

## BPC300 Photochromic Spectrometer

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The Bentham BPC300 is a turn-key solution for the characterisation of photochromic lens transmission in accordance with international standards<sup>1</sup> and a key tool in the development of photochromic formulations.

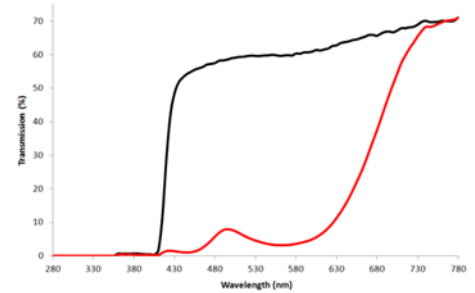
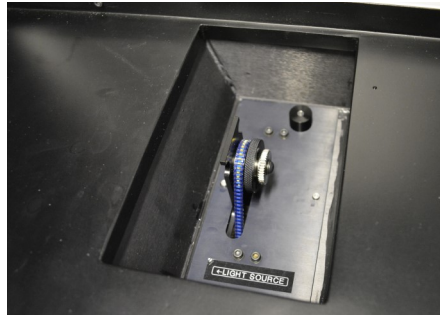
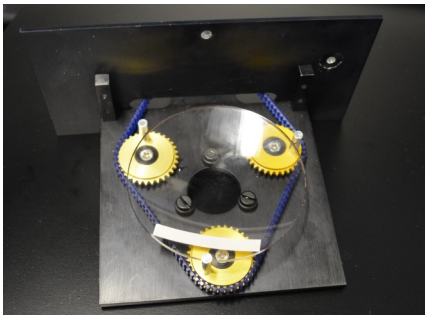
In the BPC300, a conditioned photochromic sample is immersed in a temperature controlled water bath prior to launching a fully-automated, pre-defined series of transmission measurements, corrected to transmission in air where desired.

In consideration of standards, the spectral transmission of the lens (280-780nm) is measured at 23°C in the faded state prior to exposure to an air mass 2 (AM2) conditioning beam at 50 klx for a period of fifteen minutes. The process is

complete by the re-evaluation of transmission, now in the darkened state and the generation of a report including all parameters required by standards (see table below).

Where specific claims are made with respect to performance at varying temperature, or for use in night driving, different measurement conditions apply.

The high degree of configurational flexibility of the BPC300 permits darkening and fading-back kinetic studies, whilst the modification of sample temperature, conditioning beam illuminance and spectrum allows accounting for a wide range of lens function scenarios.



## BPC300 Reported Parameters

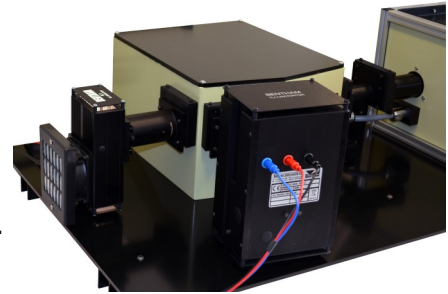
$\tau_{V0}$	Luminous transmittance in the faded state at (23± 2)°C
$\tau_{V1}$	Luminous transmittance in the darkened state at (23± 2)°C
$\tau_{V0} / \tau_{V1}$	Photochromic Response
$\tau_{VW}$	Luminous transmittance at (5± 2)°C
$\tau_{VS}$	Luminous transmittance at high temperature (35± 2)°C
$\tau_{VA}$	Luminous transmittance at reduced solar simulator level and (23±2)°C
$\tau_{SUVA}$	Mean UVA spectral transmittance weighted by AM2
$\tau_{SUVB}$	Mean UVB spectral transmittance weighted by AM2
$Q_{sign}$	Visual attenuation coefficient for red, green, blue and yellow incandescent and LED traffic signals
$\tau_{sb}$	Solar blue light transmittance
	Lens category in faded and darkened states
	Colourimetric parameters in CIE 1931 & CIE Lab colour spaces

<sup>1</sup> ISO/ EN 8980-3:2013: "Ophthalmic optics. Uncut finished spectacle lenses. Transmittance specifications and test methods."

ISO/ EN 12312-1:2013: "Eye and face protection. Sunglasses and related eyewear. Sunglasses for general use"

## System Overview **Spectrometer**

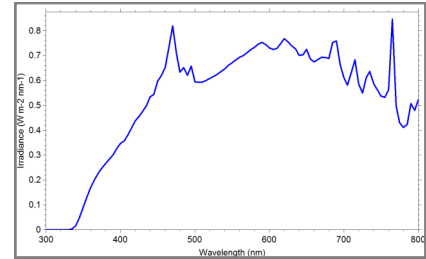
Lens transmission is measured by illuminating the sample with an optically chopped, monochromatic probe output from a TMc300 single monochromator. Light transmitted by the sample is measured by a dual detector station coupled to a fully automated DSP lock-in amplifier.



Optical chopping is important to allow measurement during activation by parallel exposure to the AM2 conditioning beam.

### **AM2 Conditioning Beam**

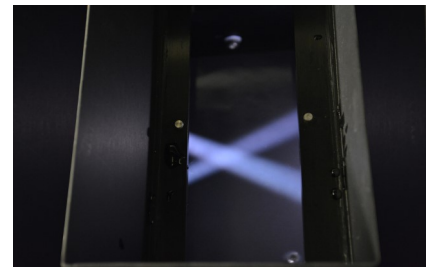
Photochromic activation is achieved, in conformance with standards, of a close AM2 spectral match conditioning beam producing an illuminance of  $50 \pm 5$  klx at the sample plane. Uniformity of illumination is ensured by the use of a bifurcated fibre. An automated shutter ensures correct timing of sample exposure.



The illuminance at the sample plane can be varied and the source filtered where required.

### **Water Bath**

The mounted sample is immersed in a temperature-controlled water bath for the purposes of maintaining temperature during conditioning beam irradiation and to allow evaluating the photochromic response at different temperatures.

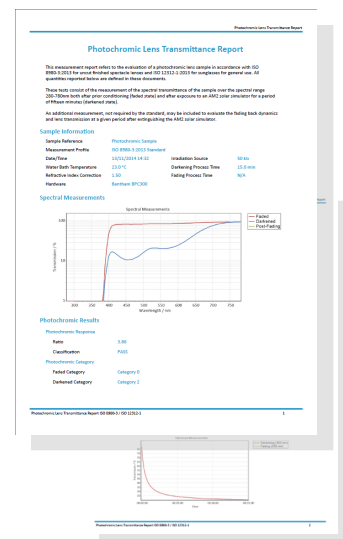


A dual optical path system is implemented to obviate the need for user intervention when measuring the "100%" reference level.



### **Software Control**

All measurements with this system are driven from the BPC300 utility in our proprietary Windows software, Benwin+. Full control of measurement conditions is permitted, allowing the definition of measurement procedure which, once in place, can be simply run to perform routine measurements. A pdf measurement report may be generated at the end of the automated procedure. USB interface



# Specifications

<b>Spectral Range of operation:</b>	280-780nm		
<b>Bandwidth:</b>	5nm		
<b>Wavelength accuracy:</b>	< 320nm, ± 0.1nm; >320nm, ± 0.2nm		
<b>Beam diameter at sample plane:</b>	4mm diameter		
<b>Minimum measured transmission:</b>	0.5%		
<b>Maximum Sample Diameter:</b>	75mm		
<b>Conditioning Beam Spectral Match:</b>	<b>Wavelength Range (nm)</b>	<b>ISO 8980-3:2013 requirements</b>	<b>BPC300 (Typical)</b>
		<b>Irradiance (W.m-2)</b>	
	300-340	<2.5 -	0.06
	340-380	5.6± 1.5	6.3
	380-420	12± 3.0	13.8
	420-460	20± 3.0	21.3
	460-500	26± 2.6	27.2
<b>Conditioning Beam Illuminance:</b>	Illuminance at sample plane 0-50klx		
<b>Conditioning Beam Attenuation:</b>	Four positions fitted with iris diaphragms		
<b>Conditioning Beam Filter Wheel:</b>	Eight positions for 25mm diameter filters		
<b>Water bath temperature range:</b>	20-50°C		
<b>Temperature Accuracy:</b>	± 0.2°C		
<b>Bench space required:</b>	1m deep x 2.5m wide		
<b>Computer Requirements:</b>	Windows 7 or newer OS (32-/64-bit) Minimum hard disk space approx. 100MB Minimum RAM: 2 GB 4 x USB 2.0 ports		
<b>Services Requirements:</b>	6 x main sockets 1200W power consumption Nitrogen gas supply there measurements below ambient are required		

