AREX™ 400

PRODUCT REFERENCE GUIDE

InfraRed Fiber Laser Marker

DATALOGIC

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This manual refers only to Arex™ 400 models running Windows 10 operating system (XXX-XX5).

ORIGINAL INSTRUCTIONS (ref. 2006/42/EC)

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PREFACE

ABOUT THIS MANUAL

This User Manual (UM) is provided for users seeking advanced technical information, including connection, programming, maintenance and specifications. The Quick Reference Guide (QRG) and other publications associated with this product can be downloaded free of charge from the website listed on the back cover of this manual.

Manual Conventions

The symbols listed below are used in this manual to notify the reader of key issues or procedures that must be observed when using the laser marker:

NOTE: Notes contain information necessary for properly diagnosing, repairing and operating the laser marker.

CAUTION: This symbol advises you of actions that could damage equipment or property.

WARNING: This symbol advises you of actions that could result in harm or injury to the person performing the task.

TECHNICAL SUPPORT

Support Through the Website

Datalogic provides several services as well as technical support through its website. Log on to (www.datalogic.com).

For quick access, from the home page click on the search icon, and type in the name of the product you're looking for. This allows you access to download Data Sheets, Manuals, Software & Utilities, and Drawings.

Hover over the Support & Service menu for access to Services and Technical Support.

WARRANTY

Datalogic warrants that the Products shall be free from defects in materials and workmanship under normal and proper use during the Warranty Period. Products are sold on the basis of specifications applicable at the time of manufacture and Datalogic has no obligation to modify or update Products once sold. The Warranty Period shall be **two years** from the date of shipment by Datalogic, unless otherwise agreed in an applicable writing by Datalogic.

Datalogic will not be liable under the warranty if the Product has been exposed or subjected to any: (1) maintenance, repair, installation, handling, packaging, transportation, storage, operation or use that is improper or otherwise not in compliance with Datalogic's instruction; (2) Product alteration, modification or repair by anyone other than Datalogic or those specifically authorized by Datalogic; (3) accident, contamination, foreign object damage, abuse, neglect or negligence after shipment to Buyer; (4) damage caused by failure of a Datalogic-supplied product not under warranty or by any hardware or software not supplied by Datalogic; (5)any device on which the warranty void seal has been altered, tampered with, or is missing; (6) any defect or damage caused by natural or man-made disaster such as but not limited to fire, water damage, floods, other natural disasters, vandalism or abusive events that would cause internal and external component damage or destruction of the whole unit, consumable items; (7) use of counterfeit or replacement parts that are neither manufactured nor approved by Datalogic for use in Datalogic-manufactured Products; (8) any damage or malfunctioning caused by non-restoring action as for example firmware or software upgrades, software or hardware reconfigurations etc.; (9) loss of data; (10) any consumable or equivalent (e.g. cables, power supply, batteries, etc.); or (11) any device on which the serial number is missing or not recognizable.

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CHAPTER 1
INTRODUCTION

GENERAL

Information included in this manual is intended for a qualified installer able to integrate the laser marker into a system, complying with all the protection features required by international rules and local legislations. Refer to the following sections for further information.

This manual refers to Arex™ 400 Fiber laser markers, that is a Class 4 Laser Product.

In addition to being professionally trained in their role, personnel assigned to work with laser marker must be informed and made acquainted with the risks inherent to invisible and visible laser radiation. The operator is required to carefully read the section of the manual concerning safety instructions as well as the sections related to matters falling under her/his responsibility.

NOTE: Datalogic shall not be held responsible for any non-conforming use of laser marker of its manufacture.

CAUTION: BEFORE INSTALLING AND USING THE LASER MARKER, CAREFULLY READ THIS MANUAL.

MODEL DESCRIPTION

Arex™ 400 laser markers are described by their model number which indicates the characteristics listed in the diagram below. Not all combinations are available. For a complete list of combinations see the Models tab on the Product page of the website.

AREX XXX-XXX

Laser Type	Power	F-Theta scan lens	Version	Operating System
1 = Pulsed Fiber	10 = 10W	3 = 160 S	6 = PRO	5= Windows® 10
A = Fiber MOPA	20 = 20W	4 = 160L		
	30 = 30W	6 = 254 S		
	50 = 50W	7 = 254 L		
		9 = 100 L		
		A = 330 L		
		B = 420 L		

COMPLIANCE

European Declaration of Conformity

Hereby, Datalogic S.r.l. declares that the full text of the European Declaration of Conformity is available at: www.datalogic.com. Select the link from the downloads section of the product page.

UKCA Declaration of Conformity

Hereby, Datalogic S.r.l. declares that the full text of the UKCA Declaration of Conformity is available at: www.datalogic.com. Select the link from the downloads section of the product page.

FCC Compliance

Modifications or changes to this equipment without the expressed written approval of Datalogic could void the permission to use the equipment.

This laser marker complies with PART 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this laser marker may not cause harmful interference, and (2) this laser marker must accept any interference received, including interference which may cause undesired operation.

This laser marker has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This laser marker generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this laser marker in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

EAC Compliance

Customs Union: this laser marker complies with CU Conformity certification; this allows the Product to bear the Eurasian Mark of conformity.

UL Compliance

Reading this manual prevents the operator from carrying out operations that could cause damage to himself or others.

CERTIFICATE OF COMPLIANCE

Certificate Number	UL-US-L499316-111-20509102-1
Report Reference	E499316-20190502
Date	12-Oct-2021
Issued to:	Datalogic S.r.l. Via San Vitalino 13 Calderara Di Reno, BO Italy 40012
This is to certify that representative samples of	PGBE - Marking and Coding Equipment, Electronic See Addendum Page for Product Designation(s).
	Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL 2178, 2nd Ed., Issue Date: 2020-04-10
Additional Information:	See the UL Online Certifications Directory at https://iq.ulprospector.com for additional information

This Certificate of Compliance does not provide authorization to apply the UL Mark. Only the UL Follow-Up Services Procedure provides authorization to apply the UL Mark.

Only those products bearing the UL Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

Follow-Up Service Procedure issued on 2019-03-26.

LASER STANDARDS

This laser marker is classified as Class 4 Laser Product according to the following:

EU: EN60825-1

USA: 21 CFR 1040.10

China: GB7247-1

Datalogic, as manufacturer of laser products, provides a laser marker which is NOT intended for immediate use, but it must be connected, by others, to other devices which have the final aim of creating a laser processing system.

The final system manufacturer MUST ensure the safety of the laser processing machine according to its standards including the risk-analysis, implementation of safety measures, certification and testing of safety measures and the production of adequate information for use of the machine.

Datalogic is available for providing to the customers all the information in its possession to help in complying with applicable standards.

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

OVERVIEW

The Fiber laser marker developed and manufactured by Datalogic employs the most advanced technologies with regards to the opto-mechanical parts, the electronic control of laser beam power, communication and the overall safety of the entire marker.

The Arex™ 400 laser marker features a control rack and a scan head. The control rack size is standard 19" 2.5U. The scan head compact dimensions make it easy to integrate.

All product connections are on the rear or front of the control rack.

Laser Source

On Arex™ 400 laser marker it is used a sealed fiber laser source. This source is based on the new fiber solid state technology. It guaranties high stability, lower sensitivity to optical misalignment and a longer product lifetime.

Galvanometric scan head

The scan head features two deflection mirrors that deflect the beam in X and Y directions, depending on the graphics/pattern to be reproduced.

Operation of a laser marker with galvanometric scanning

During the marking the laser generates an invisible, high-energy infrared beam.

In order to obtain a more accurate focus, the laser beam is first enlarged using an optical expansion system and then deflected by a scanning system consisting of two mirrors mounted on galvanometric motors.

These mirrors deflect the beam in a controlled path along the X and Y axes; processing of the product surface occurs by coordinating the movement of the two mirrors and the turning on/off of the laser beam.

The deflected laser beam is focused by an F-Theta scan lens on the surface of the product.

Generally speaking, the marking is carried out within the focus plane of the F-Theta scan lens.

Marking Software

The Lighter™ marking software is preinstalled on the product.

NOTE: Consult Lighter™ software user's manual for a proper use of the same.

NOTE: If necessary, consult “How to update the marking software” on page 128, to upgrade the preinstalled software.

Important Warnings

Access to the internal parts of the laser marker is allowed only to authorized personnel, duly qualified and trained with regards to risks of optical and electrical nature.

Datalogic declines any and all responsibility for work carried out on active parts by untrained or unauthorized personnel.

CAUTION: It is forbidden to change the intended use for which the product was designed and developed.

Datalogic declines any and all responsibility for improper use of its laser product..

CAUTION: The integration and use of this laser marker is customer responsibility.

CAUTION: Never expose reflecting surfaces to laser radiation!

The reflected laser beam may cause damage to laser marker.

CAUTION: Laser marking interacts with materials through, for example, a thermal carbonization process which may lead to the emission of fumes, dust and vapors.

Adequate fume/dust extractor and treatment must be provided by customer!

WARNING: Marking PVC (or other plastic material) can cause the release of chlorine gas which can be harmful to the laser operator and to the laser marker itself. Always use adequate fume extractor during PVC and plastic marking.

CAUTION: It is the responsibility of the customer to install the laser marker in proper safety condition!

CHAPTER 2
INSTALLATION

UNPACKING

CAUTION: Control rack and scan head are joined by a connection cable 3 meters long, referred as Head Cable. Control rack and scan head are NOT separable.

CAUTION: Be extremely careful to not damage the connection cable between scan head and control rack.

CAUTION: To avoid damaging or breaking the optical fiber, never subject the Head Cable to a bending radius below the limits specified in the technical specification table (see “Head Cable minimun bending radius” on page 23).

CAUTION: The Arex™ 400 laser marker is a delicate optical device, that can be damaged by shock and vibrations.

Before installing or operating the laser marker, you should:

- Inspect the shipping container for damage
- Inspect the laser marker for signs of damage
- Confirm that the shipping box contains all items on the shipping inventory list including any accessories

When unpacking the laser marker from the shipping box you should:

- Remove the accessories and documentations
- Carefully remove the laser marker from the packaging using both hands

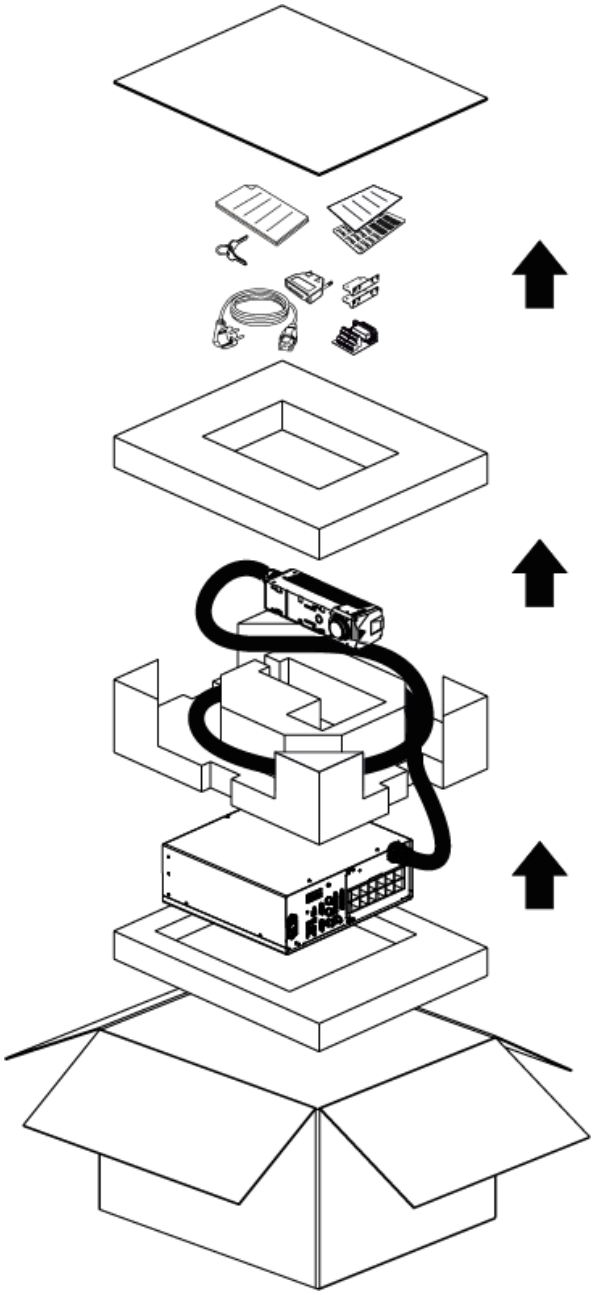
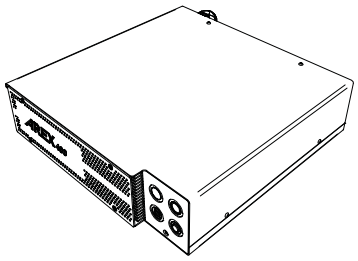
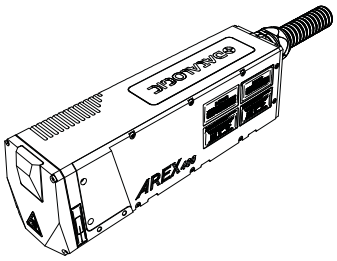
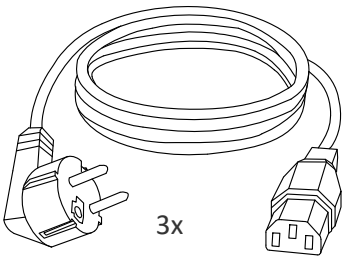
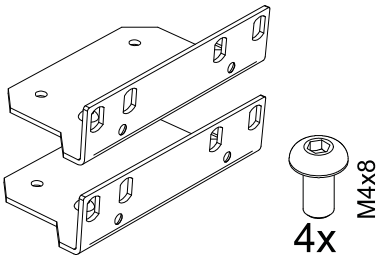
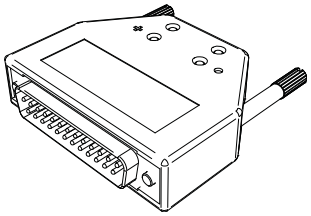
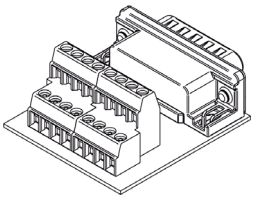
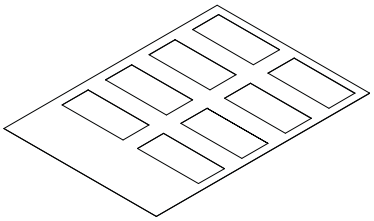
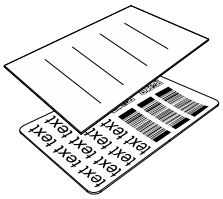
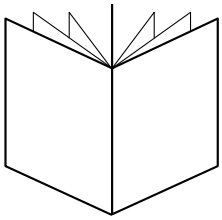
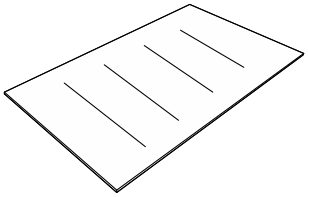


Figure 1: Unpacking

Keep all packing materials until the laser has been inspected for completeness and damage. If something is missing or defective, call Datalogic (see “Technical Support” on page vii for contact details).
Be sure to use the original packaging material for the transportation of this laser marker, otherwise transportation could cause malfunctions or damage. Keep the original packaging materials for future use. Be careful to ship the laser marker following the recommendations present in the packaging labels.

CONTENTS OF THE PACKAGING

 Control Rack	 Scan Head	 Power Supply cables
 Rack Fixing Brackets	 Command Box MUTING DEVICE	 SLO External Connector
 Safety labels	 Test report and sample test plate	Selector Keys
 Quick Reference Guide	 EULA Windows 10	

ON MOISTURE CONDENSATION

If the laser marker is brought directly from a cold to a warm location, moisture may condense inside or outside the laser product. This moisture condensation may cause a malfunction of the laser marker.

Note on moisture condensation

Moisture may condense when you bring the laser marker from a cold place into a warm place (or vice versa) and when you use the laser marker in a humid place.

If moisture condensation occurs

Turn off the laser marker and wait about 1 hour for the moisture to evaporate.

How to avoid moisture condensation

Before moving the laser marker from a cold place into a warm place, put it in a plastic bag and seal it tightly. Remove the bag when the air temperature inside the plastic bag has reached the ambient temperature (after about 1 hour).

FIXING AND POSITIONING

CAUTION: Fix the laser marker according to instructions shown in the figures.

CAUTION: It is mandatory to secure the laser marker before you start marking, since improper securing or positioning may cause serious damage.

Do not secure the laser marker in a way other than the one described in the figure.

CAUTION: Introduction of optical or mechanical surfaces, such as mechanical shutters or additional protective glass, between F-Theta scan lens output and marking surface may case optical feedback into the laser marker.

Optical induced damage caused to laser marker by reflection from external surfaces is not covered by warranty.

NOTE: In order to prevent marking distortions, avoid vibrations and bumps during the marking process!

NOTE: It is recommended to install the scan head on a positioning Z-axis system for accurate mounting at focal distance!

CONTROL RACK INSTALLATION

Horizontal installation

The control rack must be positioned in a safe manner, following the recommendations below:

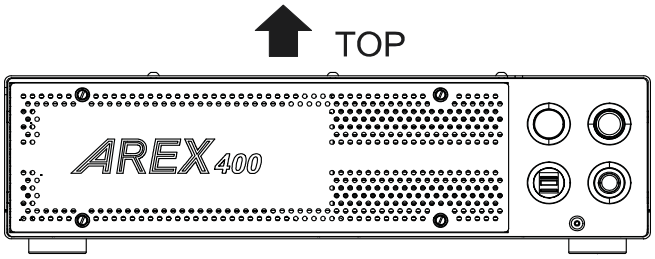


Figure 2: Control rack horizontal positioning

The control rack can be installed on a standard 19" rack cabinet using the fixing brackets supplied as a standard equipment.

Rack handles for an easier installation are available as an accessory (see "Rack Handles" on page 84).

The figure below shows the fixing points for installation in a rack cabinet.

Using the fixing brackets is possible to install the control rack in three different positions inside the cabinet:

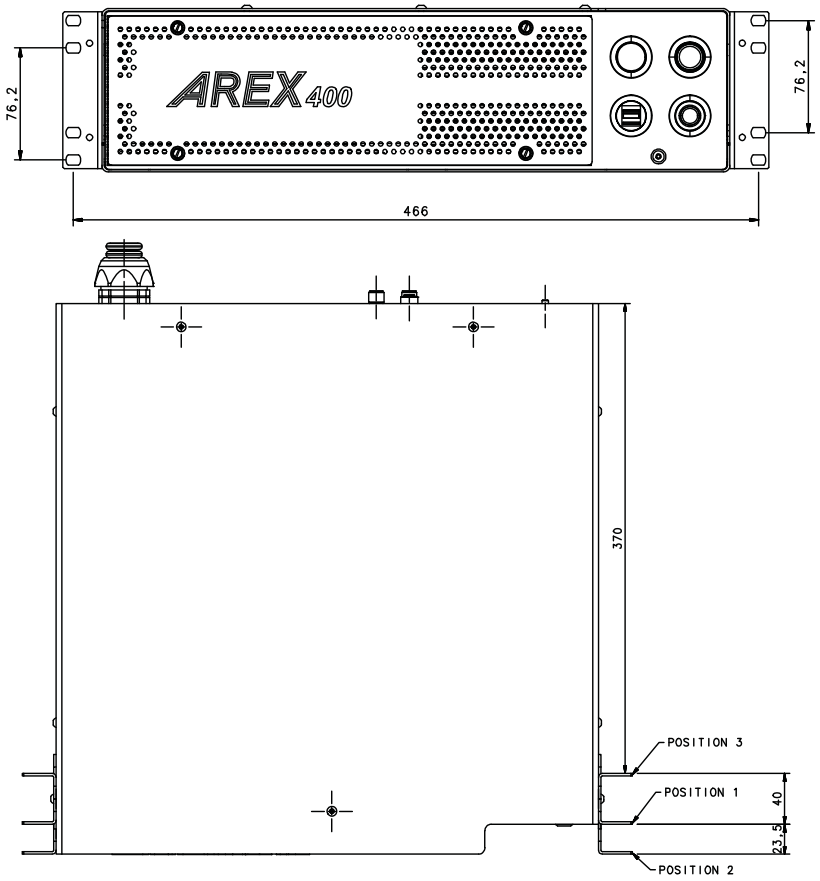


Figure 3: Control rack fixing bracket mounting configuration

NOTE: All dimensions are in millimeters.

Using this position the fixing brackets are aligned with the console.

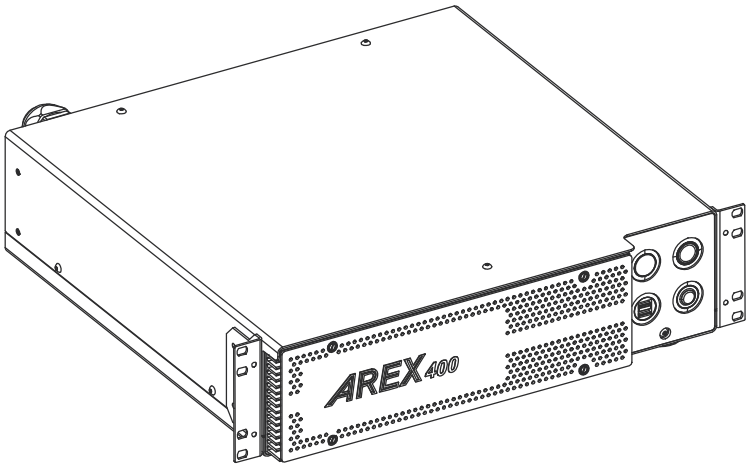


Figure 4: Control rack fixing brackets mounting position 1

Using this position the fixing brackets are aligned with the frontal grid panel.

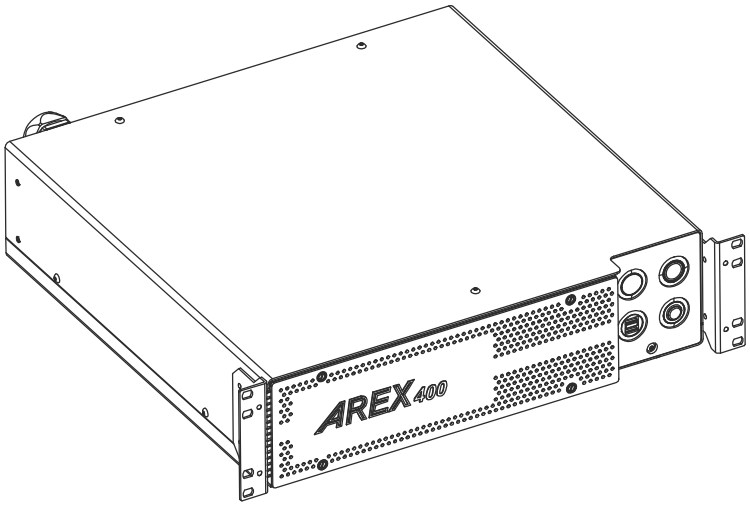


Figure 5: Control rack fixing brackets mounting position 2

Use this position if you want to use a pre-existing integration for AREX™ 3 and it is required that the back panel of AREX™ 400 is in the same position as the back panel of AREX™ 3 inside the cabinet.

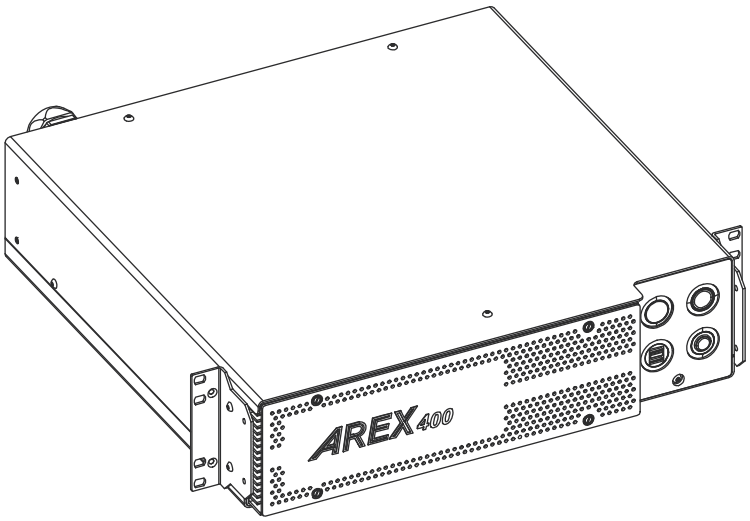


Figure 6: Control rack fixing brackets mounting position 3

Vertical installation

The control rack must be positioned in a safe manner, following the recommendations below.

NOTE: The feet must be removed from the bottom of the control rack and installed on the left side of the control rack using the appropriate fixing points. Tightening torque = 0.5 Nm.

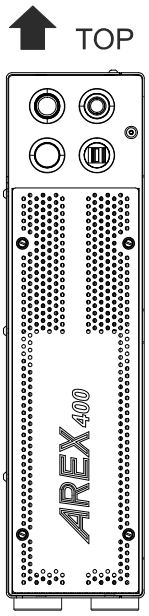


Figure 7: Control rack vertical positioning

CAUTION: The control rack MUST be fixed to a side wall using the appropriate fixing points placed on the bottom of the control rack.

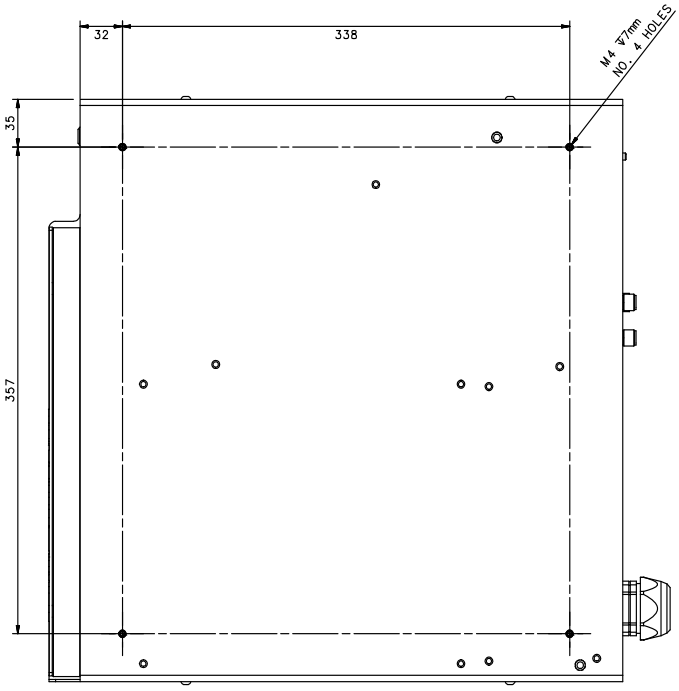


Figure 8: Control rack fixing points for vertical installation

Control rack mounting screws length

To determine the length of the mounting screws, consider the thickness of the mounting plate and the thickness of the washer.

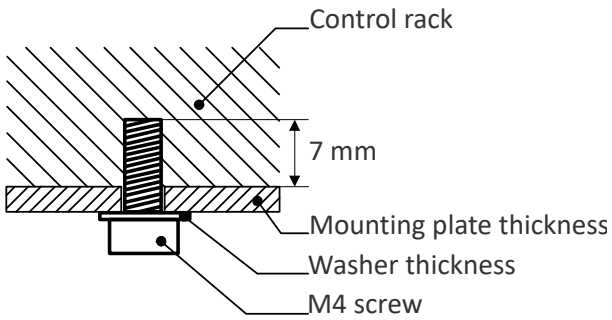


Figure 9: Length of mounting screws

NOTE: Mounting holes depth is = 7mm. Tightening torque = 2 Nm.

SCAN HEAD INSTALLATION

The scan head can be installed in any orientation and must be fixed to a suitable base (not supplied by Datalogic) using the dedicated threaded holes and the high-precision slotted seats:

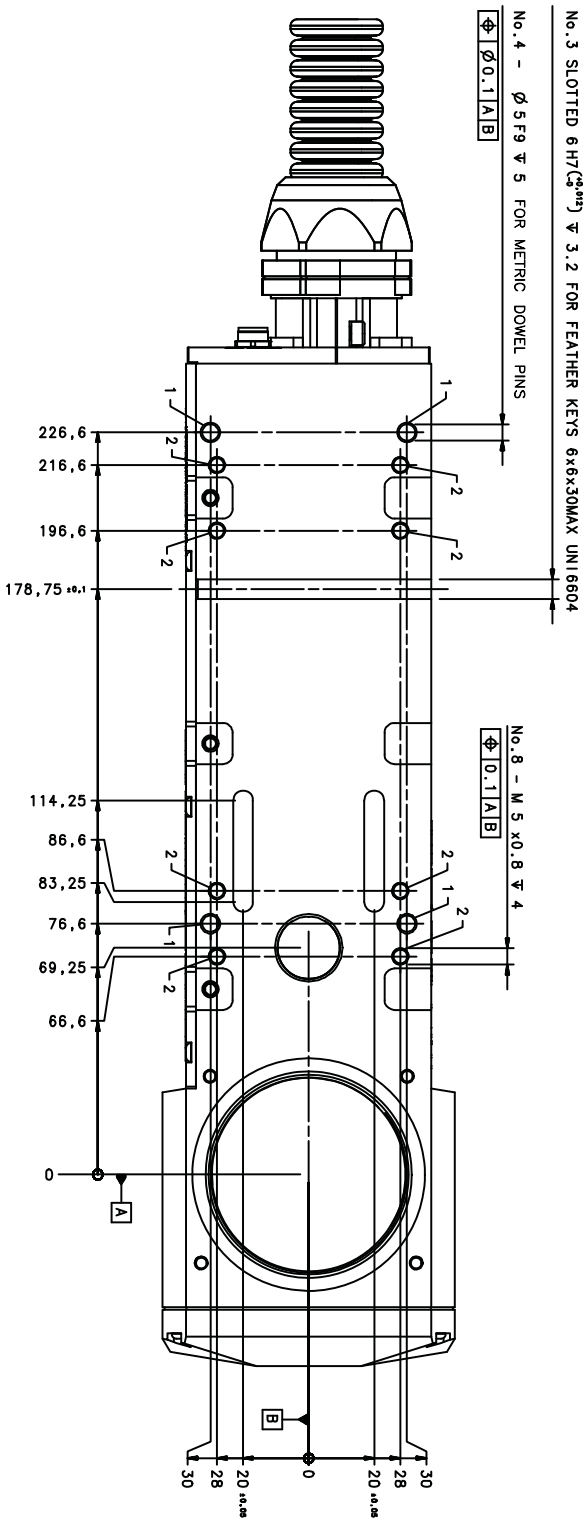


Figure 10: Fixing points on scan head (bottom view)

NOTE: All dimensions are in millimeters.

It is also possible to mount the scan head sideways using dedicated threaded holes:

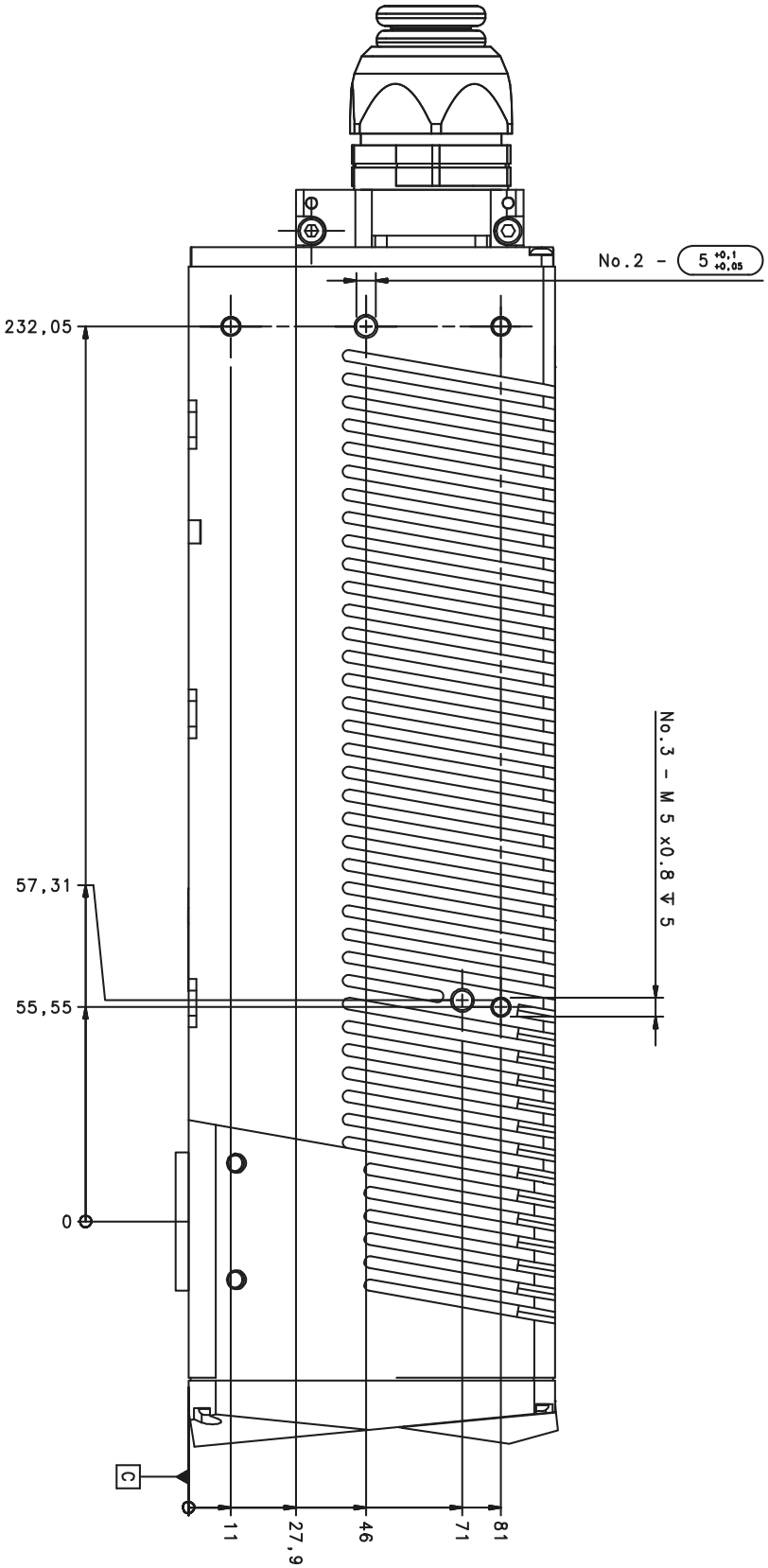


Figure 11: Fixing points on scan head side

NOTE: All dimensions are in millimeters.

Scan head mounting screws length

To determine the length of the mounting screws, consider the thickness of the mounting plate and the thickness of the washer.

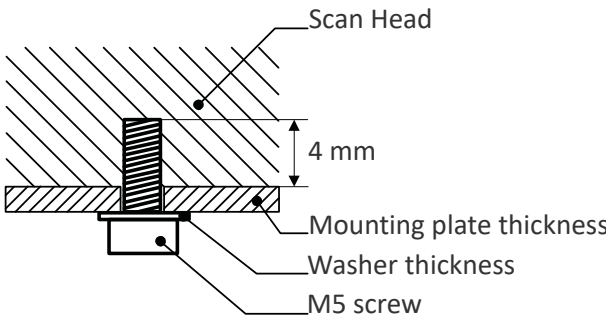


Figure 12: Length of mounting screws

NOTE: Mounting holes depth is = 4mm. Tightening torque = 2 Nm.

INSTALLATION ENVIRONMENT

Control rack

The control rack must be installed in a suitable environment in order to allow proper air flow and correct housing of the cables.

The control rack uses a forced air cooling system: an adequate air flow is necessary to guarantee its correct cooling. Install the control rack so that air flow is not obstructed. Moreover, do not install it near a heat source.

CAUTION: If not enough space is provided, the temperature inside the control rack could rise, causing temperature error.

Clean the air filter when it is dirty. If the air filter is dirty, insufficient air-flow might not ensure correct cooling and might stop the marking operation. Clean or replace the air filter periodically.

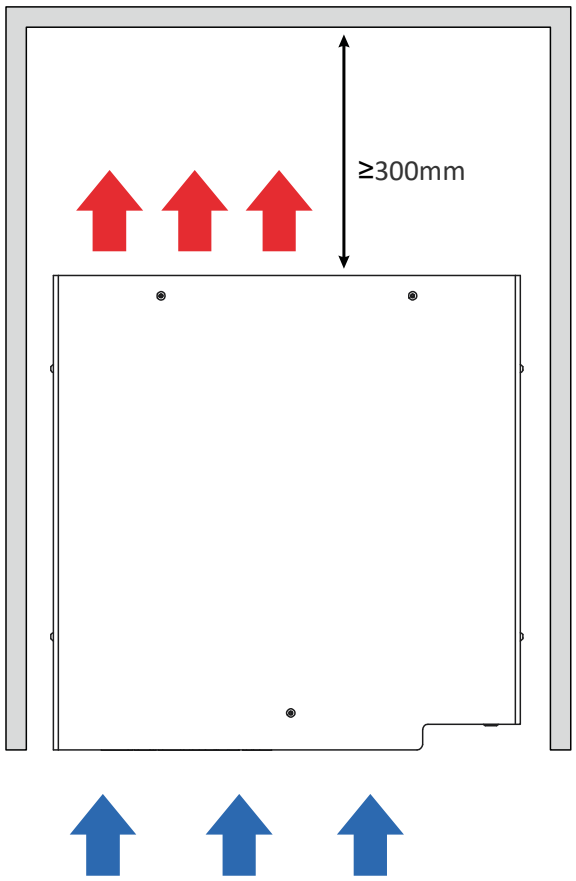


Figure 13: Control rack installation environment

CAUTION: DO NOT place heavy objects on top of the control rack!

NOTE: The control rack IP rating is IP31 in horizontal position, otherwise IP30.

Scan Head

The scan head must be installed in a suitable environment in order to allow proper air flow and correct housing of the cables.

The scan head uses a passive air cooling system: an adequate air flow is necessary to guarantee its correct cooling. Install the scan head so that air flow is not obstructed. Moreover, do not install it near a heat source.

CAUTION: If not enough space is provided, the temperature inside the scan head could rise, causing temperature error.

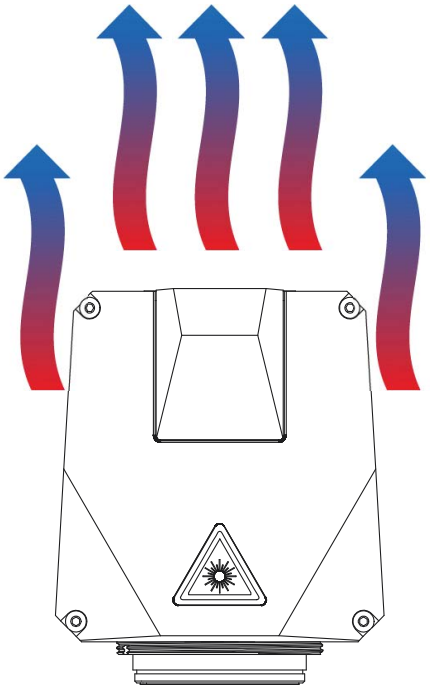


Figure 14: Scan head installation environment

NOTE: The scan head IP rating is IP64 not considering F-Theta scan lens.

NOTE: To ensure a complete IP64 protection for 160S and 254S F-Theta scan lenses use the proper accessory (see “M39 F-Theta protective cap” on page 84).

FUME / DUST EXTRACTOR

During the marking process, dust and/or fume may be produced. It is important to use an adequate fume/dust extractor and/or air filtration (see “Fume Extractor” on page 84).

CAUTION: Marking PVC (or other plastic material) can cause the release of chlorine gas which can be harmful to the laser operator and to the laser marker itself. Always use adequate fume extractor during PVC and plastic marking.

CHAPTER 3
TECHNICAL SPECIFICATIONS

TECHNICAL CHARACTERISTICS

AREX 400 MODELS		A20-X6X	110-X6X	120-X6X	130-X6X	150-X6X
ELECTRICAL SPECIFICATIONS						
Input Voltage (main power supply)	V (AC)	100 to 240 @ 50-60 Hz				
Max. Input Current (main power supply)	A	3 - 1.25			4 - 1.7	
Max power	W	300			400	
LASER SOURCE SPECIFICATIONS[1]						
Laser Type		Pulsed Fiber Laser				
Nominal Average Power	W	20	10	20	30	50
Pulse Energy (max.)	mJ	≥ 0.75	1			
Peak Power (max.)	kW	≥ 10	10			
Central Emission Wavelength	nm	1050-1080	1064			
Typical Nominal Pulse Width	ns	4 to 250	100			
Repetition Rate	kHz	20 to 500	2 to 200			
Laser Aiming Beam / Focus Beam		Class 2: 655 nm				
ENVIRONMENTAL SPECIFICATIONS						
Operating Temperature	°C (°F)	5 to 40 (41 to 104)				5 to 35 (41 to 95)
Storage Temperature	°C (°F)	-10 to 60 (14 to 140)				
Humidity	%	< 90 without condensation				
Altitude	m	2000				
Shock and Vibration		MIL 810E “CAT 1 Basic Transportation”				
Package Drop Test	cm	60				
Pollution Degree		2				
Overvoltage Category		II				
PHYSICAL SPECIFICATIONS						
Control Rack dimensions (HxWxD)	mm in	113x432x434 4.4x17x17.1				

AREX 400 MODELS		A20-X6X	110-X6X	120-X6X	130-X6X	150-X6X
Control Rack Weight	Kg lbs	17.5 38.5				
Control Rack IP Rating		IP31 (in horizontal position, otherwise IP30)				
Control Rack Cooling		Forced Air Rack fans: L10@40°C = 70000 h Laser source fans: L10@40°C = 65000 h				
Scan Head dimensions (HxWxD)[2]	mm in	96x90x326 3.7x3.5x12.8				
Scan Head Weight[3]	Kg lbs	3.5 7.7				
Scan Head IP Rating[4]		IP64				
Scan Head Cooling		Air Cooling				
Noise	dB (A)	<65 at 1 meter				
Head Cable minimun bending radius	mm in	80 (fixed installation); 110 (mobile installation) 3.15 (fixed installation); 4.33 (mobile installation)				
Head Cable length	mm in	2885 113.5				
Beam deflection		High speed galvanometer scanning system				
OTHER SPECIFICATIONS						
Marking speed[5]	mm/s	Up to 10000				
Char Marking Speed[6]	char/s	Up to 600				
MOF (marking on fly)		YES (constant speed or encoder)				
Line speed - Productivity	m/min pcs/s	Up to 75 3				
Marking Control and Software		EMC (Embedded Marking Control) and Lighter™ Suite				
Communication		RS232, Ethernet (TCP/IP 10, 100 Mbit), EtherNet/IP ProfiNet I/O, TcpServer Protocol, Digital I/O				

1. Specification @ 25°C
2. Without F-Theta scan lens
3. Without F-Theta scan lens
4. Using M39 F-Theta scan lens protective cap
5. May vary: measured with f =160mm
6. Single line string, Roman-s font, 1mm height

PRODUCT DESCRIPTION

Control rack

A description of the main parts of the control rack unit is provided here below:

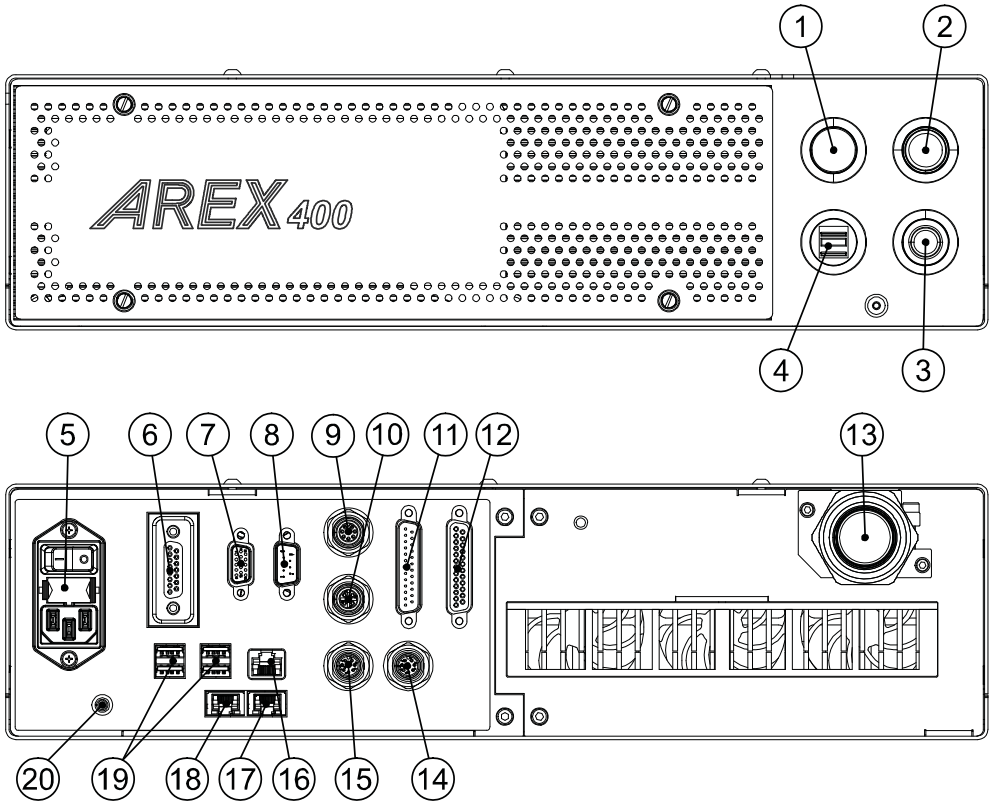


Figure 15: Control rack overview (front and back panels view)

Front panel:

1. Status LED
2. Start Marking button
3. Key Selector
4. 2x USB 2.0 ports

Back panel:

5. Main Power Supply connection
6. X3 - SLO connector
7. VGA port
8. RS232 port
9. Encoder connector
10. Photocell connector
11. X2 - Axes connector (I/O Control)
12. X1 - Command Box connector (Laser Control)
13. Head Cable
14. Device Port 2
15. Device Port 1
16. LAN 1 port
17. LAN 3 port
18. LAN 2 port
19. 4x USB 2.0 ports
20. Earth ground connection

Scan head

A description of the main parts of the scan head unit is provided here below:

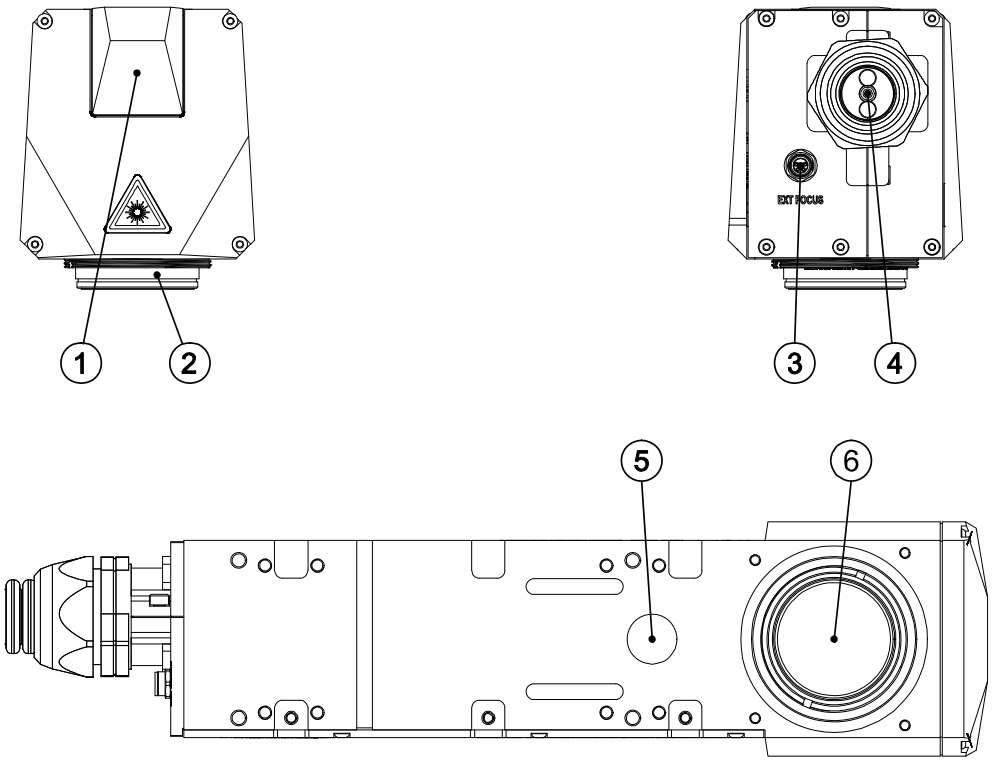


Figure 16: Scan head overview (front, rear and bottom view)

1. Status LED
2. F-Theta Scan Lens
3. External Focus Beam connector
4. Head Cable
5. Focusing Beam output
6. IR laser beam output / Aiming laser beam output / Green Spot beam output

MARKING AREA SPECIFICATION

Datalogic provides a wide range of laser marker models with different F-Theta scan lenses configurations.

These configurations are provided to best match customer needs regarding marking field size, working distance and power density.

NOTE: Contact Datalogic if other configurations are necessary.

NOTE: Definition of Marking Area:

- **Arex™ 110-X6X/120-X6X/A20-X6X: square marking field measured on black anodized aluminium plate.**
- **Arex™ 130-X6X/150-X6X: square marking field within which power is >95% with respect to power in center.**

CAUTION: This product was designed to use only certain configurations of F-Theta scan lens and marking field. If your needs are not satisfied by the currently available F-Theta scan lens configurations please contact Datalogic for a solution. The use of other F-Theta scan lenses or operation outside the specified marking field for a certain F-Theta scan lens configuration can lead to damage of the F-Theta scan lens, scan head or laser source. Such damage is not covered by warranty!

CAUTION: For each F-Theta scan lens configuration Datalogic provides a specific adapter. This adapter ensures that residual back reflections caused by the F-Theta scan lens do not damage the scanning head optics. The removal of such adapter or its incorrect use (for example incomplete threading, use of another F-Theta scan lens adapter, etc.) can lead to damage of the F-Theta scan lens, scan head or laser source. Such damage is not covered by warranty!

F-Theta Scan Lens for Arex™ 110-X6X and 120-X6X

The table below lists the standard F-Theta scan lenses currently available for Arex™ 110-X6X and 120-X6X:

F-Theta Scan Lens diameter M39			
F-THETA SCAN LENS		f = 160S	f = 254S
Working Distance (WD)	mm	185 ± 2	285 ± 4.5
Fixing Distance (FD)	mm	199.5 ± 3	305.5 ± 5.5
Marking Area (MA)	mm^2	100 x 100	140 x 140

F-Theta Scan Lens diameter M85					
F-THETA SCAN LENS		f = 100L	f = 254L*	f = 330L*	f = 420L*
Working Distance (WD)	mm	99.5 ± 1	300.5 ± 4	397 ± 6	507 ± 9
Fixing Distance (FD)	mm	141.5 ± 2	372 ± 5	480 ± 7	576 ± 10
Marking Area (MA)	mm^2	50 x 50	180 x 180	220 x 220	285 x 285

(*) **NOT AVAILABLE** for 130-X6X

F-Theta Scan Lens for Arex™ A20-X6X

The table below lists the standard F-Theta scan lenses currently available for Arex™ A20-X6X:

F-Theta Scan Lens diameter M39			
F-THETA SCAN LENS		f = 160S	f = 254S
Working Distance (WD)	mm	185.5 ± 2	285.5 ± 5
Fixing Distance (FD)	mm	200 ± 3	306 ± 6
Marking Area (MA)	mm^2	100 x 100	140 x 140

F-Theta Scan Lens diameter M85					
F-THETA SCAN LENS		f = 100L	f = 254L	f = 330L	f = 420L
Working Distance (WD)	mm	99.5 ± 1	300.5 ± 4.5	397.5 ± 6.5	508 ± 10
Fixing Distance (FD)	mm	141.5 ± 2	373 ± 5.5	480.5 ± 7.5	577 ± 11
Marking Area (MA)	mm^2	50 x 50	180 x 180	220 x 220	285 x 285

F-Theta Scan Lens for Arex™ 130-X6X and 150-X6X

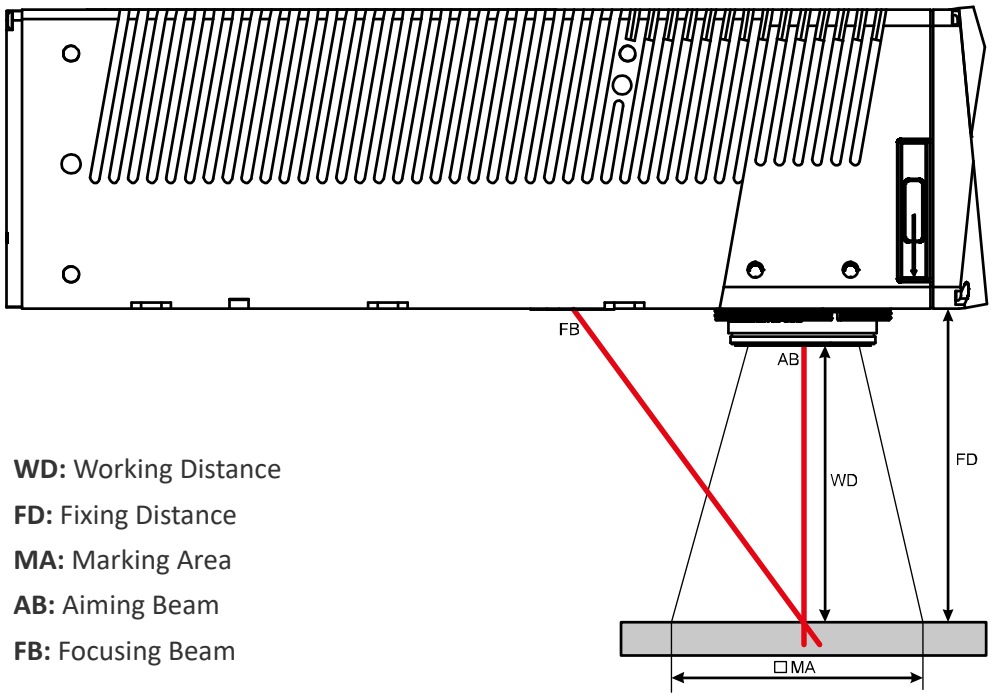
The table below lists the standard F-Theta scan lenses currently available for Arex™ 130-X6X and 150-X6X:

F-Theta Scan Lens diameter M85					
F-THETA SCAN LENS		f = 160L	f = 254L	f = 330L	f = 420L*
Working Distance (WD)	mm	178 ± 3.5	300.5 ± 4	397 ± 6	507 ± 9
Fixing Distance (FD)	mm	214 ± 4.5	372 ± 5	480 ± 7	576 ± 10
Marking Area (MA)	mm^2	100 x 100	180 x 180	210 x 210	285 x 285

(*) **NOT AVAILABLE** for 130-X6X

NOTE: Working Distance is defined as the distance between the center of the marking area (defined in the focal plane) and the closest mechanical edge of the F-Theta scan lens.
The Working Distance tolerance is defined as the ± 2-Sigma value of deviation from Working Distance mean value of the estimated Gaussian model.
Refer to the following figure.

NOTE: Fixing Distance is defined as the distance between the base of the scan head and the marking area.
The Fixing Distance tolerance is defined as the ± 2-Sigma value of deviation from Fixing Distance mean value of the estimated Gaussian model.
Refer to the following figure.



WD: Working Distance
FD: Fixing Distance
MA: Marking Area
AB: Aiming Beam
FB: Focusing Beam

Figure 17: Marking Area

NOTE: For products equipped with 160S, 254S, 160L and 100L F-Theta scan lenses the focus position, defined at the point where the focus beam overlaps with the aiming beam, is preset at factory.

GREEN SPOT

The Green Spot is an indicator integrated in the scan head able to provide a green visual feedback in the center of marking field area.

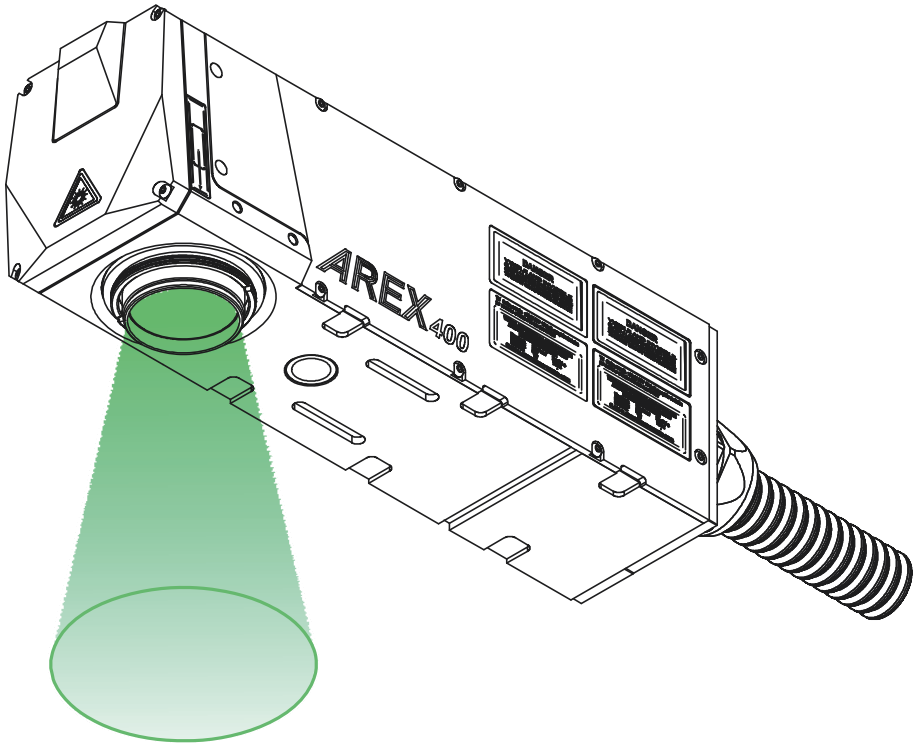


Figure 18: Green Spot indicator

CONFIGURATION[1]	DESCRIPTION
OFF	The Green Spot indicator is not active (always OFF)
SYSTEM READY TO MARK	The Green Spot is steady ON only when all these events are verified: • the laser marker is in READY state • a document is in AUTO MODE or WORK MODE • the marking process is not in progress
MARKING CONFIRMATION	The Green Spot turns ON when all these events are verified: • the laser marker is in READY state • a document is in AUTO MODE or WORK MODE • the marking process was correctly executed (no errors, no stop marking, no state changing) The Green Spot indicator turns ON at the end of the marking process and stay active for a configurable range of time from 0.1s to 5s
MARVIS VERIFICATION	This is available only if MARVIS™ feature is enabled. The Green Spot turns ON when all these events are verified: • the laser marker is in READY state • a document is in AUTO MODE or WORK MODE • the marking process was correctly executed (no errors, no stop marking, no state changing) • the verification of the marking content made by MARVIS™ device was positive The Green Spot indicator turns ON at the end of the marking process and stay active for a configurable range of time from 0.1s to 5s

1. refer to Lighter™ user's manual “Setting I/O parameters” paragraph to set the signal properties

CONNECTORS SPECIFICATIONS

X3 - SLO (Safe Laser Off)

Control rack back panel connector

Socket Sub-D, 15 pins, female.

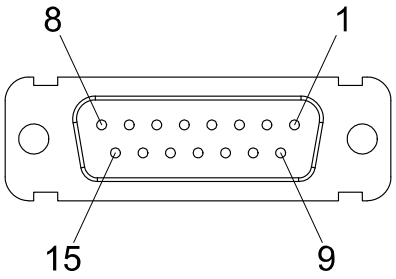


Figure 19: X3 - SLO connector, female panel plug (front view)

PIN	SIGNAL	TYPE	DESCRIPTION
X3.1	VCC	Power Output	Isolated Auxiliary 24V DC power supply
X3.2	RESERVED	-	DO NOT CONNECT
X3.3	VCC	Power Output	Isolated Auxiliary 24V DC power supply
X3.4	SAFETY_FDBK+	Digital Output	Clean contact pole for feedback monitor (Common)
X3.5	SAFETY_FDBK-	Digital Output	Return of clean contact pole for feedback monitor (Normally Closed)
X3.6	GND	Ground	Isolated Ground reference
X3.7	RESERVED	-	DO NOT CONNECT
X3.8	GND	Ground	Isolated Ground reference
X3.9	INTERLOCK_A	PNP Digital Input	INTERLOCK_A positive signal (to be connected to VCC)
X3.10	RESERVED	-	DO NOT CONNECT
X3.11	INTERLOCK_B	PNP Digital Input	INTERLOCK_B positive signal (to be connected to VCC)
X3.12	LASER_STOP_A	PNP Digital Input	LASER_STOP_A positive signal (to be connected to VCC)
X3.13	/LASER_STOP_A	NPN Digital Input	LASER_STOP_A negative signal (to be connected to GND)
X3.14	LASER_STOP_B	PNP Digital Input	LASER_STOP_B positive signal (to be connected to VCC)
X3.15	/LASER_STOP_B	NPN Digital Input	LASER_STOP_B negative signal (to be connected to GND)

Table 1: X3 - SLO connector pinout

CAUTION: For a correct use of the LASER STOP functionality, exclusively use all PNP inputs or alternatively all NPN inputs (mixed configurations not allowed).

X3 - SLO Electric Diagram

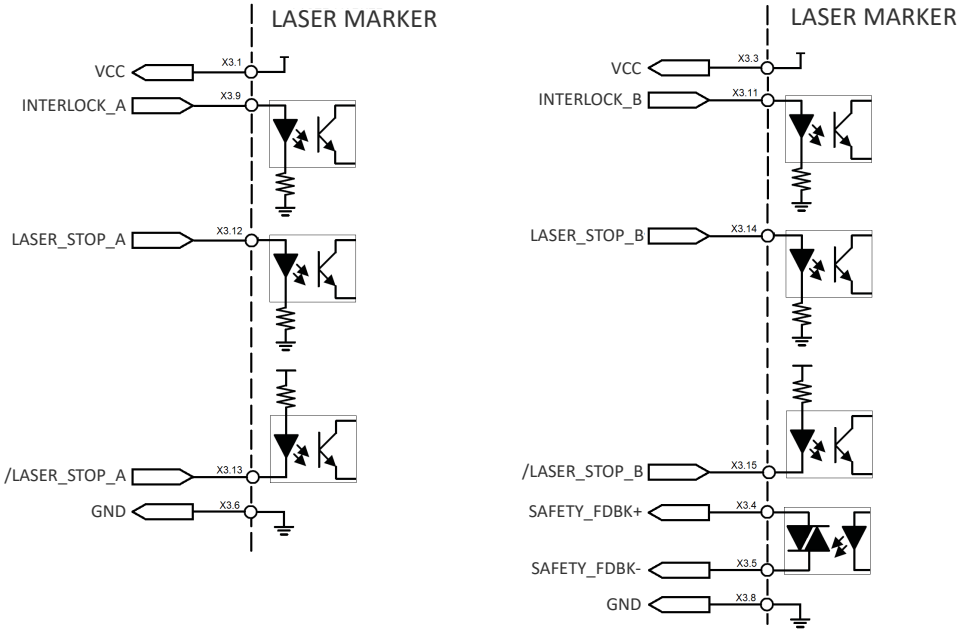


Figure 20: X3 - SLO connector, electric diagram

Input

TECHNICAL CHARACTERISTICS			
Type	Optocoupler		
Vtyp	24 V DC		
Imax	15 mA @ 24 V DC		
Pulse Width	≥ 1ms (debounce)		
	MIN	TYP	MAX
INPUT Logic LOW	0.0 V DC	0.0 V DC	2.0 V DC
INPUT Logic HIGH	20.0 V DC	24.0 V DC	28.0 V DC

Table 2: Input specification

Output

TECHNICAL CHARACTERISTICS	
Type	Opto Relay
Supply voltage	7 to 36VDC (24V nominal)
Imax	150 mA
ON Resistance Max.	8 Ω
Leakage current	≤ 1 µA

Table 3: Output specification

SAFETY_FDBK Output Status

SYSTEM	INTERLOCK_A (X3.9)	INTERLOCK_B (X3.11)	SAFETY_FDBK (X3.4-X3.5)	MARKING ALLOWED[1]
OFF	DON'T CARE	DON'T CARE	CONTACT CLOSED	NO
ON	CONTACT OPEN	CONTACT OPEN	CONTACT CLOSED	NO
ON	CONTACT OPEN	CONTACT CLOSED	CONTACT OPEN	NO
ON	CONTACT CLOSED	CONTACT OPEN	CONTACT OPEN	NO
ON	CONTACT CLOSED	CONTACT CLOSED	CONTACT OPEN	YES

1. "*LASER_STOP_A*" and "*LASER_STOP_B*" signals are enabled, where "enabled" means contacts CLOSED

SYSTEM	LASER_STOP_A (X3.12)	LASER_STOP_B (X3.14)	SAFETY_FDBK (X3.4-X3.5)	MARKING ALLOWED[1]
OFF	DON'T CARE	DON'T CARE	CONTACT CLOSED	NO
ON	CONTACT OPEN	CONTACT OPEN	CONTACT CLOSED	NO
ON	CONTACT OPEN	CONTACT CLOSED	CONTACT OPEN	NO
ON	CONTACT CLOSED	CONTACT OPEN	CONTACT OPEN	NO
ON	CONTACT CLOSED	CONTACT CLOSED	CONTACT OPEN	YES

1. "*INTERLOCK_A*" and "*INTERLOCK_B*" signals are enabled, where "enabled" means contacts CLOSED

Table 4: SAFETY_FDBK Output Status Tables

SLO External Connector

Sub-D 15 pins to terminal blocks electrical board.

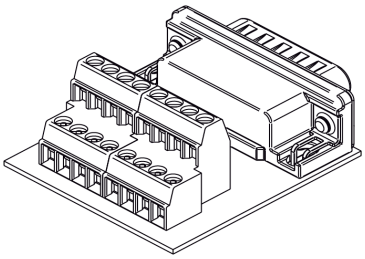


Figure 21: SLO External Connector

SLO Muting Device

NOTE: The laser marker is not equipped with a SLO Muting Device.

CAUTION: Do not use the SLO Muting Device for external devices, since this will result in loss of the safety function of the machine to which this product is installed.
Do not use the SLO Muting Device except for maintenance of this product.

CAUTION: It is the customer's responsibility to provide a correct integration of the safety signals according to applicable regulations.

In order to develop a SLO Muting Device, the following connections must be made:

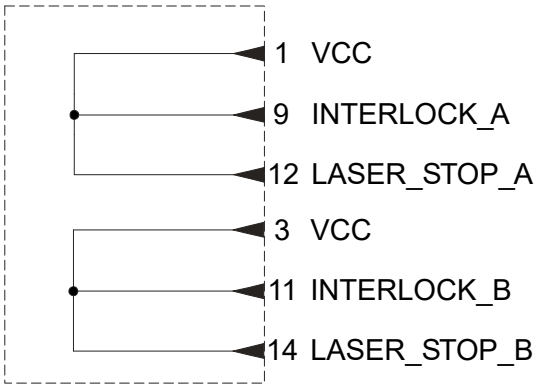


Figure 22: SLO Muting Device

X1 - Command Box (Laser Control)

Control rack back panel connector

Socket Sub-D, 25 pins, female.

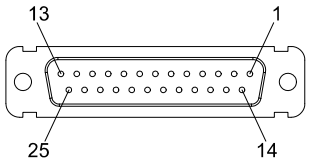


Figure 23: X1 - Command Box connector, female panel socket (front view)

PIN	SIGNAL	TYPE***	DESCRIPTION
X1.1	24V_ENABLE_B	Output power supply	Auxiliary 24V DC power supply available for EXT_ENABLE_B (max 125mA)
X1.2	EXT_ENABLE_B	Digital Input	Secondary external ENABLE signal: - HIGH level: contact closed - LOW level or disconnected: contact opened
X1.3	MARKING_KO	Digital Output PNP/NPN configurable	This signal is used to notify a BAD marking: - ON in case of bad marking (the marking process has been stopped due to STOP_MARKING signal; laser emission has been interrupted due to change in the system status; MOF process has been interrupted due to invalid parameters)
X1.4	EXT_24V	Output power supply	Auxiliary 24V DC power supply available for drive input logical HIGH (max 125mA)
X1.5	EXT_24V	Output power supply	Auxiliary 24V DC power supply available for drive input logical HIGH (max 125mA)
X1.6	EXT_24V	Output power supply	Auxiliary 24V DC power supply available for drive input logical HIGH (max 125mA)
X1.7	24V_ENABLE_A	Output power supply	Auxiliary 24V DC power supply available for EXT_ENABLE_A (max 125mA)
X1.8	EXT_ENABLE_A	Digital Input	Primary external ENABLE signal: - HIGH level: contact closed - LOW level or disconnected: contact opened
X1.9	BUSY	Digital Output PNP/NPN configurable	This signal is used to know if the current spooler is executing (marking in progress): - ON during marking process
X1.10	CONNECTOR_ PRESENCE	Digital Input	This signal is used to check the presence of the Command Box connector: - HIGH level: normal operation - LOW level or disconnected: laser marker faulty
X1.11	START_MARKING*	Digital Input	This signal is used to start to the marking process when a document or a sequence is running in AUTO MODE** or WORK MODE**: - HIGH level pulsed signal start the marking process
X1.12	EXT_KEY	Digital Input	External KEY signal: - HIGH level: contact closed - LOW level or disconnected: contact opened
X1.13	STOP_MARKING*	Digital Input	This signal is used to stop the marking process: - HIGH level pulsed signal stop the marking process
X1.14	RESERVED	-	DO NOT CONNECT
X1.15	RESERVED	-	DO NOT CONNECT
X1.16	VIN_EXT	Input power supply	External reference input power supply voltage for PNP output type configuration: - NOT CONNECTED or GND: sets all digital outputs to NPN (default) - 10÷28V DC sets all digital outputs to PNP
X1.17	END	Digital Output PNP/NPN configurable	This signal is used to know if the marking process is finished: - ON at the end of marking process
X1.18	POWER_ON	Digital Output PNP/NPN configurable	This signal is used to know if the laser marker is already warmed up: - ON when the laser is in STAND_BY or READY state

PIN	SIGNAL	TYPE***	DESCRIPTION
X1.19	GND	Ground	Ground reference
X1.20	SYSTEM_ALARM	Digital Output PNP/NPN configurable	This signal is used to know if the laser marker is in booting up state or in error state: - ON during BOOTING UP - ON in case of system error
X1.21	GND	Ground	Ground reference
X1.22	ENABLE_OUT	Digital Output PNP/NPN configurable	This signal is used to know if the laser marker is ready to emit laser radiation: - ON when the laser marker is in READY state
X1.23	SW_READY*	Digital Output PNP/NPN configurable	Depending on the configuration this signal can be used in different ways: - COMPATIBILITY: ON when a document or a sequence is running in AUTO MODE** or WORK MODE** independently from the laser marker state. The signal is ON regardless of whether the laser marker is ready to start a new marking - STANDARD: ON when a document or a sequence is running in AUTO MODE** or WORK MODE** and the laser marker state is READY. The signal is ON regardless of whether the laser marker is ready to start a new marking - READY TO MARK: ON only when a document or a sequence is running in AUTO MODE** or WORK MODE** and the laser marker state is READY. The signal is ON only if the laser marker is ready to accept a new START_MARKING event (loading/spooling already executed) This signal can also be driven using Lighter™ Script engine "IoPort.setReady (true)" function
X1.24	GND	Ground	Ground reference
X1.25	GND	Ground	Ground reference

Table 5: X1 - Command Box connector pinout

(*) refers to Lighter™ user's manual “Setting I/O parameters” paragraph to set the signal properties
(**) refers to Lighter™ user's manual
(***) see “Input/Output specifications” on page 41

Muting Device

Sub-D, 25 pins, male, with shell.

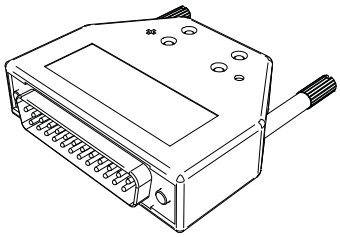


Figure 24: Command Box Muting Device provided

CAUTION: If the Command Box Muting Device provided is connected, the laser marker enable is bypassed.

Internal electric diagram

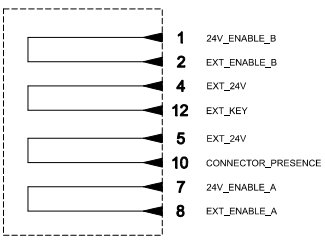


Figure 25: Command Box Muting Device electric diagram

X2 - Axes (I/O Control)

Control rack back panel connector

Plug Sub-D, 25 pins, male.

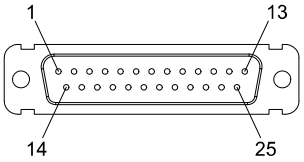


Figure 26: X2 - Axes connector, male panel plug (front view)

PIN	SIGNAL**	TYPE***	DESCRIPTION
X2.1	EXT_24V	Output Power supply	Auxiliary 24V DC power supply available for drive input logical HIGH (max 125mA)
X2.2	OUTPUT_0 (*) or STEP_Y	Digital Output PNP/NPN configurable	Generic output or Y-Axis drive step signal (Clock) for axis control (**)
X2.3	OUTPUT_2 (*) or STEP_Z	Digital Output PNP/NPN configurable	Generic output or Z-Axis drive step signal (Clock) for axis control (**)
X2.4	OUTPUT_4 (*) or BRAKE X	Digital Output PNP/NPN configurable	Generic output or X-Axis electromechanical brake release signal. ON during drive motion
X2.5	OUTPUT_6 (*) or BRAKE Y	Digital Output PNP/NPN configurable	Generic output or Y-Axis electromechanical brake release signal. ON during drive motion
X2.6	OUTPUT_8 (*) or BRAKE Z	Digital Output PNP/NPN configurable	Generic output or Z-Axis electromechanical brake release signal. ON during drive motion
X2.7	INPUT_0 (*) or ZERO X	Digital Input	Generic input or X-Axis home sensor input. The home search is stopped when this signal goes HIGH
X2.8	INPUT_1 (*) or ZERO Y	Digital Input	Generic input or Y-Axis home sensor input. The home search is stopped when this signal goes HIGH
X2.9	INPUT_2 (*) or ZERO Z	Digital Input	Generic input or Z-Axis home sensor input. The home search is stopped when this signal goes HIGH
X2.10	INPUT_3 (*) or DISABLE X	Digital Input	Generic input or X-Axis disable signal. When HIGH, the corresponding step signal remains in the state prior to activation
X2.11	INPUT_4 (*) or DISABLE Y	Digital Input	Generic input or Y-Axis disable signal. When HIGH, the corresponding step signal remains in the state prior to activation
X2.12	INPUT_5 (*) or DISABLE Z	Digital Input	Generic input or Z-Axis disable signal. When HIGH, the corresponding step signal remains in the state prior to activation
X2.13	GND	Ground	Ground reference
X2.14	OUTPUT_12 (*) or STEP R	Digital Output PNP/NPN configurable	Generic output or R-Axis drive step signal (Clock) for axis control
X2.15	OUTPUT_1 (*) or STEP X	Digital Output PNP/NPN configurable	Generic output or X-Axis drive step signal (Clock) for axis control
X2.16	OUTPUT_3 (*) or DIR Z	Digital Output PNP/NPN configurable	Generic output or Z-Axis drive direction signal
X2.17	OUTPUT_5 (*) or DIR Y	Digital Output PNP/NPN configurable	Generic output or Y-Axis drive direction signal
X2.18	OUTPUT_7 (*) or DIR X	Digital Output PNP/NPN configurable	Generic output or X-Axis drive direction signal
X2.19	INPUT 9	Digital Input	Generic Input
X2.20	INPUT 8	Digital Input	Generic Input

PIN	SIGNAL**	TYPE***	DESCRIPTION
X2.21	INPUT_7 (*) or ZERO R	Digital Input	Generic input or R-Axis home sensor input. The home search is stopped when this signal goes HIGH
X2.22	INPUT_6 (*) or DISABLE R	Digital Input	Generic input or R-Axis disable signal. When HIGH, the corresponding step signal remains in the state prior to activation
X2.23	OUTPUT_9 (*) or BRAKE R	Digital Output PNP/NPN configurable	Generic output or R-Axis electromechanical brake release signal. ON during drive motion
X2.24	OUTPUT_11 (*) or DIR R	Digital Output PNP/NPN configurable	Generic output or R-Axis drive direction signal
X2.25	GND	Ground	Ground reference

Table 6: X2 - Axes Connector pinout

(*) enabling an axis causes the corresponding control signals to no longer be available as generic inputs/outputs. Refer to Lighter™ user's manual, "Setting the X, Y, Z, and Rotor Axes parameters" to enable/disable Axes and set the Axes properties. Generic input/output can be used also as MARVIS™ control signals. Refer to Lighter user's manual, "MARVIS™ configuration" to set the MARVIS™ properties

(**) see “Axes I/O signals behavior” on page 51

(***) see “Input/Output specifications” on page 41

NOTE: PNP/NPN digital output selection made by X1.16 input.

Encoder

Control rack back panel connector

Socket, M12, 8 pins female. Recommended encoder: incremental Encoder PNP, M12, 8 pins, push/pull outputs AB0 only, 10-30 VDC.

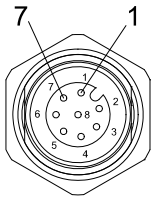


Figure 27: Encoder connector, female panel socket (front view)

PIN	SIGNAL	TYPE*	DESCRIPTION
1	GND	Ground	Ground reference
2	VCC	Power Output	Auxiliary 24V DC power supply (750mA max)
3	ENC_A	Digital input	Encoder HTL A channel signal
4	GND	Ground	Return signal for ENC_A
5	ENC_B	Digital Input	Encoder HTL B channel signal
6	GND	Ground	Return signal for ENC_B
7	RESERVED	-	DO NOT CONNECT
8	RESERVED	-	DO NOT CONNECT
BODY	SHIELD	Shield	Shield

Table 7: Encoder connector pinout

(*) see “Input/Output specifications” on page 41

Photocell

Control rack back panel connector

Socket, M12, 4 pins female. Recommended photocell: Datalogic S51-PA-5-B01-PK; Datalogic S15-PA-5-B01-PK or equivalent.

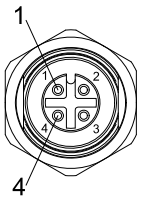


Figure 28:Photocell connector, female panel socket (front view)

PIN	SIGNAL	TYPE*	DESCRIPTION
1	VCC	Power Supply	Auxiliary 24V DC power supply (120mA max)
2	RESERVED	-	DO NOT CONNECT
3	GND	Ground	Ground reference
4	PHOTOCELL	Digital input	PNP photocell signal

Table 8: Photocell connector pinout

(*) see “Input/Output specifications” on page 41

Device Port 1

Control rack back panel connector

Plug, M12, 8 positions male.

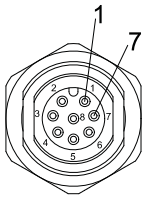


Figure 29: Device Port 1 connector, male panel plug (front view)

PIN	SIGNAL	TYPE*	DESCRIPTION
1	VCC	Power Output	Auxiliary 24V DC power supply (15W max power)
2	GND	Ground	Ground reference
3	EXT_TRIG_#1	Digital Output	Reserved output for MARVIS™
4	EXT_INPUT_#1	Digital Input	Reserved input for MARVIS™
5	RESERVED	-	DO NOT CONNECT
6	INT_RS232_RX	Digital Input	Reserved RS232 for micrometric distance sensor
7	INT_RS232_TX	Digital Output	Reserved RS232 for micrometric distance sensor
8	RESERVED	-	DO NOT CONNECT
BODY	SHIELD	Shield	Connector case provides electrical connection to the body

Table 9: Device Port 1 connector pinout

(*) see “Input/Output specifications” on page 41

Device Port 2

Control rack back panel connector

Plug, M12, 8 positions male.

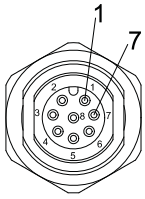


Figure 30: Device Port 2 connector, male panel plug (front view)

PIN	SIGNAL	TYPE*	DESCRIPTION
1	VCC	Power Output	Auxiliary 24V DC power supply (15W max power)
2	GND	Ground	Ground reference
3	EXT_TRIG_#2	Digital Output	Reserved output for MARVIS™
4	EXT_INPUT_#2	Digital Input	Reserved input for MARVIS™
5	RESERVED	-	DO NOT CONNECT
6	RESERVED	-	DO NOT CONNECT
7	RESERVED	-	DO NOT CONNECT
8	RESERVED	-	DO NOT CONNECT
BODY	SHIELD	Shield	Connector case provides electrical connection to the body

Table 10: Device Port 2 connector pinout

(*) see “Input/Output specifications” on page 41

RS232 (COM3)

Control rack back panel connector

Plug Sub-D, 9 pins, male.

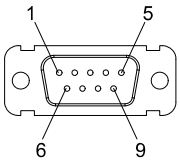


Figure 31: RS232 connector, male panel plug (front view)

PIN	SIGNAL	TYPE	DESCRIPTION
1	DCD	Input	Data Carrier Detect
2	RXD	Input	Receive Data
3	TXD	Output	Transmit Data
4	DTR	Output	Data Terminal Ready
5	GND	Ground	Ground reference
6	DSR	Input	Data Set Ready
7	RTS	Output	Request To Send
8	CTS	Input	Clear To Send
9	RI	Input	Ringing Indicator

Table 11: Standard RS232 connector pinout

Ext Focus

Scan head connector

Socket, M8, 4 pins female.

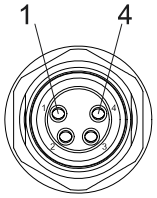


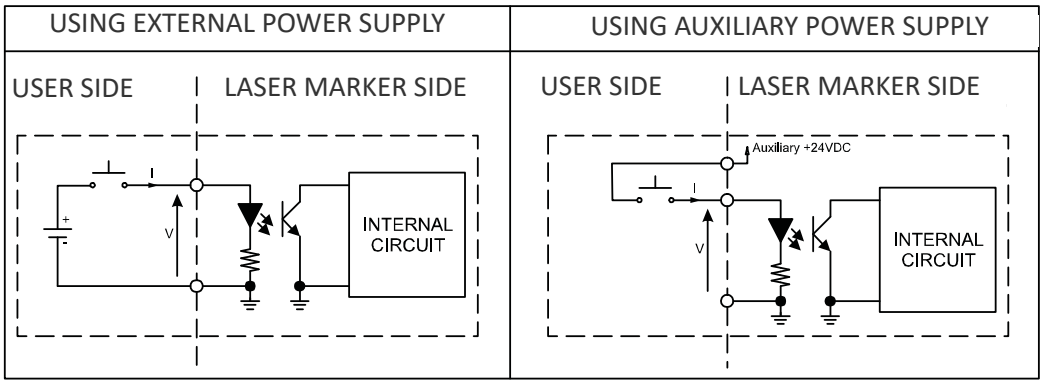
Figure 32: Ext Focus connector, female socket (front view)

PIN	SIGNAL	TYPE	DESCRIPTION
1	EXT_FOCUS-	Ground	Reserved ground for focusing beam
2	EXT_FOCUS+	Power Output	Reserved Auxiliary power supply for focusing beam
3	RESERVED	-	DO NOT CONNECT
4	RESERVED	-	DO NOT CONNECT

Table 12: Ext Focus connector pinout

INPUT/OUTPUT SPECIFICATIONS

Digital Input

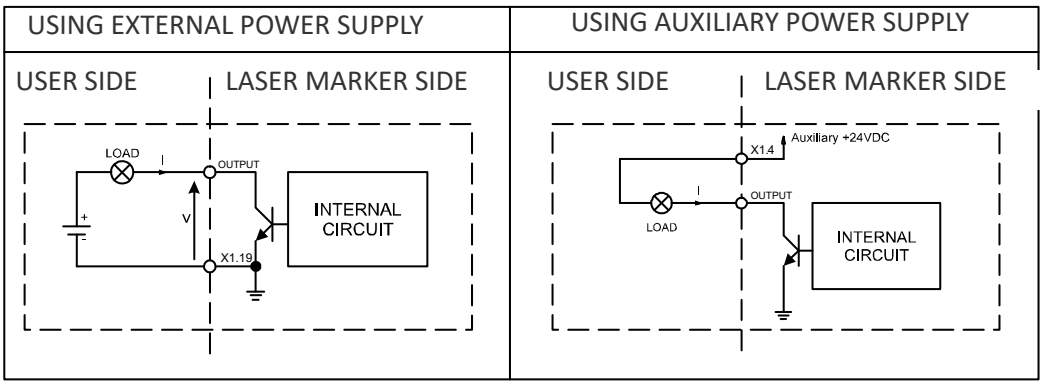


TECHNICAL CHARACTERISTICS			
Type	Optocoupler		
Vmax	28 V DC		
Imax	10 mA @ 24 V DC		
Pulse Width	≥ 1ms (debounce)		
	MIN	TYP	MAX
INPUT Logic LOW	0.0 V DC	0.0 V DC	2.0 V DC
INPUT Logic HIGH	10.0 V DC	24.0 V DC	28.0 V DC

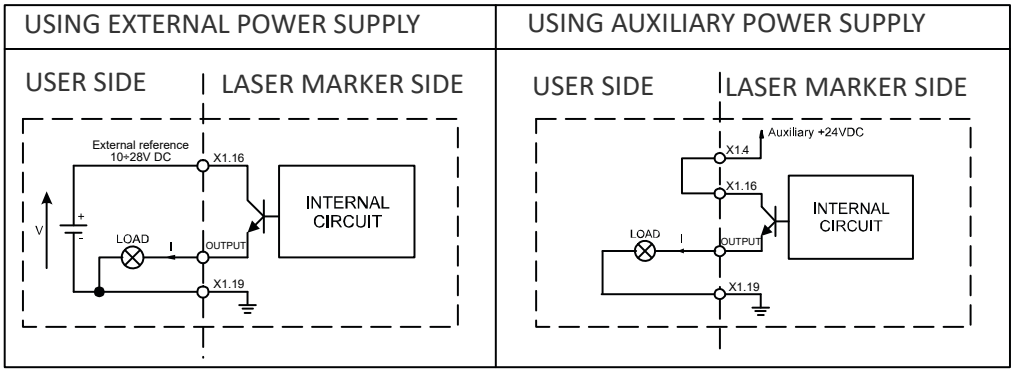
Table 13: Digital Input specification

Digital Output

NPN Configuration (default)



PNP Configuration



TECHNICAL CHARACTERISTICS	
Type	PNP/NPN configurable output
Supply voltage	10 to 28VDC (24V nominal)
Imax	50 mA[1]
VDS (ON) MAX	< 1.0V@50mA
Leakage current	< 80µA

1. Max current for each output if all are used.
   If only maximum 2 outputs are used, it could reach about 300mA for each one.

Table 14: Digital Output specification

LASER MARKER STATES

Normal Operation States

STATE	DESCRIPTION	STATUS LED
SYSTEM BOOTING UP	This state occurs since the laser marker is switched on until Laser Engine has been loaded and no errors occurred	Blinking
WAIT FOR START	In this state the laser marker cannot emit IR lasers radiation and Aiming and Focus beam cannot be activated	Steady
STANDBY SHUTTER CLOSED	In this state Aiming and Focus beam can be activated while the laser marker cannot emit IR laser radiation	Steady
READY	In this state the laser marker is able to emit IR laser radiation	Steady

Error States

STATE	DESCRIPTION	STATUS LED
ERROR	This state occurs if the laser marker detects an error that prevents normal operation	Blinking

SYSTEM ERROR	DESCRIPTION
INTERLOCK ERROR	This error occurs if the INTERLOCK function is ON. To reset the error, set INTERLOCK function to OFF and repeat the turning on sequence
CBOX ERROR	This error occurs if the CONNECTOR_PRESENCE signal (pin X1.10 Command Box connector) is LOW or not connected. To reset the error, set CONNECTOR_PRESENCE signal to HIGH value and repeat the turning on sequence
RACK TEMPERATURE ERROR	This error occurs if the temperature inside the control rack is out of the operating temperature range. To reset the error, a Laser marker restart is required
SCANHEAD TEMPERATURE ERROR	This error occurs if the temperature inside the scan head is out of the operating temperature range. To reset the error, a Laser marker restart is required
SCANHEAD CONNECTION ERROR	This alarm occurs if the cable between control rack and scan head is not connected. To reset the error, a Laser marker restart is required

LASER SOURCE ERRORS	DESCRIPTION
TEMPERATURE ERROR	This error occurs if the temperature inside the laser source is out of the operating temperature range. To reset the error, a Laser marker restart is required
POWER SUPPLY ERROR	This error occurs if the power supply of the laser source is out of range. To reset the error, a Laser marker restart is required
BACK REFLECTION ERROR	This error occurs if high optical power is reflected back to the laser source. To reset the error, a Laser marker restart is required
GENERIC ERROR	This error occurs if the laser source detects an internal failure. To reset the error, a Laser marker restart is required

Warning State

STATE	DESCRIPTION	STATUS LED
WARNING INVALID START SEQUENCE	This state occurs if the turning on sequence has not been followed. To restore normal laser marker operation, repeat the turning on sequence	Blinking

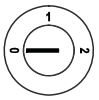
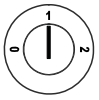
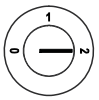
Control the Laser Marker States

The laser marker states can be controlled by:

- **Key Selector**
- **X1 - Command Box connector**

Key Selector mode

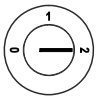
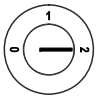
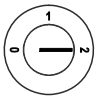
Controlling the laser marker states using the *Key Selector* on the control rack front panel requires that the input signals of the *X1 - Command Box* connector **X1.12** *(EXT_KEY)*, **X1.8** *(EXT_ENABLE_A)* and **X1.2** *(EXT_ENABLE_B)* are set to fixed **HIGH** level:

STATE	X1 - COMMAND BOX INPUT STATE		KEY SELECTOR	STATUS LED
SYSTEM BOOTING UP	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	HIGH HIGH HIGH		 Blinking
WAIT FOR START	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	HIGH HIGH HIGH		 Steady
STANDBY SHUTTER CLOSED	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	HIGH HIGH HIGH		 Steady
READY*	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	HIGH HIGH HIGH		 Steady

* *LASER_STOP* safety function not active

Command Box mode

Controlling the laser marker states using the *X1 - Command Box* connector on the control rack back panel requires that the *Key Selector* is set to fixed position "**2**":

STATE	X1 - COMMAND BOX INPUT STATE		KEY SELECTOR	STATUS LED
SYSTEM BOOTING UP	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	LOW LOW LOW		 Blinking
WAIT FOR START	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	LOW LOW LOW		 Steady
STANDBY SHUTTER CLOSED	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	HIGH LOW LOW		 Steady
READY*	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	HIGH HIGH HIGH		 Steady

* *LASER_STOP* safety function not active

OPERATING MODES

MODE	MEASURE			DESCRIPTION
	KEY SELECTOR	LASER_STOP[1]	INTERLOCK[2]	
LASER OFF	0	DISABLED	ENABLED	• PC running • Marking not allowed • Aiming beam not allowed • Focusing beam not allowed • SAFETY LEVEL according to proper use of safety inputs
	0	ENABLED	ENABLED	
	ANY	ANY	DISABLED	
SETTING	1	DISABLED	ENABLED	• PC running • Marking not allowed • Aiming beam allowed • Focusing beam allowed • SAFETY LEVEL according to proper use of safety inputs
	1	ENABLED	ENABLED	
	2	DISABLED	ENABLED	
OPERATING	2	ENABLED	ENABLED	• PC running • Marking allowed • Aiming beam allowed (smart aiming) • Focusing beam not allowed • SAFETY LEVEL according to proper use of safety inputs

1. "LASER_STOP_A" or "LASER_STOP_B" signals are disabled, where "disabled" means contacts open
2. "INTERLOCK_A" or "INTERLOCK_B" signals are disabled, where "disabled" means contacts open

TIMING DIAGRAMS

Turning On sequence

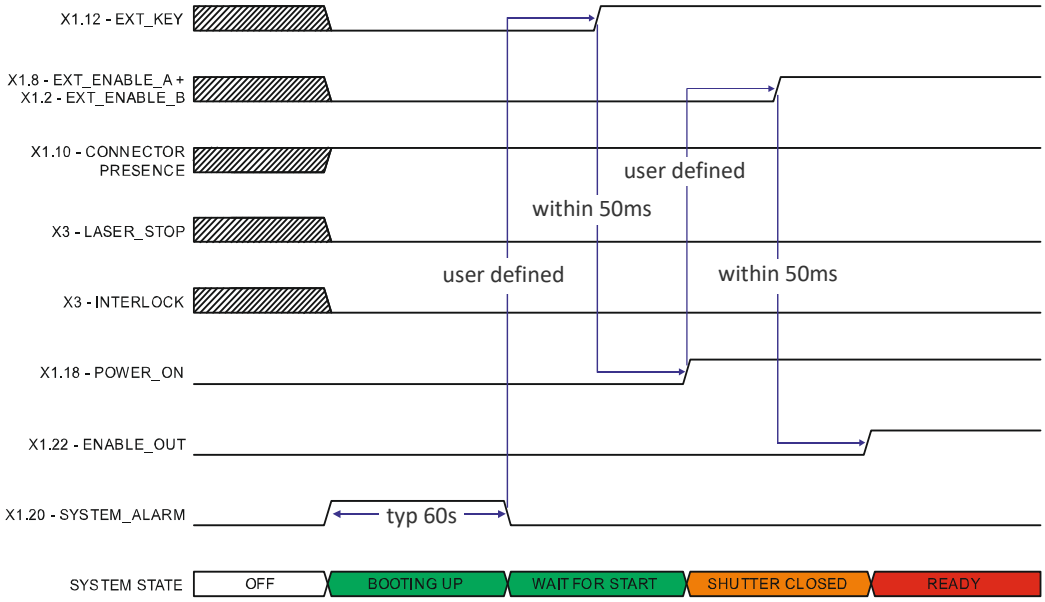


Figure 33: Turning On sequence timing diagram

Marking control signals behavior

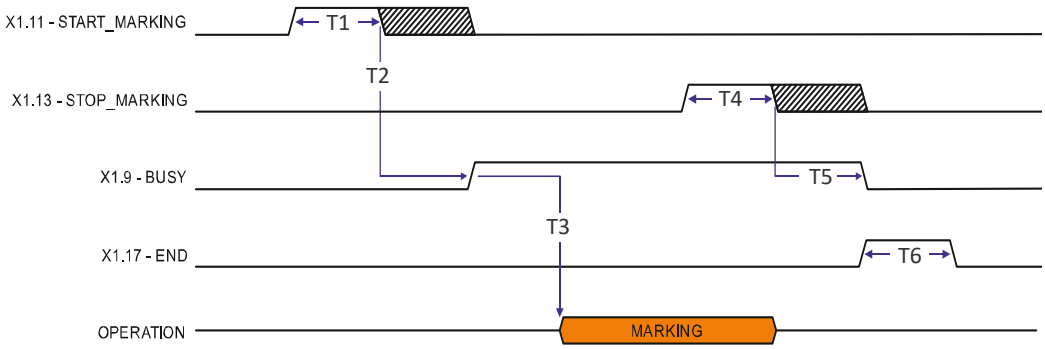


Figure 34: Marking process timing diagram

REF.	NAME	DESCRIPTION
T1	Start Time	Minimum time duration that the START_MARKING signal must have in order to be accepted as a valid START_MARKING event
T2	Start Delay	Delay between the acceptance of the START_MARKING signal and the rising edge of the BUSY signal
T3	Busy Advance	Delay between the rising edge of the BUSY signal and the laser emission
T4	Stop Time	Minimum time duration that the STOP_MARKING signal must have in order to be accepted as a valid STOP_MARKING event
T5	Busy Delay	Delay between the end of the laser emission and the falling edge of the BUSY signal
T6	End Time	Time duration of the END signal

NOTE **Consult Lighter™ software user's manual for a proper use of the same.**

SW_READY output signal (Ready to Mark mode)

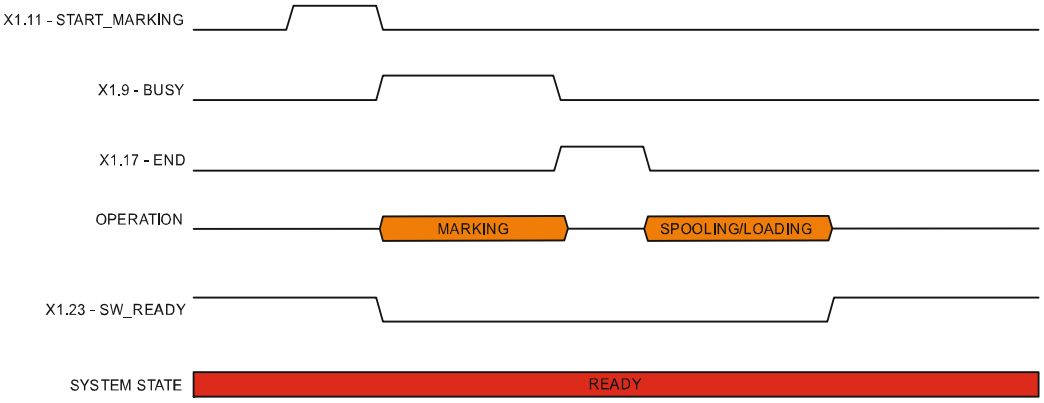


Figure 35: SW_READY signal timing diagram

MARKING_KO output signal

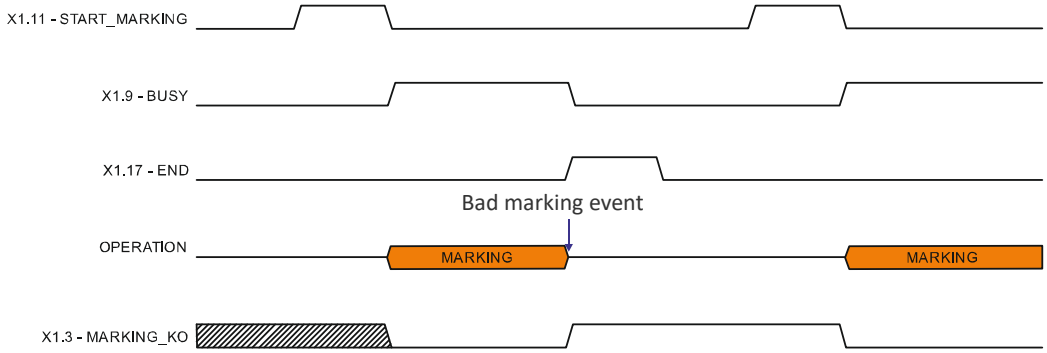


Figure 36: MARKING_KO signal timing diagram

SYSTEM_ALARM output signal

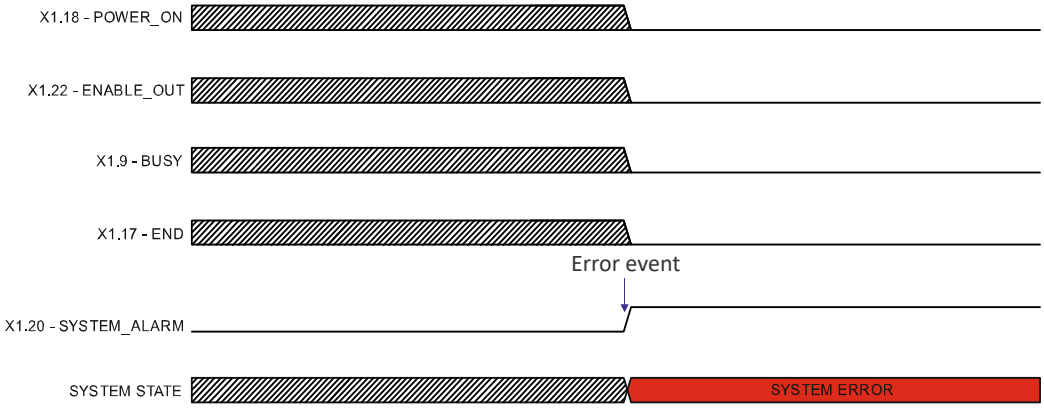


Figure 37: SYSTEM_ALARM timing diagram

MARVIS™ I/O signals behavior

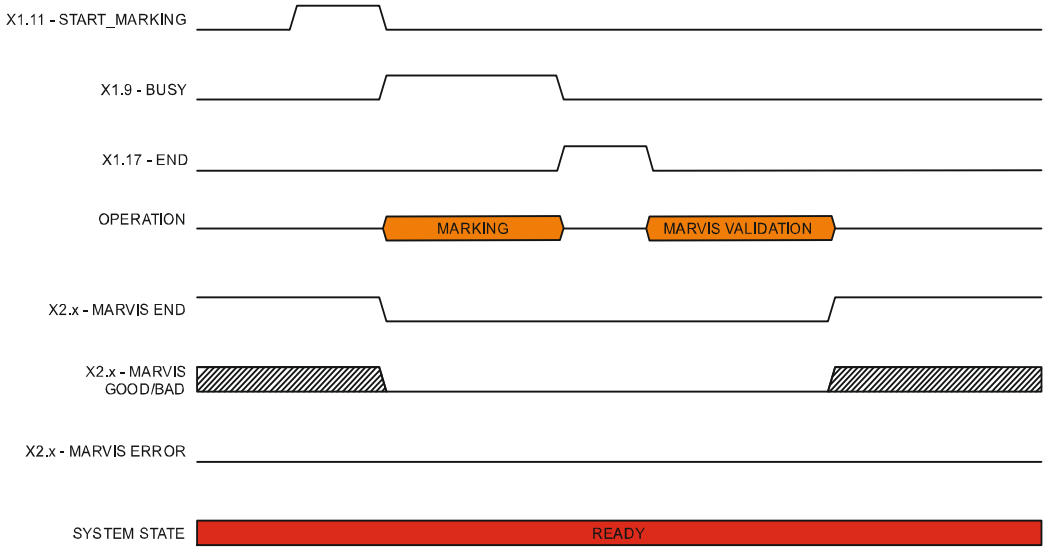


Figure 38: MARVIS™ I/O signals behavior

Safety functions behavior

INTERLOCK behavior

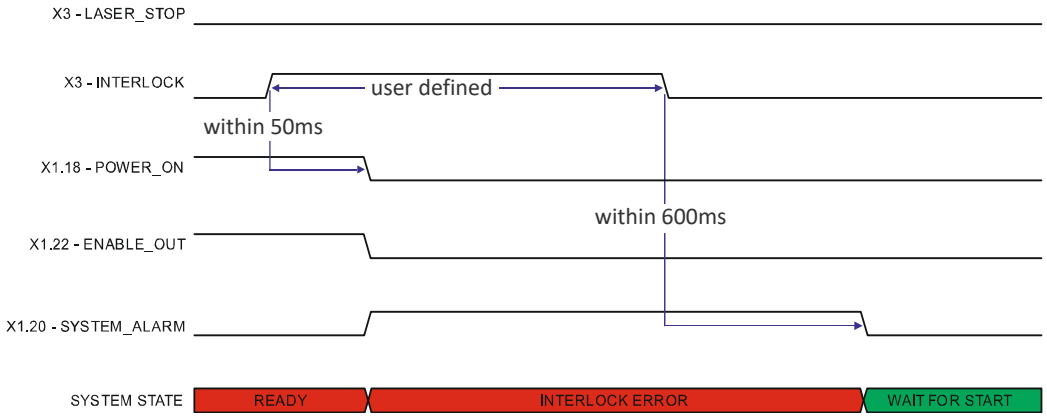


Figure 39: INTERLOCK behavior

LASER_STOP behavior

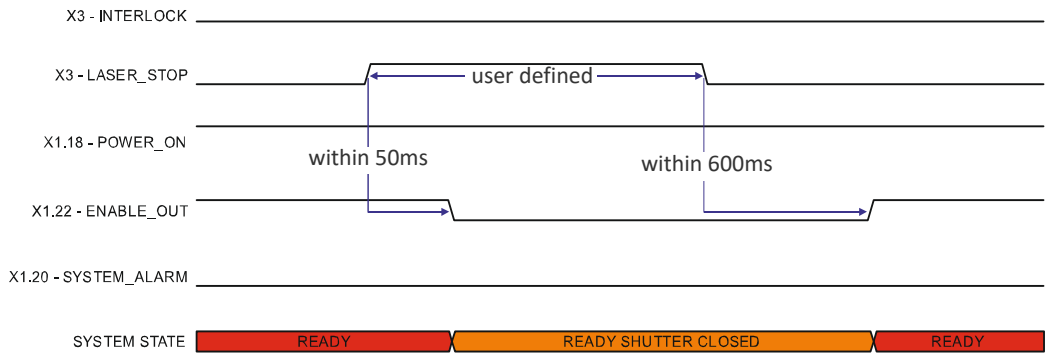


Figure 40: LASER_STOP behavior

Green Spot behavior

System Ready to Mark mode

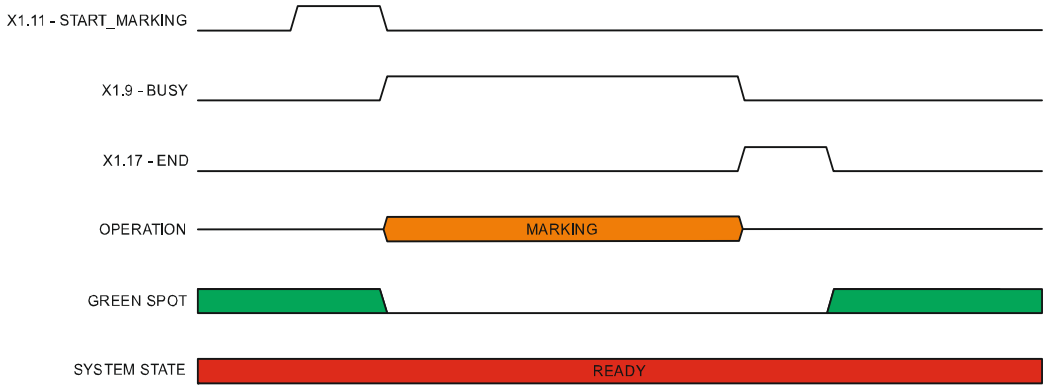


Figure 41: Green Spot: System Ready to mark

Marking Confirmation mode

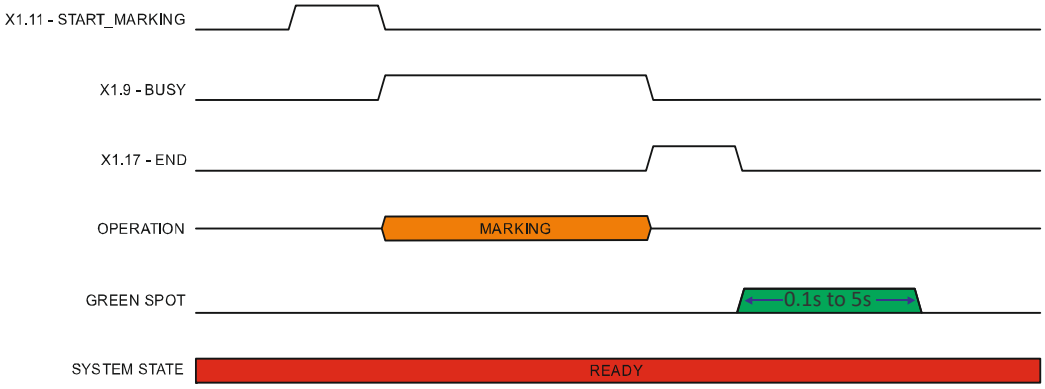


Figure 42: Green Spot: Marking Confirmation

MARVIS™ Verification mode

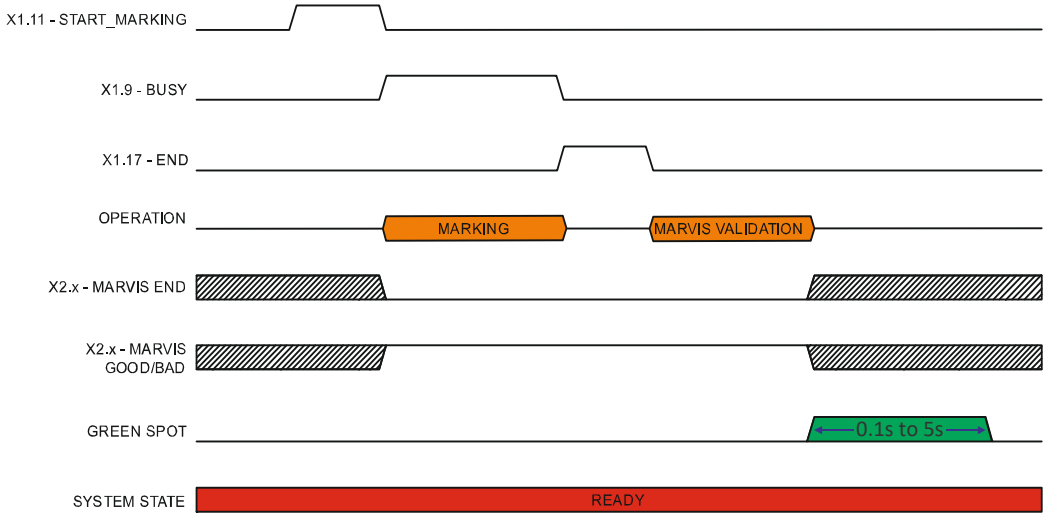


Figure 43: Green Spot: MARVIS™ Verification

Axes I/O signals behavior

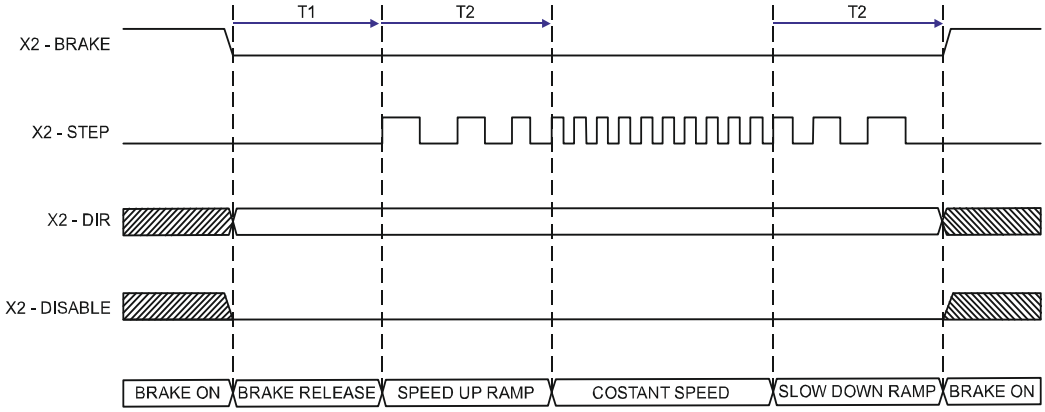


Figure 44: Axes I/O signals behavior

REF.	NAME	DESCRIPTION
T1	Brake release	The time that elapses between the brake release signal activation and the start of mechanical movement
T2	Ramp Time	The time to go from minimum speed (Start speed) to working speed (Speed)

LIGHTER™ SUITE MARKING SOFTWARE

The laser marker is equipped with Lighter™ Suite marking software.

Lighter™ Suite is the all-inclusive editing and laser management software for all Datalogic Laser Marking products.

Lighter™ Suite with its innovative approach focused on the user experience is revolutionizing Laser Marking management; the powerful and simple interface, the flexible and comprehensive customization capabilities and effective production tools represent an important step-ahead in traceability and branding industrial applications.

Lighter™ Suite combines into a unified GUI (Graphical User Interface) a powerful vectorial graphical editor, an advanced laser controller and the innovative MARVIS™ (MArk Read Verify Integrated Solution) feature to seamless interact with AutoID code reader for in-line validation of marked traceability codes.

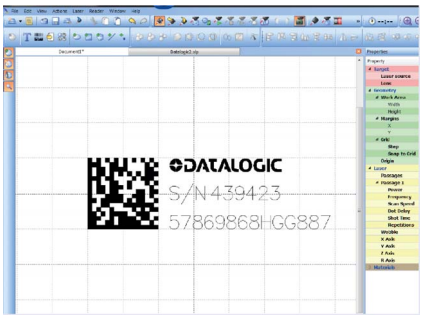
MARVIS™ connects Datalogic MATRIX™ N-series reader with the laser marker, enabling controlling from one single interface and enhancing individual products' performances.

MARVIS™ is also available as update for existing products.

Object-Oriented Configuration

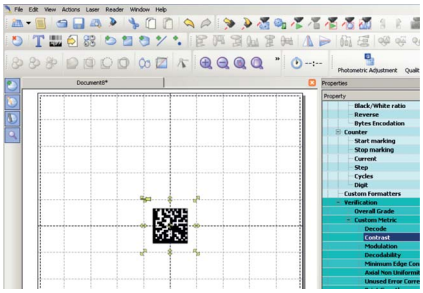
In the Lighter Suite, each object is associated with specific LASER parameters and READER configuration; loading a graphical layout will automatically retrieve and update laser and reader configurations.

Advanced Editing Function



- Easily create, import and edit texts, shapes and logos
- One-click code generator for 1D and 2D symbologies
- Object-related Property Browser for fast adjustment of Marker and Reader parameters
- Imports Bitmap and Vector files (DXF, DWG, PLT, PDF, AI, SVG, BMP, JPG, PNG and TIFF...)
- Advanced filling featured with various laser-optimized patterns

MARVIS™ Integrated Configuration And Setup



- IP address discovery and connection management
- Dedicated Digital output for in-line parts selection
- Dedicated Digital input for deferred reader trigger
- Configurable images storage pool
- New Code Quality Training feature to automatically define code quality threshold from "Golden Sample"
- Patent Pending "Quality Grade Metric Profile" (QGP)

Connectivity

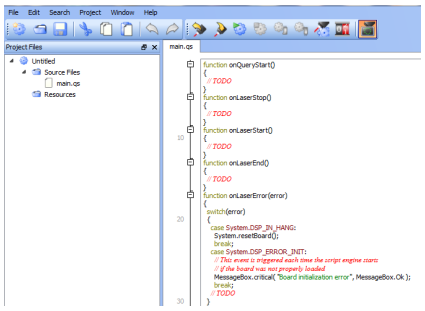
The Lighter™ Suite allows OEMs and Machine builders to develop a complete and cost effective Laser Marking Station, based on embedded hardware and software resources (such as STAND ALONE mode) or to design an advanced Laser Marking Solution able to control machinery over a simple Ethernet connection with a supervisor computer (MASTER-SLAVE mode).

Lighter™ Suite natively embeds TcpServer, Profinet I/O and EtherNet/IP protocols.

Scripting programmability

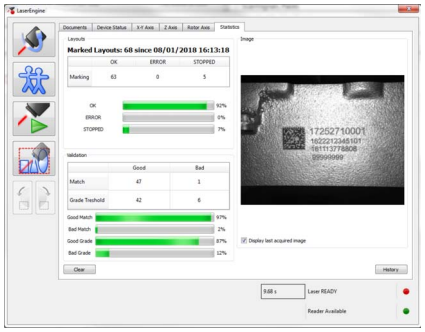
The LIGHTER Suite integrates the IDE (Integrated Development Environment) providing the users with a full set of tools to be used for extremely flexible customization.

The programming language is ECMAScript (also called JavaScript).



- Control the entire marking process
- Create and fully customize marking layout and its content at runtime
- Interact with local or centralized databases
- Create alternative customized interfaces
- Interact with Third Party devices

Runtime Production Statistics and Reports



Built-in validation statistics dashboard.

Configurable log file with Quality Reporting and code images.

CHAPTER 4
SET UP

CONNECTIONS

The laser marker connections are described here below. Follow the operations as described.

CAUTION: Control rack and scan head are joined by a connection cable 3 meters long. Control rack and scan head are NOT separable.

Connecting X1 - Command Box connector

The *X1 - Command Box* connector must always be inserted with proper signals provided in order to use the laser marker. The absence of such connector blocks the laser marker operations.

WARNING: If the Command Box Muting Device provided is connected, the laser marker enable is bypassed.

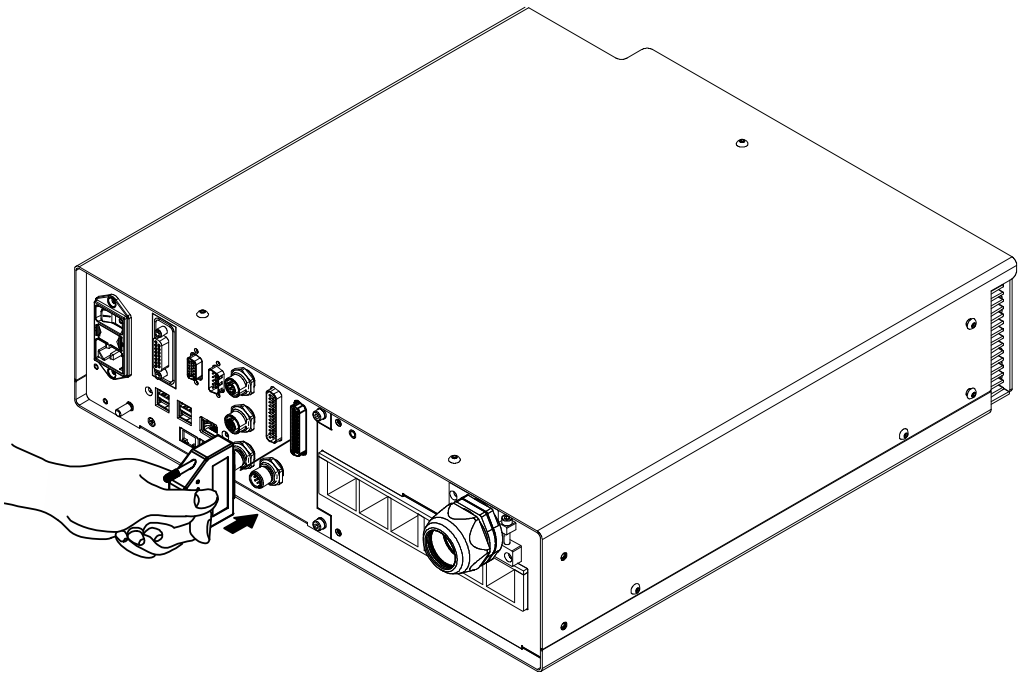


Figure 45: Connecting X1 - Command Box connector

Connecting X3 - SLO connector

The *X3 - SLO* connector must always be inserted with proper signals provided in order to use the laser marker. The absence of such connector blocks the laser emission.

WARNING: Do not use the SLO Muting Device for external devices, since this will result in loss of the safety function of the machine to which this product is installed.
Do not use the SLO Device except for maintenance of this product.

WARNING: It is the customer's responsibility to provide a correct integration of the safety signals according to applicable regulations.

NOTE: See "Appendix B " on page 100 **about the compliance to safety.**

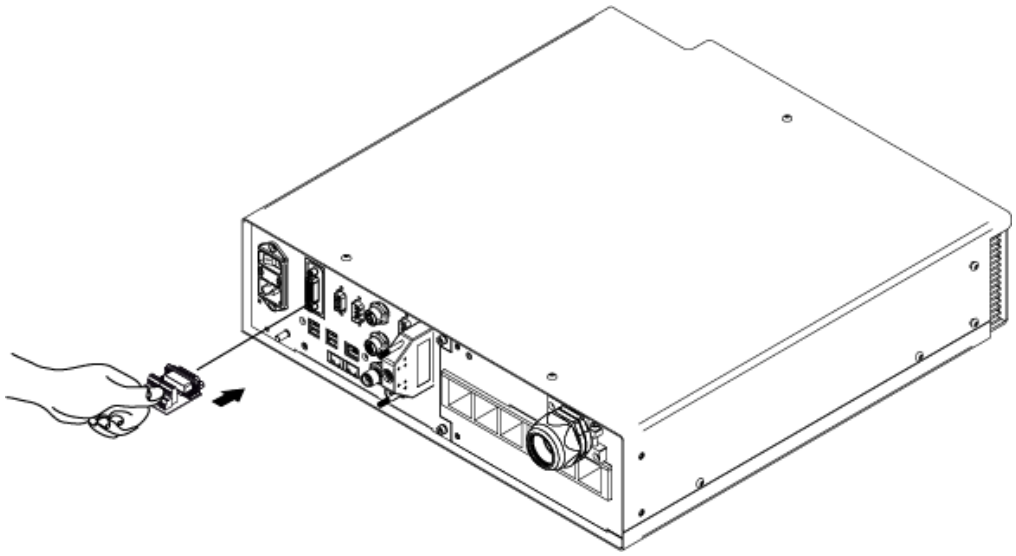


Figure 46: Connecting X3 - SLO connector

Connecting Power Supply cable

Connect the Power Supply cable using the cord retention system.

NOTE: The locking mechanism is released again by pressing the release lever. Thanks to its luminous bright yellow color, it is easily recognizable and distinguishes this system from conventional mains connections.

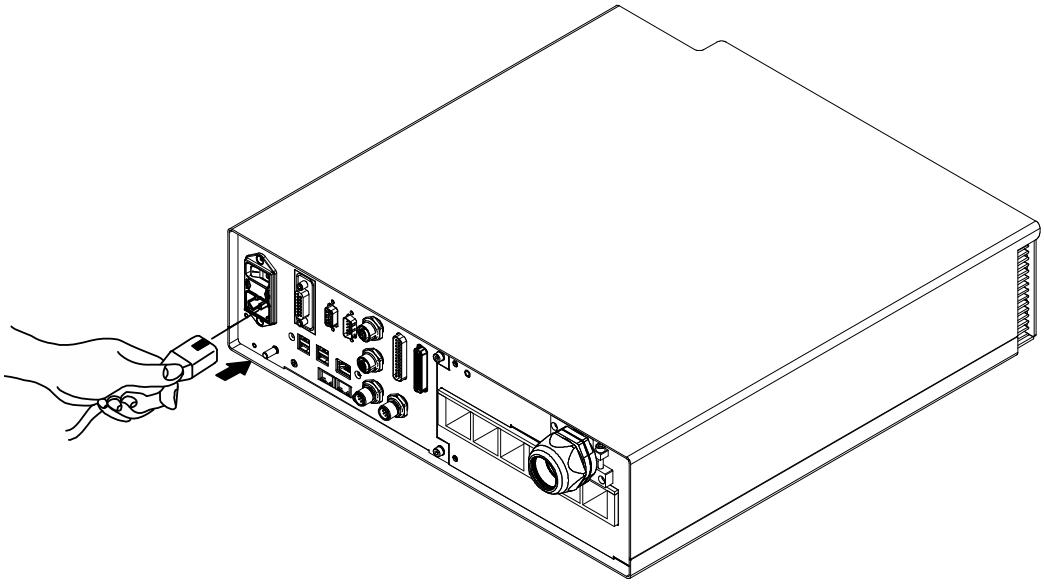


Figure 47: Connecting Power Supply cable

Connecting the Earth Ground

To ensure high electrical noise immunity it is strongly recommended to connect the chassis to suitable earth ground.

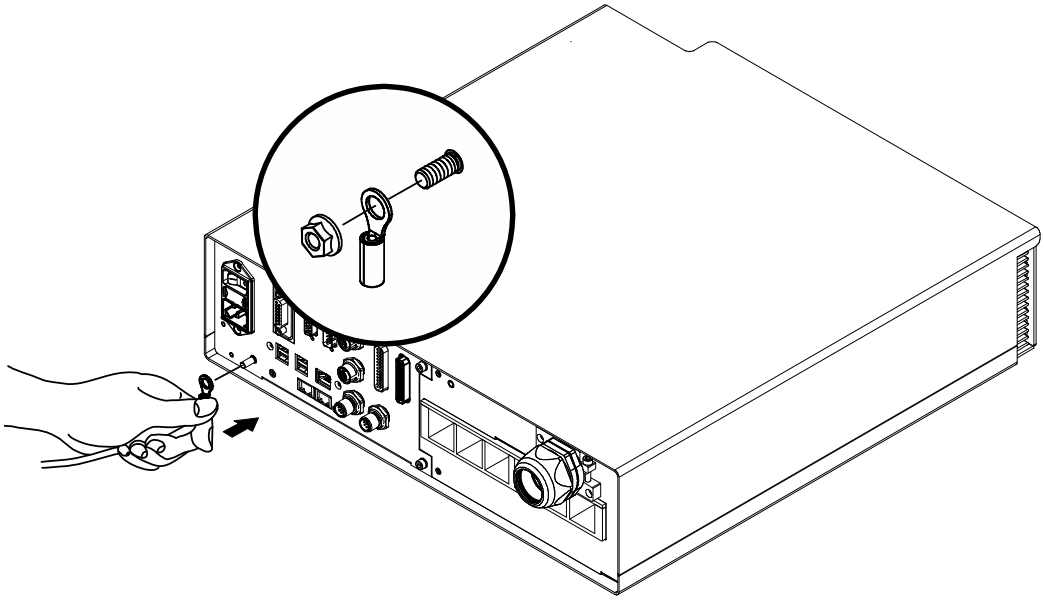


Figure 48: Connecting the Earth Ground

Local Mode Control connections

To use the laser marker in “Local Mode Control” it is necessary to install a mouse, keyboard and monitor. Connect the monitor and input devices to laser marker as shown below:

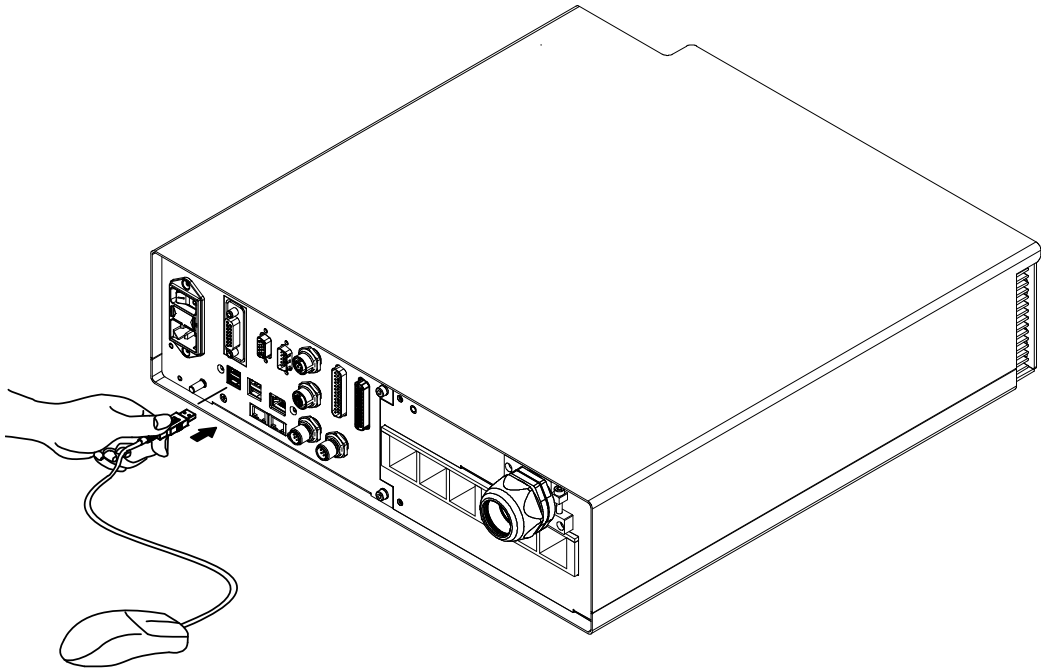


Figure 49: Connecting the mouse

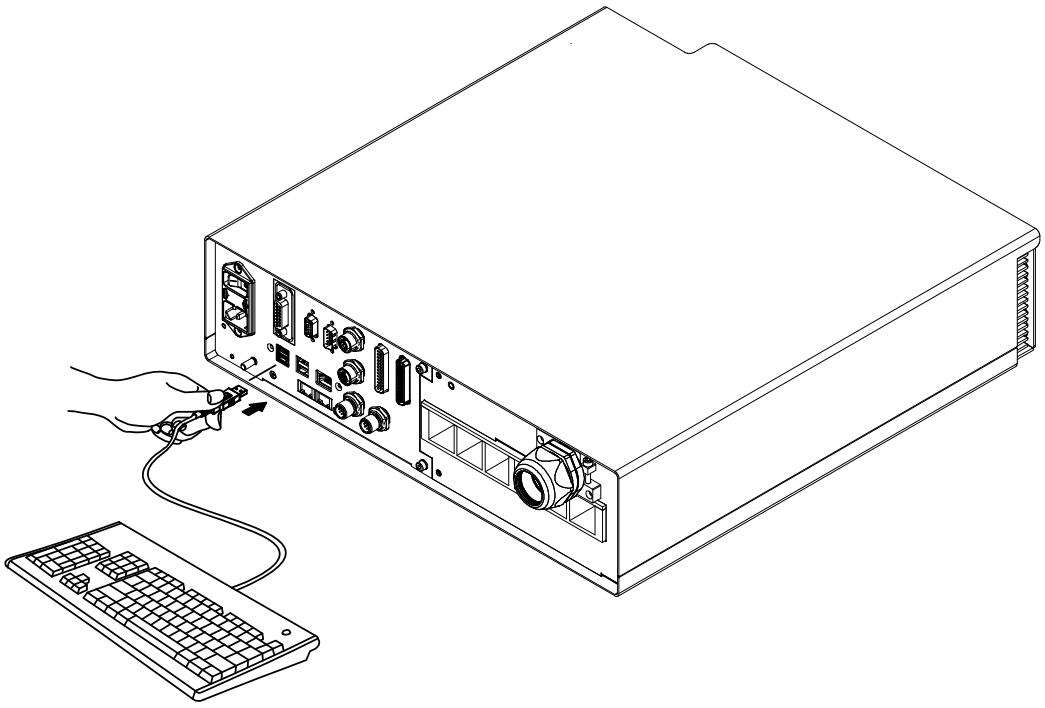


Figure 50: Connecting the keyboard

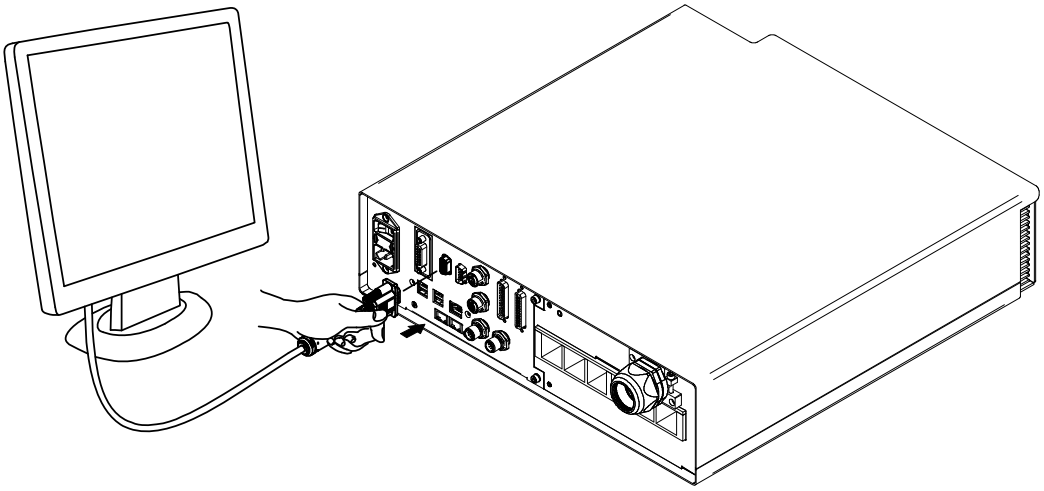


Figure 51: Connecting the monitor

NOTE: Minimum monitor resolution 800 x 600 (VGA standard).

Remote Mode Control connection

To use the laser marker in “Remote Mode Control” it is necessary to connect a network cable:

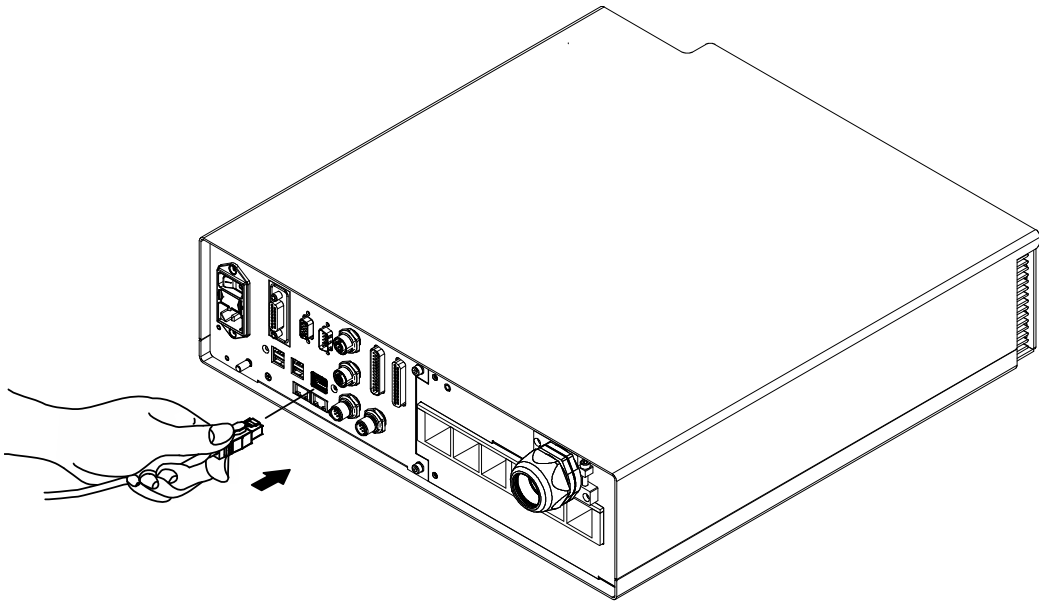


Figure 52: Connecting LAN port

NOTE: The LAN ports are configured by default with a fixed IP Address and Subnet Mask:

- LAN 1 Default IP address: 192.168.1.10

- LAN 2 Default IP address: 192.168.3.10

- LAN 3 Default IP address: 192.168.0.10

- Default Subnet Mask: 255.255.255.0

See “Change the LAN configuration and IP address” on page 74 in order to change LAN configuration.

NOTE: Ethernet TCP/IP 10, 100 Mbit.

F-THETA SCAN LENS PROTECTION CAP REMOVAL

Remove the F-Theta scan lens protection cap before marking operation:

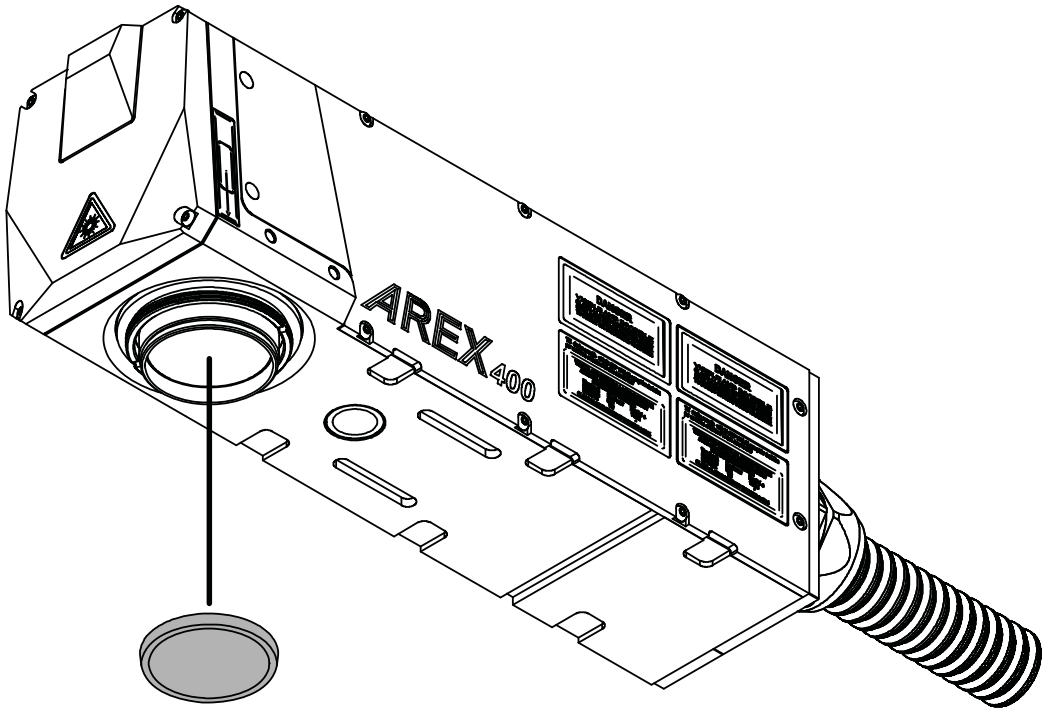


Figure 53: F-Theta scan lens protection cap removal

CAUTION: Marking with the lens protection cap in place could result in damage to the laser marker.

CHAPTER 5
USE AND OPERATION

Before turning on the laser marker, be sure that the laser marker is connected as previously described. Check the presence of:

- Voltage power supply connection
- X3 - SLO connection
- X1 - Command Box connection

WARNING: Do not use the SLO Muting Device for external devices, since this will result in loss of the safety function of the machine to which this product is installed.

Do not use the SLO Muting Device except for maintenance of this product.

WARNING: It is the customer's responsibility to provide a correct integration of the safety signals according to applicable regulations.

WARNING: If the Command Box Muting Device provided is connected, the laser marker enable is bypassed.

TURNING ON SEQUENCE

The laser marker states can be controlled by:

- Key Selector (see “Sequence using Key Selector” on page 62)
- X1 - Command Box connector (see “Sequence using X1 - Command Box connector” on page 65)

Sequence using Key Selector

CAUTION: Controlling the laser marker states using the Key Selector on the control rack front panel requires that the input signals of the X1 - Command Box connector X1.12 *(EXT_KEY)*, **X1.8** *(EXT_ENABLE_A)* **and X1.2** *(EXT_ENABLE_B)* **are set to fixed HIGH level.**

Set the Key Selector to “**0**” and turn ON the main power supply switch in the back panel of the control rack. The laser marker turn on and goes in booting-up state:

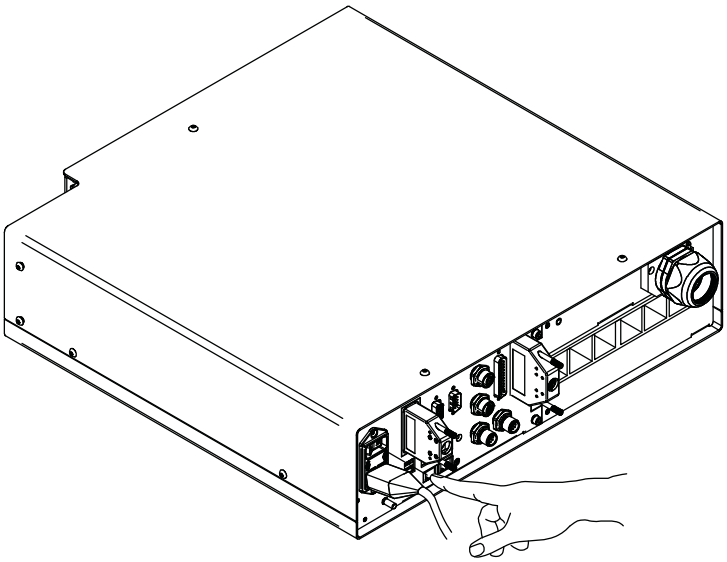


Figure 54: Power on the laser marker

During booting up state, the status LED on the control rack and the status LED on the scan head blink green.

Wait until booting-up finish: the status LED on the control rack and the status LED on the scan head are steady green. The laser marker is in WAIT FOR START state.

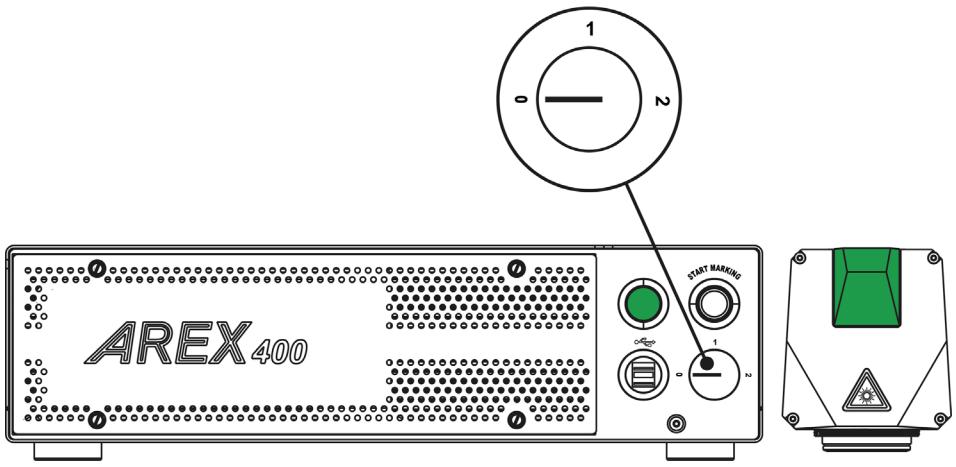


Figure 55: Wait for start state

Rotate the key selector one-step to “**1**” position:

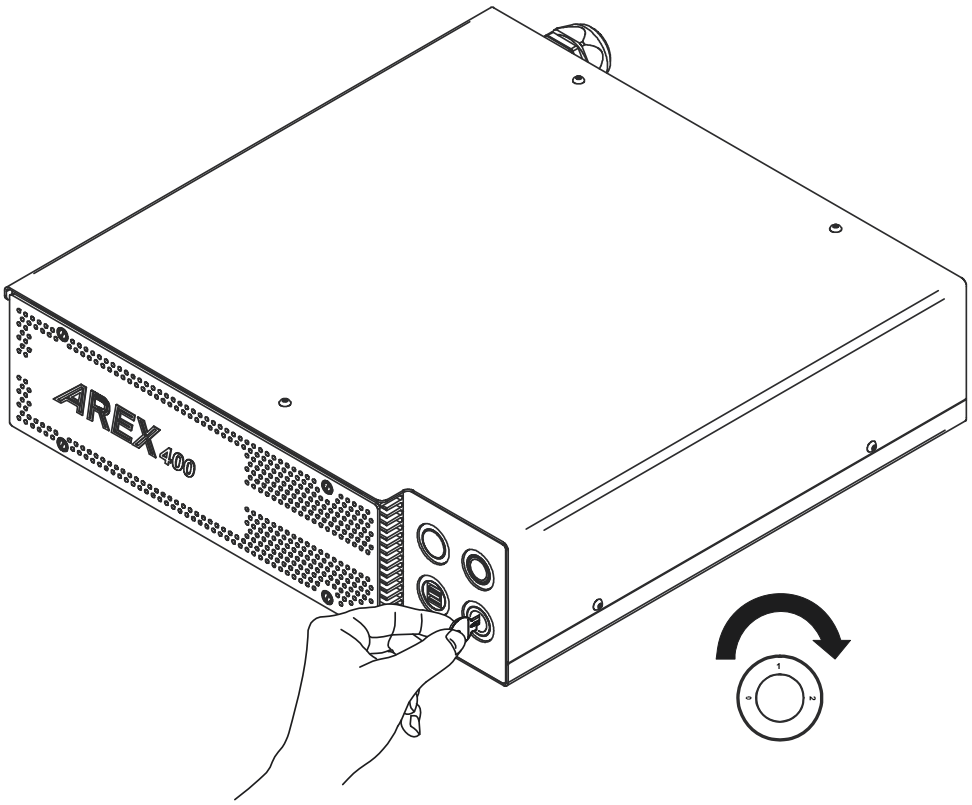


Figure 56: Key selector in “1” position

The status LED on the control rack and the status LED on the scan head are steady orange. The laser marker is in STANDBY SHUTTER CLOSED state.

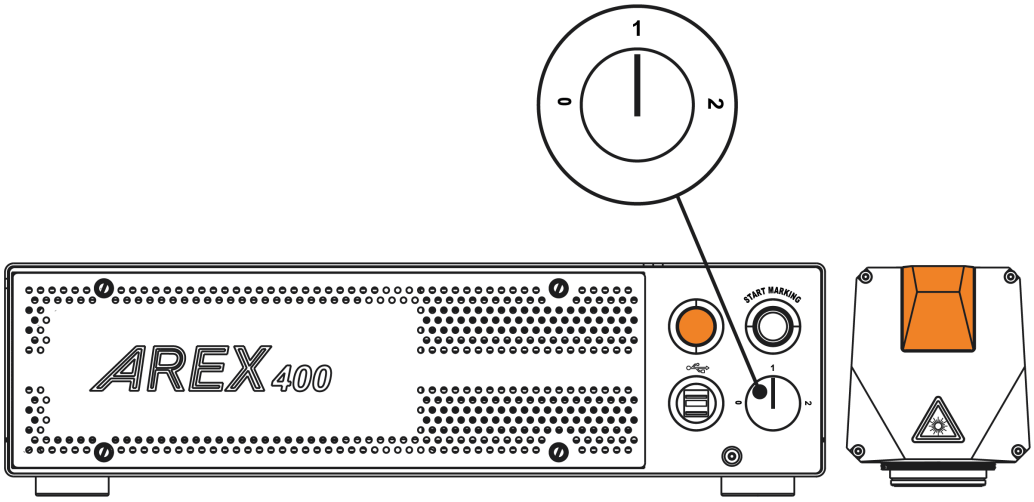


Figure 57: Standby Shutter closed state

Rotate the key selector one-step to **“2**” position:

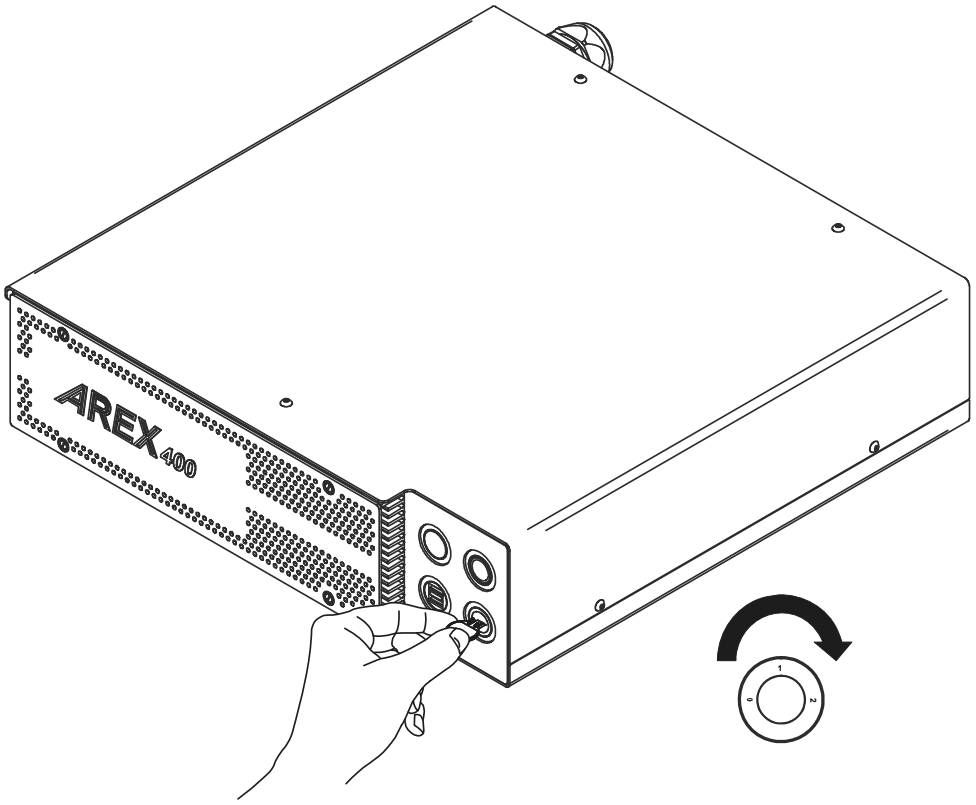


Figure 58: Key selector in “2” position

The status LED on the control rack and status LED on the scan head will turn red. The laser marker is in READY state.

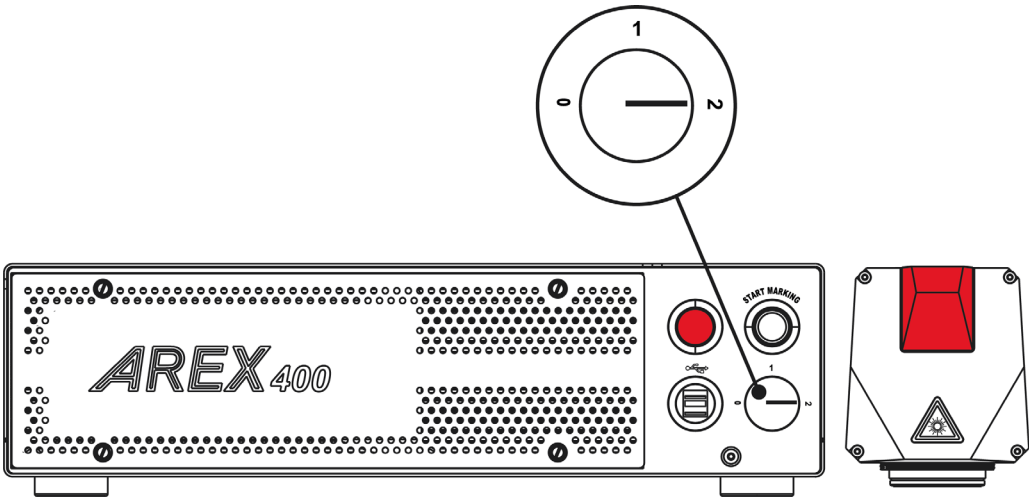


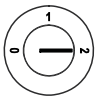
Figure 59: Ready state

Sequence using X1 - Command Box connector

CAUTION: Controlling the laser marker states using the X1 - Command Box connector on the control rack back panel requires that the Key Selector is set to fixed position "2".

Turn ON the main power supply switch in the back panel of the control rack. The laser marker turns on and goes in booting-up state. During booting up state, the status LED on the control rack and the status LED on the scan head blink green.

Wait until booting-up has ended: the status LED on the control rack and the status LED on the scan head are steady green. The laser marker is in WAIT FOR START state.

STATE	X1 - COMMAND BOX INPUT STATE		KEY SELECTOR	STATUS LED
WAIT FOR START	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	LOW LOW LOW		 Steady

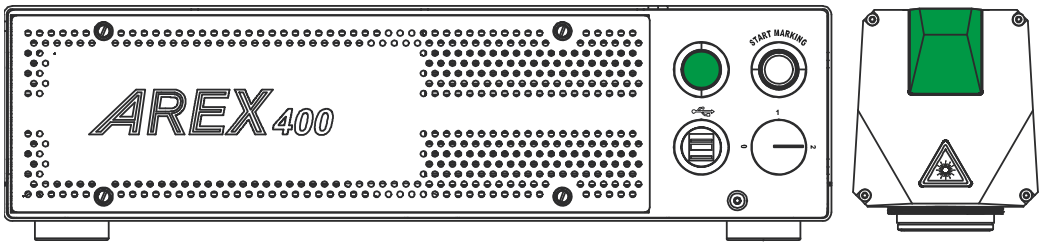
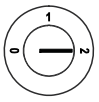


Figure 60: Wait for start state

Set the Command box input signals as in the table below:

STATE	X1 - COMMAND BOX INPUT STATE		KEY SELECTOR	STATUS LED
STANDBY SHUTTER CLOSED	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	HIGH LOW LOW		 Steady

The status LED on the control rack and the status LED on the scan head are steady orange. The laser marker is in STANDBY SHUTTER CLOSED state.

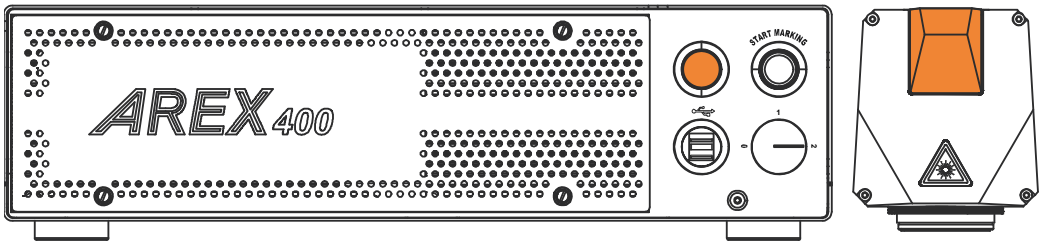
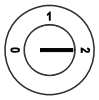


Figure 61: Standby Shutter closed state

Set the Command box input signals as in the table below:

STATE	X1 - COMMAND BOX INPUT STATE		KEY SELECTOR	STATUS LED
READY	EXT_KEY EXT_ENABLE_A EXT_ENABLE_B	HIGH HIGH HIGH		 Steady

The status LED on the control rack and status LED on the scan head will turn red. The laser marker is in READY state.

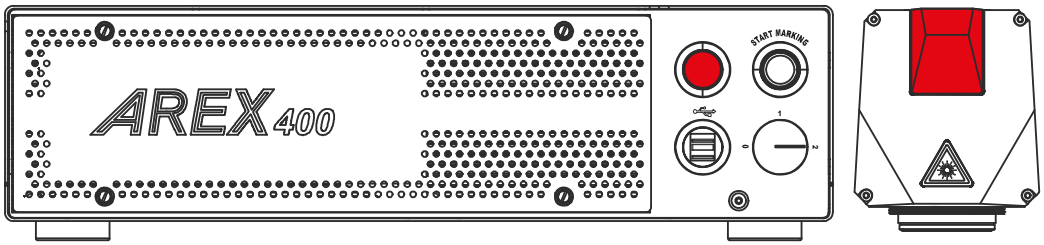


Figure 62: Ready state

CHAPTER 6

CUSTOMIZE THE LASER MARKER SOFTWARE

SYSTEM PROTECTION

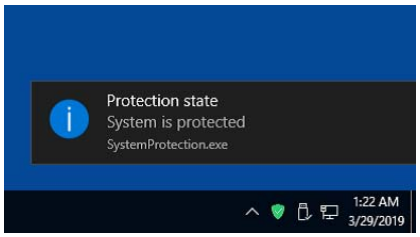
The System Protection enhances the security of the system against disk corruption that might be caused by unexpected system shutdowns or malware attacks and protects the **C:\ drive** from unwanted changes.

When the System Protection is enabled, any change or deletion on the C:\ drive will be restored after system reboot, otherwise when the System Protection is disabled any modification will be stored on the disk and it will persist after reboot.

System Protection Tool

The System Protection tool shows the status of the System Protection and is visible on the tray-bar icon in the lower- right corner of the screen.

A notification popup message that shows the status of System Protection is still visible on the screen for a few seconds after system startup.



The tray-bar icon color represents the protection state:

- **Red**: the system protection is **disabled**
- **Green**: the system protection is **enabled**
- **Yellow**: the system **must be rebooted** to apply the new settings

How to use the System Protection tool

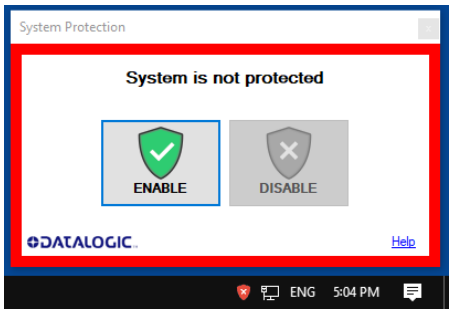
The System Protection tool GUI can be opened:

- By clicking on the notification popup
- By right-clicking the tray-bar icon then, “Configure”
- Double-clicking the tray-bar icon
- From *Start Menu\Datalogic\System Protection*

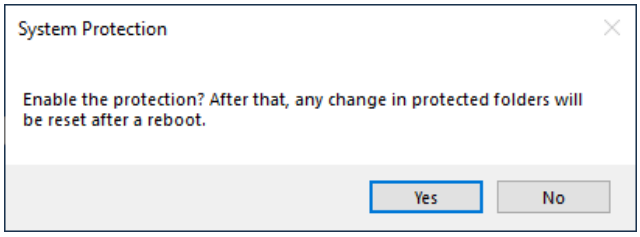
Enable the system protection

NOTE: When the System Protection is enabled any change or deletion on the C:\ drive will be restored after system reboot.

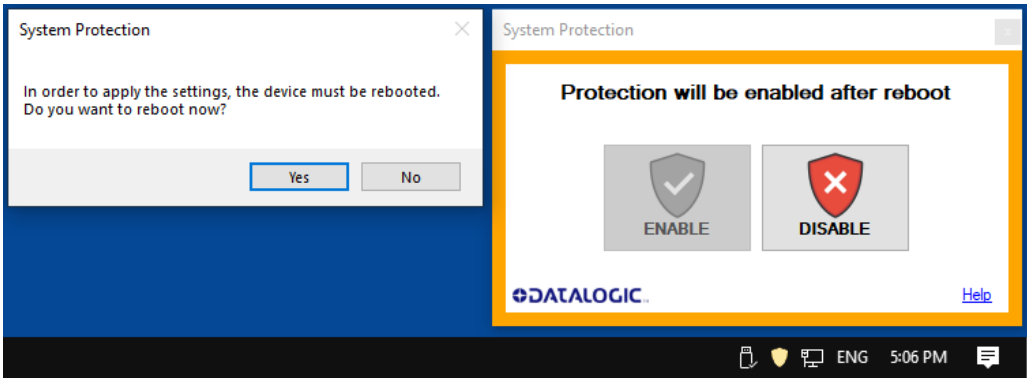
- Open the System Protection tool GUI
- Click the **ENABLE** button



- A message advise the User to confirm the new setting. Press **YES** to enable System Protection



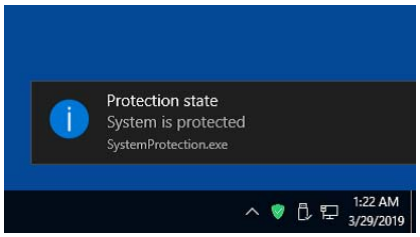
- A message advise the User that the system will be rebooted. Press **YES** to continue



- Wait for system reboot

CAUTION: DO NOT turn OFF or UNPLUG the system while Windows® is shutting down.

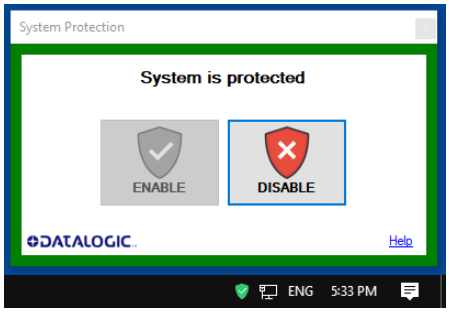
- Check if the Tray-bar icon color is **GREEN** (protection enabled)



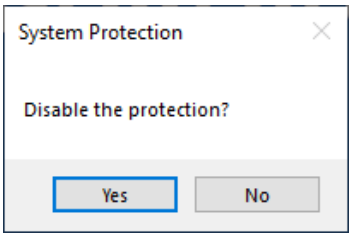
Disable the system protection

CAUTION: When the System Protection is disabled the system is not protected against disk corruption or malware attacks. Disable the protection only for the time necessary to make disk changes.

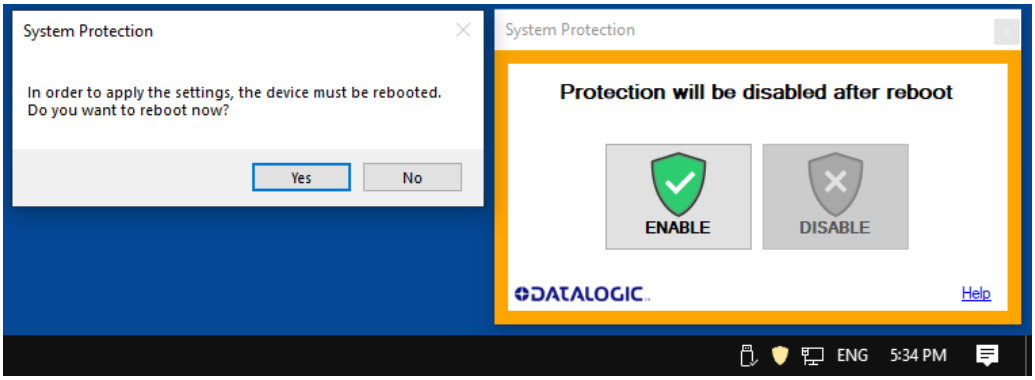
- Open the System Protection tool GUI
- Click the **DISABLE** button



- A message advise the User to confirm the new setting. Press **YES** to disable System Protection



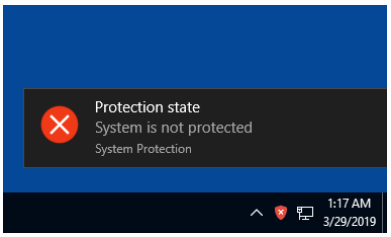
- A message advise the User that the system will be rebooted. Press **YES** to continue



- Wait for system reboot

CAUTION: DO NOT turn OFF or UNPLUG the system while Windows® is shutting down.

- Check if the Tray-bar icon color is **RED** (protection disabled)



CHANGE O.S. LANGUAGE AND KEYBOARD LAYOUT

The laser marker allows you to customize the operating system changing the language used in menus, dialogs and languages you can use to enter text and keyboard layout.

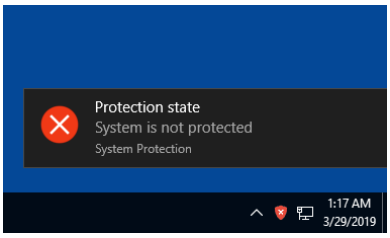
The following languages are pre-installed in the system: Chinese (PRC), Chinese (Taiwan), English (United States), French (France), German (Germany), Italian (Italy), Japanese (Japan), Korean (Korea), Spanish (Spain).

NOTE: In order to perform this setting it is necessary to connect mouse, keyboard and monitor to the laser marker (see "Local Mode Control connections" on page 57).

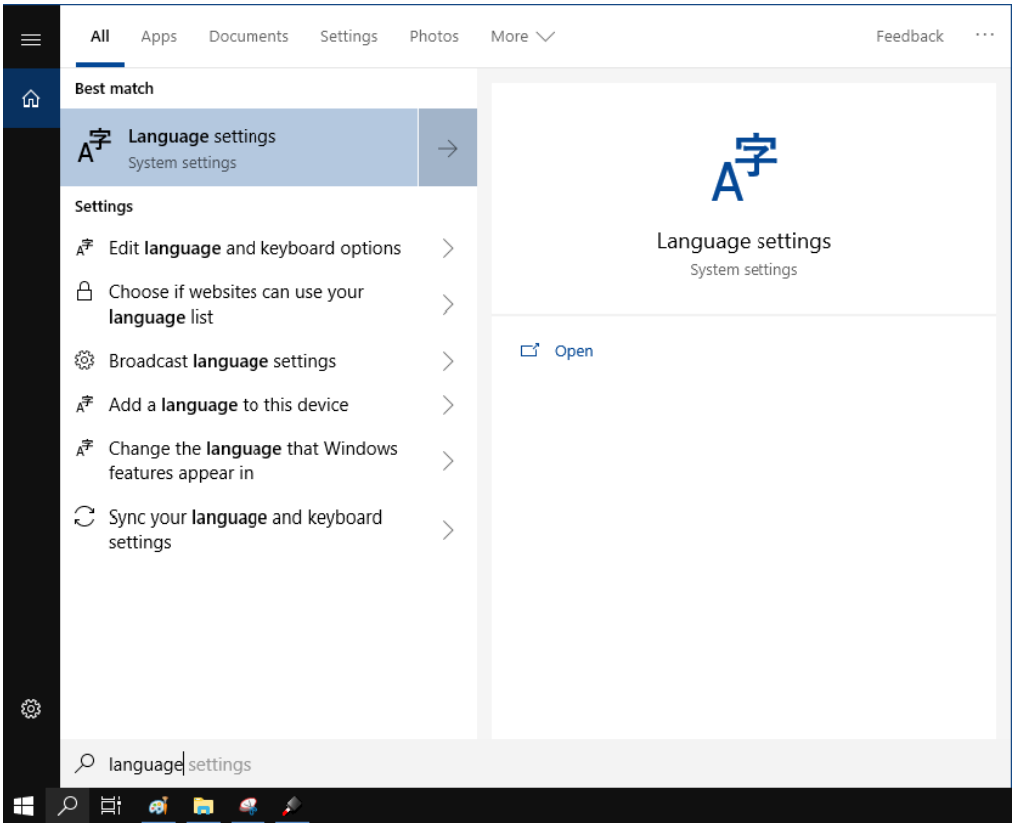
1. Disable system protection (see "Disable the system protection" on page 69)

CAUTION: When the System Protection is disabled the system is not protected against disk corruption or malware attacks. Disable the protection only for the time necessary to make disk changes.

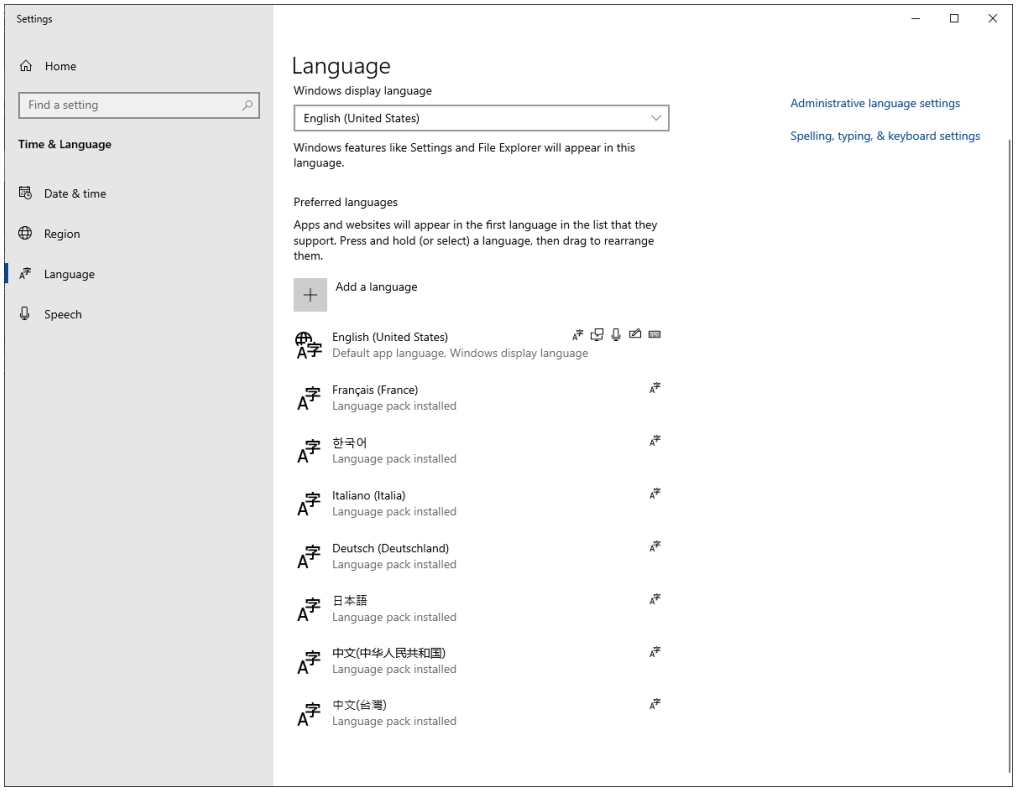
2. Wait for the operating system to **restart**
3. Check that the System Protection is **disabled** (red icon):



4. Click the **Search icon** and type "**language**"
5. Click on **Language settings**

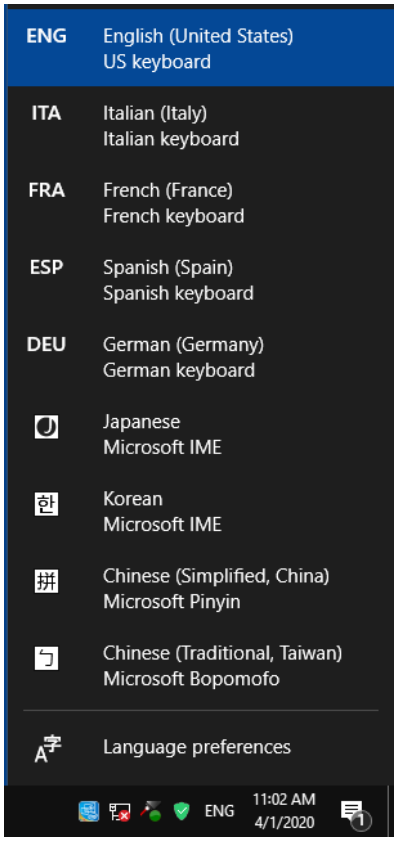


6. Select the Windows display language:



7. Click on the **Input Indicator** icon in the taskbar

8. Select the **keyboard layout** from the list:



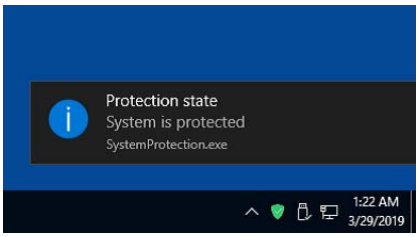
9. Close all the open windows

10. Enable system protection (see “Enable the system protection” on page 68)

CAUTION: When the System Protection is disabled the system is not protected against disk corruption or malware attacks.

11. Wait for the operating system to **restart**

12. Check that the System protection is **enabled** (green icon):



CHANGE THE LAN CONFIGURATION AND IP ADDRESS

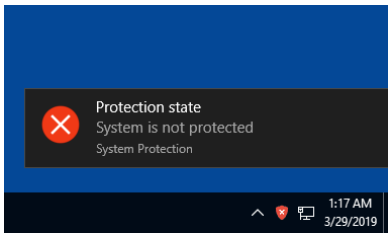
The operating system allows you to change the LAN configuration and IP address.

NOTE: In order to perform this setting it is necessary to connect mouse, keyboard and monitor to the laser marker (see "Local Mode Control connections" on page 57).

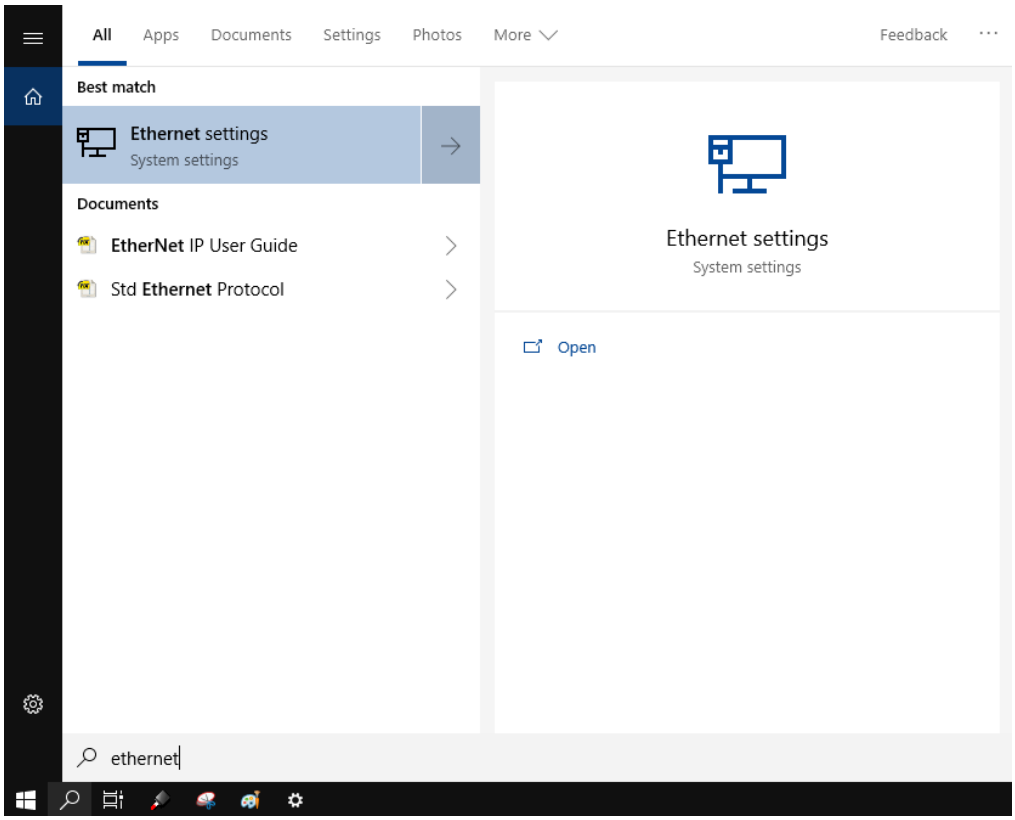
1. Disable system protection (see "Disable the system protection" on page 69)

CAUTION: When the System Protection is disabled the system is not protected against disk corruption or malware attacks. Disable the protection only for the time necessary to make disk changes.

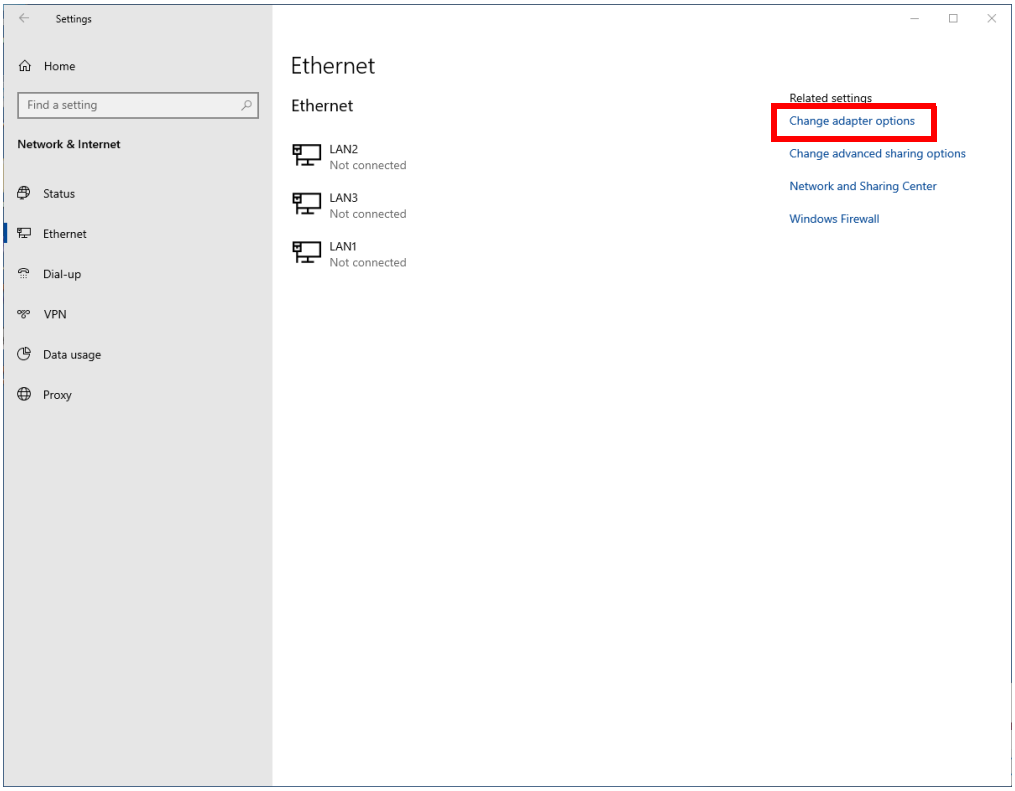
2. Wait for the operating system to **restart**
3. Check that the System protection is **disabled** (red icon):



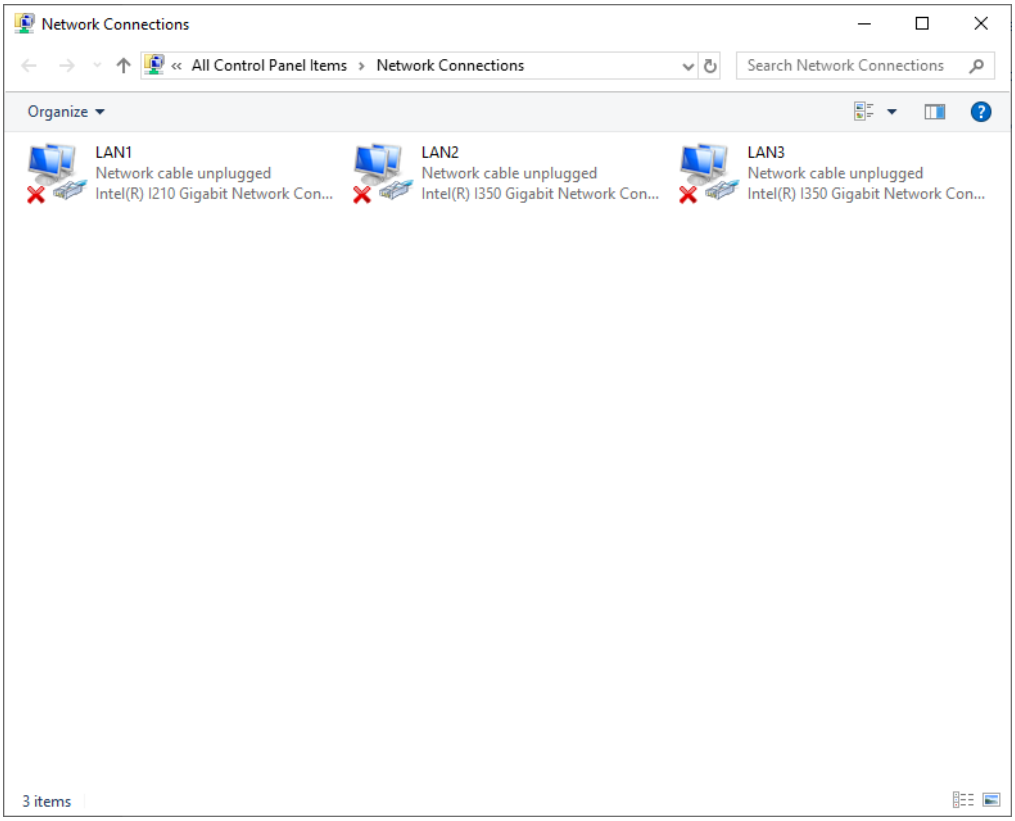
4. Click the **Search icon** and type "**Ethernet**"
5. Click on **Ethernet settings**



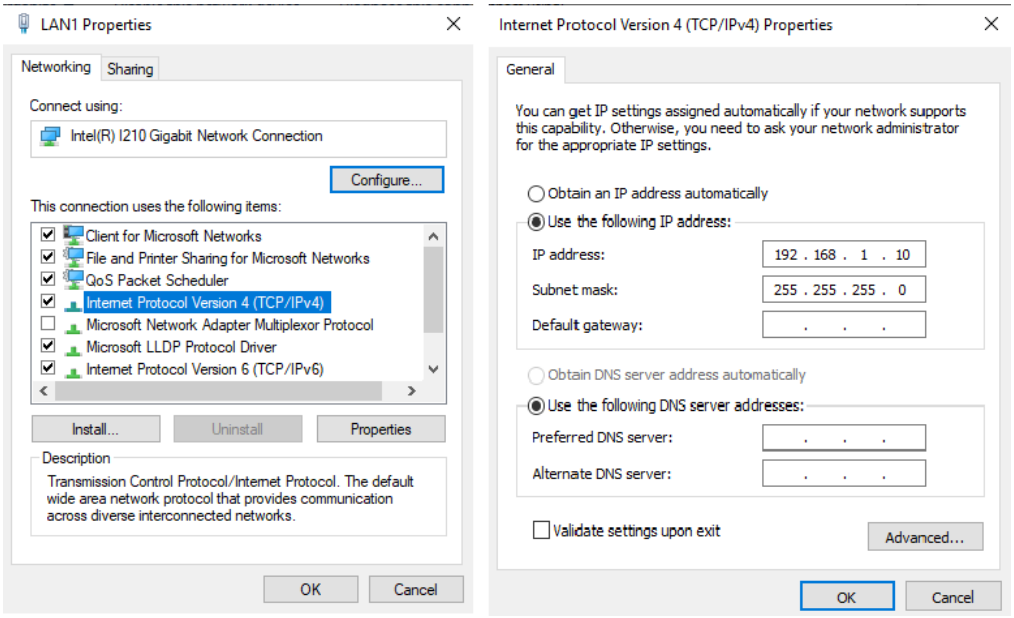
6. Click on **Change adapter options**



7. In the Network Connections window double click on the desired Network icon:



8. In the Network Properties window double click on **Internet Protocol Version 4 (TCP/IPv4)** and edit the IP address and/or subnet mask.



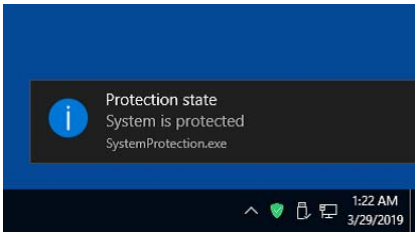
9. Close all the open windows

10. Enable system protection (see “Enable the system protection” on page 68)

CAUTION: When the System Protection is disabled the system is not protected against disk corruption or malware attacks.

11. Wait for the operating system to **restart**

12. Check that the System protection is **enabled** (green icon):



CHANGE THE VIDEO SETTING

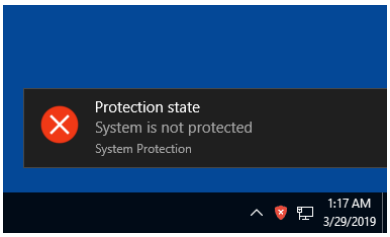
The operating system allows you to change the Video setting.

NOTE: In order to perform this setting it is necessary to connect mouse, keyboard and monitor to the laser marker (see "Local Mode Control connections" on page 57).

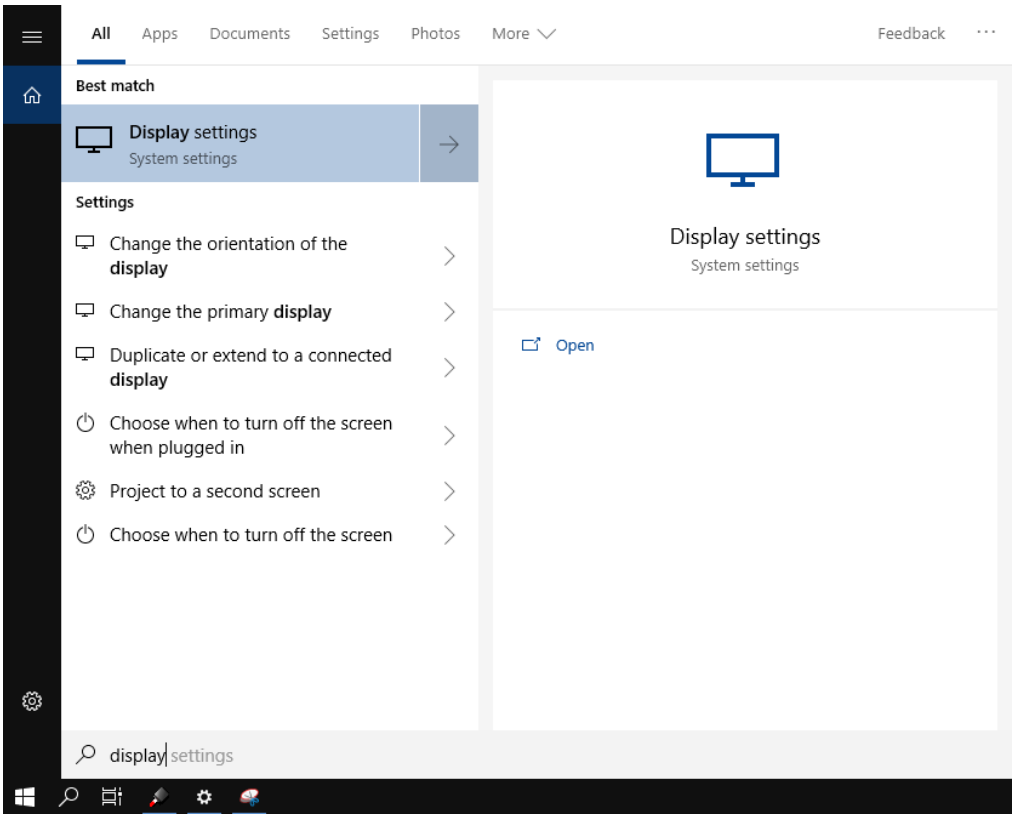
1. Disable system protection (see "Disable the system protection" on page 69)

CAUTION: When the System Protection is disabled the system is not protected against disk corruption or malware attacks. Disable the protection only for the time necessary to make disk changes.

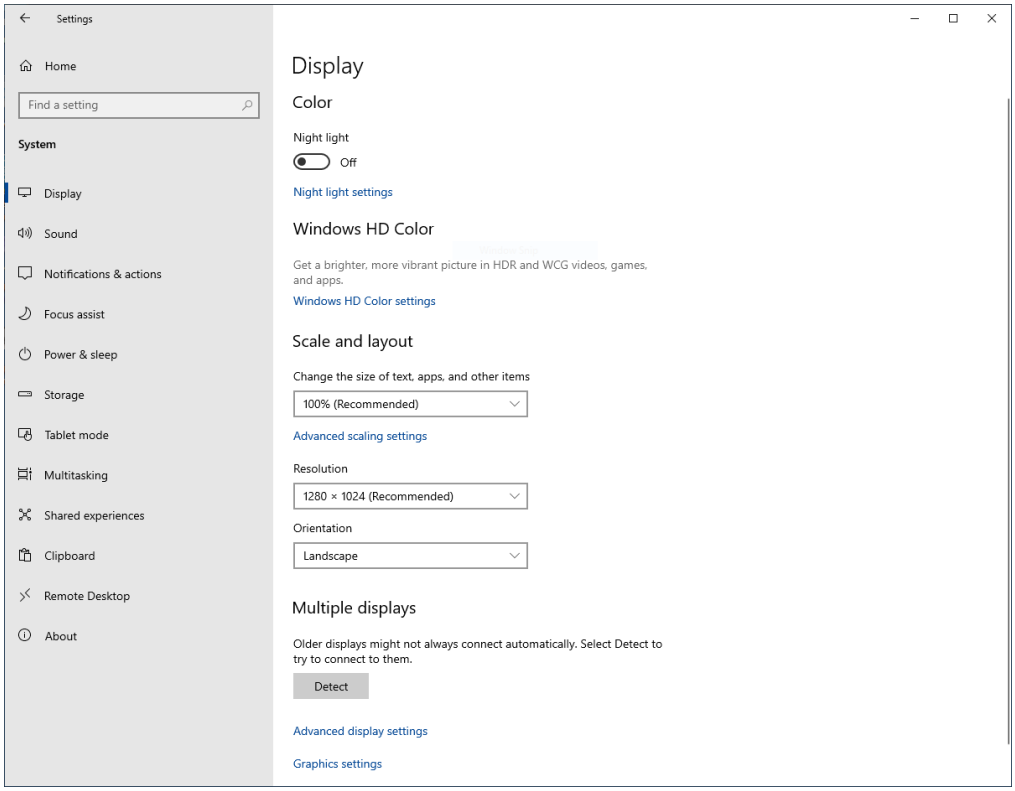
2. Wait for the operating system to **restart**
3. Check that the System protection is **disabled** (red icon):



4. Click the **Search icon** and type "**display**"
5. Click on **Display settings**



6. Change the Display settings



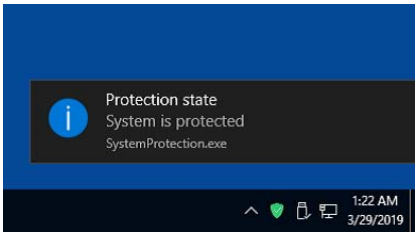
7. Close all the open windows

8. Enable system protection (see “Enable the system protection” on page 68)

CAUTION: When the System Protection is disabled the system is not protected against disk corruption or malware attacks.

9. Wait for the operating system to **restart**

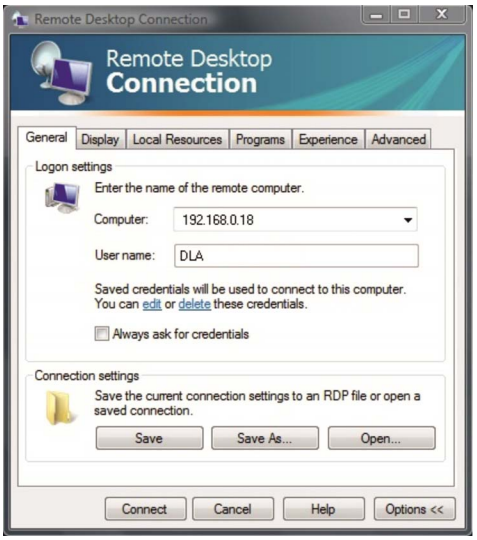
10. Check that the System protection is **enabled** (green icon):



REMOTE DESKTOP CONNECTION

To connect the laser marker to a remote Windows® based computer, follow these steps:

1. Turn on the laser marker
2. Make sure that both laser marker and remote computer are connected to the LAN
3. On the remote computer click **Start > All Programs > Accessories**, and then click **Remote Desktop Connection**
4. Click **Options**
5. In the Computer list, type the host name or the IP address of the computer to which you want to connect
6. Type the user name, password, and domain (if applicable) of an account to which you have allowed remote access into the corresponding boxes, and then click **Connect**



7. In the **Log On to Windows®** dialog box that appears, type the password of the account with remote access privileges into the Password box:

   User name: **DLA**

   Password: **dla**

8. In the **Log on to** list, if applicable, select the domain or remote computer that you want, and then click **OK**.
   The Laser Marker desktop is displayed in a window on the desktop. The Laser Marker computer is locked during this session
9. To disconnect the session, click the **Close** button in the session window, and then click **OK** when you are prompted to disconnect the Windows® session.

CHAPTER 7
ACCESSORIES

The accessories listed here below are described for information purposes only, and are not necessarily included in the packaging. The minimum contents of the packaging include the main hardware, cables and keys. For additional information, please see “Contents of the packaging” on page 10.

CONTROL BOX

This accessory is used to control the laser marker through the Control Box interface.

The Control Box allows to perform the following functions:

- Changing laser marker state
- Starting and Stopping the marking process
- Showing the marking process state
- Showing the system error state

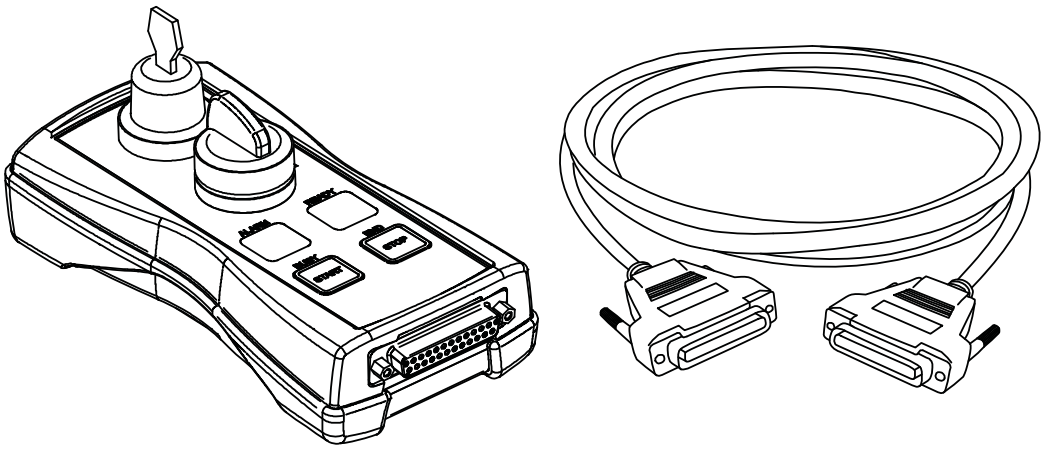


Figure 63: Control Box (ordering no: 985330031)

NOTE: See “X1 - Command Box (Laser Control)” on page 34 for detailed control signal description.

REMOTE START FOOT SWITCH

This accessory is used to provide the *START_MARKING* signal to the laser marker when the pedal is pressed by the operator.

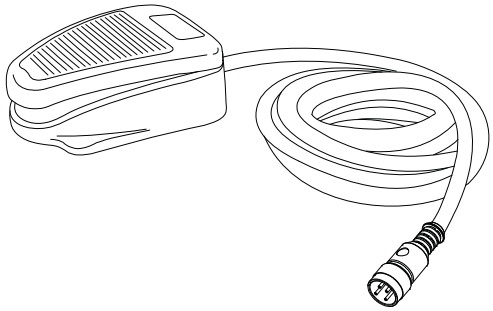


Figure 64: Remote Start Foot Switch (ordering no: 985350035)

NOTE: Refer to Remote Start Foot Switch instruction manual for more information.

I/O INTERFACE

Dedicated to on-site quick and easy termination, PLC interfacing, System Test, I/O troubleshooting, etc. The DB25 Pass-through Command Box connector allows the integrator to use the interface as a I/O test tool on previously installed products.

- I/O Monitoring LED
- Easy assembly thanks to screw down termination
- Dry contact outputs
- Dry contact inputs
- DIN rail mounting enclosure

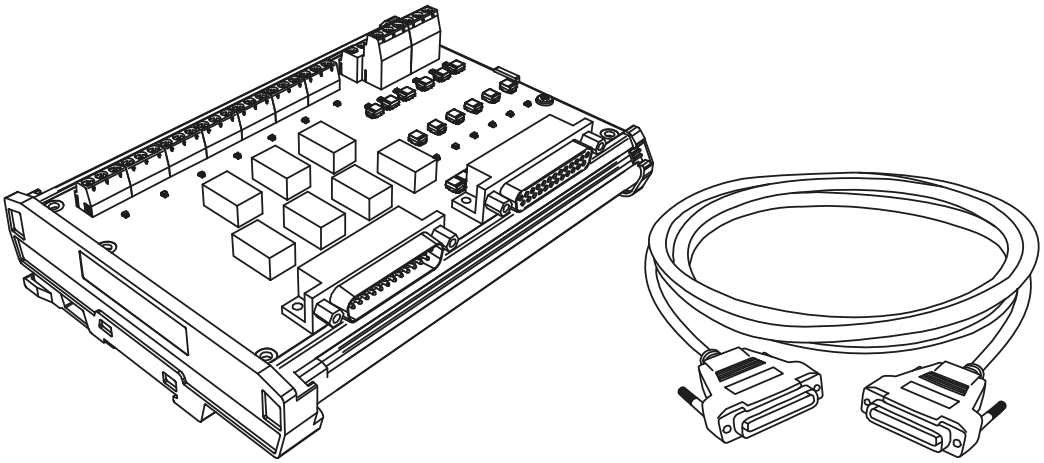


Figure 65: I/O interface (ordering no: 985330032)

NOTE: Refer to I/O Interface instruction manual for more information.

DB25-TO-FREE LEADS CABLE

This accessory allows an easier integration of the laser marker: the Command Box connector signals are all available on the free leads side of the cable, labeled with cable tags.

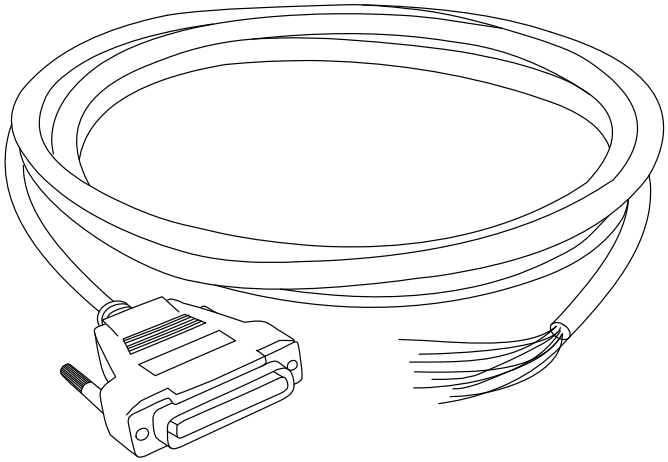


Figure 66: DB25-to-free leads cable (ordering no. 985350032)

MARVIS™ ADD-ON

MARVIS™ is the most advanced MARK and VALIDATE solution for traceability. The innovative Code Quality Training dramatically simplifies setup in a real production environment. The MARVIS™ Add-on for AREX 400 includes:

- MATRIX™ 300N reader
- Power & signals cable
- Ethernet cable
- MARVIS™ license

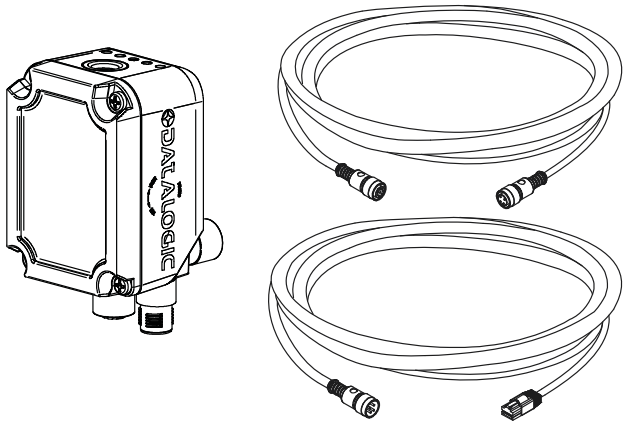


Figure 67: MARVIS™ Add-on for Arex™ 400 (ordering no: 937600124)

NOTE: Refer to MARVIS™ Application Note for more information.

MARVIS™ Mounting Bracket

This accessory is used to properly fix the MATRIX™-N and the MARVIS™ LED Ring Light ID 50mm - White to the scan head in a MARVIS™ application (suitable for F160S and F254S F-Theta scan lens).

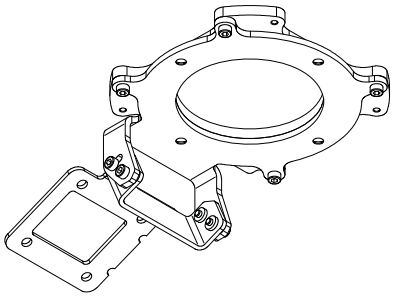


Figure 68: MARVIS™ Mounting Bracket (ordering no: 93ACC1916)

MARVIS™ LED Ring Light ID 50mm - White

This accessory is used as external illuminator in MARVIS™ application (suitable for F160S and F254S F-Theta scan lens).

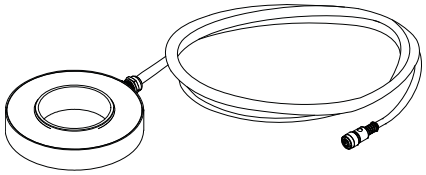


Figure 69: LED Ring Light ID (ordering no: 93A051394)

MICROMETRIC DISTANCE SENSOR KIT

Automatically measure target position displacement from pre-setted focus position, and automatically drive the external (optional) Z-axis stage to the correct laser head position

- Simplified connectivity with dedicated Device Port 1
- KIT includes sensor, mounting brackets, wires and protective YAG filter

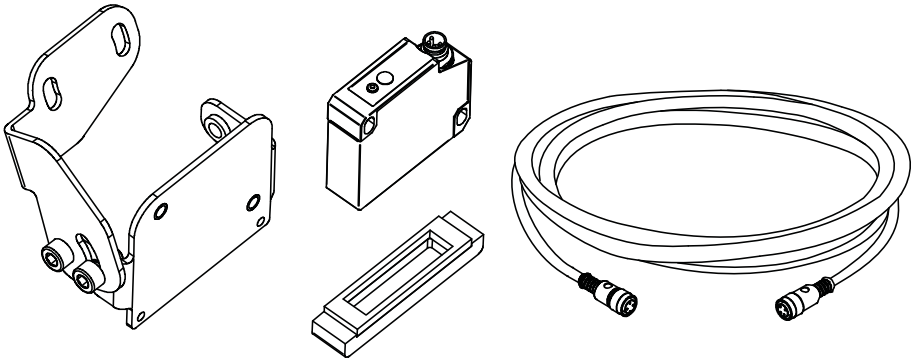


Figure 70: Distance sensor (ordering no: 985350037)

NOTE: Refer to Micrometric distance sensor kit instruction manual for more information.

M39 F-THETA PROTECTIVE CAP

Easy to install, easy to replace; simplifies preventive/periodic maintenance cleaning operation on F-Theta scan lens and allow no-stop operations.

- Ensure complete IP64 protection
- Protect expensive lens from dust and scratches
- Suitable for 160S and 254S F-Theta scan lenses

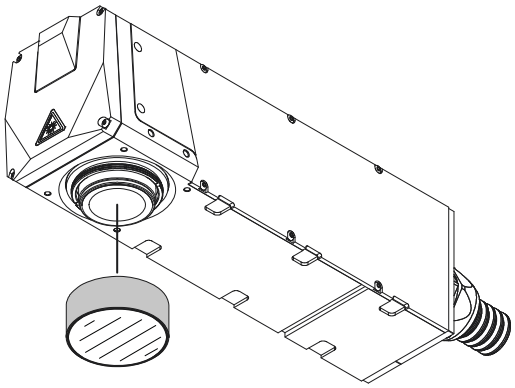


Figure 71: M39 F-Theta protective cap (ordering no. 985350038)

NOTE: The Protective Cap guarantees IP64 protection grade.

RACK HANDLES

This accessory is used to easily fasten the control rack to the cabinet. The fixing brackets are equipped with handles for easier handling.

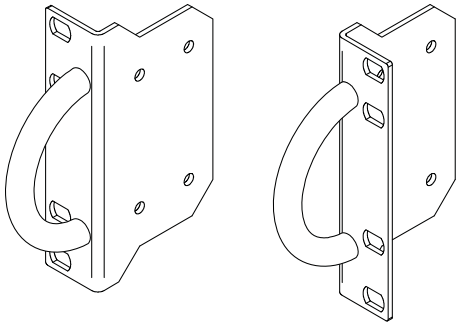


Figure 72: Rack Handles (ordering no: 985350039)

FUME EXTRACTOR

This accessory is suitable for collecting and filtering dry and non combustible types of dust contained in non explosive air mixtures produced during laser marking.

MODEL	ELECTRICAL DATA	HOSE / NOZZLE
985340038 - FUME EXTRACTOR BASIC 230VAC	230 VAC, 1 phase, @ 50 Hz (EU)	50-50 mm hose, length 4 m. 50 mm nozzle assembly
985340040 - FUME EXTRACTOR BASIC 115VAC	115 VAC, 1 phase, @ 60 Hz (US)	50-50 mm hose, length 4 m. 50 mm nozzle assembly
985340039 - FUME EXTRACTOR PRO 90-257VAC	90 - 257 VAC, 1 phase, @ 50-60 Hz	75-50 mm hose, length 4 m. 50 mm nozzle assembly

EXTERNAL FOCUS FINDER

This accessory is used to show the focus distance in all those cases where the focusing beam pointer integrated in the scanhead cannot be used due to the mechanical interference between the red laser beam and large F-Theta lenses (suitable for F100L, F254L, F330L, F420L F-Theta scan lens).

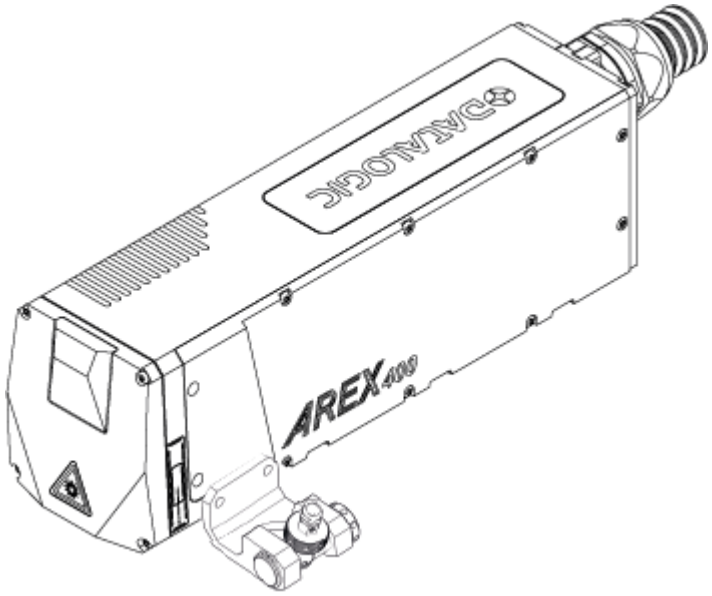


Figure 73: External Focus Finder (ordering no: 93ACC0413)

CHAPTER 8
TECHNICAL SUPPORT

SEALS

The laser marker has seals in some areas. The seals must not be broken or removed for any reason. The sealed parts may be opened only and exclusively by Datalogic. Breaking these seals voids the warranty on the entire laser marker.

CAUTION: If customer breaks or removes the seals placed by Datalogic on the laser marker the warranty will immediately become “null and void”.

CAUTION: Datalogic shall not be held liable for any non-conforming use of the laser marker.
It is forbidden to operate the laser marker before the machine where it is integrated has been declared in conformance with applicable statutory Directives.

CAUTION: Only Datalogic authorized personnel, who have been trained and instructed on the electrical and optical risks, is allowed to access the internal parts of the control rack.
Datalogic shall not be held liable for any damage caused by inadequate work from non-authorized personnel.

CAUTION: Only Datalogic authorized personnel, who have been trained and instructed on the electrical and optical risks, is allowed to access the internal parts of the scan head.
Datalogic shall not be held liable for any damage caused by inadequate work from non-authorized personnel.

MAINTENANCE

The ordinary maintenance program of the laser marker includes only simple operations. Some operations consist in a mere “check” of the operating condition.

The maintenance activities must be done in compliance with the legal directives regarding the safety rules during these operations.

The following parts/functions have to be controlled periodically:

COMPONENT	TYPE OPERATION	INTERVALS
F-Theta Scan Lens	Check / Clean	Weekly: wipe gently with a dry cloth (or soaked in high-purity isopropyl alcohol) or clean it with dry air blowing
Rack Air filter	Clean / Replace	Every 3 months (according to the environment and frequency of use)

CAUTION: Disconnect AC power cable before starting any maintenance operations.

F-Theta scan lens cleaning procedure

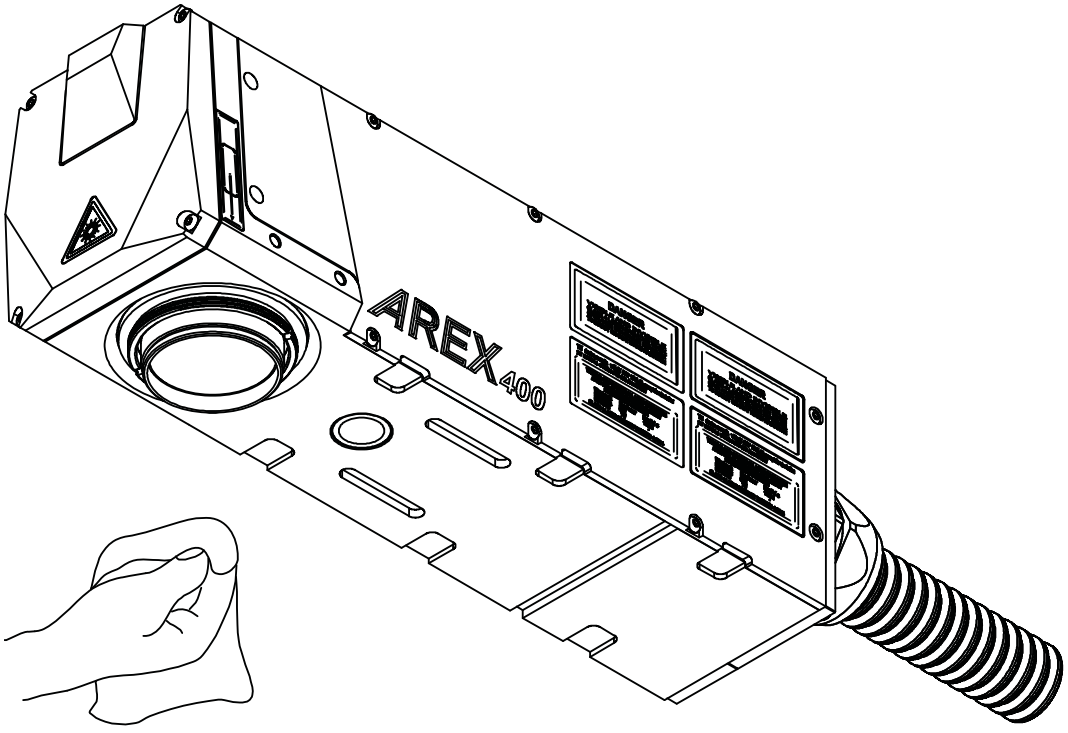


Figure 74: Cleaning F-Theta scan lens

Air filter cleaning procedure

Procedure:

1. Turn off key switch on controller unit
2. Disconnect AC power cable
3. Unscrew grid panel screws and remove it
4. Remove filter

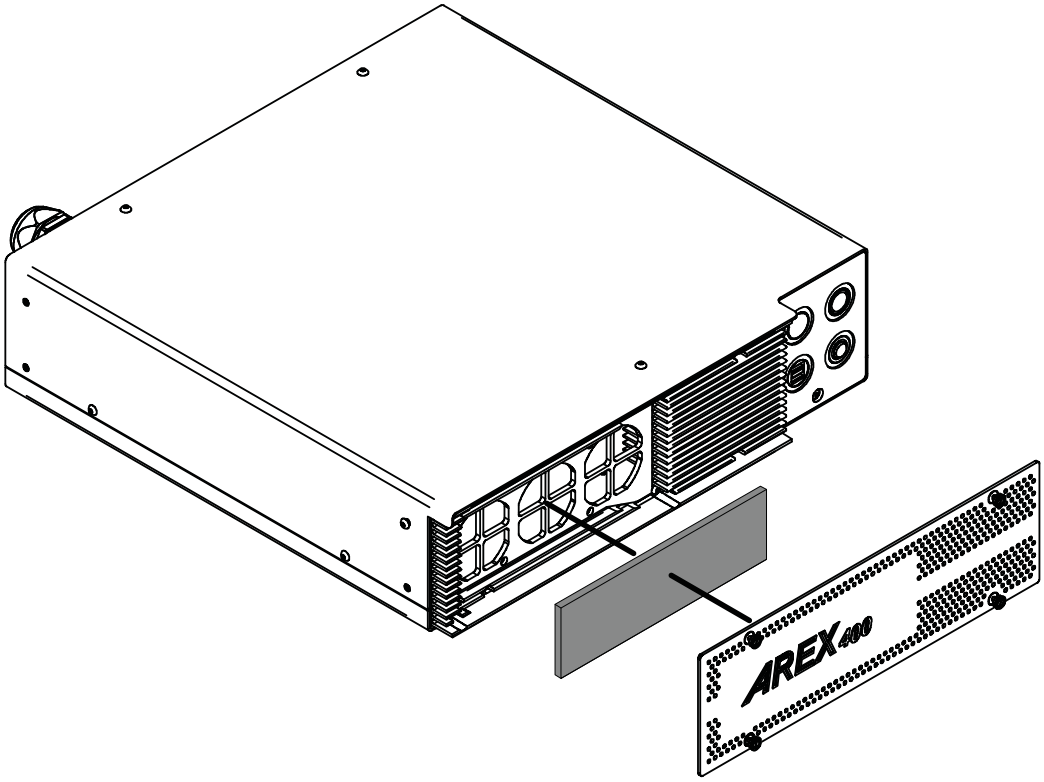


Figure 75: Removal of air filter

5. Clean filter with compressed air or with neutral detergent and air-dry it
6. Reinstall filter and grid panel

CAUTION: Insert the filter making sure that the surface with the wider meshes is oriented towards the outside.

CAUTION: DO NOT install wet filter!

7. If filter cannot be cleaned, replace the filter
8. Suitable filters are available as spare parts

TROUBLESHOOTING

If a problem occurs during operation, first check the following troubleshooting. If you cannot fix the problem, contact Datalogic Customer Service (see “Technical Support” on page vii).

Service Interface

The laser marker is equipped with a Service Interface integrated in *Lighter™ Laser Configuration - Service* useful for service purpose.

The Service Interface provide the following information:

SYSTEM INFO	
INFO TYPE	**DESCRIPTION**
Serial Number	Laser marker serial number
FW revision	Shows the FW and HW revision (separated by dot) installed in the Laser Control Board
System Working Hours	Counter of the laser marker working hours expressed in hours and minutes
CPU Temperature	Shows the CPU temperature of the Laser Control Board
BOARD#1 Temperature	Shows the temperature measured by BOARD#1 sensor of the control rack
BOARD#2 Temperature	Shows the temperature measured by BOARD#2 sensor of the control rack
Scan Head Temperature	Shows the internal temperature of the Scan Head
ERROR TYPE	**DESCRIPTION**
System Temperature error	This counter is incremented every time the system temperature is out of the operating temperature range
Scan Head Temperature error	This counter is incremented every time the scan head temperature is out of the operating temperature range
Service Interface error	This counter is incremented every time the service interface detect a MMC error

SAFETY INFO	
INFO TYPE	**DESCRIPTION**
Safety relay switching	Counter of the safety functions events. The safety functions events counter is incremented every time the INTERLOCK or LASER_STOP safety function are activated

LASER SOURCE INFO	
INFO TYPE	**DESCRIPTION**
Serial Number	Source serial number
Source Working Hour	Counter of the laser source working hours expressed in hours and minutes
Diode Working Hours	Counter of the source diode working hours expressed in hours and minutes. The counter starts to count every time the laser marker is in READY state
Temperature Error	This counter is incremented every time the Laser source temperature is out of the operating temperature range
Power Supply Error	This counter is incremented every time the External supply voltage of the laser source is out of the specified range
Back Reflection Error	This counter is incremented every time the laser source detect an high optical power reflected back to the laser
Generic Error	This counter is incremented every time the laser source detects an internal failure

BACKUP AND RESTORE SERVICE DATA	
INFO TYPE	**DESCRIPTION**
Backup button	The BACKUP button shall be used to save the actual service data in a XML file

List of warning and error states

STATUS LED	DESCRIPTION	POSSIBLE CAUSE	ACTION	X1 - COMMAND BOX CONNECTOR OUTPUT STATE	
Blinking ORANGE	Warning invalid start sequence	Incorrect turning-on sequence	Set *Key Switch* to "**0**" and repeat the turning-on sequence. See "Turning On sequence" on page 62	SYSTEM_ALARM POWER_ON ENABLE_OUT	OFF OFF OFF
Blinking RED	System Error	Interlock error	- Check *X3 - SLO connector* signals (see "X3 - SLO (Safe Laser Off)" on page 30) - Check X3 - SLO connector presence	SYSTEM_ALARM POWER_ON ENABLE_OUT	ON OFF OFF
		CBOX error	- Check if *X1 - Command Box connector* is present - Check **X1.10** CONNECTOR_PRESENCE input signal (see "X1 - Command Box (Laser Control)" on page 34)		
		Rack Temperature error	Check the temperature of the environment where the control rack is placed. The temperature must not exceed the operative limit		
		Scan Head Temperature error	Check the temperature of the environment where the scan head is placed. The temperature must not exceed the operative limit		
		Scan Head Connection error	Contact Datalogic Technical Support		
		Source Temperature error	Check the temperature of the environment where the control rack is placed. The temperature must not exceed the operative limit	SYSTEM_ALARM POWER_ON ENABLE_OUT	ON OFF OFF
		Source generic error	Contact Datalogic Technical Support		
		Source Power Supply error	Contact Datalogic Technical Support		
		Incorrect Firmware version error	Contact Datalogic Technical Support		
		Back reflection error	Check the reflectance of the material to be marked. Marking on high reflective material could damage the laser source.		

List of problems related to laser marker states

PROBLEM DESCRIPTION	STATUS LED	POSSIBLE CAUSE	ACTION
Laser marker never goes to WAIT FOR START state	Blinking GREEN	- Lighter™ Suite marking SW corrupted - C:\ or D:\ drive corrupted	Restore the laser marker (see "Recover the laser marker" on page 134)
Laser marker never goes to READY state	Steady ORANGE	*Key Switch* selector in wrong position	Check the *Key Switch* is set to "**2**" (see "Turning On sequence" on page 62)
		EXT_ENABLE_A and/or *EXT_ENABLE_B* contact are **LOW** level or disconnected	Check **X1.8** (*EXT_ENABLE_A*) and **X1.2** (*EXT_ENABLE_B*) input signals on the *X1 - Command Box connector* are set to **HIGH** level (see "X1 - Command Box (Laser Control)" on page 34)
		LASER_STOP safety function is active	Check **X3.13** (*/LASER_STOP_A*) and **X3.15** (*/LASER_STOP_B*) input signals on the *X3 - SLO* connector are both closed to GND or **X3.12** (*LASER_STOP_A*) and **X3.14** (*LASER_STOP_B*) input signals on the *X3 - SLO* connector are both closed to VCC
Laser marker never goes to STANDBY SHUTTER CLOSED state	Steady GREEN	*Key Switch* selector in wrong position	Check the *Key Switch* is set to "**1**" (see "Turning On sequence" on page 62)
		EXT_KEY contact is **LOW** level or disconnected	Check **X1.12** (*EXT_KEY*) input signal on the *X1 - Command Box* connector is set to **HIGH** level (see "X1 - Command Box (Laser Control)" on page 34)

List of most common problems

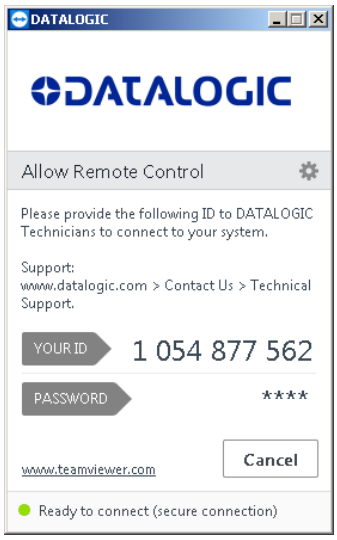
PROBLEM DESCRIPTION	POSSIBLE CAUSE	ACTION
Laser marker doesn't turn ON	*POWER SUPPLY CABLE* cable disconnected	Check the *POWER SUPPLY CABLE* connection to the power grid
	Power supply *SWITCH* of set to **OFF**	Check that the *POWER SUPPLY* switch is set to **ON**
	FUSES damaged	Check that *FUSES* of power supply are not damaged
Impossible to control the marking process using the Command Box control signals	Incorrect integration	Check that the *X1 - Command Box* control signals are compatible with the external devices used for integration
Bad marking result	*F-Theta* scan lens is dirty	Clean the *F-Theta* scan lens. See "F-Theta scan lens cleaning procedure" on page 88
	Incorrect focus distance	Check that the material to be marked is placed at the right *working distance*. See "Marking Area Specification" on page 26
	Incorrect laser parameters	Check that the laser parameters set in the layout are appropriate for the material to be marked. Contact Datalogic Technical Support
Laser marker doesn't engrave	Incorrect laser marker state	Check the laser marker state is set to **READY**
	F-Theta lens protection not removed	Check that the *F-Theta* scan lens protection has been removed
	The optical path is obstructed	Check that the optical path is free

PROBLEM DESCRIPTION	POSSIBLE CAUSE	ACTION
Laser marker doesn't start to engrave using external START_MARKING signal on the Command Box connector	*STOP_MARKING* signal is active	Check that the **X1.13** (*STOP_MARKING*) signal on the *X1 - Command Box* connector is not set to **HIGH** level
	START_MARKING signal incorrect timing	- Check the **X1.11** (*START_MARKING*) signal on the *X1 - Command Box* connector (see "X1 - Command Box (Laser Control)" on page 34). **HIGH** level pulsed signal start the marking process (refer to Lighter™ user's manual "Setting I/O parameters" paragraph to set the signal properties) - Use Lighter™ System Test to check external *START_MARKING* and *STOP_MARKING* signals
	Lighter™ is not set in *AUTO MODE* / *WORK MODE*	Check that Laser Engine is set in *AUTO MODE* or that Laser Editor is set in *WORK MODE*
Laser marker doesn't start to engrave using the START MARKING button on the frontal rack Console	*STOP_MARKING* signal is active	Check that the **X1.13** (*STOP_MARKING*) signal on the *X1 - Command Box* connector is not set to **HIGH** level (see "X1 - Command Box (Laser Control)" on page 34)
	Lighter™ is not set in *AUTO MODE* / *WORK MODE*	Check that Laser Engine is set in *AUTO MODE* or that Laser Editor is set in *WORK MODE*
Laser marker doesn't start to engrave using an external photocell	*STOP_MARKING* signal is active	Check that the **X1.13** (*STOP_MARKING*) signal on the *X1 - Command Box* connector is not set to **HIGH** level
	Incorrect photocell type or incorrect connection	Check that the photocell is compatible with the laser marker (see "Photocell" on page 38). **HIGH** level pulsed signal start the marking process (refer to Lighter™ user's manual "Setting I/O parameters" paragraph to set the signal properties)
	Lighter™ is not set in *AUTO MODE* / *WORK MODE*	Check that Laser Engine is set in *AUTO MODE* or that Laser Editor is set in *WORK MODE*
Laser marker doesn't work in Marking On Fly mode	*MOF* is not enabled or not configured	- Use the Laser Engine *MOF wizard* to setup the laser marker (refer to Lighter™ User's Manual) - Check that the *MOF MODE* is enabled (refer to Lighter™ User's Manual)
	Laser Engine is not set in *AUTO MODE*	Check that Laser Engine is set in *AUTO MODE* (refer to Lighter™ User's Manual)
	Incorrect encoder's type or connection	- Check that the encoder is compatible with the laser marker (see "Encoder" on page 38) - Check that the encoder is working using Laser Engine *MOF* wizard (refer to Lighter™ User's Manual)
	Incorrect photocell type or connection	- Check that the photocell is compatible with the laser marker - Check that the photocell is working using Laser Engine *MOF wizard* (refer to Lighter™ User's Manual)
	Inappropriate layout	Check that the layout to engrave is compatible, in terms of marking time, with the MOF application

PROBLEM DESCRIPTION	POSSIBLE CAUSE	ACTION
Red Aiming Beam not visible	*F-Theta* Lens protection not removed	Check that the *F-Theta* scan lens protection has been removed
	Aiming Beam Standby time expired	The laser marker is provided with a system that prevent diode wear turning of the diode when the *Aiming Beam Standby time* expired. Change laser marker state to reset the Standby time
	Laser marker is not in the correct state	Check that the laser marker state is coherent with the *AIMING BEAM TYPE* property set in Laser Engine Configuration "**LASER**" (refer to Lighter™ User's Manual)
	Incorrect Aiming beam setting in Laser Engine	Check *STANBY POSITION* property in Laser Engine Configuration "**SCANNER**". Depending on the setting, the aiming beam could be not visible because pointed outside the marking field (refer to Lighter™ User's Manual)
		Check *AIMING BEAM TYPE* property in Laser Engine Configuration "**LASER**" (refer to Lighter™ User's Manual) • **OFF**: always OFF • **AUTOMATIC**: active only in *STANDBY SHUTTER CLOSED* state • **SMART**: active only on request
Red Focusing Beam not visible	The focusing beam output window is obstructed	Check that the focusing beam output window is not obstructed
	Laser marker is not in the correct state	Check that the laser marker state is coherent with the *FOCUSING BEAM TYPE* property in Laser Engine Configuration "**LASER**" (refer to Lighter™ User's Manual)
	Incorrect Focusing Beam setting	Check *FOCUSING BEAM TYPE* property in Laser Engine Configuration "**LASER**" (refer to Lighter™ User's Manual) • **OFF**: always OFF • **AUTOMATIC**: active only during *STANDBY SHUTTER CLOSED* state
X, Y, Z, R Axis doesn't work	Incorrect integration	Check that the Axes control signals are compatible with the external devices used for integration
	Axis is not enabled	Check that the selected Axis is enabled in Laser Engine Configuration (refer to Lighter™ User's Manual)
	Axis is not correctly configured	Check that the selected Axis is correctly configured in Laser Engine Configuration (refer to Lighter™ User's Manual)
Windows settings are not saved at system restart	C:\ drive is write-protected by UWF filter	Follow the procedure present in ""System Protection Tool" on page 67
Generic I/O signals doesn't work	Incorrect integration	Check that the I/O control signals are compatible with the external devices used for integration
	I/O already used by Axis	Generic I/O and Axes share the same I/O signals. Check that the selected I/O are not used by an Axis that is enabled
X1 - X2 Digital Output signals doesn't work in NPN mode	Wrong setting	Check that **X1.16** is **NOT CONNECTED** or connected to **GND**
X1 - X2 Digital Output signals doesn't work in PNP mode	Wrong setting	Check that **X1.16** is set to **10-28V DC** reference power supply voltage.

REMOTE ASSISTANCE

The laser marker is equipped with a remote connection tool that can be used for diagnostic purposes by Datalogic technical support.



NOTE: The laser marker must be connected to the Internet.

APPENDIX A
LABELS

LABELS

LABEL	DESCRIPTION
	Identification label
	Warning laser logotype
	Laser Label (scan head) for Arex™ A20-X6X models (*)
	Laser Label (scan head) for Arex™ 110-X6X/120-X6X, 130-X6X and 150-X6X models (*)
	Aperture Label
	Label for non-interlock protective housing
	Caution, possibility of electric shock
	USB port
	MAC Address
	Windows 10 IoT Enterprise COA

LABEL	DESCRIPTION
0 - 1 - 2	Key Selector positions
X1	Command Box connector
X2	Axes connector
X3	SLO connector
LAN1 - LAN2 - LAN3	LAN ports
RS232	RS232 port
VGA	VGA port
PHOTOCELL	Photocell connector
ENCODER	Encoder connector
DEVICE PORT 1	Device port 1
DEVICE PORT 2	Device port 2
EXT FOCUS	External focusing beam connector
2xT5A	Fuses T5A (110-120-A20 models)
2xT6.3A	Fuses T6.3A (130-150 models)

(*) Maximum output of laser radiation as per definition 3.55 of IEC60825-1 considering single fault conditions.

POSITIONING OF EXTERNAL LABELS

Positioning of labels on the control rack

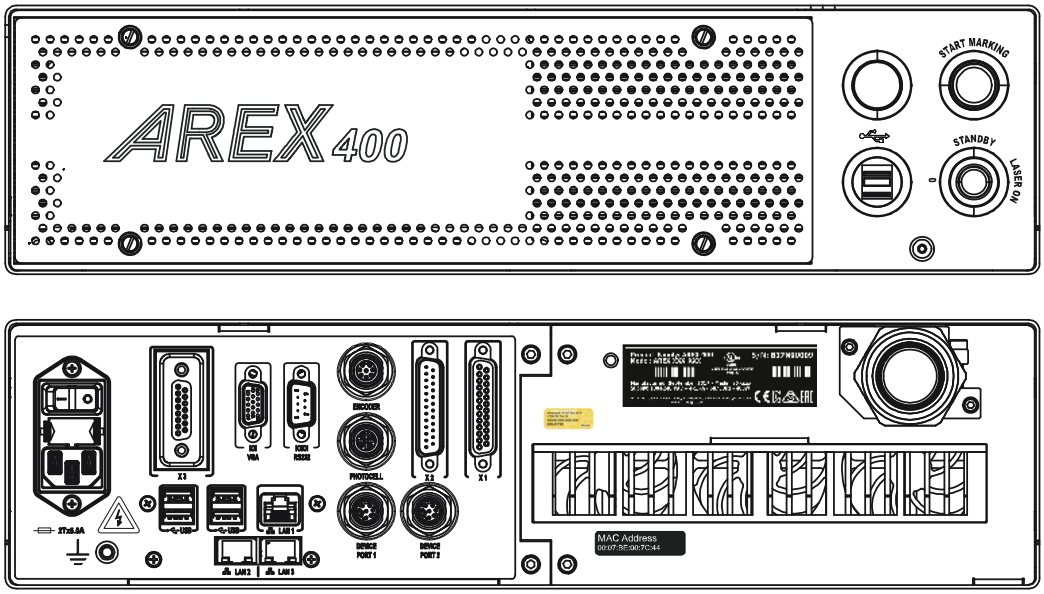


Figure 76: External labels rack location

Positioning of labels on the scan head

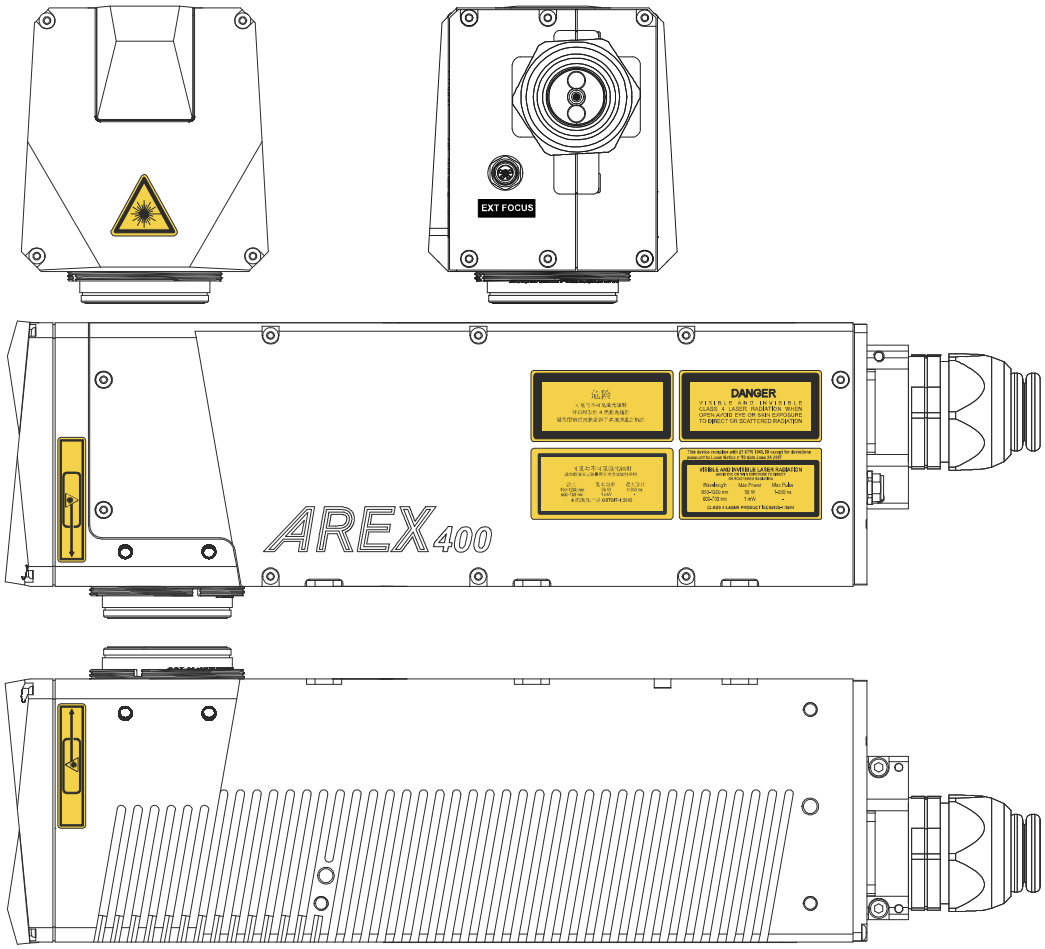


Figure 77: External labels Scan Head location

SAFETY LABELS IN LOCAL LANGUAGES

The laser marker is provided by default with laser labels and labels for non-interlock protective housing in Chinese and English language already attached to the product.

Additional labels in French, Swedish, German, Italian, Spanish, Korean, Russian and Polish languages are provided with the laser marker.

NOTE: Be sure to attach the labels in a language understandable to operators in the locations shown in “Positioning of external labels” on page 98.

APPENDIX B
UNDERSTANDING SLO: SAFE LASER OFF SAFETY CONSIDERATIONS ACCORDING TO EN ISO 13849-1:2008

MACHINE SAFETY

The European Community Directives establish that industrial machinery should not present a risk for workers and operators. The manufacturers should retain full responsibility for certifying the conformity of their machinery to the provisions of **Machine Directive**.

The **CE mark** (CE) is the only marking which guarantees that machinery conforms to the requirements of the Machine Directive.

The Machinery Directive 2006/42/EC compels machine manufacturers to meet a **minimum set of requirements** before a machine may be placed on the market, Annex I, of such directive, provides a **list of Safety Requirements** to which machinery must comply where relevant.

It is the responsibility of the final machine manufacturer to ensure that all the Safety Requirements are satisfied.

Several harmonized Standards have been published to support Manufacturers in Safety Requirements fulfillment.

For Laser Processing machine:

1. EN 60825-1
2. EN ISO 11553-1

The process that brings evidence that all potential machine hazard are addressed is the **risk assessment**.

RISK ASSESSMENT

Core of the Machine Directive are “Risk Assessment” and “Risk Reduction” process.

EN ISO 12100:2010 is aimed to support manufacturers during Risk Assessment.

Machinery must be designed to be **operated, adjusted** and **maintained** without putting persons at risk when these operations are carried out.

Risk Assessment must also taking into account any **reasonably foreseeable misuse** of the system.

RISK ASSESSMENT is based on a clear understanding of the machine limits and functions and the tasks that may be required to be performed at the machine throughout its life.

During Risk Assessment all the **Hazards** must be **identified** and analyzed for all the possible tasks of the machine (such as maintenance or cleaning).

As an example, for a “Laser Processing Machine” the hazards list will include laser-related hazards like:

- Direct, scattered, diffused and indirect laser radiation
- Fumes, particles and vapors from target material
- Fire/explosion from target material

Refer to EN ISO 11553-1 for a complete list.

Each Hazard represent a risk of harm, and each **Risk** must be **estimated** and quantified in terms of:

- THE SEVERITY OF POTENTIAL INJURY
- THE PROBABILITY OF ITS OCCURRENCE

Once the Risk Estimation is completed, next step is the Risk Reduction.

The 2006/42/EC Directive provides a **hierarchy of measures** for eliminating the risk:

1. Inherently Safe Design: Eliminate/reduce risks as far as possible by machine design
2. **Additional Protection Devices:** Install safeguarding and protective measures in relation to risks that cannot be eliminated by design
3. Personal Protective Equipment and/or Training

In case of Protective Devices It will be necessary to ensure that access can only be gained while the machine is safe. Protective measures such as interlocked guard doors and/or trip systems will be required.

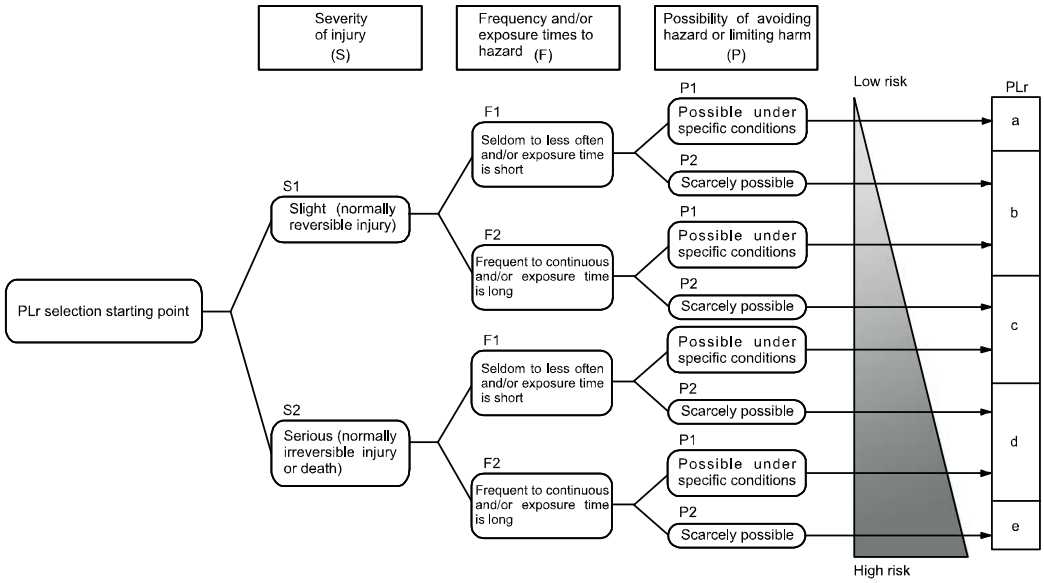
THERE is no ONE SINGLE SOLUTION TO SAFETY but a SYSTEMATIC PROCESS.

RISK ASSESSMENT based on a clear understanding of the machine limits and functions and the tasks that may be required to be performed at the machine throughout its life.

RISK REDUCTION is then performed if necessary and safety measures are selected based on the information derived from the risk assessment stage. The manner in which this is done is the basis of the SAFETY STRATEGY for the machine.

PERFORMANCE LEVEL (PL)

The PL is specified in EN-ISO13849-1. The risk analysis will lead to a PLr (Performance Level required) for a safety function based on the following graph:



DATALOGIC LASER MARKERS

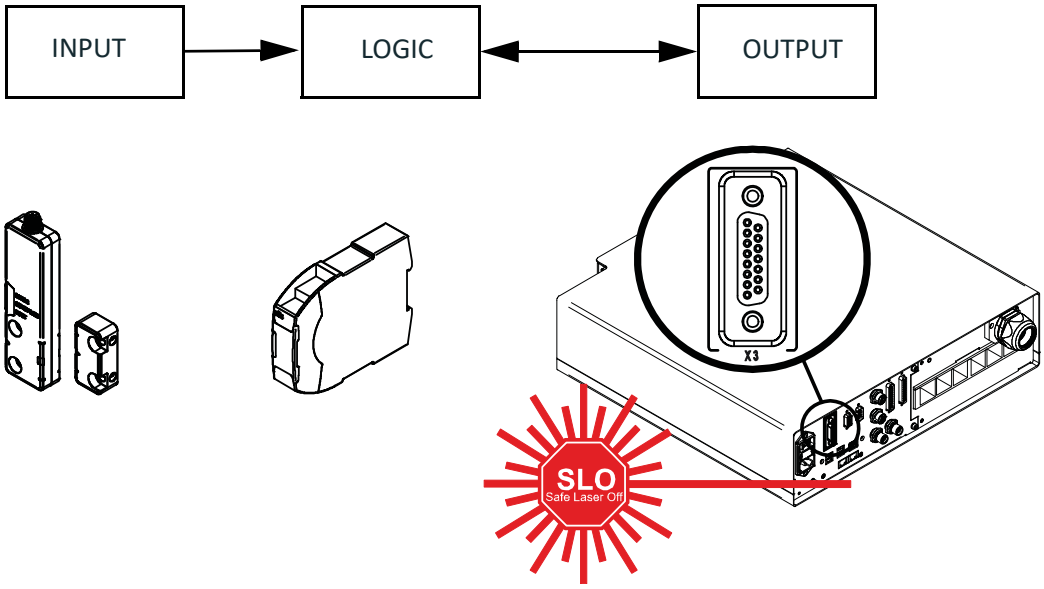
The Machinery Directive 2006/42/UE, EN 13849-1 and EN ISO 11553-1 are NOT applicable to Datalogic Laser Markers.

Datalogic, in order to help customers in their approval process, as a voluntary act, has applied in its laser marker, where possible, some points of above mentioned regulations.

The examples of this appendix relate only to the features introduced in Arex™ XXX-X6X models to assist in the laser radiation risk reduction.

CAUTION: Any other risks (mechanical, electrical, etc.) must always be evaluated and appropriate risk reduction measures taken where necessary.
The target safety integrity or performance level (e.g. PLd according to ISO13849-1) shall be determined by the customer, taking into account the machinery directive, the harmonized standards and any sector-specific standard that may apply.

SLO CONNECTION DIAGRAM



SLO is one of the components of the Protective System and Equipment.

SLO is intended to be used in combination with safety PLC or safety relays.

SAFETY FUNCTIONS

SAFETY FUNCTION	PHYSICAL INTERFACE	
SF.1: Enable **no laser emission if "EXT_ENABLE_A or "EXT_ENABLE_B" signals are disabled, where "disabled" means contacts open**	X1- Command Box connector (Sub-D 25 F type)	Number of Channels: 1 Category: B MTTFd: 3 to 10 years Continuous operation: yes Reaction Time: 10 ms IP degree: IP31
SF.2: Interlock **No laser output if "INTERLOCK_A" or "INTERLOCK_B" signals are disabled, where "disabled" means contacts open. This SF complies with IEC 60825-1_2014**	X3 - SLO connector (Sub-D 15 F type)	Number of Channels: 2 Category: 3 PFHd:8,68 FIT each channel DC Coverage: up to 99% Continuous operation: yes Reaction Time (Class IV to Class I): 100 ms IP degree: IP54
SF.3: Laser Stop **no laser output if "LASER_STOP_A" or "LASER_STOP_B" signals are disabled, where "disabled" means contacts open**	X3 - SLO connector (Sub-D 15 F type)	Number of Channels: 2 Category: 3 PFHd: 14,4 FIT each channel DC Coverage: up to 99% Continuous operation: yes Reaction Time (Class IV to Class I): 100 ms IP degree: IP54
SF.4: Fast Turn OFF The voltage applied to the laser source is reduced to 0,5V in less that 100ms when SF.2 or SF.3 is requested	X3 - SLO connector (Sub-D 15 F type)	Number of Channels: 2 Category: 3 PFHd:3,4 FIT years each channel DC Coverage: 0% Continuous operation: yes Reaction Time: <100ms IP degree: IP54

Example 1

Risk Analysis of a fully automatic laser processing machine that operates only when protection system is disengaged.

- Operative cycle: 500 pcs/hour, 3 shifts (8h/shift) 350 days/year
- Dedicated enclosures prevent laser emission also during parts loading/unloading
- An interlocked door is dedicated to **maintenance and cleaning**
- Maintenance technicians are **SKILLED** on laser risks and have specific **DPI**
- In case of access line is stopped and restarted

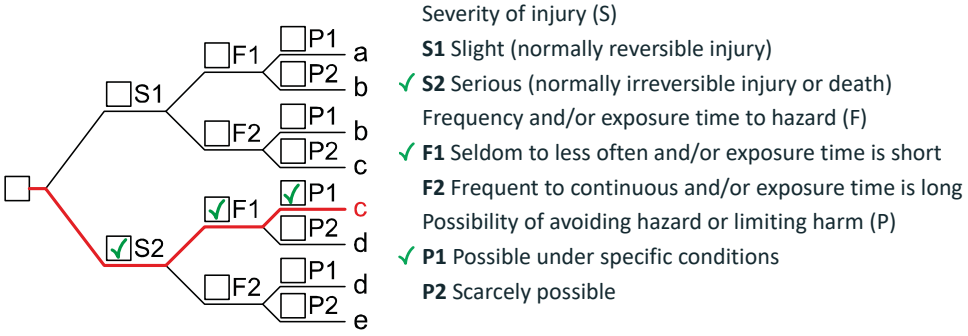
LASER RISK ASSESSMENT: HAZARD, direct and scattered laser radiation:

- RISK SEVERITY: **SEVERE** (irreversible eye damage)
- RISK FREQUENCY: **RARE** (1/month for maintenance)
- AVOIDANCE PROBABILITY: **POSSIBLE** (with DPI)

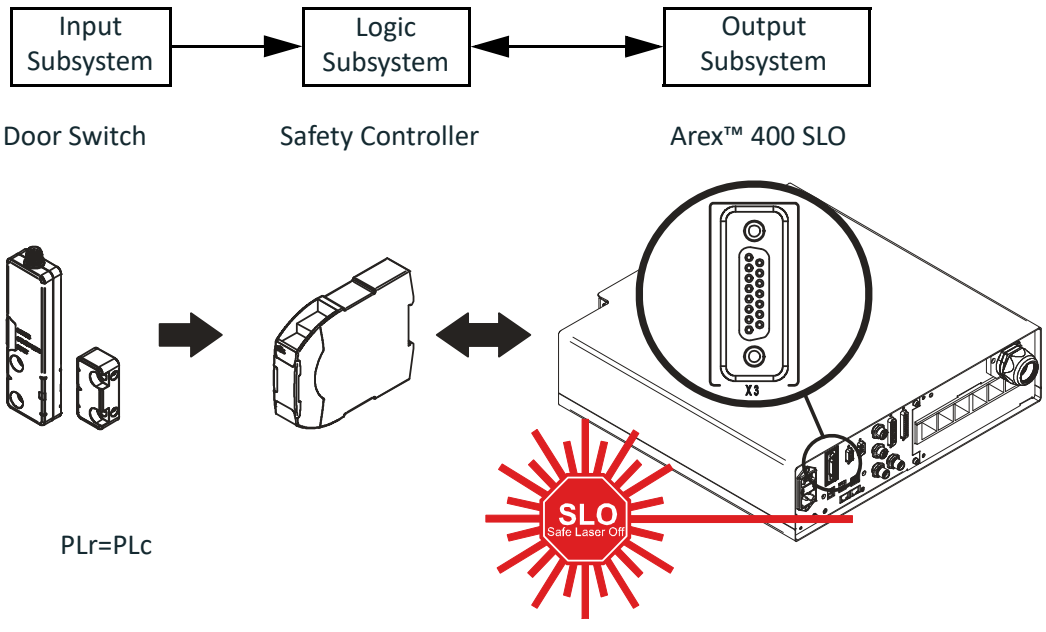
RISK REDUCTION: INTERLOCKED DOOR

Estimation of PLr for door interlock safety function

- SEVERITY: SEVERE **S2**
- FREQUENCY: SELDOM **F1**
- POSSIBILITY OF AVOIDING HAZARD: POSSIBLE **P1**



PLr = PLc



PLr=PLc

Restart: manual reset

Example 2

Risk Analysis of a fully automatic laser processing machine that operates only when protection system is disengaged.

- Operative cycle: 500 pcs/hour, 3 shifts (8h/shift) 350 days /year
- Dedicated enclosures prevent laser emission also during parts loading / unloading
- An interlocked door is dedicated to **maintenance and blockage recovery**
- Operator are **NOT SKILLED** on laser risks and do **NOT** have **DPI**
- In case of access line is stopped and restarted

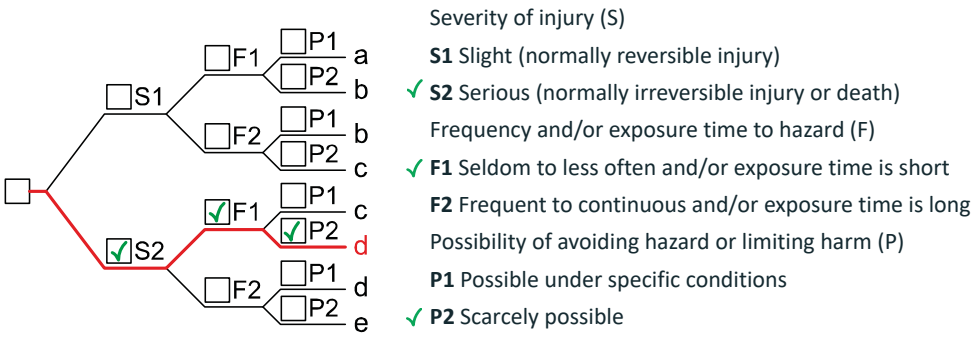
LASER RISK ASSESSMENT: HAZARD, direct scattered laser radiation:

- RISK SEVERITY: **SEVERE** (irreversible eye damage)
- RISK FREQUENCY: **SELDOM** (1/week)
- AVOIDANCE PROBABILITY: **NOT POSSIBLE**

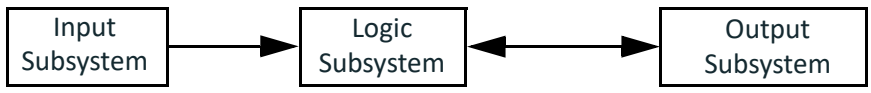
RISK REDUCTION: INTELOCKED DOOR

Estimation of PLr for door interlock safety function

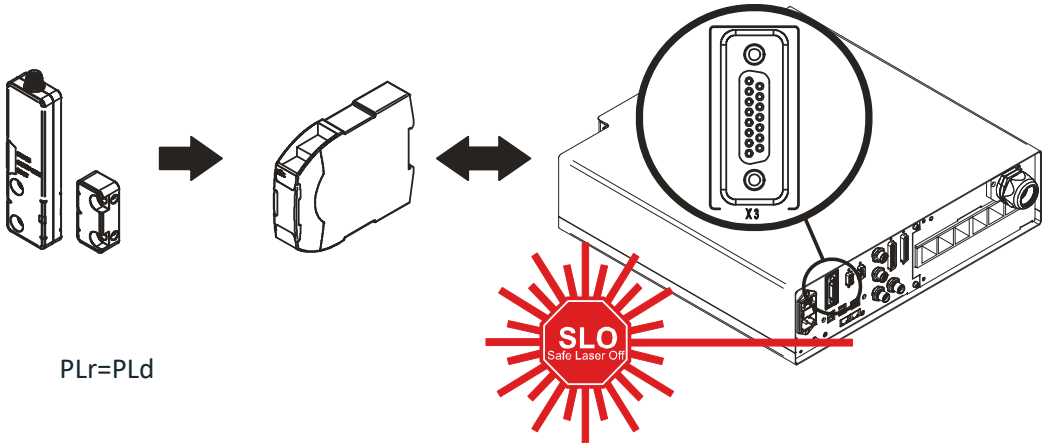
- SEVERITY: SEVERE **S2**
- FREQUENCY: SELDOM **F1**
- POSSIBILITY OF AVOIDING HAZARD: NOT POSSIBLE **P2**



PLr = PLd



Door Switch | Safety Controller | Arex™ 400 SLO



PLr=PLd

Restart: manual reset

Example 3

Risk Analysis of a manual loading laser processing machine.

- Operative cycle: 600 pcs/hour (load every minute)
- Dedicated enclosures prevent laser emission during laser processing
- An interlocked door is dedicated to **part loading**
- Operator are **NOT SKILLED** on laser risks and do **NOT** have **DPI**
- In case of access to marking area, laser is disabled, system is not stopped

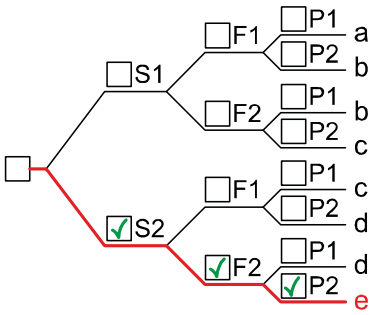
LASER RISK ASSESSMENT: HAZARD, direct scattered laser radiation

- RISK SEVERITY: **SEVERE** (irreversible eye damage)
- RISK FREQUENCY: **FREQUENT** (1/minute)
- AVOIDANCE PROBABILITY: **NOT POSSIBLE**

RISK REDUCTION: INTELOCKED DOOR

Estimation of PLr for door interlock safety function

- SEVERITY: SEVERE **S2**
- FREQUENCY: FREQUENT **F2**
- POSSIBILITY OF AVOIDING HAZARD: NOT POSSIBLE **P2**



Severity of injury (S)

S1 Slight (normally reversible injury)

✓ **S2** Serious (normally irreversible injury or death)

Frequency and/or exposure time to hazard (F)

F1 Seldom to less often and/or exposure time is short

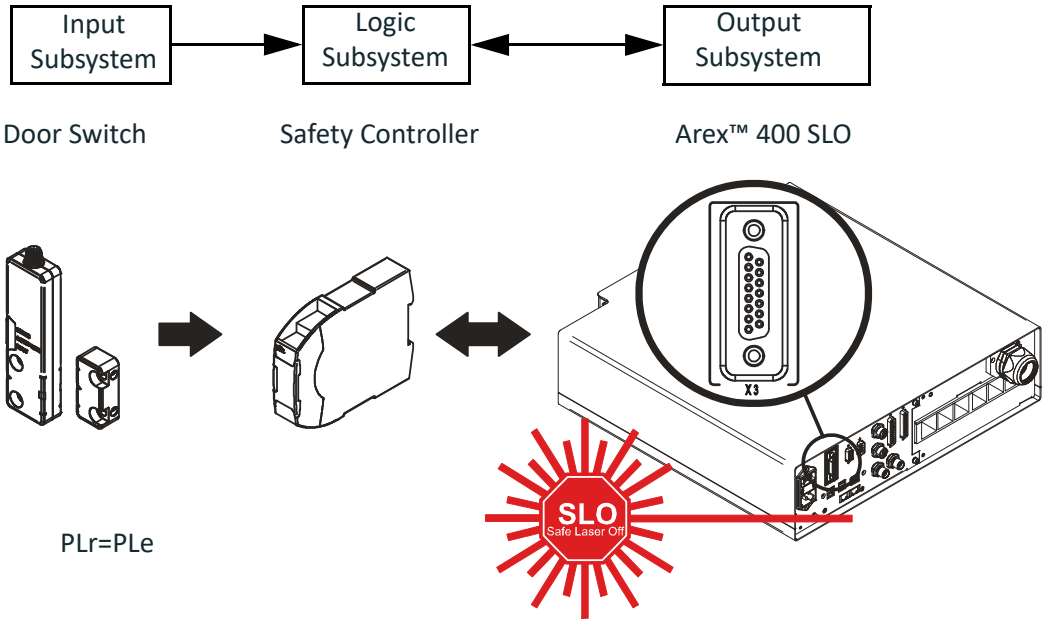
✓ **F2** Frequent to continuous and/or exposure time is long

Possibility of avoiding hazard or limiting harm (P)

P1 Possible under specific conditions

✓ **P2** Scarcely possible

PLr = PLe



PLr=PLe

Restart: automatic

APPENDIX C
LASER SAFETY

The following information is provided in compliance with regulations set by International Authorities, and it refers to proper use of the laser marker.

LASER RADIATION

Laser radiation is form of electromagnetic emission in the wavelength range from the ultraviolet (e.g. from excimer lasers), through visible (e.g. HeNe or Argon lasers) and near infrared (e.g. Yb Doped Fiber and Nd:YAG, Nd:YVO4 DPSS lasers) up to long infrared (e.g. CO2 lasers). It should be considered as non-ionizing Radiation.

In the Arex™ 400 laser marker, the laser radiation emission, at near 1 micron wavelength range, is obtained thought a diode optical pumping of an Yb doped rare earth doped pulsed fiber laser. Depending on the model, the laser is a standard Q-switch or Fiber MOPA fiber laser system installed at the control rack. The laser optical radiation is delivered to the scan head through an armored fiber cable (inside the Head cable), and an isolated beam delivery optical system (IBDO). The laser beam exiting the IBDO is a collimated laser beam that is then processed inside the Scan Head through an optical scan system and F-Theta scan lens to scan and focus the laser beam at the marking plane.

The radiation of the Arex™ 400 laser marker is therefore invisible to human eye and thus not blocked by the natural pupil reflex and can result is severe damage to human eye and skin.

WARNING: Directly viewing a laser beam can cause irreversible damage to human eye.

Arex™ 400 laser markers are classified Class 4 according to applicable norms. This means that the laser radiation level emitted by these laser markers is dangerous even when not directly exposed to the laser beam. Partial reflected laser beam or scattered laser radiation surfaces can cause damage to human eye and skin. It is therefore mandatory that customer apply all applicable regulatory safety protection measures when integrating these laser markers into their machines including, but not limiting, to individual operator protection devices such as protective eye goggles, etc.

WARNING: Viewing of a reflected laser beam can cause irreversible damage to human eye. The use of accessory external optics may increase the risk of damage.

In addition to possible injuries to human eye and skin, these lasers can ignite flammable materials and cause fires even at long distances.

WARNING: This laser marker is classified as Class 4. Class 4 Lasers can cause damage, not only from direct or reflected laser radiation, but also from scattered radiation. These lasers cause significant risk of irreversible damage to human eye and skin as well as risk of ignition and fire of flammable materials, even at long distances form laser radiation output aperture.

WARNING: Make sure that no flammable objects/materials are within the laser beam path. Use only non-flammable materials for enclosures or any other machine surfaces that may be exposed to direct or indirect laser beam radiation.

ABSORPTION OF LASER RADIATION

Human tissues absorbs electromagnetic radiation in different ways depending on tissue characteristics and the wavelength of the radiation. Certain wavelengths may be transmitted or absorbed, in different levels, by the human tissue. In the specific case of the eye, the Cornea and Crystalline lens allows most of the radiation within the wavelength range of 400nm to 1400nm to pass a reach the retina (where are the vision sensors). This range includes the visible light as wells a s near-infrared. The Arex™ 400 laser markers emit in the 1060nm range and thus can be focused by the eye lens at retina with serious risk of causing irreversible damage to vision sensors.

Regarding human skin, the tissue abortion level is higher for the same wavelength range but the maximum exposure tolerance level, before there is a damage, is different compared to eye.

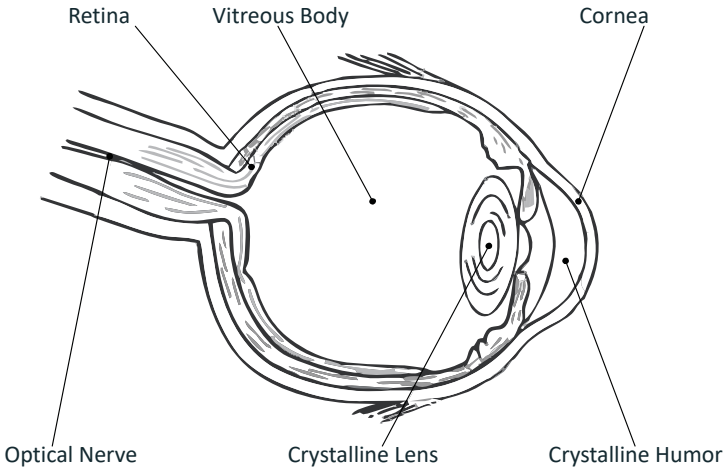


Figure 78: Eyeball section.

The degree of injury depends on the amount of absorbed radiation; the power, energy and peak power of the radiation source, as well as the time exposed to such radiation.

CLASSIFICATION AND DANGER LEVEL

Regulations have established different classes of Lasers, based on their ability to cause human injury. These classes ranges from Class 1 (basically safe in all conditions) to Class 4 (dangerous in several conditions).

Lasers that can produce risk to human being, not only from direct or reflected radiation but also from scattered radiation, belong to Class 4. These lasers sources can also present risk of causing fires through ignition of flammable materials. For these reasons the Customer must, when integrating the laser marker into their machine, implement all necessary measures to contain laser radiation and ensure compliance with applicable safety regulations. All operators using lasers systems should also use appropriated individual protection devices such as goggles, etc.

WARNING: The Arex™ 400 laser marker contain Class 4 invisible laser sources. Refer to applicable regulations (including Laser Safety and Machine safety) for recommendations for compliance of your machine with integration and use of such Class lasers type.

DEGREE OF RISK WITH RADIATION VIEWING CONDITIONS

If F-Theta scan lens is removed from scan head the output radiation is a collimated intense coherent laser beam. The image of such a beam, created by any lens is then a very small spot with extremely high power and energy density. Such a beam is also focused by the human eye and thus result in irreversible damage to the retina. The output radiation of the laser marker, with the F-Theta scan lens, is not a collimated beam but a convergent (before focus plane) and divergent (after focus plane) laser beam. The degree of convergence and divergence depends on the F-theta scan lens specifications and thus varies with the different laser marker models. While marking the laser radiation is typically scattered at the object being marked. Special attention must my taken with objects with high reflectivity to the laser wavelength range since such objects may not only reflect the laser radiation but also change its characteristics according to the shape of such surface (that can work as a lens element). Thus the risk related with laser radiation depends on the characteristics of the beam at which the human is exposed.

In the following sections the risk degree to human eye, related with different viewing conditions, is qualitatively described. Please note that this is intended only as awareness on such risks.

WARNING: It is responsibility of Customer to makes an independent risk evaluation and to implement the necessary safety measures, according to applicable regulations, pertinent to Class 4 Lasers.

Direct viewing of the laser beam

This type of viewing is the most danger for human eye and can occur if looking directly into laser output aperture. Risk is higher in case F-Theta scan lens is removed since output laser beam is, in such conditions, collimated.

WARNING: Do not look directly to laser beam. Individual Protection Devices such goggles do not warrant protection for direct exposure to laser radiation.

Viewing of a laser reflected beam

This may occur when beam is reflected on a mirror surface. This type of viewing is as danger for human eye as direct viewing of the laser beam.

WARNING: Do not look to reflected laser beam. Individual Protection Devices such goggles may only provide protection for a short period of time and thus do not warrant protection for exposure to reflected laser radiation.

WARNING: Many materials, including metals and plastics, have surfaces that strongly reflect laser radiation. Make sure to use non-reflective materials for enclosures or any other machine surfaces that may be exposed to direct or indirect laser beam radiation. Pay special attention when marking objects with high reflectivity properties.

Viewing of direct laser beam from a fiber output

Although unlikely to happen since fiber is protected by an armored stainless steel cable, this may occur when Cable Head, that connect control rack with scan head is damaged and fiber is broke. The laser radiation is highly divergent but power and energy is high and risk is similar to direct viewing of a laser beam.

WARNING: Do not look to fiber output laser beam. Individual Protection Devices such goggles may only provide protection for a short period of time and thus do not warrant protection for exposure to direct laser radiation.

Viewing of scattered laser beam

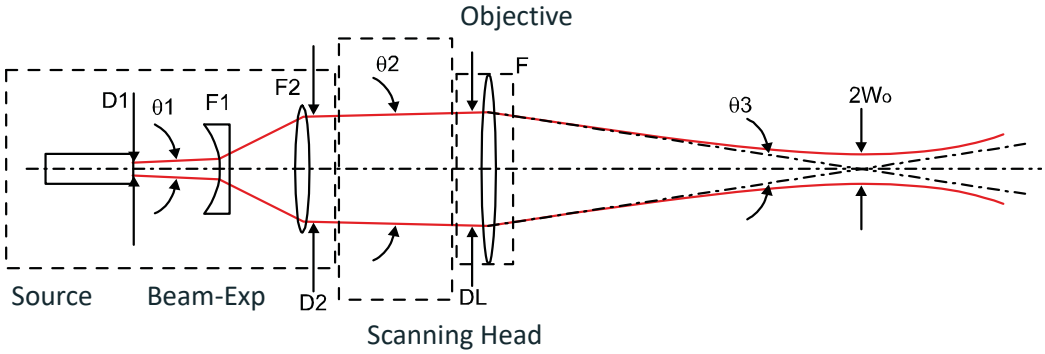
This is the most typical exposure condition when laser is scattered by at a non-reflective surface (such as blocking element or when marking of some materials). In this case, special filter widows and Individual Protective Devices (such as goggles) may allow full protection even for prolonged exposures if is such protective means respect applicable norms for the type of laser radiation.

WARNING: Always use certified protecting goggles appropriated for the laser radiation characteristics to which you can be exposed.

WARNING: Remember that none goggles can provide sufficient protection for prolonged direct or reflected laser beams.

N.O.H.D. DETERMINATION AND O.D. OF PROTECTION GOGGLES

In order to determine the characteristics of the protection goggles, it is essential to determine the characteristics of the laser radiation, knowing its optical path, the dimensions of the beam and its divergence.



It is very important to know the real divergence of the laser beam at the output of the F-Theta scan lens.

With the availability of these optical data, it is possible to calculate the Nominal Ocular Hazard Distance (N.O.H.D.) and the Optical Density (O.D.) required by the laser radiation protection filters (goggles).

Below results have been done considering Directive 2006/25/CE on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation). The user must check if Directive 2006/25/EC was implemented as a law in his own country and regulate himself accordingly.

Only accidental direct exposure has been considered (exposure time = 10 seconds).

PARAMETER	UNIT	A20-36X	110-3XX	120-3XX	130-46X	150-46X
Wavelength	nm	1064				
Pulse Energy	mJ	0.7 @ 30 kHz	1 @ 10kHz	1 @ 20kHz	1 @ 30kHz	1 @ 50kHz
Pulse Duration	ns	30	100			
Beam Diameter (DL)	mm	6.5	7			
Working Distance (WD)[1]	mm	185.5	185	185	178	178
Real Divergence after the lens (θ_3)	mrad	35.04	37.84		39.33	
N.O.H.D.[2]	m	21.69	18.01	19.43	23.08	29.68
O.D.[3]		> 5				

1. See Note on page 28
2. Assuming the F-Theta scan lens as reference point
3. Assuming the F-Theta scan lens as reference point, this O.D. is valid for a distance greater of 0.5 m + WD

EN207 AND EN208

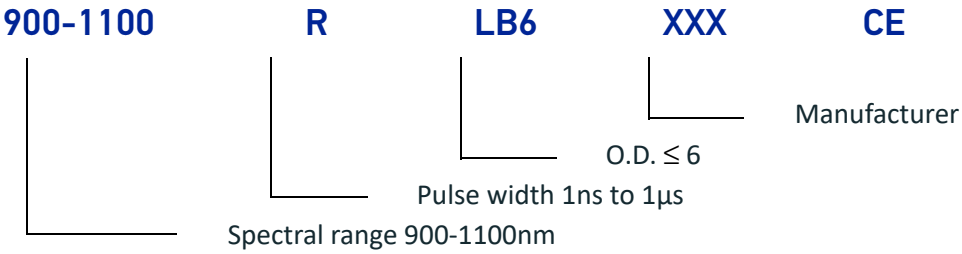
The O.D. value specifies the attenuation factor that the filter material theoretically has on the beam. However it does not specify the damage threshold of the filter material! The filter material may not be able to withstand the power of a particular laser and may fail instantaneously and result in serious eye injury.

In Europe, two standards have been developed for materials used as filters and frames for laser protective eye wear and laser protection windows. The EN207 and EN208 norms both specify the damage threshold of the filter material used.

The EN207 standard is used for full attenuation, these filters are used to completely block the wavelength for which they are specified.

The EN208 standard is used for partial attenuation, these filters are used only in the visible range 380-700nm where they reduce the beam intensity down to the Maximum Permissible Exposure (safe level). They are particularly useful for alignment where seeing the beam is necessary.

Safety goggles are labeled according to EN207 or EN208 as appropriate. For example, a filter labeled 900-1100 R LB6 xxx CE means that:



EYES AND SKIN RISKS

If exposed to intense Laser radiation, even of a short duration, or a less intense but longer lasting duration, both the Cornea and the Retina can burn and be damaged irreparably. This is particularly critical for Class 4 laser beam.

If subject to direct focalized radiation, even the skin can burn.

GENERAL SAFETY REGULATIONS

The user of the laser marker must comply with all regulations and work best practices regarding safety. Therefore it is necessary to develop a Standard Operating Procedure (S.O.P.) related to operations of the machine incorporating this laser marker. This procedure, shall be available at time of installation, shall serve as a reference for the Operator and shall be written in his/her language.

Training is essential and must include:

- Familiarization with system operating procedures.
- Knowledge of the biological effects of radiation on the Eyes and Skin.
- Understanding of the necessity for Individual Protection Devices (I.P.D.)

OTHER RISKS

An additional risk may be represented by fire caused by processing materials other than those the laser marker was designed for.

WARNING: Do not use this laser marker for other purpose than the one it was designed for.

Another additional risk associated with the laser marker is electricity. This may occur when accessing internal parts of the laser marker.

CAUTION: Only Datalogic authorized personnel, who have been trained and instructed on the electrical and optical risks, is allowed to access the internal parts of the control rack.

Datalogic shall not be held liable for any damage caused by inadequate work from non-authorized personnel.

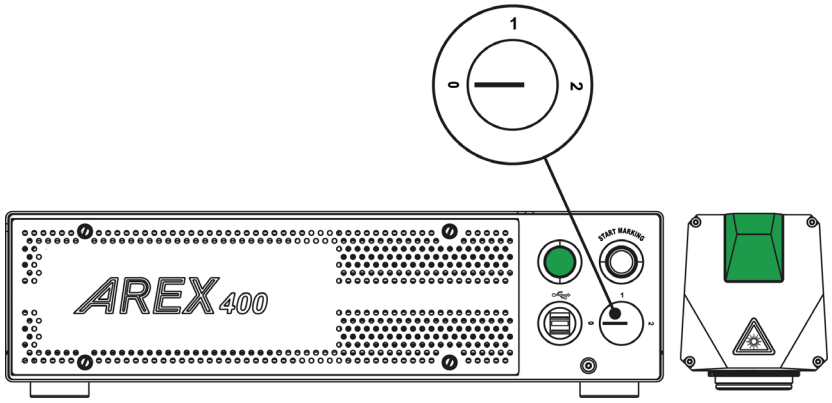
CAUTION: Only Datalogic authorized personnel, who have been trained and instructed on the electrical and optical risks, is allowed to access the internal parts of the scan head.

Datalogic shall not be held liable for any damage caused by inadequate work from non-authorized personnel.

APPENDIX D
USING MARKING SOFTWARE

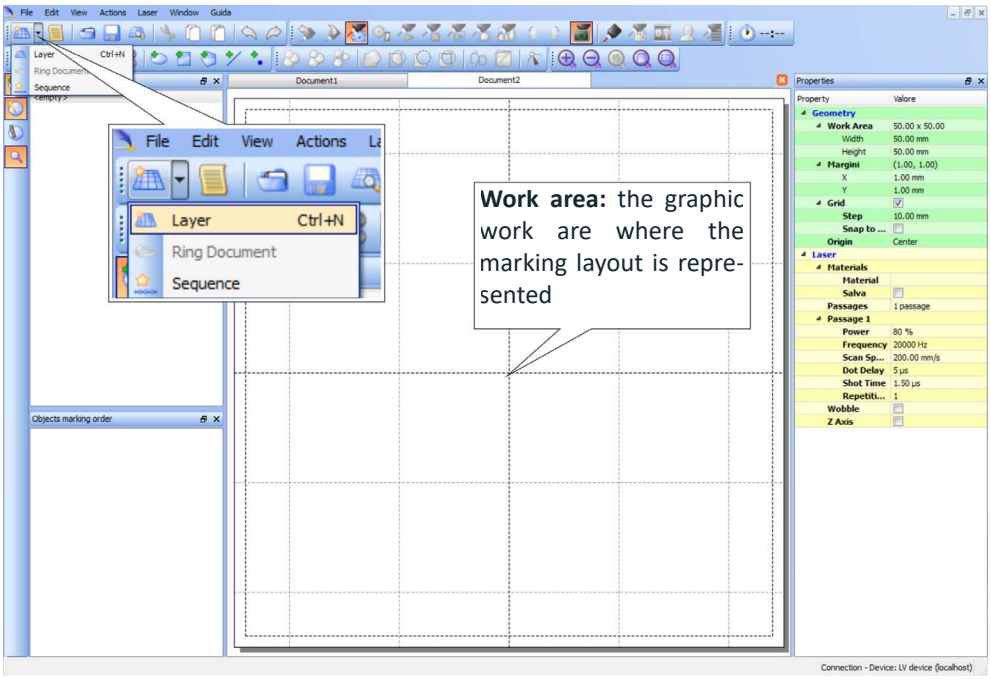
HOW TO CREATE AND EDIT GRAPHICS LAYOUT

NOTE: This example considers that the laser marker is controlled in Key Selector mode (see “Key Selector mode” on page 45).

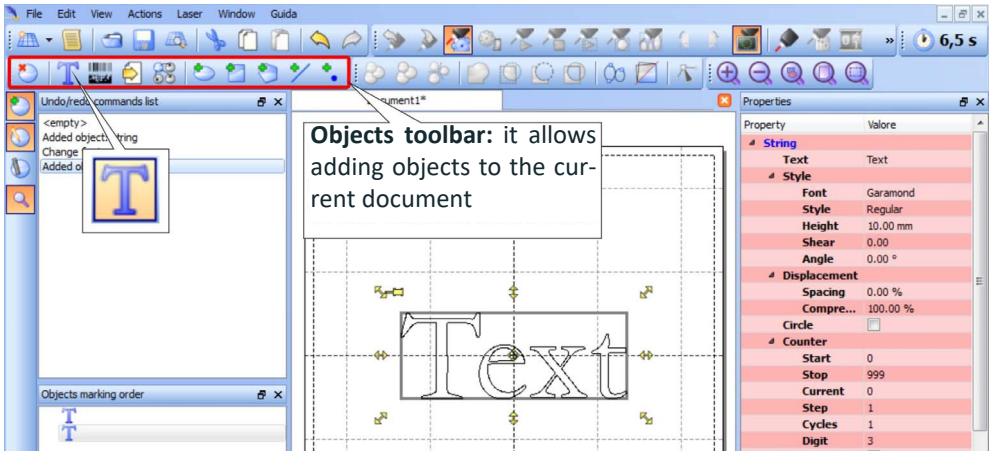


In “WAIT FOR START” state, double click the **Laser Editor** icon to start the layout editor application.

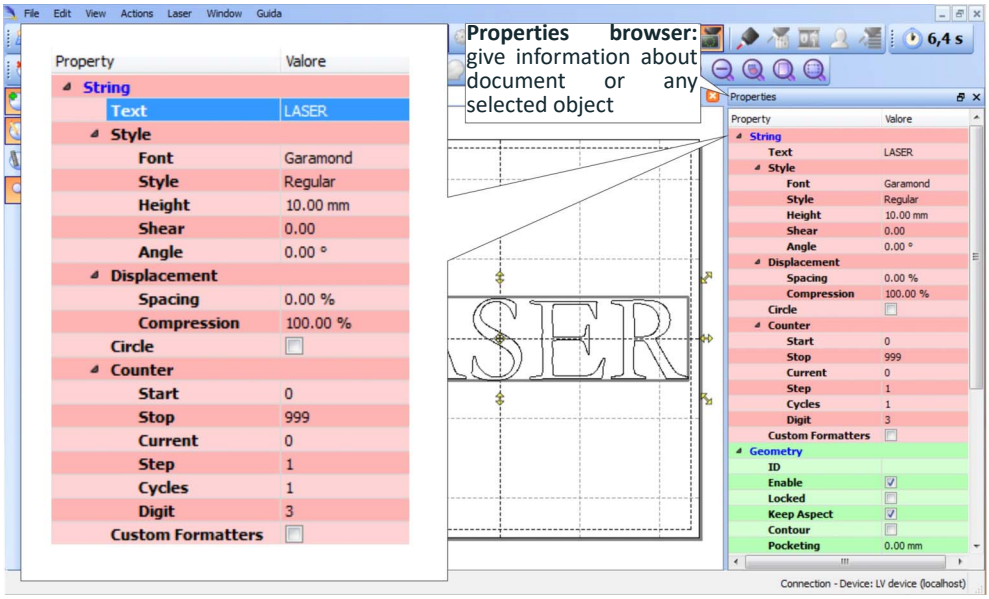
Click on the document type selector and choose **Layer**:



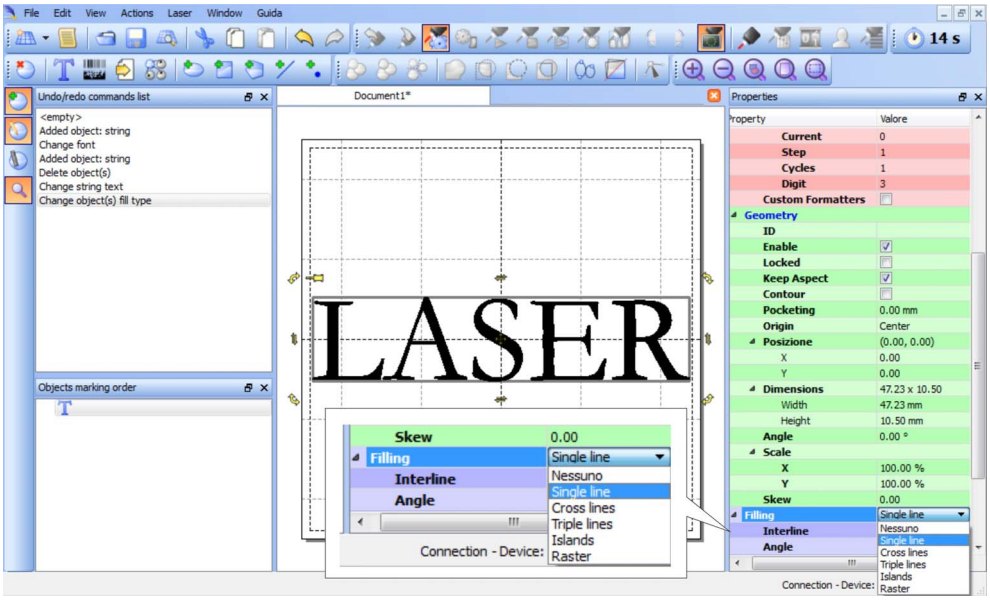
Click on the **Text String** icon in the **Object toolbar** to add a string object to the layer:



Edit String properties such as value, font, style, etc. using the **Properties browser**:



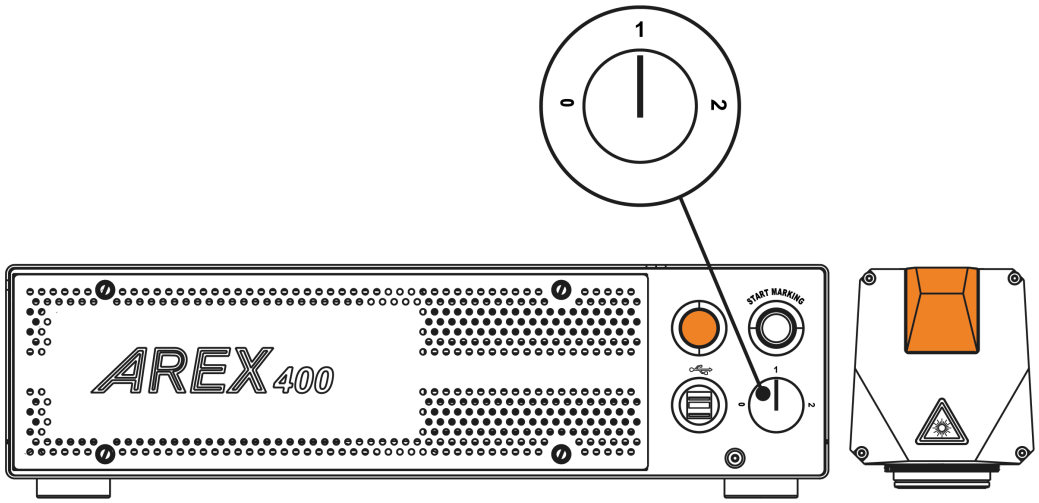
Edit Filling properties such as filling type, interline, etc. using the **Properties browser**:

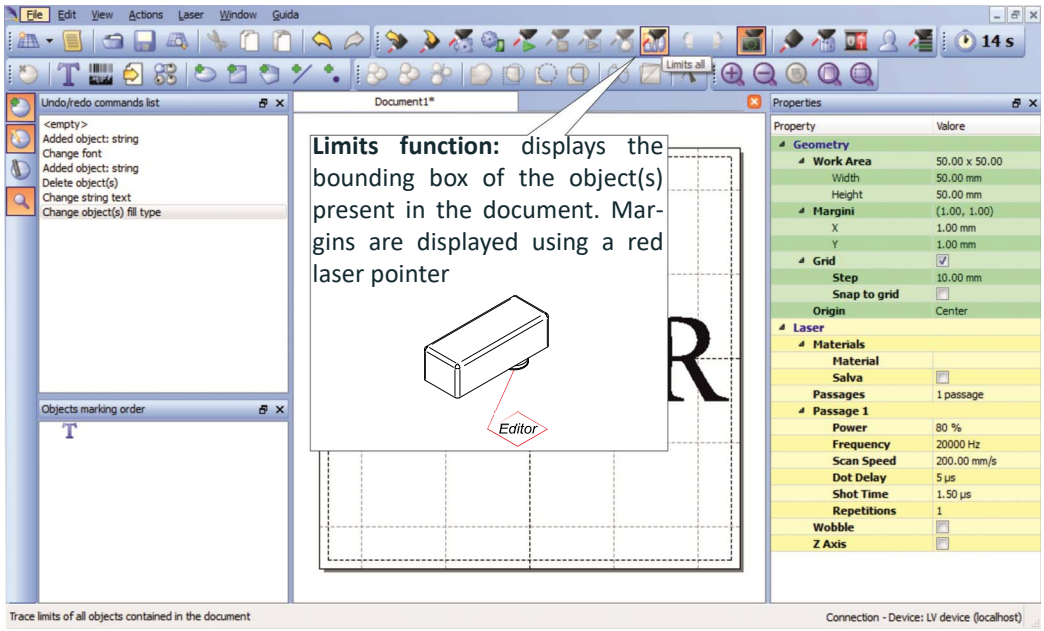


NOTE: Consult Lighter™ software user's manual for a proper use of the same.

HOW TO TEST AND MARK LAYOUT

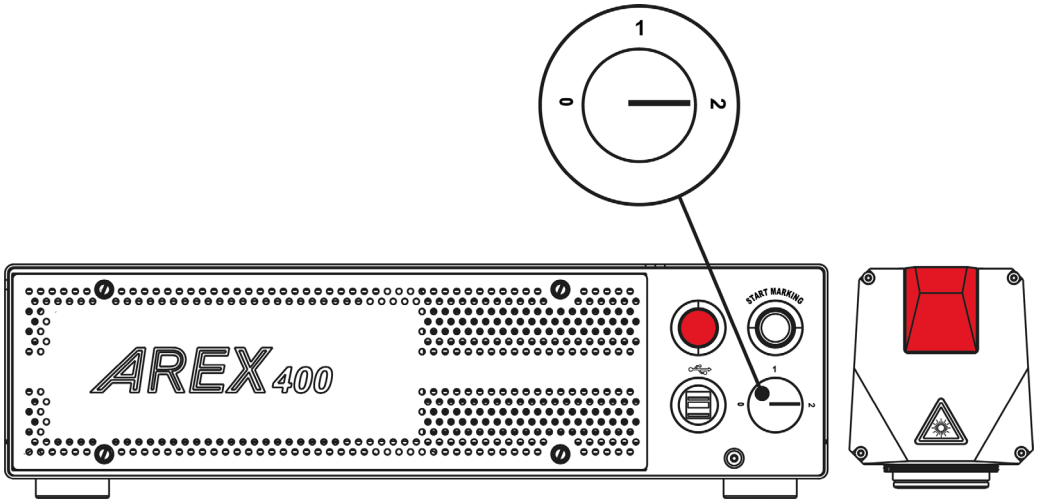
In “STANDBY SHUTTER CLOSED” state, press **Limits All** button in the **Laser Toolbar** to adjust the object position in the marking field:

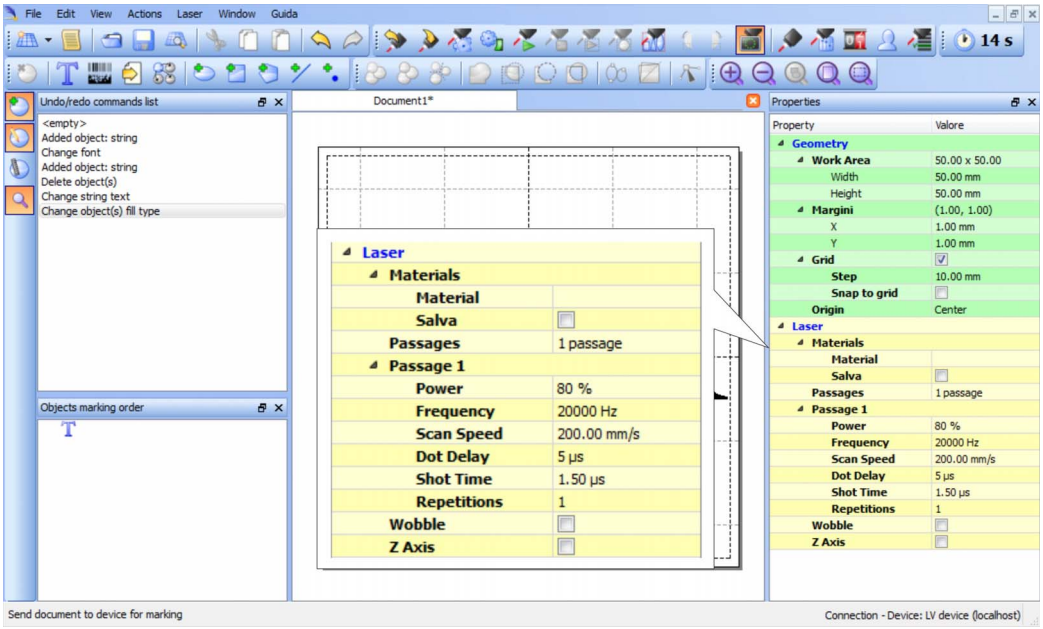




CAUTION: Marking highly reflective materials might cause optical feedback into laser marker. This may result into irreversible damage of the optical components of laser marker.
Verify that the position and geometry of the object to mark does not cause any reflection into the optical aperture of the laser marker F-Theta scan lens.
Please contact our Customer Support Service for support on your particular application.
Optically-induced damage caused to laser marker by back reflection from high reflective materials is not covered by warranty.

In “READY” state, adjust the Laser parameters using the **Properties browser**:



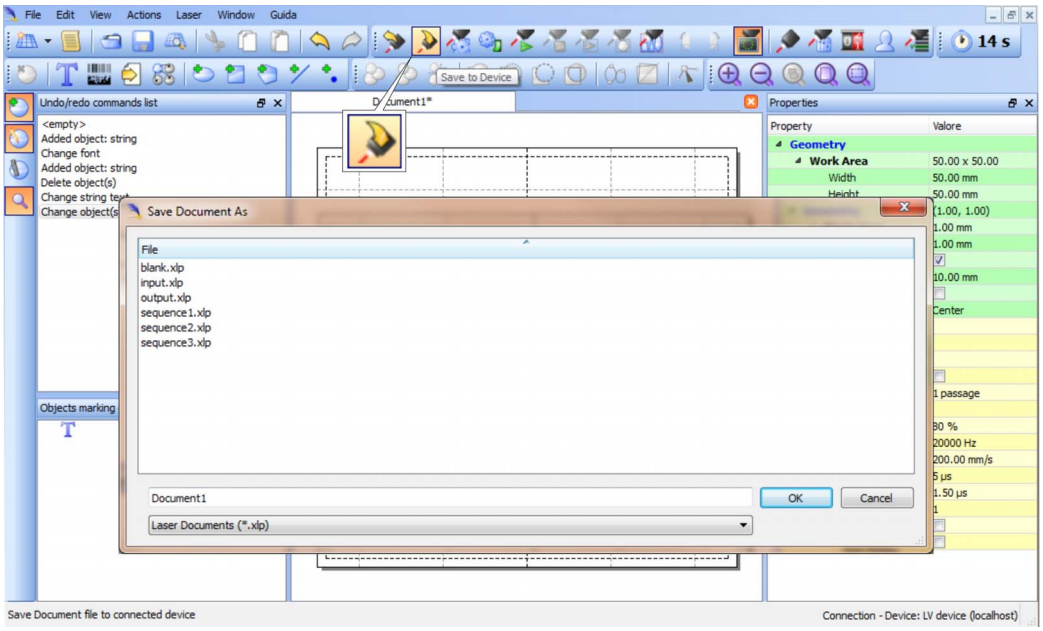


Press the **Send Marking** button in the **Laser Toolbar** .

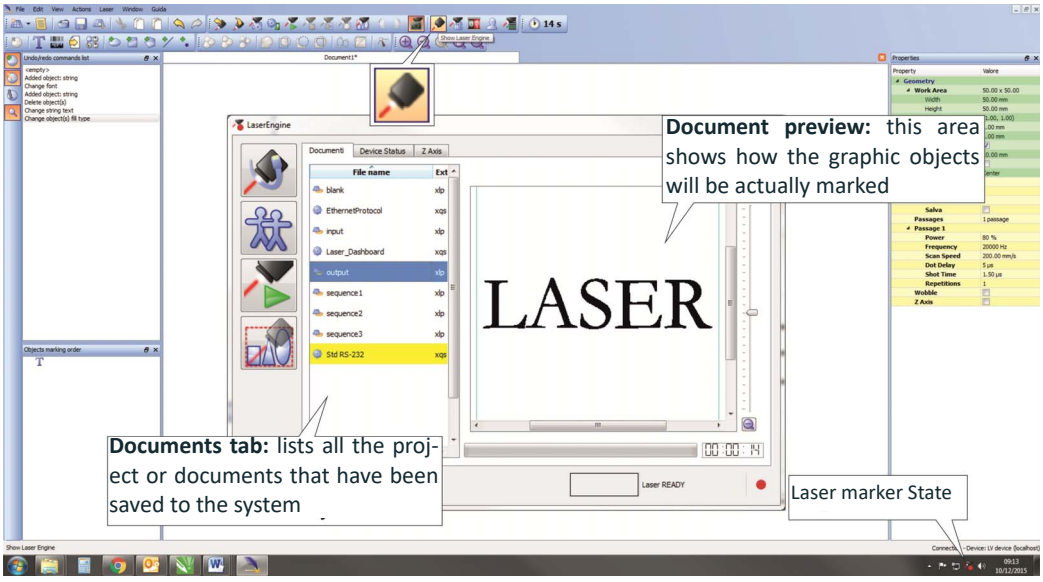
HOW TO USE COMMAND BOX SIGNALS TO MARK LAYOUT

Automate the marking process allowing documents to be marked using external **X1.11** *(START_MARKING)* and **X1.13** (*STOP_MARKING*) signals, which can be generated by PLC or other external devices.

Click on the **Save to Device** button to save the layout in the device memory:



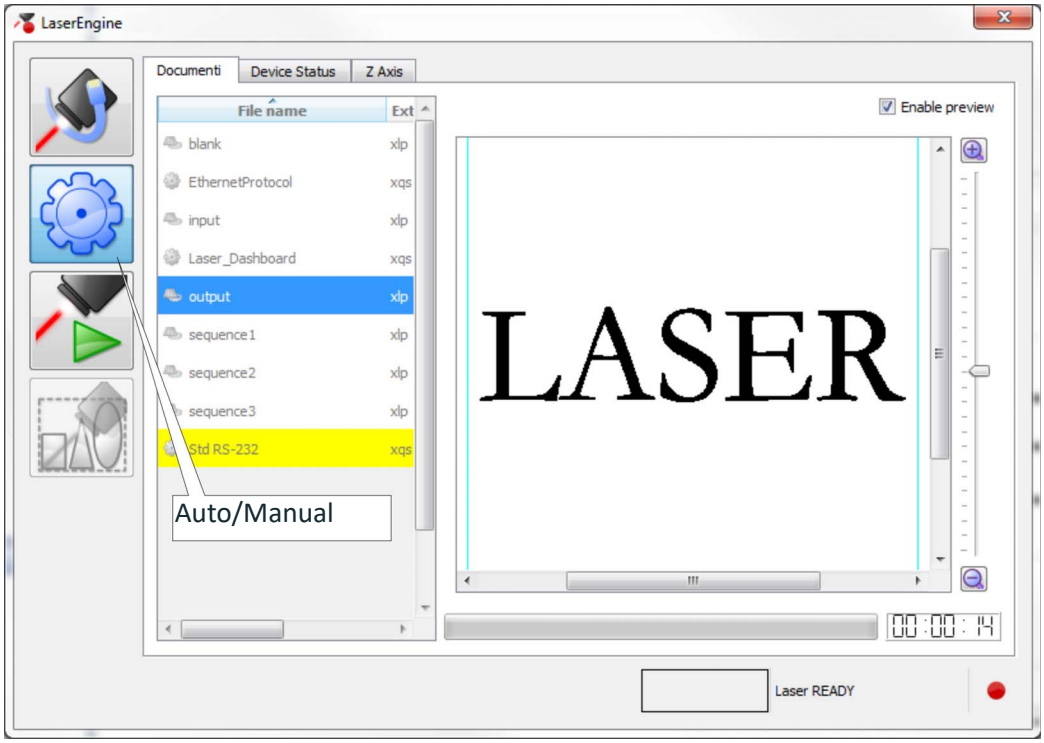
Click on the **Show Laser Engine** button to display Laser Engine window:



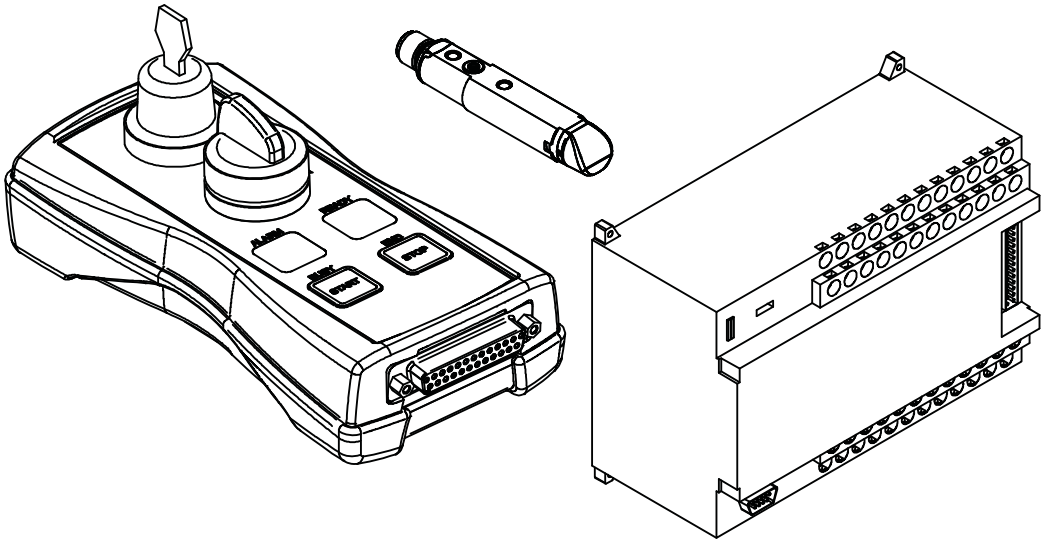
AUTO/MANUAL Mode button allows switching between the two available working modes:

- Auto mode: the engraving operations are executed automatically using external signals.
- Manual mode: used for displaying the margins of the graphic objects to be marked and to test layouts.

Select the document from the list and click on the **To Auto Mode** button:



The laser marker is ready to mark the document using external ***X1.11*** (*START_MARKING*) and **X1.13** (*STOP_MARKING*) signals:



NOTE: Consult Lighter™ software user's manual for a proper use of the same.

APPENDIX E
MOPA FIBER LASER

LASER MARKER OPERATIONS

The Arex™ A20-X6X is a very flexible laser marker based on a master oscillator power amplifier (MOPA) architecture, that allows the user for a wide selection of pulse profiles and pulse repetition frequencies.

Depending on the Pulse Profile selection and pulse Frequency the laser will generate pulses with stable output energy/peak power or stable laser average power.

The following picture illustrates the pulse peak power and laser average power dependence on the frequency, for the entire operating frequency range.

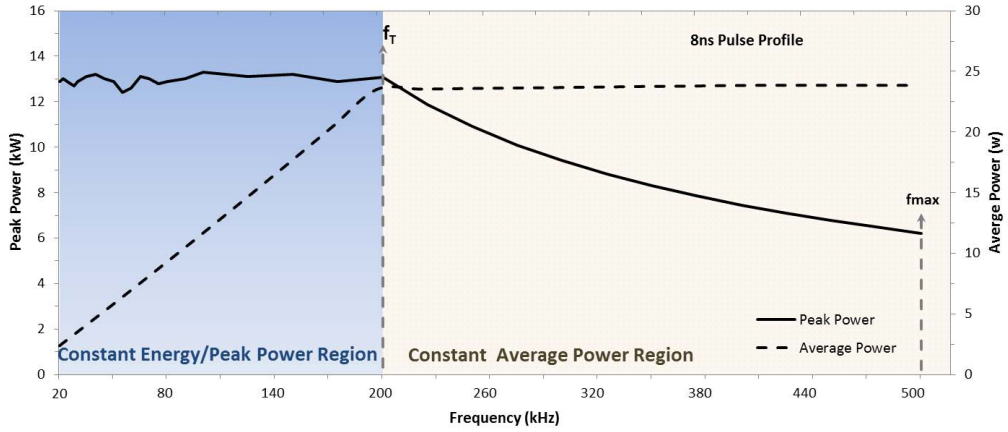


Figure 79: Typical average power (dash line) and peak power (solid line) dependence on the frequency for the 8 ns the pulse profile

As shown, when the laser is operated with Frequency above the pulse transition Frequency (fT) (typically 200 kHz for the 8 ns pulse profile) the average power (dash lines) remains constant while the pulse energy/peak power (solid lines) will change. This is the more common operating region for most applications. Datalogic designates this region as the “Constant Average Power Region”.

A characteristic of the Datalogic Arex™ A20-X6X laser marker is that user is allowed to operate the laser at pulse repetition frequencies that can be reduced down to 20kHz and up to 500kHz (depending on Pulse profile selected). If the laser was allowed to operate down to lower frequencies without any restriction, the pulse energy would keep increasing until reaching non-linear thresholds that would result in laser performance degradation or even self-destructive failure. To prevent the laser marker from reaching these undesired conditions, while allowing the user to set the laser pulse frequency freely, Datalogic implemented laser internal safety controls to allow stable pulse peak power/energy below the transition frequency (fT).

Thus, within the extended operating region below the transition frequency, the pulse energy/peak power will remain constant (as illustrated in the figure above). Datalogic designates this extended region as “Constant Energy/Peak Power Region”. This region is ideal for applications that require changing of the laser pulse frequency while keeping pulse energy or peak power constant.

The maximum frequency of operation (fmax) depends on the pulse profile setting: for Pulse Profiles 4 to 100ns, fmax is 500kHz; for Pulse Profile 200ns the fmax is 250kHz, and for Pulse Profile 250ns fmax is 200kHz.

The Arex™ A20-X6X shows similar behavior for all other pulse profiles, within the same operating conditions. For each pulse profile there is a maximum allowed input frequency (fmax) and a Transition Frequency (fT) (refer to your device Test Report for details about your specific laser). As illustrated in following picture, below the transition frequency, the pulse peak power and energy will remain constant for all pulse profiles.

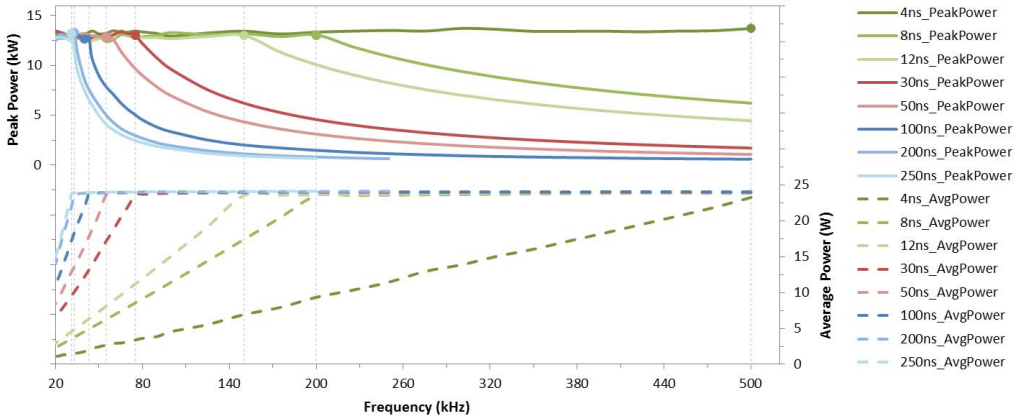


Figure 80: Typical average power (dash line) and peak power (solid line) dependence on the frequency for the typical pulse profile available - 4ns to 250ns.

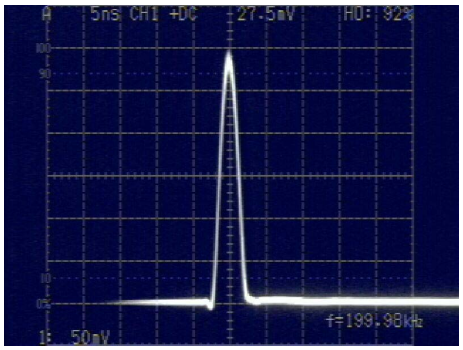
Note that, typically, fT =fmax=500kHz for 4ns Pulse Profile

Pulse Profile

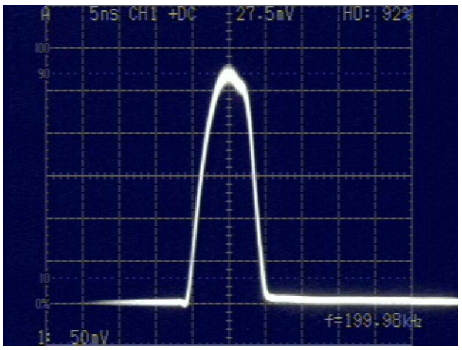
Datalogic's Arex™ A20-X6X laser marker includes 8 factory preset pulse profiles, user selectable through software interface (see “Lighter™ Pulse Profile Configuration” on page 125).

The following figures illustrates the typical pulse shape of these pulse profiles at 200 kHz frequency.

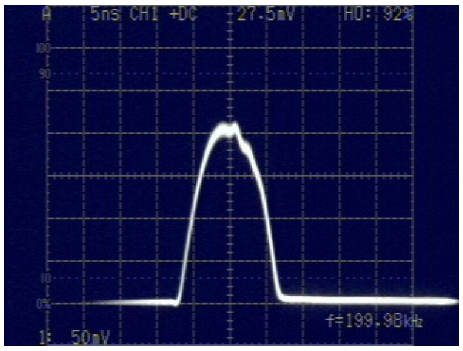
4 ns



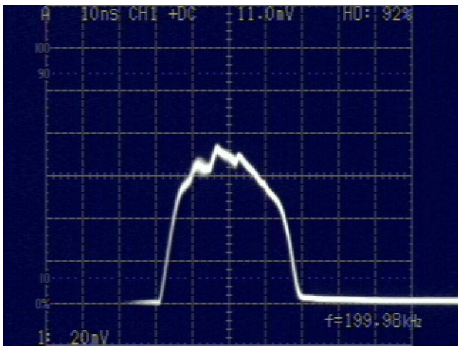
8 ns



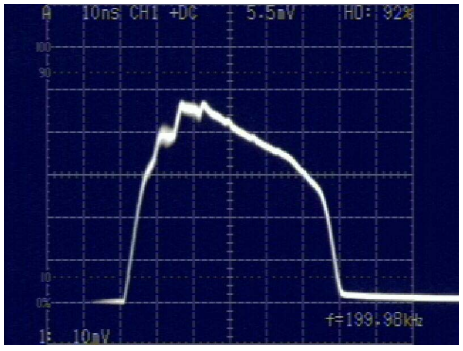
12 ns



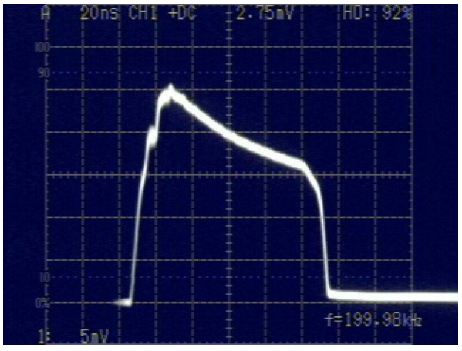
30 ns



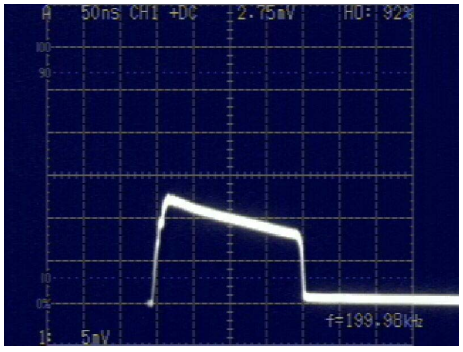
50 ns



100 ns



200 ns



250 ns

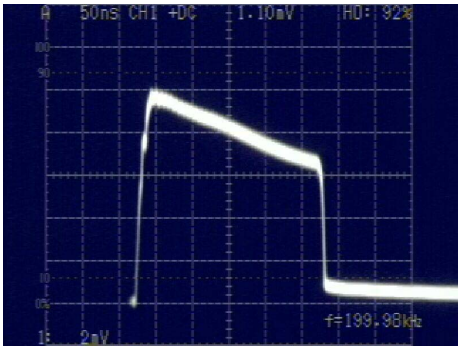


Figure 81: Typical optical output pulse shape for standard laser single pulse profiles at 200 kHz (bandwidth limited by 500 MHz oscilloscope)

For the longer pulse profiles (above 20 ns), the pulse shape varies with pulse frequency and Power level. Below the pulse transition frequency (fT), the pulse profile shape will remain invariant, i.e., will not vary with pulse frequency, while above fT the shape will vary with pulse frequency. Increasing the pulse frequency and/or decreasing the Power level will make the pulse shape less “leading peak” like and more “square” like.

The following pictures illustrates for some typical Pulse Profiles, the pulse shape variation in the “Constant Average Power Region” and the “Constant Energy/Peak Power Region”.

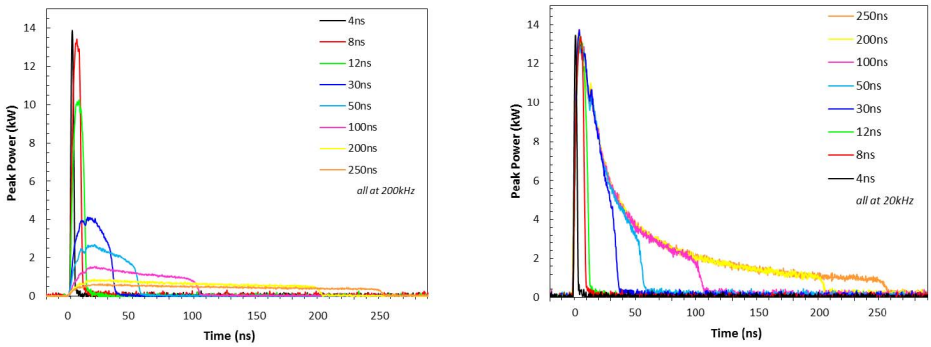


Figure 82: Typical optical output pulse shape in the “Constant Average Power Region” at 200kHz (left) and the “Constant Energy/Peak Power Region” at 20kHz (right)

If operating below transition frequency (fT), the user can vary the pulse energy without any other setting change (namely Peak Power) by changing the Pulse Profile selected.

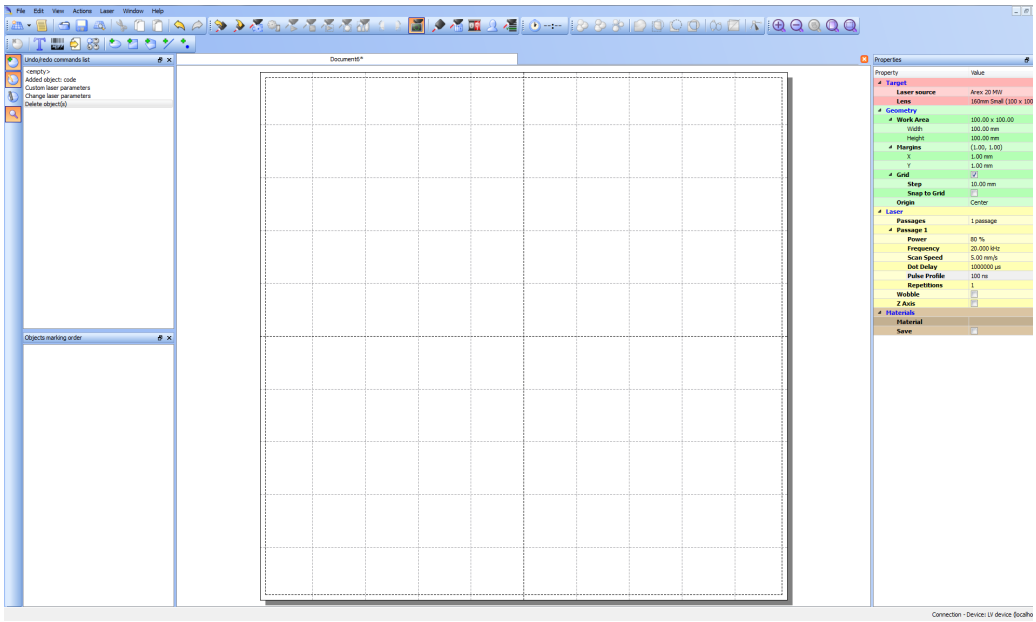
If operating above transition frequency (fT), the user can vary pulse peak power without changing pulse energy by changing the Pulse Profile selected.

LIGHTER™ PULSE PROFILE CONFIGURATION

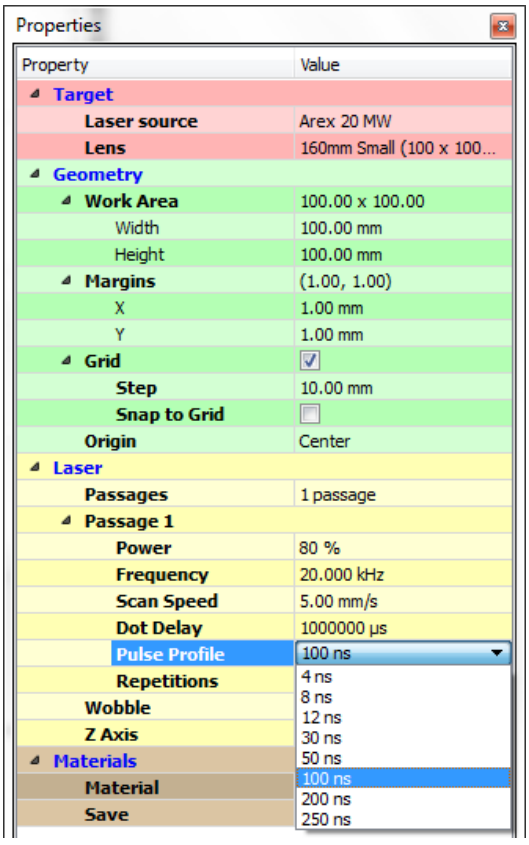
Creating a document with multiple objects using a single pulse profile

You can create documents with multiple objects, using the same pulse profile.

To accomplish this, create a **new document**:



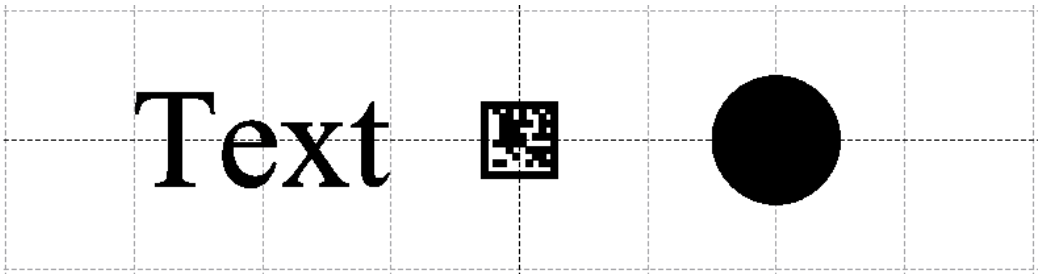
In the **Property** window, **Laser** section, select the **Pulse Profile** you want to use for the entire document:



Add the desired objects to the document using the **Insert object** toolbar:

By default, the new objects use the same laser property as those set for the document.

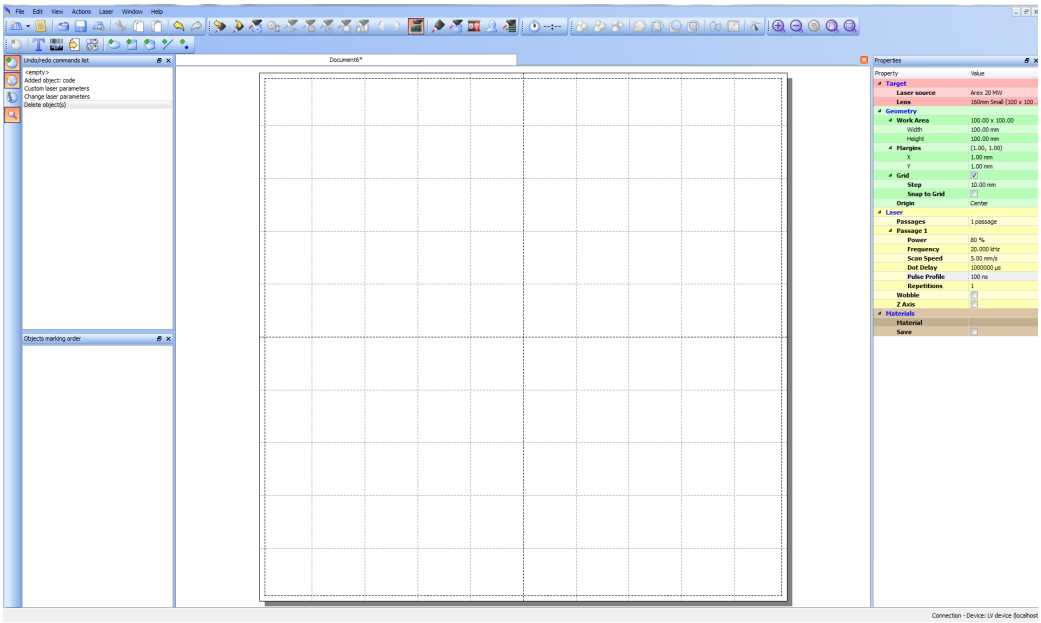
The new objects are shown in black color to indicate that their laser property are the same as those set for the document:



Creating a document with multiple objects using different pulse profiles

You can create a document with multiple objects, each having its own Pulse Profile.

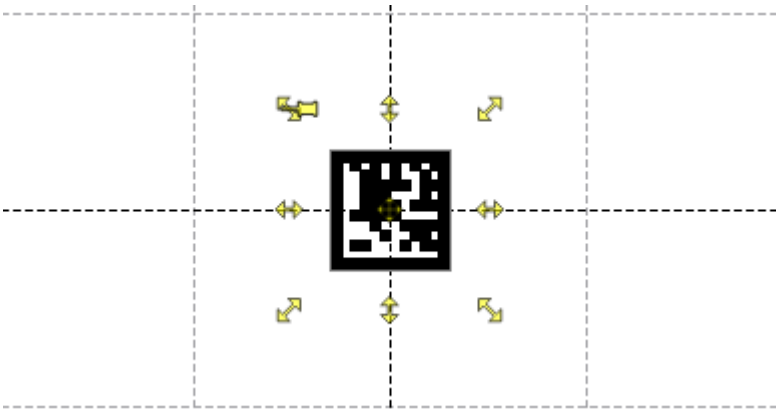
To accomplish this, create a **new document**:



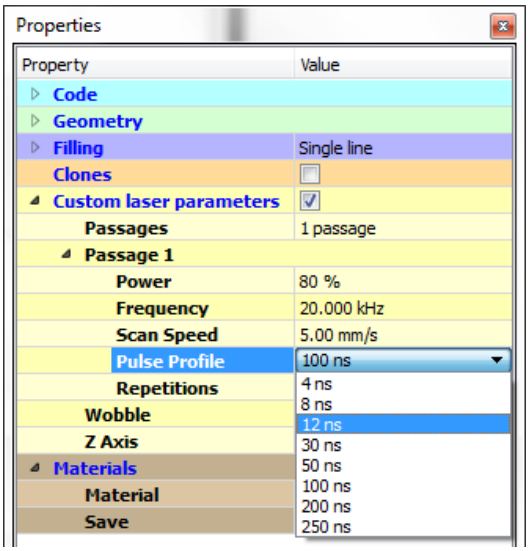
Add the desired objects to the document using the **Insert object** toolbar:

By default, all the added objects use the same laser property as those set for the document.

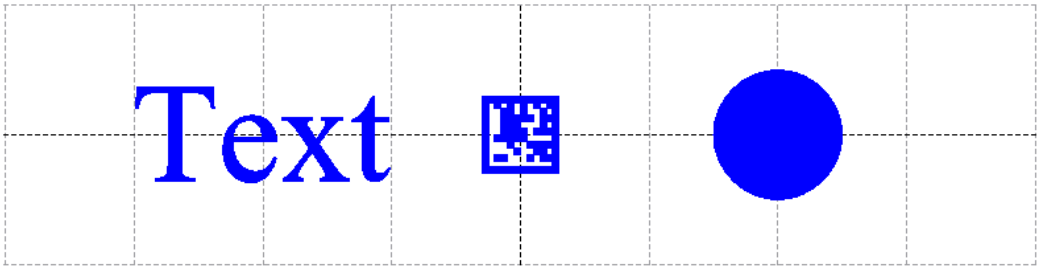
Select the object you want to change the **Pulse Profile**:



In the **Property** window flag the **Custom laser parameters** property and select the desired **Pulse Profile**:



The object will be shown in blue color to indicate that its laser property are different from those set for the document:



NOTE: Consult Lighter™ software user's manual for a proper use of the same.

APPENDIX F
MARKING SOFTWARE UPGRADE

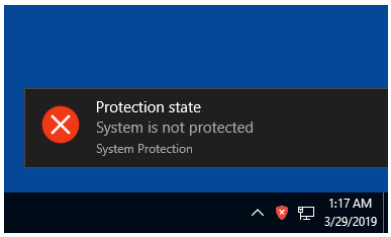
HOW TO UPDATE THE MARKING SOFTWARE

This document describes how to update the Lighter™ Suite software version.

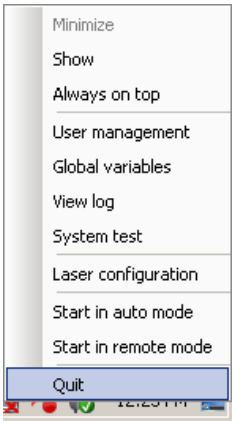
Before updating the software, disable system protection (see “Disable the system protection” on page 69).

CAUTION: When the System Protection is disabled the system is not protected against disk corruption or malware attacks. Disable the protection only for the time necessary to make disk changes.

1. Wait for the operating system to **restart**
2. Check that the System Protection is **disabled** (red icon):

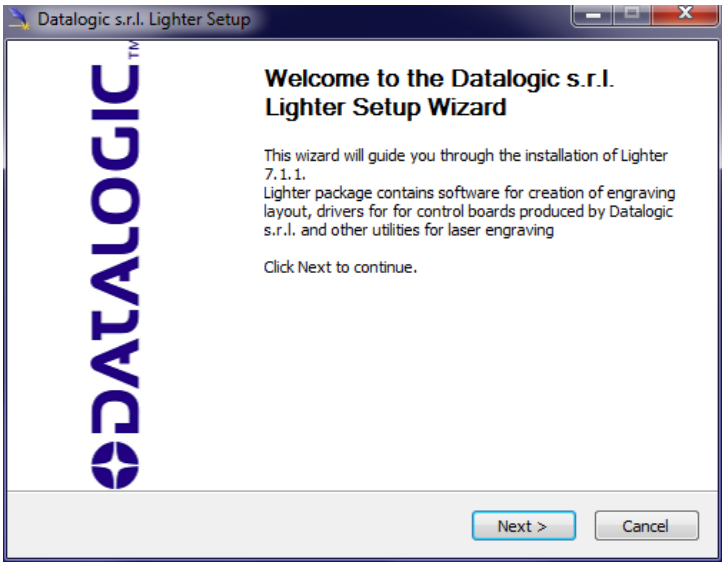


3. Close Lighter™ *Laser Editor* and *Laser Engine* (right-click on the icon in the tray bar and select **QUIT**)

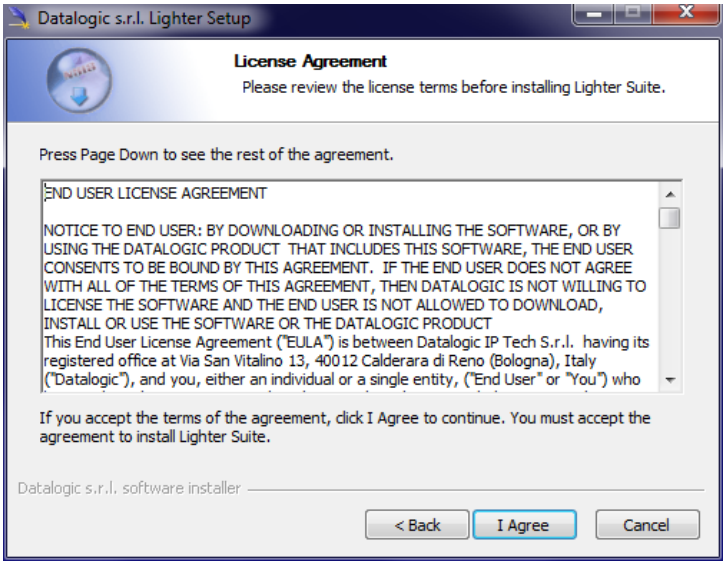


4. Run the new *Lighter™ Suite installer* from an external USB device.

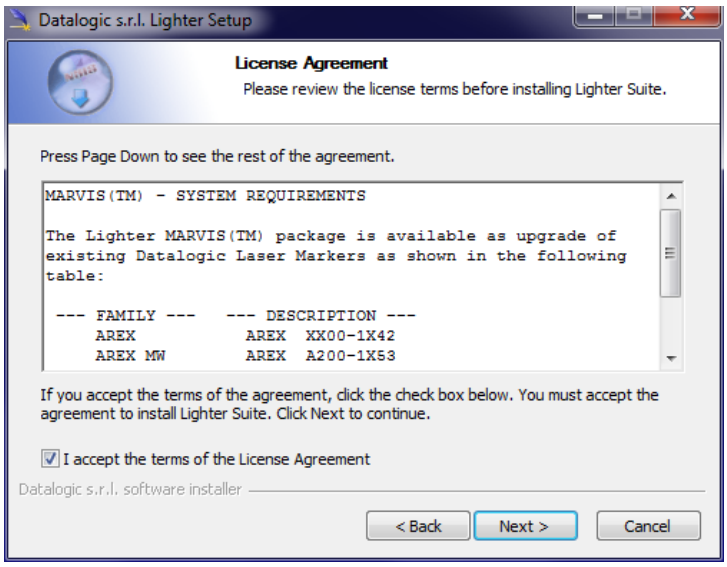
5. Press **Next** to continue:



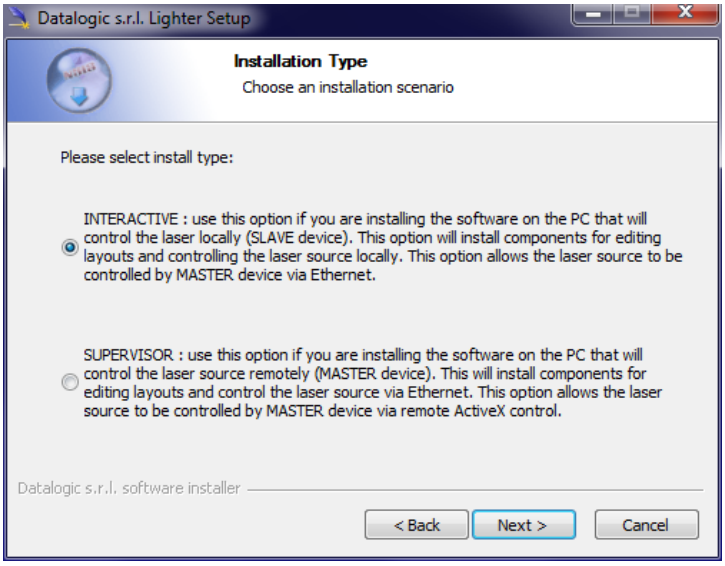
6. Press **I Agree** to continue:



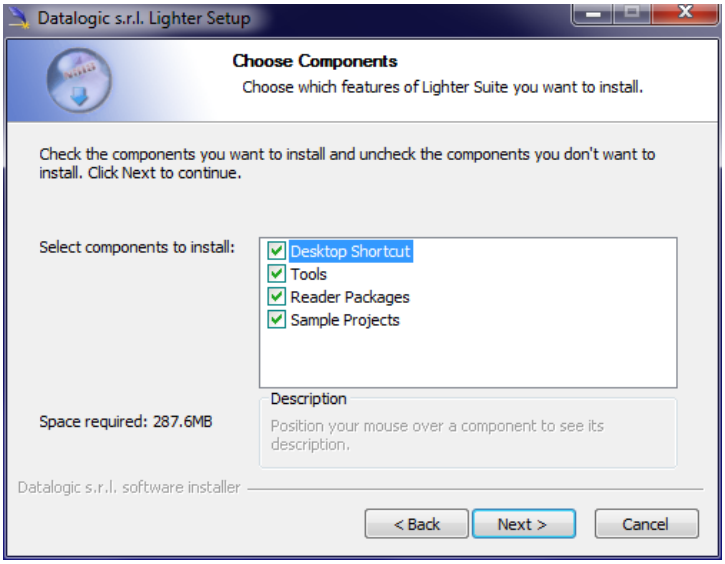
7. Check *"I accept the terms of the License Agreement"* and press **Next** to continue:



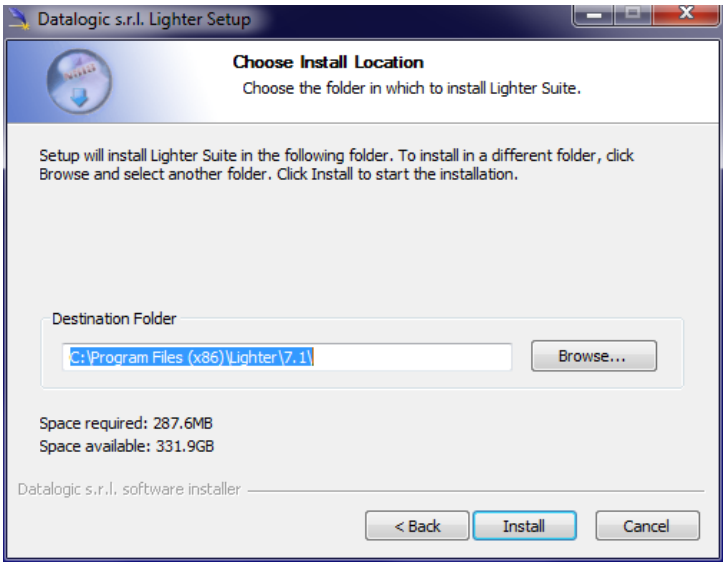
8. Choose the *INTERACTIVE* installation type and press **Next** to continue:



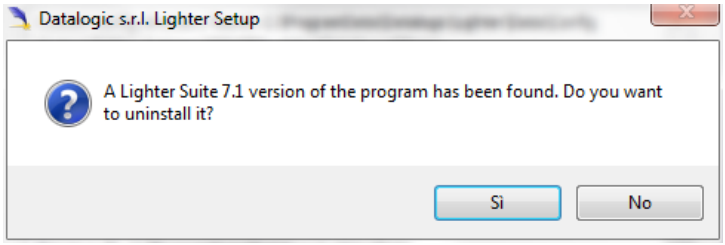
9. Choose the components to install and press **Next** to continue:



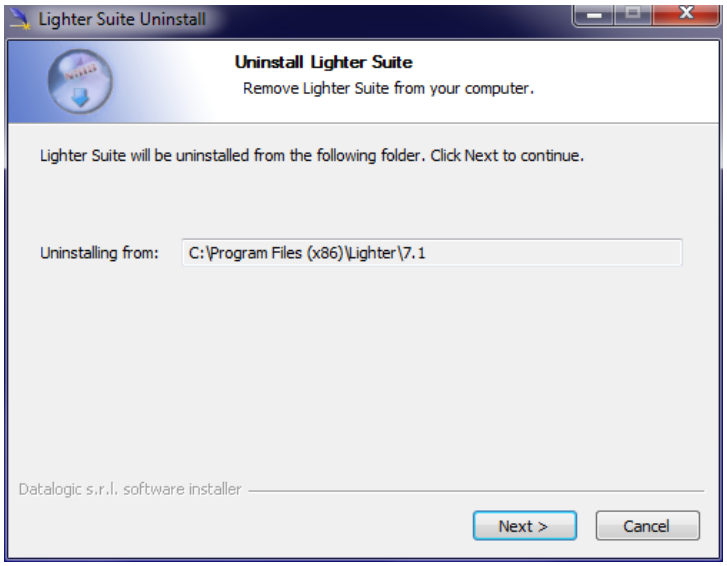
10. Do not change the destination folder and press **Install** to continue:



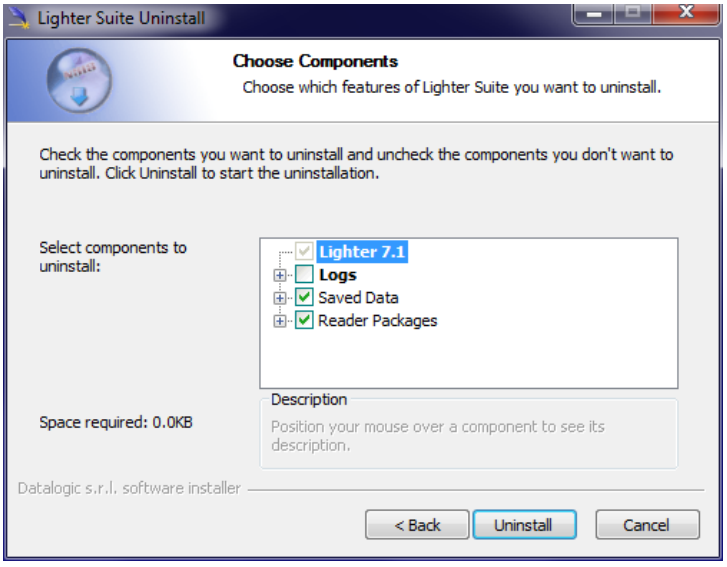
11. Press **OK** to uninstall the old Lighter™ Suite version



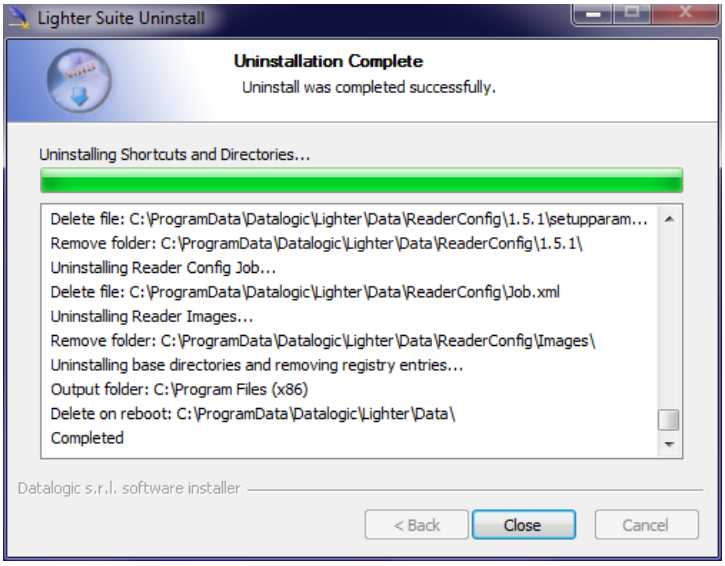
12. Press **Next** to continue:



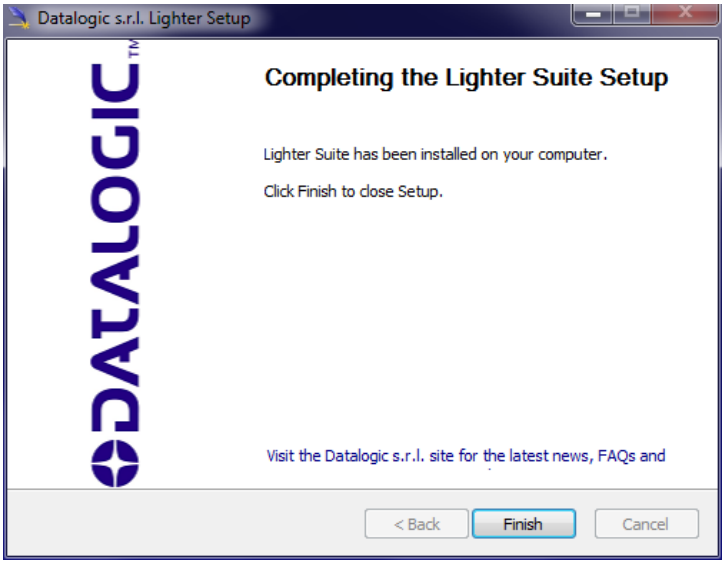
13. Select the components of the old Lighter™ Suite version to remove and press **Uninstall**:



14. Wait until the uninstallation is complete and press **Close** to continue:

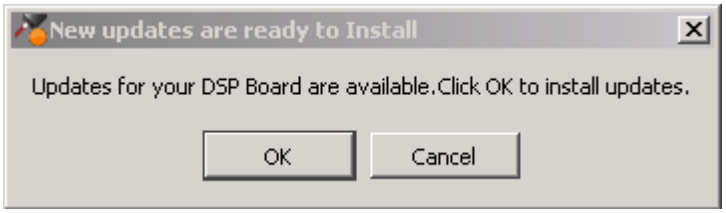


15. Lighter Suite will be installed. Press **Finish** to complete the procedure:



16. If Lighter™ Suite update includes any **control board updates** follow the procedure below otherwise jump to step 17:

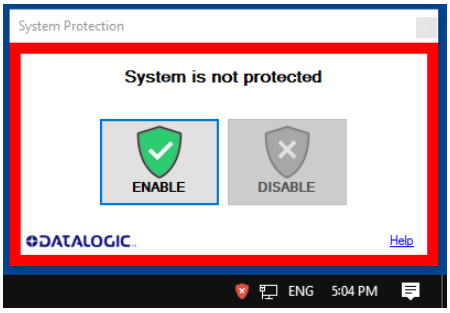
- Procedure with laser **control board upgrade**:



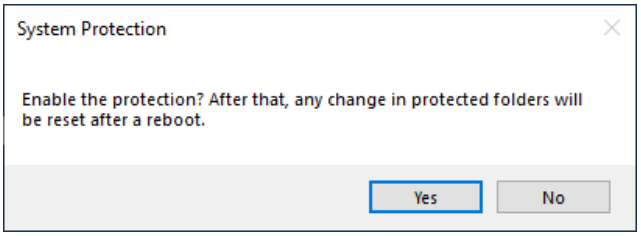
- press **OK** to execute control board update
- wait for the laser control board update

17. Open the System Protection tool GUI

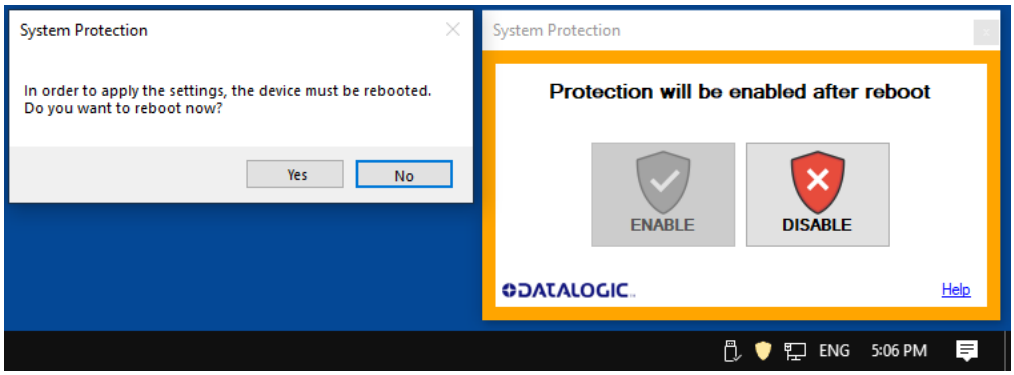
- Click the **ENABLE** button



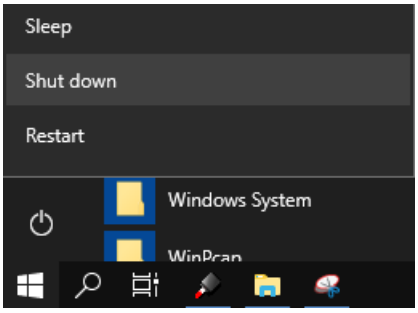
- A message advise the User to confirm the new setting. Press **YES** to enable System Protection



- A message advise the User that the system will be rebooted. Press **NO** to continue



- Shut down the system:



- wait until the operating system shuts down (black screen)

CAUTION: DO NOT turn OFF or UNPLUG the laser marker while Windows® is shutting down!

- **POWER OFF** the laser marker to complete installation

APPENDIX G
RECOVER THE LASER MARKER

OVERVIEW

The laser marker is provided with a *RECOVERY partition* able to restore the system to the factory settings.

The RECOVERY procedure should be used if the Operating System is corrupted or disks are corrupted.

HOW TO RECOVER THE LASER MARKER

CAUTION: All existing data in the laser marker will be overwritten. All existing data will be lost. If possible, make a backup of all the customer's data located by default in D:\Data folder, before recovering the system.

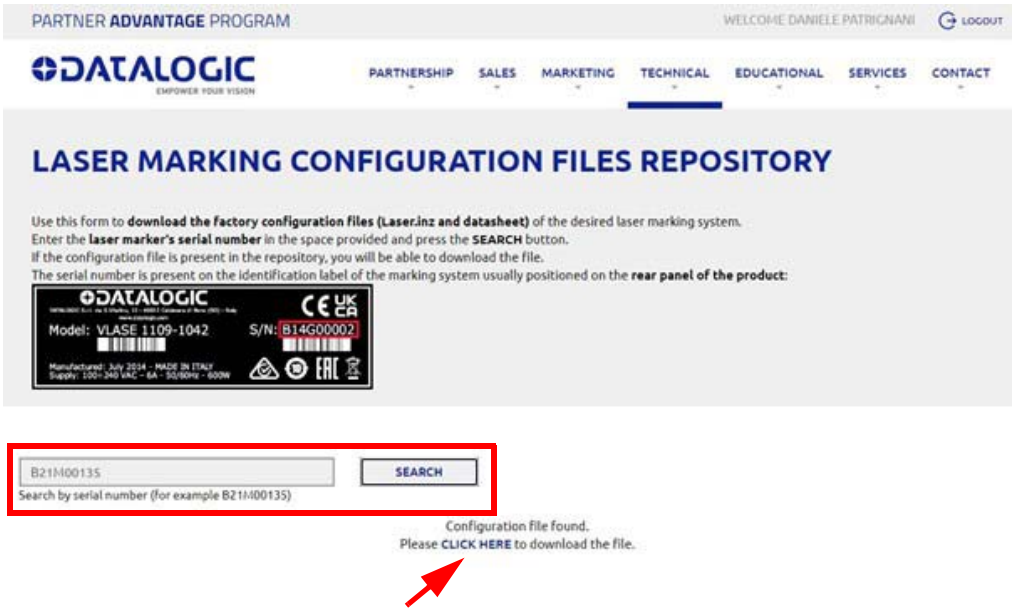
NOTE: The following images are indicative only.

Preliminary Operations

Before proceeding with the recovery procedure, it is necessary to get the original factory configuration file (`laser.inz`):

1. From an external PC connected to the Internet, go to Datalogic web site and click on **PARTNER LOGIN**.
2. If you are not registered yet, you will be asked to **Create your login**.
3. Enter **Username** and **Password**.
4. Select **TECHNICAL** and click on **LASER MARKING CONFIG. FILES REPOSITORY**.

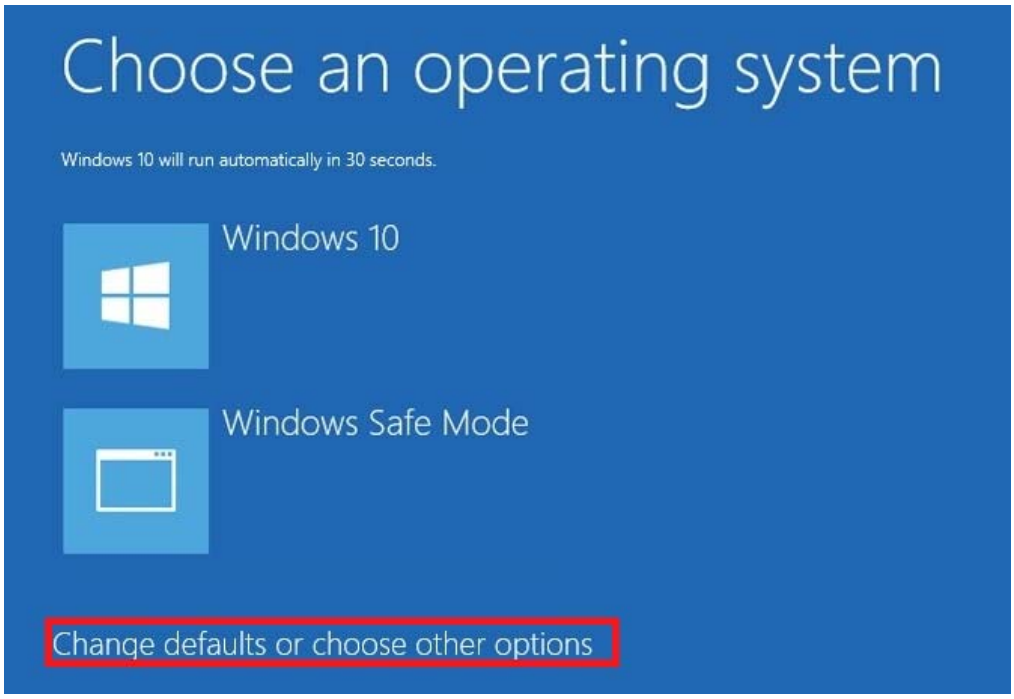
5. Insert the **Serial Number** and press **SEARCH** button.
6. Select **CLICK HERE** to download the file in **zip** format.



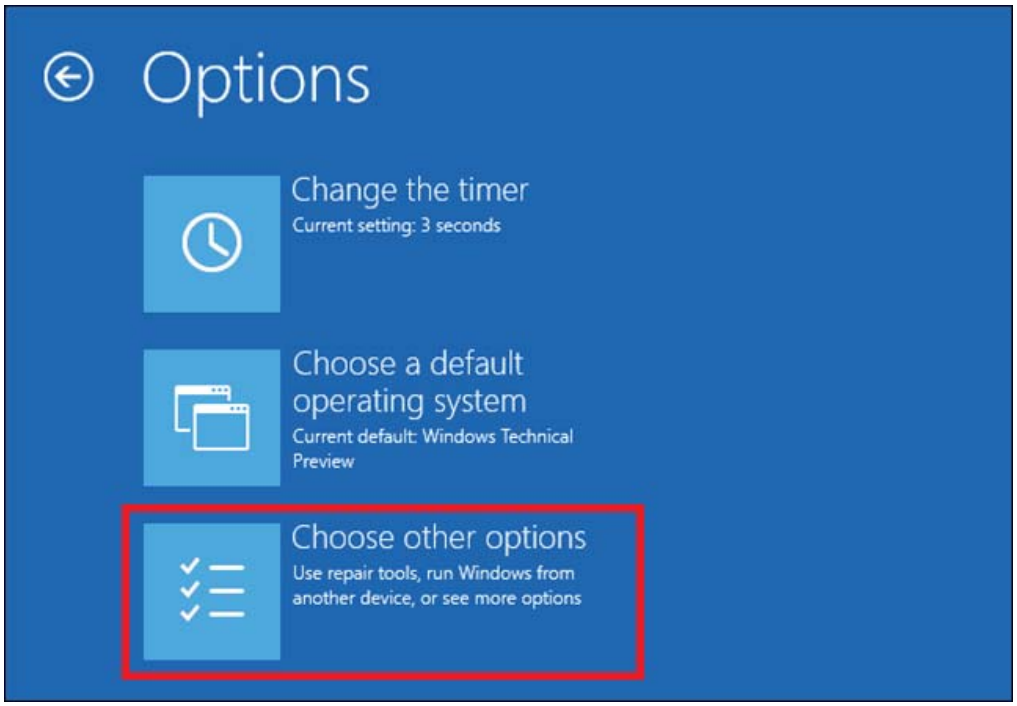
7. **Extract** the content of the **zip** file in a USB drive (the file `laser.inz` is contained in the folder ***Fileinz and report***).

Recover the system

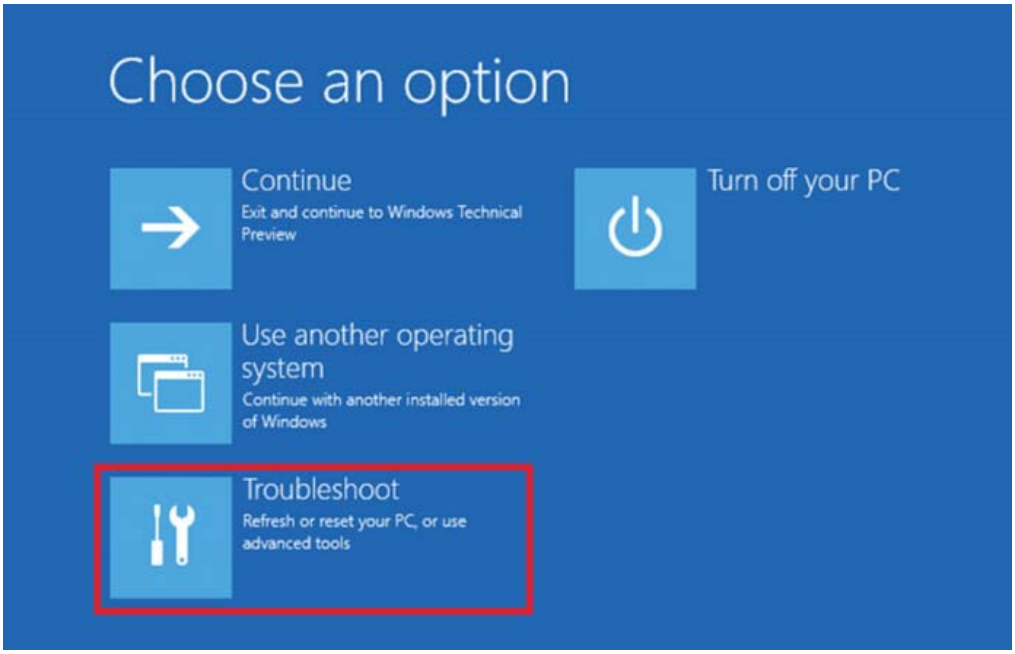
1. **Turn ON** the laser marker
2. Wait for '**Choose an operating system**' menu to appears
3. Select '*Change defaults or choose other options*' using **TAB** key and then press **ENTER** key



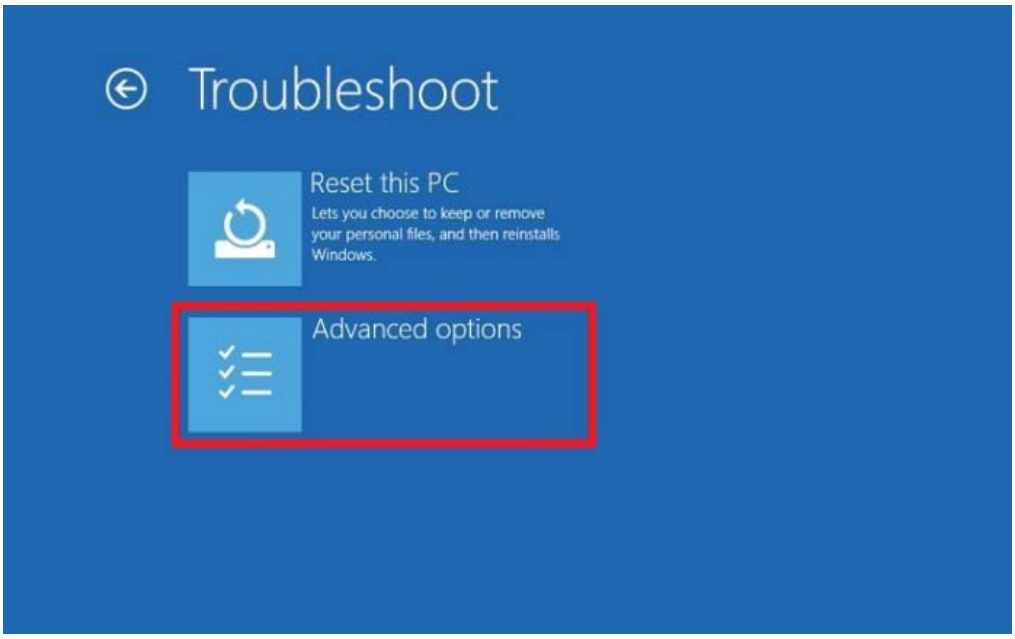
4. The **Options** screen will be shown
5. Select '*Choose other options*' using **TAB** key and then press **ENTER** key



6. The **Choose an Option** menu will be shown
7. Select '*Troubleshoot*' using **TAB** key and then press **ENTER** key

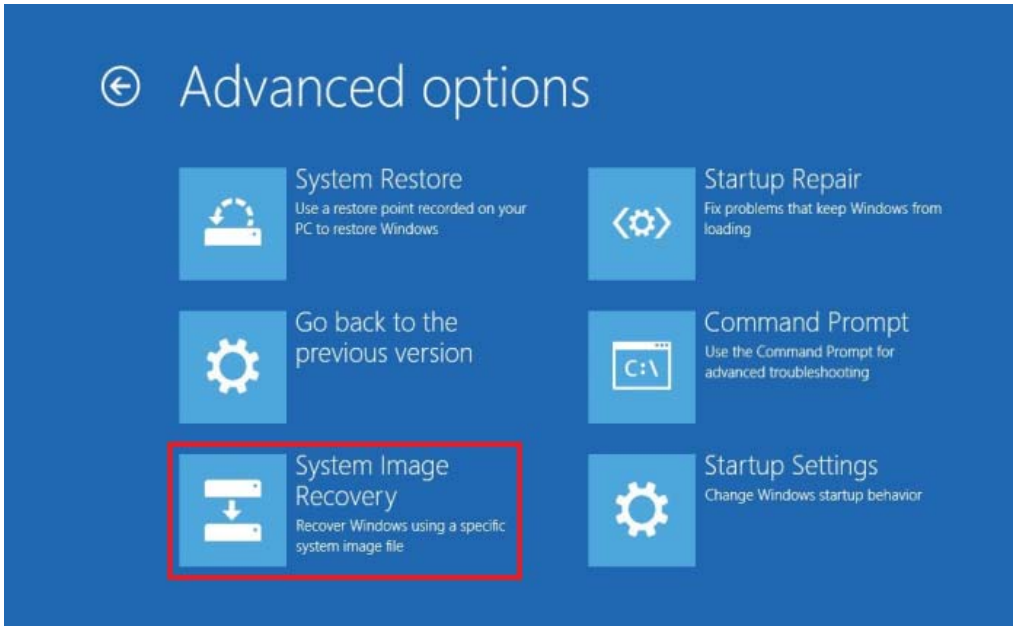


8. The **Troubleshoot** menu will be shown
9. Select '*Advanced Options*' using **TAB** key and then press **ENTER** key

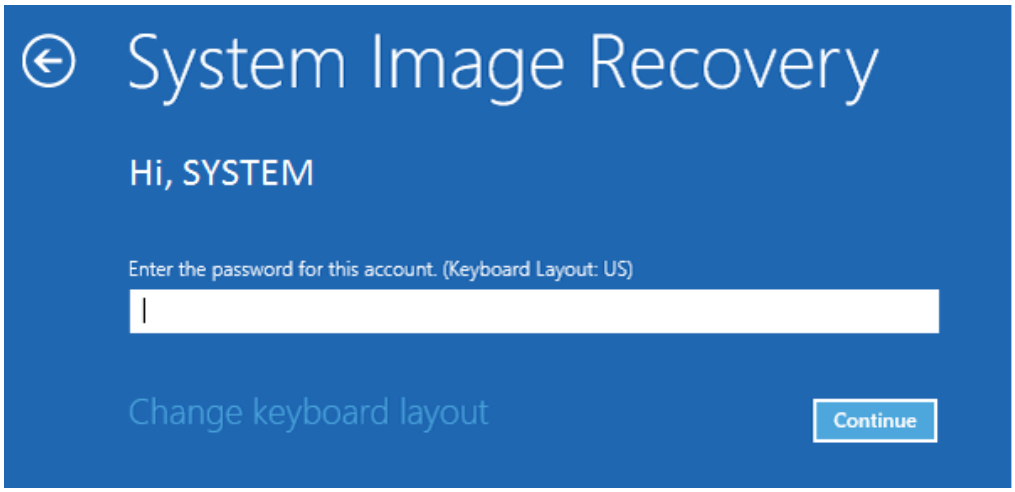


10. The **Advanced options** menu will be shown

11. Select '*System Image Recovery*' using **TAB** key and then press **ENTER** key

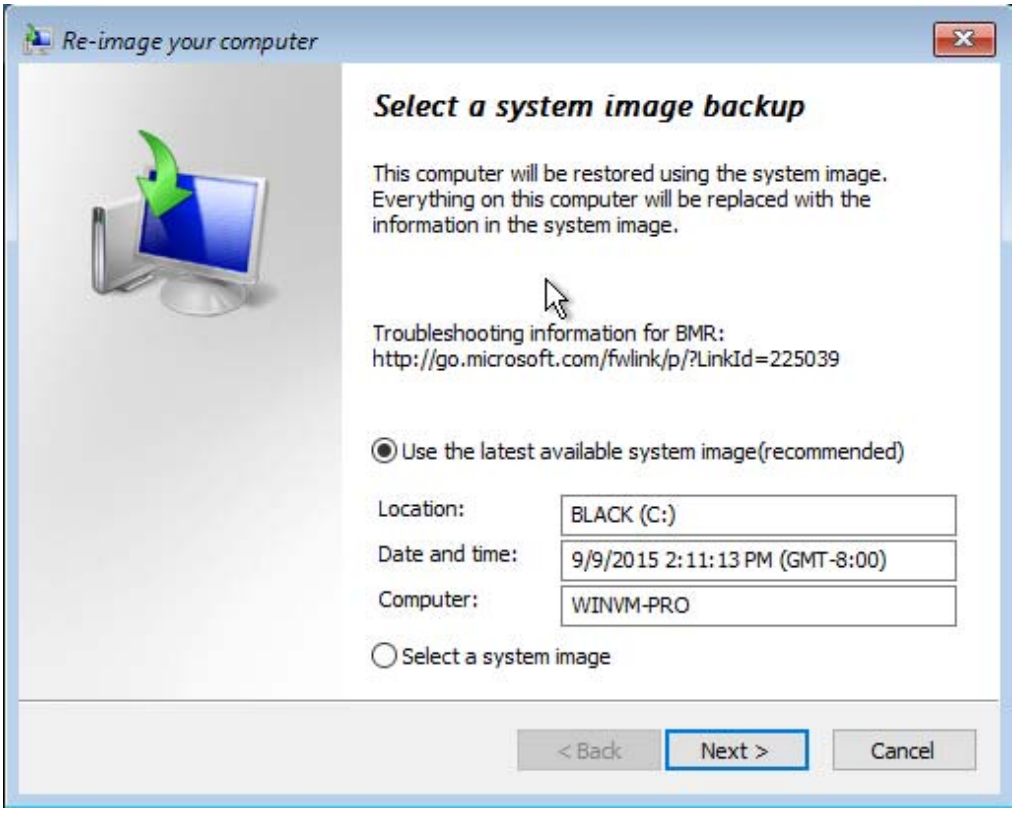


12. Enter the password '*dla*' and press **CONTINUE**

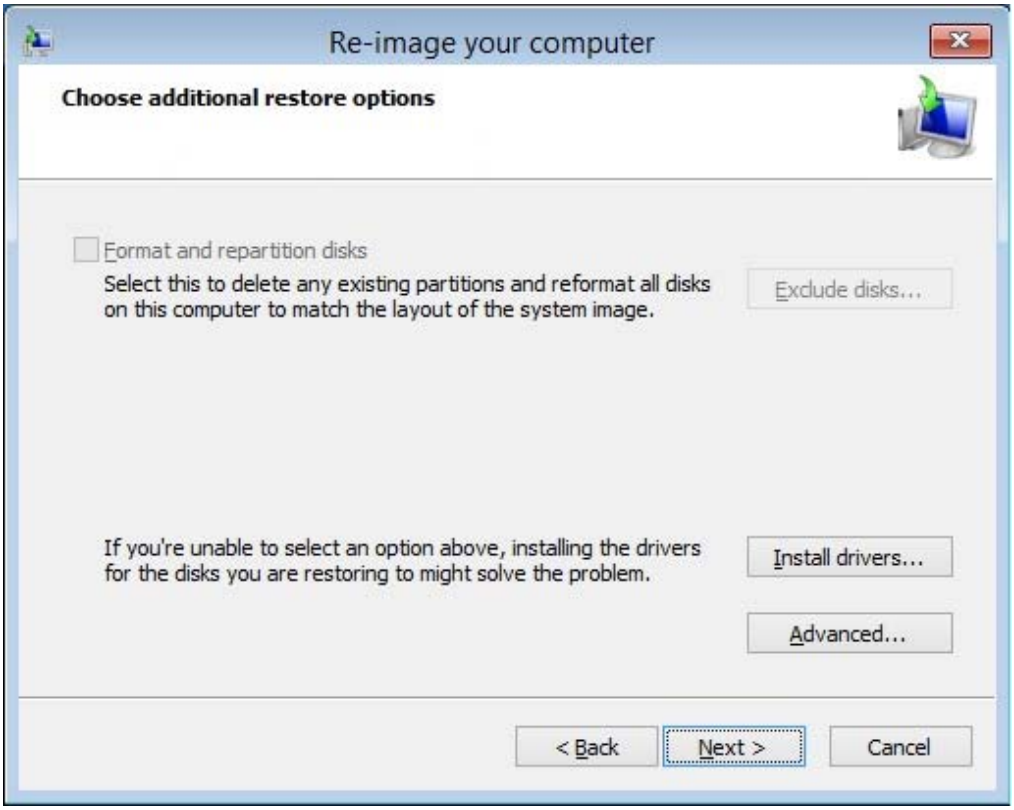


13. Select '*Use the latest available system image (recommended)*'

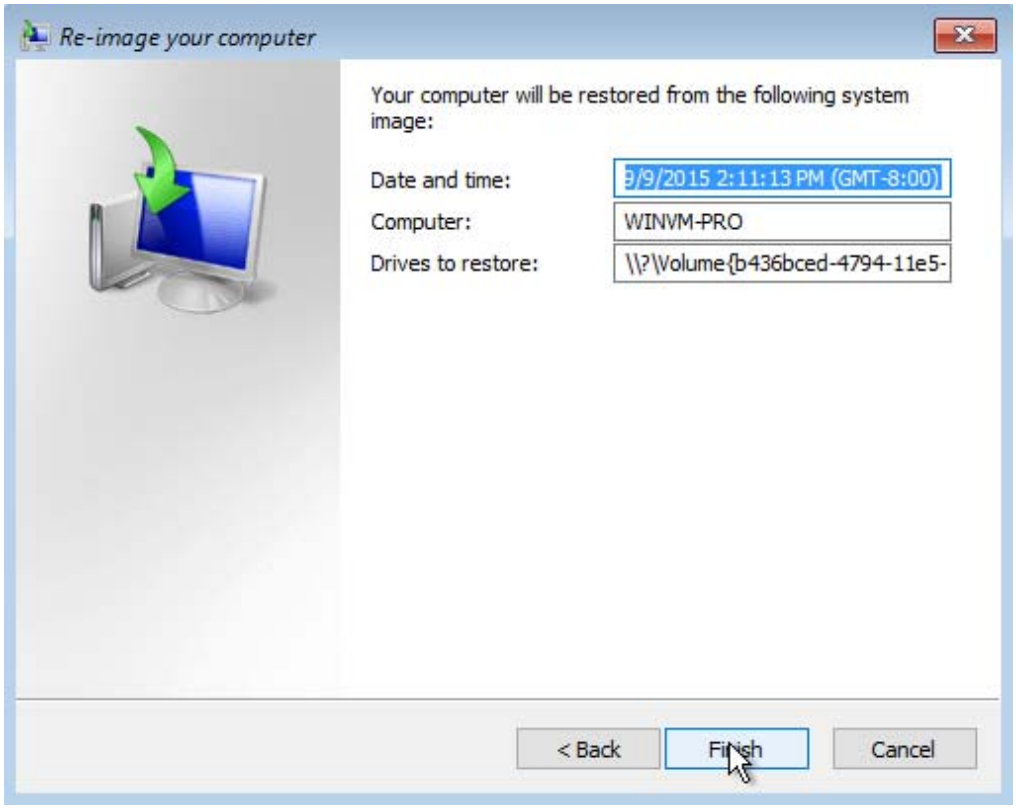
14. Press NEXT to continue



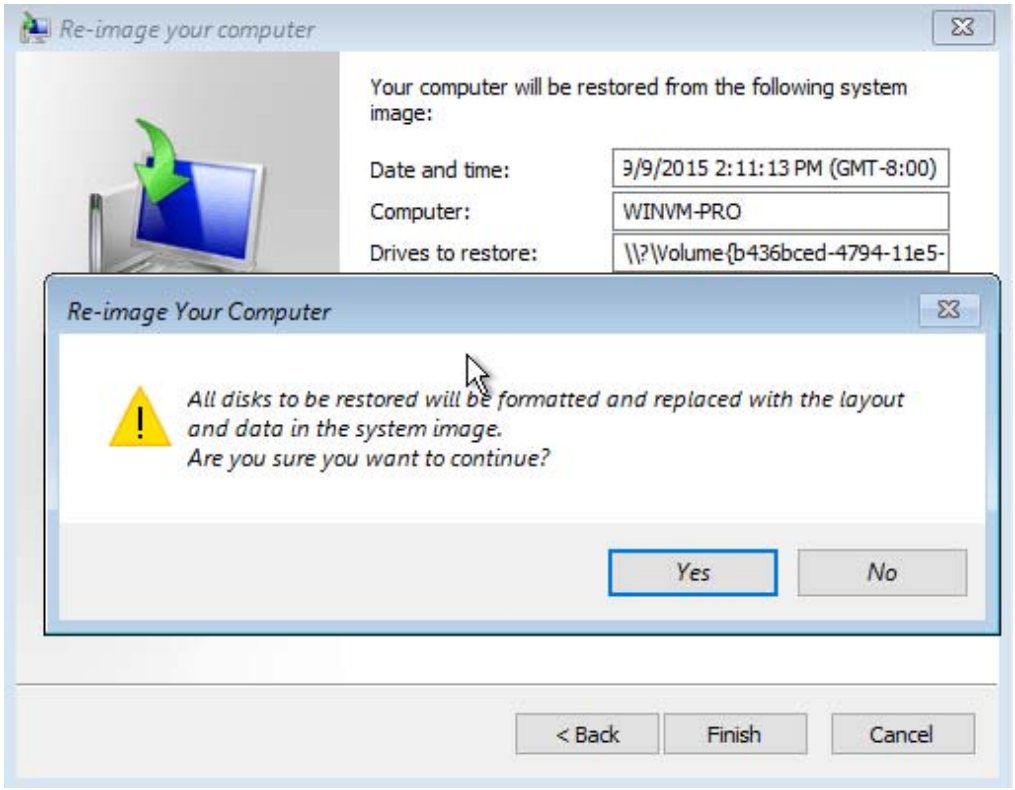
15. Press **NEXT** to continue



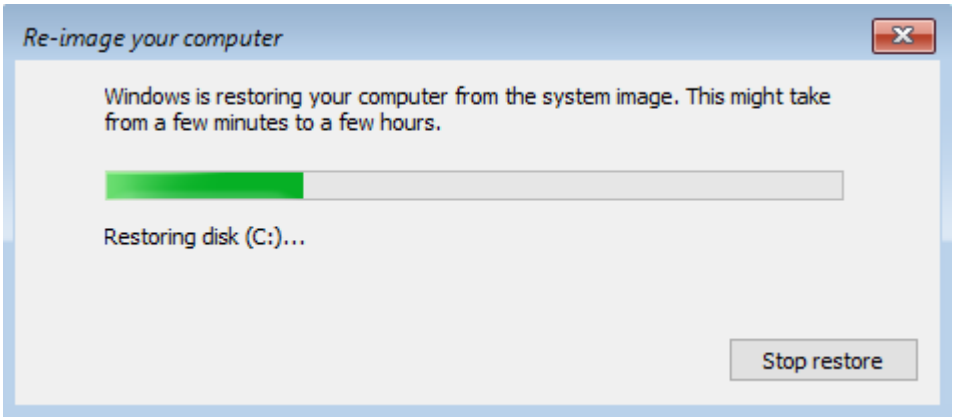
16. Press **FINISH** to continue



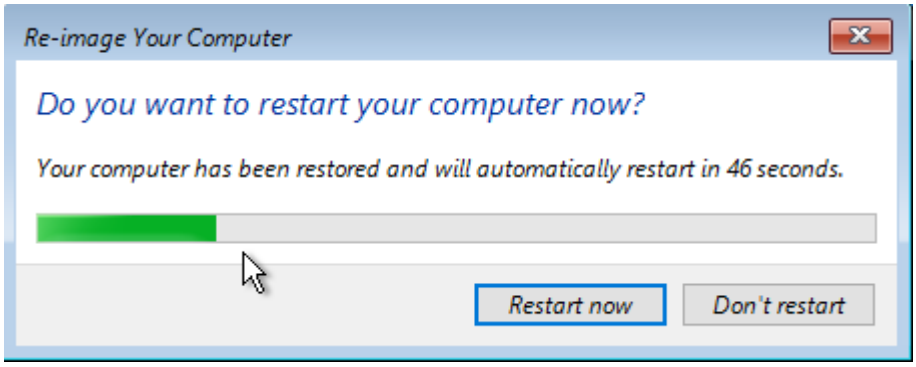
17. Press **YES** to continue



18. **Wait** for disks restoring

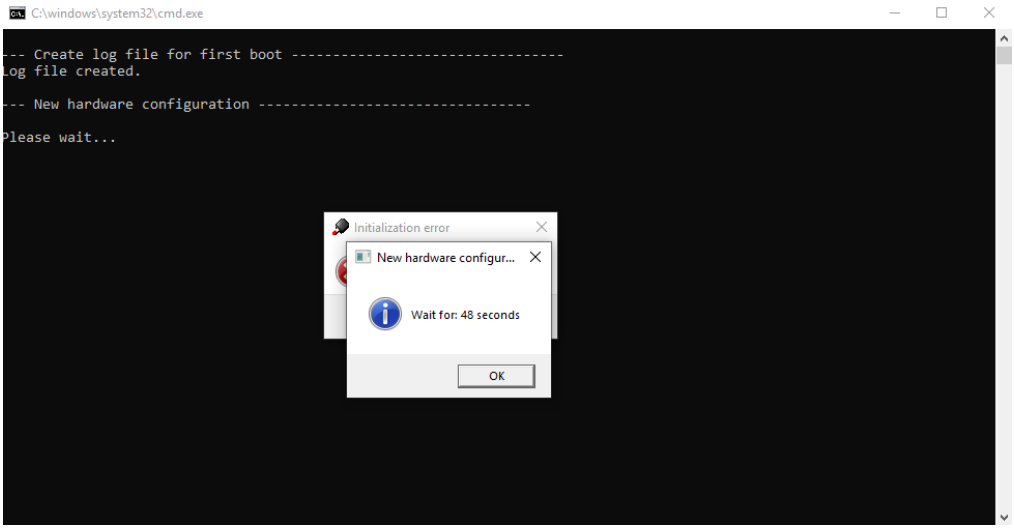


19. The system will **restart** automatically



20. After the restart, the system will perform the ***New Hardware Configuration*** procedure

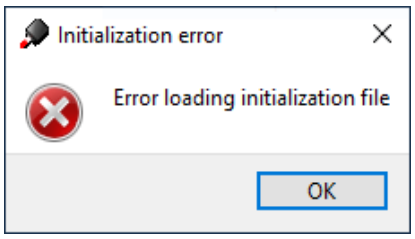
21. **Wait** for the end of the procedure



22. The system will **restart** automatically

CAUTION: DO NOT turn OFF or UNPLUG the laser marker while Windows® is restarting!

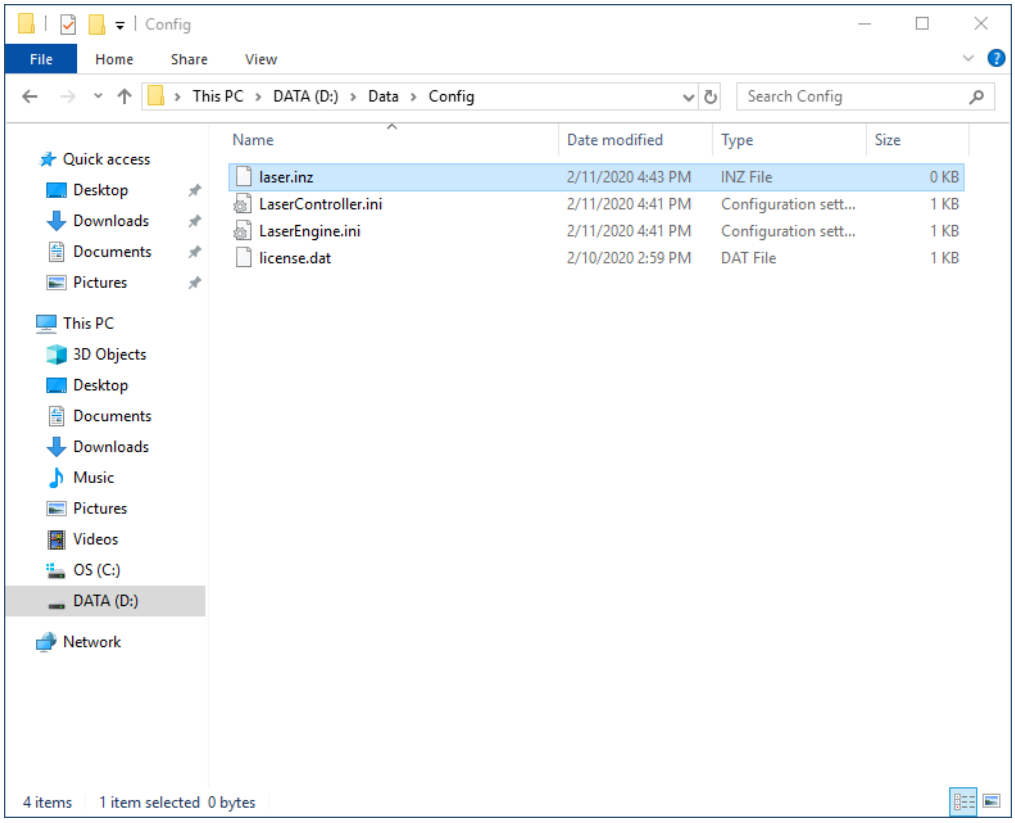
23. After the restart, an error message will advise you that Lighter™ initialization file is not present. Press **OK** to continue:



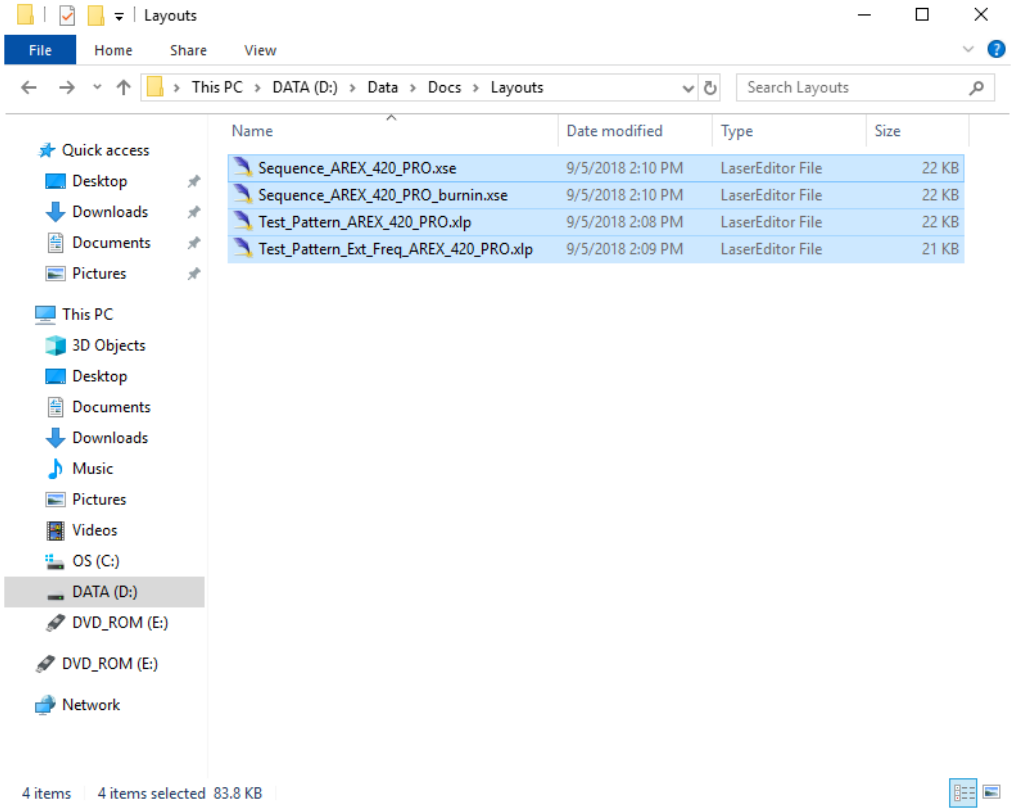
NOTE: In order to work, the marking software must be customized with the factory configuration file. The custom `Laser.inz` file is present in the Partner Area of the Datalogic website (see "Preliminary Operations" on page 135).

24. Insert the USB drive with the `laser.inz` file in a USB port of the laser marker.

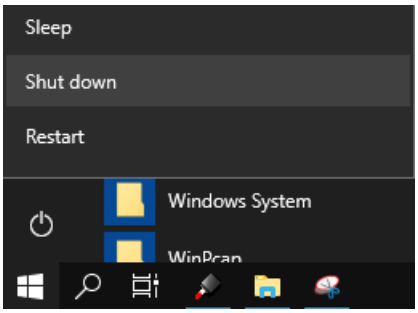
25. Navigate to the folder ***Fileinz and report*** and copy customized `laser.inz` to ***D:\DATA\CONFIG***



26. Navigate to the folder ***Test Layouts***, select the right test layout files depending on the laser marker model and copy them to ***D:\DATA\DOCS\LAYOUTS***



27. **Shut down** the operating system:



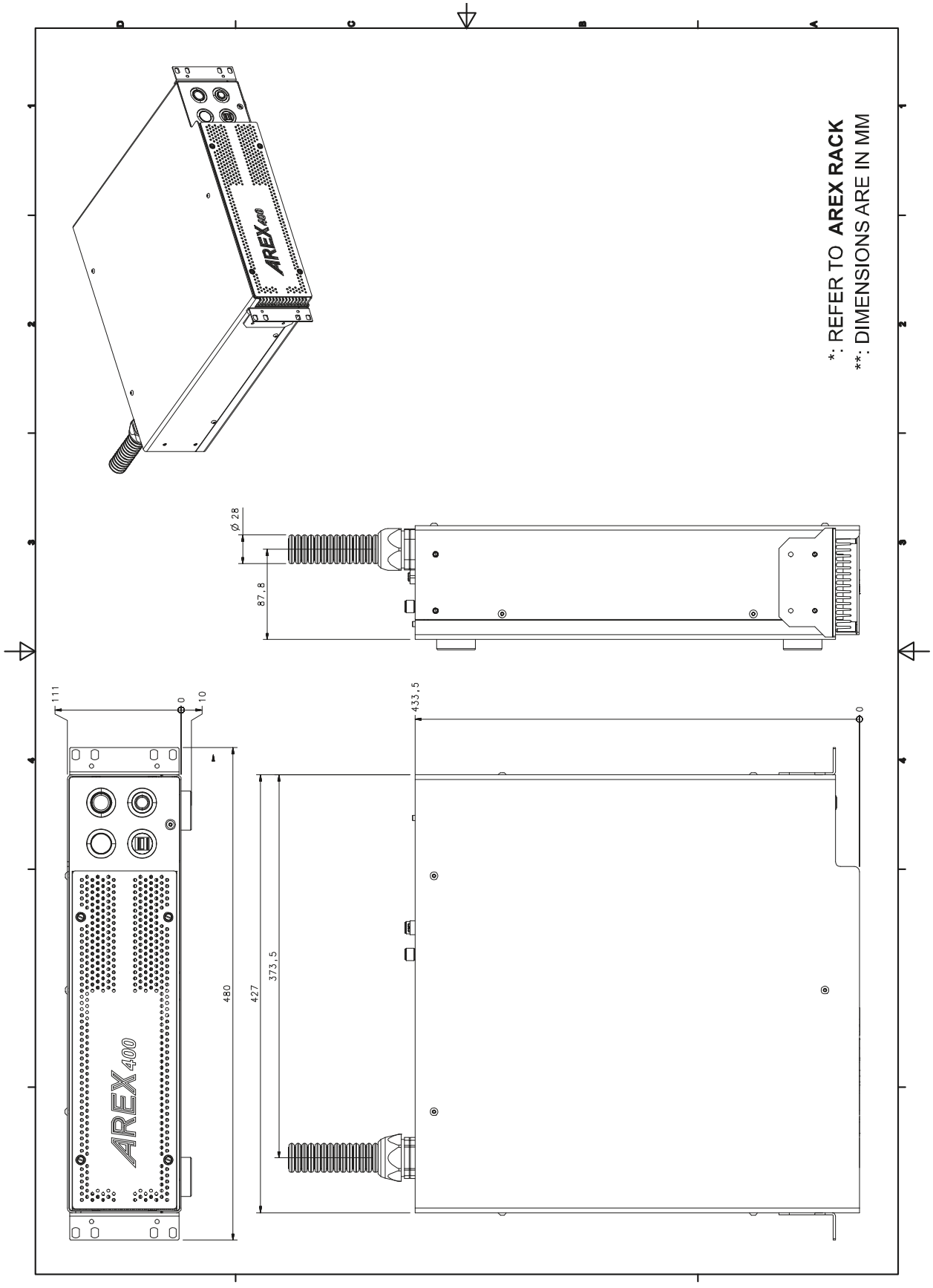
CAUTION: DO NOT turn OFF or UNPLUG the laser marker while Windows® is shutting down!

28. **Wait** until the operating system is shutting down

29. Turn **OFF** the laser marker

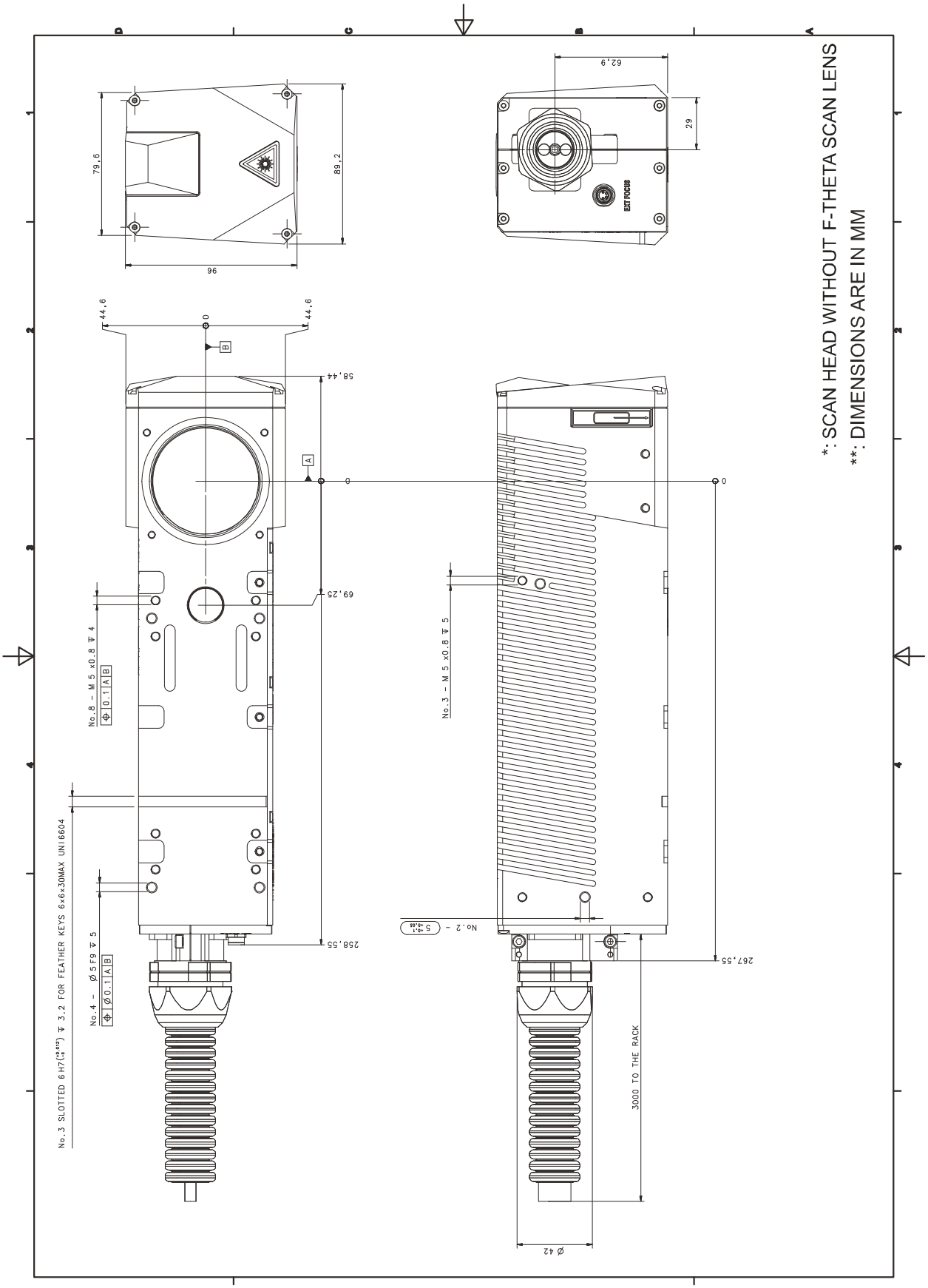
APPENDIX H
MECHANICAL DRAWINGS

CONTROL RACK



NOTE: Please refer to Datalogic website for detailed drawings.

SCAN HEAD



NOTE: Please refer to Datalogic website for detailed drawings.

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801000050 (Rev A) December 2022