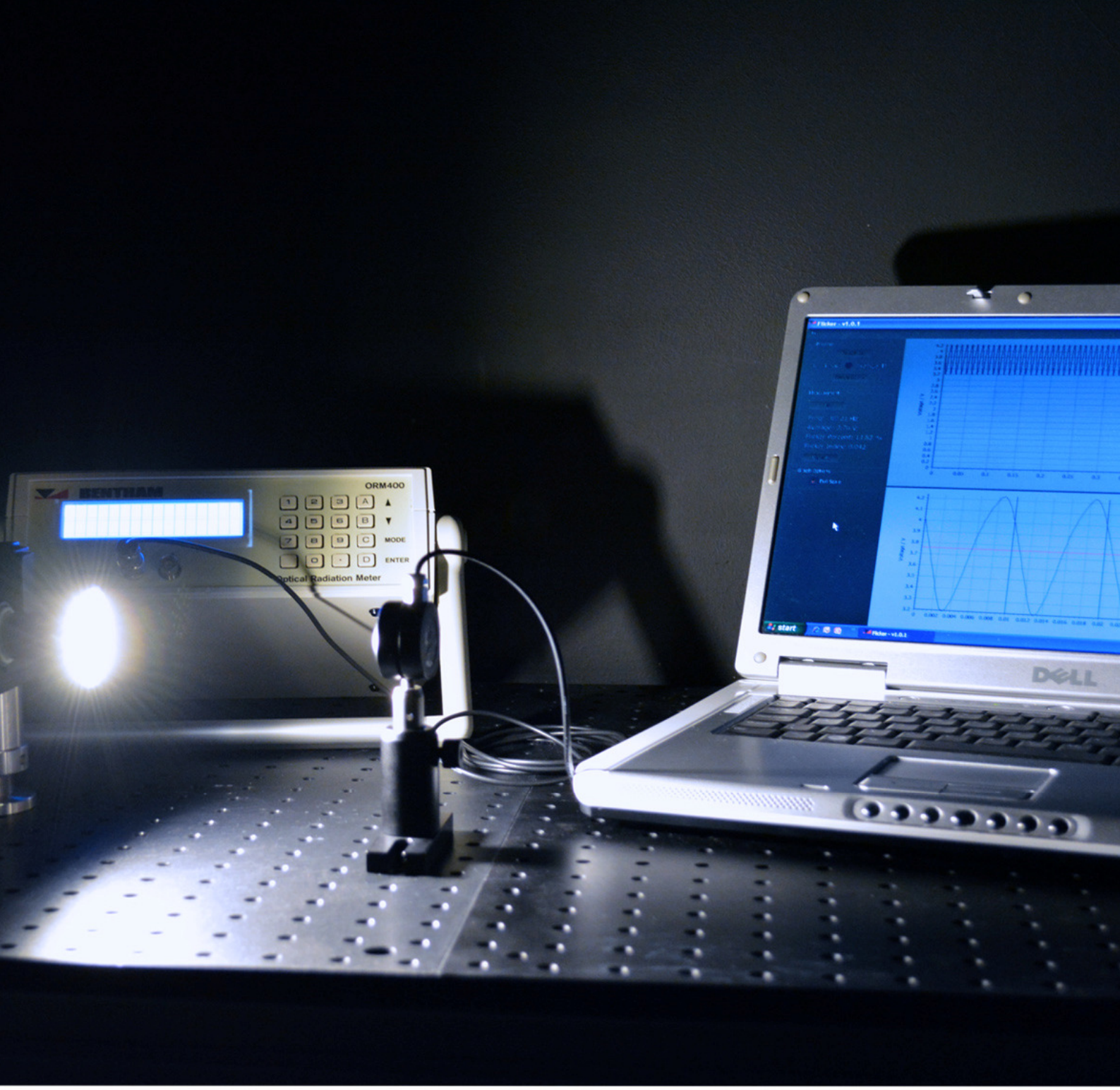

BENTHAM

FMS400
Photometric Flicker Measurement System

WONWOO SYSTEMS CO.,LTD
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FMS400 Photometric Flicker Measurement System

Recent reports have demonstrated that some SSL systems, particularly those paired with dimming controls, demonstrate significant photometric flicker, thought to cause photosensitive epilepsy, migraines, headaches, eye strain and non-specific malaise.

Bentham have developed the FMS400, fully automated time-resolved photometric detection system for the measurement of flicker.

- DH400-VL Precision photometer with NMI traceable calibration
- FMS400 high speed amplifier and data acquisition
- Fully automated measurement through Windows application and USB 2.0 interface
- Reporting of flicker percent, flicker index and flicker frequency

Definition and Sources of Flicker

Flicker is the term used for the rapid and repeated modulation of light output from a source. The principle source of flicker is the periodic variation in AC mains operated lamp output, at twice the AC frequency.

Flicker has in the past been a concern in the specific case of fluorescent lamps with magnetic ballasts. As the lamps aged, light output generated in one current direction could become less than that generated in the other, resulting in flicker at the mains supply frequency. This problem was rectified with the use of electronic ballasts.

Flicker has largely been forgotten until recently, when the effect of SSL lamp drive circuitry and phase-cut dimming circuits have caused concern once again.

Potential Effects of Flicker

The health effects of flicker are generally divided into those due to visible flicker and those due to invisible flicker. In the visible domain, frequencies in the range ~3 to 70Hz represent a risk of seizure in those with photosensitive epilepsy, whilst in the invisible domain, at higher frequencies, migraines, headaches, eye strain and non-specific malaise may result.

Quantifying Flicker

Two metrics are currently defined for the evaluation of flicker, percent flicker, and flicker index, the latter being generally preferred since it takes account of difference in waveform shape or duty cycle. As standards for the evaluation of flicker are developed, account may also be taken of flicker frequency.

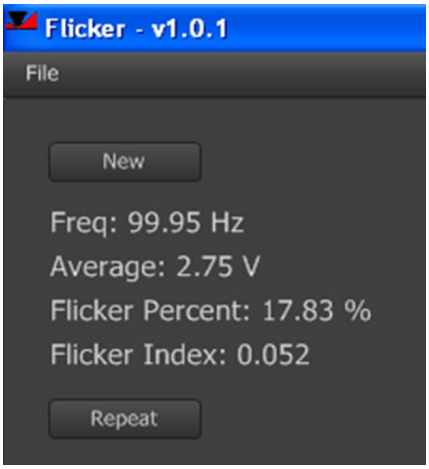
Bentham FMS400

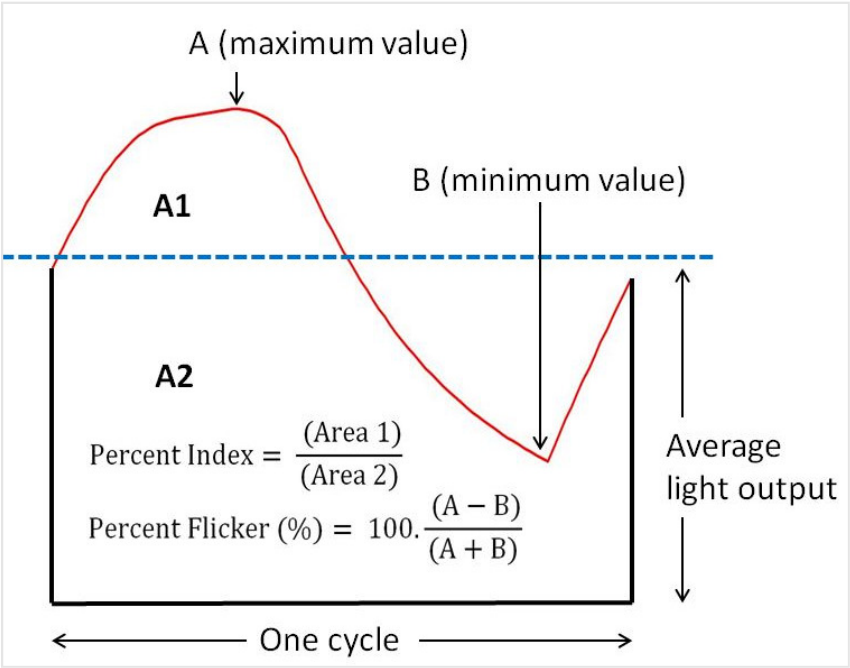
Whilst flicker is essentially a luminance-based property, one can use any input optic to perform this measurement – a telescope, diffuser or integrating sphere.

The Bentham FMS400 comprises a Bentham DH400-VL close-match photometric detector, high-speed amplifier and data acquisition to determine the time–resolved source emission. This data is captured by a Windows® Flicker application, and upon which calculation of the flicker percent and flicker index are performed.

Flicker Standards

At present, the only country having published normative standards regulating the level of photometric flicker in light sources is Russia, through a range of Sanitary Norms and Regulations (SanPiN) and GOST R 54945-2012 "Buildings and structures. Methods for measuring of illuminance pulsation factor".





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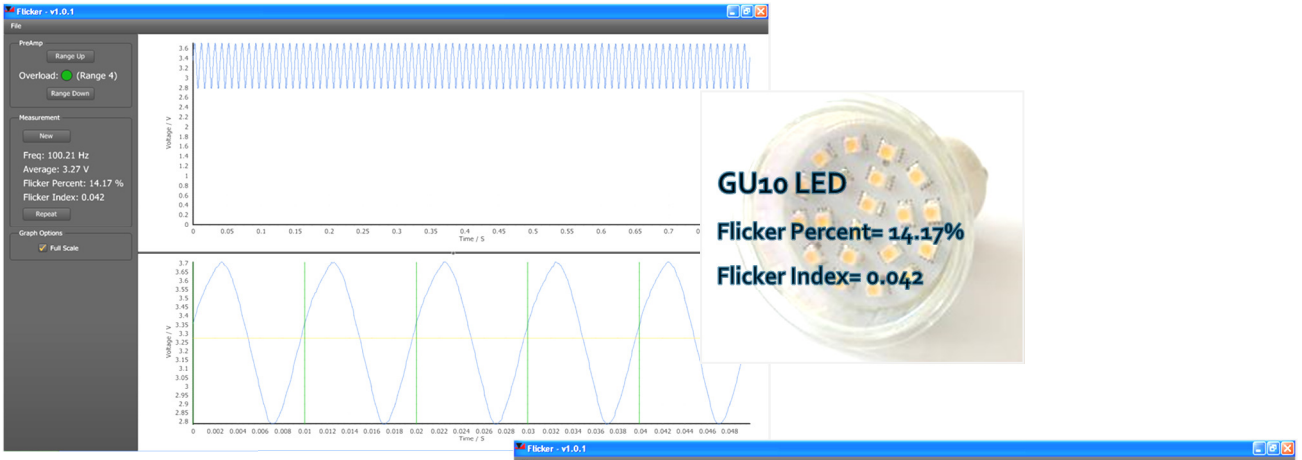
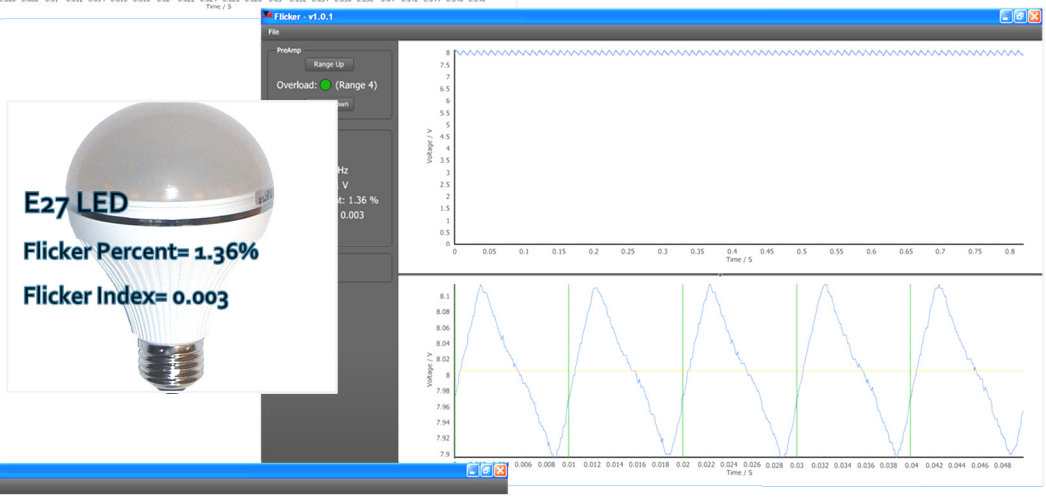
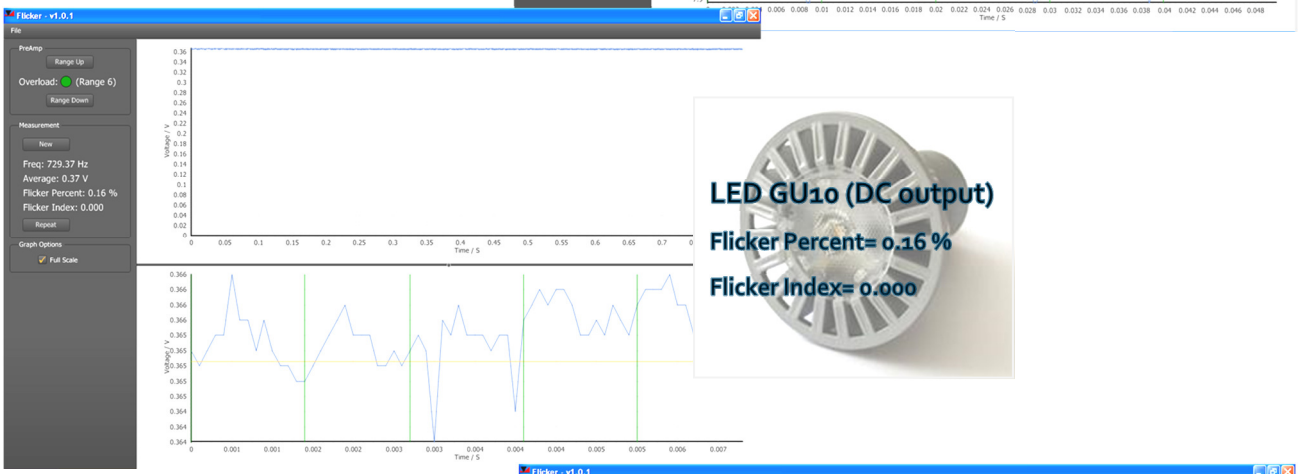
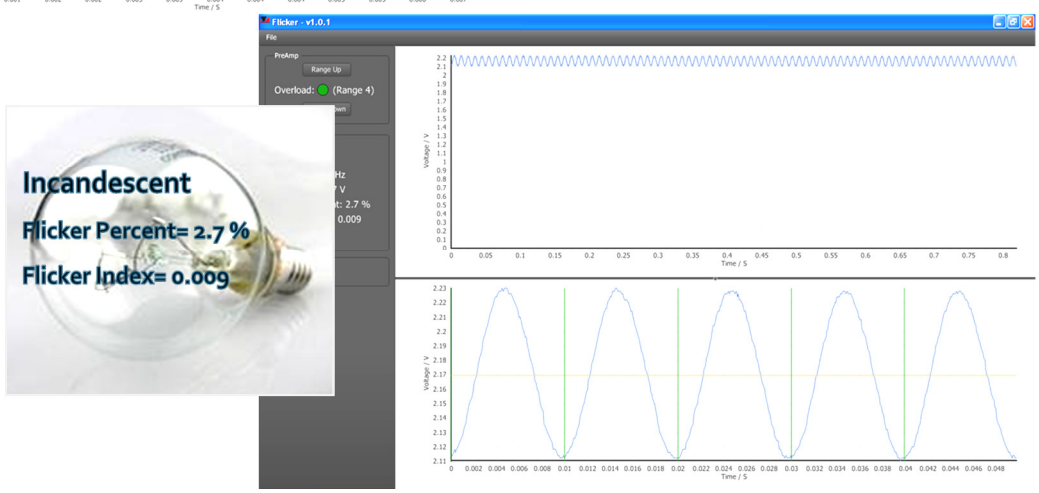
Example Flicker Results









Specifications

DH400-VL Photometer	
Spectral function	CIE 1924 V(λ) Spectral Luminous Efficiency Function for Photopic Vision
Spectral response range	380-780nm
Photopic match, f_1	<3%
Angular response, f_2	<1.5%
Linearity, f_3	< 0.2%
Diffuser diameter	7 mm
Connector	BNC
Mounting	M6 threaded hole
FMS400	
Inputs	2, remotely/ manually selected
Amplifier gain ranges	10^{10}-10^5 V/A
Maximum input	10mA
Frequency response	Gain range dependent, most restrictive <4 kHZ
Input Impedance	Virtual ground
Gain accuracy	± 1%
Gain stability	200 ppm/ °C
Output stability	5 ppm/°C to 500 ppm/°C dependent on gain range
Data acquisition	12 bit ADC resolution, 20M samples/ s
Interface	USB 2.0
Power supply	12V provided by external transformer