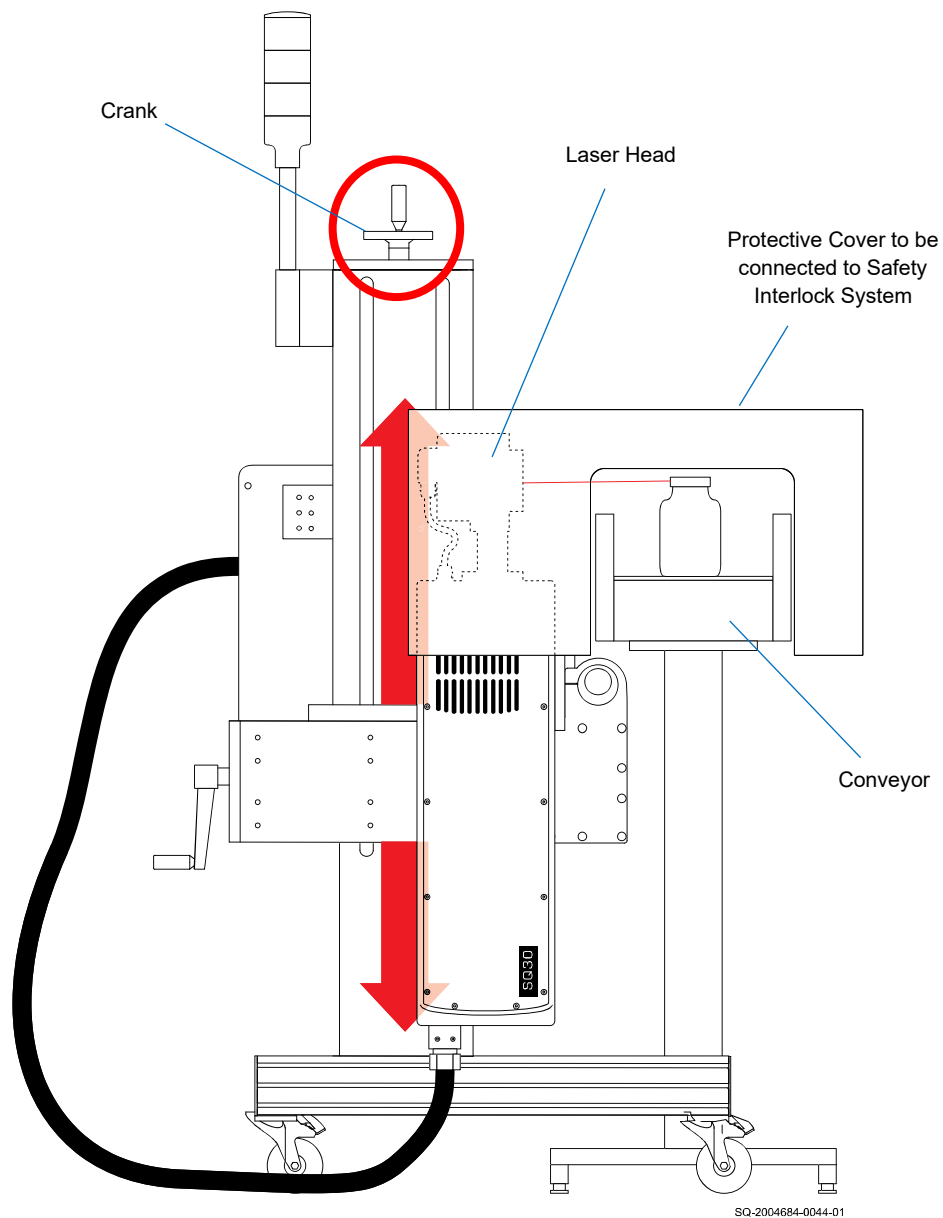
- a. Align the screw holes in the Laser Head Platform with the screw holes in the Sliders.
- b. Insert the four (4) 5 mm socket head cap screws into the screw holes and tighten them using the 5 mm Allen wrench to secure the Laser Head firmly to the Laser Head Platform.



4. Adjust the Position of the Laser Head:

- a. Turn the Crank on the end of the Y-Direction Arm to adjust the vertical position of the Laser Head.

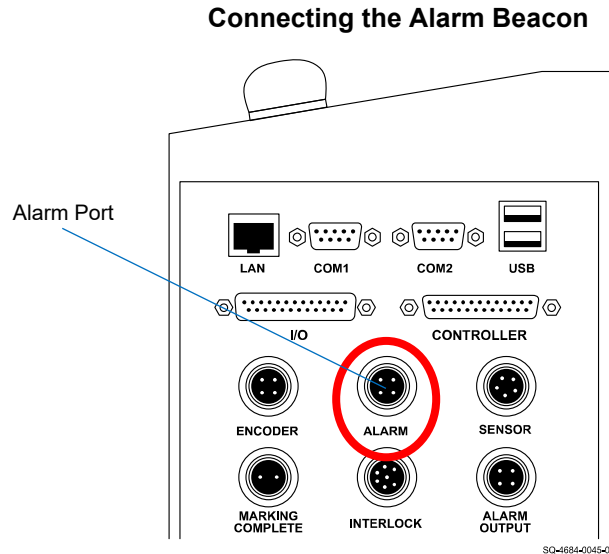
Adjusting the Vertical Position of the Laser Head



Connections

Connecting the Alarm Beacon

While mounting the SQ-30 to the Stand, the Alarm Beacon was mounted to the Stand. The Alarm Beacon needs to be connected to the Controller by plugging it into the Alarm port.



4-Pin Female Alarm Connector:

- Pin 1: 24 V, 2A
- Pin 2: Red LED
- Pin 3: Yellow LED
- Pin 4: Green LED

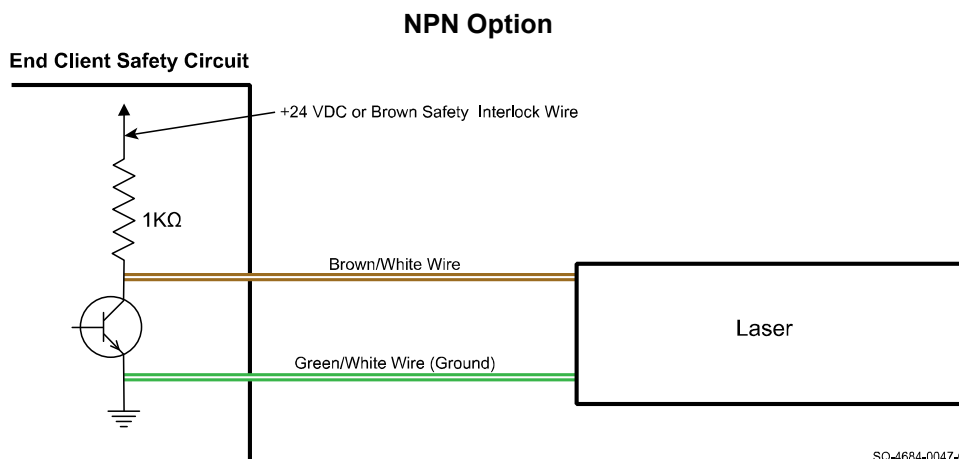
Connecting the Safety interlock System

There are four input connections provided by the Safety Interlock System. One of these input options must be properly used for the laser to operate. The Safety Interlock Cable provides access to two low active inputs and two high active inputs, along with a +24 VDC and Ground connections as identified by their wire colors below.

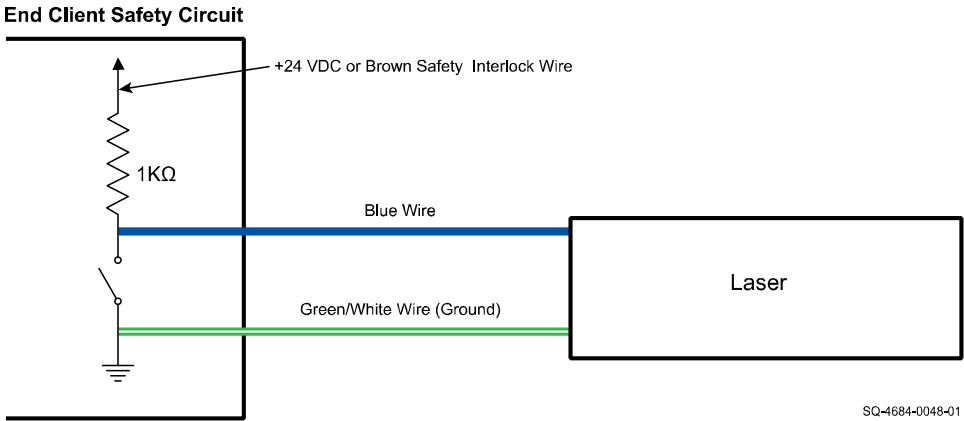
Interlock Cable Connections			
Connection Number	Description	Wire Color	Voltage
1	+24VDC	Brown	+24VDC
2	NPN	Brown/White	
3	Relay to Ground	Blue	
4	PNP	Blue/White	
5	Relay to +24 VDC	Green	
6	GND	Green/White	GND
7	NC		

Wiring Diagrams for Four Possible Connection Options:

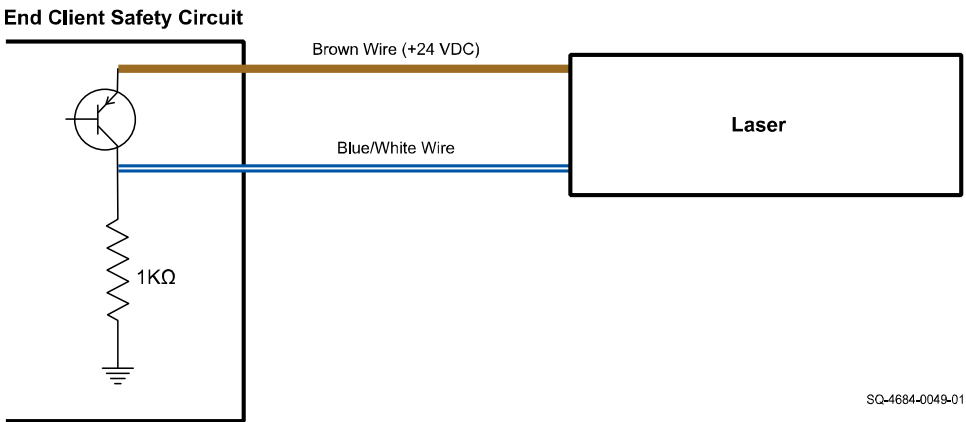
The End Client Safety Circuit in the diagrams below are the end user's circuit that is to be integrated with the included Safety Interlock Cable. The brown/white wire and the green/white wire represent the Safety Interlock Cable. The End Client Safety Circuit "box" is the end user's existing or supplied circuit, with +24 VDC either being supplied by the end user or by the brown safety interlock wire.



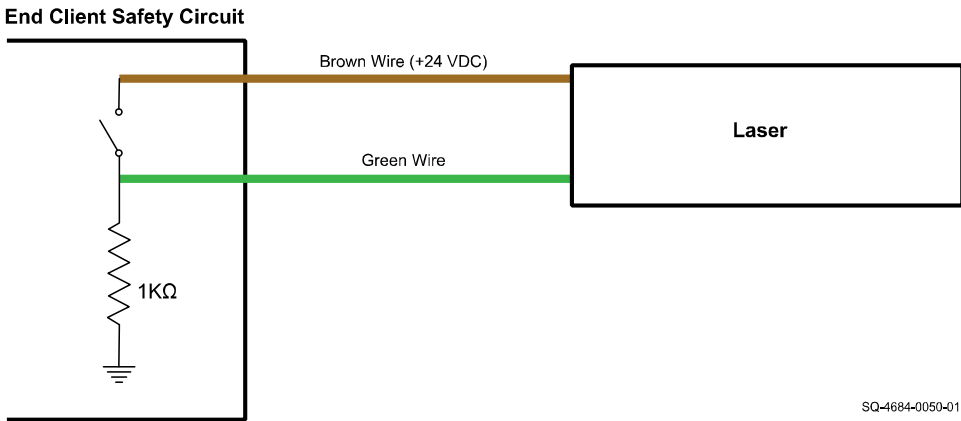
Relay to Ground Option



PNP Option

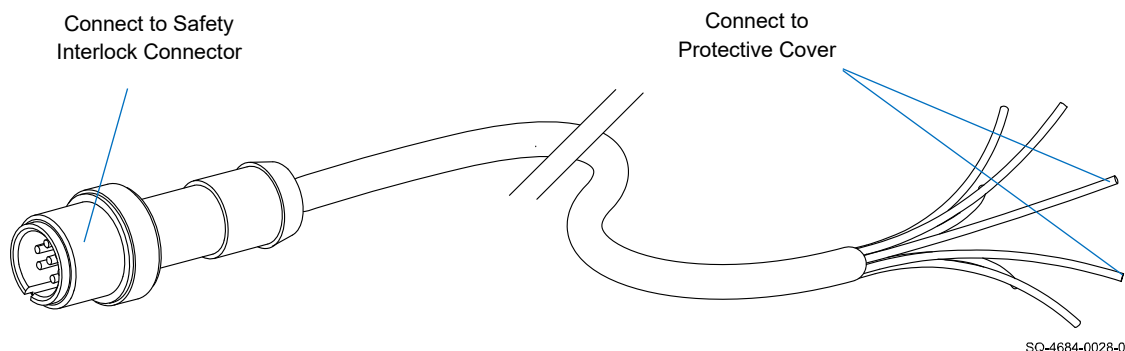


Relay to +24 VDC Option



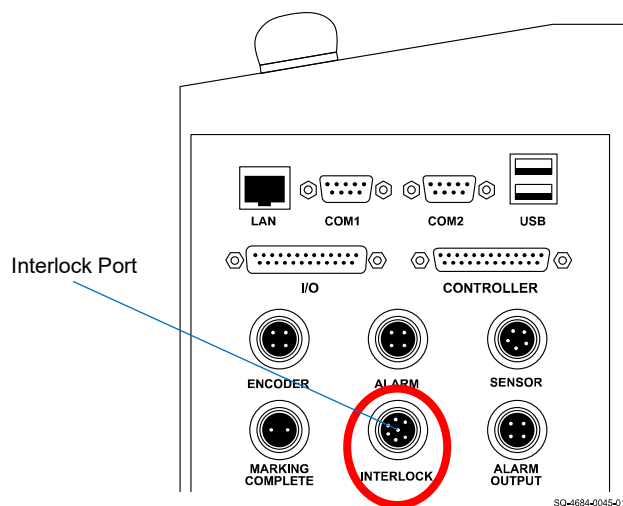
Ensure that transistor or relay is pulled to ground for proper operation.

Safety Interlock Cable



The supplied Safety Interlock Cable must be plugged into the Controller as shown below:

Connecting the Safety Interlock System

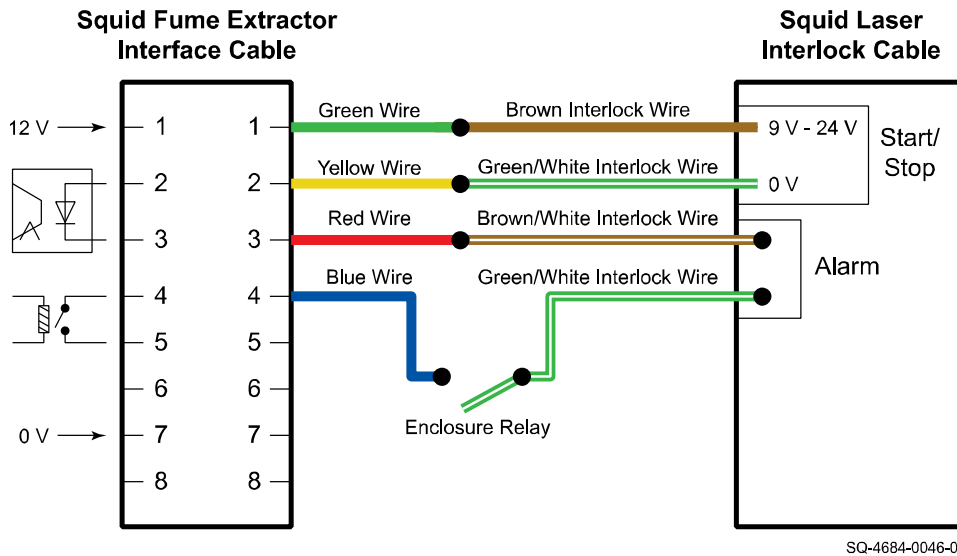


Connecting a Fume Extractor

Ensure that the appropriate Fume Extractor is being used for the desired application (see “Fume Extraction System” on page 32).

The Fume Extractor must be connected to the laser Safety Interlock circuitry using the following connections:

Connection: Laser to Fume Extraction System



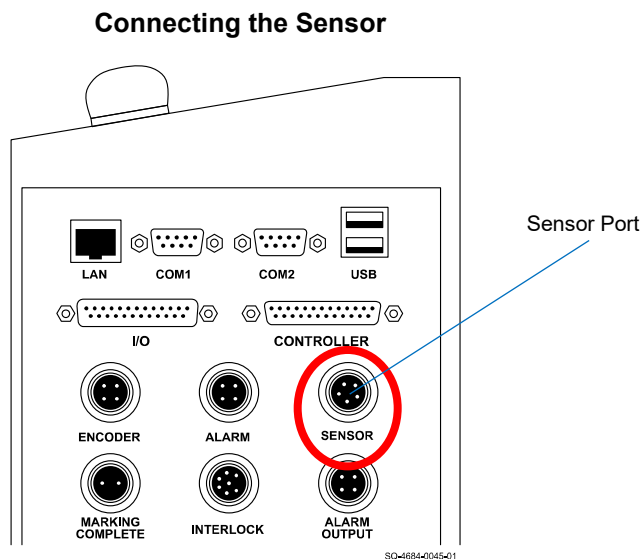
The proper setup is as follows. The Safety Interlock Cable should already be connected to the SQ-30 (see “Connecting a Fume Extractor” on page 61). The Safety Interlock Cable has six wires, of which three (Brown, Green/White, and Brown/White) are shown in the schematic above. These wires from the Safety Interlock Cable must be connected to the cable that is supplied with the Fume Extractor for proper operation. The connections should include the Protective Cover Relay shown above (see also “Connecting the Safety interlock System” on page 58).

Once these connections are made and the Fume Extractor has been plugged into a standard AC electrical outlet, the SQ-30 will automatically turn on the Fume Extractor via remote start when the SQ-30 is powered on. These connections will also cause the Fume Extractor to automatically shut down the SQ-30 if any errors occur in the Fume Extractor (for example, lack of air flow or a full filter that needs to be replaced).

The end of the Fume Extractor’s hose should be placed as close as possible to the marking area without interfering with conveyor flow, so that it can pull away hazardous fumes from the marking process.

Connecting a Sensor

The SQ-30 will need a sensor – usually a Photocell – to let it know when a product is about to pass beneath the Laser Head. The sensor should be placed upstream from the Laser Head. Your authorized Squid Ink Distributor can provide guidance regarding the best sensor for your needs and its proper installation.

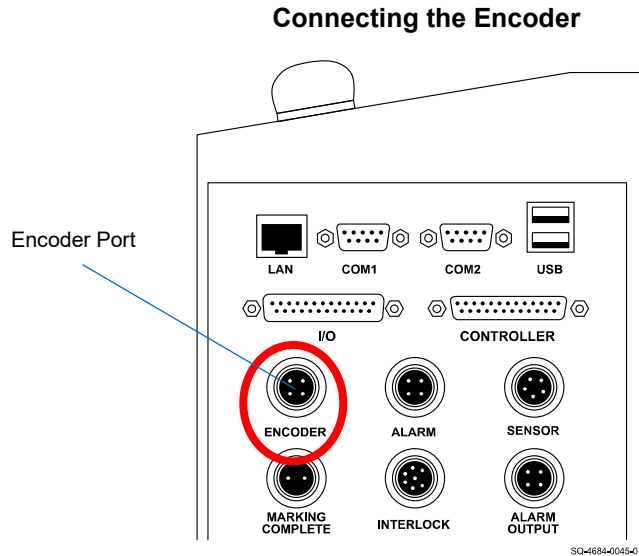


5-Pin Female Sensor Connector

- Pin 1: 12 VDC
- Pin 2:
- Pin 3:
- Pin 4: Photocell Input
- Pin 5: GND

Connecting an Encoder

If the SQ-30 is used with a variable-speed conveyor (start/stop/start/stop) it will need an Encoder to translate the distance traveled by the products on the conveyor into accurate timing information to trigger marking. Squid Ink offers a high-resolution Encoder (Part Number 2004630) that is ideal for use with the SQ-30.

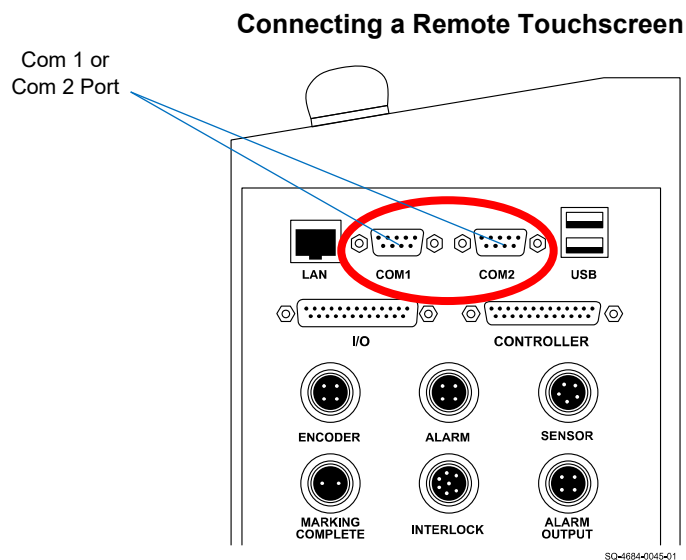


4-Pin Female Encoder Connector

- Pin 1: 24 VDC
- Pin 2: Encoder Input B
- Pin 3: Encoder Input A
- Pin 4: GND

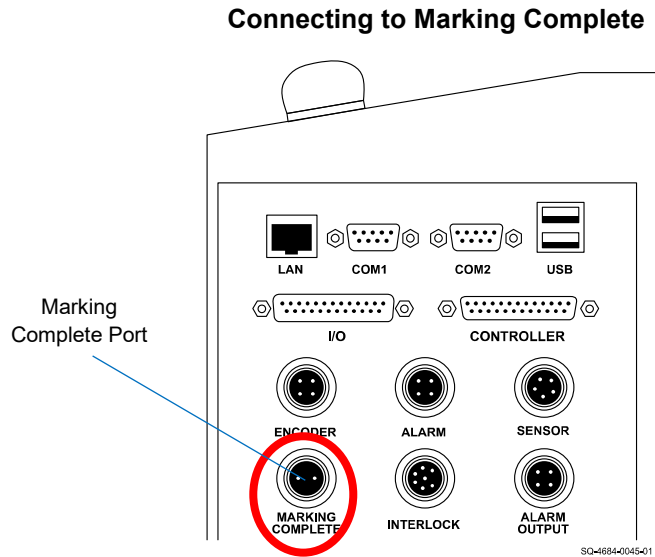
Connecting a Remote Touchscreen

If the user desires a larger Touchscreen than what is on the top of the Controller, a Remote Touchscreen (Part Number 2004635) can be connected to the SQ-30 through the Com 1 or Com 2 port.



Connecting to Marking Complete

Connecting a PLC (Programmable Logic Controller) or other controller to Marking Complete informs the operator remotely when marking is complete.



2-Pin Female Counter Connector

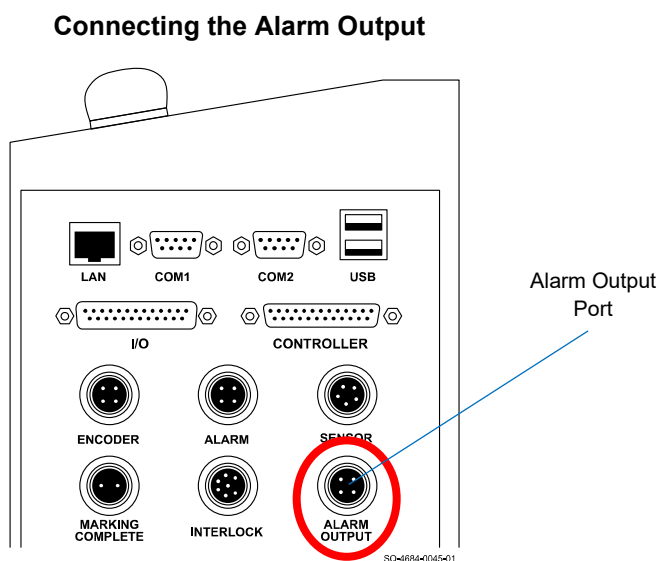
Pin 1: TTL Input

Pin 2: GND

Connecting to Alarm Output

The system can communicate basic information about its operational status to an external device such as a Programmable Logic Controller (PLC) or Human Machine Interface (HMI). Status communicated to the external device would be:

- Marking
- Not Marking
- High-Level Alarm

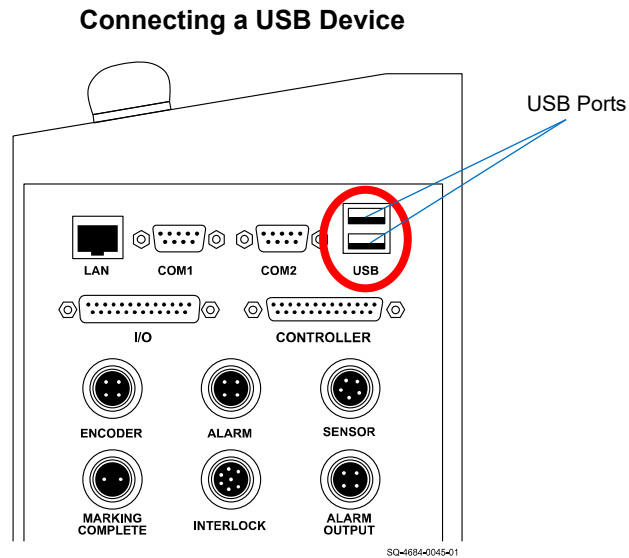


4-Pin Female Alarm Output Connector

- Pin 1: 24 VDC
- Pin 2: System On
- Pin 3: Marking On
- Pin 4: Alarm On

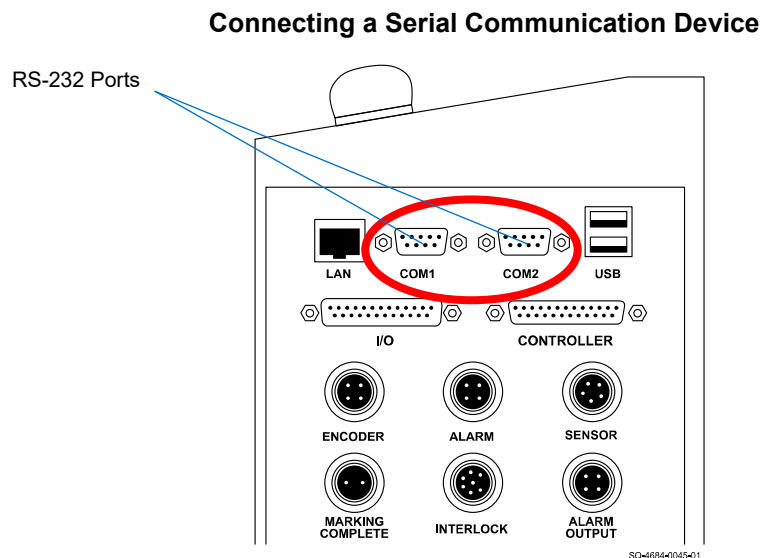
Connecting a USB Device

The SQ-30 includes two USB ports suitable for a USB thumb drive, mouse, keyboard, or other external USB devices. The USB ports may also be used for external peripheral expansion, and are necessary for updating the SQ-30's system software.



Connecting a Serial Communication Device

The SQ-30 includes two RS-232 serial communication DB9 interface ports for devices such as Barcode Scanners that require a RS-232 connection.



DB9 Male COM1 Connector

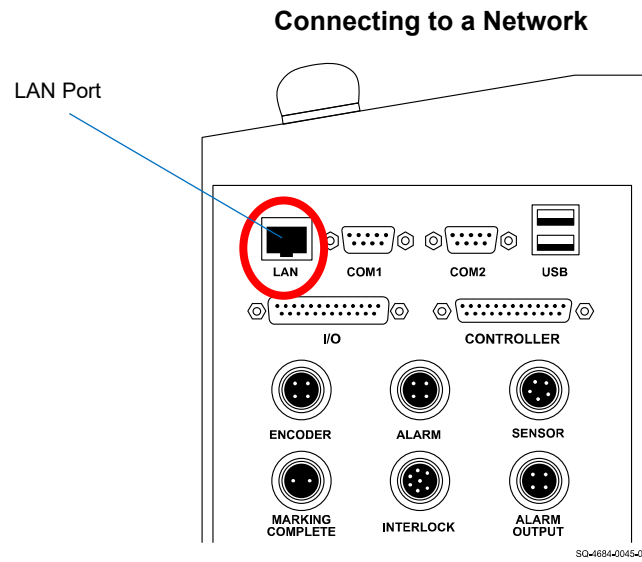
- Pin 2: TX
- Pin 3: RX
- Pin 4: 5 VDC
- Pin 5: GND
- Pin 6: GND
- Pin 9: 5 VDC

DB9 Male COM2 Connector

- Pin 2: TX
- Pin 3: RX
- Pin 4: 5 VDC
- Pin 5: GND
- Pin 6: GND
- Pin 7: 12V, 2A output
- Pin 9: 5 VDC

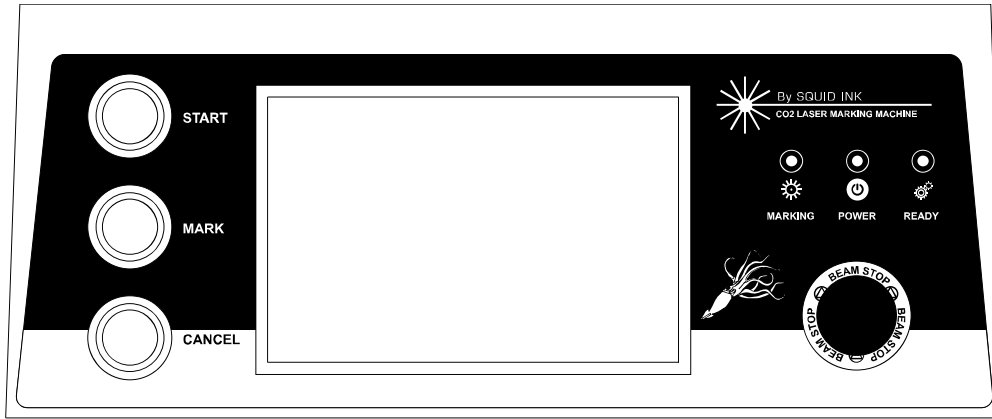
Connecting to a Network

The SQ-30 includes an Ethernet port for connecting to an external server.



User Interface

The physical part of the SQ-30 CO₂ Laser Marking System's interface is simple. The Controller has a small handful of buttons, whose functions are described below:



SQ-2004684-0051-01

Start Button:

Activates laser marking capabilities. Once the “Start” button is pressed, the laser will begin marking every time it is triggered.

Mark Button:

Manually activates marking for testing purposes – for example, to determine optimal distance between the Laser Head and passing product – and for troubleshooting purposes.

Cancel Button:

Stops marking.

Marking Light:

Illuminates when the laser is actively marking.

Power Light:

Illuminates when the system is powered on.

Ready Light:

Illuminates when the laser is ready to begin marking.

Beam Stop Button:

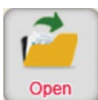
Stops the laser. This button should mainly be used in emergencies. For routine stopping, use the “Cancel” button.

Touchscreen:

Provides access to the SQ-30's software, called FMark, which is already installed in the Controller and is necessary for creating, opening and saving marking messages. While commands can be entered into the Touchscreen using fingers, the Stylus (included) provides more precise and accurate control. The rest of the “Interface” section below describes all aspects of the software's user interface.

NOTE: FMark software can also be installed on a PC running Windows XP. Message templates can be created on the PC and then transferred to the SQ-30 using USB drive or other means. The PC version of FMark saves the files in .PLT format. Graphics such as logos can also be created using software like Corel Draw, which is capable of saving in the .PLT file format. These can similarly be brought into the SQ-30 using a USB drive.

Touchscreen Buttons

Button	Name	Function	Appears On
	New	Makes a new marking file/template. A blank screen appears. The blue frame on the screen is the marking area, and the gray grid represents centimeters.	Home Screen
	Open	Opens an existing marking file/template. Selecting the desired file and clicking OK loads the file into the system.	
	PLT Import		
		Saves a marking file/template for future use. As on a PC, if the filename already exists, there will be a prompt to overwrite the existing file or save it with a new filename. The default file format for FMark files saved internally in the Controller is ".LMF" (Laser Marking File). If there is a saved marking file, it will have the extension ".MRK"	
	Users	Allows selection of current user. This option becomes available after work shift information or a password has been entered on the Password screen.	
	Keyboard		
	Zoom In	Zooms in on the screen content.	
	Zoom Out	Zooms out from the screen content.	
	Normal View	Scrolls and/or zooms the screen in or out from the current view to the default view.	
	Zoom All	Scrolls and/or zooms the screen in or out to show all items filling the screen.	

	Name	Function	Appears On
	Select	Selects an item on the screen to be move or edited. A selected item turns from white to whichever pen color is active.	Home Screen
	Multi-Select	Selects one or more items on the screen by dragging over them. Selected items turn from white to whatever the pen color is for the selected object(s).	
	Text	Creates a text object. Each time Text is selected, a new text object is created. Character settings that were input for the last text object carry over for the new text object, but can be changed if desired.	
	Date	Creates a date object. Each time Date is selected, a new date object is created.	
	Time	Creates a time object. Each time Time is selected, a new time object is created.	
	Sequence Number	Creates a counter object. The counter number increases each time a specified number of markings (usually one marking) takes place.	
	Serial Number	Imports a list from an external source, and uses a different item from the list for marking each product that passes beneath the Laser Head.	
	Object List	Shows a list of all objects in the file and the order in which they have been input.	
	Draw Lines	Draws straight lines. Tap the screen for the point that begins the line segment. Tap the screen again for the second point that completes the line segment. A third tap on the screen will connect the second point to the third point, and so on. To stop drawing, click a different tool.	
	Circle	Draws a circle. Tap the screen once to place the center of the circle, and then drag out to describe the distance of the radius.	
	Pen Para	Adjusts different aspects of the laser beam, such as its power level.	

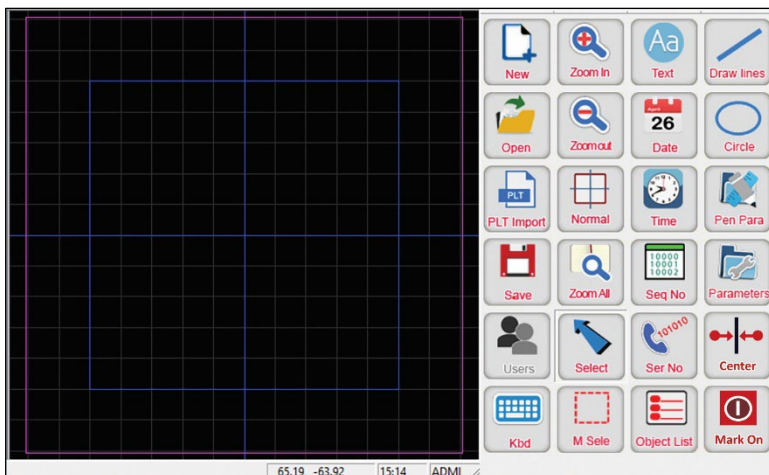
Button	Name	Function	Appears On
	Parameters	Sets timing and other factors related to how the SQ-30 interacts with markable products, the Photocell, Encoder, and other external factors.	Home Screen
	Center	Adjusts the horizontal position of all objects on the screen.	
	Mark On	Provides access to controls for marking and testing.	
	Basic Parameters	Allows access to some of the FMark software's parameter settings.	System Parameters Submenu (Press "Control" key, then "S" key to access this area)
	Interface Parameters	Sets how the SQ-30 takes in external data and information.	
	Pen Color	Does not change marking color. Enables users to differentiate between on-screen representations of objects that have different marking intensities and qualities.	
	Display Settings	Provides access to settings for the Touchscreen's display.	
	Password Screen	Allows an administrator to set a password to limit access within the system, and to assign work shift information.	
	Reboot and Go Back	Saves settings accepted in the System Parameters Submenu , reboots the system, and applies the changes to current files.	
	Go Back	Goes back to the previous screen.	Text Character Date Time Sequence Number Serial Number Object List Pen Parameters Parameters Basic Parameters Interface Parameters Pen Color Display Settings Password

Button	Name	Function	Appears On
	Accept	Accept the change made.	Text Character Date Time Sequence Number Serial Number Object List Pen Parameters Parameters Basic Parameters Interface Parameters Pen Color Display Settings Password
	Character	Controls parameters for a selected object that contains text.	Text Date Time Sequence Number Serial Number
	Chinese Characters	Switches from an English keyboard to a Chinese Keyboard.	Text Date Time
   	Directional Arrows	Moves the selected object.	Text Date Time Sequence Number Serial Number
	Enlarge Move Units	Increases the amount that an object is moved by one press of a Directional Arrow.	
	Reduce Move Units	Reduces the amount that an object is moved by one press of a Directional Arrow.	
	Ungroup	Ungroups the selected object. For example, ungrouping a text object will make it possible to	

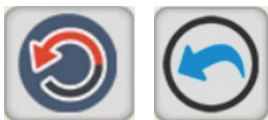
Button	Name	Function	Appears On
		move each character around the screen independently.	Text Date Time Sequence Number Serial Number
	Delete	Deletes the selected object.	

Home Screen

The **Home** screen is the main screen for the software. Most software functions are accessed through this screen.



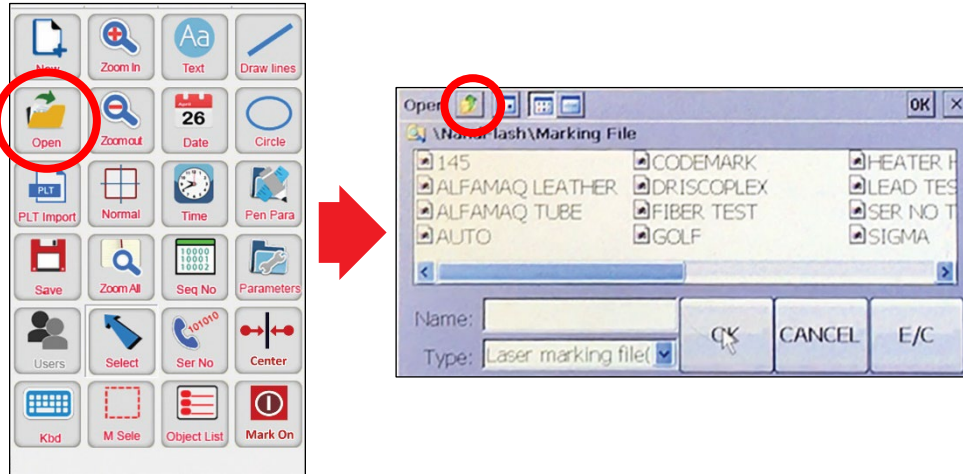
The **Home** screen can generally be accessed from other screens by selecting **Go Back**.



NOTE: As mentioned in the description of the **New** button, the gray grid on the screen represents centimeters, and shows a maximum marking area size of 10 cm X 10 cm. Squid Ink also offers a lens that can provide a maximum marking area of 20 cm X 20 cm.

Open

Selecting **Open** results in the dialog box below. From it, any previously saved marking file/template can be selected.

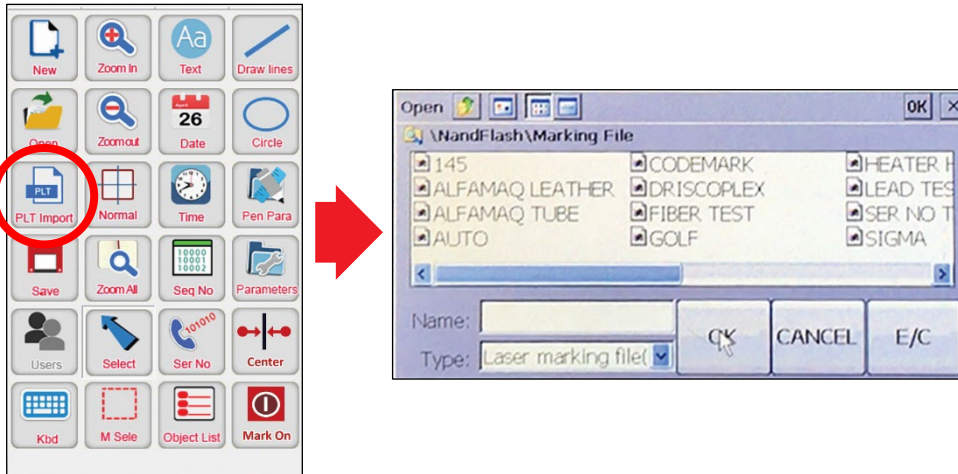


Selecting **E/C** switches the language of the keyboard between English and Chinese.

To select a file from another device, such as a USB drive, clicking the top left icon (next to the word “Open”) navigates up one level in the file storage hierarchy (similar to files inside folders that are inside other folders on a PC). When the outermost level is reached, different devices can be selected. A USB Drive appears as “Hard Disk.” The SQ-30’s internal hard drive appears as “NandFlash.”

PLT Import

Selecting **PLT Import** opens the dialog box below. From it, a PLT file (such as a logo or other graphic) can be imported, typically from a USB drive, using the file folder navigation methods described in **Open** (see “Open” on page 79).

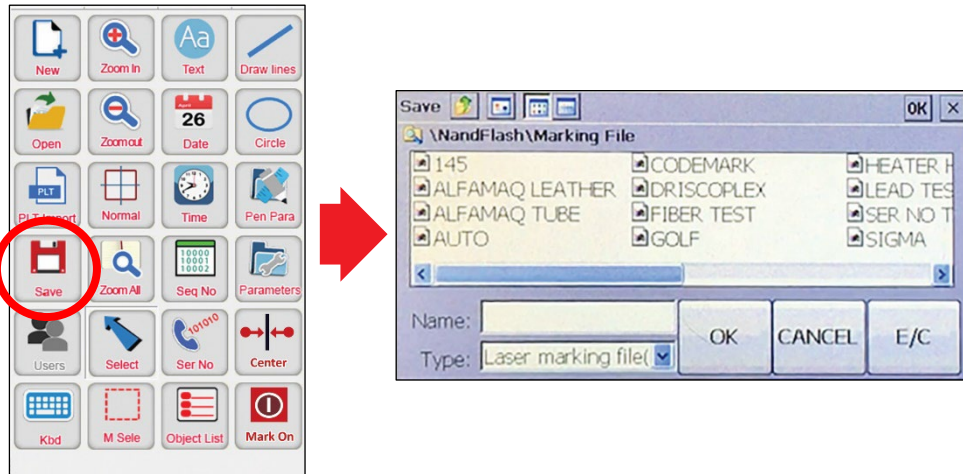


Selecting **E/C** switches the language of the keyboard between English and Chinese.

Unlike **Open**, **PLT Import** can bring the graphic file into a marking file/template that is already open.

Save

Selecting “Save” results in the dialog box below. From it, the currently open marking file/template can be saved to the internal hard drive of the SQ-30 or to an external device, using the file folder navigation methods described in “Open” (see “Open” on page 79).



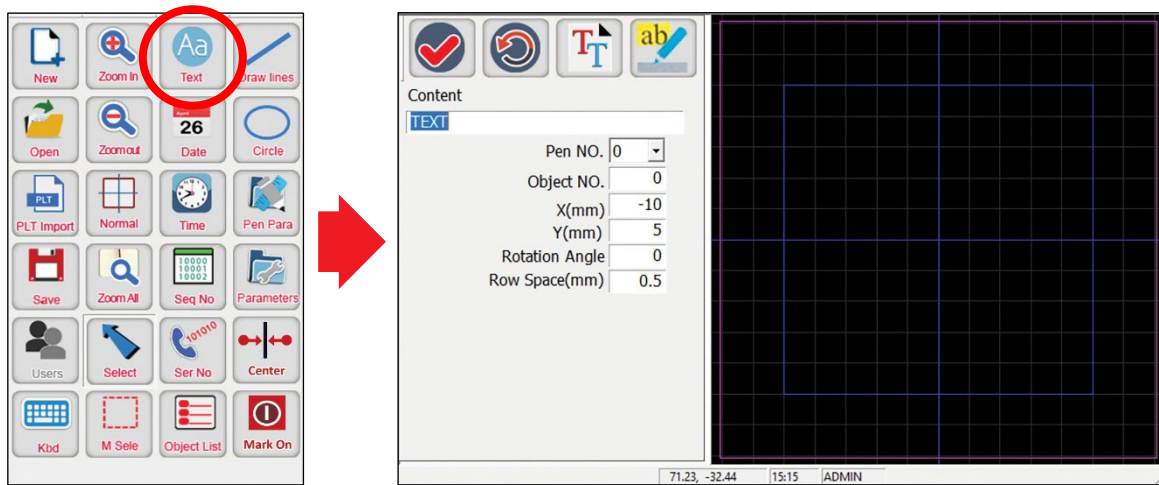
Selecting “E/C” switches the language of the keyboard between English and Chinese.

Marking files saved on the SQ-30 (“NandFlash”) should be saved in the “Marking File” folder.

After entering a name for the file, select “OK” to save it.

Text Screen

The Text Screen is used for inputting alphanumeric text.



The text is input in the “Content” box using the keyboard.

Editable attributes include:

Pen Number:

An object or set of objects can be assigned one of eight pen numbers. Doing this allows the user to set different marking strengths in the “Pen Parameters” screen.

Object Number:

Describes the order in which the text object has been input relative to other objects.

X (mm):

Describes the location to place the object relative to the center axis of the screen.

Y (mm):

Describes the location to place the object relative to the center axis of the screen.

Rotation Angle:

Rotates the text object. Positive numbers rotate the object counterclockwise, and negative numbers rotate the object clockwise.

Row Space (mm):

Adjusts the horizontal spacing between characters. This is somewhat similar to “kerning” in traditional printing.

To make adjustments to the text characters, such as changing the font, select the “Character” button.



To reject the changes and return to the previous screen, select the “Go Back” button.

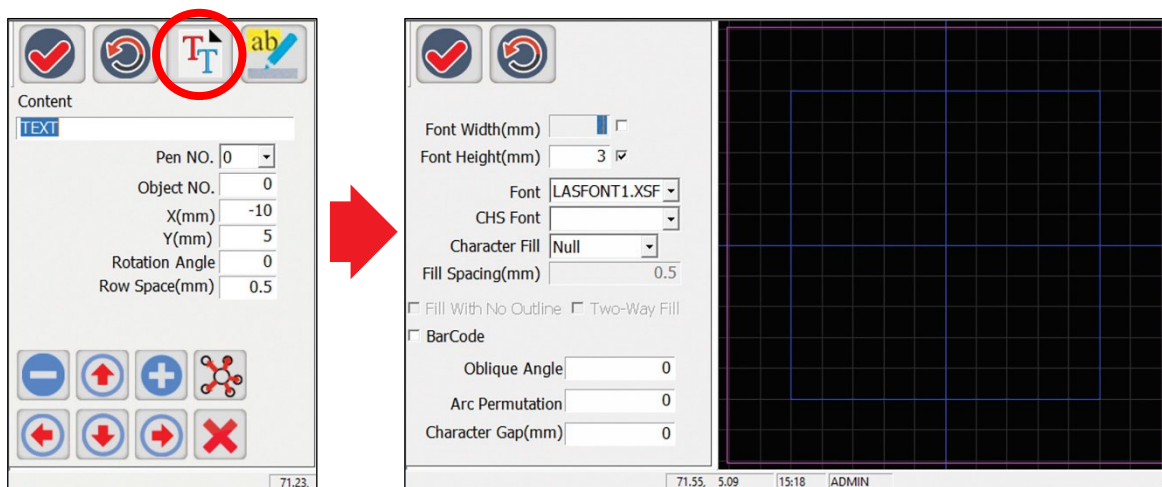


To accept and view the changes, select the “Accept” button.



Character Screen

The Character Screen is where the look of a text object is changed.



Editable attributes include:

Font Width:

The font width, in millimeters. If this option is deselected, the width automatically scales proportionately with the height.

Font Height:

The font height, in millimeters.

Font:

English font style. Bold fonts are generally identified with "BD" in the font name.

CHS Font:

Chinese font style.

Character Fill:

Describes the fill of the font. All fonts, including bold fonts, are created as outlines by default. However, "fills" made of tiny parallel lines, can be added. The lines can be seen on screen by zooming in on the text object. "Character Fill" options are:

- Null:** No fill, just outline.
- Transverse:** Filled with horizontal lines.
- Vertical:** Filled with vertical lines.
- Diagonal:** Filled with diagonal lines.

Fill Spacing:

Only available when "Character Fill" is active. Including a fill adds significantly to marking time, because the laser is printing the outline as well as the fill lines. "Fill Spacing" can reduce that time slightly by adjusting the amount of spacing between lines in the fill.

Fill With No Outline:

Only available when “Character Fill” is active. Marks the fill for the characters without including the outline.

Two-Way Fill:

Only available when “Character Fill” is active. Uses two different fill directions. This increases marking time dramatically, but results in a more solid-looking fill.

BarCode:

Uses the text that was input on the previous page as data for creating a barcode.

BarCode Type:

Only available when “BarCode” is active. Selects barcode format. Barcode formats that begin with “RCode” are marked as a negative image of the barcode.

Bar Height:

Only available when “BarCode” is active. Sets the barcode height in millimeters. “Font Width” (above) can be used to adjust the size of the barcode horizontally.

Character Gap:

When “BarCode” is active, sets the amount of spacing (in millimeters) between human-readable characters in the barcode.

Level:

Only available when “BarCode” is active and “BarCode Type” is set to QR Code. It is the error correction level for the QR Code.

L class:	7% code can be corrected
M class:	15% code can be corrected
Q class:	25% code can be corrected
H class:	30% code can be corrected

For example, if 30% of an H class printed code is damaged or dirty, the data can still be scanned successfully.

Dot Size:

Only available when “BarCode” is active and “BarCode Type” is set to “QR Code.” Sets the size of the dots that make up the QR Code. Smaller dot sizes will result in faster marking times.

Oblique Angle:

For “inclining” text, similar to italicized text. The range is -45 to 45.

Oblique Angle: 0
Positive Oblique Angle
Negative Oblique Angle

5Q-5020-08105-01

Arc Permutation:

Entering a value other than “0” causes the text to be arranged in an arc.

Arc Permutation: 0

Positive Arc Permutation

Negative Arc Permutation

8Q-SQ50-00106-01

Character Gap:

Creates spacing between text characters.

Character Gap: 0

Positive Character Gap

8Q-SQ50-00107-01

To reject the changes and return to the previous screen, select the “Go Back” button.

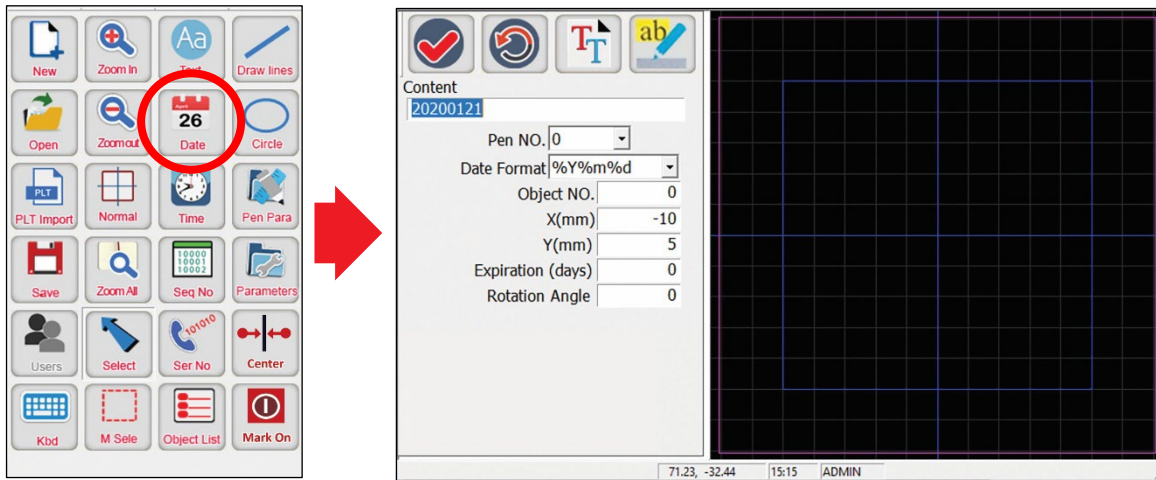


To accept and view the changes, select the “Accept” button.



Date Screen

The Date Screen is used to create a date object.



The “Content” box displays the date to be printed. The system ships with the current date already programmed.

Editable attributes include:

Pen Number:

An object or set of objects can be assigned one of eight pen numbers. Doing this allows the user to set different marking strengths in the “Pen Parameters” screen.

Date Format:

Selects the way the date is written (eg, Year Month Day, Year.Month, etc.). The Content box will show a preview of the selected date format.

Object Number:

Describes the order in which the date object has been input relative to other objects.

X (mm):

Describes the location to place the object relative to the center axis of the screen.

Y (mm):

Describes the location to place the object relative to the center axis of the screen.

Expiration (days):

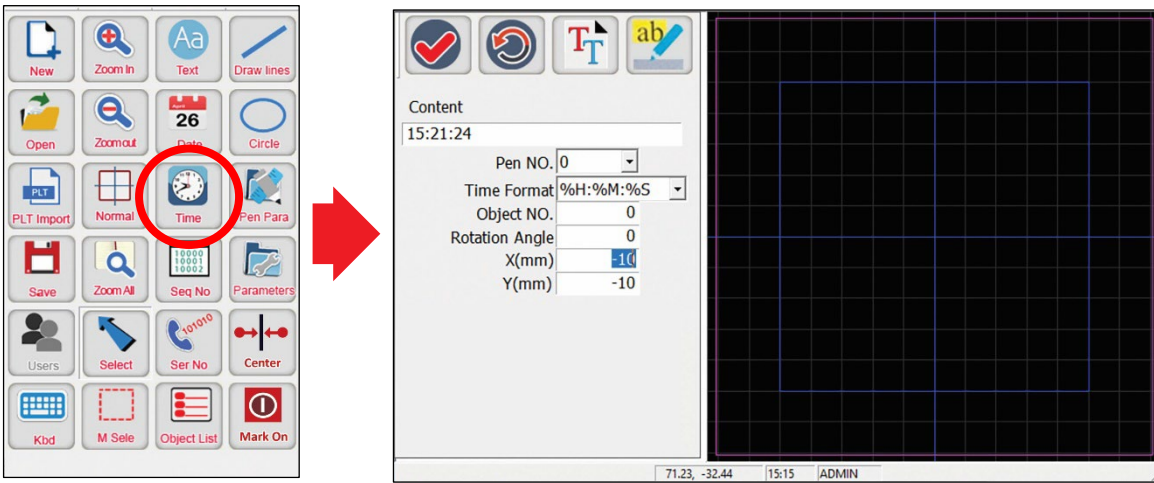
When marking an expiration date, sets the number of days that the expiration date is from the current date. For example, a product marked on January 5 that expires in 10 days will be marked “January 15.” The next day, if this info has been saved in a template, the date will automatically roll over and mark “January 16.”

Row Space (mm):

Adjusts the horizontal spacing between characters. This is somewhat similar to “kerning” in traditional printing.

Time Screen

The Time Screen is used to create a time object.



The “Content” box displays the time to be printed. The system ships with the current time already programmed.

Editable attributes include:

Pen Number:

An object or set of objects can be assigned one of eight pen numbers. Doing this allows the user to set different marking strengths in the “Pen Parameters” screen.

Time Format:

Selects the way the time is written (for example, military time, etc.). The Content box will show a preview of the selected time format.

Object Number:

Describes the order in which the time object has been input relative to other objects.

Rotation Angle:

Rotates the time object. Positive numbers rotate the object counterclockwise, and negative numbers rotate the object clockwise.

X (mm):

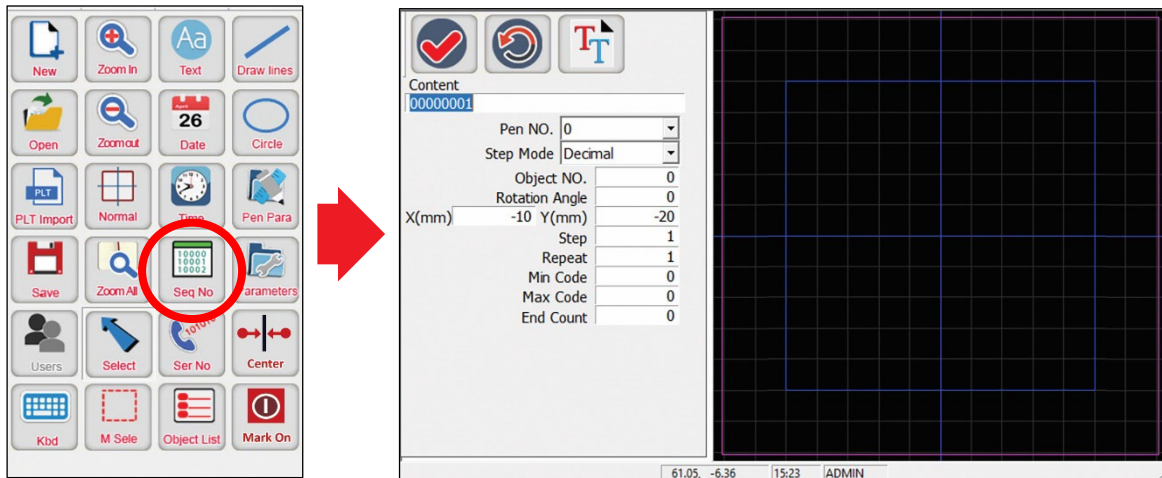
Describes the location to place the object relative to the center axis of the screen.

Y (mm):

Describes the location to place the object relative to the center axis of the screen.

Sequence Number Screen

The Sequence Number Screen is used to input settings for creation of a dynamic (updating) counter objects.



The “Content” box displays the counter to be printed.

Editable attributes include:

Pen Number:

An object or set of objects can be assigned one of eight pen numbers. Doing this allows the user to set different marking strengths in the “Pen Parameters” screen.

Step Mode:

Selects the format for characters. Options include:

Decimal:

Only digital numbers 0 - 9 are used.

Hexadecimal:

Digital numbers 0 - 9 and letters A - F are used. Increments past “F” return to “0”.

Alphanumeric:

Numbers 0 - 9 are used. Increments past “9” return to “0,”

Letter:

Letters A - Z are used. Increments past “Z” return to “A.”

Exclude 4,7:

Excludes the numbers 4 and 7. Uses 0, 1, 2, 3, 5, 6, 8, and 9.

Septenary:

Uses 0, 1, 2, 3, 4, 5, and 6.

Random Number:

Generates random numbers.

Object Number:

Describes the order in which the sequence object has been input relative to other objects.

Rotation Angle:

Rotates the object. Positive numbers rotate the object counterclockwise, and negative numbers rotate the object clockwise.

X (mm):

Describes the location to place the object relative to the center axis of the screen.

Y (mm):

Describes the location to place the object relative to the center axis of the screen.

Step:

Defines the increments. An increment of “1” would result in counting 1, 2, 3, 4, 5, 6.... An increment of “5” would result in counting 5, 10, 15, 20, 25, 30

Repeat:

Sets the number of times to repeat each character in the count (for example, 11, 22, 33, 44 ,55, etc.)

Min Code:

Starting number for the count.

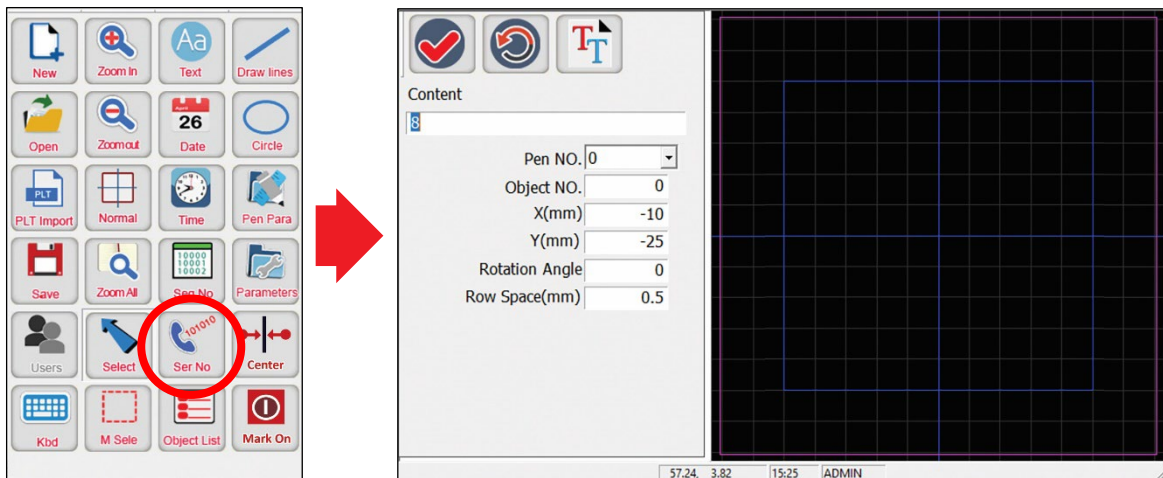
Max Code:

Final number of the count.

Serial Number Screen

The Serial Number Screen is used to input settings for importing dynamic (updating) objects from an external device, such as a list from a PC that causes the laser to mark each product with a different piece of data from the list.

NOTE: In the imported file, the number of characters in each line in the serial number must always be the same



The “Content” box displays a sample of the data to be printed.

Editable attributes include:

Pen Number:

An object or set of objects can be assigned one of eight pen numbers. Doing this allows the user to set different marking strengths in the “Pen Parameters” screen.

Object Number:

Describes the order in which the sequence object has been input relative to other objects.

X (mm):

Describes the location to place the object relative to the center axis of the screen.

Y (mm):

Describes the location to place the object relative to the center axis of the screen.

Rotation Angle:

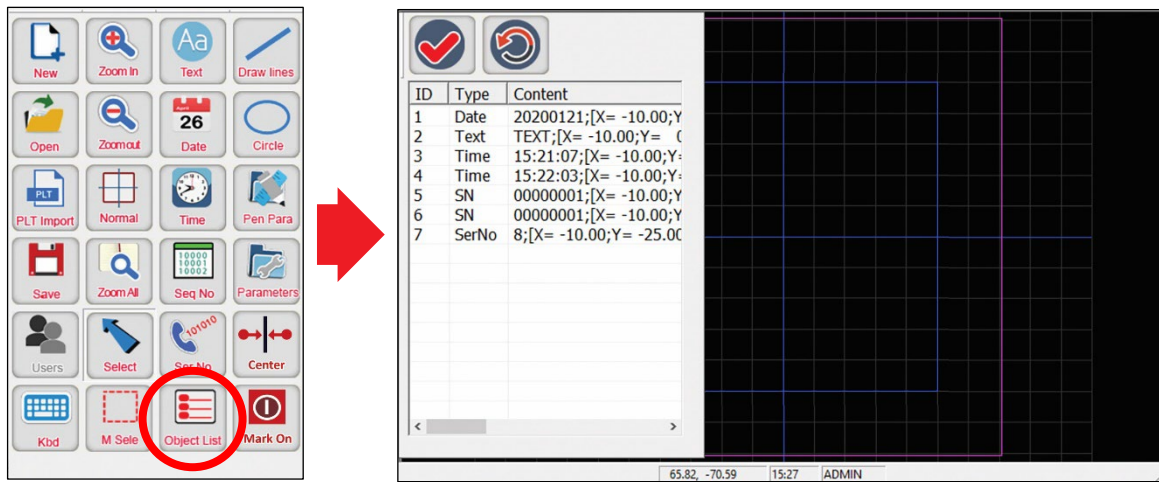
Rotates the object. Positive numbers rotate the object counterclockwise, and negative numbers rotate the object clockwise.

Row Space (mm):

Adjusts the horizontal spacing between characters. This is somewhat similar to “kerning” in traditional printing.

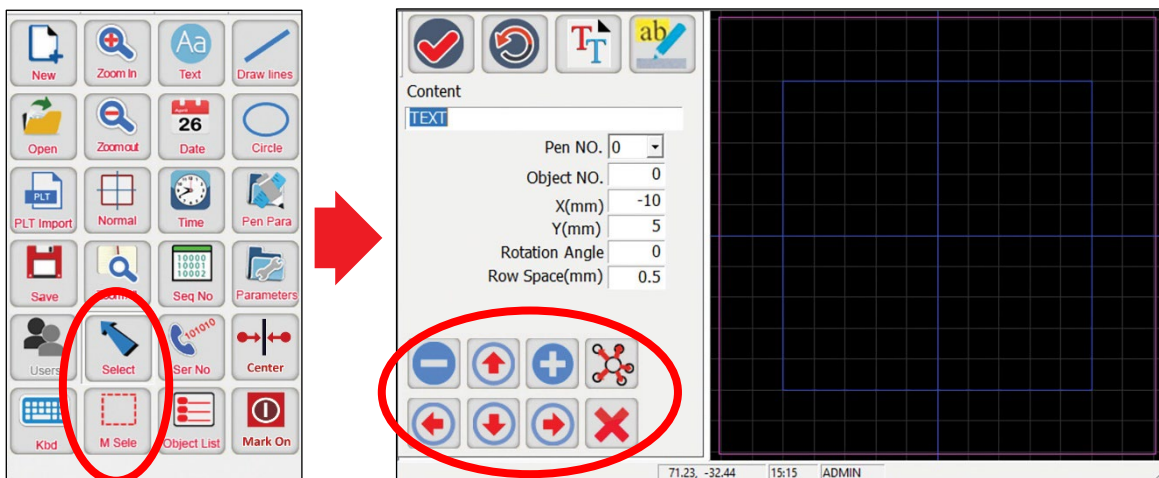
Object List Screen

The Object Screen displays a list of all objects in the order in which they have been created.



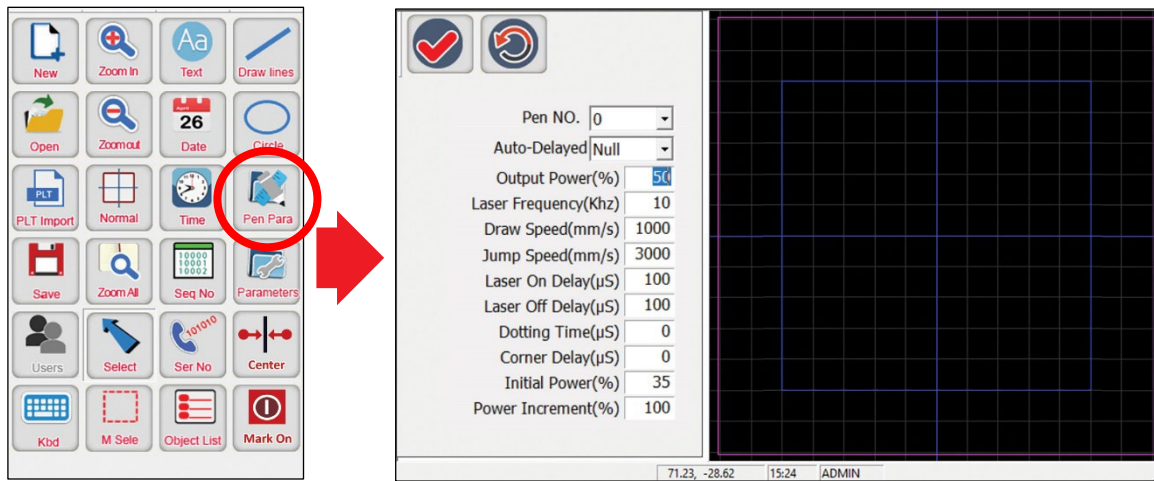
Additional Tools

Once the text, date, time, sequence number or serial number object has been accepted, the software returns to the Home Screen. To make further edits to the object, select it using the “Select” or “Multi-Select” tool. The editing page for that object reopens with additional tools at the bottom for moving the object around the screen (arrow keys), changing the amount that a tap on an arrow key moves an object (+ and -), deleting it (x) or ungrouping it.



Pen Parameters Screen

The Pen Parameters Screen is where different aspects of the laser beam itself are adjusted.



Editable attributes include:

Pen Number:

An object or set of objects can be assigned one of eight pen numbers. Doing this allows the user to set different marking strengths. To create a new pen, assign a new pen number that has not already been assigned, and input the desired characteristics of the new pen using the other features in the “Pen Parameters” screen.

Auto-Delayed:

This function is primarily used with product that is moving very slowly past the Laser Head, such as a pipe on an extrusion line. “Auto-Delayed” adjusts the amount of time for the SQ-30 to pause marking as the product is passing by. For normal speed applications, this setting should be on “Null.”

Output Power:

Sets the amount of power used for marking. The range is 0 - 100%. A higher number will cause marking to be heavier.



CAUTION: Class IV lasers are powerful. Use caution with settings related to power, speed and frequency. When marking some types of products, setting too high a value for “Output Power,” especially combined with a high value for “Pulse Repetition Rate,” a low value for “Draw Speed,” and/or a high value for “Corner Delay” can result in damage to the product and potentially even damage to the conveyor. Enter sensible values and test by adjusting them incrementally. Squid Ink is not responsible for misuse of the SQ-30.

Laser Frequency:

Sets the pulse rate for the laser. Lower settings result in a dot-matrix-like appearance,

but also yield higher marking speeds. Higher settings increase image quality but reduce marking speeds.

Draw Speed:

Sets the speed of the galvanometer movements, which changes the speed with which markings are drawn. Higher Draw Speeds result in faster marking, but because the laser is targeted on a given spot for a shorter time, markings will be lighter. “Draw Speed” (rather than “Dotting Time”) is best used with vector drawings and non-bitmap fonts.

Jump Speed:

Sets the amount of time that the beam deactivates between marked characters. This number should generally be set to 3x the Draw Speed.

NOTE: “Laser On Delay,” “Laser Off Delay,” “Dotting Time,” “Corner Delay,” and “Laser on Wait.” are all preset in the factory and should generally not be adjusted by users.

Laser On Delay:

Because the speed of the mechanical movement of the galvanometers is lower than the electrical operating speed, to ensure the accuracy of the marking position, “Laser On Delay” must be added. The time unit is in microseconds, and is directly related to the speed of the galvanometers.

Laser Off Delay

Sets the length of time to turn off the laser when the line drawing is finished. The time unit is in microseconds. If the segment is not closed, “Laser On Delay” can be increased to postpone the closing time of the laser, and finish the marking. However, it should be noted that too much “Laser On Delay” will result in wasting time marking, and will also cause the laser to dwell at the marking endpoint, which will affect the marking result (may burn a hole).

Dotting Time:

This parameter is designed for “dotting.” It is used when marking vector images, and is used instead of “Draw Speed” when marking bitmap fonts.

Initial Power:

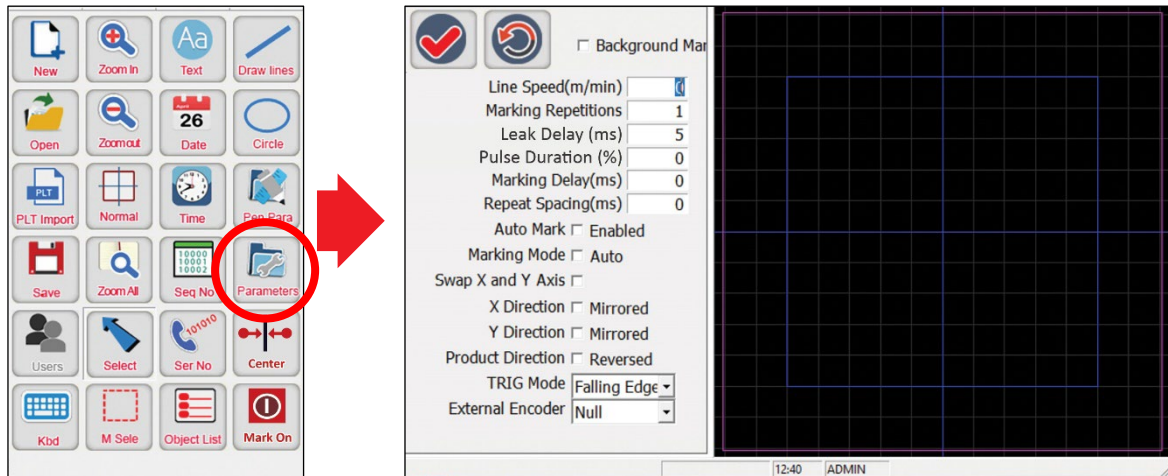
This setting controls the primary power of the laser. Since this initial radiation pulse is higher than the steady laser power, reducing this setting below 100% can provide a more consistent mark from the start to the end of the mark.

Power Increment:

Combined with “Initial Power,” this setting adjusts the power increment from when the marking content starts to when marking is active, and can help keep the mark consistent from start of mark to end of marking segment. This is typically set to 100% at the factory.

Parameters Screen

The Parameters Screen is used to set timing and other factors related to how the SQ-30 interacts with markable products, the Photocell, Encoder, and other external factors.



Editable attributes include:

Line Speed:

Describes the speed (in meters/min) that the object to be marked is traveling on the conveyor. This should be set to "0" for static marking applications.

Marking Repetitions:

Sets the number of times per trigger that the SQ-30 should mark the object for each trigger from the sensor.

Laser Standby Frequency:

The output frequency of the laser in standby state. Generally, the manufacturer presets this, and the parameter does not need to be changed.

Laser Standby Power:

Sets the output power of the laser in standby state, so that the laser is as close to marking power as possible. Using this function keeps the system ready to mark right away when marking is turned on, rather than having a delay to ramp up to the power level needed to begin marking. If this number is set too high, the laser will mark even in standby state. If set too low, it will affect switch time. Therefore, the ideal setting should generally be the highest value possible without laser leakage (usually somewhere between 0.5% - 1.0%). To check for laser leakage, set a piece of marking test paper in the focal point and test it when marking. If it marks without marking turned on, laser leakage is occurring. Decrease the Laser Standby Power slightly and test again. Continue doing so until there is no longer any laser leakage.

Marking Delay:

Sets the delay time before marking starts after the trigger is received. The most common example would be the time between when the Photocell "sees" the product and when the product is marked.

Repeat Spacing:

The minimum amount of time between marks. Setting this value too high can result in the SQ-30 not marking some products as they pass by on the conveyor. Setting this value too low can result in some products being marked twice.

Auto Mark:

When enabled, this setting results in continuous marking without an external signal.

Marking Mode:

Determines whether the laser should mark objects in the order that they were input (based on "Object Number") or in the order that works best for marking. With rare exceptions, "Auto" should be selected to optimize marking speed and quality.

Swap X and Y Axis:

When selected, this setting causes text to rotate 90°.

X Direction:

Changes the X marking direction (left-to-right or right-to-left).

Y Direction:

Changes the Y marking direction (top-to-bottom or bottom-to-top).

Product Direction:

Describes the direction of conveyor movement (left-to-right or right-to-left) for different products. As the product passes beneath the Laser Head, the first part of the product should begin to be marked with the first part of the laser message, and then should continue to be marked as it passes through. To ensure that "Product Direction" is set correctly, test it using a long text object. For testing only, in the "Pen Parameter" section, temporarily reduce the Output Power and Drawing Speed for the text object's Pen Number. Place a piece of marking test paper in the laser's focal point (without the conveyor running), and press the "Mark" button on the Controller to print the characters in the text object one by one, sliding the paper slightly in the direction of the conveyor flow each time. If the text object is not printing "first come, first mark," select "Reversed" for the "Product Direction."

NOTE: Remember to reset the Output Power and Drawing Speed to their correct settings when done testing.

TRIG Mode:

Assigns which part of the signal from the Sensor/Photocell triggers marking. There are two possible options:

Falling Edge:

End of a Photocell signal triggers marking.

Rising Edge:

Beginning of a Photocell signal triggers marking.

External Encoder:

Sets how the SQ-30 should interact with an Encoder. There are two possible options:

Null:

Used for static marking or marking without an Encoder.

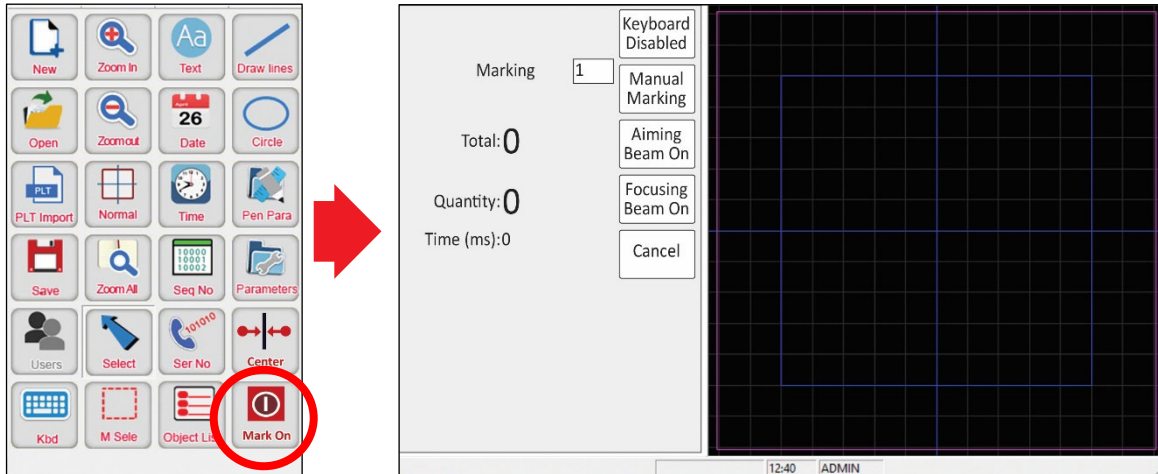
Isolated Input:

When using an Encoder, tells the SQ-30 that the signal is coming through the optical coupler (through Pin 2 of DE9 female). When the Encoder is enabled, the “Line Speed” setting (top of screen) becomes “Resolution” to indicate the physical distance between products on the conveyor as described by the Encoder.

NOTE: When setting up for using an Encoder, the message must be centered with the Encoder running at the desired line speed in order to obtain proper spacing.
--

Mark On Screen

The Mark On Screen provides access to commands related to marking and testing the system in preparation for marking.



Commands include:

Keyboard Disabled:

This button is the switch button for keyboard “locked” or “open,” allowing the user to lockout the keyboard to avoid someone touching it by mistake when marking is active.

Manual Marking:

Does a test mark using current parameters.

	WARNING: Laser Safety Eyewear must be worn during manual marking.
---	---

Aiming Beam On:

Shows the size and orientation of the marking area.

Focusing Beam On:

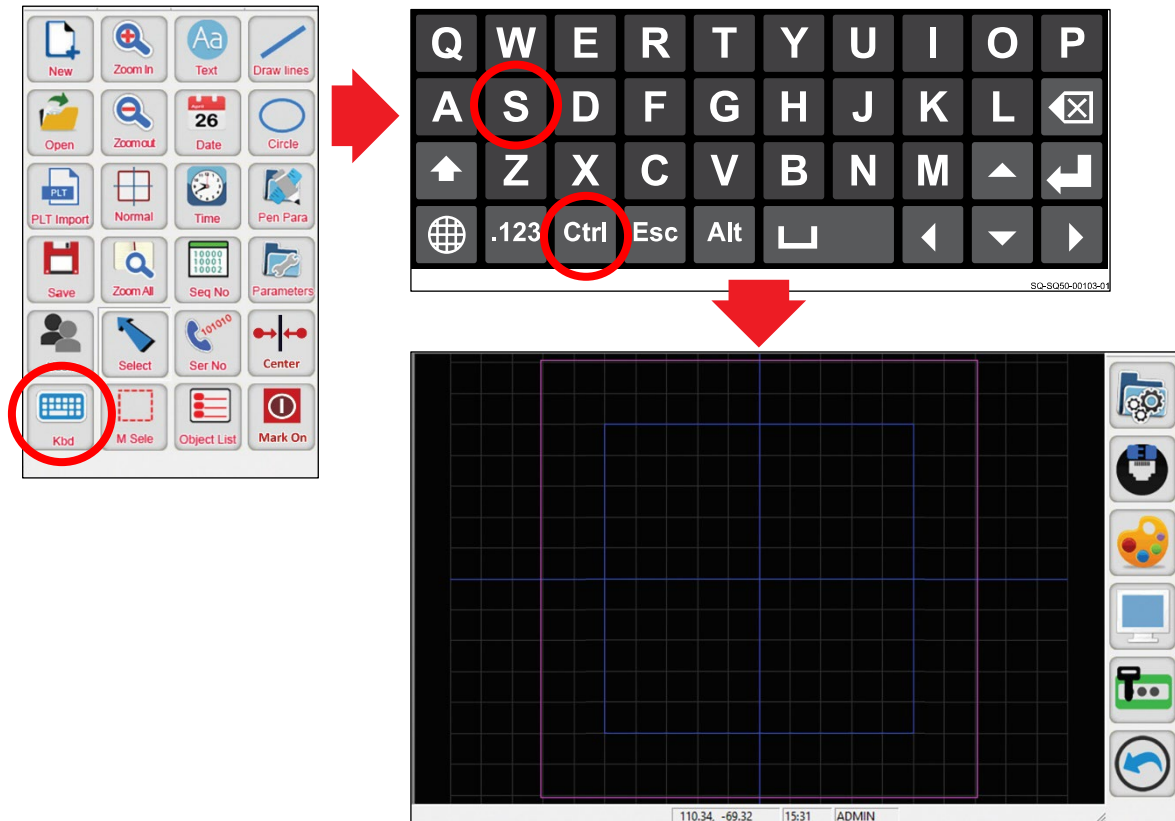
Turns on two beams – one producing a red line on the conveyor, and one producing a red dot on the conveyor. These are used to set the correct focal distance between the Laser Head and the markable products that will pass beneath it.

Cancel:

Closes marking mode.

System Parameters Submenu

The System Parameters Submenu is used to access screens that set how the software operates. It can be accessed from the Home Screen by selecting the “Keyboard” function and pressing “Ctrl” and “S.” A dialog box will appear showing the software version, hardware version and machine number. In the dialog box, select “OK” to access System Parameters.



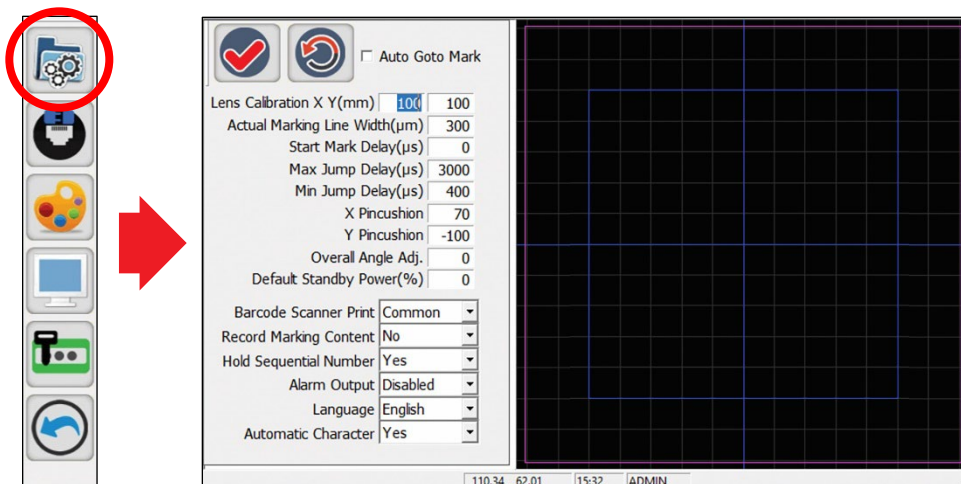
The System Parameters Submenu provides access to the following screens:

- Basic Parameters Screen
- Interface Parameters Screen
- Pen Color Screen
- Display Settings Screen
- Password Screen

These screens are each explained on the following pages. Selecting the “Back” button  from the “System Parameters Submenu” screen will result in the system rebooting. After reboot, any changes that were accepted on any of the five screens above by selecting the “Accept” button  will become active.

Basic Parameters Screen

The Basic Parameters Screen allows access to some of the FMark software parameter settings.



Editable settings include:

Auto Goto Mark:

Checking this box causes the SQ-30 to go directly into Marking Mode on startup.

Lens Calibration XY (mm):

Ensures that everything in the blue square on the screen marks properly. In general, this parameter has been set before shipment, so there is no need to reset it unless replacing the Laser Head and f-theta.

Actual Marking Line Width (μm):

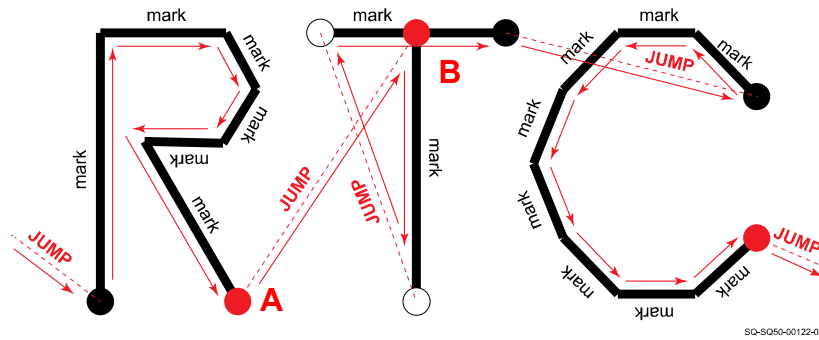
This does not set a marking line width. It controls the width of the marking area on the actual product.

Start Mark Delay (μs):

Adjusts the position of the start stroke of marking from the Galvanometer. Most of the time, of the first stroke of a message marking is not at the origin point. The operator must add a start delay here to adjust for this.

Max Jump Delay (μs):

The jump delay is the distance from the current stroke to the starting position of the next stroke divided by the jump speed, which is set in “Pen Parameters” (see “Pen Parameters Screen” section starting on page 93).



The maximum and minimum jump delay are determined by the moving performance of Galvanometers. When the set jump delay is longer than Max Jump Delay, the jump delay is set to be same as Max Jump Delay; when the set jump delay is shorter than Min Jump Delay, the jump delay is set to be same as Min Jump Delay.

For example:

In the diagram above, the laser reaches the end of a stroke (point A), and jumps to the beginning of a new stroke (point B) to continue marking. In the scenarios below, “V” is Jump Speed and “T” is Jump Delay. The Max Jump Delay (T_{max}) = 4ms, the Min Jump Delay (T_{min}) = 0.6ms.

- If Jump Speed $V = 6\text{mm/ms}$, then Jump Delay $T = S/V = 6/6\text{ms} = 1\text{ms}$
Therefore, $T_{min} < T < T_{max}$, so $T = 1\text{ms}$
- If Jump Speed $V = 1\text{mm/ms}$, then Jump Delay $T = S/V = 6/1\text{ms} = 6\text{ms}$
Therefore, $T > T_{max}$, so $T = T_{max} = 4\text{ms}$
- If Jump Speed $V = 12\text{mm/ms}$, then Jump Delay $T = S/V = 6/12\text{ms} = 0.5\text{ms}$
Therefore, $T < T_{min}$, so $T = T_{min} = 0.6\text{ms}$

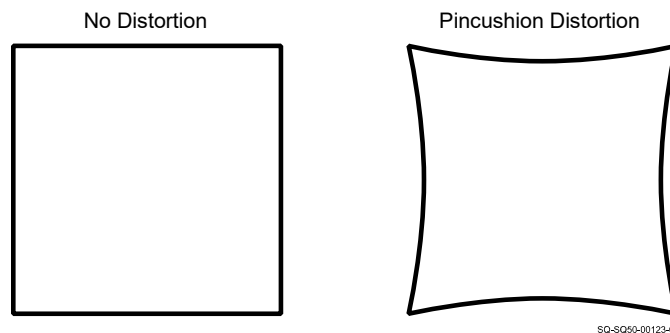
There is usually no need to adjust the Max Jump Delay or Min Jump Delay.

Min Jump Delay (μs):

Defines the minimum delay time from the end of one marking stroke to the beginning of the next stroke. See above explanation for Max Jump Delay. There is usually no need to adjust the Max Jump Delay or Min Jump Delay.

X Pincushion:

Used to prevent/correct for pincushion distortion in the X-axis direction.



Calibrating the Pincushion:

4. Using the FMark software, draw a square box with sides set to the value of the XY dimension of marking area (all four sides overlapping with the blue border frame).
5. Then do a test marking to see the effect.
6. If all four sides are straight lines, there's no need to do any adjustment.
7. If they are convex arcs, increase the value.
8. If they are concave arcs, decrease the value.

The correct X and Y Pincushion values have already been calibrated in the factory and there should be no need to change it.

Y Pincushion:

Used to prevent/correct for pincushion distortion in the Y-axis direction. See above explanation for X Pincushion.

Overall Angle Adj. (μ s):

When the X-axis and Y-axis of the Galvanometer are not in orthogonal (90°) position, this parameter needs to be modified. This is an unlikely scenario in most uses, and this setting should only be adjusted by an authorized technician.

Default Standby Power:

(%) of 0.3. Normally, the factory setting is acceptable. Setting it higher can help with high-speed marking. The laser will "leak beam" when not marking if this setting is too high.

Barcode Scanner Print:

Selects the Barcode Scanner Printing mode (Normal, Buffer, or Instant Printing).

Normal Mode:

In this mode, a single message is scanned in, and marking is triggered by an external sensor. The single message will be deleted after marking. If the scanned message is not marked before the next message scanned in, it will be directly overwritten by next scanned in message.

Buffer Mode:

In this mode, multiple scanned messages can be buffered and marking is triggered by external sensor.

Instant Print Mode:

The scanned message will be marked immediately, no external sensor is needed.

NOTE: Two consecutive marks of the same information are not allowed.

Record Marking Content:

The Record Marking Content setting is a function to record the serial numbers being

marked. The interface will have a “Record the Serial Number” button. When this button is selected, recording is activated, and the user is prompted to enter a name for the file in which the serial numbers are to be logged as they are marked. After confirmation, the system will begin marking the serial number recorded in the following format: (starting serial number is 00000011).

```
2012.08.25 10:22:21;00000011
2012.08.25 10:22:22;00000012
2012.08.25 10:22:23;00000013
2012.08.25 10:22:24;00000014
2012.08.25 10:22:25;00000015
2012.08.25 10:22:26;00000016
2012.08.25 10:40:40;00000017
2012.08.25 10:40:41;00000018
2012.08.25 10:40:41;00000019
2012.08.25 10:40:43;00000020
```

Hold Sequential Number:

Holds the position of the sequential number, so that if the power is cycled, the sequential number resumes where it left off, rather than restarting at the beginning.

Alarm Output:

Turning this function on causes an Enable Alarm button to appear on the marking screen. If the Enable Alarm button is pressed, the system will prompt to input the marking quantity. Once this value is entered, each marking will cause an internal counter to decrease by 1. When the counter reaches 0, the system exits marking state and sends a “Mark Completed” notification.

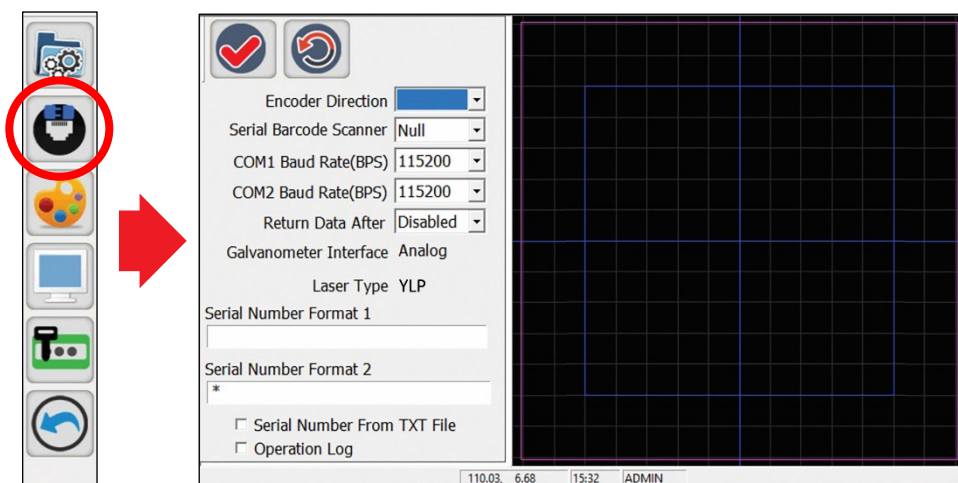
Language:

Selects the language of the system interface. Available options are:

- English
- 简体中文 (Simplified Chinese)
- 繁体中文 (Traditional Chinese)

Interface Parameters Screen

The “Interface Parameters” screen sets how the SQ-30 takes in external data.

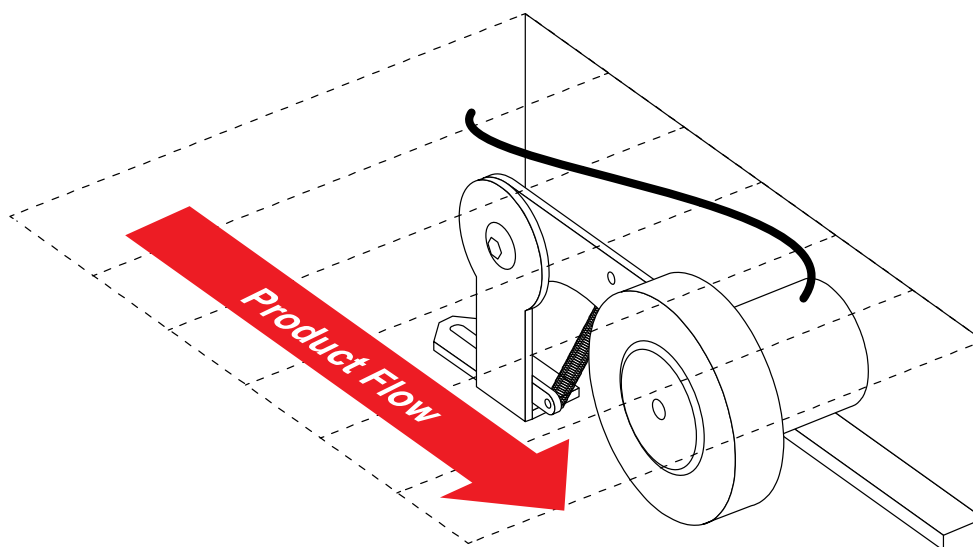


Editable settings include:

Encoder Direction:

Describes the direction that the conveyor is going while the Encoder sends near-instantaneous information to the SQ-30 about the distance that the conveyor has traveled. When the Encoder is connected, a counter will appear above this setting. If the counter is incrementing up, the “Encoder Direction” is programmed correctly relative to the direction that the Encoder Wheel is turning.

Encoder Direction



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Serial Barcode Scanner:

Describes the data coming in from a Barcode scanner using a RS232 connection. Three possible options are:

Null:

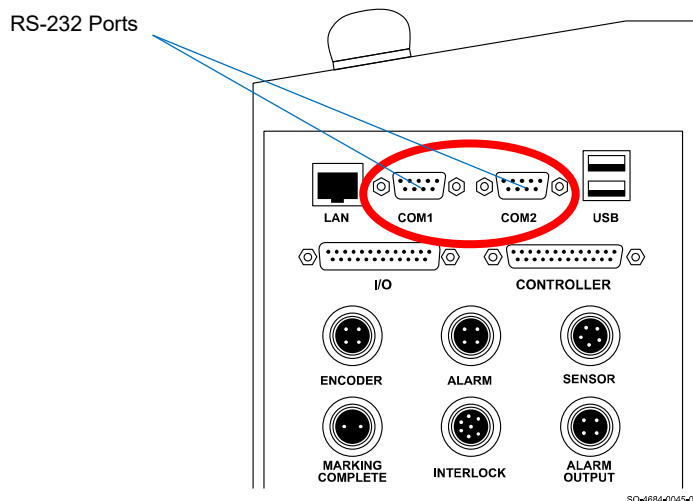
A Barcode Scanner is not connected.

COM 1:

A Barcode Scanner is connected to the COM 1 Port, which is equivalent to redirecting the keyboard to COM 1. Once in use, the COM 1 Port cannot be used for remote control or other data input.

COM 2:

A Barcode Scanner is connected to the COM 2 Port, which is equivalent to redirecting the keyboard to COM 2. Once in use, the COM 2 Port cannot be used for remote control or other data input.

RS232 Barcode Scanner Connections**COM 1 Baud Rate (BPS):**

Sets the serial connections speed for the Controller's COM 1 port. The value must match the speed of the connected peripheral.

COM 2 Baud Rate (BPS):

Sets the serial connections speed for the Controller's COM 2 port. The value must match the speed of the connected peripheral.

Return Data After Coding:

This is similar to "Record Marking Content," but instead of writing the serial number into a file, it sends out the marked data through a port defined by the first field.

Serial Number Format 1:

Defines the marking format of the serial number in the first line. A hash mark (#) represents one digit of the serial number data. One or more spaces can be added

between “#” to set the marking format. The number of “#”s must be the same as the total digits of serial number data. Otherwise, the marking format will be disordered. An asterisk (*) can be used to represent unlimited length.

Example:

Single line format:

8 characters in the first line, with 3 spaces between each 2 digits.

Serial Number Format 1
##
Serial Number Format 2

- In the image below, the total number of actual digits (7) is lower than the number of digits (8) in the setting.



- In the image below, the total number of actual digits (7) is lower than the number of digits (8) in the setting.



- In the image below, the total number of actual digits (9) is higher than the number of digits (8) in the setting. The extra digit is moved down to the next line.



Serial Number Format 2:

Defines the marking format of the serial number in the second line. See Serial Number Format 1 above for further explanation. The example below shows application of proper formatting to a double line serial number.

Example:

Double line format:

8 characters in the first line, add three spaces between each 2 characters

4 characters in second line, add one space between each 2 characters

Serial Number Format 1
##
Serial Number Format 2
#

- The image below shows the total number of digits displaying correctly as assigned in the setting.

**Serial Number From TXT File:**

Tells the SQ-30 to read the serial number(s) from a .txt (Windows) file. This file could be transmitted to the SQ-30 through the LAN port or one of the USB ports.

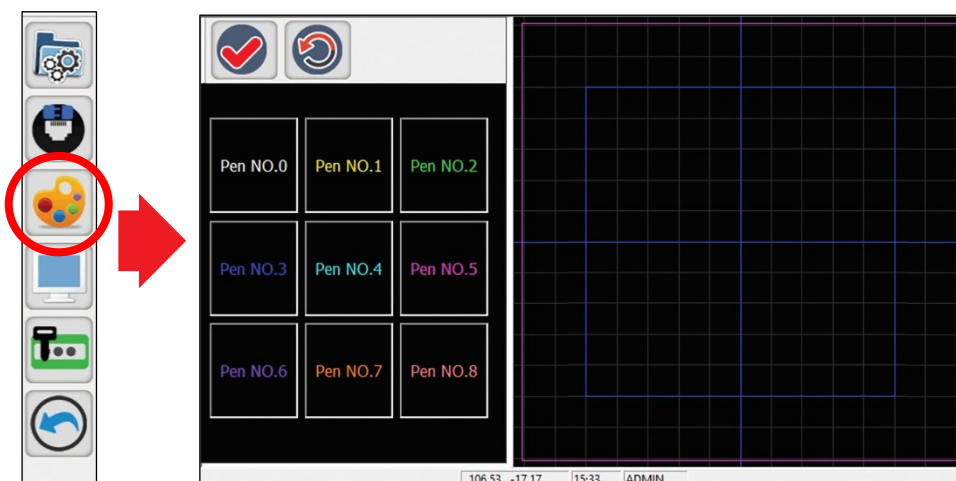
Operation Log:

The SQ-30 tracks and logs the data that it has marked on a product. The Operation Log is the file where this is logged.

Pen Color Screen

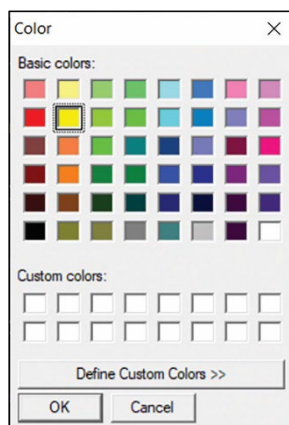
The Pen Color screen allows the user to easily differentiate between different pens.

In the FMark software, “pens” do not describe the color of the marking, but rather the quality and intensity of the marking. For example, one pen can be created to produce a bold, heavy mark, another pen can be created to produce a faint mark with a “dot matrix” appearance, and both of these pens can be used in a single marking file.



Pens are created in the “Pen Parameters” screen (see “Pen Parameters Screen” on page 93). Each new pen is created by assigning a new pen number and then choosing the characteristics for that pen using the features on the “Pen Parameters” screen.

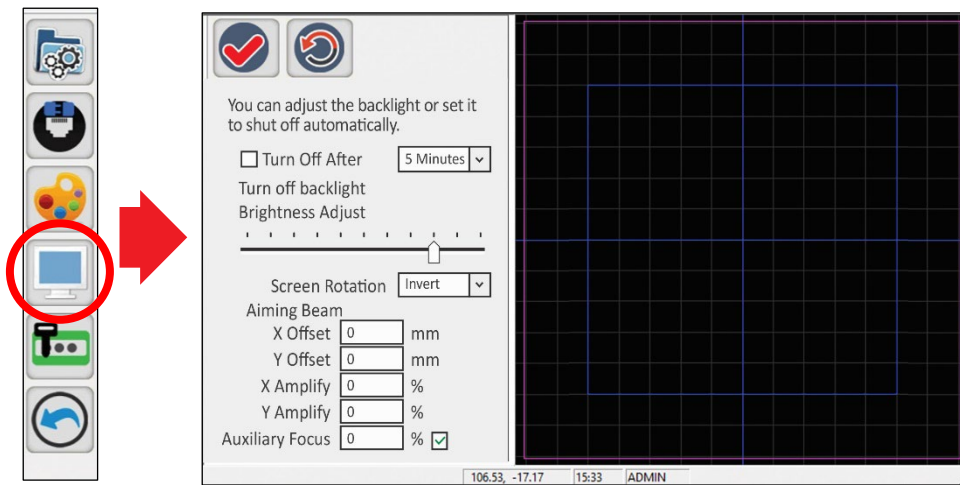
Once the pens have been created, the color that they will display on the Touchscreen can be changed in the “Pen Color” screen. Selecting any of the nine possible pens opens a window from which to select that pen’s desired display color. Custom colors can also be created using a color wheel by selecting “Define Custom Colors.” Once a color in the “Basic Colors” or “Custom Colors” has been selected, clicking “OK” will assign that color to the pen.



By assigning different pen colors, the user can easily tell what marking characteristics each element in a marking file will have simply by looking at that element on the Touchscreen.

Display Settings Screen

Offers access to adjust the display on the top of the Controller.



Editable settings include:

Turn Off After:

Sets an amount of idle time after which the SQ-30 should go into “Sleep” mode.

Brightness Adjust:

Adjusts the brightness of the screen by moving the slider.

Screen Rotation:

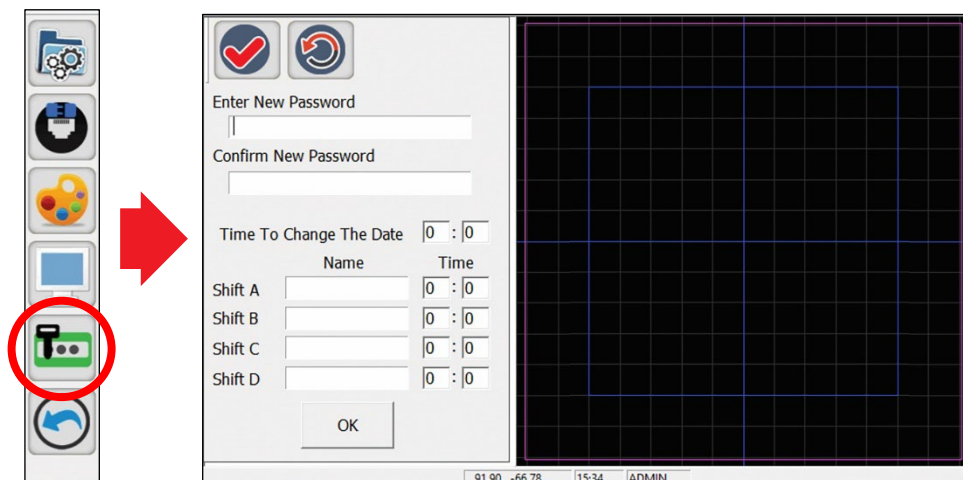
Rotates the orientation of the content on the screen (for example, if accessing the screen from the other side of the Controller is desired).

Aiming Beam:

All settings below this point relate to the laser guides for the Aiming Beam and Focusing Beam. The values are factory-set calibration settings and should not be changed.

Password Screen

Allows a password to be set to limit access to the System Parameters Submenu and the Parameters field. Also allows the assigning of shift information for up to four work shifts.



To Set a Password:

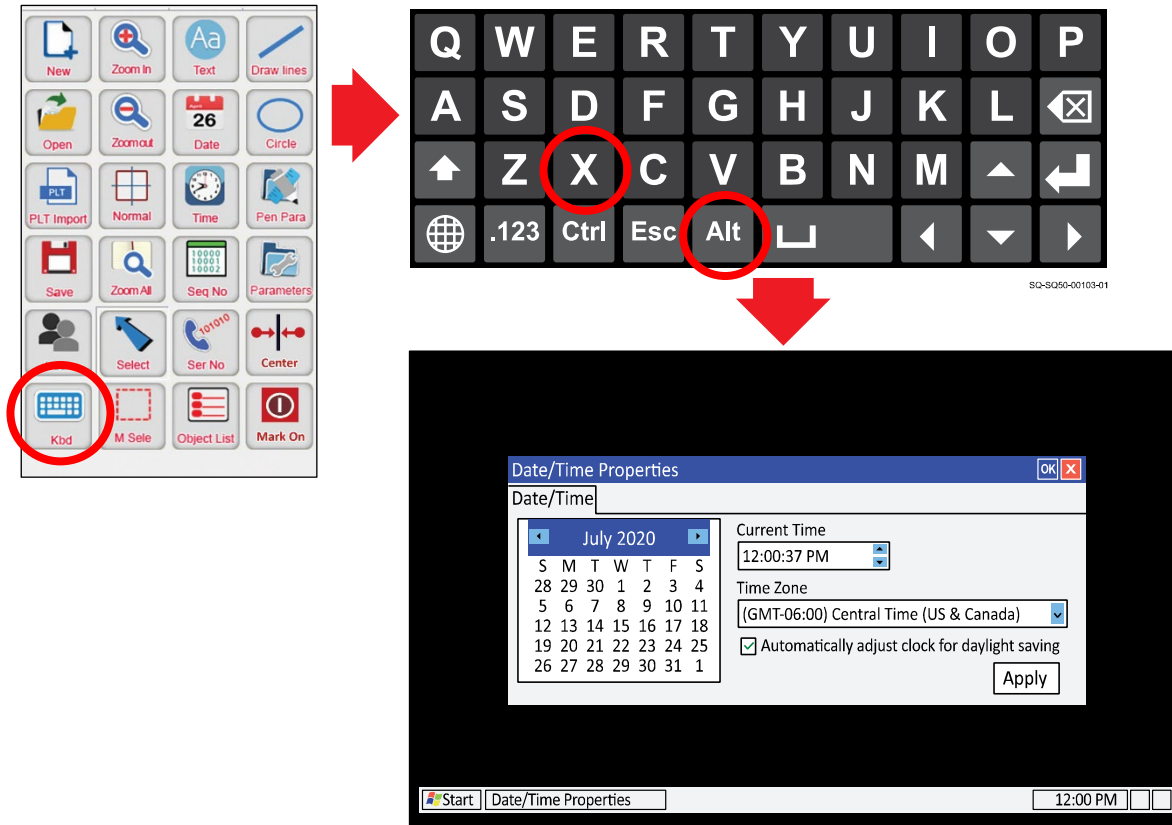
1. Use the keyboard to enter the desired password in the “Enter New Password” box.
2. Enter the same password in the “Confirm Password” box.
3. Select the “Accept” button. 

To Assign Shift Information:

1. Use the keyboard to enter names for up to four work shifts.
2. Enter the start times for each shift.
3. Select the “Accept” button. 

Time and Date Submenu

If the SQ-30's internal clock or calendar is not accurate, or if the machine has been moved to a different time zone, the Time and Date screen can be used to input the correct information. To access the Time and Date screen, select the keyboard and press "Alt" and "x."



A Windows interface displays on the Touchscreen. To change the date and time, select the time in the lower right corner. A "Date/Time Properties" dialog box will appear. Change the date and time to the correct information and select "Apply."

To exit the Windows interface and return to the FMark software, select "Start" in the lower left corner. In the dialog box that appears, select "Programs" and then select "Mark."

Operation

Startup

To power on the SQ-30, do the following:

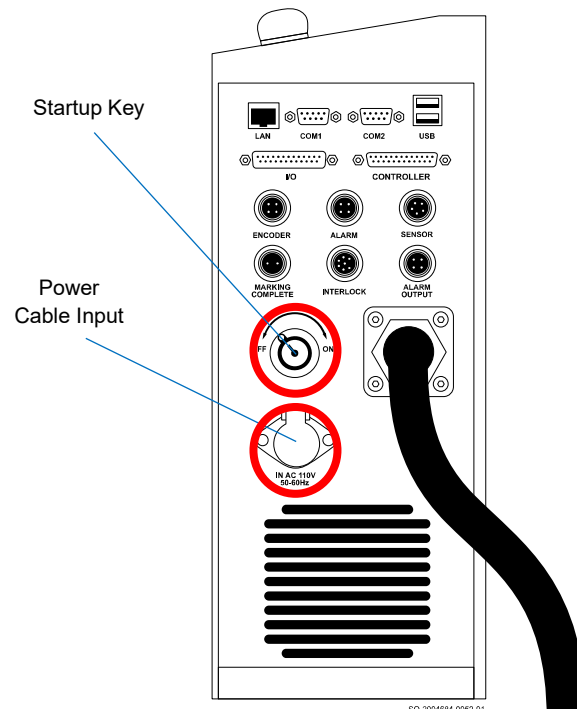
Ensure that all safety precautions are in place, including that the Protective Cover is closed and properly mounted, the Safety Interlock System is properly connected, and all people in the area are wearing laser safety eyewear (see “Safety” section, starting on page 11).

1. Ensure that the red Emergency Beam Stop button on the top of the Controller is in the “up” position. If not, turn it slightly clockwise and it should pop up.
2. Plug the Power Cord (included) into the Power port and ensure that the other end is connected to a properly grounded standard electrical outlet.



CAUTION: Do not attempt to use any power cable other than the one supplied specifically for this machine by Squid Ink. Doing so can cause a safety hazard, damage the equipment, and void the warranty.

Powering the System On



3. Insert the Startup Key in the Safety Lock, and turn the key clockwise to the “ON” position.

NOTE: Once the system has been powered on, the Alarm Beacon may sound.

Creating a New Marking Message/Template

To create a new marking message/template using the FMark software, do the following:

1. Select “New” to open a new template.



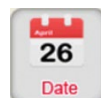
2. Depending on the desired message, add the appropriate objects to the template.
Possible marking message objects include:



**PLT Import
Object**



Text Object



Date Object



Time Object



**Sequence
Number**



Serial Number



Line



Circle

For further information on each of these objects, review the “Touchscreen Buttons” section, starting on page [73](#).

3. To adjust each marking object, review the section on “Screens,” located on the following pages of this manual:
 - a. **PLT Import Screen:** page [80](#).
 - b. **Text Screen:** page [82](#).
 - c. **Date Screen:** page [87](#).
 - d. **Time Screen:** page [88](#).
 - e. **Sequence Number Screen:** page [89](#).
 - f. **Serial Number Screen:** page [91](#).

Testing

Before printing, testing should be done to ensure the optimal distance between the Laser Head and the passing product.

Items Needed to Perform Testing:

- Product sample(s)

To Perform Testing:

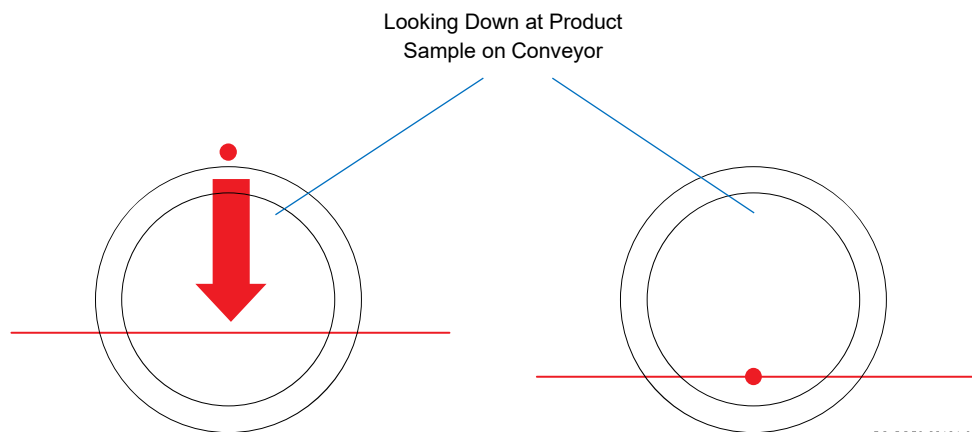
Ensure that all safety precautions are in place, including that the Protective Cover is closed and properly mounted, the Safety Interlock System is properly connected, and all people in the area are wearing laser safety eyewear (see “Safety” section, starting on page 11).

1. Place a product on the product path on the (stopped) conveyor directly below the Laser Lens.
2. Be sure that the system is plugged in and has been powered on.
3. On the Touchscreen, select the “Mark On” button.



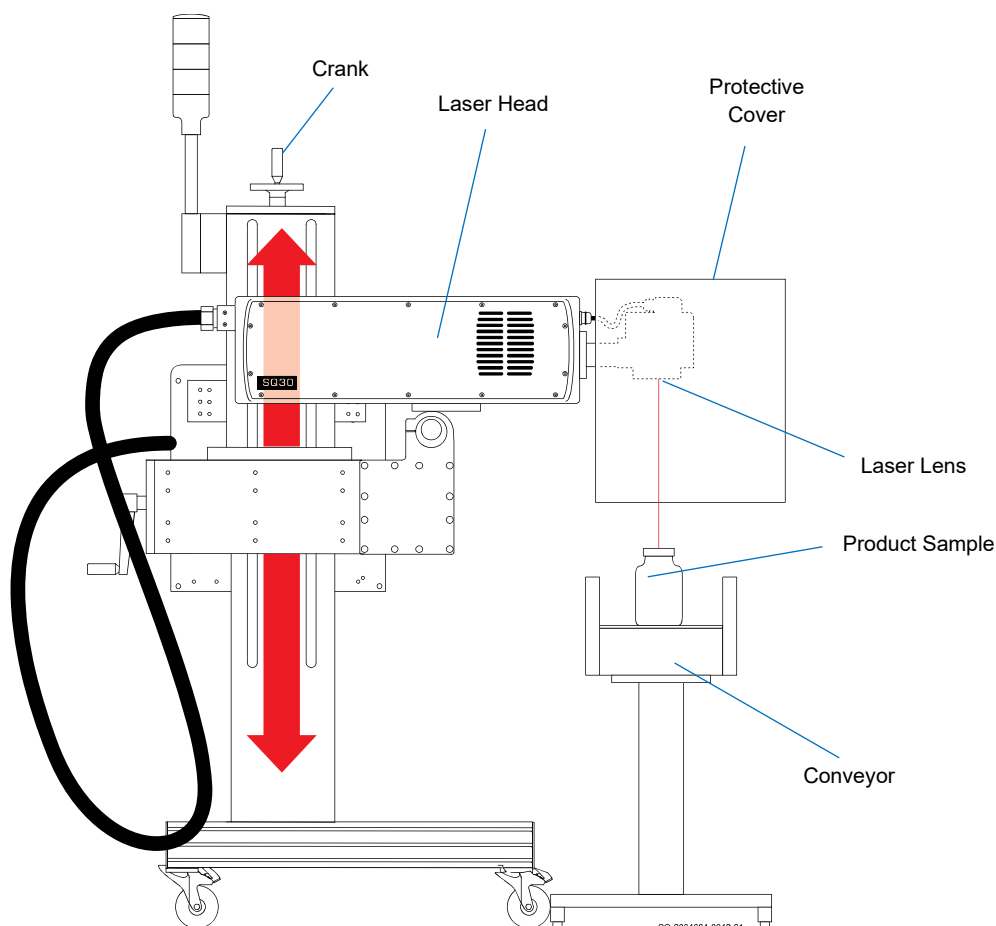
4. On the “Mark On” screen, select “Focusing Beam On.” Directly below the Laser Head Lens, two laser guides will appear – a red dot and a red line. These are for adjusting the distance of the Laser Head from the markable surface of the product.
5. Using the Crank on the top of the Stand, adjust the vertical position of the Laser Head until the red dot is directly on the red line on the surface of the product to be marked. The Laser Head is not at the correct distance for proper focusing of the marking beam.

Focusing Beam: Using the Laser Guides



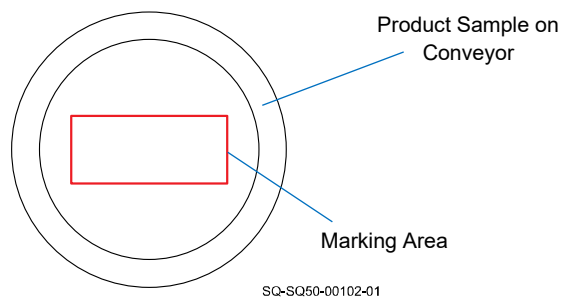
SO-SQ50-00101-02

Adjusting the Height of the Laser Head



6. Turn the focusing beam off by selecting “Focusing Beam.”
7. On the “Mark On” screen, select “Aiming Beam On.” Directly below the Laser Head, a red rectangular laser guide will appear. This indicates the area where marking will occur as all products on the conveyor pass by. If the marking area is too large or too small, make adjustments to the marking file in FMark and test again.

Aiming Beam: Marking Area



8. Turn the aiming beam off by selecting “Aiming Beam.”

9. If needed, adjust the “Line Speed” or “Encoder Resolution” on the “Parameters” screen (see “Parameters Screen” on page 95) to ensure proper product flow and timing.
10. If needed, adjust the “Output Power,” “Draw Speed,” and “Pulse Repetition Rate” on the “Pen Parameters” screen (see “Pen Parameters Screen” on page 93) to adjust the intensity and quality of marking to preference.
11. If desired, test mark the product on the conveyor by selecting “Manual Marking” on the “Mark On” screen (see “Mark On Screen” on page 98).



WARNING: When the SQ-30 is in marking mode, the laser is operating at a frequency that is invisible to the human eye. Not seeing the beam does not mean that the beam is not there or that it cannot cause damage.



WARNING: Laser Safety Eyewear must be worn during manual marking.

12. Adjust settings on the Pen Parameters screen and the Parameters screen as needed to achieve the desired marking speed, intensity, and quality.

Marking

When all appropriate setup and testing has been done, and all present are wearing proper personal protective equipment, marking can begin.



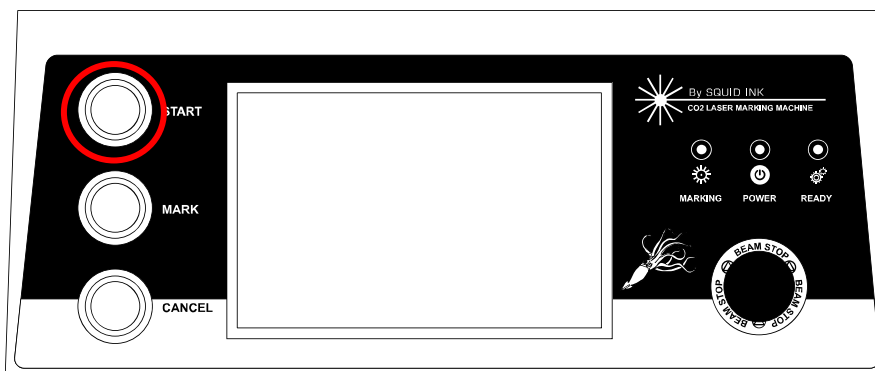
WARNING: When the SQ-30 is in marking mode, the laser is operating at a frequency that is invisible to the human eye. Not seeing the beam does not mean that the beam is not there or that it cannot cause damage.



WARNING: Laser Safety Eyewear must be worn during manual marking.

To Begin Marking:

1. Confirm that all safety precautions are in place, including that the Protective Cover is closed and properly mounted, the Safety Interlock System is properly connected, and all people in the area are wearing laser safety eyewear (see “Safety” section, starting on page 11).
2. Ensure that the Photocell, Encoder, or other triggering device is properly connected and all timing setup has been performed (see “Parameters Screen” on page 95).
3. Start the conveyor.
4. Press the “Start” button on the top of the Controller. The Alarm Beacon should be illuminated green, indicating that the system is ready for marking. It will now mark products according to input from the triggering device.



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5. To stop marking, press the “Cancel” button on the top of the Controller.

Maintenance

The SQ-30 is designed to be relatively maintenance-free. Additionally, because of the sensitivity and risk involved in working with Class IV lasers, virtually all maintenance on the SQ-30 system should be performed by a qualified and certified laser technician. The only maintenance that can be performed by non-certified laser technicians is simply cleaning the lens.



WARNING: Do not attempt to perform maintenance on the SQ-30 beyond what is described in this User Guide. If in doubt, contact your authorized Squid Ink distributor. Failure to do so can result in injury, can damage the equipment, and will void the warranty

Cleaning the Lens

The lens can become damaged, and if that is the case cleaning is not the appropriate remedy: the system needs to be serviced by a qualified and certified laser technician. Potential lens damage that would require service rather than cleaning are:

- Scratching
- Scraping
- Scuffing
- Etching
- Chemical damage

A variety of issues can result in the lens simply requiring cleaning. Most commonly, particulates that are released by marked substrates during the marking process can spatter or evaporate and contaminate the lens. This can adversely affect marking, and can eventually lead to a hazardous situation.

A solvent must be used when cleaning the lens. Because the cause of lens contamination will vary by customer and by substrate being marked, the choice of solvent will also vary. A real-world analogy is presented by Laser Beam Products of England:

“Rock salt is obviously easily dissolved into water, but no matter how many gallons of water were used, no one would expect it to dissolve even a fleck of tar. However, a drop of paraffin results in complete removal of tar. This shows how successful the approach is of knowing the properties of the contamination, and then choosing the appropriate solvent. The only restrictions in choosing a solvent are, avoiding chemical damage to the optic and its coating, and Health and Safety guidelines.”

To restate this point, the correct solvent for cleaning the lens should:

- Completely remove the contaminant
- Not damage or leave a film on the lens
- Not ignite if residue is exposed to the laser
- Be compliant with all federal Health and Safety guidelines

Only the outside of the lens should be cleaned. Do not attempt to clean parts of the lens that are within the Laser Head.



CAUTION: Any attempt to access parts inside the Laser Head can result in injury, can damage the equipment, and will void the warranty

The solvent should be applied and removed using the correct wipe, whose criteria should include:

- Non-abrasive to the lens surface (wipes of pure cotton wool fit this criteria)
- Clean and free from all particles (fresh wipes should therefore be stored in a sealed bag)
- At least as large as the lens diameter
- Made of material that will not chemically react with the lens (wipes of pure cotton wool fit this criteria)
- Made of material that will not chemically react with the solvent or contaminant

Squid Ink offers a Cleaning Kit (Part Number 2004615) that contains some of the items typically needed for cleaning the lens of the SQ-30. The Cleaning Kit includes:

- Isopropyl Alcohol, reagent grade: .25 oz bottle
- Acetone, reagent grade: .25 oz bottle
- Lens Paper Booklet: 50 sheets
- Cotton-Tipped Swab Pack, lint-free: 24
- Finger Cot Pack, large, powder-free: 24
- Optics Cleaning Instruction Booklet



Items Needed to Clean the Lens on the Laser Head:

- “Canned Air” Sprayer
- Appropriate Solvent (see above)
- Appropriate Wipes (see above)

To Clean the Lens:

1. Be sure that the SQ-30 is powered off and is unplugged from any power supply.



WARNING: Failure to have the SQ-30 turned off and unplugged while cleaning the lens can result in serious injury.

2. Remove any loose dust from the lens by blowing “canned air” at it. Be sure to spray around the rim of the lens as well to remove any particulates that may be caught in crevices.



ATTENTION: Do not use breath or use air from a compressor to blow on the lens. Both of these actions can further contaminate the lens.

3. Wet the swab with a moderate amount of solvent.
4. Gently and slowly drag the swab across the lens under its own weight ONLY, allowing the leading edge to dissolve the lens contaminants, and allowing the trailing part of the swab to soak up the dissolved contaminants.
5. Repeat this several times, using a fresh wipe each time so that dissolved solvents are not repeatedly dragged back across the lens.
6. On the last wipe, use slightly less solvent so that all solvent on the lens is ultimately removed, rather than being allowed to dry onto the lens.
7. Check that the lens is free of stains and marks. If any imperfections are still visible, continue wiping with a fresh wipe with solvent.

Changing the Fume Extraction Filter

The fumes from the laser processing of PVC usually contain solid polymeric particles and droplets of hydrochloric acid, together with droplets of oil-like substances used to make the PVC more flexible (plasticizers such as Dioctyl Phthalate).

When the SQ-LFX-PVC system extracts these fumes, it becomes contaminated with the hydrochloric acid droplets, and the plasticizers which appear often as a clear viscous liquid. Most of the contaminated particles and droplets are collected in the pre-filter bag and it is this filter which is changed most frequently.

Health risks associated with changing filters:

Action	Health Risk	Risk Level
Removing spent filter bag and packing for disposal	Hand skin contamination/sensitization	High
	Eye contamination from ejection of particles/droplets from the filter inlet	Moderate
	Breathing in particles/droplets	Low
Removing and replacing spent combined filter for disposal	Hand skin contamination/sensitization	High
	Eye contamination from ejection of particles/droplets from the filter inlet	Moderate
	Breathing in particles/droplets	Low
	Dropping Filter on feet	Moderate

Items Needed to Change the Fume Extraction Filter:

- Safety Glasses
- Safety (steel toe capped) shoes/boots
- Safety Gloves
- Face shields
- Overalls with long sleeves to prevent contact with arms

To Change the Fume Extraction Filter:

Carefully follow all instructions included with the Fume Extraction System.

Troubleshooting

Because of the sensitivity of precision laser equipment and the risks associated with Class IV lasers, troubleshooting for the SQ-30 is limited to the following.



CAUTION: Do not attempt to perform troubleshooting on the SQ-30 beyond what is described in this User Guide. If in doubt, contact your authorized Squid Ink distributor. Failure to do so can result in injury, can damage the equipment, and will void the warranty

Problem	Possible Cause	Solution
Marking is not occurring in the right place on the product, or is missing the product entirely.	Improperly installed conveyor guides.	Correctly install conveyor guides.
	Incorrect marking setup.	Redo setup (see “Testing” on page 115).
Marking is too faint.	Incorrect “Pen Parameters” settings.	Increase “Output Power,” decrease “Draw Speed,” and/or increase “Pulse Repetition Rate.” (see “Pen Parameters Screen” on page 93). Make the changes in small increments and test until desired results are achieved (see “(see “Testing” on page 115).
	Lens is contaminated.	Clean the Lens (see “Cleaning the Lens” on page 119).
Marking is too bold and/or product is being damaged by the intensity of the laser.	Incorrect “Pen Parameters” settings.	Decrease “Output Power,” increase “Draw Speed,” and/or decrease “Pulse Repetition Rate.” (see “Pen Parameters Screen” on page 93). Make large changes at first to get more reasonable settings, and test until desired results are achieved, using incremental changes (see “Testing” on page 115).
Marking skips or is inconsistent.	Electrical line noise.	Install a good quality line conditioner.
Marking is distorted.	Lens is contaminated.	Clean the Lens (see “Cleaning the Lens” on page 119).

Parts List

Part Number	Description
2004605	Stand (see page 29)
2004611	Laser Protective Eyewear (1 pair) (see page 32)
2004615	Lens Cleaning Kit
2004617	Safety Interlock Cable (see page 21)
Varies. Contact your authorized Squid Ink distributor for guidance.	Photocell
2004630	Encoder (see page 31)
2004670	SQ-LFX Fume Extraction System (see page 32)
2004671	SQ-LFX-PVC Fume Extraction System (for marking PVC) (see page 32)
2004672	Fume Extractor Interfacing Cable
2004673	Pre-Filter for the SQ-LFX Fume Extraction System (Purex 9000-300i)
2004674	Main Filter for the SQ-LFX Fume Extraction System (Purex 9000-300i)
2004676	Pre-Filter for the SQ-LFX-PVC Fume Extraction System (Purex 9000-400i PVC)
2004677	Chemical Pad Filter (Purex 9000-400i PVC)
2004678	Main Filter for the SQ-LFX-PVC Fume Extraction System (Purex 9000-400i PVC)

Squid Ink Laser Product Warranty

Warranty Statement

Squid Ink Manufacturing, Inc. warrants that all of the Laser printer products it ships will be in good working order and free from defects in material and workmanship and will conform to the published specifications for that product.

Warranty Period

For hardware and software products, the warranty period is 12 months from the date of shipment from Squid Ink.

Repairs

All repairs are rigorously tested for optimum operation and print performance and warranted to be, under normal and proper use, free from defects in material and workmanship for a period of 90 days from the date of service.

Print Quality

Print quality achieved in a given application is dependent on the installation, the material handling, and the maintenance provided. Squid Ink makes no warranty that the print quality achieved in an application will be the same as that achieved during a printer demonstration or on a test piece in our print laboratory.

Shipping Policy

Customer pays all incoming shipping charges. If the item is defective and under warranty, Squid Ink will pay all return shipping charges via the least costly method. If expedited shipping is desired, the customer must furnish their shipping account number and shipping fees will be charged to that account.

Exclusions

Damage due to tampering, abuse, improper adjustment, electrical interference, or the use of non-approved components will void any and all warranties by Squid Ink and its distributors.

Warranty Procedures

If you believe that a product may be defective and may be covered by warranty, please call your local Squid Ink distributor. Your local distributor will provide support and information regarding warranty claims.

Warranty Eligibility

The warranty provided by Squid Ink Manufacturing, Inc. is only to the original buyer.

Limited Warranty

THE ABOVE WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT.

Disclaimer of Damages

REGARDLESS OF WHETHER ANY REMEDY SET FORTH HEREIN FAILS OF ITS ESSENTIAL PURPOSE, IN NO EVENT WILL SQUID INK MANUFACTURING, INC. BE LIABLE FOR ANY SPECIAL, CONSEQUENTIAL, INDIRECT OR SIMILAR DAMAGES, INCLUDING LOST PROFIT OR LOST OPPORTUNITIES OF ANY TYPE ARISING OUT OF THE USE OR INABILITY TO USE THESE PRODUCTS EVEN IF SQUID INK MANUFACTURING, INC. HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Technical Support

For help installing, operating, and maintaining the SQ-30 CO₂ Laser Marking System, contact your authorized Squid Ink reseller or Squid Ink Technical Support.

Toll-Free Phone: 800-877-5658

Phone: 763-795-8856

Fax: 763-795-8867

Email: info@squidInk.com

www.squidInk.com

Thank you for your purchase of Squid Ink products. We are pleased to be a part of your marking and coding needs.

