



Operating Instructions

Videojet 3020

P/N: AL-73151

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Preface

This manual...

...contains all information required for the safe operation, remedy of minor malfunctions and maintenance of the laser system. The operation manual is always enclosed to every laser system. This operation manual is intended for the **trained operation and service personnel** of the laser system.

This operation manual is subject to technical modifications for improvement or technical progress without notice.

Before starting your work carefully read the chapter "Safety Instructions"!

Note The printed safety instructions must be stored near the laser system, easily accessible for the operator.

Make sure that you have understood all notes. In case of any questions please contact Videojet Technologies Inc. directly.

Strictly follow the instructions!

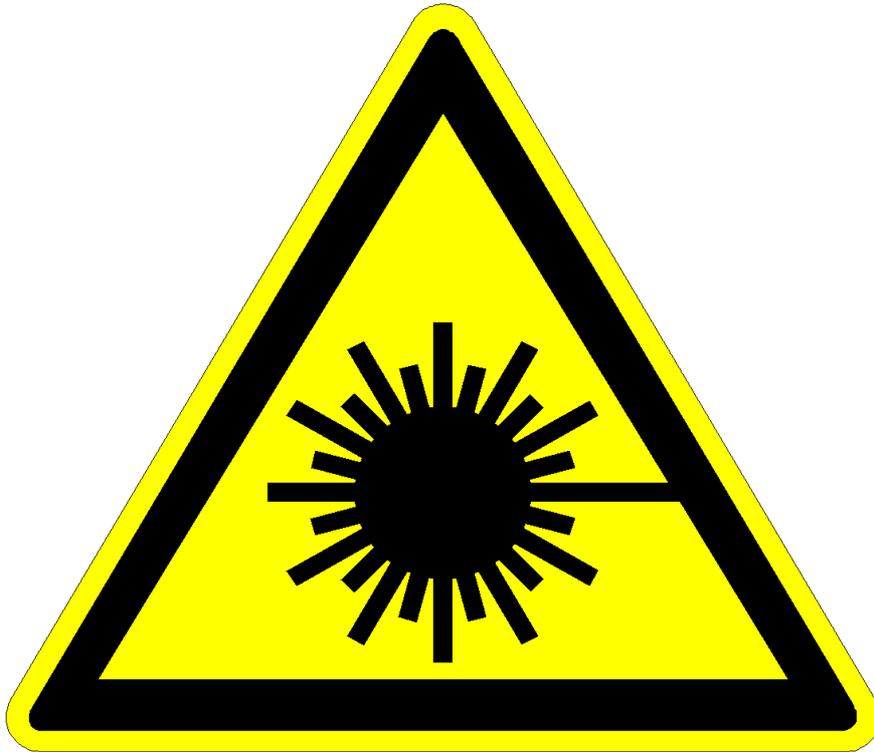
If you need help...

...please contact Videojet Technologies Inc. at 1-800-843-3610 (for all customers within the United States). Outside the U.S., customers should contact their Videojet Technologies Inc. distributor or subsidiary for assistance.

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Caution Laser Radiation!

Caution!

**With open delivery system
dangerous laser radiation
class 4 might be released!**

**This might cause severe burns of the eyes
and the skin as well as damage to objects!**

**Thoroughly read this operation manual
and strictly follow the safety instructions!**

Contents

- 1 **Safety Instructions**
- 2 **Installation**
- 3 **Description of the Laser System**
- 4 **Operating the Laser System**
- 5 **Maintenance**
- 6 **Malfunctions**
- 7 **Appendix**

1 Safety Instructions

1.1 Symbols Used

- Danger** refers to an immediately impending danger. If the danger is not avoided, it could result in death or severe (crippling) injury.
- Warning** refers to a possibly dangerous situation. If it is not avoided, it could result in death or severe injury.
- Careful** refers to a possibly dangerous situation. If it is not avoided, it could result in slight or minor injury. May also be used to warn of damage to property.
- Caution** refers to a possibly harmful situation. If it is not avoided, damage could be caused to the product or to something in its environment.
- Important** refers to handling tips and other particularly useful information. This does not signify a dangerous or harmful situation.
- Laser radiation** refers to the emission of laser radiation and therefore to a possibly dangerous situation. Please comply exactly with the safety instructions! Failure to comply with the instructions could result in minor or major injuries to the eyes or to the skin, together with damage to property.

Note:

Registered trademarks, patterns, designs and patents are not indicated explicitly in this manual. This does not mean that they are out of copyrights or that they may be used freely.

1.2 Laser Classes

The Complete Laser System

The laser itself is classified as class 4 laser system. Up to the beam outlet the **closed** laser system acts as a **class 1 laser system** in **normal operation**¹.

If the beam outlet including the object to be marked is shielded appropriately, the **complete, closed** laser system acts as a **class 1 laser system** in **normal operation**¹ and no additional protection is required for operation. The shielding prevents emerging of laser radiation or laser beam reflexes.

Note The shielding is not included in the scope of delivery!

Laser radiation The beam path must always be closed, also if there is no product in front of the laser lens.

The Laser Source

The CO₂ laser - hereinafter called laser - is operated in pulsed or continuous wave operation. The laser itself is classified as **class 4**. It produces invisible (infrared) radiation which is extremely dangerous for the eye and dangerous for the skin.

In pulsed operating mode the pulse frequency adjusts between 50 Hz and 20 kHz. The actual operating mode and pulse frequency depends on the application.

The following values can be reached (no specification):

	max. average power density	energy density
at the beam outlet	up to $1.5 \times 10^6 \text{ W/m}^2$	$7 \times 10^2 \text{ J/m}^2$ (at 1 kHz and 50 % duty cycle ^a)
in focus	up to $5 \times 10^9 \text{ W/m}^2$	$3 \times 10^6 \text{ J/m}^2$ (at 1 kHz and 50 % duty cycle ^a)

a. duty cycle: The ratio between the period of laser emission and the operation terms.

Laser radiation **Caution!**

As soon as the closed shielding or the housing of the laser are opened anywhere the complete laser system is set to class 4!

In that case appropriate measures have to be taken in order to protect people working in the laser area against too high radiation. Make sure to meet the local regulations regarding protection against laser radiation.

1. Normal operation does **not** include service, maintenance nor repairs.

Laser radiation

Caution with modifications!

EN 60825, part 1, »Safety of laser systems«, section 4.1.1 says:

If a modification by the user to a laser system previously classified in accordance with this standard leads to a change of its performance data and/or its intended use that person or organization performing the modification is responsible for a new classification and labeling of the laser system.

1.3 Intended Use

The laser system must **only be used for the treatment of material surfaces**. The surfaces are locally heated by intensive class 4 laser radiation and are modified thereby. These systems are mainly applied for marking of product surfaces (expiry dates, batch printing, serial numbers, etc.).

The radiation produced by the laser system is of high energy and therefore improper use represents a danger to persons or objects!

Laser radiation

- **Never expose human beings or animals to laser radiation!**
This might result in severe burns of eyes or skin.
- **Never expose flammable materials to laser radiation!**
Always ensure appropriate shielding of the laser beam! Errors during marking on flammable materials (e.g. paper) might cause fires. Take suitable safety measures by installing e.g. smoke or fire detectors, or similar!
- **Never expose reflecting surfaces to laser radiation!**
The reflected laser beam may cause the same dangers - in individual cases even greater dangers - as the original laser beam.
- **Never expose unknown materials to laser radiation!**
Some materials (e.g. polyethylene, polypropylene, glass) are easily penetrated by the laser beam, although they seem to be opaque for the human eye.
- **Danger of explosion!**
Make sure that the laser area is free of explosive materials or vapors!
- **For safety reasons arbitrary modifications or changes to the laser system are forbidden!**
If a modification made by the user to a previously classified laser system leads to a change of its performance data and/or its intended use that person or organization performing the modification is responsible for a new classification and labeling of the laser system. The person or organization is then regarded as »manufacturer«.
- **The laser system must be operated with open laser and/or open beam delivery system by specially trained personnel only!**
Make sure that the laser protection rules are always observed!

1.4 Maintenance and Service

The maintenance tasks described hereinafter should only be carried out by **especially trained personnel**. The service tasks are exclusively to be carried out by service personnel of VIDEOJET or one of their representatives. During these works the laser system has to be operated in **class 4**. The Unfallverhütungsvorschrift (*Accident Prevention Regulations*) 46.0 »Laser Radiation« (BGV B2) says that the responsible trade cooperative association and the authority responsible for occupational safety (Trade Supervisory Office) have to be given notice of class 3B or 4 laser systems before initial operation.

- Important**
- Give notice of the laser system to the responsible trade cooperative association and the Trade Supervisory Office before initial operation.
 - Have a person responsible for the safety of the laser system trained as laser safety officer and inform the trade cooperative association in writing about this person.

Note:

In order to facilitate safe performance of all necessary maintenance and service tasks without assistance and to ensure highest safety for the operating and maintenance personnel we offer special training seminars.

- **Training for technicians:**
The trainee gains the knowledge required to perform all maintenance and service tasks at the laser system safely and professionally without assistance.
- **Combined training:**
In addition to the knowledge gained during the training for technicians the person is trained as laser safety officer. This training is accepted by the trade cooperative association (see above).

Ask for free information material!

Please be aware that (in Germany) the personnel operating the laser system must be instructed according to §12 of the Health and Safety at Work Act and §4 BGV A1 (Prevention Principles) at least once a year.

1.5 Safety Devices and Warning Lights

The complete laser system includes various safety devices and warning lights which shall prevent damages to people or objects. There must not be any alterations to safety devices nor warning lamps (see section "Laser Classes" on page 8)!

Safety Devices

Key-operated switch prevents operation of the laser system by unauthorized people. The "switch" is closed by entering a password in the Touch Control. Make sure that the login information is available to authorized personnel only!

Beam shutter is located within the marking head and prevents the emission of laser radiation.

Interlock switch(es) open(s) the safety circuit. The marking process is stopped immediately. If several interlock switches are connected: Laser radiation cannot be emitted if at least one interlock switch is opened.

All safety doors, protective covers, etc. must be safeguarded by interlock switches. Number and position of the interlock switches are system-specific.

For wiring the safety circuit single wires must be used and they must be laid separately to avoid the risk of short-circuits.

For the marking process all interlock switches must be closed. In an interlock switch is open the message "Error Interlock open" is displayed in the software.

After closing the interlock switch the marking process can be continued after a delay of 5 seconds.

We recommend the interlock monitoring module for proximity safety switches AES 1235 in combination with the magnetic guard door BNS 33 and the actuating magnet BPS 33 by Schmersal.

The interlock circuit must be checked regularly.

Note The input »Interlock« is to be used exclusively for connecting external interlock switches. It is **not** intended for controlling the laser system. For that purpose please use the input »Shutter Lock«.

Warning Lights

Red light ("bumper") on the head of the laser system lights up when the emission of laser radiation is possible.

Red LED "Laser emission" on the keypad of the laser system, lights up when the emission of laser radiation is possible.

Important When installing the laser you must ensure that at least one of the warning LEDs is always visible.

1.6 Dangers to Eyes and Skin

The laser system produces **class 4** laser radiation. **Infrared** laser radiation is **not visible** for the human eye. Therefore eyes and skin are endangered through high-energy laser radiation.

High irradiation causes an extreme local heating and **burning of the tissue**. The eyes are subject to special risks. High radiation intensity causes a local heating and burning of the cornea and thus a **reduction or loss of sight!**



People within the area of the laser **must wear** suitable **safety goggles** against laser radiation while carrying out maintenance, adjustment or service work at the open laser housing and/or open beam delivery system!

Never look directly into the laser beam!

Suitable safety goggles provide protection against direct, specularly reflected or diffusely scattered laser radiation.

Suitable safety goggles are:

- designed for the **wavelength range** of the CO₂ laser of 10.6 µm. See name plate of the laser system.

Careful with confusions!

Safety goggles for other lasers, e.g. Nd:YAG laser, do not provide adequate protection against radiation of a CO₂ laser!

- designed for the **power range** of the laser. Values of maximum average power:

Videojet 3020 15 W

- are designed for **pulse and continuous wave operation**.

The skin can withstand higher radiation intensities than the eye. However - depending on the radiation period and radiation intensity - the tissue is destroyed through burns. Therefore **protect your skin by wearing adequate protective clothing!** Avoid any exposure of your skin to the laser radiation! Avoid the laser beam to get in contact with your clothing!

1.7 Safety Information for Zinc Selenide Lenses

Caution The focusing module consists of coated zinc selenide and contains an extremely small amount of the radioactive substance thorium. This applies to all CO₂ laser marking systems available on the market.

Zinc Selenide

This material contains components which are dangerous to health!

Zinc selenide is toxic when inhaled or ingested. Dust may lead to irritation of the eyes and the respiratory system. Do not eat, drink or smoke while handling zinc selenide. Wash hands thoroughly afterwards.

For detailed information see safety data sheet in the chapter "Appendix".

Thorium

Thorium is a potential health hazard when inhaled or ingested. The thorium layer is embedded within other layers within the lens. Thus no radioactive material can escape from the coating as long as the lens is intact. Avoid any surface scratches of the lens.

Note **There is no danger of radiation during normal handling and cleaning of the optical system!**

In case of a broken lens...

...do not inhale material particles! In case of breaking of the lens please collect the fragments wearing gloves (avoid raising dust when sweeping up the pieces), pack the fragments into a closed plastic bag and send them back to us for disposal.

Maintenance of the focusing module

Information concerning the maintenance of the focusing module can be found in chapter "Maintenance", section "Cleaning the focusing module".

Please contact us if more information is required.

1.8 Adjustment/Modification of the Marking Field

Via the software the marking field of the laser can be modified in such a way that the laser beam can possibly be directed to the shielding or onto other components or parts. Thus, surfaces exposed to irradiation can be damaged or destroyed.

Laser radiation If, as a result of the modification, the laser beam gets accessible the complete laser system is set to class 4 (see section "Laser Classes" on page 8).

Caution Fire and explosion hazard if there are flammable materials or explosive atmospheres within the area of the laser beam.

A password is required for changing the marking field (if the password protection has been activated in the software). The password can be changed subsequently by a user authorized for the corresponding user level.

We explicitly point out that the person who will fulfil a modification of the marking field, will assume the full responsibility for any consequential damages and problems!

1.9 Fire and Explosion Hazard

Laser radiation The high output power of a class 4 laser can inflame various materials. Therefore, while performing maintenance and service work at the open laser housing and/or open beam delivery system, make sure that fire protection measures were taken **before** starting the works!

Paper (circuit diagrams, leaflets, posters on the walls, etc.), curtains which are not impregnated fire retardantly, wooden boards or similar flammable materials can easily be inflamed by **direct or reflected** laser radiation.

Make sure that the **working area** of the laser system is **free from containers with flammable or explosive solvents or cleaning agents!** Unintended exposure of a container to intensive invisible laser radiation might easily cause fires or explosions.

1.10 Electrical Safety

The laser system was designed in accordance with the general rules of technology including regulations EN 60950-1 and EN 60825-1.

Caution During works at the open laser housing alive components are accessible!

Make sure that rules and regulations for works on alive components are always observed!

All works at the open laser housing, especially at electrical components, must only be performed by specially trained personnel!

1.11 Decomposition Products

Caution When treating materials with laser radiation decomposition products are produced which are dangerous to health!

Through vaporization of materials fine dust and vapors are produced which might include hazardous decomposition products depending on type and composition of the respective materials.

Therefore we highly recommend to install an fume extractor according to the respective requirements which is equipped with special dust and activated charcoal filters to ensure that the decomposition products are sucked off where they are produced.

Protect yourself and your colleagues against hazardous decomposition products!

A fume extractor also prevents contamination and gradual destruction of optical elements of the beam delivery system by dust particles. We offer different fume extractors as accessories.

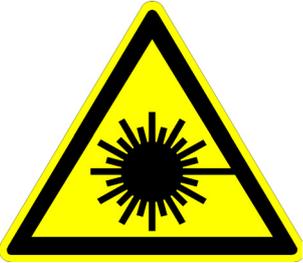
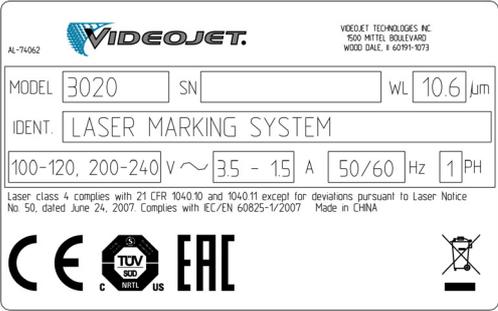
1.12 Cleaning Agents

Caution The housing of the laser system is made of PC/ABS (polycarbonate with acrylonitrile butadiene styrene). This material can be corroded by aggressive substances.

To clean the housing use only a damp cloth (water or mild detergent solution).

Acetone must only be used for cleaning the lens surface and must not get in contact with the housing!

1.13 Warning and Information Labels

Label/Symbol	Position
 	<p>Left and right side of the housing, at the back end.</p>
	<p>Left and right side of the housing, at the front end (above the focusing module).</p>
	<p>Inside</p>
	<p>Bottom side, close to the type plate.</p>
	<p>Bottom side of the laser system.</p>

2 Installation

2.1 Installation and Start-up

In order to facilitate quick and easy start-up please prepare the place of installation such that the system can be installed:

- Proceed as described in section "Unpacking", page 22.
- Please provide all connections - as described in section "Installation Conditions" and in the documents you received upon order handling - in time.
- Install the system according to the description in the QUICK START GUIDE.

In case of questions please contact us.

Note The company operating the laser system is responsible for the safe use of the laser system, especially for meeting the local codes and regulations regarding the operation of laser systems and their components (beam protection, exhaust system, cooling, etc.).

Videojet Technologies Inc. does not accept responsibility for any damages due to misuse of equipment, incorrect operation or negligence.

2.2 Transport and Storage

The laser system is a precision-made instrument and includes numerous electronic and optical components. Please avoid any mechanical stress (shock, vibrations, etc.) on the laser system!

In case of questions concerning transport and storage please contact us.

Transport

Attention Switch off the laser system before transport and disconnect mains connection!

Storage

Store the laser system in a horizontal position and protected against dust and humidity. Never expose the laser system or one of its components to direct sunlight! The storage temperature must be between -10 °C and +70 °C. The air humidity must be between 10 % to 90 %, non condensing.

2.3 Unpacking

1. Open the packaging and remove the filling material.
2. Remove the individually packed components.
3. Check all parts for damage during transport.
In case of damage please inform the forwarding agent and Videojet Technologies Inc. or their representative immediately in writing. Keep the packaging material and note damages on the inside and outside.
4. Transport the laser system and the components to the intended place of installation.
5. Protect the laser system and all components from dust and humidity until installation.



Please ensure that the enwrapping cardboard box and the packaging material are recycled separately!

2.4 Installation Conditions

Important The laser system must not be subject to any mechanical stress (shock, vibrations, etc.) since this reduces the marking quality and can result in damaging the system.

Space Required

The standard dimensions of the laser system can be found in the drawings in the chapter "Appendix".

For systems manufactured according to special customer requirements this information can be found in the installation plan or the dimension and data sheets you received upon order handling.

Connections

The laser system requires a mains connection. Information on the type, number and reference values of the connections can be found in the terminal diagrams you have received upon order handling.

The power connection cable of the laser system is 2 m long. Make sure that the adequate power sockets are in range.

Warning Only the delivered power connection cable must be used!
Check the cable regularly for damages. If the cable is damaged it must be exchanged to avoid the risk of electrical shocks due to insufficient grounding.

Ambient Conditions

Temperature range: 5 - 40 °C at 70 % duty cycle
(up to 45 °C at 30 % duty cycle)

Air humidity: 10 - 90 %, non condensing

Caution To avoid condensation wait one hour before starting the system if the system was brought from a cold to a warm environment.

Make sure that there is no condensed water in the system.

Note The venting slots of the supply unit must not be covered. Make sure that there is sufficient air supply (see also section "Cooling").

2.5 Cooling

The laser system is cooled by air. The internal cooling system is designed to supply sufficient cooling.

Make sure that the cooling air can be sucked in and blown out freely and that there is sufficient air exchange at the installation site to ensure heat dissipation.

2.6 Fume extractor

In order to remove marking residues which might be dangerous to health we recommend installing a fume extractor. The fume extractor is to be installed such that marking particles are sucked off directly at the place of the formation. Make sure that there are no air leaks.

In addition a fume extractor prevents that dust particles gradually destroy optical components of the laser system.

We offer fume extractors as accessories. If an fume extractor is part of the complete delivery please find further information in the enclosed operation manual of the fume extractor.

2.7 Interfaces of the Laser System

Touch Control interface	Connection of the Touch Control. Make sure that the laser system can be seen when operating the touch control.
Interlock circuit	The interlock circuit is used to safeguard the laser system. If one of the interlock switches connected to the interlock circuit opens the marking stops immediately. The marking cannot be continued until all interlock switches are closed and the START-button is pressed. The closed interlock circuit is supplied by the laser system.
Customer interface	The general assignment of the customer interface can be found in chapter "Appendix". The customer-specific assignment of the customer interface can be found in the data sheets you received upon order handling.

2.8 Product Detector

A product detector (light barrier) is included upon delivery of the system.

Type	photoelectric sensor, diffused reflection
Detecting distance	110 mm
Sensitivity adjustment	rotation volume

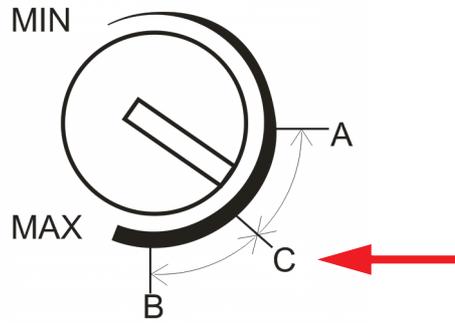
For mounting and setup of the product detector please refer to the QUICK START GUIDE and the software description in chapter "Touch Control".

2.8.1 Adjusting the Sensitivity Control

To adjust the sensitivity control of the sensor please proceed as follows:

1. Set the detectable object at the detection position and turn the sensitivity control slowly from MIN towards MAX until the indicating lamp lights up. Call it position A.
2. Remove the detectable object and turn the sensitivity control from MAX towards MIN until the indicating lamp is extinguished. Call it position B.

3. Point C in the middle between A and B is the optimum sensitivity position (see below).



2.9 Shut-Down

2.9.1 Temporary Shut-Down

If the laser system is shut down temporarily (e.g. for the duration of a works holiday), the following work is to be carried out:

1. Save the data onto a USB device before switching the laser system off. See manual of Touch Control software for details.
2. Switch the laser system off after the data backup.
3. Secure the laser system against unauthorized start-up.
4. Clean the focusing module (lens).

2.9.2 Final Shut-Down

Warning Disassembly work must only be carried out by a qualified electrician or under the direction and supervision of a qualified electrician in accordance with the respective electro-technical regulations.

Ensure that all live parts are switched off and that work can be carried out safely on these parts.

If the laser system is shut down permanently (e.g. for selling or disposal), the following work is to be carried out:

1. Carry out all work listed in section “Temporary Shut-Down” on page 26.
2. Disconnect the laser system from the electric power supply.

In case of selling and transport

3. Package the laser system according to the instructions in section “Transport and Storage” on page 21.

In case of disposal

4. Dispose of the components of the laser system in a manner that is safe and environmentally compatible. Observe all applicable legal and local regulations.



Please dispose of the components of the laser system separated for recycling of raw materials.

3 Description of the Laser System

3.1 The Marking of the Product Surface

The marking of the product surface is performed by the effect of intense laser radiation on the product material.

The laser beam is focussed onto the product surface and heats up the topmost layer of the material, which causes a color change or a vaporization of the topmost dye layer.

Two movable mirrors deflect it such that it passes over the lines of the active job on the product. The lines are divided into vectors (X and Y coordinates). The line up of vectors produces a marking on the product, the laser »writes« on the product surface.

When the laser beam jumps from one stroke to the next (2) the laser is switched off and the product is not marked.

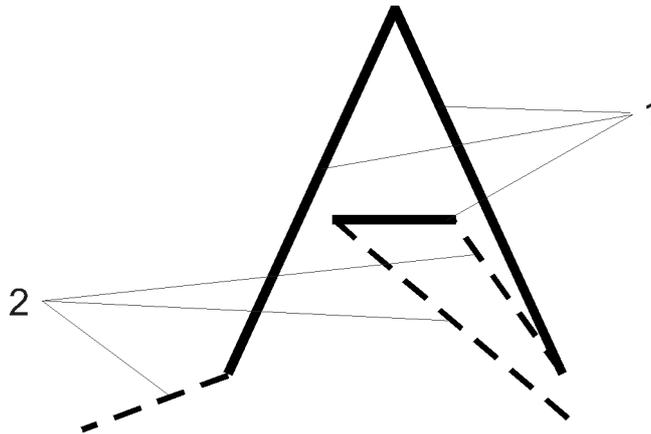


Figure 3-1: Strokes and jumps

3.2 The Structure of the Laser System

The laser system consists of the following components:



1 Fan (air intake)

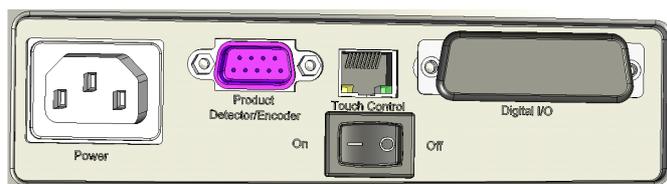
2 Keypad (see page 34)

Using the keypad the marking process can be started and stopped. For controlling the laser system, creating and editing marking contents etc., the Touch Control is required (see chapter "Touch Control").

3 Mounting

4 Interfaces (see page 34)

On top of the system are the interfaces for power supply, encoder, Touch Control and customer interface.



On the bottom is the interface and mounting point for the product detector.

5 Air outlets

6 Warning light

7 Focusing module (lens, aperture for laser radiation)

3.3 Technical Data

	Unit	<i>Videojet 3020</i>
Laser type		sealed-off CO ₂ laser
Operating modes		- continuous wave (cw) - pulsed 50 Hz - 20 kHz
Laser class		4
Laser power typ.	W	10
Max. power consumption	VA	350
Supply voltage	VAC	100 to 120/200 to 240; 1-phase
Mains frequency	Hz	50 / 60
Fuse		T8A/250 V
Ambient temperature	°C	5 - 40 (for special requirements please contact us)
Humidity	%	10 - 90; non condensing
Dimensions	mm	610 x 155 x 150
Weight (typical)	kg	7
Sealing		IP 20
Wavelength	µm	10.6
Marking speed ^a	mm/s	1 - 10,000
Speed of production line	m/s	0 - 3
Characters/Second ^a		max. 500
Working distance	mm	80, 130, 180
Focus diameter	µm	150 - 450 (depending on the installed optics)
Line width		depends on the material and the laser parameters
Fonts (character sets)		any standard font (special characters on demand for additional charge)
Cooling		internal air-cooling
Control		Touch Control

	Unit	<i>Videojet 3020</i>
Interfaces		<ul style="list-style-type: none">• encoder (D-type, 9-pin, female)• product detection (circular, 4-pin, female)• connection to Touch Control (ethernet)• customer interface (D-type, 25-pin, female)

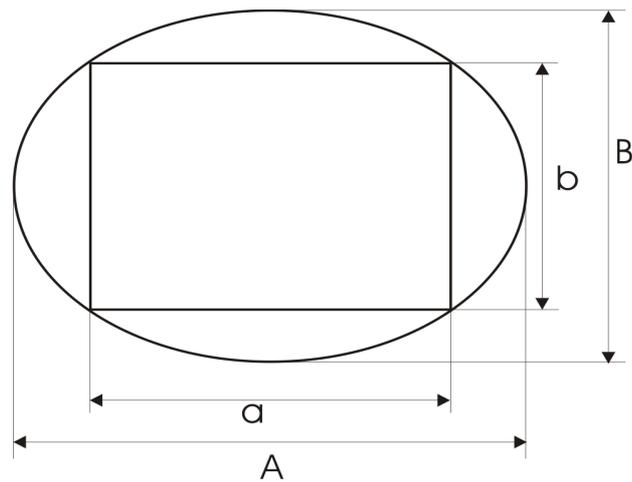
- a. Any statements referring to marked characters or actual markings are typical values. These values highly depend on the material and may only be taken as a guideline. These are no specifications

Due to our policy of continuous improvement, technical data is subject to change without notice.

3.4 Working Distance and Marking Field

Marking Head (all values in mm)

Focusing module: working distance	80	128	179
focal length	100	150	200
max. width (A)	44	65	87
max. height (B)	63	94	126
width for max. rectangle (a)	31	46	62
height for max. rectangle (b)	45	67	89
max. rectangle: marking field	31 x 45	46 x 67	62 x 89



4 Operating the Laser System

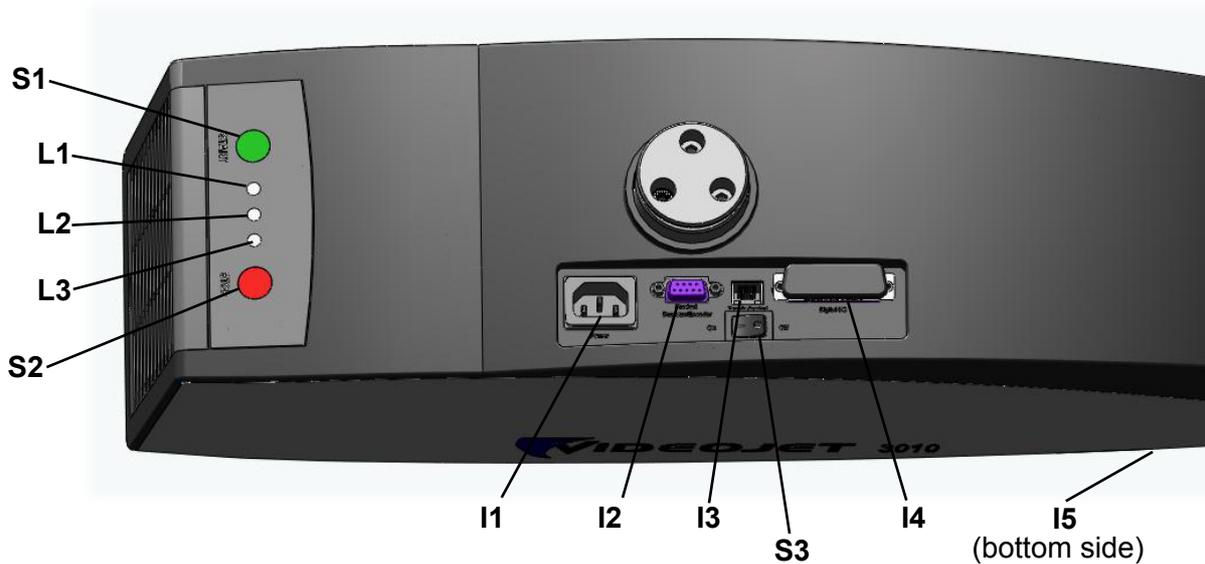
4.1 Operation of the Laser System

The laser system is operated using the Touch Control. The Touch Control is a touch screen connected to the laser system.

The software on the touch screen runs under Windows[®]. With the software you can access the full range of fonts, logos and tools to create layouts and preview the marking on the screen. In addition you can access all laser parameters and system settings.

A detailed description on creating jobs and layouts can be found in the chapter "Touch Control" and in the Quick Start Guide.

4.2 Elements on the Laser System



No.	Type	Function
S1	Push button START -green-	With »START« the currently selected job can be marked. Laser radiation is emitted! Make sure that the safety instructions are observed.
S2	Push button STOP -red-	With »STOP« a marking process can be stopped.
S3	Main power switch	switches the laser system on.
L1	LED status indicators Emission -red-	is on when the key switch is in position »1« and the interlock is closed. Simultaneously the red LED at the front lights up.
L2	Error -yellow-	flashes in case of malfunction.
L3	System -white-	<ul style="list-style-type: none"> flashes during initialization of the laser system. is on when the laser system is ready for operation. flashes when data are written to the memory card.
I1	Socket	connection of mains supply
I2	Socket	connection of encoder
I3	Socket	connection of Touch Control
I4	Socket	connection of customer interface
I5	Socket (bottom side)	connection of product detector (light barrier)

4.3 System States of the Laser System

On the Touch Control user interface the current laser system state is displayed.

There are the following system states:

System State	Description
Initialize	The control components of the laser system are started.
Key-switch open	The initialization is complete. The system can now be started by logging into the system via Touch Control.
Laser start-up	After closing the key-switch the laser and the cooling system are activated.
Laser ready	The laser system is ready for marking.
Prepare for marking	After pressing »START« the laser requires a preparation time, the length depends on the template contents and the configuration.
Marking	The current marking content is marked onto the product. Laser radiation is emitted! Make sure that the safety instructions are observed.
Standby	If no marking is carried out for some time the laser switches to standby in order to relieve the system components.
Interlock open	The safety circuit is interrupted (e.g. protective door open). A marking process is stopped immediately. Marking is only possible with closed safety circuit.
Error	An error occurred. To continue operation the error must be confirmed. Information on the error can be found on page »Messages«.
Fatal error	A fatal error occurred and has deactivated the system. This error cannot be confirmed and the operation cannot be continued. The laser system has to be turned off. Information on the error can be found on page »Messages«.

4.4 Switch-On/Off of the Laser System

4.4.1 Switch-On

1. Make sure that the safety instructions are observed.
2. If installed: Switch on the fume extractor.
3. Switch on the main power switch (switch S3).
The white LED flashes, indicating the initialization of the laser system. This process can take 1 to 2 minutes. After that the system is ready for operation and the white LED is on.
4. Switch on the Touch Control.
5. Log into the system via Touch Control by pressing the key switch button in the upper right corner of the software and entering the password (see Quick Start Guide).
The red LED on the keypad and the red LED on the front of the laser system are on. The laser is ready.

4.4.2 Switch-Off

1. Stop the marking process.
2. Open the key switch via Touch Control by clicking on the key switch button and confirming the displayed message.
The red LED on the keypad and the red LED on the front of the laser system are turned off.
3. If the white LED is flashing, wait until it is continuously on.
Note The white LED is flashing while data are written to the SD card.
 Do not switch off the system during this process!
4. Switch off the main power switch (switch S3).
The white LED is turned off.
5. Switch off the Touch Control.
6. If installed: Switch off the fume extractor.

5 Maintenance

5.1 General Notes Concerning Maintenance

The time for maintenance of the laser system is very short. Please carry out maintenance works in the stated intervals.

The laser system is designed such that maintenance can be performed safely.

- Caution**
- Maintenance has to be performed by instructed operating and maintenance personnel only!
 - **Before the beginning of the cleaning works of the laser system and its environment, the laser system must be disconnected from the power supply.**
 - Document the regular maintenance in the maintenance protocols in this chapter! Non-conformance with the maintenance plan might result in limitations of warranty.

- Important**
- Before carrying out the maintenance works at the optics, please note the following:**
- Acetone is not included upon delivery and has to be purchased via other companies. Open the following Internet page to order acetone in a quick and uncomplicated way: www.vwr.com/index.htm
 - When purchasing acetone make sure that you order acetone pro analysi (p.a. = highest purity grade).
 - Make sure that the acetone does not get in contact with the housing since it might corrode the PC/ABS.

5.2 Maintenance Plan

The maintenance intervals are laid out for a use of the laser system of approximately 10 hours daily and regular dirty work area.

If the time of daily use should exceed 10 hours continuously or in case of very dirty ambient conditions please shorten the maintenance intervals accordingly. In case of questions please contact Videojet Technologies Inc. or one of their representatives.

The basic maintenance works are described in the following sections. For all other potential tasks please check the Maintenance screen of the Touch Control.

Maintenance Interval

Measures

Monthly

(more frequently when operated in dirty ambient conditions)

Check the focusing module for dust and dirt. Clean the focusing module in case of dust or stains.

Exchange the filter in the laser system.

Monthly or when control lamp lights up

If installed: Exchange the filter bag inside the fume extractor (refer to manual of the fume extractor).

Every three months

(more frequently when operated in dirty ambient conditions)

Carry out a visual inspection of the laser system including the warning labels. They must be readable and positioned correctly.

Check the product detector (light barrier). Clean or readjust if necessary.

Check the fume extractor for air leaks.

Every six months

If installed: Exchange the charcoal filter inside the fume extractor (refer to manual of the fume extractor).

Note:

We recommend a professional check by our service engineers once a year (more often in a very dusty environment).

We offer special training seminars for maintenance and service personnel. In case of questions please contact Videojet Technologies Inc. or one of their representatives.

5.3 Cleaning the Focusing Module

The focusing module is located at the front of the laser system (bottom side).



It may be contaminated by dust or floating particles. Contamination of the focusing module can lead to damages of the focusing module and gradually reduce the quality of the marking. Therefore the lens has to be cleaned regularly.

Generally just the outwardly facing side of the focusing module has to be cleaned, but check both sides for contamination and clean them, if necessary.

Important As with all optical components the focusing module is an object of highest and sophisticated design.

Slightest damages of the surface might (in the long term) result in unusability of the component or reduction of marking quality. Any contaminants must only be removed by means of a cotton tip and acetone!

Make sure that no contaminants enter the marking head while cleaning the focusing module!

To clean the focusing module you need:

- Optics cleaning paper
- Acetone
- Protective gloves

Important **Wear protective gloves during the complete procedure!**

5.3.1 Disassembly of the Focusing Module

Danger Before starting any work the laser system must be dead!

1. Switch off the laser system (main switch on top of the laser system).
2. Disconnect the mains connector.

1. Firmly grip the focusing module and turn it carefully until it is released from the thread.
Do not touch the lens surface!

Important The fine thread requires several turns before the scan lens is released. Make sure that you are holding the lens firmly.

2. Remove the focusing module from the marking head and place it on a clean surface.

5.3.2 Cleaning the Focusing Module

1. Place the focusing module onto a clean surface. Fold a sheet of optics cleaning paper (at least 5 times) creating a flat cushion.
2. Hold the optics cleaning paper between thumb and index finger and put some drops of acetone onto the optics cleaning paper.
3. Carefully and slowly pull the optics cleaning paper across the surface to be cleaned. Make sure that you do not touch the surface with the gloves.
Apply only very light pressure onto the paper!
4. If necessary repeat the procedure with a new sheet of optics cleaning paper.

Important

- **Never use polishing agents! Polishing agents destroy the focusing module!**
- **Never use contaminated optics cleaning paper.**
- **Make sure that the optics cleaning paper is stored in a clean place.**

5. Check the surface of the lens side located in the marking head for contamination. If necessary, clean it as described above.

5.3.3 Mounting the Focusing Module

1. Place the focusing module straight onto the laser beam outlet and turn it in the wrong direction until you hear the clear click as the first thread engages.
2. Screw in the focusing module slowly and straight in the right direction, handtight.

5.4 Exchange of the Focusing Module

In order to exchange the focusing module proceed as follows:

Danger **Before starting any work the laser system must be dead!**

1. Switch off the laser system (main switch on top of the laser system).
2. Disconnect the mains connector.
3. Firmly grip the focusing module and turn it carefully until it is released from the thread.
Do not touch the lens surface!

Important The fine thread requires several turns before the scan lens is released. Make sure that you are holding the lens firmly.

4. Remove the focusing module from the marking head.

If it is broken dispose of the lens according to the local regulations.

If it is to be reused place it on a clean surface. Place the protective caps onto the lens and wrap it up e.g. in bubble foil so that it is shockproof and protected against dust and dirt.

5. Place the focusing module straight onto the laser beam outlet and turn it in the wrong direction until you hear the clear click as the first thread engages.
6. Screw in the focusing module slowly and straight in the right direction, handtight.
7. Remove the protective cap from the focusing module.
8. Place the focus finder under the focusing module and push the protective cap of the focus finder upwards onto the focusing module.
9. Adjust the working distance between the focusing module and the product.

5.5 Cleaning the Housing

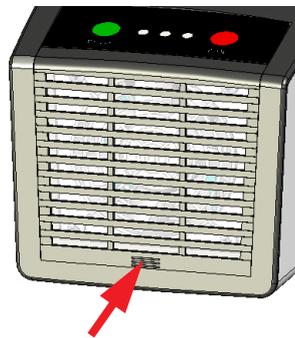
For cleaning the housing of the laser system use only a damp cloth (water or mild detergent solution). Make sure not to touch the lens surface.

Make sure that all warning labels are clean, readable and positioned correctly.

5.6 Exchange of the Filter Mat

To exchange the filter mat proceed as follows:

1. Open the grille at the back of the system by pressing the grooves (see figure) and pushing the grille upwards.



2. Remove the mat. Dispose of the mat according to the local requirements.
3. Insert a new mat.
4. Close the grille.

5.7 Update of the Touch Control Software

To update the software proceed as follows:

1. Unzip the ZIP file containing the new software version and copy it to a USB device.
2. Start the Touch Control.
3. Connect the USB device containing the new software.
4. Start the file setup.exe and follow the instructions of the InstallShield wizard.

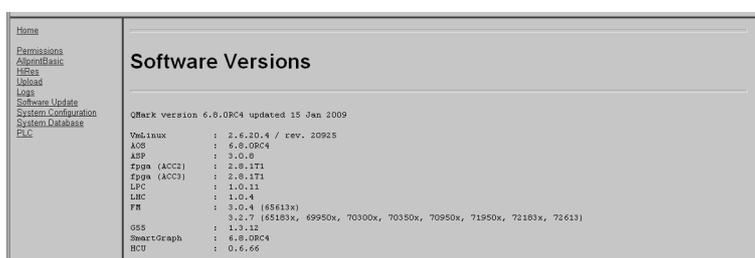
5.8 Update of the IceMark Software

The update can be carried out via Ethernet using the Laser Web Interface.

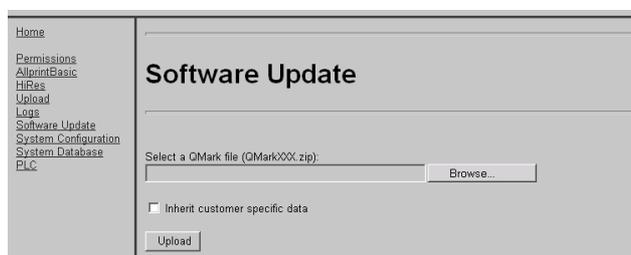
Note Please note that the corresponding IceMark version (zip file) has to be copied beforehand to a directory accessible by the Touch Control!

Please contact our Service department or hotline for more information how to receive the appropriate IceMark version for your laser system.

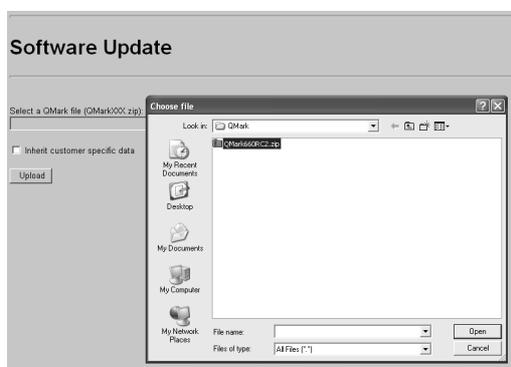
Open the Internet Explorer on the Touch Control. It will automatically open the laser's home site. An overview about the current software versions which are installed on the laser system and a navigation column on the left hand side is displayed.



By clicking on the »Software Update« link in the column on the left side, the following page is displayed. From here, you can upload a IceMark.zip file with the appropriate IceMark version onto your laser system.

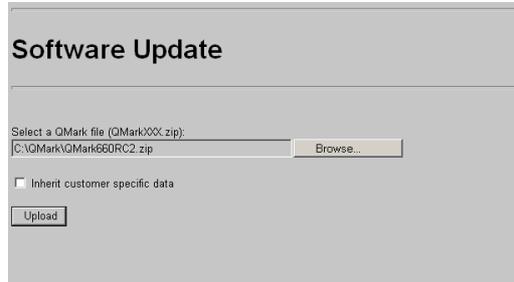


1. Click onto »Browse«. The following dialog is displayed.



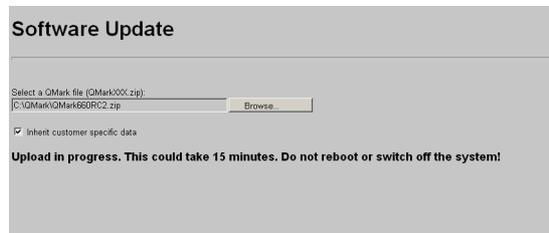
2. Select and open a IceMark version (zip file) from a directory on your PC.

The path and the respective IceMark version are displayed in the Main window.



If the checkbox »Inherit customer specific data« is checked, the customer’s former database and other specific data are kept and can be used with the new IceMark version.

3. Click onto »Upload« to upload the selected IceMark version to your laser system.

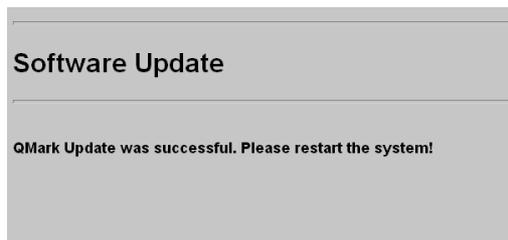


Note Please note that the upload process may take a couple of minutes. During that time, a text is displayed.

Do **not** cancel the process by closing the browser, as the process might fail and the laser system cannot be rebooted later!

Do **not** switch off the laser!

4. After the upload process has been carried out successfully, the following message is displayed:



5. Restart the laser system by turning the laser system off and on again.

5.9 Protocols for Maintenance, Repair and Replacement

It is strongly recommended that accurate records are kept of maintenance, repair and replacement procedures.

On the following pages you will find forms to record all maintenance tasks specified. Copies can be made and used to keep an ongoing record of the procedures recommended throughout the life of the laser system.

You will also find forms to record the repairs and replacements. The records will provide a useful tool in anticipating future maintenance requirements and in determining cost of ownership of the laser system.

Update of the Touch Control Software

Carried out on: Date	Carried out by: Name

Update of the IceMark Software

Carried out on: Date	Carried out by: Name

Repair and Replacement Protocol

Laser model:

Serial number:

Date: Carried out by:	Repair or Replacement	Comments (faults, etc.)
Date: Carried out by:	Repair or Replacement	Comments (faults, etc.)
Date: Carried out by:	Repair or Replacement	Comments (faults, etc.)
Date: Carried out by:	Repair or Replacement	Comments (faults, etc.)

6 Malfunctions

6.1 Notes

In this chapter you will find a description of possible malfunctions, their possible causes and suitable measures for troubleshooting. The measures stated must be performed by instructed operation and maintenance personnel only.

Important Tasks for troubleshooting going beyond the ones mentioned here must be performed by **specially trained personnel** only! Strictly follow the safety instructions!

6.2 Malfunction Descriptions

Symptom	Causes/Measures
The laser system cannot be switched on.	<ul style="list-style-type: none"> • Check the plug. • Check the main switch. • Check the power supply, e.g. RCD (residual current protective device).
The system does not boot or booting takes very long.	<ul style="list-style-type: none"> • Please note that the booting process can take several minutes. • Check the size of the database, the booting time depends on that. • Note the booting time and report it to the service helpdesk.
The laser cannot be started.	<ul style="list-style-type: none"> • Check the interlock (must be closed). • Check for error messages. • Check the key switch (must be closed). • Check for an external STOP signal. • Check the kill switch (if available).
No marking although START has been pressed.	<ul style="list-style-type: none"> • Check the encoder. • Check the product detection. • Check the working distance. • Check the lens. Clean it if necessary. • Check the power setting of the parameter set. • Is the correct product registration selected? • Check the total working time of the laser beam source. • Check the external STOP signal (if existing).
Lopsided marking.	<ul style="list-style-type: none"> • Check the laser positioning. • Check the template.
Shifted marking.	<ul style="list-style-type: none"> • Check the sensor position. • Check the product carrier for accuracy.
Stretched/shrunk marking.	<ul style="list-style-type: none"> • Check the encoder setting.

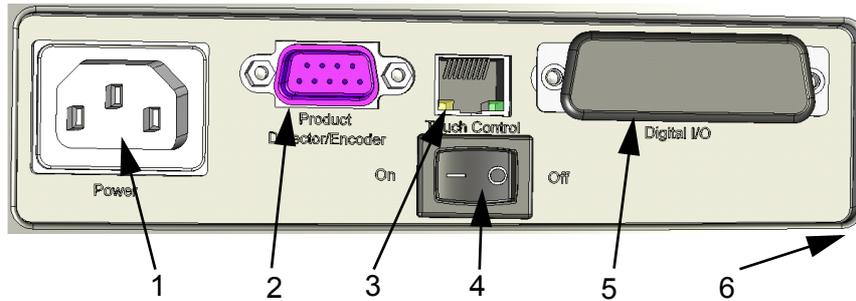
Symptom	Causes/Measures
Faint marking.	<ul style="list-style-type: none"> • Has the product been changed (e.g. dimensions, material)? • Check the lens. Clean it if necessary. • Check the working distance. • Check the parameter set (power too low, speed too high). • Check the product (must be free from dirt, water, dust, oil, etc.). • Check the fume extractor (must be on and suitable for the application).
Incomplete marking.	<ul style="list-style-type: none"> • Check the product speed. • Check the lens. Clean or exchange if necessary. • Check the product (must be free from dirt, water, dust, oil, etc.). • Check the encoder. If it is slipping increase the press-on force of the roll.
Faint or incomplete marking after switch-on. (only CO ₂ lasers)	<ul style="list-style-type: none"> • After activating the system (via key switch or key switch code) wait for 3 minutes before starting the marking process.
Poor marking quality.	<ul style="list-style-type: none"> • Check for product or laser vibration. • Has the product been changed (e.g. dimensions, material)? • Check the lens. Clean it if necessary. • Check the working distance. • Check the parameter set (power too low, speed too high). • Check the product (must be free from dirt, water, dust, oil, etc.). • Check the fume extractor (must be on and suitable for the application). • Check the encoder. If it is slipping increase the press-on force of the roll.

Symptom	Causes/Measures
Laser stops due to overtemperature.	<ul style="list-style-type: none">• Clean filter(s) and system.• Is the ambient temperature within the specified limits (see product documentation)?• Is there enough space for the air intake?• Check the cooling system (if existing).

7 Appendix

7.1 Interfaces

The laser interface is located on top of the laser system and it consists of four connectors and one switch (a fifth connector is on the bottom of the system):



#	Function
1	Power inlet, 100 to 120/200 to 240 V
2	Encoder
3	Ethernet connection for Touch Control
4	Power switch
5	Digital I/O
6	Product detector (on bottom of system)

7.1.1 Encoder

D-Type connector, 9 pin, female, with same pin out:

Pin	Function
1	24V
2	Encoder Channel A
3	Encoder Channel B
4	Encoder Index
5	GND
6	24V
7	Product Detect ^a
8	24V
9	GND

a. The connection for the product detector included upon delivery is on the bottom of the system. If a different product detection is applied you can also use this connection.

7.1.2 Ethernet

Standard RJ45, 100 MBit/s, no power

Connection for the touch screen with Touch Control.

Note This interface cannot be used for PC connection.

7.1.3 Digital I/O

D-Type connector, 25 pins, female, galvanically separated.

Customer interface. The galvanically separated inputs and outputs are provided as a standard. They are used for sending digital status signals and receiving digital command signals.

Upon delivery a dongle will be provided with every laser system. It will connect the interlock and shutter lock pins and also STOP with 24 V.

Pin	Name	Description
1	INTERLOCK_IN	Together with INTERLOCK_OUT: Need to be connected for marking. If the interlock is open the laser is disconnected from power and the shutter is closed.
2	START	Starts the marking-process, awaits trigger signal, reacts to low-high edge. START has no function if STOP is set to LOW.
3	STOP	Stops the marking-process, reacts to LOW level. Has to be tied HIGH if not used.
4	SHUTTER_LOCK_IN	Together with SHUTTER_LOCK_OUT: Need to be connected for marking. If open, the beam shutter will be closed and the PWM signal will be disconnected from the laser tube. The laser is on standby and can start the next marking immediately after the SHUTTER_LOCK is closed again.
5	DATA0	Bit 0 of the external job selection
6	DATA2	Bit 2 of the external job selection
7	DATA4	Bit 4 of the external job selection
8	MARKING	This signal is set during the marking process.
9	CTS	RS232 Clear To Send
10	RXD	RS232 Receive Data
11	INTERFACE_24V	Input 24 V for digital interface (together with pin 13)

Pin	Name	Description
12	ERROR	This output is LOW active. The system is stopped immediately if an error occurs during the marking process (e.g. laser overtemperature). The output is reset after eliminating the cause of the error and acknowledgment of the error message.
13	INTERFACE_GND	GND for the digital interface (together with pin 11)
14	INTERLOCK_OUT	Together with INTERLOCK_IN: Need to be connected for marking. If the interlock is open the laser is disconnected from power and the shutter is closed.
15	READY_TO_MARK	Ready to mark is set as soon as all necessary data and a start signal have been received. The system is ready to mark and awaits a trigger signal. In case of an error the signal is set to low.
16	SHUTTER_LOCK_OUT	Together with SHUTTER_LOCK_IN: Need to be connected for marking. If open, the beam shutter will be closed and the PWM signal will be disconnected from the laser tube. The laser is on standby and can start the next marking immediately after the SHUTTER_LOCK is closed again.
17	SHUTTER_CLOSED	This signal is set if the beam shutter is closed.
18	DATA1	Bit 1 of the external job selection
19	DATA3	Bit 3 of the external job selection
20	EXT_EVENT	Rising edge on this signal transfers job selection bits into internal register and selects the job.
21	RTS	RS232 Request To Send
22	TXD	RS232 Transmit Data
23	SYSTEM_24V	Output 24 V for digital interface (together with pin 25)
24	ACKNOWLEDGE	This output is LOW active and indicates that the new template was selected.
25	SYSTEM_GND	GND for digital interface output (together with pin 23)

7.1.3.1 Output Specification:

Rated voltage	24 V DC (-15 %/+20 %)
Load type	ohmic, inductive, lamp
Max. output current (per channel)	100 mA (short-circuit proof)

7.1.3.2 Input Specification:

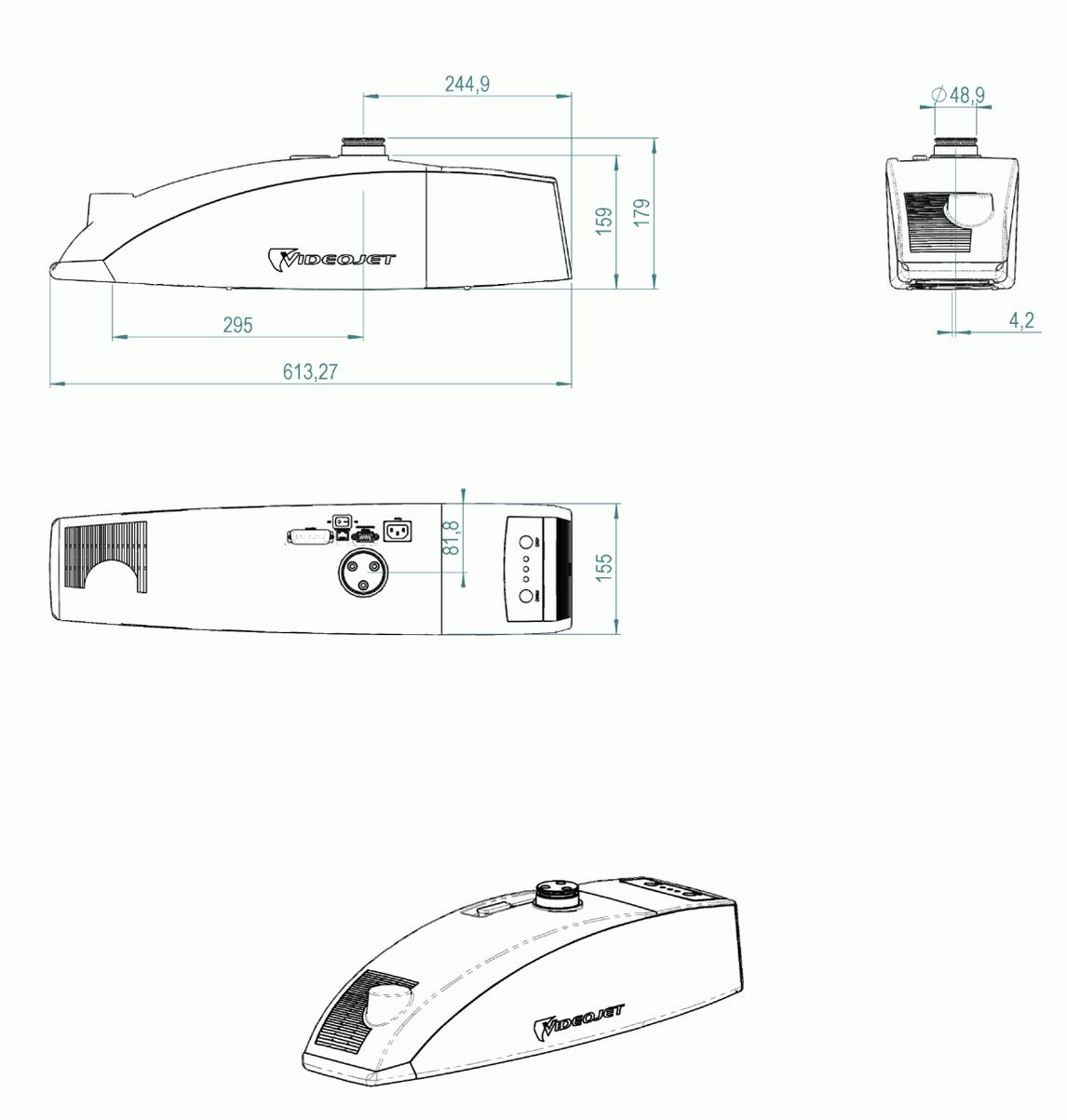
Rated voltage	24 V DC (-15 %/+20 %)
"0" signal voltage	0 V to 8.3 V
"1" signal voltage	9.5 V to 30 V, nominal 24 V
Current input	typ. 5 mA
Min. signal length	300 μ s

7.1.4 Product Detection

Circular connector, 4 pin, female, of Binder series 768

Pin	Function
1	24 V
2	Trigger
3	24 V
4	GND

7.2 Drawings



7.3 Safety Data Sheets

7.3.1 Zinc-Selenide (ZnSe) + Thorium Fluoride (ThF₄)**Material Safety Data Sheet II-VI Deutschland**

Revision Date: 21.08.2001

1. Product identification

Trade name of the product:	Zinc Selenide (ZnSe)-Optic with AR- (Anti-Reflection-) Coating for 10.6 μm
CAS-No.:	1315-09-9
Synonyms:	Raytran ZnSe, Kodak Irtran-4
Form:	Solid Optical Element
Chemical family:	Inorganic chemical belonging to the II-VI compound group

2. Hazardous ingredients

Material components:	atomic	CAS-Number
Zinc	50 %	7440-66-6
Selenium	50 %	7782-49-2
Coating ingredients:		
Zinc Selenide	N/A	1315-09-9
Thorium Fluoride	N/A	13709-59-6

3. Physical properties

Boiling point, 760 mm HG	:	sublimes
Melting point	:	1525 °C
Specific gravity (H₂O=1)	:	5.27 g cm ⁻³
Vapor pressure	:	N/A
Vapor density (Air = 1)	:	N/A
Solubility in H₂O, % by WT	:	insoluble
% Volatiles by volume	:	N/A
Appearance & odor	:	yellow / transparent / solid / odorless

4. Flammability and explosive properties

Flash point (test method) : not flammable and not explosive

5. Health hazard data

Threshold limit value

<i>Material</i>	<i>Limit</i>
Zinc oxide fumes	5 mg/m ³
Zinc oxide dust	10 mg/m ³
Selenium and compounds	0.2 mg/m ³

Threshold value of the amount of inhaled particles that can be handled by the body of persons who permanently deal with this material job related:

For Thorium Fluoride Dust with 1 µm Particle Size
 (This value is getting higher significantly with bigger particles.
 Particles bigger than 20 µm can not be inhaled any more.) 136 mg

Threshold value of the amount of inhaled particles that can be handled by the body of persons who does not deal with this material job related:

For Thorium Fluoride Dust with 1 µm Particle Size
 (This value is getting higher significantly with bigger particles.
 Particles bigger than 20 µm can not be inhaled any more.) 3 mg

Effects of overexposure:

ZnSe - Effects are not known, but some Zinc and Selenium can be formed, such as: Zinc Oxide - Chills and fever. Selenium and Compounds - Acute exposure might produce sternal pain, cough, nausea, pallor, coated tongue, gastro-intestinal disorders, nervousness and/or conjunctivitis. A garlic odor of the breath or sweat may occur.

Thorium - eventually cancer producing, because of its radio activity. But no impact has been recognized through inhalation of less than 270 - 540 mg/year. One assumes that from this point the risk enlarges linear to the inhalation. The exposure through the continuing contact with a lens for 2000 hours/year is less than the exposure that occurs when your teeth are x-rayed two times, you make a trans-continental flight or fume 1/3 of a cigarette/day. Inorganic Fluorides - normally an irritant and toxic. Inhaling can be the cause for irritations of the respiratory tract and the mucosa, asthma attack, increased salivation, thirst, sweating, vomitus and colic.

Emergency and First Aid Procedures (in dust form):

Eyes:	wash with plenty of water - see physician
Skin:	wash with plenty of water - see physician
Ingestion:	call physician
Inhalation:	remove from exposure, treat symptomatically, call physician

6. Reactivity data

Stability:	stable
Conditions to avoid:	extreme heat greater than 500 °C could result in decomposition
Materials to avoid	strong acids, strong bases
Hazardous decomposition products:	Selenium / Oxides of Selenium / Zinc Oxide
Hazardous polymerization:	will not occur
Conditions to avoid:	N/A

7. Spill or Leak Procedures

Steps to take in case material is released or spilled: N/A

8. Special Protection Information

Type of respiratory protection required:

NIOSH approved respiratory with fume type cartridge

Ventilation:

In case of vaporization leave the room and allow the dust to settle. Clean all surfaces if the room has ventilation, allow for several air changes. Locate exhaust near location of ZnSe processing or use if failure by melting is likely.

9. Special Precautions

Handling and storage precaution:

If material is to be machined, ground or polished, processes should be done wet so as to minimize dust which could result in inhalation. Good work practices such as keeping hands clean and not letting slurry splash significantly should be followed so that transferal to mouth by contamination on the hands or clothing followed by ingestion will not occur. Wash hands and face thoroughly after handling material and before eating.

If parts are dropped or otherwise broken, sweep up pieces which may have sharp edges as one would clean up broken glass and safely TRANSFER TO DISPOSAL CONTAINER: large pieces may have salvage value.

References for material safety and threshold limit values:

1. "Dangerous Properties of Industrial Materials" Richard J. Lewis, Sr., 1992, 8th Edition
2. "TLVs Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1981" American Conference of Industrial Hygienists
3. 1998 "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices" edited by the American Conference of Industrial Hygienists
4. Zinc Selenide Material has been found not toxic in a study about toxic limit values by Toxikon. This test was initiated on January 7th, 1993 by II-VI, according to the prescription "Federal hazardous substances Act. 16CFR, Part 1500.3, January 1990."
5. International Commission on Radiological Protection, ICRP Publication 71, "Age-dependant Doses to members of the Public from Intake of Raionuclides: part 4 Inhalation Dose Coefficients", 1996
6. International Commission on Radiological Protection, ICRP Publication 26, "Recommendations of the International Commission on Radiological Protection", 1977
7. This information has been taken from the Material Safety Data Sheet of our distributor. The datasheet has been generated carefully. However we will take no liability for the content, no matter which legal ground is given.

Details of the Manufacturer and the Distributor

Address of the manufacturer:

II-VI Incorporated
375 Saxonburg Blvd.
Saxonburg, Pennsylvania 16056
USA

Address of the distributor (please call here for further information):

II-VI Deutschland GmbH
Im Tiefen See 58
64293 Darmstadt
Tel.: 06151-8806-29 / Fax: 06151-8966-67

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