GE Healthcare
Life Sciences

Spectrophotometer Health & Safety Document including General Operating Instructions

Original Instructions

Page finder

1. HEALTH AND SAFETY

1.1. Scope

This booklet covers the following ranges of instruments:

- Ultrospec 10 cell density meter
- Novaspec III and Novaspec Plus Visible spectrophotometers
- GeneQuant 100 & 1300 UV/Visible spectrophotometers
- Ultrospec 2100/3100/5300/6300/7000/8000/9000 UV/Visible spectrophotometers
- NanoVue Plus micro volume spectrophotometer

Translations of these instructions into 22 European languages are available on the User Manual CD supplied with the instrument and on the internet at GE Healthcare Lifesciences home page www1.gelifesciences.com

1.2. Intended use

Visible and UV/Visible spectrophotometers shine light through a liquid sample and measure it's Absorbance. This sample is typically held in a cuvette but when sample volume is limited, an instrument such as the NanoVue Plus can be used where a 2 µl sample can be pipetted directly onto the measurement area. Typical applications of spectrophotometers include DNA/RNA/Oligo concentration and purity measurements as well as protein determinations.

This manual addresses the needs of scientists and technicians who operate UV/Visible spectrophotometers. The level of information presented in this manual assumes the user possesses basic laboratory and technical skills, and has the knowledge and documentation to safely operate. If you need assistance with the instructions in this manual, contact GE Healthcare for more information.

1.3. Safety Notices

These operating instructions contain Warnings and Cautions concerning the products with meanings as defined below:

WARNING

Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury. It is important not to proceed until all stated conditions are met and clearly understood.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. It is important not to proceed until all stated conditions are met and clearly understood.

WARNING

- There are no bio-hazardous materials within the unit; however this unit could be used with bio-hazardous samples. Before using the instrument, the customer should have in place decontamination procedures designed to protect laboratory workers from occupationally acquired infections. The sample chamber cell holders are removable and may be decontaminated using the appropriate disinfectant for the bio hazard in question, rinsed with distilled water and then allowed to dry. The sample chamber and exterior may be wiped with a suitable disinfectant cleaning wipe. It is the responsibility of the customer to ensure that the user of the equipment is provided with a safe working environment.
- Any chemicals used in Analyses should be used, stored and disposed of in accordance with manufacturer's guidelines and local safety regulations.
- Toxic Fumes. Efficient laboratory ventilation must be provided when working with volatile solvents or toxic substances.
- Waste disposal. Disposal of some solvents and chemicals may be classed as hazardous waste and must be dealt with in accordance with local regulatory practice.
- Personal protective equipment. This is not required to operate the unit but the samples measured may require PPE. A local risk assessment should be carried out.
- Decontamination. Equipment returned for repair should include an appropriate decontamination certificate.

1.4. General Safety

This equipment has been designed to conform to the following directives

2006/95/EC	Low Voltage Equipment Safety Directive
2004/108/EC	EMC directive
2002/96/EC	Waste electrical and electronic equipment (WEEE)
2002/95/EC	Restrictions of the use of certain Hazardous Substances in electrical and electronic equipment (ROHS)
2006/42/EC	Machinery directive
1999/5/EC	Radio and Telecommunications terminal equipment directive - for Bluetooth devices. (Only for instruments with optional Bluetooth accessory)

Standards to which conformity is declared include:

EN61010-1:2001	Safety requirements for electrical equipment for measurement, control and laboratory use.
EN 61326-1:2006	Electromagnetic compatibility - generic emission standard Electrical equipment for measurement, control and laboratory use. Classified as Class B for conducted and radiated emissions
EN ISO 12100:2010	Safety of machinery – Basic concepts, general principles for design

1.5. General Hazards

There a number of warning labels and symbols that may be present on your instrument. These are there to inform you where a potential danger exists or particular caution is required. Before commencing installation, please take time to familiarise yourself with these symbols and their meaning. This instrument is subject to the following hazards:

CAUTION

Some of the above instruments contain a UV source which generates a light beam that traverses the sample chamber and is accessible in the lamp chamber. Under normal use the lamp beam is confined within the instrument. The unit should not be operated with the sample chamber lid open or the lamp housing lid removed as prolonged exposure to the beam may cause permanent eye damage.(Not applicable to Ultrospec 10, Novaspec III/Plus)

WARNING

High voltages exist inside the Ultrospec 2100/3100/5300/6300/7000/8000/9000, GeneQuant 100/1300 and NanoVue Plus instruments. Repair and maintenance should only be carried out by individuals trained specifically to work on these instruments.

CAUTION

These instruments may be connected to a separate PC. To preserve the integrity of the measuring equipment it is essential that the attached PC itself conforms to basic safety and EMC standards and is set up in accordance with the manufacturers' instructions. If in doubt consult the information that came with your PC. In common with all computer operation the following safety precautions are advised.

- To reduce the chance of eye strain, set up the PC display with the correct viewing position, free from glare and with appropriate brightness and contrast settings.
- To reduce the chance of cross contamination from biological samples, use appropriate personnel protection measures and disinfectant wipes on keyboard and mouse

CAUTION, HOT SURFACE

- These instruments may be fitted with heated cell holder accessories that depending on operation may become hot to touch. Care should be taken to avoid touching the heated accessory when running at elevated temperatures

1.6. Unpacking and installation

NanoVue Plus instrument

External power supply

- Inspect the instrument for any signs of damage caused during transit. If any damage is discovered, do not use the instrument and report the problem to your supplier.
- Ensure your proposed installation site conforms to the environment conditions for safe operation
  - Indoor use
  - 5 to 40°C
  - Maximum relative humidity 90% up to 31°C decreasing linearly to 50% at 40°C
- Extremes of temperature may require recalibration of the unit for optimum performance
- If the instrument has been stored in a cold environment then it should be allowed to come to thermal equilibrium for 2 to 3 hours before operation so that start up calibration is not compromised by condensation.
- The instrument must be placed on a stable, level bench or table capable of taking its weight with sufficient space around the instrument for ventilation to circulate freely.
- The equipment must be connected to the local supply outlet using the provided power cables, compatible voltages are shown in the table below. Replace power inlet fuses only with the same type and rating as follows

Instrument Type	Power requirements	Replacement Fuse
Ultrospec 10 units	100-240 V AC 50 - 60 Hz	3 A (UK plug only)
Novaspec III and Novaspec Plus	100-240 V AC 50 - 60 Hz	3 A (UK plug only)
GeneQuant 100 & 1300 units	100-240 V AC 50 - 60 Hz	3 A (UK plug only)
Ultrospec 2100/3100 units	85-264 V AC, 50 - 60 Hz	T 2 A H 250 V AC (Anti-Surge, High breaking capacity)
Ultrospec 5300/6300 units	90-132 V or 180-264 V AC , 50 - 60 Hz	T 1.6 A H 250 V AC (Anti-Surge, High breaking capacity)
Ultrospec 7000/8000/9000 units	85-264 V AC, 50 - 60 Hz	T 1.6 A H 250 V AC (Anti-Surge, High breaking capacity)
NanoVue Plus units	100-240 V AC 50 - 60 Hz	3 A (UK plug only)

- The instrument should be positioned so that the power cable may be readily removed in the event of a hazard or malfunction occurring.
- Site the instrument in an atmosphere free from dust and corrosive fumes.
- Ultrospec 2100/3100/5300/6300 instruments have the on/off switch on the back of the instrument on the right hand side. Ultrospec 7000/8000/9000 instruments have the on/off switch on the left hand side of the instrument. Ultrospec 10, Novaspec III/Plus, GeneQuant 100/1300 and NanoVue instruments have an on/off button on the keypad – to disconnect power from these units remove the power lead from the instrument. The instruments will automatically perform some start up self diagnostic checks, please wait for these to finish before attempting to use the equipment.
- The spectrophotometer may be fitted with a range of accessories for specific applications. For the GeneQuant 100/1300 and NanoVue Plus these include a built in printer, Bluetooth or SD card accessory. The Ultrospec 2100/3100/5300/6300 /7000/8000/9000 have a range of accessories that can be fitted in the sample compartment including a sipper, long path length cell holder and thermostatted cell holder. Full instructions on fitting accessories are within the instrument or accessory user manual.

3. OPERATING AND MAINTENANCE

All spectrophotometers are operated in the same generic way by comparing the amount of light Absorbed by a sample when compared to a reference solution:

3.1. Preparation before starting

- The instrument is switched on and allowed to initialise, Ultrospec 10, Novaspec III/ Plus, GeneQuant 100/1300 and NanoVue Plus units have the on/off switch on the keypad.

- Ultrospec 2100/3100/5300/6300 units have an on/off switch on the back of the instrument on the right hand side.
- Ultrospec 7000/8000/9000 instruments have the on/off switch on the left hand side of the instrument.
- The relevant software module for the application being carried out is selected from within the instrument software e.g. fixed wavelength measurement, concentration measurement, wavelength scan, kinetics measurement or a dedicated method such as DNA concentration & purity. The options within the application set up the instrument parameters such as wavelength and define any calculations taking place on the measured results.

3.2. Performing a run - cuvettes

- On the Ultrospec 10, Novaspec III/Plus , GeneQuant 100/1300 and Ultrospec 2100/3100/5300/6300/7000/8000/9000 units samples are measured in a cuvette. A suitable cuvette must be used for the application to be carried out – it must be of the correct material to allow the selected wavelength of light to pass through and must be of the correct physical size to fit the relevant instrument and the sample volume available. The cuvette is filled with a solution of reference material which is typically the solution that the sample is dissolved in, the cuvette is placed in the cell holder in the correct orientation as per the diagrams below:

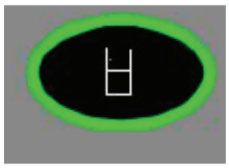
Ultrospec 10, front to back

All other units, right to left

- The instrument is then zeroed by pressing the Zero key on the keypad:

Ultrospec 10

Novaspec III/Plus



GeneQuant 100/1300

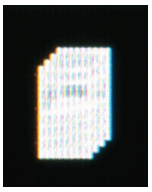
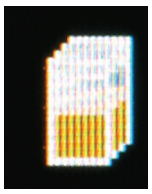
Ultrospec 2100/3100

Ultrospec 6300

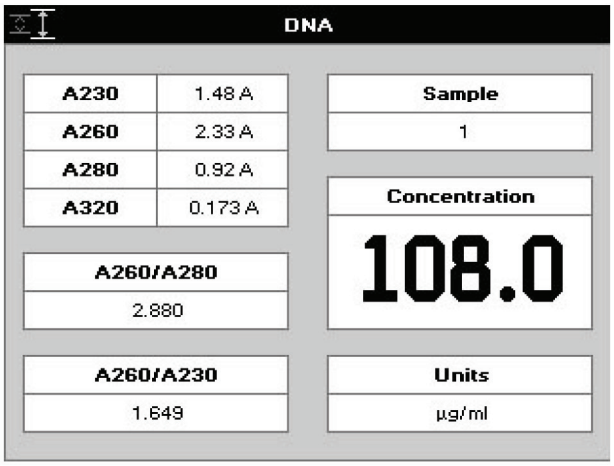
- The reference solution is then removed, the cuvette filled with the sample and the sample measured by pressing the run button on the keypad. The measured results will be displayed on the instrument display.

Ultrospec 10 | Novaspec III/Plus | GeneQuant 100/1300 | Ultrospec 2100/3100 | Ultrospec 6300

- The Ultrospec 7000/8000/9000 instruments have a coloured Touchscreen for operation and a double beam optical system. In normal operation a cuvette filled with reference solution is put in the rear cell holder , a cuvette filled with sample in the front cell holder, the relevant application method is loaded and the Run Icon pressed. If a single cell is being used e.g. a microcell it should be filled with reference solution, placed in the front cell holder, the Zero icon pressed, the cuvette filled with sample, placed in the front cell holder and the Run Icon pressed

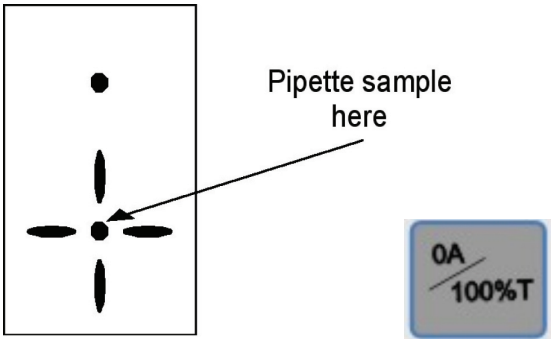
Zero  Run 

- Typical results screen (DNA application GeneQuant 100)

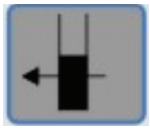


3.3. Performing a run – NanoVue Plus

- On the NanoVue Plus units samples are measured on a sample plate. Using a pipette a solution of reference material which is typically the solution that the sample is dissolved in, is dropped onto the measurement position on the sample plate and the instrument zeroed by pressing the zero key on the keypad.



- The reference solution is then wiped away with a tissue; the sample is pipetted into place and measured by pressing the run button on the keypad.



- The measured results will be displayed on the instrument display.

3.4. Post run procedures

Cuvettes – empty cuvette of sample and rinse with deionised water. Cuvettes may be periodically cleaned by using commercially available cell cleaning solutions or dilute detergent solutions but should always be rinsed in deionised water.

NanoVue Plus – wipe sample with tissue. At end of sample run wipe plates with tissue wetting with deionised water. The plates can also be cleaned with isopropyl alcohol or a dilute detergent solution but the plates should always be rinsed with deionised water after cleaning.

Sample disposal

- Waste disposal. Disposal of some solvents, chemicals or samples may be classed as hazardous or bio hazardous waste and must be dealt with in accordance with local regulatory practice..

3.5. User Maintenance

Instrument Type	User Maintenance
Ultrospec 10 units	None
Novaspec III and Novaspec Plus	Changing Tungsten lamp, removal of cell holder for cleaning
GeneQuant 100 & 1300 units Ultrospec 7000 unit	Removal of cell holder for cleaning
Ultrospec 2100 & 3100 units	Removal of cell changer for cleaning
Ultrospec 5300 & 6300 units	Changing Deuterium/Tungsten lamps, removal of cell changer for cleaning
Ultrospec 8000 & 9000 units	Changing Deuterium/Tungsten lamps, removal of cell holders for cleaning
NanoVue Plus units	Cleaning of sample plates, recalibration of pathlength

3.6. Novaspec III/Plus Lamp Change

1. Switch off the instrument, remove the sample from the cell holder and disconnect the power supply cord
2. Remove the protective layers at the lamp access and plug in points on the underneath of the instrument
3. Remove the lamp wires from the groove by gently unclipping it
4. Remove the lamp by twisting the lamp assembly counter-clockwise
5. Remove the lamp connection end by gently pulling with your fingers
6. Replace with new lamp using the reverse of these actions
7. Dispose of the faulty lamp in accordance with local regulatory practice.

3.7. Ultrospec 5300/6300 Lamp Change

1. Switch off the instrument, remove sample from cell holder and disconnect the power supply cord. Allow time for lamps to cool.
2. Locate the lamp access cover on the left-hand rear side of the instrument, remove the screw and push the cover back using the insert at its front.

3. Turn the lamp select mirror so that it is facing away from you.
4. Undo the black knurled screw on the lamp cover plate with your fingers and remove the plate.
5. Undo the large cross-headed screw holding down the lamp assembly housing, and tilt it upwards.
6. Slide the lamp plate out and unplug the cable connector.
   - If the tungsten lamp has failed, the replacement should be inserted onto the plate, pushing it all the way down into its holder.
   - If the deuterium lamp has failed, insert the tungsten lamp onto the plate as above and then replace the whole assembly with the new one.
7. Reconnect the cable connector and slide the lamp plate in until it locates.
8. Push the lamp assembly housing down and attach with the large cross-headed screw.
9. Replace the lamp cover plate, attach by re-tightening the black knurled screw.
10. Replace the lamp access cover and attach with the screw at the rear.
11. Reconnect the power supply cord and switch the instrument on.
12. Dispose of the faulty lamp in accordance with local regulatory practice.

After the lamp has warmed up sufficiently (30 minutes), run a new baseline.

3.8. Ultrospec 8000/9000 Lamp Change

1. Switch the instrument off, disconnect the power supply cord and allow lamps to cool.
2. Locate the lamp access cover at the rear of unit and remove the two top screws and slide top cover back and lift off. Never operate the unit with the lamp housing cover removed.
3. 

4. Remove the lamp and dispose of in accordance with local regulatory practice.
5. Follow the handling instructions supplied with the lamp. Do not touch the glass envelopes of the replacement bulbs directly.
6. Replace the lamp cover and screw securely.
7. Attach power cord, switch on and wait at least 30 minutes for the unit to warm up.
8. Perform a new instrument baseline (on all bandwidth settings if variable bandwidth unit) and save this as the permanent baseline (see the online help or user manual).
9. Reset the lamp hours after replacing the lamp (see the online help or user manual).

4. TROUBLESHOOTING

Detailed in the table below are the most common faults found whilst using our spectrophotometers

Instrument	Problem	Possible causes
Ultrospec 10	A flashing Absorbance reading of 2.00 Abs is obtained.	This indicates an Absorbance of more than 1.99 and is therefore out of range. The sample needs to be diluted.
Ultrospec 10	REF is displayed when T is pressed.	The instrument has not been zeroed before a sample measurement has been attempted.
All instruments	A negative reading is obtained.	In normal measurements the test sample has a positive Absorbance compared to that of the Reference. Negative readings will be obtained if the Reference and Test cuvettes are mixed up.
All instruments	Unexpected results are obtained.	Any bubbles in solution will produce considerable error.
All instruments	Absorbance values higher than expected.	Possible issue with optical alignment. Contact service support.
All instruments	Absorbance values lower than expected.	Check sample cuvette filled to 20 mm from base of cuvette. Possible stray light issue. Contact service support.
All cuvette models	Instrument will not zero.	Cuvette placed in wrong orientation, Wrong cuvette material used for wavelength.
Novaspec III	Error code 001 symbol  .	Lamp needs changing.
Novaspec III	Error code 006 symbol  .	Pixel clock too high. Instrument needs optical alignment. Contact service support.
Novaspec III	Error code Flashing number!	Wavelength accuracy failure. Instrument needs optical alignment. Contact service support.
Novaspec plus	X against Lamp on initialisation screen.	Lamp needs changing.
Novaspec plus	X against Wavelength calibration on initialisation screen.	Check sample beam is clear when instrument switched on.
Novaspec plus	- against all calibration items on initialisation screen.	Instrument needs optical realignment or reprogramming. Contact service support.
GeneQuant 100/1300, Ultrospec 2100/3100/5300/6300, Ultrospec 7000/8000/9000	Poor reproducibility on DNA concentration and purity measurements.	Wrong cuvette being used – not a 15 mm beam height or wrong material – not letting UV light pass through. Background correction mode not switched on. Measured Absorbance too low, should be >0.1 A for accurate results.
GeneQuant 100/1300, Ultrospec 2100/3100/5300/6300, Ultrospec 7000/8000/9000	Instrument fails start up calibration check.	Check sample and reference beams are clear when instrument switched on. Ultrospec 5300/6300 check lamp life and replace if hours >1000. GeneQuant 100/1300, Ultrospec 2100/3100/7000/8000/9000 report failure message to service support.

Ultrospec 10, Novaspec III/Plus, GeneQuant 100/1300, NanoVue Plus	Instrument switches off after calibration.	You may be keeping you finger on the ON/ OFF button too long, so that the instrument receives both ON and OFF signals and switches off after the calibration. Try adjusting the timing of your finger press at switch on.
Novaspec plus	Instrument fails to initialise – "cell holder obstructed UV" error message.	Ensure sample plates are clean.
Novaspec plus	Absorbance readings unstable.	Ensure Reference QA switched on. Ensure Background correction is switched on. Ensure 2 µl sample being used.
Novaspec plus	Absorbance readings stable but incorrect.	Check pathlength calibration.

Detailed instructions on how to carry out the above user maintenance and trouble shooting for the different models may be found in the relevant user manual supplied on a CD with the instrument.

4.1. Emergency Procedures

In the event of a malfunction or hazard occurring, the user responsible shall disconnect the unit from power and isolate the instrument for decontamination by an appropriate means if bio hazardous material is spilt on, in or around the instrument.

Ultrospec 2100/3100/5300/6300 instruments have the on/off switch on the back of the instrument on the right hand side. Ultrospec 7000/8000/9000 instruments have the on/off switch on the left hand side of the instrument.

Ultrospec 10, Novaspec III/Plus, GeneQuant 100/1300 and NanoVue instruments have an on/off button on the keypad – to disconnect power from these units remove the power lead from the instrument.

4.2. Recycling Procedures

This equipment should be decontaminated before decommissioning and all local regulations shall be followed with regard to scrapping of the equipment.

4.3. Recycling of hazardous substances

Spectrophotometers contain hazardous substances. Detailed information is available from your local GE Healthcare representative.

4.4. Disposal of electrical components

Waste of electrical and electronic equipment must not be disposed of as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

4.5. Specifications

Specification	NanoVue Plus	Ultrospec 9000	Ultrospec 8000	Ultrospec 7000	Ultrospec 6300	Ultrospec 5300	Ultrospec 3100	Ultrospec 2100	GeneQuant 1300	GeneQuant 100	Novaspec Plus	Novaspec III	Novaspec 10
Wavelength Range	200-1100 nm	190-1100 nm			190-1100 nm		190-900 nm		190-1100 nm	190-900 nm	330-800 nm		600 nm dedicated
Light Source	Xenon	Deuterium/Tungsten		Xenon	Deuterium/Tungsten		Xenon		Xenon		Tungsten		600 nm LED
Bandwidth	5 nm	0.5 nm, 1.0 nm, 2 nm, 4 nm	1.0 nm	2.0 nm	1.0 nm		< 3 nm		5 nm		< 7 nm		40 nm
Absorbance Range (A)	0 to 125 A	-4 A to 4 A			-3 A to 3.A				-0.3 A to 2.5 A				- 0.3 A to 1.99 A
Pathlength	0.5 mm, 0.2 mm	1 mm to 100 mm			1 mm to 100 mm				10 mm				
Wavelength Accuracy	± 2 nm across range, ± 1 nm from 240 nm to 330nm	± 0.3 nm		± 0.5 nm	± 0.5 nm		± 1 nm		± 2 nm		± 2 nm		N/A
Absorbance Accuracy	+/- 1% at 259 nm at 0.7–0.8 A using uracil	± 0.002 A at 0.5 A ± 0.004 A at 1 A ± 0.006 A at 2 A at 440 nm, 465 nm, 546.1 nm, 590 nm, 635 nm ± 0.005 A using 60 mg/l K2Cr2O7			± 0.5% or ± 0.003 A to 3.000 A at 546 nm, whichever is the larger		within 0.5% of Absorbance value to 3.000 A at 546 nm		± 0.005 Abs or 1% of the reading, whichever is the greater at 546 nm		± 2.0% or ± 0.010 A to 1.000A at 546nm, whichever is the greater		<± 0.05 A at 1 A using Neutral Density Filters

Full specification and operating instructions are contained within the relevant user manual.

4.6. Manufacturing information

Requirement	**Content**
Name and address of manufacturer	Biochrom Ltd, 22 Cambridge Science Park, Milton Road, Cambridge, CB4 0FJ, UK
Name and ID notified body	dB Technologies (Cambridge) Ltd. FCC reg. no 90528
Place and date of declaration	
NanoVue Plus Family	Cambridge, June 2010
GeneQuant Family	Cambridge, June 2010
Novaspec Family	Cambridge, June 2010
Ultrospec 10, 2100, 3100, 5300, 6300 Family	Cambridge, June 2010
Ultrospec 7000, 8000, 9000 Family	Cambridge, August 2011
Identity of person authorized to sign DoC	Brian Clarkstone, Technical Director

Full specification and operating instructions are contained within the relevant user manual.

5. LEGAL

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