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Novacure® 2100

USER'S GUIDE

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Novacure® 2100 User's Guide

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Introduction

By providing up to 20,000 mW/cm² of curing power, the Novacure® 2100 can reduce cure times. It can also be used in a wider variety of applications than most commercially available spot curing systems. However, the real benefit lies in its ability to provide the user with a repeatable process and guaranteed cures. It is designed to allow the user to enter the exact intensity required by the application and provide that specified intensity time after time.

The Novacure is the only intelligent spot cure system that gives the user complete exposure control. Menu driven, user friendly software prompts the user to enter application parameters such as intensity, exposure time and/or dose. Internal system monitoring and logic maintain these parameters and advise the user in the form of a flashing LCD and alarm beeper when they cannot be met. In automated environments, the advice appears in the form of a signal from the client status line and alarm output signal.

The microprocessor receives a continuous signal from the Novacure's closed loop intensity monitor and adjusts the proportional shutter to ensure requested intensity levels are maintained. A daily calibration procedure measures the intensity output at the end of the light guide via the built-in radiometer, and adjusts the internal feedback loop accordingly. This means that intensities displayed take light guide transmission variances into consideration. Software selectable light guide diameter works with the radiometer to measure and display irradiance accurately. The built-in radiometer is calibrated to NIST and is easily removed for calibration, ensuring the integrity of the Novacure. The radiometer must be calibrated every 6 months by EXFO Photonic Solutions Inc., to insure continued accuracy. The radiometer is available as a replacement part for rotation while the other radiometer is returned to EXFO Photonic Solutions Inc. for its biannual calibration.

To further ensure repeatability, the Novacure monitors other possible areas of concern, such as shutter functionality, operating temperature, AC power status and lamp module power status. Internal sensors monitor the position of the on/off shutter and proportional shutter and continually verify shutter functionality. To ensure optimum performance in any climate, the lamp temperature is continually monitored and the fan speed is adjusted accordingly.

The Novacure's slide out lamp housing facilitates fast and simple lamp module replacement from the front of the unit. The lamp housing drawer is available as a replacement to minimize down time during service.

Not only does the Novacure monitor its functionality, it also validates it with system reporting. The Novacure reports internal calibrations, accumulated hours on the bulb, intensity requested and the number of exposures, by date and time. Opto Link® 2100 side software is provided with each Novacure for data downloading and communication with any connected PC.

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1.1 What's New?

The Novacure 2100 has several changes from the previous model. The most apparent change is the new color and design of the system, along with our new name: EXFO Photonic Solutions Inc. With the new name we have added features, which serve to increase it's functionality and capabilities, thereby ensuring it's continued position as the leader in spot curing systems.

An extended lamp life feature has been added to the Novacure 2100 to provide even longer typical lifetimes for the lamps. The extended life feature can be turned on and off by the user depending upon the application. Running continuously in extended life mode has shown to provide over 2000 hours of lamp life.

Our improved power supply technology dramatically improves lamp maintenance over the lifetime of the lamp. This results in a more stable lamp output over an extended period of time, and leads to a longer useful lamp life.

The Novacure 2100 now has an enhanced Intelli-lamp technology, to accumulate lamp hours directly on the lamps and automatically updating the unit with the number of lamp hours. When changing lamps, the lamp hours are automatically reset on the Novacure unit.

The Novacure 2100 includes Opto Link® 2100; a new Windows based history download software to monitor its functionality with system reporting. The Novacure reports internal calibrations, accumulated lamp hours, intensity requested and number of exposures by date and time. There is now an added feature of turning off the history data saving feature if it is not required for your application. This eliminates the need to periodically download the history data from the unit when the memory is full.

The Novacure incorporates a new proprietary optical measurement system into the radiometer. The new radiometer has a flat response over the spectral range of 250nm to 600nm. Its new optical interface has eliminated measurement inaccuracies due to variations in light guide diameter or positioning. The new radiometer is still removable for easy replacement, as is required periodically for calibration purposes.

In support of the radiometer change, the intensity monitor provides an output that is related to power, as opposed to irradiance. The transfer standard remains similar, 250mV per W of optical output power. The exception is that older models had a transfer standard of 250mV per W/cm^2 that was valid only for 5mm liquid light guides.

There are a number of changes to the Novacure 2100 to make it easier to control externally. The ability to send the unit to a known register, having StepCure methods automatically return to the starting register when stopped and a shutter interlock input have all been added to the Novacure 2100. Use the optional ACS 1000 Automated Control System to monitor, control and program the registers the Novacure 2100 from your PC using the WINDOWS based Opto Link UV software.

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2 Safety Precautions

2.1 Glossary of Symbols



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Safety Precautions

This series of cautions, warnings and dangers relate to the operation and maintenance of the Novacure. They are also presented throughout the User's Guide where necessary.



Caution
Never look into the light emitting end of the light guide. The light could severely damage the cornea and retina of the eye if the light is observed directly. UV protective eye shielding must be used at all times as well as clothing to protect exposed skin.



A shielded line cord and I/O cord (used for interfacing with the Novacure) must always be used to ensure trouble-free operation.



Warning
To reduce the risk of fire or shock, always replace the fuses with the same type and rating.



Danger
This unit contains HIGH VOLTAGE components. It is recommended that ONLY QUALIFIED TECHNICAL PERSONNEL perform any testing or repairs described in this manual. Disconnect the AC power cord from the unit before opening the cover of this unit. All cover screws (quantity 7) must be replaced prior to applying power to the unit, or safety of the unit will be impaired.



Warning
Eye damage may result from directly viewing the light produced by the lamp used in this product. Always turn the lamp off before removing cover.



Monitoring the unit during Manual mode operation
The level of UV energy supplied by the Novacure is sufficient to ignite flammable substances. While the unit is in Manual mode, the unit must be attended at all times by a qualified operator. The unit must not be left unattended while turned on. If an operator leaves the work area of the unit, the rear panel switch must be turned off and the display must read "Lamp cooling down...".

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Monitoring the unit during Automated mode operation
The level of UV energy supplied by the Novacure is sufficient to ignite flammable substances. Therefore, when the unit is operated unattended in the Automated mode, an alarm function must be provided by the user to indicate a malfunction in the associated equipment used.

Warning
Hg – LAMP CONTAINS MERCURY, Manage in Accord with Disposal Laws, see: www.lamprecycle.org or 1-800-668-8752.

Lamps may be returned to EXFO Photonic Solutions Inc., providing it is returned in its original packaging and postage-paid. EXFO Photonic Solutions Inc. will dispose of them in the appropriate manner.

Danger
Lamps must always be handled in the clear plastic safety cover included with lamp carton. The high internal pressure may cause the lamp to burst either when cold or hot. When unpacking or installing, always wear protective clothing and a face mask. Operate lamp only in the Novacure lamp housing. This prevents direct viewing of the arc and in the case of lamp bursting, contains lamp particles. In the rare instance in which a lamp bursting occurs, and the mercury content is released, the following safety precautions are recommended: All personnel should be immediately evacuated from the area to prevent inhalation of the mercury vapor. The area should be well ventilated for a minimum of 30 minutes. After the lamp housing/fragments have cooled, the mercury residue should be collected with the use of a special absorbing agent available from laboratory equipment suppliers.

Warning
Should this Novacure unit be used in a manner not specified by EXFO Photonic Solutions Inc., the protection provided by the equipment may be impaired.

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Caution
The lamp module's operational life can be significantly shortened if it is handled incorrectly. Be sure only to handle the ceramic surfaces. Do not touch the bulb's glass envelope or the inside surface of the reflector. Skin oils can cause the lamp module to fail prematurely.



Caution
Prior to opening the unit and handling the lamp module, allow the lamp module to cool down completely. Do not interrupt the auto-cool down sequence.



Caution
Any electronic equipment connected to the Novacure must be IEC950 certified.

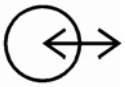
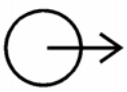


Warning
Disconnecting of mains supply source is only possible by unplugging the attachment plug.

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2.1 Glossary of Symbols

Symbols as they appear in this User's Guide and on the Novacure unit

 Caution, risk of danger, consult accompanying documents	 Shock hazard
 ON, Part of the equipment	 OFF, Part of the equipment
 WARNING: Eye damage may result from directly viewing the light produced by the lamp used in this product. Always turn off lamp before removing cover.	 Protective earth
 Input / Output signals	 DC Voltage (Intensity Monitor Output)
 History Download	

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Warning: Routine Maintenance and Service is to be performed only by Qualified Service Personnel.

3 Setting Up the Novacure

3.1 Checking the contents of the box

3.2 Front Panel

3.3 Rear Panel

3.4 Installing the Lamp Module

3.5 Installing the bandpass filter

3.6 Bandpass Filter Replacement

3.7 Inserting the Light guide

3.8 Removing the Light guide

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3.1 Checking the contents of the box

1. Carefully unpack the unit and accessories.

2. Store the packing material for future use.

Note The lamp module is a pre-focused precision optical device and as such must be handled with care. It is packed in a protective container within the master carton.

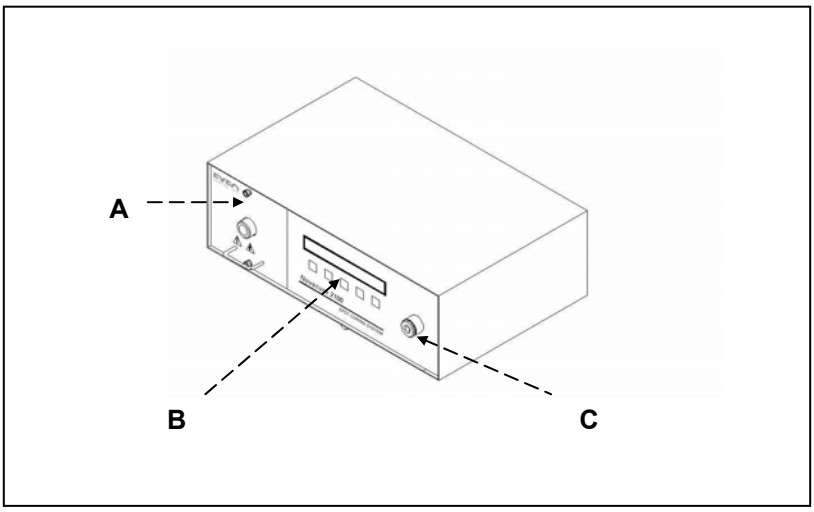
Box Contents

1. The Novacure 2100 curing unit
2. The Novacure lamp module
3. Light guide (if ordered)
4. Protective eyewear
5. Grounded and shielded power cord
6. Hexcap ball driver
7. Foot pedal
8. Instruction manual, including PC side software and radiometer certificate of calibration
9. Radiometer adapters (3mm, 5mm)

If your packaged unit is missing any of the above components, call EXFO Photonic Solutions Inc. at 1-905-821-2600 or TOLL FREE 1-800-668-8752.

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3.2 Front panel

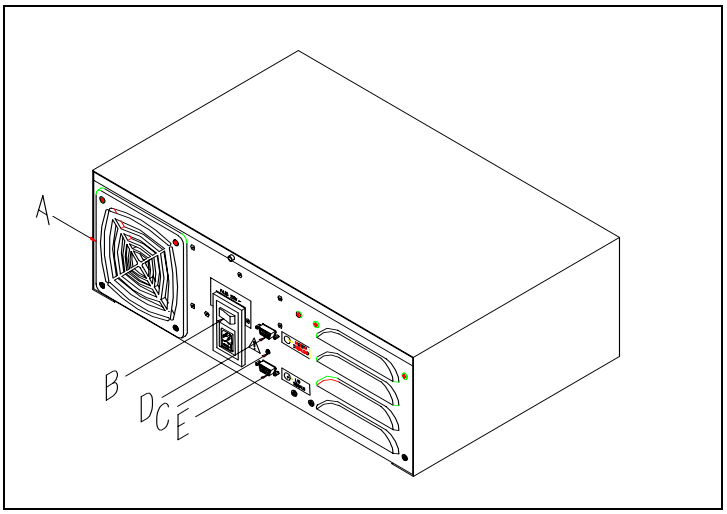


A Lamp Housing Front Panel

B LCD And Keypad

C Radiometer Port

3.3 Rear Panel



A Fan with Filter

B AC Receptacle Module (main inlet)

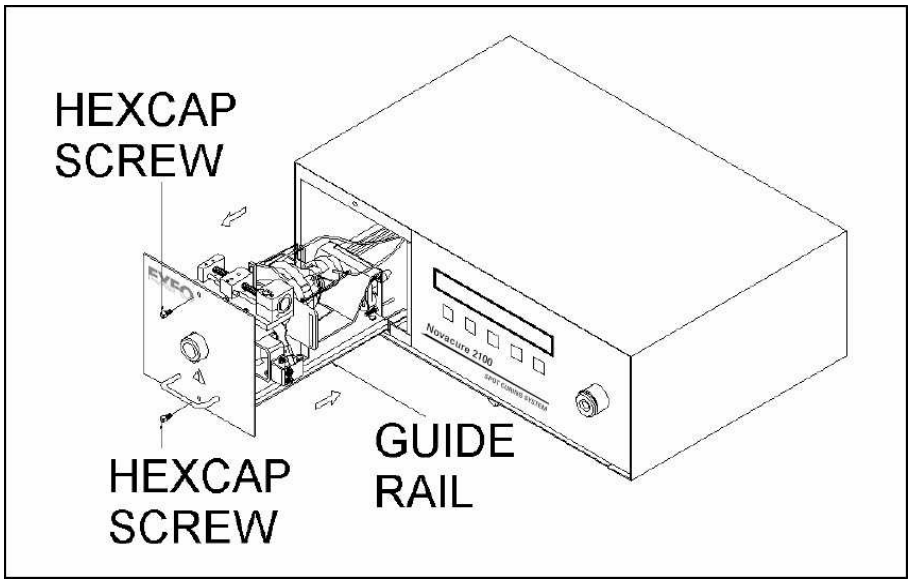
C Intensity Monitor Output/Shutter Interlock Input

D D-Sub, 9 pin socket Connector (data download)

E High density D-Sub, 15 pin male Connector (I/O signal port)

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3.4 Installing / Replacing the Lamp Module



1. Be sure the AC power cord is disconnected from the unit.

2. Remove the two hexcap screws with the supplied tool from the lamp housing front panel and set them aside.

3. Hold the lamp housing handle and give it a firm, controlled pull to disengage it from the internal electromechanical connections.

You will probably find it easiest to give the handle a quick and forceful pull of about five inches to overcome the initial force.

4. Slide the lamp housing out along the guide rails until it reaches the stop position.

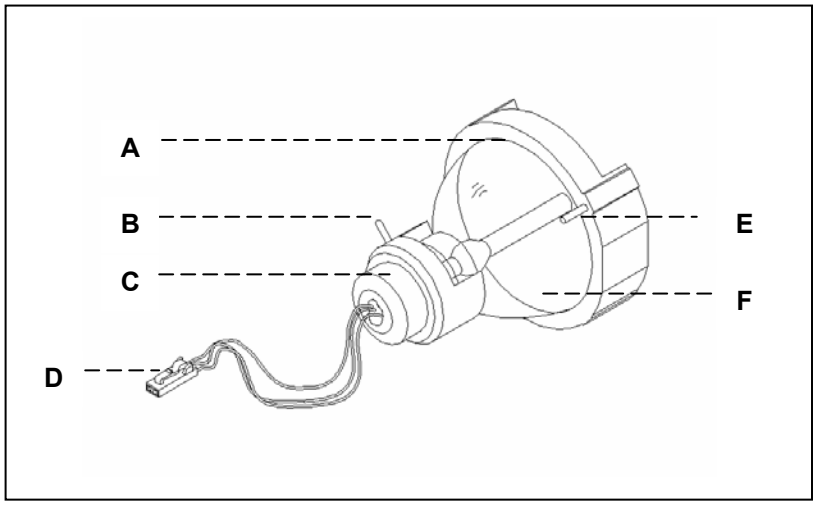
From here you should be able to look straight down on the back end of the lamp housing.

Note The lamp housing assembly is not designed to be completely removed from the Novacure chassis during lamp module installation or replacement.

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5. If there is currently a lamp installed, disconnect the temperature sensor termination from its mate on the heat shield of the lamp drawer housing. Disconnect the positive and negative terminals from the lamp. Remove the lamp from the spring clips.

Contact the service department to return all lamps in their original packaging to EXFO Photonic Solutions Inc. for disposal



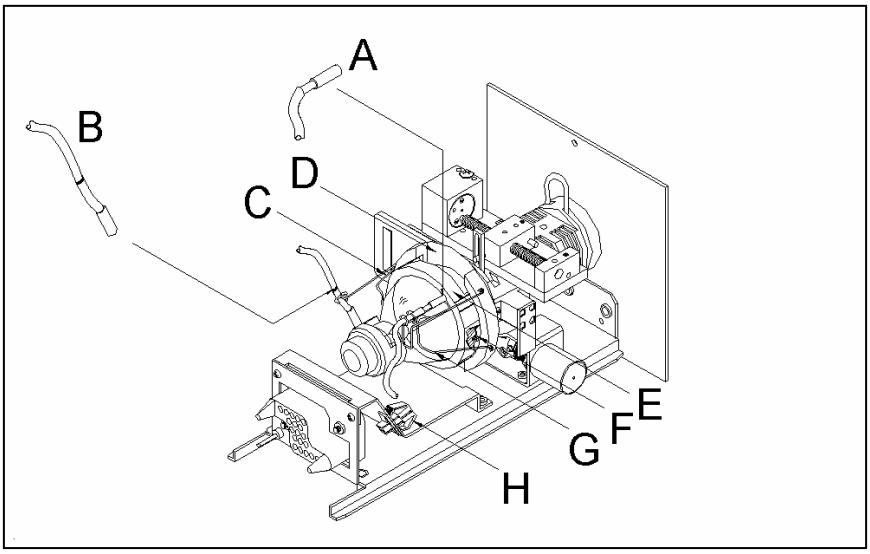
A, C : Ceramic components. **B**: Negative terminal. **D**: Temperature sensor termination. **E**: Positive terminal. **F**: Glass envelope.

6. Carefully remove the lamp module from its container, holding only the ceramic components.

7. Locate the temperature sensor termination at the rear of the lamp module and connect it to its mate located on the heat shield of the lamp drawer housing.

Caution
The lamp module's operational life can be significantly shortened if it is handled incorrectly. Be sure only to handle the ceramic surfaces. Do not touch the bulb's glass envelope or the inside surface of the reflector. Skin oils can cause the lamp module to fail prematurely.

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A: Positive terminal. **B**: Negative terminal. **C, G** : Spring clips. **D**: Back edge of module bracket. **E**: Ceramic mount. **F**: Locating notch. **H**: Temperature sensor termination.

8. Locate the lamp module power wires and move them into a position so they do not interfere with the lamp module placement.

9. Hold the ceramic mount of the new lamp module with the negative connector aimed upward.

10. Position the front of the lamp module's ceramic reflector mount just above the spring clamps and on the back edge of the lamp module bracket.

11. Push the lamp module downwards into the gap found between the spring clamps.

The spring clamp's tension will allow them to separate far enough to allow the lamp module to slide down. The lamp module must be pushed far enough downwards so that the outer edge of the ceramic reflector mount mates with the inner edge of the lamp module bracket. The lamp module may have to be rotated slightly in order to center the locating notch, situated in the ceramic reflector mount, over the locating socket head cap screw.

12. Connect the wire with the black stripe to its terminal on the ceramic mount (negative connection) and connect the second wire without black stripe to its terminal (positive connection), located on the ceramic reflector mount.

Note The two terminal sizes are designed to make it impossible to inadvertently connect the lamp module wires incorrectly. The lamp module is now properly installed.

13. Hold the lamp housing handle and carefully slide the drawer back into the unit. A firm but controlled push will ensure that the lamp housing front panel is flush with the unit.

14. Replace the two hexcap screws that secure the lamp housing drawer to the Novacure.

15. Connect the AC power cord.

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3.5 Care and handling of your lamp module

The lamp module used in the Novacure is a precision optical device that is sensitive to misuse. More importantly, it is sensitive to extreme shock and vibration, heat, length of operation and run up times. The useful life of the 100W mercury arc lamp can be maximized if the following points are observed and adhered to:

>Always ensure that the lamp has been allowed to operate for a minimum of 20 minutes prior to turning it off. Allowing the lamp to run for 16-20 hour periods of time, as opposed to turning the lamp on and off several times per day, will result in longer lamp life.

>Never interrupt the 90-second lamp warm up time. If the lamp is turned off during this warm up period, the user can expect the lamp life to be cut in half.

>Never expose the Novacure to extreme shocks or vibrations while it is in operation. The burner and electrodes of the lamp module are extremely hot during operation and are therefore more sensitive to shock and vibration.

>Never touch the inside reflector or burner with your fingers. Skin oils as well as other contaminants will shorten the lamp life.

>Allowing the Novacure to go through its automated cool-down process will ensure that the lamp experiences a minimum of thermal shocks thereby increasing its life.

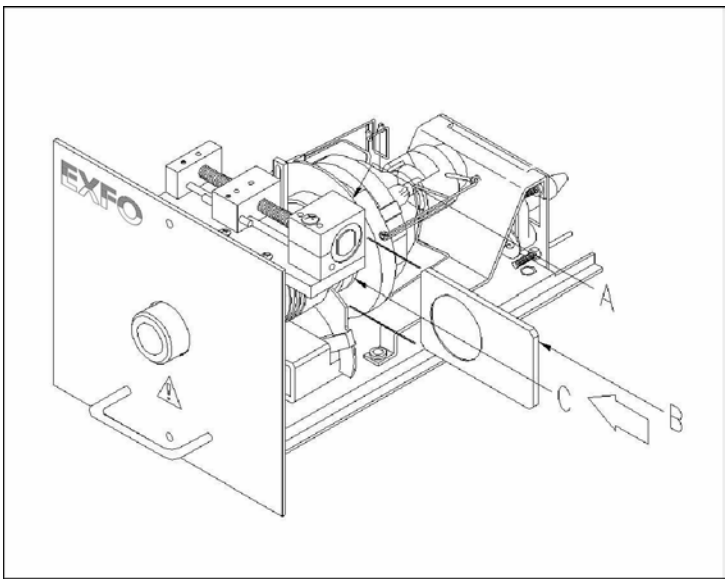
>Always ensure that the Novacure has adequate ventilation. The rear of the unit must have a minimum clear space of 6 inches to allow the hot air exhausted by the fan to escape (and not re-enter the unit).

>Ensure that the ambient temperature that the Novacure is operating in does not exceed 40°C. Lower ambient temperatures will result in longer lamp life.

>Never operate the Novacure with a faulty fan or with the cover removed. Either of these conditions will result in the lamp module running at elevated temperatures, which will in turn reduce the lamp life.

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3.6 Bandpass filter replacement



1. Open the lamp housing drawer by following steps 1 through 4 in section 3.4.

2. Remove the filter assembly retainer from its packaging. Ensure that the filter portion of the assembly does not come in contact with any objects.

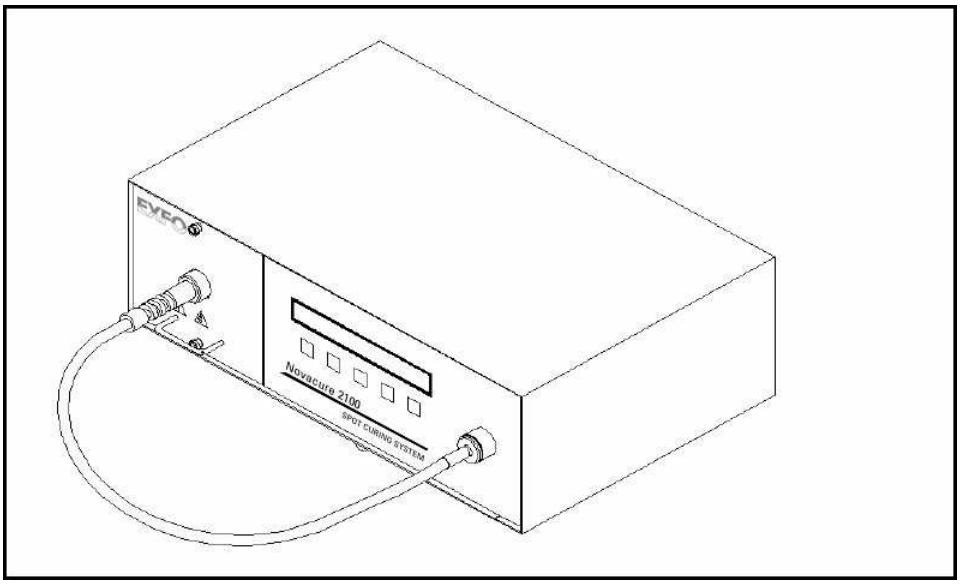
3. The filter assembly retainer, (C) located on the lamp module bracket, (A) is used to accurately position the filter assembly. Insert the filter assembly, (B) into the filter assembly retainer, (C) as shown above.

4. Ensure that the filter identification marking, (D) is facing the lamp module. Push the filter assembly in until a "click" can be heard/felt.

5. Close the lamp housing drawer by following steps 12 through 14 in section 3.4.

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3.7 Inserting the light guide



1. Insert the light guide into the light guide retainer until it seats with a positive click.

2. Never grip the light guide during installation or removal in a place other than the strain-relief nearest the I/P end of the light guide.

3.8 Removing the light guide

1. Firmly grip the strain relief near the light guide retainer and pull the guide out steadily.

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4 Turning Power on to the Novacure

4.1 Powering Up

4.2 Powering Down

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4.1 Powering up



1. Plug the unit into a properly grounded AC outlet.

2. Ensure the lamp drawer is fully engaged, a lamp and filter have been installed and that the cover is completely closed.

3. Turn on the power switch and check the fan at the rear for air flow.

Your LCD and fan should now be active.

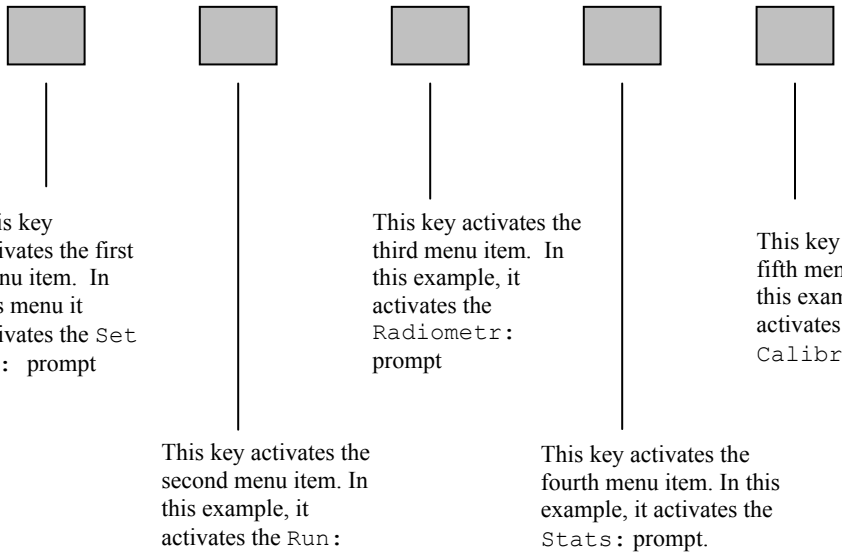
Lamp module ignition and fan speed are determined by the lamp module temperature, the status of the lamp disable signal and the position of the lamp disable switch. If the lamp module temperature is within specification, the lamp module will ignite automatically.

4. The welcome screen appears

```
Lamp Warming Up .....Waiting:XXX%
Software Version XX        EEPROM S.N.#####
```

5. When the lamp has warmed up, the main menu appears

```
Main Menu                          Ver. 2.0
Set Up:   Run:  Radiometr:  Stats:   Calibrt:
```



This key activates the first menu item. In this menu it activates the `Set Up:` prompt

This key activates the second menu item. In this example, it activates the `Run:`

This key activates the third menu item. In this example, it activates the `Radiometr:` prompt

This key activates the fourth menu item. In this example, it activates the `Stats:` prompt.

This key activates the fifth menu item. In this example, it activates the `Calibrt:` prompt.

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4.2 Powering down

The Novacure's automatic cool down cycle enables the user to turn the mains switch to the off position, allow it to cool down the lamp module on its own, then shut itself off once the lamp module has reached the proper temperature.

To power down the Novacure, simply switch the mains power switch to the OFF position.

NOTE: Increasing the time between turning the Novacure on and off will increase the useful bulb life.

If the Novacure was not powered up for a long enough period, the Novacure will indicate this state with a `Too soon for lamp out. Waiting: XXX%` message. At this point you can choose to press the `OUT NOW!` key to immediately turn off the lamp module (not recommended), or you can allow the Novacure to automatically turn the lamp module off when the optimum powered up period has been reached.

Once the lamp module has been shut off (manually via the mains switch or automatically after a waiting period) the `Lamp cooling down. Waiting: XXX%` message will appear. After a predetermined time which is based on lamp module temperature and time, the Novacure will shut itself completely off.

You can leave the Novacure unattended at any time after the mains power switch has been switched off and be confident that the Novacure will shut itself and the lamp module off at a time which ensures optimum lamp module life.

Caution
If you do not follow the power down sequence and instead simply remove the power cord from the socket, all new register settings will be lost.

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5 Programming the Novacure

5.1 Viewing/selecting a register

5.2 Running a register

5.3 Working from the set up menu

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5.5 Setting up registers (application parameters)

- 5.5.1 Set up #1: Intensity
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5.6 Choosing mode of operation

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5.10 Turning history data saving on/off

5.11 Turning Extended Life feature on/off

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5.1 Viewing/selecting a register

Register A set of user defined and programmed parameters that automate the curing procedure. Definable parameters include intensity, dose, operation mode, exposure time and dwell time. The Novacure allows users to define up to four registers. These registers are initially factory programmed to common settings that you can modify immediately. Additionally, the StepCure feature can be set-up here.

1. **Press** `Stats:`.

```
Main Menu                          Ver. 2.0
Set Up:   Run:  Radiometr:   Stats: Calibrt:
```

This selects the status prompt that lets you see the full status of the register that is currently in active mode.

2. **Press** `Next:` **to scroll through the four sets of parameters. When you have chosen the register you want to make active, press** `OK:`.

```
I=XXXXX/XXXXXmW   D=XXXXXmJ   L=XXXXHr M=NNN
T=XX:XX.X   Dw=NNN   R=X   Sc=X   Next:   OK:
```

I = Intensity (selected intensity/actual intensity)
D = Dose (Intensity * time)
L = Lamp hours (automatically resets to 0000 when a new lamp is installed)
M = Mode of Operation (see section 5.7)
T = Exposure time
Dw = Dwell
R = Current register
Sc = StepCure status

Each time you press Next:, the register indicator (R=) in this menu increments by one until the fourth register is reached. Then the sequence is repeated, starting at R=1.

The Novacure now uses the parameters of the register you have selected.

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5.2 Running a register

Run The execution of a Novacure register.

1. **Select** `Run:` **from the main menu**. There are a number of menus that give you the `MMenu:` (main menu) prompt. If your current menu does not show the prompt, continue through its commands until it appears. Then **press** `MMenu:`.

```
Main Menu                          Ver. 2.0
Set Up:   Run:  Radiometr: Stats:  Calibrt:
```

2. **Press** `No:`.

```
Current register=X...Select Another Reg?
                           Yes:     No:
```

If yes, **press** `Yes:` another register can be viewed and selected (see section 5.1).

3. **Press** `Run:`. Note that the Run key is only active if the mode of operation (M=NNN) is set to Key (keypdd)

```
I=XXXXX/XXXXXmW D=XXXXXmJ L=XXXXHr M=NNN
T=XX:XX.X  Dw=NNN  R=X Sc=x  Run: Abrt/Mnu:
```

Exposure time is now displayed and counts down to `T=00:00.0`.

Your register completes one run cycle when your dwell feature is disabled. It completes continuous cycles when dwell is enabled, until you press Abrt/Mnu:.

The proportional shutter will take a maximum of two seconds, with the on/off shutter fully open, to adjust the intensity accordingly.

StepCure™ Status
1= Active (ON)
0= Disabled (OFF)

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5.3 Working from the Set Up menu

1. **Select** `Set Up:` **from the main menu**. There are a number of menus that give you the `MMenu:` (main menu) prompt. If your current menu does not show the prompt, continue through its commands until it appears. Then **press** `MMenu:`.

2. **Enter the password.**

```
Enter Password  __ __ __ __
    1       2       3       4     MMenu:
```

The password is a user defined four digit number composed of any combination of the numbers `1`, `2`, `3`, and `4` that protects register setup, mode of operation and date/time settings. The factory programmed default password is `1111`. To change the password see section 5.7.

What you can do from here

```
Set Up.......(1)
M-Op:  Exposure:  Passwrd:  More:  MMenu:
```

You are now at the first set up menu. From here you can:
- Change mode of operation (section 5.6);
- Set up application parameters (section 5.5);
- Change password (section 5.7);
- Choose more setup parameters (`More:`); or
- Return to main menu.

```
Set Up.......(2)
ClkCal:  LtGd:  StepCure:    More:   Back:
```

You are now at the second set up menu. From here you can:
- Set date and time (section 5.4)
- Select the light guide diameter to be used with the Novacure (section 5.9)
- Activate or disable StepCure™ (section 5.8)
- Choose more setup parameters (`More:`); or
- Return to the first set up menu (`Back:`).

```
Set Up.......(3)
HistXXX:   XlifeXXX:                 Back:
```

You are now at the third set up menu. From here you can:
- Turn the history data saving feature on or off
- Turn the extended lamp life feature on or off
- Return to the second set up menu (`Back:`).

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5.4 Setting the clock/calendar

1. **Move to the second set up menu.** (See section 5.3)

2. **Press** `ClkCal:`.

```
Set Up.......(2)
ClkCal:  LtGd:  StepCure:    More:   Back:
```

3. Use the first four keys (`+Year`; `+Month`; `+10Day`; and `+1Day`) to set the numbers corresponding to the current date. **Now press** `OK:`.

```
Date (YY/MM/DD):  YY/MM/DD
 +Year   +Month   +10Day    +1Day    OK:
```

4. Use the first four keys (`+Hour`; `+10Mins`; `+1Min`; and `Sec=`) to set the numbers corresponding to the current time. **Now press** `OK:`.

```
Time (HH:MM:SS):  HH:MM:SS
 +Hour   +10Min   +1Min    Sec=0    OK:
```

The Novacure is delivered with calendar clocks set to North American Eastern Standard Time.

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5.5 Setting up registers (application parameters)

1. **Move to the first set up menu.** (See section 5.3)

2. **Press** `Exposure:`.

```
Set Up.......(1)
M-Op: Exposure: Passwrd: More: MMenu:
```

3. **Press** `No:`.

```
Current register=X...Select Another Reg?
                            Yes:     No:
```

If you press `Yes:` another register can be viewed and selected. (See section 5.1)

What you can do from here

```
Setup Parameters for Register X.....
Intensity: Time:  Dose:  Dwell:  MMenu:
```

You are now at the main exposure set up menu. From here you can:

- Set up desired intensity and exposure time (section 5.5.1);
- Set up exposure time only (section 5.5.2);
- Set up dose by joules and exposure time (section 5.5.3);
- Enable or disable dwell feature and set dwell time, if needed (section 5.5.4 and 5.8); or
- Return to the main menu.

The next four subsections in this guide take you through the steps required to set up these four parameters: intensity, time, dose, and dwell.

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5.5.1 Setup #1: Intensity

Intensity The procedure that first measures and displays the maximum lamp module intensity available, measured in mW/cm², then allows you to set a desired intensity level and exposure time. Prior to setting up the intensity ensure that the light guide diameter setting matches that of the light guide being used (see section 5.9).

1. **Press** `Intensity:`.

```
Setup Parameters for Register X.....
Intensity: Time:  Dose:  Dwell:  MMenu:
```

2. **Follow the displayed instructions.**

```
Intensity setup. Insert light guide into
recepticle on front panel..      Cont:
```

```
BUSY.........Reading Intensity. DO NOT
remove light guide until setup completed
```

Both shutters will fully open, enabling the Novacure to measure the full available light output.
The Novacure's output intensity is measured at the light guide entrance, not at the light guide exit or radiometer.

Insert the light guide into the radiometer port as a safety precaution. Safely fixtured light guides, however, do not need to be repositioned.

3. Read and note the maximum available intensity as shown on the display and **press** `Cont:`.

```
Max Intensity Available: XXXXX mW/cm2
                          MMenu:  Cont:
```

4. Use the first three keys (`+10000`; `+1000`; and `+100`) to set up the desired intensity for the register. **Now press** `OK:`.

```
Desired Intensity:  Reg x=XXXXX mW/cm2
 +10000 +1000  +100   NextR:          OK:
```

It is impossible to select intensities higher than that available.
This displays the values you are entering.

By pressing the "NextR:" key, you can quickly cycle through all 4 registers and set-up each register's intensity value without having to go through the full procedure listed here. This is a time saving feature. Note: whichever register is set-up last will become the current active register once the "OK:" key is pressed.

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5. Use the first three keys (+10Secs; +1Sec; and +.1Sec) to set up the desired exposure time in seconds. **Now press** Min:.

```
Time=   XX Mins / XX>X Secs
 +10Secs: +1Sec: +.1Secs:   Min:     OK:
```

When you press Min: you toggle back to the minutes' parameters menu. You can then toggle back to the seconds' parameters menu by pressing Secs: until you have precisely defined your intensity time.

This menu enables you to set a time up to a maximum of 59 minutes, 59.9 seconds.

6. Use the first two keys (+10Mins; +1Min) to set up the desired exposure time for the register. **Now press** OK:.

```
Time=   XX Mins / XX.X Secs
+10Mins: +1Min:             Secs:     OK:
```

This menu will enable you to set an exposure time up to a maximum of 59 minutes 59.9 seconds.

7. Use the first three keys (+10Secs; +1Sec; and +.1Sec) to set up the maximum desired exposure time in seconds. **Now press** Min:

```
Max Time=   XX Mins / XX.X Secs
+10Secs: +1Sec: +.1Secs:   Min:       OK:
```

When you press Min: you toggle back to the minutes' parameters menu. You can then toggle back to the seconds' parameters menu by pressing Secs: until you have precisely defined your maximum intensity time.

This menu enables you to set a time up to a maximum of 59 minutes, 59.9 seconds.

8. Use the first two keys (+10Mins; +1Min) to set up the maximum desired exposure time for the register. **Now press** OK:

```
Max Time=    XX Mins / XX.X Secs
 +10Mins: +1Min:               Secs:   OK:
```

As output intensity decreases during normal operation, the Novacure automatically attempts to maintain user selected output energy levels by increasing exposure time up to its maximum time as set by max time in this menu. The Novacure will position the proportional shutter to it's final position at which time the ON/OFF shutter will close. Press Cont:
It is recommended that the Max Time be set to a minimum of 1.3 times the Exposure Time setting.

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What you can do from the Test/Run menu

```
I=XXXXX/XXXXXmW D=XXXXXmJ L=XXXXHr R=X
T=XX:XX.X  Dw=NNN Cont:   Run:   Abort:
```

- Press Cont: to move to the menu below
- Press Run to initiate a test cycle exposure. (Note that the dwell function is inoperative during this test cycle. Also note that if the mode of operation is set to any external source, the Run button is inoperative.)
- Press Abort: to interrupt any active cycle and move you to the menu below

What you can do after pressing `Cont:` or `Abort:` in the Test/Run menu

```
Set up is complete.
Retest: Set Up:       MMenu:
```

- Press Retest: to return to the test/run menu
- Press Set Up: to return to the set up parameter menu (Step 1)
- Press MMenu to return to the main menu.

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5.5.2 Setup #2: Exposure Time

Features to note The exposure time parameter is a mandatory input during both the intensity and dose set up. If the exposure times entered during the intensity and/or dose set up are acceptable, they do not need to be reentered here. The purpose of the exposure time menu selection is to provide the operator with an efficient way of changing exposure times only.

1. **Press** `Time:`.

```
Setup Parameters for Register X.....
Intensity: Time:  Dose:  Dwell:  MMenu:
```

2. Use the first three keys `(+10Secs; +1Sec; and +.1Sec)` to set up the desired exposure time in seconds. **Now press** `Min:`.

```
     Time=   XX Mins / XX.X Secs
+10Secs: +1Sec: +.1Secs:   Min:     OK:
```

This menu enables you to set a time up to a maximum of 59 minutes, 59.9 seconds.

When you press `Min:` you toggle back to the minutes' parameters menu. You can then toggle back to the seconds' parameters menu by pressing Secs: until you have precisely defined your intensity time.

3. Use the first two keys (`+10Mins`; `+1Min`) to set up the desired exposure time for the register. **Now press** `OK:`.

```
     Time=   XX Mins / XX.X Secs
+10Mins: +1Min:            Secs:     OK:
```

This menu will enable you to set an exposure time up to a maximum of 59 minutes 59.9 seconds.

4. Use the first three keys (`+10Secs`; `+1Sec`; and `+.1Sec`) to set up the maximum desired exposure time in seconds. **Now press** `Min:`.

```
Max Time=    XX Mins / XX.X Secs
+10Secs: +1Sec: +.1Secs:   Min:     OK:
```

5. Use the first two keys `(+10Mins; +1Min) to` set up the maximum desired exposure time for the register. **Now press** `OK:`.

```
Max Time=   XX Mins / XX.X Secs
+10Mins: +1Min:            Secs:     OK:
```

As output intensity decreases during normal operation, the Novacure automatically attempts to maintain user selected output energy levels by increasing exposure time up to its maximum time as set by max time in this menu. It is recommended that the Max Time be set to a minimum of 1.3 times the Exposure Time setting.

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What you can do from the Test/Run menu

```
I=XXXXX/XXXXXmW D=XXXXXmJ L=XXXXHr R=X
T=XX:XX.X  Dw=NNN Cont:   Run:   Abort:
```

- Press Cont: to move to the menu below
- Press Run to initiate a test cycle exposure. (Note that the dwell function is inoperative during this test cycle. Also note that if the mode of operation is set to any external source, the Run button is inoperative.)
- Press Abort: to interrupt any active cycle and move you to the menu below

What you can do after pressing `Cont:` or `Abort:` in the Test/Run menu

```
Set up is complete.
Retest:    Set Up:    MMenu:
```

- Press Retest: to return to the test/run menu
- Press Set Up: to return to the set up parameter menu (Step 1)
- Press MMenu to return to the main menu

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5.5.3 Setup #3: Dose

Features to note When you set a dose value, the Novacure automatically calculates and sets intensity and exposure time values that enable it to efficiently produce the desired dose. If you modify either the register's desired intensity or if the lamp module's maximum available intensity decreases, the Novacure automatically increases the exposure time to enable it to produce the desired dose. Similarly, if you modify the exposure time value, the Novacure will automatically calculate and set the necessary intensity needed to produce the desired dose. Any intensity or time value modified by the user which does not meet the maximum and minimum allowed values will not be accepted and must be re-entered. Note that if the mode of operation is set to "toggle" or "Extim", the Novacure cannot regulate the dose setting. Only the intensity will be regulated. See Sections 5.6 and 9.1 for more detail.

1. **Press** `Dose:`.

```
Setup Parameters for Register X.....
Intensity: Time:  Dose:  Dwell:  MMenu:
```

2. **Follow the displayed instructions.**

```
Dose setup. Insert light guide into
receptacle on front panel..      Cont:
```

Insert the light guide into the radiometer port as a safety precaution. Safely fixtured light guides, however, do not need to be repositioned.

```
BUSY.........Reading Intensity. DO NOT
remove light guide until setup completed
```

Both shutters fully open, enabling the Novacure to measure the full available light output.
The Novacure's output intensity is measured at the light guide entrance, not at the light guide exit or radiometer.

3. Read and note the maximum available intensity as shown on the display and **press** `Cont:`.

```
Max Intensity Available: XXXXX mW/cm2
                         MMenu:  Cont:
```

4. Use the first three keys `(+10000; +1000; and +100)` to set up the desired dose in mJoules/cm2.

```
Set Desired Dose:  XXXXX mJ/cm2
 +10000  +1000   +100    Joules:     OK:
```

If the required dose value is larger than 99,900 mJ, press `Joules:` and continue to step 5. Otherwise, skip to step 6 after pressing `OK:`.

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5. Use the first three keys (+10000; +1000; +100; and 10) to set up the desired dose in Joules/cm2. **Now press** mJoules,then **press** OK:.

When you press mJoules: you toggle to the mJoules' parameters menu. You can then toggle back to the Joules' parameters menu by pressing mJoules: until you have precisely defined your dose. When you toggle between mJoules and Joules the display will show 00000J/cm2 if the value was entered in the mJoules menu. Toggling back to the menu in which the value was entered, will once again show the entered value.

```
Set Desired Dose:  XXXXX J/cm2
 +10000  +1000   +100 +10  mJoules:
```

6. Use the first three keys (+10Secs; +1Sec; and +.1Sec) to set up the desired exposure time in seconds. **Now press** Min:.

```
     Time=   XX Mins / XX.X Secs
 +10Secs: +1Sec: +.1Secs:   Min:     OK:
```

This menu enables you to set a time up to a maximum of 59 minutes, 59.9 seconds.

When you press Min: you toggle back to the minutes' parameters menu. You can then toggle back to the seconds' parameters menu by pressing Secs: until you have precisely defined your intensity time.

7. Use the first two keys (+10Mins; +1Min) to set up the desired exposure time for the register. **Now press** OK:.

```
  Time=   XX Mins / XX.X Secs
 +10Mins: +1Min:           Secs:     OK:
```

This menu will enable you to set an exposure time up to a maximum of 59 minutes.

It is impossible to enter a time that is lower than that required to achieve the desired dose.

8. Use the first three keys (+10Secs; +1Sec; and +.1Sec) to set up the maximum desired exposure time in seconds. **Now press** Min:.

```
Max Time=    XX Mins / XX.X Secs
 +10Secs: +1Sec: +.1Secs:   Min:     OK:
```

9. Use the first two keys (+10Mins; +1Min) to set up the maximum desired exposure time for the register. **Now press** OK:.

```
Max Time=   XX Mins / XX.X Secs
+10Mins: +1Min:           Secs:     OK:
```

As output intensity decreases, the Novacure automatically attempts to maintain user defined output energy levels by increasing exposure time up to its maximum time in seconds as set by max time.
It is recommended that the Max Time be set to a minimum of 1.3 times the Exposure Time setting.

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What you can do from the Test/Run menu

```
I=XXXXX/XXXXXmW D=XXXXXmJ L=XXXXHr R=X
T=XX:XX.X  Dw=NNN Cont:   Run:   Abort:
```

- Press Cont: to move to the menu below
- Press Run to initiate a test cycle exposure. (Note that the dwell function is inoperative during this test cycle. Also note that if the mode of operation is set to any external source, the Run button is inoperative.)
- Press Abort: to interrupt any active cycle and move you to the menu below

What you can do after pressing `Cont:` or `Abort:` in the Test/Run menu

```
Set up is complete.
Retest: Set Up:  MMenu:
```

- Press Retest: to return to the test/run menu
- Press Set Up: to return to the set up parameter menu (Step 1)
- Press MMenu to return to the main menu.

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5.5.4 Setup #4: Dwell Interval

Dwell A user defined time value that enables the Novacure to produce repeated exposures with a defined time interval between exposure cycles. See also section 5.8, StepCure.

1. **Press** `Dwell:`.

```
Setup Parameters for Register X.....
Intensity: Time:  Dose:  Dwell:  MMenu:
```

2. This menu lets you enable or disable the dwell mode. To enable the dwell mode **press** `Enable:`. To disable the dwell mode **press** `Disable:`. If the StepCure function was activated all registers will have their respective dwell modes activated.

Caution: Turning dwell off with Step Cure activated will result in exposure inaccuracies and error messages.

```
Dwell is.............Enabled
Enable:   Disable:                Cont:
```

3. **Press** `Cont:`.

When dwell is enabled you are prompted to enter a dwell time as described in the steps below.

When dwell is disabled you return to the main set up menu.

4. Use the first three keys `(+10Secs; +1Sec; and +.1Sec)` to set up the desired dwell time in seconds. **Now press** `Min:`.

```
Dwell  = 00 Mins / 00.0 Secs
 +10Secs: +1Sec: +.1Secs:    Min:    OK:
```

This menu enables you to set a time up to a maximum of 59 minutes, 59.9 seconds.

The minimum allowed dwell time is .3 seconds.

5. Use the first two keys `(+10Mins; +1Min)` to set up the desired dwell time in minutes. **Now press** `OK:`.

```
Dwell  = 00 Mins / 00.00 Secs
+10Mins: +1Min:           Secs:      OK:
```

6. **Press** `MMenu:`.

```
Setup Parameters for Register X.....
Intensity: Time:  Dose:  Dwell:  MMenu:
```


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5.6 Choosing mode of operation

Mode Of Operation Allows the user to select the source of the exposure trigger. (See section 9.3 for I/O signal descriptions.)

Keypad (keypad:**)**	Run a complete cure cycle when the Run: keypad is pressed
External Control Mode (`External:`**)**	Run a complete cure cycle with a single trigger from an external source (footpedal, I/O).
External Toggle Mode (`Toggle:`**)**	Start the cure cycle with a single trigger from an external source (footpedal, I/O) and stop the cure cycle with a subsequent trigger.
External Time Mode (`Extim:`**)**	Start the cure cycle by sending a continuous signal from an external source (footpedal, I/O) and stop the cure cycle when the signal is stopped.

Note: *Using External mode automatically regulates both Time and Intensity. On the other hand, using Toggle or External Time (Extim) mode regulates Intensity only; the user manually regulates Time.*

1. **Move to the first set up menu. See section 5.3.**

```
Set Up.....(1)
M-Op: Exposure: Passwrd: More: MMenu:
```

2. **Press** `M-Op:`.

```
Mode of Operation= NNNNNNNN
Keypad:  External: Toggle:Extim: Cont:
```

   The Mode of Operation menu appears

3. The top line displays the current mode of operation
4. Press the key for the mode of operation to be selected. It will be displayed on the top line.
5. Press **Cont** to return to the first set up menu and then **MMenu** to return to the main menu.

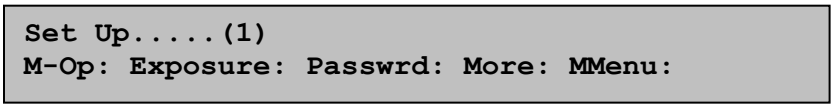
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5.7 Choosing a password

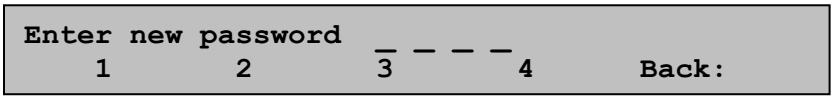
Password A user defined four digit number composed of any combination of the numbers 1, 2, 3, and 4 that must be entered to modify any setup settings. The factory programmed default password is 1111. This makes it quicker and easier to access the setup menus. However it does also make it easier for unauthorized people to modify these parameters. The following procedure enables you to set a unique four-number password.

1. Move to the first set up menu. (See section 5.3).

2. Press Passwrd:.

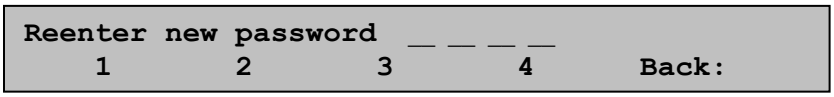


3. Use the keypad to key in a four number series using any combination of the numbers 1, 2, 3, **and** 4.



Each time you press a number, the screen displays an "X" to mirror each keystroke and reduce the chance of someone noting the code.

4. When the fourth password digit is keyed in, the Novacure automatically prompts you to reenter the sequence for verification. Key in the four digit password.



An error message appears if the new password is re-entered incorrectly. By pressing **Cont**: after seeing the error message, the new password is not recorded and you are returned to the main menu.

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5.8 Setting up StepCure

StepCure®. Allows the user to program in an exposure during which the exposure time, intensity and dwell times are independently varied as per the pre-programmed register settings. A StepCure® cycle will deliver timed exposures as per the settings contained in each of the registers, including the dwell setting. Once the last exposure has been delivered, which is always, by default, register 4, the step counter will return to the first register from which a StepCure® has been initiated.

For instance, from the Run menu, if StepCure® is activated while the current register is 2, a 3 stage StepCure® cycle will be initiated as follows. The settings of register 2 will be used for the first step of the StepCure® exposure cycle. A waiting period as per register 2 dwell setting will be initiated. The settings of register 3 will be used for the second step of the StepCure® exposure cycle. A waiting period as per register 3 dwell setting will be initiated. The settings of register 4 will be used for the third (and last) step of the StepCure® exposure cycle. Once the shutter has closed, the register counter (step counter) will revert back to register 2. A four stage StepCure® cycle can be initiated by activating a StepCure® exposure cycle, from the Run menu, while register 1 is the current/active register.

Setting up a StepCure® exposure cycle requires the following: activate StepCure® (steps 1 through 4) then set-up as many registers (intensity, exposure time, max. exposure time and dwell time) as there are steps in the StepCure® exposure cycle.

1. Move to the first set up menu. See section 5.3.

2. **Press** `More:`

```
Set Up.....(1)
M-Op: Exposure: Passwrd: More: MMenu:
```

3. **Press** `StepCure:`

```
Set Up.......(2)
ClkCal:  LtGd:  StepCure:    More:   Back:
```

4. **Press** `Enable:` to turn the StepCure® feature on. **Press** Disable: to turn the StepCure® feature off.

```
Step Cure feature is: xxxxxxxx
Enable: Disable:                  OK:
```

Once StepCure® has been enabled, the dwell mode for all the registers will be activated. If StepCure® has been turned off, the dwell mode for all of the registers will also be turned off. Although dwell mode operation is slightly different in StepCure® mode, see section 5.5.4 for more information on dwell mode. In StepCure® mode, dwell is defined as the period of time between each of the steps/exposures in a StepCure™ exposure cycle. When StepCure® is off, dwell is defined as the period of time between each identical exposure using the same register.

5. Press `OK:`

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5.9 Selecting the correct light guide diameter

Light Guide Diameter Selection. Allows the user to select one of 10 standard light guide diameters so that the Novacure can properly calculate the irradiance settings associated with the user's light guide and application.

1. Move to the first set up menu. See section 5.3.
2. **Press** `More:`

```
Set Up.....(1)
M-Op: Exposure: Passwrd: More: MMenu:
```

3. **Press** `LtGd:`

```
Set Up.......(2)
ClkCal:  LtGd:  StepCure:    More:   Back:
```

4. The default light guide diameter is 5mm. Press the "Inc" key to change the selected light guide diameter to a larger diameter. Press the "Dec" key to reduce the selected light guide diameter.

```
Light Guide Diameter=   mm
Range=1 to 10mm.  Inc     Dec      OK:
```

5. Press **OK**

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5.10 Turning the History data saving On/Off

History data savings: The Novacure unit has the ability to monitor its functionality with system reporting. The Novacure reports internal calibrations, accumulated hours on the bulb, intensity requested and the number of exposures, by date and time. The data is saved in the unit memory, where it can then be downloaded to a PC.

1. Move to the first set up menu. See section 5.3.
2. **Press** `More:`

```
Set Up.....(1)
M-Op: Exposure: Passwrd: More: MMenu:
```

3. **Press** `More:`

```
Set Up.......(2)
ClkCal:  LtGd:  StepCure:    More:   Back:
```

4. The display shows if the History data saving feature is on (**`HistOn`**) or off (**`HistOff:`**).

```
Set Up.......(3)
HistXX:   XlifeXXX:                  Back:
```

5. Press the keypad below **`HistXX:`** to change the state of the history data saving feature.

When the History function is on, the data must be periodically downloaded to a PC, when the unit memory is full or the saved data on the unit will be lost. The message “Memory almost full. Do a history download or data will be lost” will appear when a download is necessary.
When the History function is off, no data is stored on the unit memory and periodical downloads are not required.

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5.11 Turn Extended Life feature On/Off

Extended Life: The Novacure has the ability to decrease the power to the lamp, resulting in extended lamp life. The initial max. intensity available from the lamp will be lower if the extended life feature is activated.

1. Move to the first set up menu. See section 5.3.
2. **Press** `More:`

```
Set Up.....(1)
M-Op: Exposure: Passwrd: More: MMenu:
```

3. **Press** `More:`

```
Set Up.......(2)
ClkCal:  LtGd:  StepCure:    More:   Back:
```

4. The display shows if the extended life feature is on (**`XlifeOn`**) or off (**`XlifeOff:`**).

```
Set Up.......(3)
HistXX:   XlifeXXX:                  Back:
```

5. Press the keypad below **`XlifeXX:`** to change the state of the Long life feature.

Note: *when changing the state of the extended life feature (XlifeXX), it is necessary to perform a calibration before running a register to insure accurate intensity output*.

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6 Using the Radiometer

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Radiometer Measures the intensity of the Novacure or other spot cure systems in mW/cm^2. The value displayed is directly proportional and dependant on the light guide diameter setting. See section 5.9 for more detail.

The EXFO radiometer incorporates a proprietary detector system to accurately measures irradiance over the full 250 – 600nm bandwidth for unmatched functionality. The proprietary optical interface virtually eliminates beam profile dependence. The radiometer calibration is traceable to NIST, and it is recommended that the radiometer be returned to EXFO Photonic Solutions for calibration every six months.

1. Move to the main menu.

There are a number of menus that give you the `MMenu:` (main menu) prompt. If your current menu does not show the prompt, continue through its commands until it appears. Now press `MMenu:`.

2. Press `Radiomtr:`.

```
Main Menu
Set Up:  Run: Radiometr: Stats: Calibrt:
```

3a. Press `Max:` to measure the Novacure's maximum output intensity.

```
Measurement Method/Source=NNNNNNNN
Max:  Other:  Current:            Cont:
```

Display reads `Max:`.

3b. Press `Other:` to measure the output intensity of any other spot cure system.

```
Measurement Method/Source=NNNNNNNN
Max:  Other:  Current:            Cont:
```

Display reads `Other:`.

The ON/OFF shutter will not open during the intensity display action.

3c. Press `Current:` to measure the regulated output intensity of the Novacure as per the intensity setting in the current active register.

```
Measurement Method/Source=NNNNNNNN
Max:  Other:  Current:            Cont:
```

Display reads `Current:`

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4. **Press** `Cont:`.

5. **Follow the displayed instructions.**

```
Insert light guide into receptacle on front
panel for intensity reading...OK:
```

This message is displayed if the Max or Current mode has been selected.

6. **Press** `OK:`.

```
Intensity=XXXXX mW/cm2
Light Source=Current          Cont:
```

This displays the regulated light intensity reading of your light source in real time.

7. **Press** `Cont:` to stop the radiometer function.

The shutter will close if it was previously open.

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7 Calibrating the Novacure

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Calibrate Calibration measures the light output at the end of the light guide, compares it to the light entering the light guide and adjusts the feedback loop accordingly.

Note to Users The Novacure should be calibrated at least once for each eight hours of use. The unit should also be calibrated each time a light guide is changed, the lamp module is changed, or the long life feature is changed.

Prior to continuing, ensure that the light guide diameter setting matches that of the light guide being used. See section 5.9 for more detail.

1. Move to the main menu.

There are a number of menus that give you the `MMenu:` (main menu) prompt. If your current menu does not show the prompt, continue through its commands until it appears. **Now press** `MMenu:`.

2. Press `Calibrt:`.

```
Main Menu
Set Up:  Run: Radiometr: Stats:  Calibrt:
```

3. Insert the light guide into the radiometer port and press `Cont:`.

```
Calibrate: Insert light guide into re-
cepticle on front panel. Skip:  Cont:
```

You will hear a click. This is the sound of the on/off shutter opening that begins the automatic calibration sequence.

If required the calibration routine can be bypassed by pressing the SKIP button. EXFO Photonic Solutions Inc. does not recommend this procedure as system accuracy will be compromised.

4. Wait for the calibration to end.

```
.............BUSY.............
Calibrating, DO NOT remove light guide
```

Leave the light guide in place until you hear another click as the shutter closes again to end the calibration. The completion of the automatic calibration procedure returns you to the main menu.

If the light guide is removed from the light guide retainer or the radiometer port during the calibration sequence, intensity inaccuracies will occur. Removing the light guide from the light guide retainer will cause the shutter to close as a safety precaution. However, removing the light guide from the radiometer port **will not** close the shutter and may place the operator at risk of UV exposure.

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8 Data Downloading

8.1 Hardware Requirements

8.2 Installing Opto Link 2100

8.3 When you should download data

8.4 Performing a history download

8.5 Clearing the history data from the unit

8.6 Turning On/Off saving the history data

8.7 Typical history data download

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8.1 Hardware Requirements

The following hardware is required for using the History download feature:

- A PC or notebook computer with an available 9-pin RS-232 serial port
- A 9-pin male to 9-pin female, one-to-one serial cable

8.1.1 Opto Link 2100 min. Computer Configuration

- 300+ MHz recommended Pentium or equivalent processor
- 32 MB RAM
- 10 MB available storage for software installation
- 20 MB additional storage (suggested) for your data files
- SVGA video 800 x 600 resolution, 8-bit color (16-bit color or better recommended)
- Available RS-232 COM port

8.1.2 Operating System

Microsoft Windows® 95, 98, 98SE, NT, 2000

8.2 Installing Opto Link 2100

Perform the following actions to install Opto Link 2100.

Note: *If there is already a version of Opto Link 2100 installed, it must be uninstalled before the following steps. Go to Start> Control panel > Add/remove programs to uninstall Opto Link 2100*

1. Turn on the PC to be used with the Novacure system. From the main Windows desktop, shut down any other Windows programs currently in use.
2. Insert the Opto Link CD into the CD-ROM drive.
3. Click the **Start**  button on the Windows taskbar and select **Run** from the Start menu group.
4. In the **Run** dialog, type `#:\setup` (where "#" is the letter used to designate the CD-ROM drive on your computer). For example, if your CD-ROM drive is designated as `E:`, type `E:\setup`.
   The setup window appears.
5. To install Opto Link 2100 to the Opto Link 2100 directory on your computer click **Finish**.
6. Click **Next** and **Next** again when the list of existing folders appears.
7. Click **Next** on the Start Copying Files dialog to install Opto Link 2100.
8. Click **OK** when the "Opto Link 2100 installation successful" message appears.

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8.2.1 Creating a Shortcut to Opto Link 2100

1. From the Windows desktop double-click **My Computer**.
2. Double-click the **C:** drive.
3. Double-click the Novacure directory name where Opto Link 2100 is located
4. Right click the **Opto Link 2100.exe** file.
5. Click on Create Shortcut
6. A shortcut to Opto Link 2100 appears on your Windows desktop.



7. Click and drag it onto your Windows desktop

8.2.2 Launching Opto Link 2100

To launch Opto Link 2100:

1. Double-click on the shortcut icon

or

2. Click the **Start**  button on the Windows taskbar.
3. Select Programs > Opto Link 2100.



Opto Link 2100 screen appears

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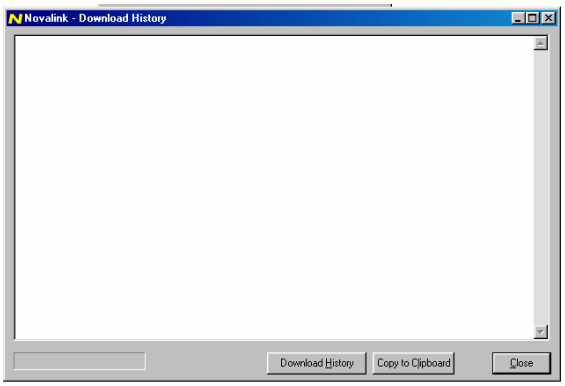
8.3 When you should download data

Data downloading must be done when the "`Memory almost full. Do a history download or data will be lost`" message appears, or once for each 1000 hours operating time. If you ignore the error message, the Novacure continues writing new performance history data over the previous history data. The previous data is then no longer accessible.

8.4 Performing a History Download

1. Turn power on to the Novacure unit, (if it is not already on).
2. Launch the Opto Link 2100 Software.
3. Connect the 9-pin serial cable between the 9-pin socket connector of the Novacure unit and the COM Port of the PC if it is not already connected.
4. Under Communication, click on Connect. The connected LED will light when a connection is made.
5. Under Data Logging, click on **Download History**.

   The download History screen appears



6. Click on Download History.
7. The Software will begin downloading the history information from the unit. Status bars will show the progress at the bottom left corner. When the downloading is finished, a message box will appear.
8. Click OK to clear the message box.
9. Highlight the data that you want to save. Click on Copy to Clipboard to save the information to the clipboard. The history data can now be pasted from the clipboard into another software.
10. Click on Print to print the data to the selected printer.
11. Click on Close to close the download history screen
12. Click on Disconnect to return user access to the Novacure unit.
13. Click on Exit to exit Opto Link 2100 software.

Note: *The 9-pin serial cable can remain connected to the Novacure unit, while Opto Link 2100 software is not active to make future history downloads more convenient.*

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8.5 Clearing the History data from the Unit

If you would like to clear the history data from the Novacure unit's memory, without saving the data:

1. Follow steps 1 to 3 from section 8.4 Performing a History download
2. Under data logging, click on Clear History. A warning message will appear that you are about to clear the history data
3. Click OK. The history data on the unit's memory will be cleared
4. Click on Disconnect to return user access to the Novacure unit.
5. Click on Exit to exit Opto Link 2100 software

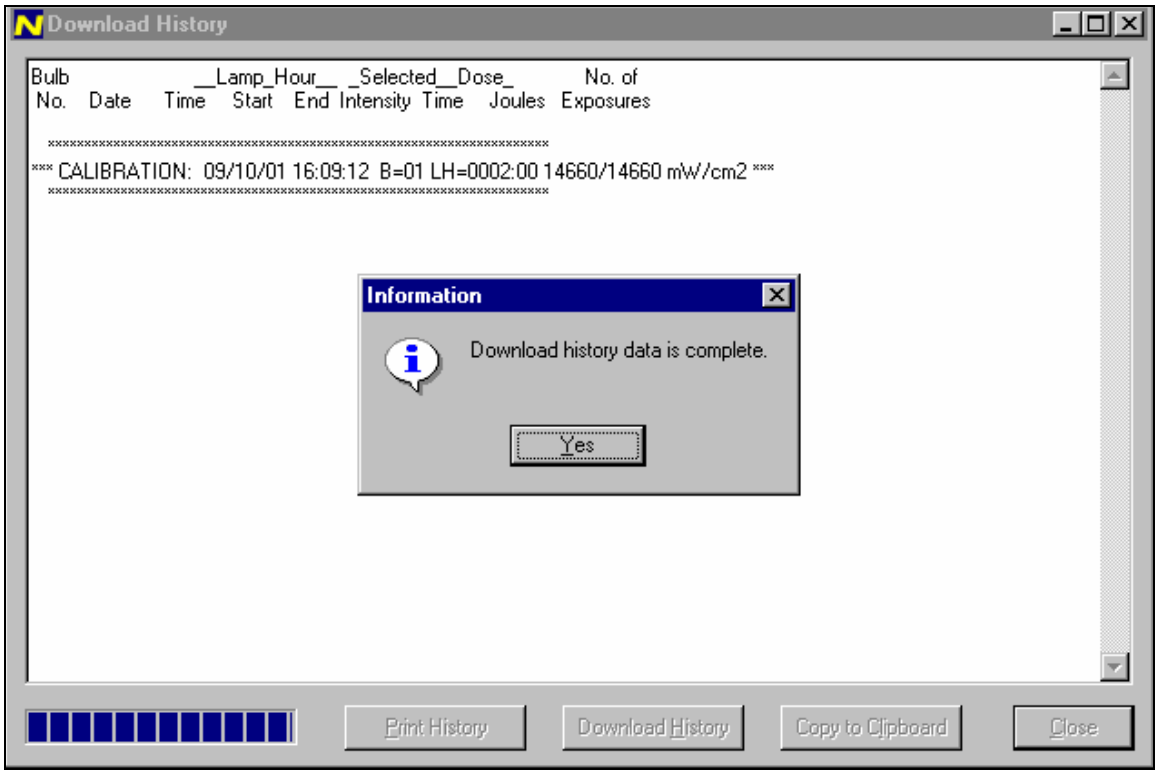
8.6 Turning on/off saving the history data

If you do not want to maintain a system report through the history feature, it is possible to turn off the saving of the history data by the Novacure unit. Turning off the History download will eliminate the alarm and message to perform the history download.

1. Follow steps 1 to 5 from 1.3 Performing a History download (section 8.4)
2. Under data logging, the history logging button will show the status of the feature. If the LED is lit, the history data is being saved on the unit.
3. Click on the history logging button to turn it off. Click on the history logging button again to turn the feature back on.
4. Click on Disconnect to return user access to the Novacure unit.
5. Click on Exit to exit Opto Link 2100 software.

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8.7 Typical history data download



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9 Interfacing with the Novacure

9.1 Connection options

9.2 Input and output signals

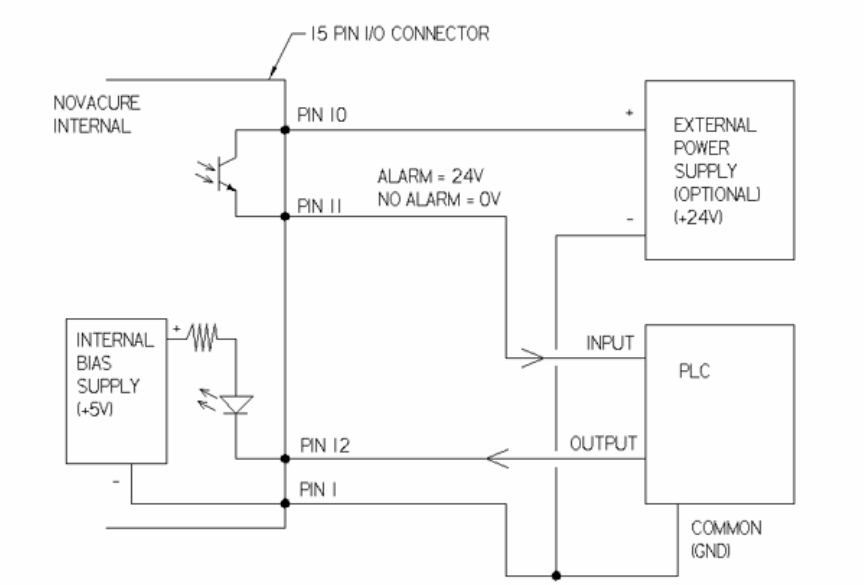
9.3 Signal descriptions

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9.1 Connection options

The data downloading connector (RS-232), a D-Sub 9-position socket can be accessed via a standard 9 pin (one to one) serial cable. The other end can be connected to any free serial port on the PC or laptop, which is to be used for interfacing. (see Section 8).

All of the input and output signals are available on the (High-Density) HD D-Sub 15 pin male connector. These signals are electrically isolated from each other and from the internal Novacure electronics through the use of optocouplers. The input side of the optocoupler contains a photodiode while the output contains an NPN transistor. All of the inputs have an internal bias supply (+5V) which removes the need for an external power supply as required on older models. The input signals can be utilized/activated by connecting the appropriate input signal to pin 1 of the 15 pin I/O connector. Connections can be made via a transistor, relay, switch, optocoupler or any other electromechanical device. See the diagram below for one method of connection.



The exception to the isolated nature of the I/O signals is the intensity monitor output. This analog output is directly connected to the electronics of the Novacure. For this reason, care must be taken not to introduce ground noise, ground loops or otherwise inject noise into the Novacure electronics.

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9.2 Input and output signals

Two connectors located on the rear panel of the Novacure contain all of the I/O signals required to properly interface with the Novacure. See the table located below for each signal and its location.

PIN NO.	SIGNAL NAME
1	N/C
2	RS232 transmit
3	RS232 receive
4	DTR (Data Terminal Ready)
5	RS232 GND
6	N/C
7	N/C
8	N/C
9	N/C

The auxiliary I/O, 4 position circular connector, has the following pin out:

PIN NO.	SIGNAL NAME
1	0 to +5VDC (positive signal)
2	Common (GND)
3	Shutter Interlock input (positive)
4	Shutter Interlock input (common)

A shielded cable is required for use with this port.

Note: The mating 4 position connector can be purchased from EXFO Photonic Solutions Inc. (p/n 020-00474).

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The I/O signal connector, the HD D-Sub 15 pin male, has the following pin-out:

PIN NO.	SIGNAL NAME	NOTES
1	Common (GND)	Return for input signals
2	Trigger Input	Momentary contact, active low
3	Client Status Output, positive	Collector of NPN transistor, output side of optocoupler
4	Client Status Output, common	Emitter of NPN transistor, output side of optocoupler
5	Shutter Position Indicator Output, positive	Collector of NPN transistor, output side of optocoupler
6	Shutter Position Indicator Output, negative	Emitter of NPN transistor, output side of optocoupler
7	Lamp ON/OFF Input	Continuous active low input required to keep lamp OFF
8	Calibrate Input	Momentary contact, active low
9	Register Increment Input	Momentary contact, active low
10	Alarm Output, positive	Collector of NPN transistor, output side of optocoupler
11	Alarm Output, negative	Emitter of NPN transistor, output side of optocoupler
12	Alarm Clear Input	Momentary contact, active low
13	Remote Power Down Input	Continuous active low input required to keep unit OFF
14	Remote Power Down Status Output, positive	Collector of NPN transistor, output side of optocoupler
15	Remote Power Down Status Output negative	Emitter of NPN transistor, output side of optocoupler

A shielded cable is required for use with this port.

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The specifications for the input and output signals are as follows:

Output Signals:

>polarized type:	NPN transistor (output side of optocoupler)
>maximum voltage withstand capability (V_{ce}):	30VDC
>maximum carry current:	10mA

The output signals are accessible on the transistor output of each optocoupler. By providing access to both the collector (+) and the emitter (-) separately for each signal, the user can use each output as an active high or active low signal thereby increasing the flexibility of the Novacure.

Input Signals:

>polarized type:	photo-diode, cathode side
>logical low time, for momentary signals:	40mS, minimum
>input (sink) current for each input	5mA
>output voltage, open circuit	+5V (max)

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9.3 Signal descriptions

9.3.1 D-Sub 9-position socket connector

Connector D-Sub 9-position socket, pins 1 through 9: *RS232 interface*. (Note: Only pins 1 thru 4 are actually utilized)
This connector is to be connected to any free serial port of the (laptop) computer, which is to be used for downloading the history information contained within the Novacure. Any standard 9 pin serial cable can be used. See section 8 for data downloading procedures.

9.3.2 HD D-Sub 15 pin male connector

Connector HD D-Sub 15 pin male, pin 1: *common GND*
This pin is used as a return for the inputs. Tying any of the inputs to this pin will activate that input/function.

Connector HD D-Sub 15 pin male, pin 2: *remote trigger input*
This input is a zero voltage type of input. A good (true) activation signal could be achieved when this input signal is momentarily pulled low to pin 1. Once the Novacure is set-up according to the instructions in Section 5.6, this signal can be used to initiate an exposure, open the shutter or close the shutter.

Connector HD D-Sub 15 pin male, pins 3 and 4: *client status line*
This output is used to notify the user (and/or any intelligent equipment connected to the Novacure) of any time periods where the Novacure unit is already in use, therefore, cannot initiate a dose as per the profile. This may occur at any time that the Novacure is busy, in the middle of a dose or otherwise unable to comply with a request for dose. The output signal, accessible through pins 3 and 4, is ON (NPN transistor is ON) when the output dose does not fall within the programmed parameters or when the Novacure is otherwise busy. The optocoupler (NPN transistor) is OFF at all other times.

Connector HD D-Sub 15 pin male, pins 5 and 6: *shutter position indicator output*
This signal gives an indication of ON/OFF shutter's position. The signal, accessible through pins 5 and 6, is ON (NPN transistor is ON) when the shutter is open. The optocoupler (NPN transistor) is OFF whenever the shutter is closed.

Connector HD D-Sub 15 pin male, pin 7: *lamp control input*
This signal can be used to control the operating state of the lamp. If the pin is left "open" the Novacure will determine the operating state of the lamp. If the pin is connected to the common (GND) of the external power source the lamp will be turned off and remain off until the pin is disconnected (from the common). Caution must be exercised when using this signal since releasing this line/pin shortly after it has been pulled low (to turn the lamp off) will result in the Novacure attempting to strike a hot lamp. This is detrimental to the lamp and will potentially shorten its lifetime.

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Connector HD D-Sub 15 pin male, pin 8: *calibrate input*
This input signal can be used to initiate a calibration procedure remotely without the need to use the front panel controls. (See also Section 7 for additional information). This input is a zero voltage type of input. A good (true) activation signal could be achieved when this input signal is momentarily pulled low to the common (GND) of the external power source via the method(s) described in Section 9.1.

Connector HD D-Sub 15 pin male, pin 9: *register increment input*
This signal allows the user or any intelligent connected equipment to remotely cycle through all of the available registers (which are pre-set by the user). This input is a zero voltage type of input. A good (true) activation signal could be achieved when this input signal is momentarily pulled low to the common (GND) of the external power source via the method(s) described in Section 9.1. When an activation signal is received by the Novacure, the current register number will increment to the next one (or reset to the first register if the previous register was already at the 4th position).

Connector HD D-Sub 15 pin male, pins 9 and 2: *set Novacure at register 1 inputs*
This feature allows the user to set the Novacure at a known register: register 1. First activate the register increment input pin 9 (by pulling it low), assert it low, then activate the "remote trigger" input pin 2 (by pulling it low). It doesn't matter how long you assert each line or which one you release first, as long as the sequence is as per the above. The current register on the Novacure unit will now be register 1.

Connector HD D-Sub 15 pin male, pins 10 and 11: *alarm output*
This signal provides an indication that some part of the user settings is outside of the capabilities of the system as it is currently operating or of some type of system parameter “out of tolerance” problem. Examples would be lamp failure, lamp intensity too low, shutter failure, inadequate maximum exposure time setting, etc. The output signal, accessible through pins 10 and 11, is ON (NPN transistor is ON) when an alarm
condition is present. The signal pulses between an ON state and an OFF state during an alarm condition at the same repetition rate as the audible alarm indicator. The optocoupler (NPN transistor) is OFF at all other times.

Connector HD D-Sub 15 pin male, pin 12: *alarm clear input*
This signal allows the user to clear the alarm state of the unit. Accompanied with an alarm signal (see above) would be an audible alarm as well as some type of flashing message on the display. In addition to clearing the output alarm signal this input signal would allow the user to shut down the audible alarm as well as clear the flashing message. This input is a zero voltage type of input. A good (true) activation signal could be achieved when this input signal is momentarily pulled low to the common (GND) of the external power source via the method(s) described in Section 9.1. When an activation signal is received, the alarm state of the Novacure will be cleared.

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Connector HD D-Sub 15 pin male, pin 13: *remote power ON/OFF input*
This signal can be used to initiate the power down sequence during which the lamp is shut off, allowed to cool down, then AC power is automatically switched OFF for the entire unit. This input is a zero voltage type of input. This signal is accessible after AC has been applied, the AC mains switch has been switched ON and the Novacure has warmed up and reached the main menu. The Novacure will go through it's power down sequence when this input signal is pulled low (and held low) to the common (GND) of the external power source. In order for the unit to become operational once again this signal must be disconnected from common. This signal bypasses the operation of the AC mains switch provided that the AC mains switch is in the ON position.

Connector HD D-Sub 15 pin male, pins 14 and 15: *remote power ON/OFF signal status output*
This signal provides a feedback to any remotely connected equipment on the power status of the Novacure. This signal, which is accessible through pins 14 and 15, is ON (NPN transistor is ON) while the Novacure is powered up and will remain ON until the lamp has turned OFF, cooled down and the unit has automatically shut OFF. Once the Novacure has been powered down, either locally or remotely, and has completely shut down, this signal (NPN transistor in the optocoupler) will switch OFF.

9.3.3 4 position circular connector

4 position circular connector pins 1 and 2: *intensity monitor output*
This signal provides an analog output voltage, which represents the optical output intensity exiting the Novacure's light guide port. The signal ranges from 0 to +5VDC over the range of 0 to 20,000mWcm^2-output intensity. The signal is capable of driving loads with up to 1mA but ideally would be connected to a high impedance instrument (>10Kohms). The relationship between output voltage and optical output intensity is 250mV per 1000mw/cm^2 when using a 5mm light guide. The intensity monitor's common (GND) is located on pin 2 of the connector while the positive is located on pin 1.

4 position circular connector pins 3 and 4: *shutter interlock input*
This signal can be used to immediately close the shutter on the Novacure. This is an active high signal, whereby biasing this input with a voltage (from +5V to +24V) will prevent the shutter from opening or close the shutter if it is already open. The positive input is on pin 3 and the negative (common) input is on pin 4. Leaving this signal open will result in normal unit operation.

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10 Error Messages

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The Novacure is designed to advise/warn you when it detects a procedural or operational problem. The following messages appear on the LCD when the appropriate conditions are met. In some cases, as indicated below, an alarm sounds and a message appears on the LCD. These messages serve to warn you of an operational problem and will stop any active exposures. The messages may suggest a possible remedy, which may be overridden by depressing the appropriate key.

```
Dose not attainable. Change time or energy
levels.                              Cont:
```

Possible Causes	**Solution**
Lamp module output intensity is too low	See section 12.5
Maximum exposure time setting is too low	Increase the Maximum Exposure time setting section 5.5.2
Dose setting is inadequate	Adjust the dose set-up: section 5.5.3
Intensity setting is too high	Adjust the intensity set-up: section 5.5.1
Light guide diameter setting is incorrect	Check setting as per section 5.9
Dwell time setting in Step Cure is too small	Increase dwell time between each step in StepCure™. See section 5.8.

The Novacure will always attempt to regulate the output dose (Watt Seconds = Joules) by adjusting either the intensity or the exposure time. Once the intensity can no longer be adjusted due to lamp module limitations, the Novacure will attempt to increase the exposure time up to the maximum time setting. Once the maximum exposure time setting becomes the limiting factor, an alarm will be generated.

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```
Output intensity is too low. Check the light
guide.                          Cont:
```

Possible Causes	Solution
Light guide has poor transmission qualities due to age or physical damage	Replace the light guide with a new one
Light guide has adhesive or other matter cured onto it's emitting end	Clean the light guide emitting end with an appropriate cleaning kit/apparatus
The light guide was not inserted into the radiometer port during the calibration procedure	Insert the light guide into the radiometer port and calibrate the Novacure, see section 7
The shutter interlock signal is active.	See section 9.3.3

During calibration the Novacure compares the energy levels entering the light guide with the energy levels exiting the light guide. If these two values are very different, an alarm will be generated.

```
Memory almost full. Do a history down-
load or data will be lost.          Cont:
```

Possible Causes	Solution
A history download was not done the last time the lamp was changed	Do a history download, see section 8

Note: *History download feature can be turned off to avoid this error message if the feature is not being used. See section 5.10*

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```
Lamp intensity is too low. Check the lamp.
Cont:
```

Possible Causes	Solution
The lamp module is not generating sufficient light output (lamp module is too old)	Replace the lamp with a new one as per section 3.4
The lamp module failed to light	See section 12.3
The proportional shutter is stuck in the closed position	Install a new lamp drawer as per section 11.6 or return the unit to EXFO Photonic Solutions Inc. as per section 15.2
The lamp module was installed incorrectly	See section 3.4 for correct installation procedure. See also section 12.3, 12.5

```
System Fault! Shutter closed prematurely
                                        OK:
```

Possible Causes	Solution
The light guide was not inserted properly into the light guide port	See section 3.6 and 12.1
The light guide was removed or shifted during exposure	Secure the light guide such that no inadvertent movement is allowed
The shutter movement is sluggish	See section 15.2
The light guide detection microswitch requires calibration / service	See section 15.2
The shutter interlock signal is active.	See section 9.3.3

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```
System Fault! Shutter opened prematurely
                                        OK:
```

Possible Causes	Solution
The light guide was installed incorrectly	See section 3.7 and 12.1 and 12.4.
The shutter movement is sluggish or the shutter is stuck open	See section 15.2
The light guide detection microswitch requires calibration / service	See section 15.2

```
Too soon for lamp out.  Waiting: NNN%
                              OUT NOW!:
```

Possible Causes	Solution
Lamp has not been ON long enough	Increase the time between firing the lamp and turning off the lamp
The ambient room temperature is less than 10°C	If feasible, raise the room temperature
The Novacure has an excessive amount of forced air flow (such as in a clean room environment)	Move the Novacure into a position where the air flow is less pronounced

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```
Too soon to strike arc. Waiting: NNN%
Waiting for lamp to cool.
```

Possible Causes	Solution
The lamp is too hot (perhaps the cool down mode was bypassed during an earlier shut-down)	Let the Novacure control the lamp cool down and increase the interval between shutting down and powering up the Novacure
The fan is running too slow or is otherwise defective	See section 12.8

```
Lamp Error. Check lamp connection and lamp drawer
Turn off AC power to cont
```

Possible Causes	Solution
The lamp is not installed correctly	Check lamp installation. See sections 3.4, 12.3 and 12.5
The lamp drawer is not installed correctly	See section 3.4, 11.6
The lamp drawer is defective	Install a new lamp module. See section 3.4

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Warning: Routine Maintenance and Service is to be performed only by Qualified Service Personnel.

11 Maintenance and Service

11.1 Routine care and maintenance

11.2 Replacing the external fuse

11.3 Removing the cover

11.4 Re-Attaching the cover

11.5 Replacing the radiometer

11.6 Replacing the lamp housing drawer

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11.1 Routine care and maintenance



1. Operate the unit in a well ventilated area with at least six inches clearance at the rear of the unit for proper air flow.

2. For safe operation, use only a grounded outlet.

3. Avoid physical shocks or jarring to the unit especially while the unit is operating. Such sudden movements reduce the lamp module life.

4. Increasing the time between turning the lamp module ON and OFF helps you achieve maximum lamp module life.



5. Replace the air filter at the back of the fan frequently to ensure unrestricted air flow. This is accomplished by removing the internal section of the plastic fan guard using a small flat head screwdriver by carefully lifting the edges. After replacing the air filter, simply snap the fan guard back into place.

6. When necessary, clean the light emitting end of the light guide using an optical cleaning solution.

7. Cleaning of unit is not required for proper operation of the unit. If cleaning is desired, disconnect the AC power cord from the unit and use only a water and simple detergent solution. Ensure that cleaning solution does not come in contact with any optical, moving mechanical or electrical parts.

8. Ensure all cables connected to the Novacure are shielded. This includes the power cord.

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11.2 Replacing the external fuses

⚠ The external (main) fuses are located in the fuse drawer located in the AC inlet module on the rear panel.

1. Turn off the main power switch and remove the AC power cord from the unit.
2. To remove the fuse retaining cover, carefully insert a small flat screwdriver into the tab located above the on/off switch.
3. Pull the cover down, exposing the two gray plastic fuse holders. Each fuse holder is marked with a white arrow pointing to the right.
4. ⚠ Next, pull out each fuse holder from the receptacle assembly, exposing the fuses. Replace fuses as required (F4A, 250V) by snapping the new fuse into the retaining clip of the fuse holder.
5. Insert both fuse holders back into the receptacle assembly (ensuring arrows are facing right).
6. Lift the fuse retaining cover back into place and snap shut.
7. Reconnect the power cord.

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11.3 Removing the cover

Service to be completed by qualified repair personnel only!



Caution
High voltages are present within the unit. Remove the AC power cord from the unit prior to removing the cover.

1. Turn the mains power switch off.
2. Allow the lamp module to cool down completely. Do not interrupt the auto-cool down sequence.
3. Carefully turn the unit upside down.
4. Unscrew the six mounting screws on the bottom edges of the unit.
5. Place the unit in its normal upright position. Unscrew the one screw on the rear panel that attaches the cover to the chassis. Carefully slide the cover back and away from the front panel until it is completely off.

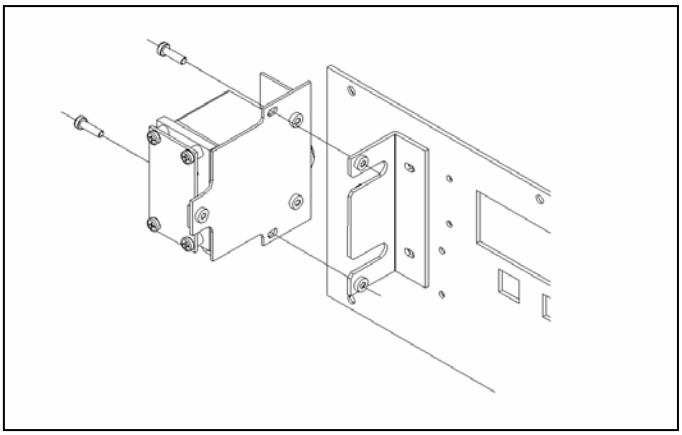
11.4 Re-attaching the cover

1. Carefully slide the cover back onto the Novacure, starting from the rear of the unit. Screw in the one screw on the rear panel.
2. Carefully turn the unit upside down.
3. Screw in the six mounting screws on the bottom panel.
4. Carefully return the unit to its upright position.

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11.5 Replacing the radiometer

Service to be completed by qualified repair personnel only!

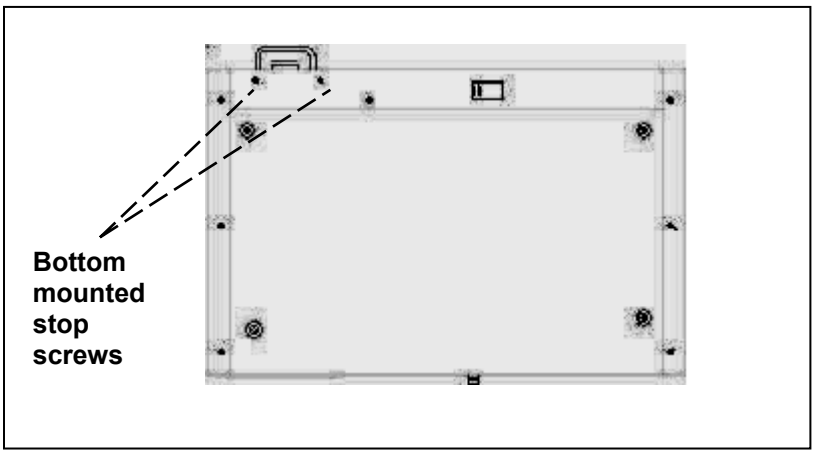


1. Remove the unit cover. (See section 11.3)
2. Locate the radiometer and carefully disconnect the 4 conductor I/O cable from the radiometer.
3. Remove the two #6 Philips screws as shown.
4. Disengage the radiometer from its retainer by pulling it away from the front panel. Set the radiometer aside in a static free bag for safe handling.
5. Insert the new radiometer.
6. Secure the radiometer with the two #6 Philips screws.
7. Reconnect the I/O cable.
8. Re-attach the unit cover. (See section 11.4)

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11.6 Replacing the lamp housing drawer

Service to be completed by qualified repair personnel only!



1. Turn the mains power switch off.

2. Remove the AC power cord.

3. Carefully turn the unit upside down.

4. Unscrew the two end stop screws from the bottom of the unit. Place the screws aside for later use.

5. Carefully turn the unit right side up.

6. Remove the two screws from the lamp housing front panel and set them aside for later use.

7. Hold the lamp housing handle and give it a firm, controlled pull to disengage it from the internal electromechanical connections.

8. Slide the lamp housing out along its guide rails until a full view of the lamp module is available.

9. Carefully disconnect the two white lamp power leads. (The negative lead displays its black band near the lamp terminal while the positive lamp power lead is a solid white.) Clip and remove the cable ties (if installed) which are used to fasten the lamp leads to the lamp drawer.

10. Pull the lamp housing drawer fully from the Novacure and place it aside.

11. Carefully unpack/prepare the new lamp drawer for installation.

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12. If the lamp module in the old lamp drawer is known to function properly it can be installed into the new lamp drawer. If the lamp module is of questionable quality, a new lamp module should be installed. Refer to Section 3.4.

13. Position the new lamp housing drawer so that the guide rails at the rear of the drawer are aligned properly with the grooves within the slide rails on the Novacure.

14. Hold the lamp housing handle and carefully slide the drawer into the Novacure so that the lamp power leads can still be connected to the lamp module.

15. Connect the black striped (negative) wire to its terminal on the ceramic mount. Connect the white (positive) wire to its terminal located on the ceramic reflector mount.

16. By holding the lamp housing handle, slide the lamp housing drawer fully into the Novacure. A firm but controlled push will ensure that the lamp housing front panel is flush with the unit.

17. Replace the two screws that secure the lamp housing drawer to the Novacure.

18. Carefully turn the unit upside down.

19. Screw the two end stop screws into the bottom of the unit as shown in the diagram.

20. Place the unit right side up. The unit is now ready for use.

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Warning: Routine Maintenance and Service is to be performed only by Qualified Service Personnel.

12 Troubleshooting

12.1 Check these areas first

12.2 Unit does not power up

12.3 Lamp module does not power up

12.4 Shutter does not open

12.5 Light intensity is too low

12.6 Maximum intensity available during exposure set up is abnormally high or low

12.7 Radiometer check produces abnormally low or high intensity reading

12.8 Fan does not work properly

12.9 Fan speed is too slow after warm up

12.10 LCD display does not work properly

12.11 Password is entered incorrectly

12.12 Calendar and/or clock readout is incorrect

12.13 Data downloading doesn't work properly

12.14 Remote trigger input does not work

12.15 Remote input signals do not work

12.16 Remote output signals do not work

12.17 The intensity monitor signal reads incorrectly

12.18 Customer service

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12.1 Check these areas first

In the event that a unit does not perform properly or fails, try going through this troubleshooting checklist step by step to help locate and eliminate problems. This checklist is not intended to serve as repair instructions.

Service to be completed by qualified repair personnel only!

Check that:

1. A lamp module has been correctly installed into the Novacure.
2. The AC power cord is securely plugged into a functional AC wall plug.
3. The AC power cord is securely plugged into the AC inlet module on the rear of the unit.
4. The mains AC power switch is in the ON position and remains in the ON position when switched into the ON position.
5. The unit cover is attached to the main unit and all hardware is present and secure.
6. The light guide has been fully inserted into the light guide retainer.
7. The lamp drawer is seated properly within the Novacure and the securement hardware is in place.
8. The lamp disable switch and input signal are not active.
9. All cables connected to the Novacure are shielded.
10. Nearby equipment is not of the noise generating type (RF welders, spot welders, high power arc lamps, etc.).
11. The light guide diameter setting matches that of the actual light guide being used. See section 5.9.
12. StepCure® is in the desired state (ON or OFF). See section 5.8.
13. Remote power down signal is not active. See section 9.3.2
14. The shutter interlock signal is not active. See section 9.3.3

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12.2 Unit does not power up (fan, display not functional)

1. Ensure that the cover is in place and that all securement hardware is in place.

2. Ensure that the lamp drawer is seated properly within the Novacure and that the securement hardware is in place.

3. Examine and, if necessary, replace the external fuses located in the fuse drawer which is found in the AC inlet module on the rear of the unit. See diagram in section 3.3.



Warning
To reduce the risk of fire or shock, always replace the fuse with the same type and rating.

4. Ensure that the mains voltage is within 90-132 VAC or 180-264 VAC.

5. Replace the AC power cord. Recheck the unit for correct operation.

6. If a spare lamp drawer is available, install a new lamp drawer. Recheck the unit for correct operation. Otherwise skip to section 15.2.

12.3 Lamp module does not power up

1. Open the unit as per the instructions in section 11.3. Ensure that the two connections to the lamp module have the correct polarity, are secure and are terminated properly at the main power supply.

2. Ensure that the service switch is oriented such that the toggled lever is away from the caution symbol. Close the unit as per the instructions in section 11.4.

3. Replace the lamp module as per the instructions in section 3.4. If, after the lamp module has been replaced, the lamp module still does not turn on, and if a spare lamp drawer is available, install a new lamp drawer. Recheck the unit for correct operation.

4. If you still experience problems in this area, refer to section 15.2.

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12.4 Shutter does not open

1. Ensure that with the AC power switch in the ON position, the fan is functional and the LCD is on. If the fan and the LCD are not functional refer to 12.2.

2. Verify that the lamp module has been turned on successfully. An error message appears if the lamp module fails to turn on. If a error message appears, refer to section 12.5.

3. From the Main Menu press the `Stats:` button to view the application parameters. Ensure that the exposure time, T=XX:XX.X is greater than 0. If the exposure time is 0, modify the exposure time as outlined in section 5.5.2.

4. If the exposure was initiated from the keypad (and failed to activate the shutter) ensure that the mode of operation is set to "Keypad". If the exposure was initiated from an external source ensure that the mode of operation is set to "External", "Toggle" or "Extim".

5. Ensure that the light guide is seated properly and securely in the light guide retainer. If possible, move the unit into an area where the ambient noise is at a low, comfortable level. With the main power switch OFF, move close to the unit and listen carefully in the area around the light guide retainer while the light guide is being moved into and out of the light guide retainer. Two clicks should be heard: when the light guide is being removed, a "loud" click will be heard as the light guide disengages from the light guide retainer end stop. A second click should be heard shortly thereafter which will indicate that the optical safety micro switch is functioning. If, after several attempts, the second click cannot be heard, and if a spare lamp drawer is available, install a new lamp drawer as per section 11.7. Check that the unit operates properly.

6. If, when inserting the light guide, the second click can be heard, power up the unit as per the power up procedure (section 4.1).

7. Check that the shutter interlock signal is not active. See section 9.3.3

8. If you still experience problems in this area, refer to section 15.2.

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12.5 Light intensity is too low



Danger
Never look into the emitting end of the light guide.

1. Ensure that the shutter is opening and that some discernible amount of light energy is being emitted from the light guide. If the emitting end of the light guide is not transmitting any amount of light energy, and the shutter is not opening, refer to section 12.4. If the emitting end of the light guide is not transmitting any amount of light energy and the shutter is opening, refer to section 12.3.

2. Open the lamp drawer and ensure that the lamp module is installed properly. Check that it is seated properly within the lamp mounting bracket.

3. Examine the light guide for possible bends, kinks or other physical damage. Replace the light guide if any physical damage is observed.

4. Ensure that there are no foreign substances such as cured adhesives on the emitting end of the light guide. Clean the emitting end of the light guide if any substances are found.

5. Insert a light guide which is known to have good transmission qualities into the light guide retainer. If the measured light energy is within acceptable limits, replace the old light guide with a new one. Operation can continue with the new light guide.

6. If the new light guide transmits the same amount of light energy as the old one, replace the lamp module as per the instructions in section 3.4.

7. If the light energy output remains low after the lamp module has been replaced, continue on to section 15.2.

12.6 Maximum intensity available is abnormally high/ low

1. If, during an exposure setup procedure, the `Max Intensity Available:` displays a reading which is too high or too low, ensure that some amount of light energy is being transmitted by the emitting end of the light guide. If some light energy can be detected, refer to section 12.5.

2. If no light energy is emitted from the light guide, check to see if the ON/OFF shutter is opening. If the shutter is not opening, refer to section 12.4. If the shutter is in fact opening, refer to section 12.3.

3. Ensure the correct light guide diameter has been selected. See section 5.9.

4. Ensure a 'calibration procedure' (from the main menu) has been done within the last 8 hours.

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12.7 Radiometer check abnormally low /high

1. During the radiometer check ensure that the emitting end of the light guide is fully inserted into the radiometer port and that the correct adapter is being used.

2. With the unit powered up and from the main menu, press the `Radiomtr:` key. Depress the `Max:` key and insert the emitting end of the light guide fully into the radiometer port. Depress the `Cont:` key then the `OK:` key from the next menu. Verify that the display reads "`Light source=Max`". If the display reads something other than `Max:`, after selecting Max as the measurement mode, refer to section 15.2.

3. Ensure the correct light guide diameter has been selected. See section 5.9 for more details.

4. Open the unit as per instructions in section 11.3. Ensure that a properly calibrated radiometer is in place with all securement hardware present.

5. Verify that the I/O cable for the radiometer is plugged in.

6. Verify that the radiometer is within calibration specifications. Calibration date and required date appear on a tag attached to the radiometer.

7. Close the unit as per instructions in section 11.4.

8. Ensure that the ON/OFF shutter is opening and that the lamp module has powered up. If either are not functioning properly, refer to section 12.4 and section 12.5 respectively.

9. If a spare lamp housing drawer is available, install a new lamp housing drawer. Check that the unit operates properly. If the unit still fails to operate, refer to section 15.2.

12.8 Fan does not work properly

1. Open the unit as per section 11.3.

2. Ensure that the fan power cable connector is properly terminated at the fan and at the system PCB. (The system PCB is located on the lamp divider wall and the fan connector is located at the top right corner of the system PCB, labeled as P201.)

3. If the fan is not functional but the unit otherwise performs properly, do not use the unit, refer to section 15.2.

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12.9 Fan speed is too slow after warm up

1. If after a five minute warm up period the fan speed is still too slow, open the lamp drawer as per instructions in section 11.6. Ensure that the lamp module temperature sensor is plugged into its mating receptacle. See diagram in section 3.4.

2. If the lamp module temperature sensor is plugged in and the problem persists, install another lamp module as per the instructions in section 3.4.

3. Following lamp module replacement and the same problem, install another lamp housing drawer if one is available. If you still experience problems in this area, refer to section 15.2.

12.10 LCD does not work properly

1. If the fan is functional, power down the unit, wait approximately one minute then power it up again. In this case, the power down must be completed by removing the AC power cord from the back of the unit once the unit has shut down completely.

2. Ensure that the Novacure download port is not connected to a PC (through a RS-232 cable).

3. If you still experience problems in this area, refer to section 15.2.

12.11 Password is entered incorrectly

1. If the message: `Password was not entered correctly ! Please try again.......` appears, repeated attempts may be made to access password protected areas.

2. In the event that the correct password cannot be found refer to section 12.18 for the appropriate telephone number. A technical representative can provide assistance in retrieving the correct password.

12.12 Calendar and/or clock readout is incorrect

1. Attempt to re-enter the new date and time as per the instructions in section 5.4.

2. If you still experience problems in this area, refer to section 15.2.

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12.13 Data downloading doesn't work properly

1. Ensure that the serial cable is connected properly to the Novacure as well as to the PC. Ensure the serial cable is a "one to one" type (pin 1 connected to pin 1, pin 2 to pin 2 etc.).

2. Ensure that the PC/laptop has been turned on and that Opto Link 2100 is running prior to applying power to the Novacure.

3. Ensure that the mouse (or any other serial device) is not using the same IRQ as the com port being used to communicate with the Novacure.

4. Ensure that the Novacure's fan is operational. This indicates that the Novacure is actually powering up.

5. Use another serial cable and repeat the steps as outlined above. If none of these checks are successful in establishing a good communication link between the Novacure and the PC/laptop, refer to Section 12.18 for the appropriate telephone number. One of our technical representatives can provide additional assistance.

12.14 Remote trigger input does not work

1. Ensure that the correct connections have been made to the (High-Density) HD D-Sub 15 pin male connector. See section 9.

2. Ensure that the correct power supply polarity and voltage levels have been used to power the I/O signals via the (High-Density) HD D-Sub 15 pin male connector. See section 9.

3. If a polarized trigger device is used to interface with the Novacure, ensure that the positive connection from the trigger device is connected to pin 2 of the (High-Density) HD D-Sub 15 pin male connector.

4. Ensure that the return line (common/GND) of the remote trigger device is connected to pin 1 of the HD D-sub 15-pin male connector

6. Ensure that the mode of operation, as set in section 5.6, is not set to KEYPAD.

7. Ensure that the trigger device is capable of sinking at least 5mA.

8. Refer to sections 9 and 12.18 for more information.

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12.15 Remote input signals do not work

1. Ensure that the correct connections have been made to the (High-Density) HD D-Sub 15 pin male connector. See section 9.

2. Ensure that the correct power supply polarity and voltage levels have been used to power the I/O signals via the (High-Density) HD-Sub 15 pin male connector.

3. If a polarized activation device is used to interface with the Novacure, ensure that the positive connection from the interface device is connected to the respective positive input on the (High-Density) HD-Sub 15 pin male connector (e.g.. pins 2,7,8,9,12 and 13).

4. Ensure that the return line (common/GND) of the remote trigger device is connected to pin 1 of the HD D-sub 15-pin male connector

5. Ensure that the trigger device is capable of sinking at least 5mA.

6. Refer to sections 9 and 12.18 for more information.

12.16 Remote output signals do not work

1. Ensure that the correct connections have been made to the (High-Density) HD D-Sub 15 pin male connector. See section 9.

2. Ensure that the correct power supply polarity and voltage levels have been used to power the I/O signals via the (High-Density) HD-Sub 15 pin male connector.

3. If a polarized interface device is used to interface with the Novacure, ensure that the positive connection from the interface device is connected to the respective positive output line and that the common connection from the interface device is connected to the respective common output line.

4. Ensure that the maximum current and voltage ratings of the output signals is not exceeded.

5. Refer to sections 9 and 12.18 for more information.

12.17 The intensity monitor signal reads incorrectly

1. Observe the polarity of the 4 position circular connector when making a connection to the Novacure (see section 9.3.3 for more details).

2. Ensure that there is a discernible amount of light energy emitted from the light guide when the shutter is opened.

3. Refer to sections 9,12.3,12.5 and 12.18 for more information.

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12.18 Toll free customer service

In Canada & the USA TOLL FREE, 1-800-668-8752 OR 1-905-821-2600

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13 Technical Specifications

13.1 Lamp module

13.2 Light guide

13.3 Removable radiometer

13.4 Power supply and battery backup

13.5 Environmental Conditions

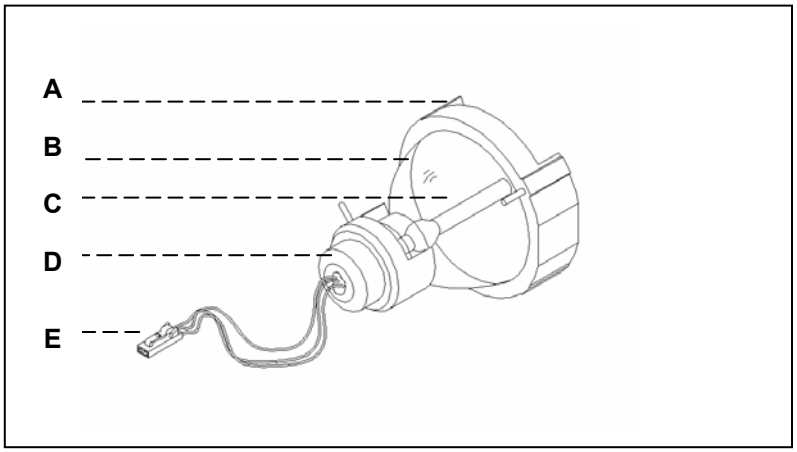
13.6 Regulatory Compliance

13.7 Mechanical Specifications

13.8 Miscellaneous

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13.1 Lamp module



A, D: Ceramic Components. **B:** Reflector Cup. **C**: Bulb.
E: Temperature Sensor Termination

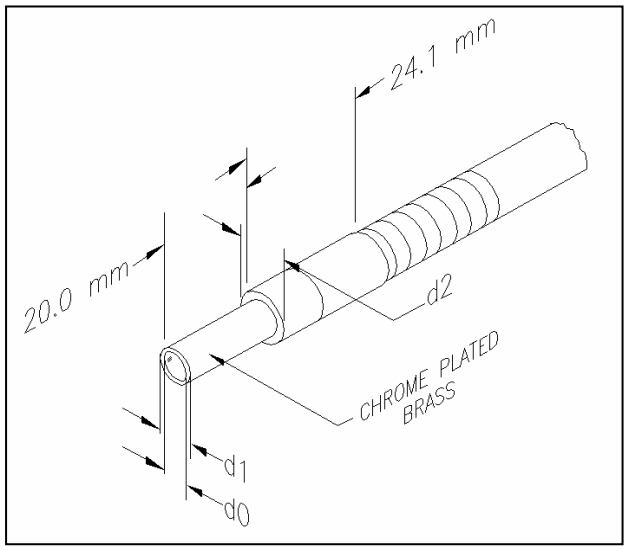
Lamp Module	High Pressure 100 Watt Mercury Vapor Short Arc
Lamp Module Life	2000 hours continuous running in long life mode (typical),1000 hours in standard mode (typical)
UV/Visible Output	User adjustable and maintained
Warm Up	180 seconds (typical)

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13.2 Light guide

Light Delivery
Flexible liquid filled light guide .75 to 3 metres in length with core diameters of 3mm, 5mm and 8mm. Dual and triple light guides available with 3mm core diameter. Custom light guides, quartz fiber light guides and specialty optics also available.

Liquid Light Guide End Fitting

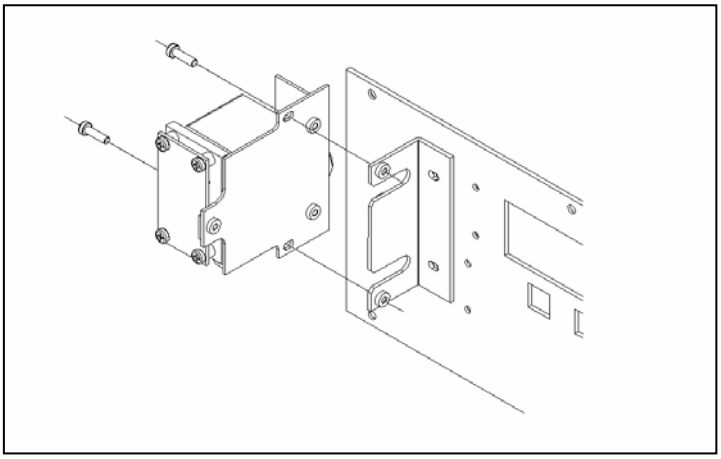


Liquid Light Guide Dimensions in mm

Core	*End Fitting*	*End Fitting*	*Minimum Bend Radius*
d0	d1	d2	
3	5	9	40
5	7	10	60
8	10	15	100

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13.3 Removable radiometer



Intensity Range	0-99,000 mW/cm^2
Spectral Range	250-600 nanometers (nm)
Resolution	20 mW/cm^2
Accuracy	+/-5% typical, 10% maximum
Display	Novacure LCD
Calibration	Traceable to NIST, recommended every 6 months
Adapters	To suit 3mm and 5mm light guides. An 8mm light guide can be accommodated without an adapter

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13.4 Power supply and battery backup

Power Supply	Proprietary, High efficiency, switch mode, constant power output
Input Voltage	100-120VAC and 200-240VAC, 50/60 Hz, auto-range selection
Current	3A Max
Inrush Current	Inrush current protection less than 50A at 90°, ½ line cycle, cold start
Protection	Dual fuse system: each fuse rated at F4A 250V (Fast acting type) EMI filtering integrated into the power supply Power supply has integrated thermal cutoff AC power cutoff when either the cover is removed or when the lamp drawer is removed from the unit
Memory Retention	Retention time for calendar and clock: 10 years Register variables: greater than 15 years
Battery Type	Integrated lithium type, non replaceable
Lamp	+22.0V at 4.5A typ
Output Power	Lamp: nominal 100W (dependent on lamp age and long life mode selected)
Line Regulation	From min Vin to max Vin lamp: +/-2%
Output Signals	Polarized type: NPN transistor Maximum voltage withstand capability (V_{ce}): 30VDC Maximum carry current: 10mA
Input Signals	Polarized type: photo-diode of optocoupler; cathode side accessible through I/P pins Bias current, per I/P: 5mA max. Logical low time, for momentary signals: 40mS, minimum

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13.5 Environmental Conditions

Operating Environment Conditions

Installation Category II, Pollution Degree 2
Temperature: 10 to 40 degrees Celsius
Relative Humidity: 30% to 75% (non-condensing)
Atmospheric Pressure: 700 to 1060 hPa
Altitude: 2,000 meters (maximum)

Transport and Storage Conditions

Temperature: -20 to 70 degrees Celsius
Relative Humidity: 10% to 100% (non-condensing)
Atmospheric Pressure: 500 to 1060 hPa

13.6 Regulatory Compliance

Complies to the following directives/standards

Council Directive 73/23/EEC	Low Voltage Directive
Council Directive 89/336/EEC	EMC Directive
EN/IEC 61010-1:2001	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use Part 1.
CAN/CSA 61010-1:2004	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use Part 1.
UL 61010-1:2004 (2nd Ed.)	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use Part 1.

FCC Class A Digital Device or Peripheral - Information to User

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

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WARNING
Changes or Modifications not expressly approved by EXFO PHOTONIC SOLUTIONS INC.Inc. could void the user's authority to operate the equipment.

NOTE: All cable assemblies used with the NOVACURE MUST BE SHIELDED!
Use only the shielded power supply cord and the footswitch cable assembly supplied with the Novacure.
The end user of the device is responsible for ensuring that shielded cables are used for the following:

- 15 pin I/O connector
- 9 pin RS232 connector
- 4 position circular connector for the intensity monitor output signal and shutter interlock input signal

CE Representative



GENTEC Benelux
Chausse de Louvain, 270
B-1410 Waterloo
Belgium

13.7 Mechanical Specifications

Dimensions		
Height	5.84”	(13.92cm)
Depth	11.21”	(28.04cm)
Width	17.22”	(43.74cm)
Unit Weight	20.75 pounds (9.4 Kg)	

13.8 Miscellaneous

Microprocessor Control	User friendly, menu driven software prompts and accepts application parameters (exposure time, intensity and/or dose) from the user and ensures these are maintained.
Display	2 line x 40 character (each character 5 x 9 pixels), LCD
Keypad	5 button, tactile
Intensity Control	Closed loop +/- 5% accuracy typical (10% maximum)
Fan/Thermal	
Lamp ignition	<70 degrees Celsius
Lamp shutdown	<70 degrees Celsius
Lamp warm temperature	>90 degrees Celsius

Specifications may vary slightly and are subject to change without notice.

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14 Replacement Parts

14.1 Ordering information

14.2 Standard parts and accessories

14.3 Optional light guides

14.4 Specialty Optics

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14.1 Ordering information

To order any items or to obtain more information, please contact

In USA

EXFO America
4275 Kellway Circle, Suite 122
Addison, TX, 75001, USA

Tel: (418) 683-0211
Fax: (418) 681-3936
Toll Free: 1-800-663-3936
e-mail: bdg.toronto@exfo.com
www: exfo-uv.com

For International and Canada

EXFO ELECTRO-OPTICAL ENGINEERING Inc.
400 Godin Avenue
Vanier, Quebec
G1M 2K2 Canada

Tel: (418) 683-0211
Fax: (418) 681-3936
Toll Free: 1-800-663-3936 (USA and Canada)
e-mail: bdg.toronto@exfo.com
www: exfo-uv.com

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14.2 Standard parts and accessories

Part No.	Description
012-60850	Replacement lamp module*
020-00393	Radiometer, 250-600nm
020-00196	Replacement intake air filter
020-00450	Replacement lamp housing drawer
020-00200	4 Amp, 250V fast blow fuse
020-00310	Foot pedal
854-16100	Safety glasses
019-01010	Light guide locking ring

Contact the sales or service department to return all lamps in their original packaging to EXFO Photonic Solutions Inc. for disposal

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14.3 Optional liquid light guides

Part No.	Description
805-00005	Liquid, 3mm x 750mm
805-00004	Liquid, 3mm x 1000mm
805-00022	Liquid, 3mm x 1500mm
805-00006	Liquid, 5mm x 750mm
805-00002	Liquid, 5mm x 1000mm
805-00007	Liquid, 5mm x 1500mm
805-00008	Liquid, 5mm x 3000mm
805-00009	Liquid, 8mm x 1000mm
805-00010	Liquid, 8mm x 1500mm
805-00019	Liquid, 2 x 3mm x 750mm
805-00011	Liquid, 2 x 3mm x 1000mm
805-00012	Liquid, 2 x 3mm x 1500mm
805-00001	Liquid, 3 x 3mm x 1000mm
805-00026	ER Liquid, 5mm x 1000mm
805-00028	ER Liquid, 5mm x 1500mm
805-00030	ER Liquid, 2 x 3mm x 1000mm
805-00027	ER Liquid, 2 x 3mm x 1500mm
806-00003	Fiber, 4 x 2mm x 1000mm

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14.4 Specialty optics

Specialty optics can be purchased from EXFO Photonic Solutions Inc. to optimize the delivery of light from the Novacure to the sample. Using these optics, both the spatial and spectral properties of the Novacure output can be customized.

810-00013 Light line, 50mm x 0.1mm (2" x 0.014")



The **Light Line** provides a line of light energy that is ideal for LCD display applications and curing multiple cure sites.

810-00009 Cure ring, no slot, 10mm ID for 8mm light guide

810-00007 Cure ring, slotted, 10mm ID for 5mm light guide



The **Cure Ring** delivers 360^{o} of light energy. It is widely used in bonding of cylindrical parts.

810-00016 Collimating adaptor w single lens for 3mm light guide

810-00017 Collimating adaptor w single lens for 5mm light guide



The **Single Lens Collimating Adaptor** is used to collimate the output from the light guides.

810-00014 Large area Collimating adaptor w dual 1" lenses for 5mm light guide (may be used with other light guides)



The **Dual Lens Collimating Adaptor** is used to create adjustable spot sizes on the target.

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019-01011	Filter assembly, 320-500nm
019-01009	Filter assembly, 320-390nm
019-01007	Filter assembly, 250-450nm
019-01006	Filter assembly, 365nm
019-01008	Filter assembly, 400-500nm* ** Contact your EXFO representative for information about using the 400-500nm filter in the Novacure 2100*
810-00001	90° angle for 3mm light guide
810-00002	90° angle for 5mm light guide
810-00003	90° angle for 8mm light guide
810-00011	90° angle w single lens for 5mm light guide
810-00012	90° angle w dual lens for 5mm light guide

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15 Warranty

15.1 Novacure warranty

15.2 Returning your Novacure to EXFO

15.3 EXFO Service Centers

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15.1 Novacure Warranty

EXFO warrants the original purchaser for a period of one (1) full year, calculated from the date of purchase, that the equipment sold is free from defects in material and workmanship.

In the event of a claim under this guarantee, the equipment is to be sent postage and carriage paid, including a description of the fault, to the EXFO Service Center. Returned equipment will not be received without a Return Authorization (RA) Number, issued by the appropriate Service Center.

In the case of damage caused by wear and tear, careless handling, neglect, by the use of force or in the case of interventions and repairs not carried out by an EXFO Service Center, the guarantee ceases to be valid. This guarantee may not form the basis for any claims for damages, in particular not for compensation of consequential damages.

The warranty is not transferable. No warranty is extended to perishable items, such as lamp modules, fuses, air filters and light guides.

Any claims for units received with defects in material or workmanship must be reported to an authorized EXFO service center within 30 days from the original date of receipt. EXFO will repair or replace these reported defects free of charge for a period of up to 2 years from the original date of receipt. The equipment must be sent postage and carriage paid.

Bulb Replacement Warranty:

For lamp failure after less than 100 hours of use, a complete credit or replacement is issued. For lamp failure after use of between 100 hours and 400 hours, a 50% credit or 50% reduction on a new lamp purchase is provided. Lamp failure is defined as inability to strike (turn on) the lamp, or output below 50% of the original output power/intensity.

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15.2 Returning your Novacure to EXFO

1. Please make a note of the problem encountered, the steps followed to isolate the problem and the result of any trouble shooting steps taken.

2. Telephone the nearest EXFO Service Center to obtain a Return Authorization Number so that repairs may be completed quickly and efficiently.

3. Enclose details of the problem with the unit and return both to the EXFO Service Center. The unit should be returned in its original packaging if possible. Please do not ship the unit with the lamp installed.

4. Include a phone number and contact person who may be reached for any additional service-related questions.

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15.3 EXFO Service Centers

Service information may be obtained by contacting your nearest EXFO Service Centre:

EXFO Photonic Solutions Inc.
2260 Argentia Rd.
Mississauga, Ontario L5N 6H7
CANADA

1-800-668-8752 (*USA and Canada)*
Tel: (905) 821-2600
Fax: (905) 821-2055
UVSupport@exfo.com
www.exfo-uv.com

EXFO China
Beijing New Century Hotel Office Tower
Rm 1754-1755
No. 6 Southern Capital Gym Road
Beijing 100044
CHINA

Tel: +86-10-6849-2738
Fax: +86-10-6849-2662
beijing.service@exfo.com

EXFO Europe
Le Dynasteur
10-12, rue Andras Beck
92366 Meudon la Foret Codex
FRANCE

Tel: +33 1 40.83.85.85
Fax: +33 1 40.83.04.42
Europe.service@exfo.com

Jenton International Inc
9-10 Ardglen Industrial Estate
Evingar Road
Whitchurch, Hampshire, RG28 7BB
UNITED KINGDOM

Tel: +44 125 689 2194
Fax: +44 125 689 6486
rlittle@jenton.co.uk

San-Ei Tech Ltd.
1-15, 7 Chome Kashiwa
Kashiwa-Shi, Chiba 277
JAPAN

Tel: +81 471 66 7411
Fax: +81 471 66 7276
info@san-ei-tech.co.jp

Alexander Jewels Co. Ltd
6F-3, No. 133, Sec. 2 Chung Shan Road
Chung-Ho City, Taipei Hsien
Taiwan, ROC

Tel: + 886 22 245 7305
Fax: +886 22 245 7404
info@alexanderjewels.com

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Printed in Canada
035-00186 Rev. 3

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