

Otoflash G171

Flashlight curing device

INSTRUCTION MANUAL

Index

- 1 Device description
- 2 Safety instructions
- 3 Initial operation of device
- 4 Important notes
- 5 Holding trays
- 6 Operation
- 7 Maintenance, cleaning, repair
- 8 Exchanging the flash-module
- 9 Transport, storing, disposal
- 10 Protective gas
- 11 Technical data / accessories / consumables
- 12 Warranty

1 Device description

The Otoflash G171 is a light-induced polymerization device for the curing of light-curable resins in laboratories, research facilities, training centers, commercial premises. There are 2 bottom-mounted flash-lamps, operating at a frequency of 10 flashes per second.

Compared to polymerisation through continuous exposure, the curing by means of light flashes has the following advantages:

1. At same radiation dosage, the light intensity is between 1,000-10,000 times higher (for the duration of the flash period of approximately 100 μ s). Due to the higher intensity, a correspondingly greater amount of free radicals are formed so that, subsequently, there are more opportunities for recombination of the excited molecules. As a result, longer polymer chains are formed and fewer residual monomers remain as compared to other sources of light. This, in turn, leads to better biocompatibility. Furthermore, the process leads to improved physical characteristics such as a higher Young's modulus and a higher Vickers hardness. The high intensity of the flashes also allows deeper penetration into the polymerization material as a sufficiently large number of excited light quanta reach deeper layers. This is particularly important for opaque materials.

Moreover, flash curing devices perform the curing process more quickly compared to other devices. For example, compared to fluorescent tube devices, the curing may be up to 10 times faster.

2. Wavelengths of the light generated in the flashes spans across 230-950 nm. Due to covering such a broad part of the electromagnetic spectrum, the excitation of all common photo-initiators – regardless of material manufacturer – is ensured and all common light-curable resins (composites, primer, sealing lacquers etc.) and 3D-printing material are fully cured.
3. The use of protective gas offers further advantages: the use of protective gas during the curing process allows curing of the material without development of an inhibition (or adhesive) layer at the surface. This, in turn,
 - reduces the need for further steps to later remove the inhibition (or adhesive) layer,
 - produces a harder, more scratch-resistant surface,
 - produces smoother and better fitting surfaces (of particular importance in the production of precise workpieces in dental, jewellery or industrial applications), and
 - further reduces the amount of residual monomers at the surface, improving bio-compatibility.

2 Safety instructions

This instruction manual contains references to residual hazards, important user tips, and handling instructions that are indicated by the following symbols and keywords.

It is essential that you observe these warnings and the prescribed restrictions. A warning sign warns in good time of the occurrence of the danger and contains suggestions for averting the danger! The keywords indicate the type of hazard and the associated symbols underline these visually. Observe the measures mentioned to ward off hazards to the operator or material assets!

Prior to operation of the device, the safety instructions are to be observed and the instruction manual is to be read and understood.

The warranty does not hold for damage resulting from non-compliance with the safety instructions.

Symbols:

Symbol	Description
 DANGER	This warning indicates hazards that can lead to serious bodily injury or death if relevant safety instructions are not followed or not followed properly
 WARNING	This warning indicates hazards that can lead to bodily injury or severe property damage if the relevant safety instructions are not followed or not followed properly
 ATTENTION	This warning indicates hazards that are potentially damaging to property and environment
 TIP	This indicates user tips and useful information
Warning symbols	Description
	Danger of hand injury (general danger of crushing)
	Danger due to hot surface

3 Initial operation of device



Danger due to electric shock

Ensure the specifications on the type plate correspond to the power supply network before connecting the device. If uncertain, consult an electrician.

The device is subject to protection class I and must only be connected to power sources grounded according to regulations.

Before initial operation, adjust the device to the correct operational voltage using the voltage selector switch on the back of device (Fig. 2/12).

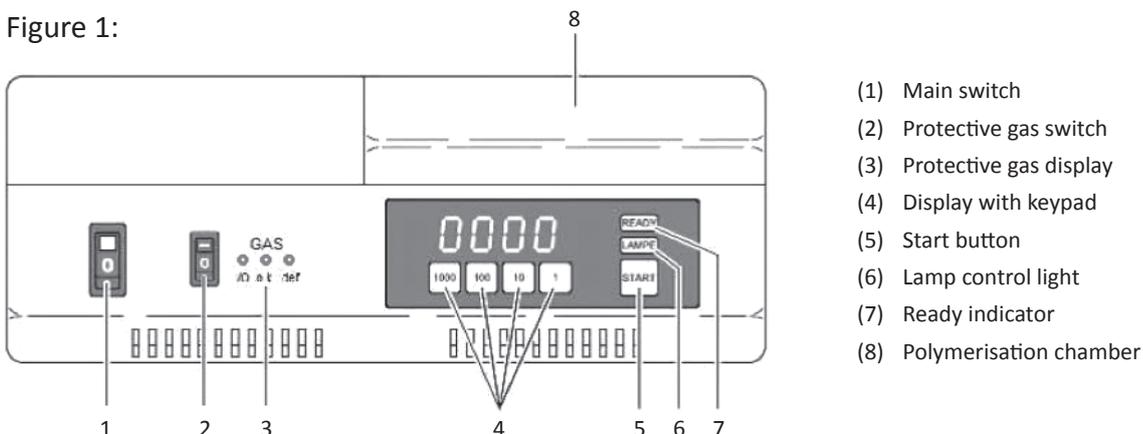
When moving the Otofash device from colder to warmer ambient temperature, e.g. transport during winter, allow the device to acclimatize for a minimum of 2 hours before operation (otherwise there is a risk of flash-overs inside the device).

When setting up the device, ensure sufficient distance between any adjacent walls and the device to ensure sufficient airflow into the device.

Do not operate the device in closed containers such as drawers, shelves, etc. Please see Section 4 “Important notes” for additional safety instructions.

Front side

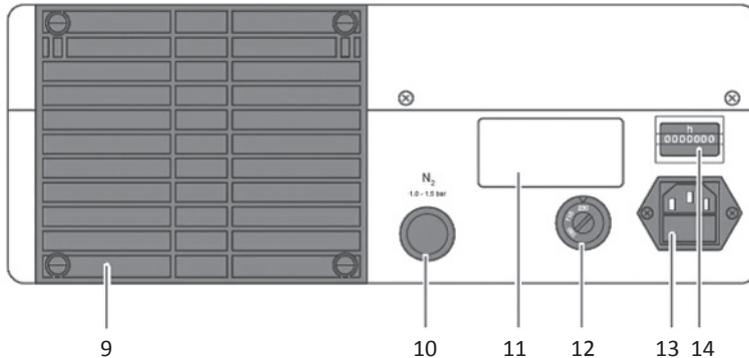
Figure 1:



- (1) Main switch
- (2) Protective gas switch
- (3) Protective gas display
- (4) Display with keypad
- (5) Start button
- (6) Lamp control light
- (7) Ready indicator
- (8) Polymerisation chamber

Rear side

Figure 2:



- (9) Ventilation fan
- (10) Quick coupling plug
- (11) Type plate
- (12) Voltage selection switch (100, 115, 230 V)
- (13) Power socket with fuse
- (14) Operating hour counter

4 Important notes

- Switch the device off and disconnect it from the power supply before carrying out any services or maintenance work (danger due to electric shock); the device must also be switched off and the mains plug disconnected in the event of danger from external influences.
- The connection point should always be accessible and not be covered.
- Do not look directly into the light from the flash-lamps (risk of damage to eyes).



Danger due to hot surface

- Extended periods of irradiation may cause the polymerization chamber to heat up. It is recommended to wait a few seconds before opening the lid after the end of polymerization (the fan will continue to run).



Danger of hand injury from closing lid

- The device will only work when the flash module is completely inserted. Likewise, the lid must always be completely shut.
- Never operate the device without flash module.
- The dust filter (figure 3/A) behind the display on the front of the device should always be kept clean. Depending on how dirty the dust filter is, it should be cleaned or replaced regularly (see Section 7).

5 Holding trays

There are 2 types of holding trays available: with and without UV-B block.

The correct type of holding tray to use depends on the resin to be cured (refer to requirements as specified by the manufacturer or distributor), and is important for good performance and, for example, to avoid yellowing of the workpiece. Tray type numbers are indicated on the top edge of the tray:

Type 280N2 = light transmission: 280-950 nm

Type 360N2 = light transmission: 360-950 nm (tray with UV-B block)



IMPORTANT

A holding tray insert is strictly necessary when operating the device using the protective gas function.

The holding trays are designed to be used with nitrogen (N₂). You must contact the device manufacturer NK-Optik GmbH if you intend to use a different inert protective gas (e.g. argon or carbon dioxide) to identify appropriate alternative trays.

Do not use alcohol or alcohol-based cleaning products to clean the holding trays as this will damage the trays.

The holding trays have a limited lifetime due to the high-intensity irradiation they are exposed to. The trays should be replaced after approximately 30-50 hours of usage time. In addition to this, the trays should be replaced if they exhibit strong yellowing, or have been severely scratched or dirtied. Cracked, dirtied, or yellowed trays reduce the effectiveness of the light irradiation.

The light intensity within the curing chamber of the device depends on the condition of the holding tray insert, the condition of the reflectors of the flash-bulb (i.e. the lid reflector), and the flash-bulbs. The light intensity can be easily monitored using a measuring device for flash light impulses, for example the Flashmeter® from the company NK-Optik GmbH.

In case of reduction in curing efficacy, the following steps should be followed:

1. Replace holding tray insert
2. Clean dirtied reflectors by blowing them out at flash-bulb module and device lid
3. Replace flash-module

6 Operation

Setting the timer (Figure 1)

The device is switched on with the main switch (1). The green light indicator labelled “Ready” (7) will light up and 4-digit figure will appear on the display (4). This figure indicates the number of flashes. The number of flashes can be programmed any number between 0 and 9999 by pressing the buttons 1000, 100, 10 and 1.

Loading of the device

Open lid (Figure 3/C) and place the polymerization workpiece into the holding tray insert above the flash-bulb. For the curing of several pieces at the same time, ensure that pieces are not in contact with one another or cast shadows on each other.



Danger of hand injury from closing lid

Work mode

The programme is started through pressing of the start button (Fig. 1/5). The timer will begin to count down with every flash. After completion of the programmed number of, an alarm tone will sound three times and the word “End” will appear on the display. The timer will return to the initially programmed number of flashes. Should the lid be opened during the process, the entire device is automatically disconnected from the power supply (except the timer), the word “Open” appears on the display, and a long alarm tone will sound. Thus, the programme can be interrupted at any time by opening of the lid. After closing the lid again, the programme will return to the initially programmed number of flashes.

Extraction of the polymerization workpiece



Danger due to hot surface

Extended periods of irradiation may cause the polymerization chamber to heat up. It is recommended to wait a few seconds before opening the lid after the end of the polymerization process (the fan will continue to run).

Error message The red field on the display labelled “Lamp” (Fig. 1/6) will light up if one or both of the flash-bulbs are defective.

Protective gas Please refer to instructions under Section 10, “Protective gas”, if using the protective gas for the polymerization.

7 Maintenance, cleaning, repair (Fig. 3)

■ Air filter

The filter fleece (Fig.3/A), located directly behind the display (accessible when the lid is open), should be carefully blown out by means of compressed air and replaced at least every 6 months.

■ Cleaning

All external surfaces can be wiped with mild household cleaners. Do not use alcohol or alcohol-based cleaning products (e.g. isopropanol).



ATTENTION

No liquids should be allowed to enter the device or the power switch.

Do not use alcohol or alcohol-based cleaning products to clean the holding trays. The flash-module must only be blown-out by means of compressed air using **slight** excess pressure.

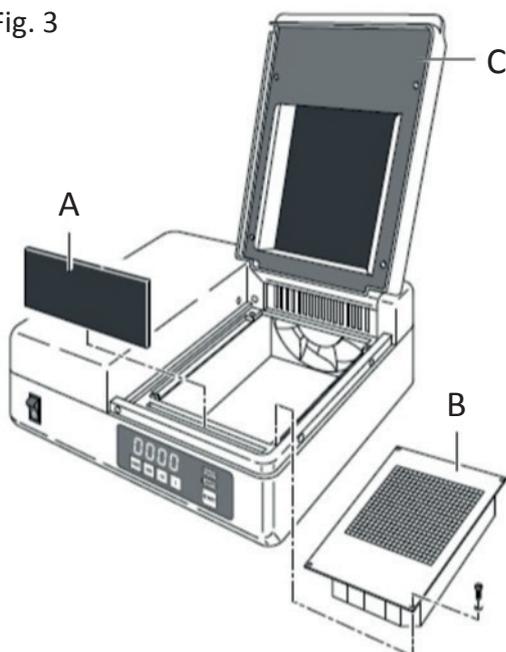
Never clean the flash-bulbs with cleaning agents or cloths. Only the reflector may be cleaned with a lint-free cloth.

■ Service/Maintenance

Servicing may only be carried out by NK-Optik GmbH or by persons authorized by NK-Optik GmbH.

8 Exchanging the flash-module (Fig. 3)

Fig. 3



- A Air filter
- B Flash-module
- C Lid

**DANGER**

Before carrying out any service or maintenance work, the device should be disconnected from the power supply.

- The flash-bulbs can only be replaced by replacing the entire flash-module.

**Danger due to hot surface**

- Allow hot flash-module to cool off by running the device in stand-by mode for approximately 1 minute.
- Turn off the device and disconnect from power supply.
- Open lid.
- Remove the 4 screws at the corners of the flash-module (Fig. 3/B). Extract the flash-module by grasping it at the centre-front and gently wiggling it, and pulling it up and out from the device. You may find using a flathead screwdriver as a lever to be helpful during the removal process. To do so, carefully wedge the screwdriver in the middle between casing and module and apply gentle pressure to lift up the module. Carefully insert the new flash-module onto the contact carrier and replace the 4 screws. Remove the protective foil.

**IMPORTANT**

The module must be inserted so that all individual electrical contacts fit tightly. Loose contacts run the risk of charring.

Never touch the flash bulbs with your bare hands as fingerprints and other marks may burn into the glass surface during the flash process.

Disposal of the flash-bulbs: Used flash-bulbs are hazardous waste and must be disposed of in accordance with statutory regulations.

9 Transport, storing, operation, disposal

The following conditions apply for transportation or storage of the device for up to 6 months:

Temperature: 0°C - +70°C

Relative humidity: 10% - 80%

After this, the following operating conditions apply:

Temperature: + 10°C - +40°C

Relative humidity: 10% - 80%

The device must be stored and operated in closed rooms only.

The device should be protected from humidity and damp. Do not expose device to strong jolts/shocks.

Disposal of the device

After dismantling of plastic parts, i.e. ventilation fan, dispose of floor and lid plates, as well as the anodized inner parts, flaps, and base plate, metal waste. The rest is to be disposed of as electronic waste, flash-bulbs as special waste.

Environment relevant materials:

Component:	Materials used
Metal chassis parts	Aluminium
Housing parts	ABS (Acrylonitrile butadiene styrene)
Transformer	Copper, iron, polyamide, polyurethane
Capacitors	Aluminium, polypropylene, polyurethane, resin with castor oil
Circuit board	Epoxy resin, electronic components
Flash-bulbs	Fused quartz, doped metals

Disposal must occur in accordance with respective national regulations.

Relevant disposal organizations should be consulted.

All devices/components may be sent back to the manufacturer for disposal purposes. In such cases, shipping and handling are to be covered by sender.

10 Protective gas (preferably nitrogen N2)

With use of the protective gas, oxygen is displaced from the polymerisation chamber. This prevents oxygen inhibition, allowing workpieces to cure without an inhibition/adhesive residue layer at the surface (see point 3 in Section 1 – Device description).

The following components are included in models with the protective gas option:

A quick coupling socket with (nominal diameter of 7.2 mm), located at the back of the device, for connection to a gas cylinder (Fig. 2/10).



WARNING

A pressure reduction valve with a maximum adjustable pressure of 10 bar must be used. The maximum permitted pressure for the device is 8 bar.

Set the pressure regulator to 1.0-1.2 bar and connect the device to the nitrogen gas container using a quick coupling (provided upon request - not included as part of the standard delivery).

A control panel for the protective gas option is located on the front of the device between the main power switch and the display, comprising 1 switch and 3 LED displays. The protective gas is turned on using this switch (Fig. 1/2+3)

The switch has 3 operating positions:

- Position – (switch pointed upwards): green LED is illuminated
- Position ○ (switch in midway position): no LEDs illuminated
- Position = (switch pointed down): no LEDs are illuminated

Position – (switch pointed upwards):

The protective-gas function including pre-flooding of the polymerization chamber (i.e. flushing of the chamber with nitrogen for a duration of 30 seconds prior to the curing process) is active:

Pressing the start button initiates a filling of the polymerization chamber with nitrogen gas for 30 s after which the flash process is started. Throughout the first 60 seconds of the flash process, the polymerization chamber continues to be flooded with the protective gas. After a total of 90 seconds (30 seconds of pre-flooding and 60 seconds during the curing process) the protective gas flow stops automatically – the yellow LED is turned off.

While the protective gas-flow into the chamber is turned on, the yellow LED (labelled “ok”) is illuminated. In case of insufficient pressure (< 0.8 bar) or absence of gas flow, the yellow LED is extinguished and the red LED (labelled “def.”) lights up.

The flow of protective gas automatically stops upon completion of the programmed curing time, even if this time is less than 60 seconds.

Position o (switch in midway position):

The protective gas function is switched off. Pressing the start button begins the flash-curing process only.

Position = (switch pointed down):

The protective gas option is active, but without pre-flooding. Press the start button to begin both the curing process and protective gas flow into the polymerization chamber. The chamber continues to be filled with the protective gas for the entire duration of the curing process. During protective gas flow into the chamber, the yellow LED (labelled “ok”) is illuminated. In case of insufficient pressure (< 0.8 bar) or no gas flow, the yellow LED extinguishes and the red LED (labelled “def.”) lights up.

Notes:

- Total curing in conjunction with the protective gas function works only with inserted holding trays.
- The use of nitrogen gas, N₂, with a quality level of 2.6 (i.e., 99.6% purity) or higher (e.g. 3.0 at 99.9% or 5.0 at 99.999% purity) is recommended as protective gas for this device. Contact the device manufacturer NK-Optik GmbH before you intend to use any alternative inert gases (e.g. Argon or CO₂) for the protective gas function, as this will require the use of specialized holding trays.
- The gas flow is about 10-11 litres per minute (when pressure-regulator is set to 1.0-1.2 bar).
- During the curing process the switch position for the flooding options of the polymerization chamber cannot be changed.

11 Warranty

All our products come with a 12-month warranty on assembly errors and material defects from the date on the invoice. Excluded from the guarantee are modifications of the unit as well as the flash bulbs, reflectors and all other parts of the unit which are subject to wear and tear. The warranty becomes invalid if non-authorized personnel carried out repairs or alterations of the unit. Exchanged parts become our property. The warranty does not include any transportation costs.

12 Technical data / accessories / consumables

Voltage	100, 115, 230 Volts AC
Frequency	50/60 Hz
Power consumption	approx. 300 Watts
Fuse	T4 AL 250 Volts AC
Mains connection	IEC connector according to national requirements
Dissipated power	approx. 200 Watts
Flash frequency	10 flashes per second
Life span of flash-bulbs	approx. 250 hours
Digital timer	programmable from 1 to 9999 flashes
Size of polymerization chamber	ca. 120 x 120 x 50 mm
Spectral distribution	230-950 nm
Measurements	approx. 310 x 310 x 140 mm
Weight	6 kg
Operating conditions	<ul style="list-style-type: none"> – Operate indoors only – to a maximum of 2000 m above sea level – Voltage supply $\pm 10\%$ – Overvoltage category II – Pollution degree 2 – Ambient temperature: 10-40 °C – Relative humidity: 10-80%
Protective gas option	<ul style="list-style-type: none"> – nitrogen N₂, minimum quality 2.6 or higher – recommended pressure: 1.0-1.2 bar. Maximum of 8 bar – flowrate: approx. 10 l/min
Consumables:	<ul style="list-style-type: none"> – flash-module, type 171.09-LM – holding tray, type 360N2, light transmission 360-950 nm (tray with UV-B block) – holding tray, type 280N2, light transmission 280-950 nm – fused quartz glass plate, light transmission 230-950 nm (for using the Otoflash for disinfecting by UV-C radiation) – air filter, type 171.11-LF
Accessories	<ul style="list-style-type: none"> – bottle pressure reducer for bottles with max. 200 bar – connecting tube, inner diameter \varnothing 6 mm with quick coupling W 7,2 mm – Flashmeter® G401, measuring device for measuring of light intensity within polymerisation chamber

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