



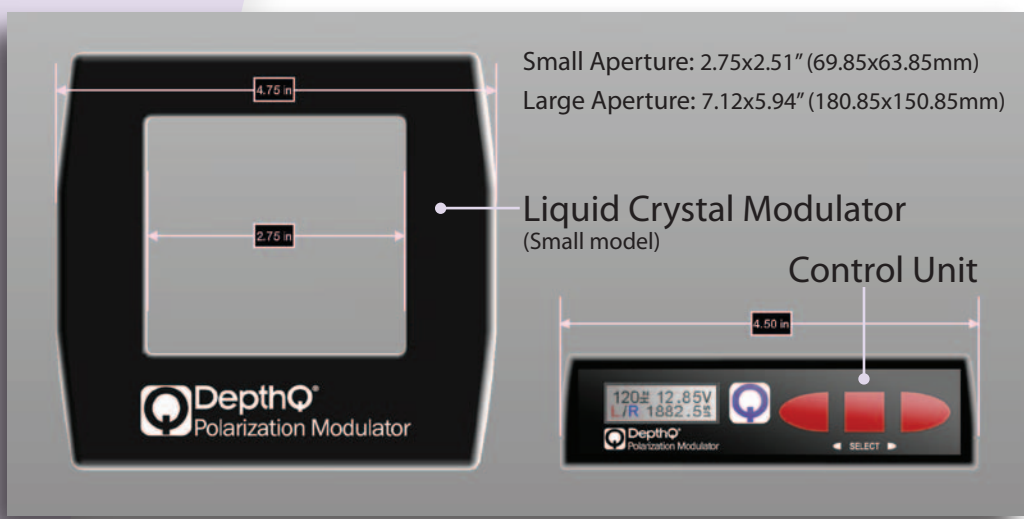
Precision **HD<sub>s</sub>3D**<sup>®</sup>

From **Lightspeed**<sup>®</sup> DESIGN



## The DepthQ<sup>®</sup> Polarization Modulator

Efficiently alternates the polarization of light passing through it between two orthogonal orientations (of either circular or linear polarization) in sync with progressive 'page-flip' stereoscopic data. In combination with a single-lens stereoscopic 3D projector and a polarization-preserving screen, this enables high-brightness, low-crosstalk (ghosting) viewing via lightweight & comfortable *passive* 3D eyewear.



The new DepthQ<sup>®</sup> Polarization Modulator is a joint product of **LC-TEC DISPLAYS AB** and **Lightspeed Design, Inc.**, and is sold and distributed worldwide exclusively by **Lightspeed Design, Inc.**

**LC-TEC DISPLAYS AB**, headquartered in Borlänge, SWEDEN, started operations in 1992 and has extensive experience in manufacturing and developing liquid crystal devices (optical-shutters & custom LCD's) on an R&D, prototyping and volume manufacturing level.



LC-TEC Manufacturing facility, Borlänge, Sweden

**Lightspeed Design, Inc.**, with headquarters in Bellevue, Washington, USA is one of the world's premiere designers of stereoscopic 3D (s3D) presentations, projection, and image-processing software technologies and has been a leader in stereoscopic 3D for over sixteen years.

**Clients include Pfizer, Intuitive Surgical, Microsoft, Harvard & Munich Universities, US Army, NASA, JPL, DreamWorks SKG, IMAX, and Walt Disney Animation.**

The **DepthQ<sup>®</sup> Polarization Modulator** utilizes a unique combination of separate liquid crystal elements stacked together, enabling both **high polarization efficiency** over visible wavelengths from 400 to 750 nm (predominantly achromatic spectral response) as well as **fast transition switching speeds** between polarization states from 120Hz to 400Hz. *Transition time between optical states is <0.5ms at room temperature.*

The system includes both the liquid-crystal modulator as well as its control unit. A standard sync output from your graphics card or projector is supplied to the control unit, which then conditions the signal to match the modulator's required input.

The modulator is available in two sizes: Small (pictured), for projectors with apertures <2.75 inches, and Large, for projectors with apertures <7.12 inches. It is also available pre-configured for either linear or circular polarization.

### Operational Example



**For more information please call +1.206.784.1385**

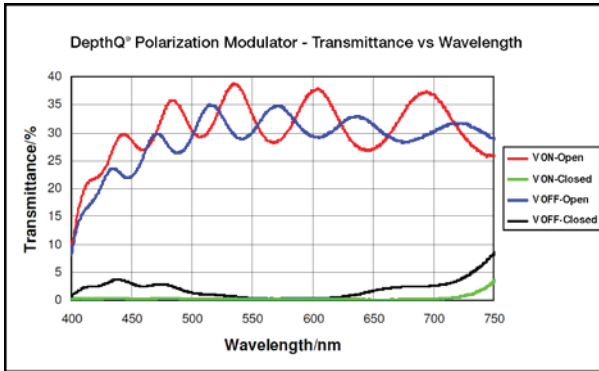


[www.depthq.com](http://www.depthq.com)



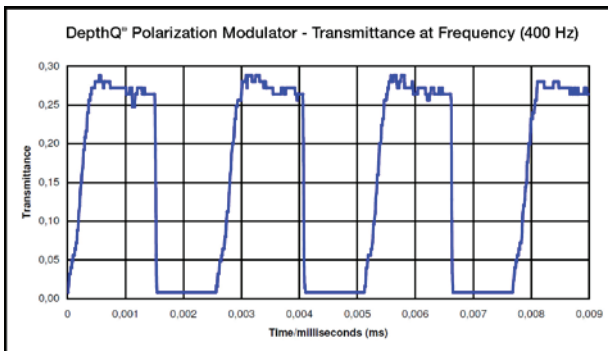
## Technical Data

Four unique optical states are used in the generation of the 3D stereoscopic image; namely (i) Left-eye OPEN (ref: V ON - Open), (ii) Right-eye CLOSED (ref: V ON - Closed), (iii) Right-eye OPEN (ref: V OFF - Open), and (iv) Left-eye CLOSED (ref: V OFF - Closed). Transmission spectra for the individual optical states are shown below, measured *after* common linear polarized eyewear.



*Optical states generated by the polarization modulator when used together with passive linear polarized viewing-glasses. Transmission spectra are predominantly achromatic for visible wavelengths.*

Optical performance of the polarization modulator when placed between mutually crossed linear polarization-sheets at room temperature (25°C) with initially unpolarized incident light is shown below. Optical polarization modulated at a frequency of 400Hz with 1.5ms zero-voltage time-period between polarity-reversals. **Transition speed between optical states < 0.5ms at room temperature.**



*Polarization Modulator operating at an optical frequency of 400Hz and placed between mutually crossed linear polarization-sheets in order to obtain optical transmission contrast.*

### Advantages of Using the DepthQ® Polarization Modulator:

- Viewer Comfort:**
- Glasses are lightweight
  - Single-projector solution eliminates possibility of geometric asymmetry between eyes
  - Likewise, no vertical or horizontal parallax problems
  - And no bulb differences (intensity and color temperature over time)

- Ease of set-up :**
- Modulator placement is simple and forgiving - just set it in front of the projector
  - No time-consuming alignment of superimposed images required

- Lower Cost/Maintenance:**
- No moving parts
  - Less hardware than two projector solutions
  - Glasses are inexpensive

- Options for Viewing:**
- Choose between circular or linear polarization models
  - Glasses are available in a variety of form-factors, from paper to plastic to wire-frame

- Versatility:**
- Enables applications from theme parks and commercial 3D theaters to scientific and industrial visualization

- Flexible Pricing:**
- Pricing model reflects application and use

## Specifications

### Absolute Maximum Ratings

Parameter	Minimum	Maximum	Units
Driving voltage (AC)	0	30	Volts
Driving frequency	10	1000	Hertz
Operating temperature	-10	+75	degrees Celsius
Storage temperature	-30	+90	degrees Celsius

### Electrical Specifications

Parameter	Sym	Remark	Minimum	Typical	Maximum	Units
Driving voltage (AC)	$V_D$	---	10	24	30	Volts
Driving frequency (rec)	$f_D$	Square Wave	10	50	1000	Hertz
Current Consumption	$I_D$	$V_D=24V; f_D=10\text{ Hz}$	---	---	---	$\mu A$
Peak Current	$I_P$	$V_D=24V; f_D=10\text{ Hz}$	---	---	---	mA
Capacitance	C	$V_D=0V$	---	0.32*	---	$\mu F$

\* Value for Small model. Capacitance is a function of the total area of Polarization Modulator.