

Pulsed Diode-Pumped Solid State MicroChip Lasers

Sealed Packages

User's manual

IR 1064 nm Sealed MicroChip

Visible 532 nm Sealed Microchip

UV 355 nm Sealed MicroChip

DUV 266 nm Sealed MicroChip

Notice

The information contained in this document is subject to change without notice. Teem Photonics shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Thank you and congratulations for selecting this
Pulsed Diode Pumped Solid State Sealed Microchip Laser

How to use this Manual

If you have just taken delivery of the laser system, please read the Preface, General Information and Installation sections. If you are installing the equipment, read the Installation section. See Operation when you are ready to operate the equipment.

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PART I: Information pertaining to all MicroChip Laser models

1. Preface

1.1 Safety Symbols

The following symbols and messages (Table 1) can be marked on the unit or used in this manual. Observe all safety instructions that are associated with a symbol.

Symbol	Description
	Laser safety. See the user's manual for instructions on handling and operating the unit safely
	See the user's manual for instructions on handling and operating the unit safely.
	Frame or chassis terminal for electrical grounding within the unit.
	Indicates hazardous voltages
	Indicates AC voltage when following the voltage value
	Protective conductor terminal for electrical grounding to the earth.
	ESD – Indicates risk of electrostatic discharge. Use proper isolation to protect devices.

Table 1: Safety Symbols

1.2 Warning and Caution Symbols

WARNING 	When you see a warning, it denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in <i>injury or death</i> . Do not proceed beyond a warning until the indicated conditions are fully understood and met.
CAUTION 	When you see a caution, it denotes a hazard. It calls attention to an operating procedure practice, or the like, which, if not correctly performed or adhered to, could result in <i>damage to or destruction of part or the entire product</i> . Do not proceed beyond a caution until the indicated conditions are fully understood and met.

1.3 Electrical Safety Precautions

MicroChip Lasers system are offered either as OEM products for incorporation into other equipment or as CDRH certified systems. Always check for part number stickers on the product that your laser head and laser controller are compatible and comply to those requirements. Please refer to the Specification Document Attached in Part II. With OEM products, the customer is responsible for CDRH certification of all systems sold with these products.

	Caution The protective housing of this laser controller product should always be left in place during normal laser operation. More generally the protecting cover of the system laser head and laser controller SHOULD NOT be removed. Removal of the protective housing is prohibited and should not be performed under any circumstances. NO SERVICEABLE PART INSIDE.
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The electrical safety hazards of solid-state laser systems should not be ignored, as they are as great as other electrical systems operating from AC power lines. The voltages involved and the current available have the potential to cause fatal electric shock (**FOR DESKTOP ONLY**).

 	Warning Although the MicroChip Laser systems conform to OSHA and CE electrical requirements (unless otherwise specified in the Specification Control Document attached in Part II) and additional safety features have been included in their design, the following safety precautions should be noted and observed under the control of the responsible authority: 1. Your laser is intended for operation only with the laser head and laser controller covers in place. Do not remove under any circumstances cover of the laser and/or the laser controller.
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	<ol style="list-style-type: none">2. For the sake of safety, NEVER depend on any electrical safety device or interlock but carefully make other determinations that all power is off and components are de-energized before working on the electrical connections of the laser system.3. Do not allow anyone to perform electrical maintenance on the laser4. The IEC connector that may be used to disconnect the laser controller from the mains. It MUST remain accessible by the user at any time (FOR DESKTOP ONLY).5. The mains cord must be plugged in a socket comprising the earth connection. Disconnection of the earth is forbidden as it may impair the electrical protection and renders the equipment dangerous (FOR DESKTOP ONLY).
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Responsible Authority is defined as an individual or a group of people responsible for the good use or preventive maintenance or servicing of the equipment and whose task is to assure that all person having to use or operate the system is properly trained.

The user's responsible authority of the MicroChip Laser system should be aware that by operating the product without due regards to the here mentioned precautions, or in a manner that is not compliant with procedures recommended here in this document or with any of the laser controller/laser specification, the protection provided by the equipment may be impaired and cause unsafe operating conditions.

1.4 Safety Recommendations for using the Laser

Safety Recommendations for Using the Laser Controller

	<p>Warning</p> <p>When operating the laser system, it is recommended that you observe the following safety precautions:</p> <ol style="list-style-type: none">1. Safety Key Switch: When laser system is un-operated or unattended but still accessible to untrained people, it is recommended to remove key from key switch or unplugged or disconnect power cord (FOR DESKTOP ONLY).2. Limit access to the laser system to those familiar with the equipment. Keep the laser out of the hands of inexperienced or untrained personnel.3. Emission Lamp (Emission LED): This is a safety feature. It MUST BE clearly visible by operator or anyone situated within confined laser system environment when laser is operated or not (FOR DESKTOP ONLY)4. Interlock: This is a safety feature. It MUST be used to prevent laser emission in the presence of unaware people entering in a defined or confined laser system security perimeter including room, inside cover, etc.5. NEVER LEAVE THE LASER system ON, OPEN, AND UNATTENDED!
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Safety Recommendations for Using the Laser

	<p>Warning</p> <p>When operating the laser system, it is recommended that you observe the following safety precautions:</p> <ol style="list-style-type: none">1. Always have the laser controller cover and the laser head cover in place when the laser is connected to line power.2. Limit access to the laser to that familiar with the equipment. Keep the laser out of the hands of inexperienced or untrained personnel.3. When the laser is on and the output beam is not being terminated in an experiment or optics system, the beam should be blocked.4. NEVER LOOK DIRECTLY INTO THE MAIN LASER BEAM, NEVER SIGHT DOWN A BEAM INTO ITS SOURCE.5. Do not allow reflective objects to be placed in the laser beam. Laser light scattered from a reflective surface can be as damaging as the original beam. Even objects such as rings, watchbands, and metal pens or pencils can be <u>hazardous</u>,6. Attenuate laser power to a low level to minimize intensity of accidental stray reflections or refractions when aligning a chain of optical components in the laser beam.7. Set up experiments so that the laser beam is NOT at eye level.8. Post warning signs and limit access to the laser area when the laser is in operation.9. Even when wearing laser safety glasses, there are two hazards that exist while operating solid-state lasers:<ol style="list-style-type: none">a. The glasses make the beam itself invisible, therefore increasing the danger of skin burns.b. Laser glasses may not afford enough protection if a very powerful beam is viewed directly.10. NEVER LEAVE THE LASER ON, OPEN, AND UNATTENDED!11. At all times during installations, operation, maintenance, or service of the laser, avoid all unnecessary exposure to laser light or collateral radiation in excess of the accessible emission limits listed in Performance Standards for Laser Products, 21CFR 1040.10 (d).
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Part I: Information Pertaining to all Sealed Microchip Laser models

1.5 Additional Laser Safety Informational Sources

Sources for additional information and assistance on laser safety are:

Director (HFX-400)
Division of compliance,
Bureau of Radiological Health
5600 Fishers Lane
Rockville, MD 20857
(Regulations and Requirements)

Laser Institute of America
400 Executive Park Drive
Cincinnati, OH 45241
(Safety Guides)

Am. National Standards Institute, Inc.
1430 Broadway
New York, NY 10018
(Safety Guides)

CEN Management Center
36, rue de Stassart
B-1050 Brussels
Fax: + 32 2 550 08 19
E-mail: infodesk@cenorm.be

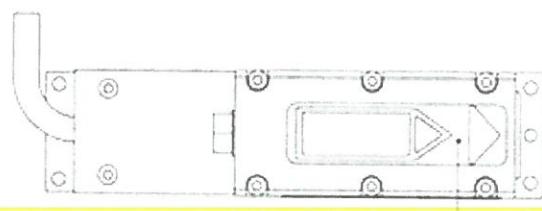
**Association Française de Normalisation
(AFNOR)**
11, avenue Francis de Pressensé
F-93571 Saint-Denis La Plaine Cedex
www.afnor.fr

**Deutsches Institut für Normung e.V.
(DIN)**
Postfach D-10772 Berlin
www.din.de

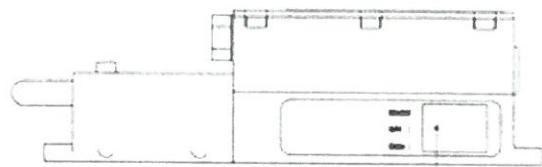
British Standards Institution (BSI)
389 Chiswick High Road
GB-London W4 4AL
www.bsi.com

Part I: Information Pertaining to all Sealed Microchip Laser models

1.6 Safety Labels and Indicators



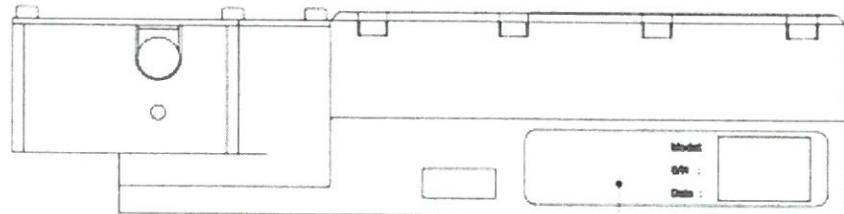
Warning, classification, Laser aperture label



Product ID label



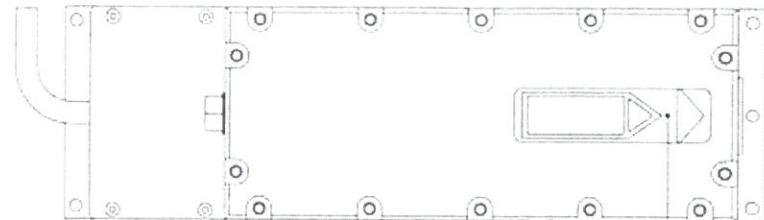
Warning, classification, Laser aperture label



Product ID label

Figure 1: Labels Settings for Sealed IR and visible laser heads

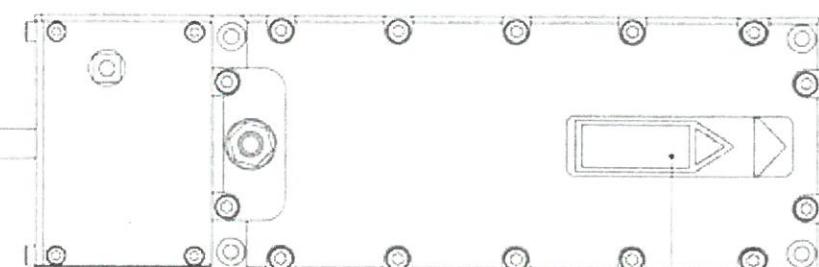
Part I: Information Pertaining to all Sealed Microchip Laser models



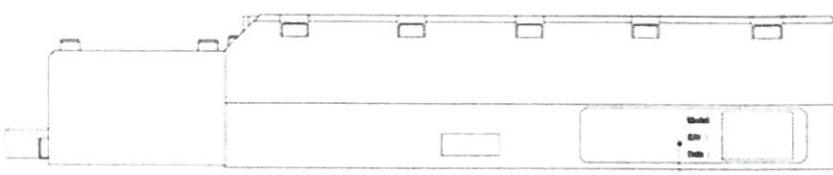
Warning, classification, Laser aperture label



Product ID label



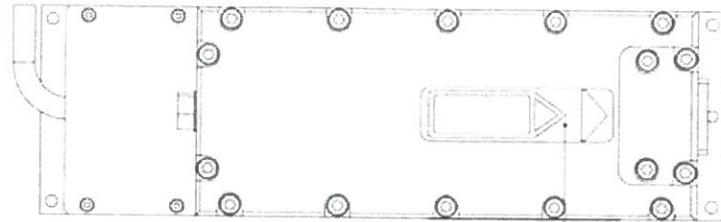
Warning, classification, Laser aperture label



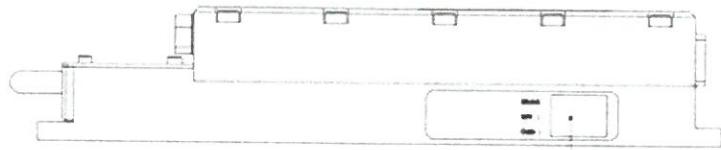
Product ID label

Figure 2: Label settings for sealed UV 355nm laser heads

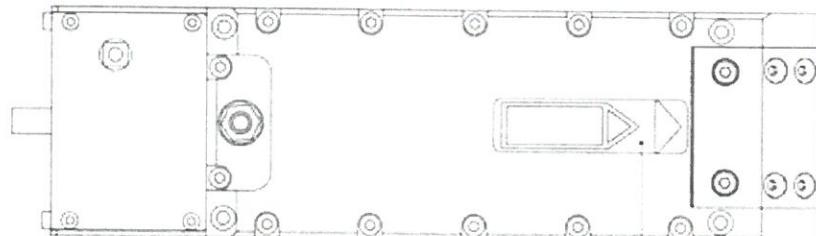
Part I: Information Pertaining to all Sealed Microchip Laser models



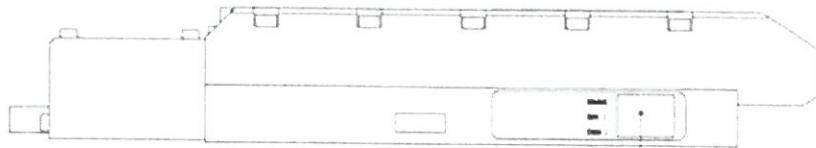
Warning, classification, Laser aperture label



Product ID label



Warning, classification, Laser aperture label



Product ID label

Figure 3: Label settings for sealed DUV 266nm laser heads

Part I: Information Pertaining to all Sealed Microchip Laser models

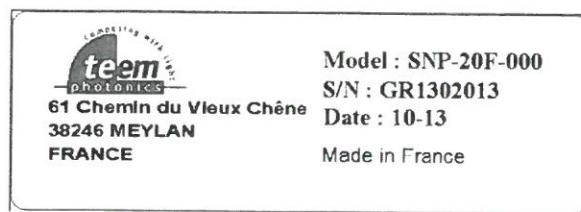


Figure 4: Product Identification Label

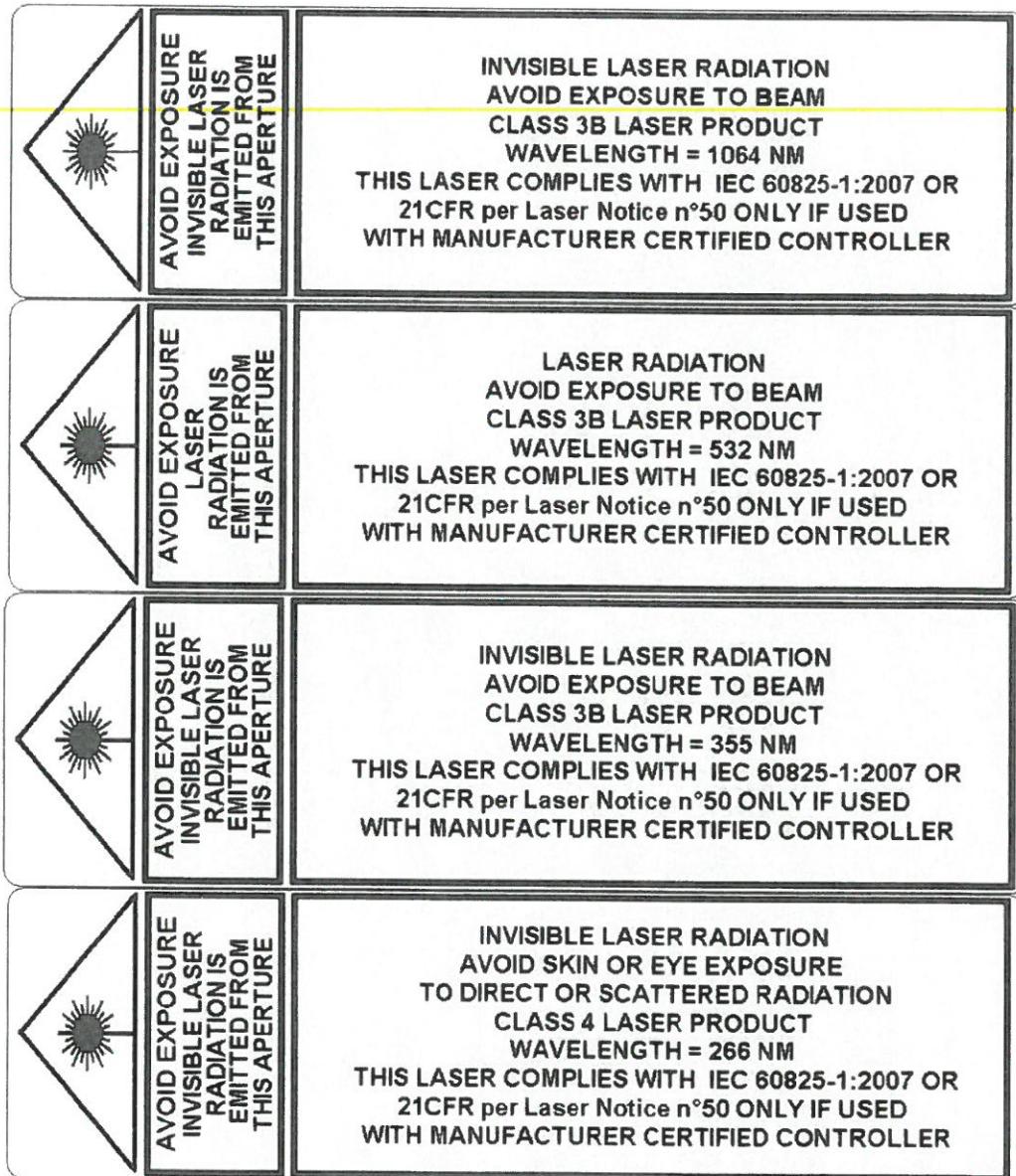


Figure 5: Safety labels for Sealed MicroChip Lasers
(Please refer to the Specification Control Document and /or the Safety label
Printed on the laser head for laser classification of your specific laser)

Part I: Information Pertaining to all Sealed Microchip Laser models

1.7 References

For proper installation, the user should refer to the latest revision of the high efficiency microchip laser controller User Manual (Ref #21059624). Please contact your Teem Photonics representatives in case you don't have this document.

2. General Information

This chapter contains general information covering Sealed MicroChip Lasers and includes the following:

- Unpacking and inspection
- Equipment supplied
- Repackaging for shipment
- Description
- Warranty and Worldwide Service

2.1 Identification labels

The Sealed MicroChip Laser systems can emit at 1064 nm, 532 nm, 355 nm or 266 nm. They consist of a laser head and a laser controller with model numbers corresponding to the following description:

Laser Head Model numbers

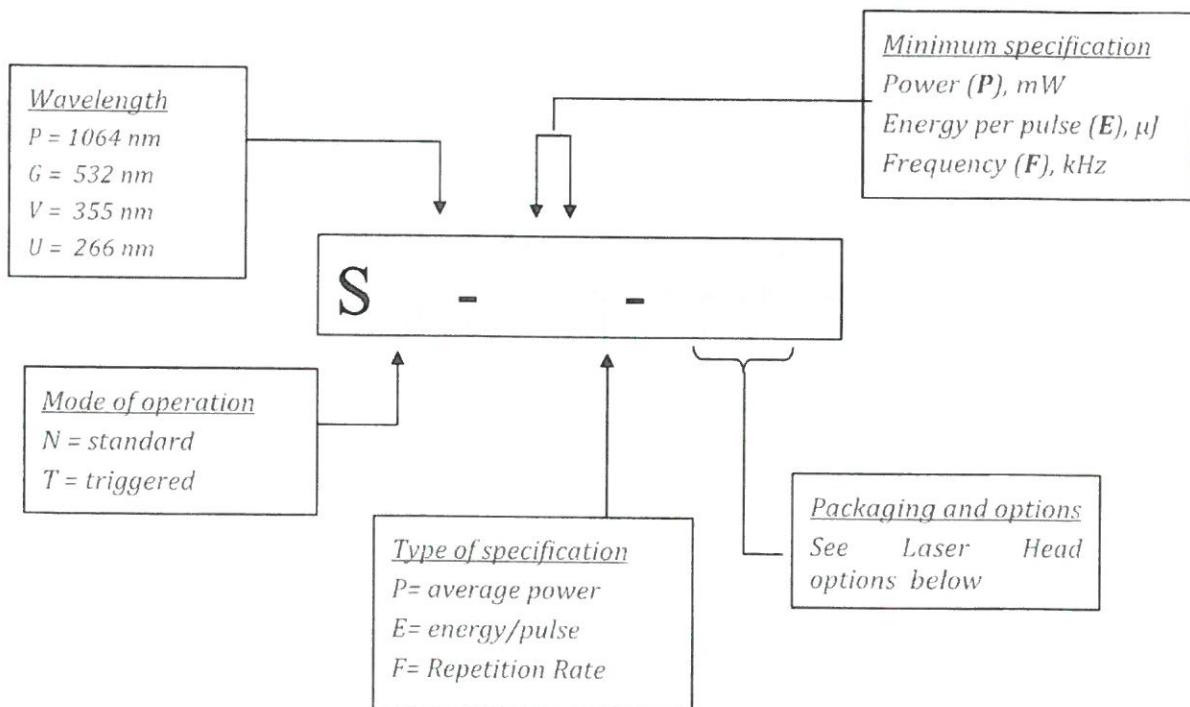


Figure 6: Laser head part numbers

Laser Head options

Standard and triggered lasers, when available :

xxx-xxx-0xx	OEM package
xxx-xxx-1xx	CDRH compliant package
xxx-xxx-Mxx	Multimode fibering option
xxx-xxx-Fxx	Singlemode fibering option
xxx-xxx-xSx	Synchronisation output
xxx-xxx-xxC	Collimation for UV microchips only

Triggered lasers only, choice of the mode of operation (one single choice):

xxx-xxx-x0x	Internal fixed rep rate mode for STx MicroChip : RR = nominal RR
xxx-xxx-x1x	Internal fixed rep rate mode for STx MicroChip : RR ≠ nominal RR
xxx-xxx-x2x	External triggering, single rep rate optimization mode for STx MicroChip
xxx-xxx-x3x	External triggering, multi rep rate (up to 3 rep rates to be chosen) optimization mode for STx MicroChip
xxx-xxx-x4x	External triggering, variable rep rate over 10Hz-2kHz for STx MicroChip

Please contact us or your nearest Teem Photonics representatives (see §2.6) for further information on the options content and availability.

Laser Controller Model numbers

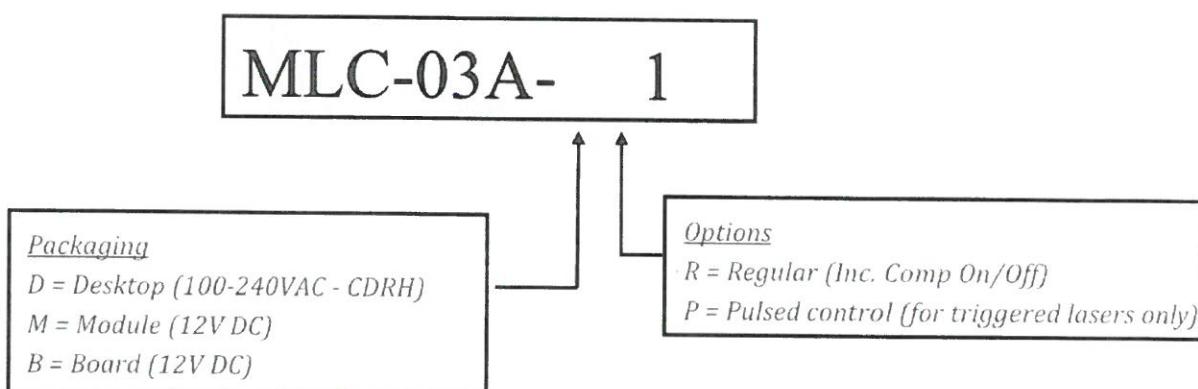


Figure 7: Laser controller part numbers

2.2 Unpacking and Inspection

Before unpacking the MicroChip Laser, inspect the shipping carton for evidence of damage. If the carton box appears to be damaged, file a claim immediately with the freight carrier. After unpacking, inspect each item carefully for evidence of damage. If any item appears to be damaged, file a claim immediately with the freight carrier. It is recommended that you retain the original shipping carton and packing material in case any Microchip Laser item has to be returned to Teem Photonics. Most shipping damage occurs when the item is not shipped in the original shipping container.

2.3 Repackaging for Shipment

If it is ever necessary to repack any MicroChip Laser item for reshipment, use the original carton box and packing material, if available. If the original carton box and material are not available, use a similar carton box and pack the item(s) in suitable packing material, or contact Teem Photonics for a container.

2.4 Equipment Supplied

MicroChip Laser Head consists of the following:

- Laser Head Model "SNx-xxx-xxx" with Laser Head Cable attached for connection to a High Efficiency Microchip Laser Controller
- Thermal pad
- User's Manual (this document)

NB: Details of your configuration may be found in Specification Control Document and will include when applicable a list of the extra equipment supplied relative to your configuration.

2.5 Description

Each Sealed MicroChip Laser Head requests a High Efficiency Microchip Laser Controller for proper operation. Laser heads and controllers are interchangeable.

2.5.1 CDRH certified laser systems

The CDRH package is intended for multipurpose experiments in a laboratory environment. CDRH certification is valid only for a complete system composed of a CDRH laser head and the adequate laser controller.

The laser head is equipped with a manual beam shutter. The laser controller includes safety features complying with CDRH such as, key switch, on/off switch, ON light indicator, a 5s delay between "ON" status and light emission and a line voltage filtering circuit.

CDRH Laser Head provide the following features and benefits:

- Rectangular design provides for straightforward mounting and heat sinking.
- Passive Q-switching reduces number of components, improving reliability.
- Monolithic microlaser design eliminates costly optics and alignments.
- Compact design promotes ease and flexibility in system integration.
- Thermoelectric cooler ensures precise temperature control.
- Hermetic sealing for improved life time in harsh environment

- Manual Beam shutter

Model MLC-03A-Dx1 Desktop Laser Controller (AC voltage)

Please refer to the Microchip Laser Controller User's Manual referenced in § 1.7 for details

2.5.2 OEM laser systems

The OEM package is intended to be integrated into OEM systems. The beam usually has a larger divergence that makes custom collimating or focusing easier and there is no beam shutter. Laser heads and laser controllers are interchangeable for easier inventory management.

OEM Laser Head provide the following features and benefits:

- Rectangular design provides for straightforward mounting and heat sinking.
- Passive Q-switching reduces number of components, improving reliability.
- Monolithic microlaser design eliminates costly optics and alignments.
- Compact design promotes ease and flexibility in system integration.
- Thermoelectric cooler ensures precise temperature control.
- Hermetic sealing for improved life time in harsh environment

Three kinds of laser controllers are available: Desktop, Module and Board

Desktop is using AC voltage, Module and Board are using DC 12 Volts.

Please refer to the Microchip Laser Controller User's Manual referenced in § 1.7 for details

2.6 Warranty and worldwide service

Except otherwise specified, Teem Photonics warrants Sealed MicroChip Laser Head to be free from defects in material and workmanship for twelve months from the date of shipment or 5,000 hours, whichever occurs first.

Except otherwise specified with the customer by writing and/or in the Specification Control Document, warranty provided for this Laser Head is defined by Teem Photonics Terms and Conditions of Sale

The warranty provided herein shall extend to any Laser Head which has proved defective and has failed through normal use, but excludes and does not cover any Laser Head or parts thereof which has been accidentally damaged, disassembled, modified, misused, repaired or reworked (by any party other than Teem Photonics or its authorized agents), improperly stored or handled, used in conjunction with another product that is electronically or mechanically incompatible or of an inferior quality, or used in applications which exceed the Product specifications or ratings, neglected, improperly installed or otherwise abused or is used in hazardous activities. Normal use of the Microchip Laser Head assumes operation with a properly selected Teem Photonics High efficiency laser controller (MLC Series). Operation with another controller will void the warranty.

If any item of the laser fails during the warranty period specified above, return the item freight prepaid to Teem Photonics or the nearest authorized assistance center. Teem Photonics only

Part I: Information Pertaining to all Sealed Microchip Laser models

accepts returns for which an approved Return Material Authorization (RMA) has been issued by Teem Photonics. This number must be obtained prior to shipping any material back to Teem Photonics. The owner's name and address, the model number and full serial number of the unit, the RMA number, and an itemized statement of claimed defects must be included with the return material.

Teem Photonics will, at its discretion, repair or replace the defective item and return it freight prepaid to your facility. Note that any attempt by the user to repair any MicroChip Laser System during the above warranty period will void the warranty.

After the expiration of the warranty period specified above, Teem Photonics will, provided the defective item is returned to Teem Photonics, repair the item on a time and materials cost basis. The item will be shipped back to you at your expense.

NB: Although Laser Heads and Laser Controller are interchangeable, it is recommended to send, unless clearly stated from your Teem Photonics local representative, the laser head and the laser controller that fails at the time of use. This should give more information to our servicing department to work from your set up prior to appearance of the defect

Worldwide Teem Photonics Assistance

For sales and service information, contact Teem Photonics or your local representative

Teem Photonics
61 Chemin du vieux Chêne
F-38246
FRANCE

Available Monday through Friday, 8:00 AM-5:00 PM Pacific Time (GMT-8)

Please contact Customer Service to get a quote, place an order, or check on the status of an order. A team of dedicated customer service professionals is on hand to answer your questions and provide the service and support you need.

North & South America 9:00 AM - 6:00 PM AT, Monday through Friday

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Fax	Fax : +1 925-886-8171
E-mail	sales@teemphotonics.com

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Phone	(+33 0) 47 604 0506
Fax	(+33 0) 47 604 0302
E-mail	sales-eo@teemphotonics.com

Please visit our web site at <http://www.teemphotonics.com/> for our worldwide representatives

3. Modes of operation

3.1 Diode pumped, passively Q-switched Microchip lasers

Diode pumped solid state lasers usually produce high peak power pulses by using active modulation of a high gain medium, such as Nd:YVO₄, resulting in complex and expensive systems. Passively Q-switched Microchip Laser technology dramatically reduces the size and cost of such lasers.

The MicroChip Lasers contain an innovative *passively* Q-switched microlaser using a saturable absorber embedded monolithically in the laser medium, thereby avoiding the costly and complicated use of electronics necessary to drive traditional Q-switched lasers.

The whole laser cavity consists of a one to two cubic millimeter crystal of Nd:Yag with a thin layer of Cr⁴⁺ doped Yag and two mirrors deposited at both ends. When pumped with a continuous wave diode laser, the output of the laser cavity is a train of sub-nanosecond pulses with 10 kWatts of peak power in the infrared at a fixed repetition rate up to 130kHz. Alternatively, the pump diode can be modulated to offer a variable repetition rate output: in this case, the effective repetition rate is given by the user provided trigger signal and limited to a few kHz (see triggered laser operation §5.3). Proper control of the focusing conditions also leads to very good beam quality.

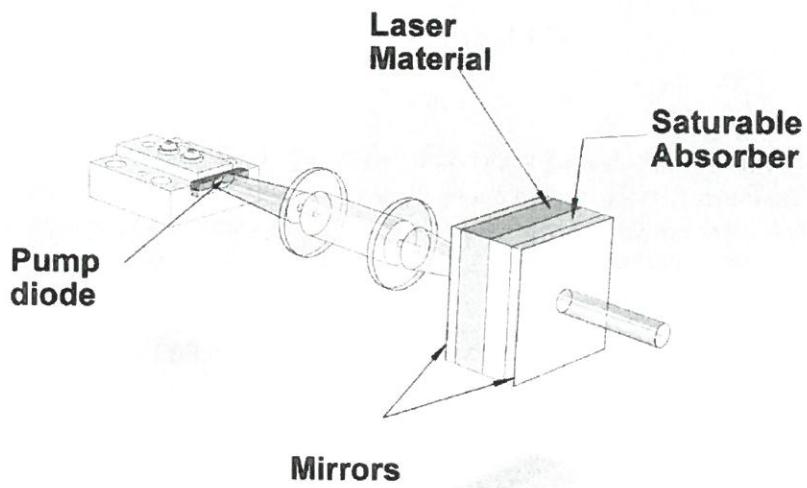


Figure 8: MicroChip Laser Optical Layout

Since the conversion efficiency to generate green and UV wavelengths increases with the incoming IR beam power, green and UV output can be efficiently generated from a passively Q-switched laser because of their high peak power. This efficiency allows the non-linear crystals to be situated outside the cavity, in a single pass configuration, giving the MicroChip Laser stability with a simple, efficient and compact design. Several milliWatts of average power at 266 nm or 355 nm can then be emitted from a very compact package.

Part I: Information Pertaining to all Sealed Microchip Laser models

The MicroChip Laser is designed as an OEM product aimed at working in different environments, the laser head includes a thermoelectric cooler to allow good performance over a large range of temperature. The laser controller drives the diode laser current and stabilizes the diode temperature to 0.06°C allowing stable operation of the laser. This OEM driver includes diode protection circuits against ESD and overheating, it has no external adjustment for trouble free operation, all parameters are factory set. The Desktop model includes an AC/DC converter to operate directly from the wall plug voltage.

3.2 Laser controllers

The MLC controllers are compact control units for driving up to 3 Amps Power Laser Diodes integrated in Microchip Laser head.

Besides the controlling of the laser diodes, the MLC features also one (extendable to two) built in thermoelectric coolers (Peltier elements) regulation control.

Thanks to this controlled thermal management MLC series operates without needs from neither additional cumbersome heat sinks nor fans. It is only set to cooling via airflow.

The MLC controllers can be declined under 2 modes or operations. Standard controllers (xR1) are to be used with standard cw pumped laser, when the triggered controllers only work with the triggered laser for which the pump power is time-modulated.

They also offer 3 packages for any kind of operation mode (see table below):

- PC board for OEM integration
- Module corresponding to a tightly packaged board conform to CE mark for easy integration
- Desktop version or table top version for laboratory and evaluation test prior to OEM integration and fully compliant to CE and CDRH regulation.

	Input Power	CE	CDRH
Desktop	100-240VAC	✓	✓
Module	12V DC	✓	
Board	12V DC		

Table 2 : MLC-03A controllers models

The MLC controllers' features consist of one external input supply line, one external RS232 standard serial link connector, one interlock jack connector and one analog "utility" connector.

MLC units functionalities are controlled by a microprocessor based central unit. All parameters are factory set and no user intervention is required to set the device to operate other than action on a start/stop button and the sending of the external trigger signal for the externally triggered lasers. Additionally a set of parameters can be accessed and set via an RS232 interface to a PC.

MLC controllers also integrate a firmware feature that can retrieve operating time, Serial number and various other SPC data collection.

Each MLC Controller is interchangeable with all compatible MicroChip laser heads including the same level of options. Data are stored into the Laser Head Board referred to as personality board. Additional technical information on the laser controller as well as the wiring details can be found in the Specification Control Document attached in the Part II.

Part I: Information Pertaining to all Sealed Microchip Laser models

The MLC controllers are CLASS 4 compatible and fully compliant laser controllers. Please REMEMBER that ONLY a complete system (laser head + laser controller) will be compliant to CDRH or OEM regulation. Check part numbers and match laser and controller specifications for exact regulation compliancy.

Additional technical information on the laser controller as well as the wiring details can be found in the High Efficiency Microchip Laser Controller User's Manual referenced in § 1.7.

4. Installation

Installation may vary from laser types and option. The intent of this paragraph is to enounce a general overview of the main consideration relative to a 1st degree level of installation. It is clearly recommended for each specific laser to read through 4.1 and to go for details in the Specification Control Document (SCD, see part II).

For proper installation of the laser controller, please refer to the Installation chapter of the Laser Controller User's Manual referenced in §1.7.

4.1 Mounting

When mounting the MicroChip Laser Head, consider the following information:

Microchip lasers should be fixed on location by the sets of holes present on its base plate. Mounting holes and registration holes are provided as described on mechanical drawing included in the provided Specification Control Document.

CAUTION	Select an environment that does not exceed the specifications, for temperature, humidity, etc., as listed in the Specifications section. The location must be as clear as possible from dust and contaminant
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Laser head heat sinking

Suitable heat dissipation must be provided for proper operation of the laser. Base plate of Laser system laser heads is the unique built-in heat dissipation interface. Requirements specify a minimum of 6Watts heat dissipation while maintaining the interface within operating temperature range of the laser specification sheets. Failing to comply with one of those requirements may cause irremediable damages to the laser heads or one of its components.

Important!!

- Never keep the laser system powered without heat sinking the laser head to avoid thermal build up inside the laser. The Laser is automatically switched off after 1 minute of under or overheating (difference between temperature measurement and temperature set-up of more than 3 °C). See Laser Controller User's Manual referenced in §1.7 for restart procedure.
- For optimal operation, it is recommended to provide a less than 1 Kelvin/Watt thermal dissipation to the base plate of the laser: this includes the heat sink itself or the mechanical support of the laser and also the thermal contact between the laser head and its support or heat sink.
- Use the 99% carbon thermoconductive media (thermal pad) who is delivered with the laser system: this is an easy way to minimize the contribution of the contact itself.

4.2 Wiring

The Laser System is shipped with the laser head and controller not connected. A 15-pins connector to be connected to the controller terminates the laser head cable. As a protection, a relay internal to the laser head short-circuit the diode as soon as the voltage supplied goes to zero.

CAUTION	The Laser Head incorporates a diode laser as the pump source. Diode lasers are extremely sensitive to electrostatic discharge (ESD). ESD is the primary cause of premature diode laser failure. Take extreme caution to prevent
ESD 	ESD, whenever the laser head is disconnected from the Laser Controller. Use wrist straps, grounded work surfaces, and rigorous anti-static techniques and procedures when handling the system in this situation.

With the above ESD precautions, connect the 15-pins connector to the controller. Please refer to the Controller User's Manual for details.

CAUTION 	NEVER CONNECT OR DISCONNECT THE LASER HEAD FROM THE CONTROLLER WHEN THE CONTROLLER IS ON. It could permanently damage the diode.
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5. Operation

5.1 Standard lasers : SNx series

For steady operation, simply connect the laser head to the sub-D15 connector on the front side of the controller.

Before you connect the controller to the line voltage, make sure that you are in compliance with the safety rules listed in the safety section. Then, plug the controller to its voltage supply, 12CDC or 115-230VAC depending on controller type (see controller SCD), and turn the key switch if you have a desktop controller. Wait for the “Laser ready” orange LEDs to stop blinking at the end of the auto-test and initialization process and push the red start button. Your laser is emitting !

During operation of the Microchip Laser, the diode current, the diode temperature and the thermoelectric cooler current are measured and regulated.

All the parameters for the operation of the Microchip Laser are factory set for optimum performance and are not adjustable.

Your laser can be operated remotely through RS232 protocol, or gated by sending an external TTL trigger signal. These remote and/or live controls are described in the Laser Controller User's Manual referenced in §1.7, "Operation" and "Interface command description" chapters.

Please refer to Laser Controller User's Manual referenced in §1.7 for a proper and complete operation of the laser.

5.2 Standard lasers with optional synchronization output : SNx-xxx-xSx series

Operation is similar to the standard lasers operation described here above in §5.1.

These lasers feature an extra photodiode output that can be used for synchronization or monitoring purposes. The synchronization output is directly conveyed from the built-in photodiode without any internal processing, so that the delay between the optical pulse and its electrical counterpart is a few nanosecond only, depending on the cable length. The synchronization pulse is TTL compatible, with a typical 100ns full width at 3V and >5V peak value (see figure 9 below)

The trigger signal is accessible from the SMB output located at the back of the laser head. 50Ohms coaxial cables (ref: RADIALL - R284C0351064) as well as 50Ohms adapted inputs are necessary to ensure optimum impedance matching.

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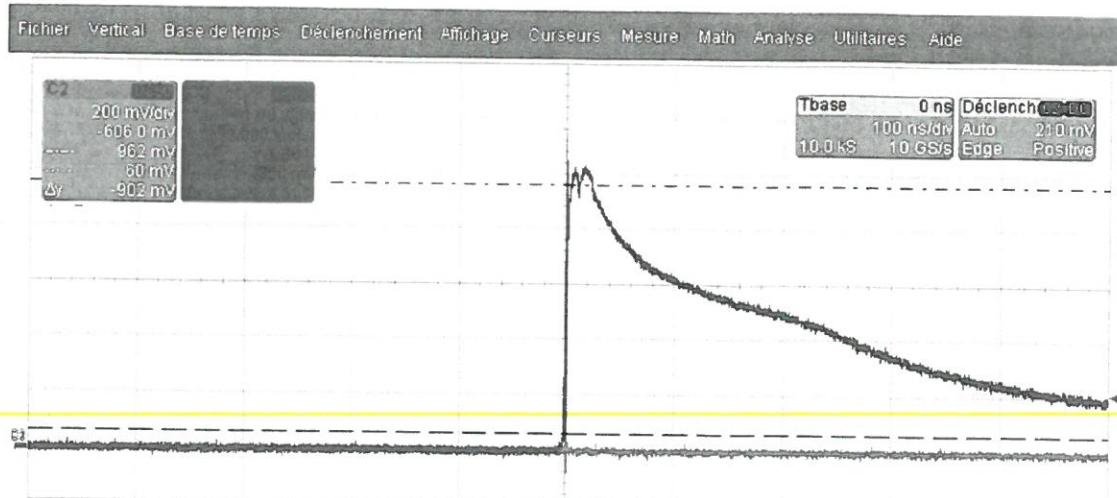


Figure 9: optical signal (pink) and synchronization output (blue) signals shape and relative delay

5.3 Triggered lasers : STx series

For triggered lasers (STx lasers) to operate, it is necessary to convey the synchronization signal between the laser head and the controller. This is why an extra cable connexion is required between the laser and the controller.

First, connect the laser head to the sub-D15 connector on the front side of the controller.
Then, locate the two SMB connectors on the front panel of your -xP1 controller dedicated to triggered lasers (see sketch below for MLC-03A-MP1):

- The right SMB connector must be connected to the laser head (the SMB plug is located at the back of the laser head) with the use of one 50Ohms coaxial SMB cable (included).
- the left SMB connector needs to be matched to 50Ohms for the laser to operate properly.
 - if you want to use the laser without any external equipment, you need to plug a 50 Ohms load (included) on the other SMB connector.
 - If you want to monitor the synchronization signal with an oscilloscope for instance, your oscilloscope input needs to be set to a 50Ohms input impedance (see fig.9)

Important!!

If you fail to connect correctly the SMB synchronization chain, the laser will start but it won't lase.

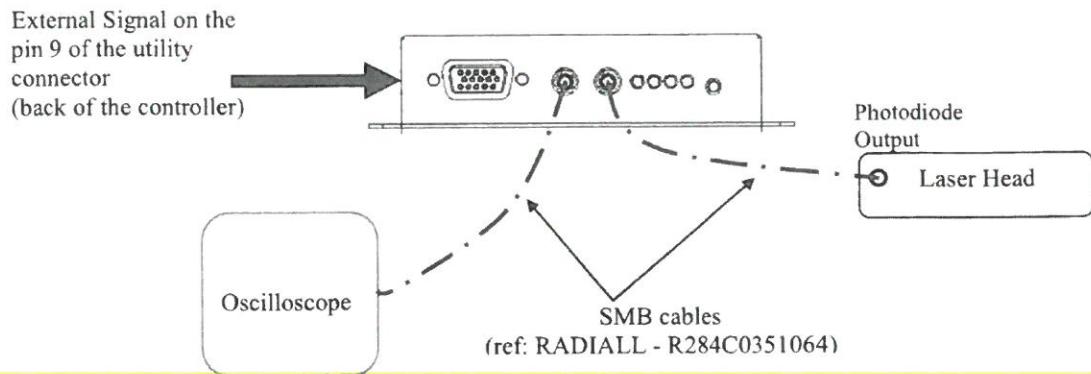


Figure 10: SMB coaxial cables connexion scheme for triggered lasers

Before you connect the controller to the line voltage, make sure that you are in compliance with the safety rules listed in the safety section. Then, plug the controller to its voltage supply, 12CDC or 115-230VAC depending on controller type (see controller SCD), and turn the key switch if you have a desktop controller. Wait for the “Laser ready” orange LEDs to stop blinking at the end of the auto-test and initialization process and push the red start button. Your laser is ready to lase.

Depending on your STx triggered laser factory set mode of operation, it may be necessary to send a trigger signal to have it effectively emitting.

This information is included in the last 3 digits of the laser reference, as described in the ‘Laser Options’ (§2.1 of this Manual)

- Internal fixed repetition rate triggered lasers (option ‘0’ and ‘1’) do not require any external signal to operate.
- Externally triggered lasers (option ‘2’, ‘3’ and ‘4’) will produce one optical pulse for each trigger signal pulse received. See §5.4 for further information on this trigger signal.

During operation of the Microchip Laser, the diode current, the diode temperature and the thermoelectric cooler current are measured and regulated.

All the parameters for the operation of the Microchip Laser are factory set for optimum performance and are not adjustable.

Your laser can be operated remotely through RS232 protocol, or gated by sending an external TTL trigger signal. These remote and/or live controls are described in the Laser Controller User’s Manual referenced in §1.7, “Operation” and “Interface command description” chapters.

All the triggered laser feature a synchronization

Please refer to Laser Controller User’s Manual referenced in §1.7 for a proper and complete operation of the laser.

5.4 Triggering externally triggered lasers: STx - xxx - xYx with Y= 2, 3, or 4

If you have selected a triggered laser with external trigger operation mode, then you need to send a trigger signal to the controller for the laser to effectively start emitting. **The laser should be started before sending the trigger signal to ensure a proper operation.**

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The trigger signal should be of TTL compatible type ($V_{il} = 0.4V$, $V_{ih} = 3.5V$, width $> 50\mu s$) and sent onto the MOD-EXT input of the utility connector (see the controller SCD or user Manual for connexion information). This signal initiates the laser pulse generation on its rising transition. The optical pulse will be emitted a few tens of microsecond after the arrival of the trigger signal, a delay corresponding to the pulse creation time inside the microchip cavity. The jitter on this delay is typically a few tenth of microsecond.

The laser will emit one optical pulse for each trigger pulse received within the specified maximum repetition rate range. It is possible to drive the microlaser continuously from single pulse up to the maximum frequency operation only by adjusting the trigger signal repetition rate.

The different options proposed for an externally triggered operation are related to the guaranteed optimized repetition rate(s).

Teem Photonics offers up to 3 optimized repetition rate within the full operating frequencies range [10Hz;4kHz], or an optimized operation over the continuous [10Hz;2kHz] range.

xxx-xxx-x2x	External triggering, single rep rate optimization mode for STx MicroChip
xxx-xxx-x3x	External triggering, multi rep rate (up to 3 rep rates to be chosen) optimization mode for STx MicroChip
xxx-xxx-x4x	External triggering, variable rep rate over 10Hz-2kHz for STx MicroChip

Operation outside these optimized regions may only affect marginally the optical performances.

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6. Servicing, cleaning and troubleshooting

No specific servicing is required for this equipment.

Avoid using the laser out of the environment specified in the Specification Control Document attached in Part II.

For cleaning, never use liquid or solvent, just wipe with a clean, soft dust cloth, never clean or touch the laser output window.

Please refer to the trouble shooting paragraph of the Laser Controller User's Manual referenced in §1.7 for trouble shooting of the laser.

PART II. Information pertaining to your MicroChip laser head

Adding to the present User Manual, your Microchip Laser was sent with the following documents that are pertaining to your product only :

- ✓ **The Certificate of Compliance (CoC)**: this is the final test report of your laser.
- ✓ **When applicable, Product Modification description** (only when a specific modification has been requested by a customer for 1 or few units)

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005

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Revision	Date	Modification
000	November 2004	Creation
001	September 2005	Update Logo
002	January 2007	Addition of new models
003	January 2010	Addition of triggered and fixed frequency versions
004	Octobre 2013	Revised product offering edition
005	July 2013	Removed SCDs from the list of documents sent with the laser