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INSTRUCTION MANUAL
OF
GEL DOCUMENTATION SYSTEM

EcoDoc
(CAT. NO. E32-10101)

Manufactured and Marketed by:

TechResource

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Dear Customer,

*Congratulations on procuring the **EcoDoc**!*

The EcoDoc is a robust and economic Gel Documentation System with a flicker free UV-trans-illuminator and CMOS sensor DSLR camera specially designed and manufactured for biotechnology laboratories on a small budget.

*The trans-illuminators are very **sensitive** and on par with imported models. Our trans-illuminators are **safe** for use and enable management even by undergraduate students and most importantly; are very **economical**.*

*A post fluorescence filter absorbs the UV light and the violet blue light to give the same high sensitivity in addition to the inherent safety characteristics of **UVA light**.*

*The EcoDoc is indigenously manufactured with high quality components and is specifically designed to suit Indian laboratory conditions. It works on an integrated circuit controlled electronic ballast which gives a **flicker free** result. There is a provision for a **high and low intensity** controller. The small foot print enables it to fit easily on a work bench. A standard DSLR camera which can be controlled by a computer gives versatility to the system.*

This Gel documentation system will give you many years of trouble free use. In any event that there is a problem our warranty of 1 year covers all manufacturing defects.

We sincerely hope you that you gain as much satisfaction in using this trans-illuminator as we achieved in designing and manufacturing it.

Regards,

The Production Team of TechResource

Precautions:

1. Keep the gel documentation system dry at all times.
2. Avoid using when the input AC voltage has fluctuations.
3. Please read the manual carefully before using the equipment.
4. Do not use Alcohols or other cleaning agents to clean the filter on the window of the gel documentation system.

Check before installation

- A. Check for any physical damage to the gel documentation system that may have occurred in transit
 - B. Check the mains supply with a multi-meter for proper and correct voltage (within limits 220 – 245 V)
 - C. Functionality test
 1. Connect the gel documentation system through a stabilizer to the mains and switch it ON via the mains switch on the front
 2. Upon activating the UV tubes will start glowing
- Note: To ensure long life of the ballast and UV lamps connect the trans-illuminator to a stabilizer.

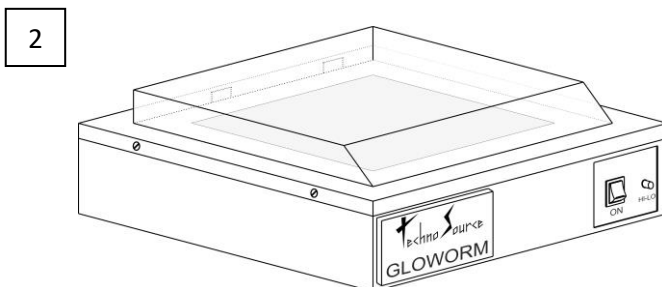
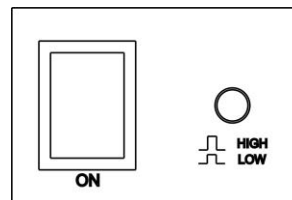
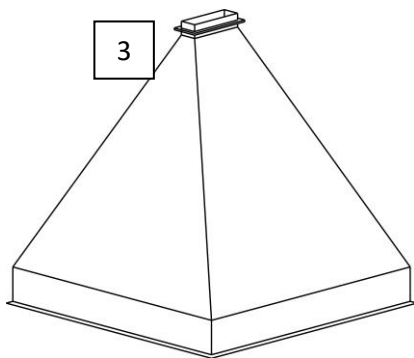
Diagrammatic representation of the Gloworm

Fig. 1 – Compact trapezoid hood

Fig. 2 – UV trans-illuminator with lid

Fig. 3 – Control panel with ON/ OFF
& HIGH / LOW switch

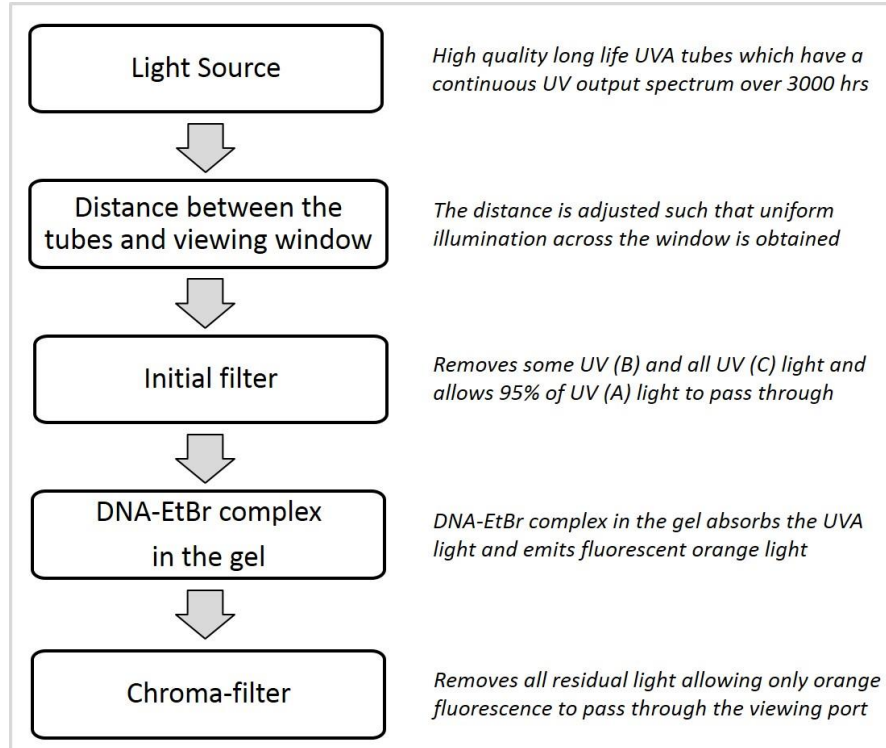
Complete Specifications:

Model	EcoDoc
Camera type	DSLR
Megapixel	18 MP
Sensor	CMOS
Number of filters	2
UV filter	Yes
IR filter	Yes
Red bandpass filter	Yes
Green bandpass filter	No
Number of UVA tubes	4
Lamp life	3000 hrs
Output wavelength: (radiation peak in nm)	315-400 nm (352 & 368)
Total tube wattage (No. of tubes x watt/ tube)	16 Watt (4 tubes x 4 W)
Total UV output wattage (no. of tubes x UVA watt/ tube) measured after 1000 hrs of usage	2 W 1.8 (4 x 0.5 W)
Viewing window	10 x 10 cm
UV output per cm ²	0.16 W/cm ²
Dimensions of the base [measurement excludes projecting knobs and switches]	(w) x (h) x (d) cm
Dimensions of the hood [measurement excludes projecting parts]	(w) x (h) x (d) cm
ON/ OFF switch position	Front panel
High-low intensity control switch	Front panel
Fusing position (Fuse rating)	Internal (1.5 mA)
Voltage input	230V rms, 50 Hz
Cooling by venting at the bottom	Yes
Upgradable to cooling via fan	No
Operating temp. range	15-45 °C
Humidity tolerance (non-condensing)	up to 85%
Software for camera control	EOS utility
Software for image analysis	ImageJ
Warranty	1 year

Using the EcoDoc

1. Inter-connecting the camera, EcoDoc and computer prior to use
 - a. Make sure the ON/ OFF switch on the front panel of the gel doc is switched off
 - b. Connect the mains plug to a stable source of power outlet (230V, 50Hz, single phase, with functional grounding)
 - c. Start the EcoDoc by switching the ON/ OFF switch on the front panel ON
 - d. Connect the camera to the computer via USB cable
 - i. Use a __ pin to USB cable
 - ii. The __ pin is to be inserted on the side of the camera
 - iii. The USB pin is to be inserted on the USB port of the computer
 - e. Start the camera
 - i. If you are using the battery to power the camera then use the ON/OFF button on the camera to turn the camera ON
 - ii. If you are using the power adapter to power the camera then the adapter has to be switched on by plugging it into a mains power supply. Make sure the ON/ OFF button on the camera is turned ON
 - f. Start the Computer
 - i. For a list of compatible computer operating systems refer to the List on page ____
 - ii. Start the EOS utility program
 - iii. Click on ____remote shooting
2. Taking an image
 - a. Carefully place your gel on the window of the trans-illuminator, taking care not to break the gel or to scratch the surface of the window
(If using a UV transparent tray then place the tray on the window)
 - b. Shut the door of the gel doc
 - c. Switch ON the mains switch on the front panel – the UV tubes would start glowing immediately
 - d. You can toggle between the High and Low intensity using the toggle switch.
 - e. Click the capture button on the EOS utility app
 - f. The image will be taken and stored
 - g. To analyse the image stored use the ImageJ app (Refer to the separate manual attached)
3. Shutting down the system
 - a. When visualization is complete switch OFF the mains switch on the front panel
 - b. Open the door of the gel doc
 - c. Carefully lift the gel from the window of the trans-illuminator, taking care not to scratch the surface of the window
 - d. Clean the window surface with a tissue paper dampened with distilled water. Wipe excess distilled water with a dry tissue paper
(DO NOT USE ANY OTHER CLEANING AGENTS. Alcohol, cleaning spirits etc. will damage the surface)
 - e. Close the door of the gel doc

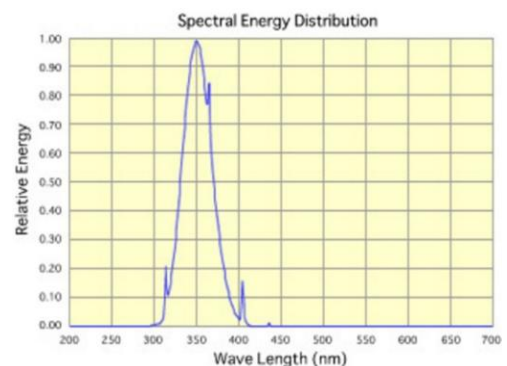
Working of the TechnoSource UV trans-illuminator



Spectral Energy Distribution of the UVA tubes used in Gloworm systems.

The tubes used in our Gloworm UV trans-illuminators have a very narrow output band. This ensures that:

- There is minimal DNA damage, as there is almost no output at wavelengths below 320 nm &
- Very low white light emissions as there is almost no output at wavelengths above 420 nm.



The principle of DNA intercalated Ethidium Bromide fluorescence:

1. Ethidium bromide (EtBr) is a powerful mutagen, toxic by inhalation, ingestion and skin contact. EtBr intercalates into the double helix increasing the spacing of successive base pairs. *This distorts the regular phosphate backbone and reduces the pitch of the helix. EtBr binding causes an increase of up to 27% in length of DNA.*
2. The fixed position and its close proximity of the bound dye to the bases cause an increased fluorescent yield compared to the dye in free solution. *It is weakly fluorescent in aqueous solution.*
3. UV light is divided into three regions:

	UVA (Used in Glowworms)	UVB	UVC
Range	~ 320-420 nm	~ 280-380 nm	~ 240-270 nm
Peak emissions of std available tubes	366	302	254

The emissions spread 50-60 nm on either side of the peak. The tubes also emit some white light.

4. The advantages and disadvantages of the three illuminating sources are listed below.
 - a. UVA bulbs: **Gloworm trans-illuminators use UVA tubes.**

UVA is a normal component of sunlight (it is responsible for giving a skin tan). It is not mutagenic or harmful to eyes and skin. It does not dimerize thymidine nor break the DNA backbone. Hence, it does not cause photo bleaching.

[Photo bleaching effect of different wavelengths can be represented as: **UVC >> UVB > UVA**]

However, the UVA tubes emit large amount of violet-blue light, adversely affecting the contrast when viewing faint fluorescent bands. The use of the chroma-filter in the Gloworm counters this and provides clear visibility.

(Radiation at 302 nm and 366 nm is absorbed by the dye itself. In both cases a fraction of the energy is re-emitted at 590 nm in the red-orange region of the visible spectrum).
 - b. UVB bulbs:

UVB is absorbed by (carbon-carbon)C-C bonds. It results in C-C bond breakage of the DNA backbone and prevents resonance transfer of the energy to the intercalated EtBr (Photo bleaching). It causes retinal damage and sunburn. The bulbs emit a small fraction (~5%) of UVC light whose deleterious properties have been outlined in section 'c'. UVB bulbs also emit white light, hence for use in trans-illuminators need a special glass filter that is transparent to UV light and blocks blue and longer wavelengths. *(But these filters do transmit violet light)*. These filters are expensive, get solarized with use and also adsorb spilled EtBr that results in auto fluorescence.
 - c. UVC bulbs:

These tubes are used for a germicidal action. UVC damages eyes and skin and is highly mutagenic. It causes DNA damage (nicks, photo-bleaching and dimerization). It is highly recommended that protective clothing and gear is worn to ensure safety. When a UVC bulb is used in a trans-illuminator UV-transparent gel trays cannot be used as the UVC does not travel through PMMA (which is the commonly used material for gel trays), hence either the gel has to be put directly on the filter or epi illumination has to be used. UVC bulbs also emit white light and a special glass filter needs to be used (As discussed in point 'b' above)

EtBr-DNA complexes yield best fluorescence at 254 nm but are subjected to photo-bleaching and DNA damage.

Trouble shooting procedure

SR. NO.	Indication	Cause	Remedy
1	Mains switch is not illuminated AND UV tubes are not glowing	Faulty main supply	Restore the mains supply
		Instrument fuse blown	Try replacing with correct fuse of 1.5A, only once. If fuse blows again contact us at sales@techresource.in. To replace fuse, open the EcoDoc using the screws on the side of the base. The fuse is in an in-line fuse holder.
2	Mains switch is illuminated but UV tubes are not glowing	Electronic ballast is blown	Ballast needs to be replaced. (We use specially designed ballast. DO NOT attempt to replace with commercially available ballast)
		UV tubes are not functional	UV tubes need to be replaced (Please contact us to get the correct UVA tubes)
3	Mains switch is not illuminated but UV tubes are glowing	The bulb in the mains switch is blown.	Mains switch needs to be replaced (Please contact us at sales@techresource.in)
4	UVA tubes are ON but no bands seen in the gel	Sample has degraded	A ladder (or any control) would help to visualize if the gel has run properly.
		Inadequate amount of sample	Load a larger amount of sample.
		Tubes have crossed their functional life of 3000 hrs	Ask for replacement set of tubes (with 1 hr of usage per day*, the tubes should remain efficient for ~ 10 yrs)
		Sample has not run.	Check if fluorescence is present in the wells. If yes please follow the trouble shooting guide in any of our Horizontal electrophoresis manuals.
		Sample has run out of the gel	Compare your band position with respect to the dye front. Bromophenol blue runs at approximately 0.5Kb-0.4Kb in 0.5 – 1.5% gels (xylene cyanol at 10Kb-4Kb) and at ~ 0.1Kb in 2-3% gels (xylene cyanol at ~ 0.5Kb).
		Low amount of EtBr	Use a higher concentration of EtBr (ideal concentration for staining is 0.5ug/mL) Stain for a longer time in EtBr
5	High EtBr background	High background of EtBr observed on the filter	Remove the gel from the window and clean the excess EtBr using tissue paper made damp with D/W. (Do not use any other cleaning agent) If problem persists contact us at sales@techresource.in
		High background of EtBr in the gel	De-staining of the agarose gel should be performed using a 0.1M MgCl ₂ in D/W or buffer. (de-staining in D/W or buffer will not reduce the background completely)
6	Camera is not detected		
7	EOS utility gives message saying it is not working	EOS utility software and the	Restart the computer.

		computer need to be restarted	
		EOS utility needs to be updated	Periodically Canon upgrades the EOS utility software and hence the older versions would not work well. Please update to the latest EOS utility software by visiting the Canon website.
		Java needs to be updated	Please contact your service provider to update JAVA on your computer
		Operation system needs to be reinstalled	Please contact your service provider to reinstall the Operating system on your computer

*Calculated with 5 working days in a week, with one hour of continuous usage at the high intensity setting, at operating temperature of 25°C.
Repeated ON-OFF cycles will shorten the life span.

If you are facing any difficulty in understanding the instruction or operating the EcoDoc, kindly contact us at: sales@techresource.in with your feedback on steps given above. This will provide us with necessary information to advise you properly.