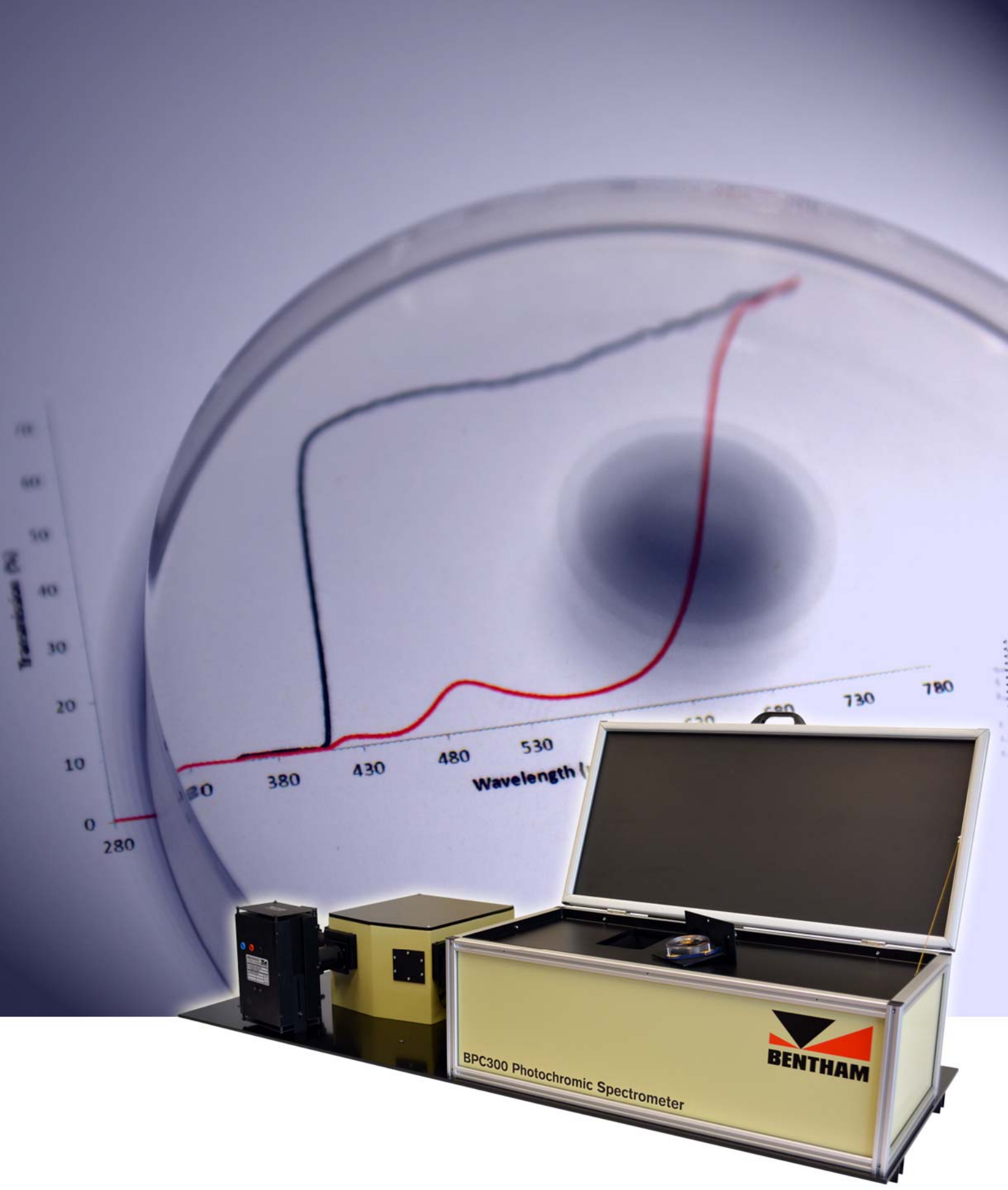


BENTHAM

BPC300
Photochromic Spectrometer

BPC300 Photochromic Spectrometer

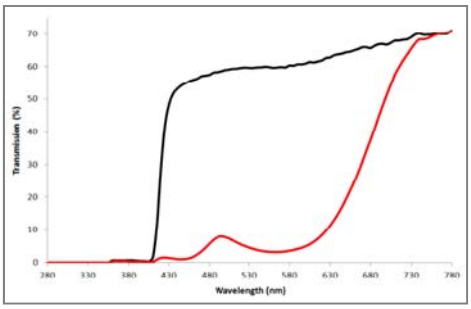
The Bentham BPC300 is a turn-key solution for the characterisation of photochromic lens transmission in accordance with international standards[1] and a key tool in the development of photochromic formulations.

In the BPC300, a conditioned photochromic sample is immersed in a temperature-controlled water bath prior to launching a 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 50klx for a period of 15 minutes. The process is completed by the re-evaluation of transmission, now in the darkened state and the generation of a report.

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 exposure conditions.



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

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

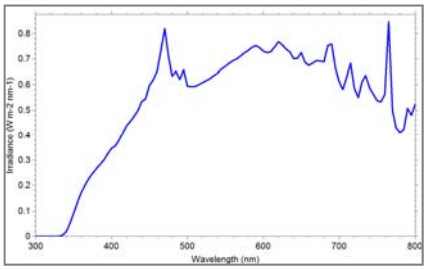
ISO/ EN 12312-1:2013: "Eye and face protection. Sunglasses and related eyewear. Sunglasses for general use"

System Overview

Spectrometer

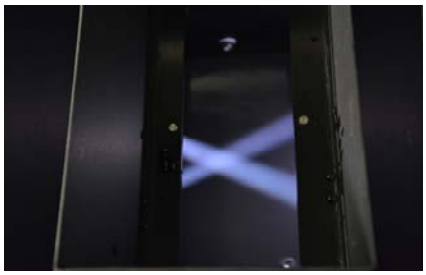
Lens transmission is measured by illuminating the sample with an optically chopped, monochromatic probe output from a TMc300 single monochromator.
Light transmitted by the sample is measured by a dual detector station coupled to a fully automated DSP lock-in amplifier.

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



AM2 Conditioning Beam

Photochromic activation is achieved, in conformance with standards, by using a close AM2 spectral match conditioning beam producing an illuminance of 50± 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.

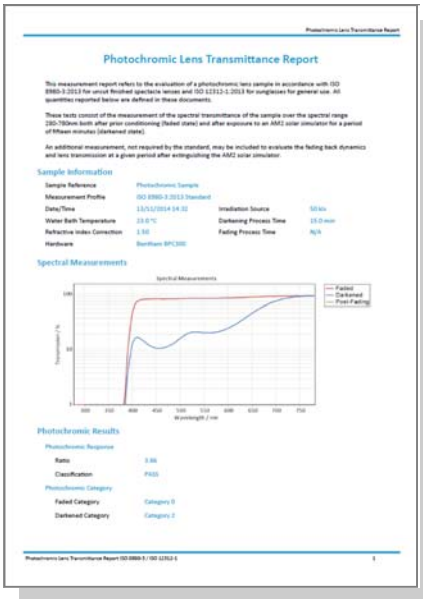


The illuminance at the sample plane may be varied and the source filtered where required.

Water Bath

The mounted sample is immersed in a temperature-controlled water bath for the purposes of maintaining temperature during conditioning 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 reference level.


Photochromic Lens Transmittance Report

Sample Information

Spectral Measurements

Photochromic Results

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.

Specification

Spectral range of operation	280-780nm	
Spectral data interval	5nm	
Spectral bandwidth (FWHM)	5nm	
Minimum measured transmittance	<0.25%	
Uncertainty spectral transmittance	<2% (k=2) at all wavelengths	
Uncertainty luminous transmittance	<1% (k=2)	
Wavelength accuracy	<320nm, ± 0.1nm; >320nm, ± 0.2nm	
Beam diameter at sample plane	4mm diameter	
Maximum sample diameter	75mm	
Conditioning beam spectral match Irradiance ($W.m^{-2}$)	**ISO 8980-3:2013**	**BPC300 (Typical)**
300-340nm	<2.5	0.06
340-380nm	5.6± 1.5	6.3
380-420nm	12± 3.0	13.8
420-460nm	20± 3.0	21.3
460-500nm	26± 2.6	27.2
Conditioning beam illuminance	0-50klx at sample plane	
Conditioning beam attenuation	Four positions fitted with iris diaphragms	
Conditioning beam filter wheel	Eight positions for 25mm diameter filters	
Water bath temperature range	5-50°C	
Temperature accuracy	± 0.2°C	
Bench space required	1m deep x 2.5m wide	
Computer requirements	OS: Windows 7 or newer (32-/64-bit) Minimum hard disk space: approx. 100MB Minimum RAM: 2 GB 4 x USB 2.0 ports	
Services requirements	6 x 110/220V AC mains sockets, 1200VA total Nitrogen gas supply (where measurements below ambient are required)	

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