



## LumiFree™ Electrically Tunable Light Shaping Panels

LumiFree™ panels from GRE Alpha enable digital light distribution control for LED lighting by dynamically modifying beam angle and shape using liquid crystal (LC) technology. Model LAM20 feature a  $\Phi 50\text{mm}$  active area, 8-bit precision beam tuning on X and Y axes (0–255 steps), and are designed for seamless integration with LED modules using GRE Alpha’s proprietary driving board.

### Features

- Digital Light Beam Shaping: Independent X/Y-axis control for beam spread and directionality
- Precise Control Resolution: 8-bit (256-level) modulation per axis for smooth transitions
- No Mechanical Parts: Silent, compact, and maintenance-free operation
- LC Technology: Liquid Crystal Optical Modulator optimized for lighting applications
- RoHS & UL Compliant: Environmentally certified and safe for integration

## LumiFree™ Electrically Tunable Light Shaping Panels



Model	Display Area	External Dimensions (Panel Only)	External Dimensions (I/O Interface)	Control Granularity	External Dimensions (Driving Board --M972A)
LAM020	$\Phi 50\text{mm}$ (50.0 x 50.0 mm)	61.2 x 61.2 x 4.45 (mm)	131.6 x 61.2 x 6.7 (mm)	8-bit (0 – 255 steps/axis)	45.0 x 45.0 x 6.7 (mm)

## Optical Characteristics (Ta = 25°C)

Parameter	Min	Typical	Max	Notes
Transmittance (OFF: T0 @ 0°)	75.0%	80.0%	85.0%	Clear state (no voltage applied)
Transmittance (ON: T255 @ 0°)	8.0%	9.0%	10.0%	Maximum dispersion (full voltage)
Chromaticity Wx0	0.447	0.452	0.457	X-axis center chromaticity
Chromaticity Wy0	0.406	0.411	0.416	Y-axis center chromaticity

## Electrical Interface\*

Control Channels	4 channels (LC Ch1 ~ Ch4)
Connector Type	J.S.T. S4B-PH-SM4-TB(LF)(SN)
Driving Board	M972A**(Included with LC Panel)
Control Resolution	8-bit (256 levels) per axis

\*Operating Humidity, 60±15% RH, Standard inspection conditions

## Environmental Specification

	Operating Temperature	Storage Temperature
LC Panel	-20 to 80°C*	-20 to 80°C*
Driving Board	-20 to 70°C*	-20 to 80°C*

\*No condensation or freezing

## System Architecture

### Complete LumiFree System Components

1. LumiFree LC Panel (LAM020)
2. LumiFree Driving Board (M972A, included with LC Panel)
3. Customer-Supplied Components (\*\*Note: GRE Alpha can also provide all these items upon request)
  - o AC/DC Converter/Power Supply
  - o LED/COB Driver and control boards
  - o LED Module/COB
  - o Operation Control Terminal and or Mobile/PC App

## Connection Overview

Dual Connectors	CN1 and CN1' with identical pin assignments
FPC Connection	Flexible printed circuit connection to relay board
Harness Connection	Customer harness to driving board
Cross-Connection Safe	CN1 and CN1' wires can be crossed without operational issues

# Compliance & Quality

## Environmental Compliance

RoHS Compliant	Meets 10-substance restriction requirements
UL Certification	All major components UL certified <ul style="list-style-type: none"> <li>• PWB: UL94V-0 flame retardant</li> <li>• Connectors: UL certified materials</li> <li>• FPC: UL94 flame retardant V0 equivalent</li> </ul>

## Quality Standards

Inspection Standards	Visual inspection at 30cm distance Min
Environmental Testing	Room temperature (20-25°C), 60±15% humidity
Defect Classification	Comprehensive standards for foreign substances, scratches, and linear defects
Warranty	2 year from delivery date

# Application Guidelines

## Design Considerations

Mounting	Avoid warping, twisting, or excessive pressure on panel surface
Protection	Use protective cover for outdoor or harsh environment applications
UV Protection	UV cut filter recommended for direct sunlight exposure (cutting 390nm and below)
Static Control	Handle with anti-static precautions (ESD sensitive)

## Power Supply Requirements

Noise Specification	Power supply voltage ripple within 50mVp-p
Power Sequence	Follow proper ON/OFF sequence for reliable operation
Driving Board	Input Voltage: 2.97V to 5.5V

## Light Source Compatibility

Optimization Required	Optical characteristics depend on light source properties
Pre-Evaluation	Test optical performance with intended light source before final implementation
Temperature Compensation	Consider temperature effects on optical response

