

# DG-4 / DG-5

## ULTRA HIGH SPEED WAVELENGTH SWITCHER

SUTTER INSTRUMENT



The Lambda **DG-4/DG-5** is a complete illumination system offering speed and versatility for experiments requiring rapid wavelength switching. The instrument retains all the advantages of interference filter based systems, yet eliminates the temporal constraints imposed by traditional filter changing devices like filter wheels. Switching between any two wavelengths is achieved in less than the 1.2msec vertical retrace period of a video signal, allowing the user to perform real-time video imaging. The high switching speed of the **Lambda DG-4/DG-5** facilitates the ability to follow fast changes in ion concentrations in dual wavelength ratio imaging applications and to monitor other concomitant changes in the studied system at additional wavelengths. Narrow bandpass systems, such as single cavity interference filters, grating monochromators, and A.O. modulators, pass unwanted harmonics of the desired wavelength. Also, with variable wavelength devices, it is not always possible to obtain sufficient blocking of out-of-band wavelengths. Modern interference filters, as used in the **Lambda DG-4/DG-5**, do not pass harmonics and have integral blocking characteristics 1000 times better than typical monochromator systems. For the same full width at half maximum (FWHM), interference filters have a narrower spectral bandpass than monochromators due to the absence of the slit function. The dual galvanometer design of the **Lambda DG-4/DG-5** allows tuning of the relative intensities at each wavelength. This adjustment is difficult to obtain in variable wavelength devices with a single optical path. Unlike monochromators and other wavelength selective systems, the **Lambda DG-4/DG-5** can be used as a source of white light when required.

### How it works:

This unique optical design of the **Lambda DG-4/DG-5** is based on dual scanning galvanometers utilizing interference filters for wavelength selection. The light from the xenon arc lamp is focused on the first galvanometer mirror which directs it via a parabolic mirror, through one of the interference filter channels. Following the filter, a second parabolic and a second galvanometer mirror collect and redirect the light into the light guide. A cold mirror in the beginning of the light path eliminates the IR radiation, reducing significantly the amount of heat absorbed by the optics and the sample. Cold mirrors modified to pass near-IR to 780 to 880nm are also available. A built-in shutter function allows reduction of light intensity by five to six orders of magnitude. For applications requiring mechanical shuttering, like time lapse experiments or very sensitive samples, the SmartShutter™ can be integrated into the device to assure that the light is completely blocked. The standard system, the **Lambda DG-4**, holds up to four 25mm interference filters. The **Lambda DG-5**, a five filter version, accommodates three 18mm and two 25mm filters. While the switching time between any two wavelengths is done in less than 1.2msec, the dwell time at any wavelength is arbitrarily set by the user. In addition to the features of the standard **Lambda DG-4/DG-5**, the digital technology used in the **Lambda DG-4/DG-5 Plus** provides 0.5msec switch-ing times between adjacent filter positions and 20% greater light output. The liquid light guide can be coupled to the illumination port of most microscopes using an adapter which can be purchased separately. Please ask for further information.

### FEATURES

#### ● Complete system for wavelength switching

The **Lambda DG-4 / DG-5** is a complete integrated 175 (or 300) Watt light source and wavelength switching excitation system.

Four or five interference filters can easily be installed in the **DG-4** or **DG-5**, respectively. An additional standard neutral density filter inserted in the common path of the light.

The light guide output from the **Lambda DG-4 / DG-5** provides uniform spatial illumination, as well as vibration isolation from your microscope. A cold mirror assembly eliminates ir radiation, extending the lifetime of the optics and the light guide, and preventing the exposure of the sample to ir when white light is necessary.

#### ● Integral shuttering

The **Lambda DG-4 / DG-5** provides a high speed shutter function with open/close times of 500µs. the shutter function reduces light intensity by 5 to 6 orders of magnitude.

If complete light shuttering is required, a mechanical shutter (i.e. Smartshutter™) can be incorporated into the **Lambda DG-4 / DG-5**.

#### ● Integral neutral density filtering

The **Lambda DG-4 / DG-5** provides a high speed shutter function with open/close times of 500µs. the shutter function reduces light intensity by 5 to 6 orders of magnitude.

If complete light shuttering is required, a mechanical shutter (i.e. Smartshutter™) can be incorporated into the **Lambda DG-4 / DG-5**.

Direct insertion of neutral density optical filters is also possible in the filter holders at any of the four optical channels. A final neutral density optical filter can be placed in the exiting light path which will reduce the light output from all optical channels.

#### ● Two outputs for monitoring filter position

A 4 bit TTL signal transmits the current optical channel (filter) position.

A digital-to-analog converter (DAC) output produces a voltage showing which filter is in use.

#### ● Turbo blanking

The turbo blanking feature is designed for situations when the switching is done between non-adjacent filter positions. When the instrument is in this mode, the input and output galvanometer mirrors move out of sync, thus preventing the sample from being exposed to light of unwanted wavelength during switching and shuttering.

## Methods of control

### ● Direct Computer Control via Parallel or Serial Interface

When operated in this mode, the **Lambda DG-4 / DG-5** control commands are a subset of our **Lambda 10-2** controller and will operate with software written for the **Lambda 10-2**.

(If you plan to control the DG-4 with other interfaces, please contact Sutter for specific issues.)

### ● Strobe-Pulsed Ring Buffer Control

A sequence of up to 32 filter values can be loaded into a ring buffer via keypad or computer. the system will switch to the next filter in the buffer on a ttl level (trigger) strobe pulse. After executing the last filter change in the string the system resets to the first filter and continues.

### ● Video sync pulsed ring buffer control

In this mode, a video sync pulse can be used to initiate and/or execute the filter change for a sequence of filter values stored in the ring buffer.

### ● Video sync with strobe low

In this mode, the system will implement a filter change on the video sync pulse, but only if the strobe line is held low. this allows a computer to override the sync pulse.

## SPECIFICATIONS

### Lamp Type

175 or 300 Watt ozone free or full spectrum xenon arc bulb

### Output Range

330nm to 700nm - Ozone free

300nm to 700nm - Full spectrum (requires ozone removal)

### Lamp Life

expected lifetime 1,000 hours (All bulbs have a prorated warranty for 500 hours)

### Power Consumption

350 Watts

### Filter Diameter

DG-4: Four 25mm filters (1 inch)

DG-5: Two 25mm filters and three 18mm filters

### Dimensions

25cm x 25cm x 48cm

### Light Guide

2 m long , 3mm wide

### Weight

20kg

### Electrical

115/230 V

50/60 Hz power line

## BASIC SYSTEM

- **DG-4/OF** DG-4/OF includes lambda DG-4 unit, pre-aligned 175 Watt ozone free xenon arc bulb, 4 slide-in filter holders, 1 neutral density filter holder, power cord, serial and parallel cables, liquid light guide, spanner wrench, and manual
- **DG-4/F30** same as **DG-4/OF**, except 300 Watt bulb
- **DG-4plus/OF30** **DG-4 Plus** with ozone-free 300 Watt bulb
- **DG-4/FS\*** Same as DG-4 , except 175W full spectrum bulb
- **DG-5/OF** Same as **DG-4/OF**, but with 5 filters and additional 18mm flat wrench. Two filters are 25mm and three filters are 18mm
- **DG-5/OF30** same as **DG-5/OF**, except 300 Watt bulb
- **DG-5plus/OF30** **DG-5 Plus** with ozone-free 300 Watt bulb
- **DG-5/FS\*** same as DG-4/Fs, except with 5 filter positions and an additional 18mm flat wrench. Three positions are 18mm and two are 25mm in diameter.

*\*WARNING: The full spectrum Xenon arc bulbs produce ozone, which is toxic and has to be eliminated. Systems containing full spectrum bulbs have to be connected to an ozone removing device or system. Please contact Sutter Instrument for more information.*

## ACCESSORIES

<b>O661176</b>	Ozone free 175 Watt xenon bulb (useful wavelength range 330-700nm)
<b>O661301</b>	Ozone free 300 Watt xenon bulb (useful wavelength range 330-700nm)
<b>O661175</b>	Full spectrum 175 Watt xenon bulb (useful wavelength range 330-700nm)
<b>O661300</b>	Full spectrum 300 Watt xenon bulb (useful wavelength range 330-700nm)
<b>DG-IF</b>	Interference filter holder (25mm)
<b>DG-IF/18</b>	Interference filter holder (18mm)
<b>DG-ND</b>	Neutral density filter holder

Mounting Adapters for Nikon, Zeiss, Leica and Olympus microscopes are available.