USHIO Applying Light to Life

SugarCUBE™

LED FIBEROPTIC ILLUMINATOR

OPERATING MANUAL

PREFACE

This manual contains important information necessary for the safe and efficient operation of the LED Fiberoptic Illuminator. Please read the manual in its entirety and heed all safety warnings before operating the light source.

The SugarCUBE™, Model 38000-M03-002 (Red), 38000-M03-003 (Green), 38000-M03-004 (Blue), 38000-M03-005 (White), and 38000-M03-305 (Ultra), is designed and tested in accordance with ANSI/UL 61010-1, CAN/CSA C22.2 Number 61010-1, EN 61326-1:2013, EN 55011:2010 and FCC Part 15 Subpart B, Class B.

WARNING:	The SugarCUBE contains ultra-intense LED emitters. DO NOT STARE AT THE LED SOURCE.

Prior to use, carefully unpack and inspect all components for any signs of damage which may have occurred during shipping. If shipping damage is suspected, notify Ushio America, Inc. or your authorized Ushio distributor immediately.

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INTRODUCTION AND INTENDED USE

The SugarCUBE is a powerful single LED light source for general scientific, industrial and machine lighting. It contains a single, high-power LED, which is direct coupled to a variety of user interchangeable liquid or fiberoptic light guides. Models are available in high-power monochromatic red, green, blue, broad spectrum white, and a high-power “Ultra” broad spectrum white.

The SugarCUBE is a very high-power, LED-based illuminator and is a direct replacement for existing 150W halogen fiberoptic illuminators.

Typical usage is for microscope stands, machine vision, automated inspection, etc. The unit is designed for continuous operation with minimal maintenance.

The illumination is directed to the target via a fiberoptic light guide or a liquid light guide (LLG). The light source supports fiberoptic light guides from .0625 inch core up to 1 inch nominal OD, and 3mm through 8mm core diameter liquid light guides.

Contact the factory for customized units built specifically to suit your needs.

The SugarCUBE uses environmentally friendly manufacturing process components.

Special instructions are emphasized as follows:

NOTE:	Notes contain important information regarding set-up and operation to facilitate ease of use and obtain effective results.
	This symbol indicates critical information regarding safe handling and use of this system. Device malfunction or property damage could result if these instructions are not followed.
WARNING:	Warnings contain critical information by identifying conditions or practices that may result in injury or loss of life if these instructions are not followed.

SAFETY

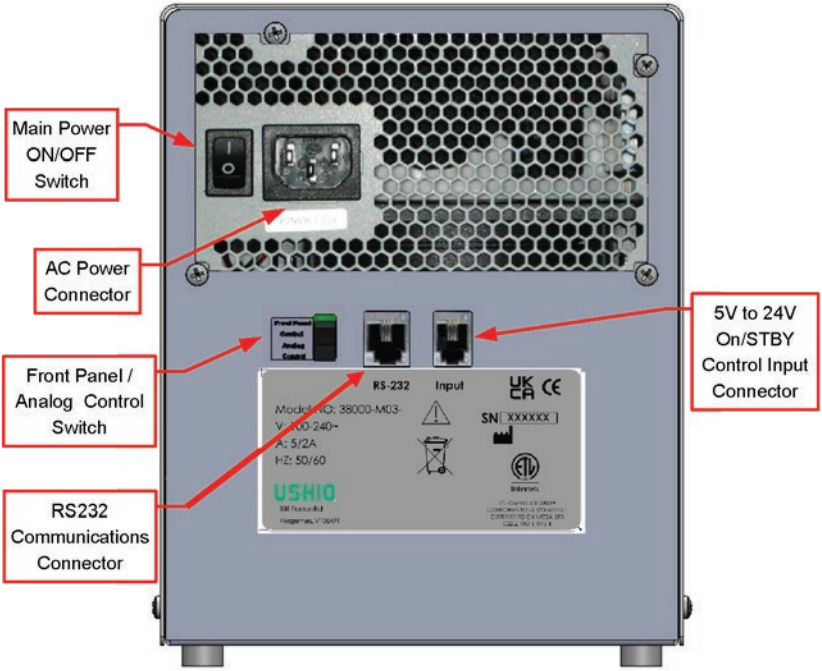
The SugarCUBE uses a high-power LED (Light Emitting Diode) that produces extremely bright light. Proper care must be taken in the setup and operation to prevent damage to the unit.

	The LEDs are NOT accessible. Please return the unit to the factory for warranty repair.
	The unit requires adequate airflow to maintain proper cooling. Ensure the ventilation holes are unobstructed and adequate clearance is provided.
	If the unit is used in a manner not specified within this manual the protection provided by the equipment might be impaired.
	Never open or remove the top cover while the unit is plugged in. Qualified personnel must perform all maintenance, including dust removal.
	Do not operate the unit near any flammable materials, including flammable gases or liquids.

SYSTEM OVERVIEW

3.1 FRONT PANEL

3.2 REAR PANEL



INITIAL SETUP

4.1 SYSTEM COMPONENTS

The SugarCUBE is comprised of:

- Light Source
- Electrical Power Cord
- Light Guide Adapter (sold separately) to match optional light guide.
- Liquid or Fiberoptic Light Guide (sold separately)

Carefully unpack all components, giving particular attention to the (optional) light guide and taking care not to touch or contaminate the ends or to exceed its bend radius. Consult the light guide manual for handling and cleaning instructions.

4.2 CHOOSING A LOCATION

Set the SugarCUBE on a flat surface in a place that allows for adequate air ventilation on all sides. Do not position the unit so that the back or sides of the unit are obstructed.

NOTE:	For adequate ventilation, maintain at least 4" of clearance around all sides of the light source in an unenclosed space.

4.3 LIGHT GUIDE CONNECTION

Insert the appropriate end of the light guide into the light guide adapter until it is fully seated. Do not force the light guide. Use the provided thumbscrew(s) to lock the light guide in place. Refer to Section 5.1 for light guide selection information.

	The light guide adapter provides for the correct position of the light guide end relative to the LED emitting surface, therefore no adjustments are necessary. Ensure the correct adapter is used.

4.4 CONNECTING THE POWER CORD

Insert the appropriate end of the power cord into the AC receptacle in the back of the unit. Insert the other end of the power cord into a standard AC outlet.

NOTE:	The unit utilizes a universal voltage power supply. Refer to Section 11 for acceptable power requirements.

4.5 OPERATING THE UNIT

1. On the rear panel, flip the Main Power ON/OFF (I/0) switch to the ON (I) position.
2. On the front panel, the Power Indicator will flash approximately once per second to indicate the unit is running and in Standby Mode.
3. The Intensity Indicators will display the current LED intensity level.
4. Adjust the LED intensity to the desired level using the Intensity Adjustment buttons.
5. Press the On/Stby button to turn the LED on at the previously selected intensity level.
6. The Power Indicator will be continuously illuminated.
7. Adjust the LED intensity using the Intensity Adjustment buttons if necessary.

ADAPTERS AND LIGHT GUIDES

⚠	Use only factory supplied light guide adapters. Use of non-authorized light guide adapters may damage the LED and/or light guide and void the warranty. Consult the factory before attempting to use non-standard light guides or adapters.

The SugarCUBE can accept a variety of light guides using standard adapters specifically designed for optimum performance.

Standard light guides and adapters are listed at www.ushio.com.
*Adapters installed with the provided flat head or phillips 4-40 thread screw, length depending on the adapter.

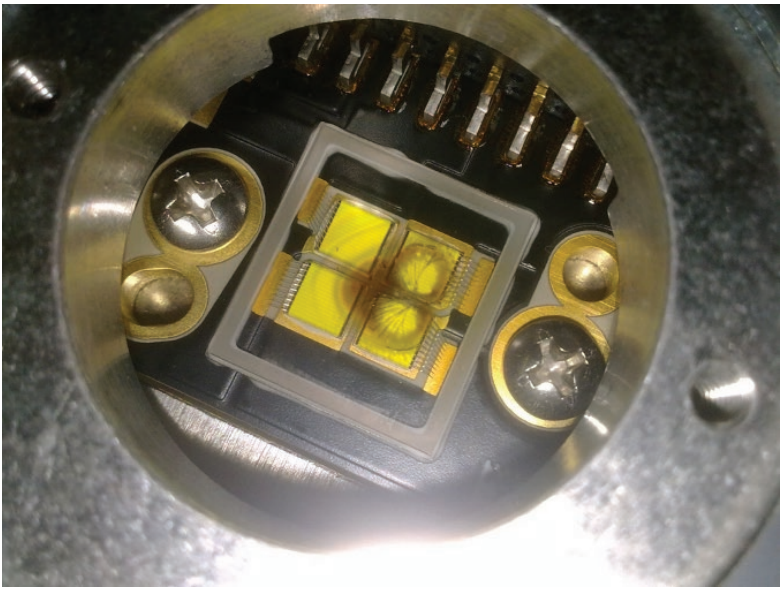
Other custom adapters are available. Contact the factory for more information.

5.1 LIGHT GUIDE SELECTION

The SugarCUBE is capable of generating up to 15W of radiometric, or radiant, power. Check with the factory to select fiber optic and liquid light guides suitable for use with the SugarCUBE.

NOTE:	The light guide may experience temperatures at or near 85°C where it comes into contact with the front panel adapter. The temperature of the light guide may be more or less, depending on its construction and ability to transmit the energy generated by the LED.
NOTE:	Due to the high output and high power densities emitted from the SugarCUBE Ultra, fiber bundles may be at a higher risk of damage. Fiber bundles typically have lower coupling efficiencies than other light guide technologies which may result in significant rises in coupling surface temperatures.

Unsuitable light guides may outgas at the end nearest the LED and create a brown or black residue on the LED and/or the light guide (see image below). In worst case situations, the deposits will cause the LED to overheat, crack, and fail. In best case situations, the deposits will cause drastic reductions in LED-to-light-guide coupling efficiency and LED lifetime. If caught early enough, the deposit can often be removed via careful mechanical scraping. The SugarCUBE warranty does not cover mechanical damage to the LED or its surface.



5.2 INSTALLING/CHANGING LIGHT GUIDE ADAPTERS

1. Flip the Main Power ON/OFF (I/0) switch to the OFF (0) position and remove the power cord from the unit.
2. Using a #1 apex Phillips screwdriver, remove the (2) mounting screws on the front of the adapter.
3. Remove the adapter.
4. Insert the new adapter and align the mounting holes.
5. Insert and tighten the (2) mounting screws.
6. Connect the power cord to the unit and flip the Main Power ON/OFF switch to the ON (I) position.

MAINTENANCE

	All maintenance is to be performed by qualified personnel only. Ensure electrical power is disconnected prior to performing maintenance.
	Wear OSHA approved safety glasses when handling and using compressed air or cleaning chemicals.
	Use only OSHA approved compressed air nozzle set at 29psi or less or electronics-grade (dust-off) canned compressed air.

6.1 CLEANING THE COOLING FANS

The SugarCUBE contains two cooling fans. One is used to cool the LED, and one is used for electronics and power supply cooling. For optimum performance, both fans must be kept clean of dust and debris.

1. Flip the Main Power ON/OFF (I/0) switch to the OFF (0) position and remove the power cord from the unit.
2. Remove the (4) top cover screws and remove the top cover.
3. Check for accumulated dust or debris.
4. Using a soft brush or cloth, wipe any dust from LED assembly heat sink, fans, vent holes and finger guards.
5. Using clean, dry compressed air, blow the remaining dust from heat sink fins and vent holes.
6. Replace the top cover and secure it using the (4) screws removed in 2.
7. Connect the power cord to the unit and flip the Main Power ON/OFF switch to the ON (I) position.

6.2 CLEANING THE LED, LIGHT GUIDE AND LIGHT GUIDE ADAPTER

NOTE:	The light guide adapters are designed to position selected light guides extremely close to the face of the LED. Dust and debris must not be allowed to accumulate on or around the LED or damage to the LED and/or light guide may occur.
	Use isopropyl alcohol sparingly. Excess isopropyl alcohol may cause damage to the LED.

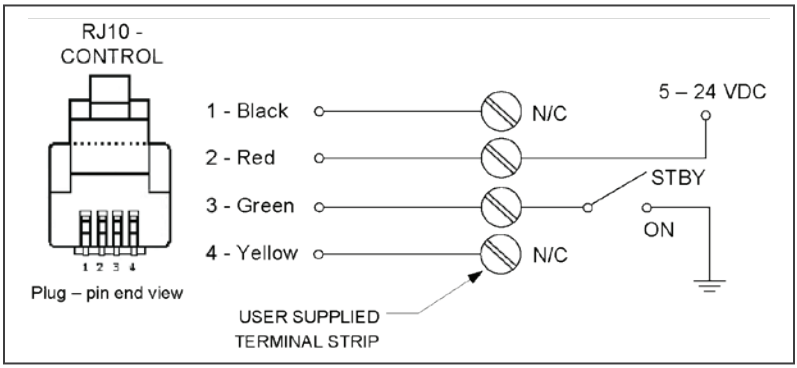
1. Flip the Main Power ON/OFF (I/0) switch to the OFF (0) position and remove the power cord from the unit.
2. Lightly dampen a clean cotton swab with isopropyl alcohol.
3. Gently swab the face of the LED glass to remove debris.
4. Clean around the light guide adapter.
5. Refer to the manufacturer's recommended cleaning procedure for cleaning the light guide conducting surface.
6. Allow alcohol to completely dry prior to using unit.
7. Connect the power cord to the unit and flip the Main Power ON/OFF switch to the ON (I) position.

REMOTE OPERATION

7.1 USING THE RELAY CONTROL

NOTE:	Relay Control and the On/Stby button can both be used to turn the LED on or off. The unit must be in Standby Mode to ensure proper operation while using the Relay Control. The necessary accessory cable can be purchased at www.ushio.com

1. Flip the Main Power ON/OFF (I/0) switch to the OFF (0) position and remove the power cord from the unit.
2. Using the Control Cable (P/N 38000-M03-022), apply a 5-24VDC control voltage (from a PLC, computer I/O device, or equivalent) to the Input connector on the rear panel. Refer to the image below for connection information.



NOTE:	The Relay Control terminals are NOT polarity specific.
NOTE:	For units having the Analog Control option: Pin 1 – Black is Analog GND Pin 4 – Yellow is Analog Control Voltage

3. Connect the power cord to the unit and flip the Main Power ON/OFF switch to the ON (I) position.
4. The Power Indicator will flash approximately once per second to indicate the unit is running and in Standby Mode.
5. The Intensity Indicators will display the current LED intensity level.
6. Adjust the LED intensity to the desired level using the Intensity Adjustment buttons.

7. Apply the control voltage to turn the LED on (5-24V DC).
8. Remove the control voltage to place the unit in Standby Mode.

NOTE:	The Relay Control input is not intended for pulsed operation of the LED.

7.2 OPERATING IN ANALOG MODE

In Analog Mode, the LED intensity is controlled by an external voltage source. The associated circuit accepts a voltage range from 0V to 10V, which equates to an intensity adjustment range of 10% - 90%.

1. Flip the Main Power ON/OFF (I/0) switch to the OFF (0) position and remove the power cord from the unit.
2. Connect the RJ10 end of the (optional) 38000-M03-022 Control Cable to the Input port on the rear panel.
3. Connect the yellow (+) and black (-) conductors to an appropriately configured voltage source (0V-10V).
4. Flip the Front Panel/Analog Control switch on the rear panel to the Analog position.
5. Connect the power cord to the unit and flip the Main Power ON/OFF switch to the ON (I) position.
6. Adjust the voltage source as necessary to achieve the desired intensity.
7. Use the On/Stby button to toggle the LED on or off.

NOTE:	In Analog Mode, the Intensity Indicators will be off, and the Intensity Adjustment buttons will be ignored. Additionally, all RS-232 commands sent to increase or decrease intensity will be ignored.
NOTE:	The unit can be powered on or off in either Front Panel or Analog Mode. Switching between Analog and Front Panel Modes may be done with the LED either ON or in Standby. When switching from Analog Mode to Front Panel Mode, previous Front Panel Mode settings are restored.
NOTE:	The Analog Mode Input circuit is polarity specific. The yellow conductor MUST be connected to the positive terminal of the voltage source. The black conductor MUST be connected to the negative terminal of the voltage source.

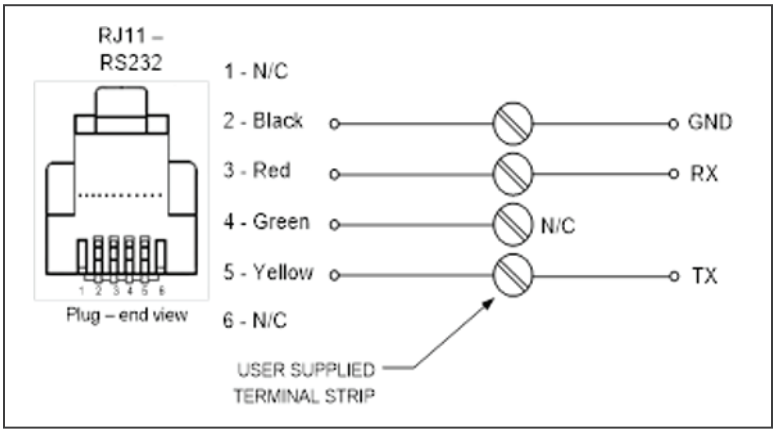
7.3 USING RS-232 COMMANDS

The SugarCUBE features an RS-232 communications port, which (via commands) can be used to remotely control all front panel functions. Additionally, commands exist to provide more precise intensity adjustments as well as helpful status indicators.

NOTE:	As with Analog Mode and the Relay Control, associated optional cables and RS232 interface adapters are available for purchase at www.ushio.com

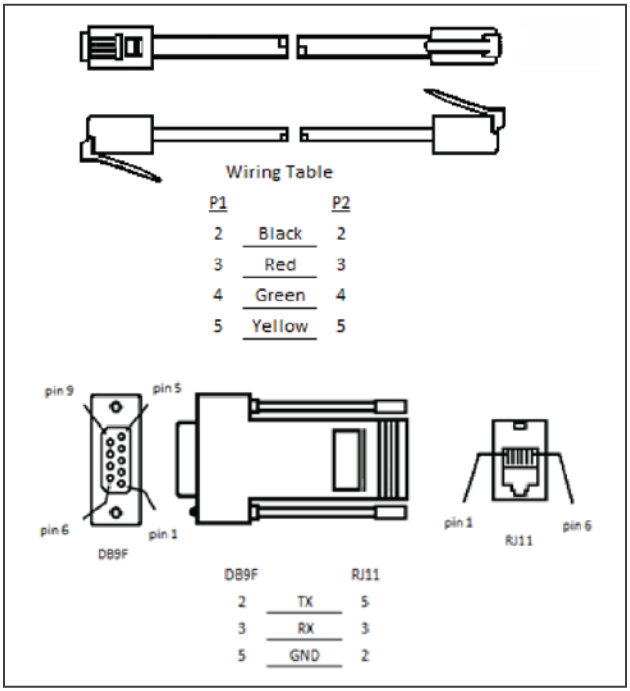
7.3.1 COMMUNICATIONS CONNECTION OPTION 1

1. Flip the Main Power ON/OFF (I/0) switch to the OFF (0) position.
2. Using the Blank Communication Cable (P/N 38000-M03-021), connect the host computer's RS-232 port to the SugarCUBE's RS-232 port. Use the image below for reference.
3. Flip the Main Power ON/OFF switch to the ON (I) position.
4. The Power Indicator will flash approximately once per second to indicate the unit is running and in Standby Mode.
5. The Intensity Indicators will display the current LED intensity level.
6. With an appropriate terminal program, computer commands can now be transmitted to control the unit and query its status. The communication protocol can be found in **Appendix A**.



7.3.2 COMMUNICATIONS CONNECTION OPTION 2

OPTIONAL RJ11 to RJ11 Cable with RJ11 to DB9F Adapter P/N 38000-M03-020



1. Flip the Main Power ON/OFF (I/0) switch to the OFF (0) position.
2. Using the RJ11 to DB9F adapter kit (P/N 38000-M03-020), connect one end of the RJ11 cable to the SugarCUBE's RS-232 port.
3. Connect the opposite end of the RJ11 cable to the DB9F adapter.
4. Connect the DB-9F adapter to the host computer's RS-232 DB9 port. Refer to the image below for more connection information.
5. Flip the Main Power ON/OFF switch to the ON (I) position.
6. The Power Indicator will flash approximately once per second to indicate the unit is running and in Standby Mode.
7. The Intensity Indicators will display the current LED intensity level.
8. With an appropriate terminal program, computer commands can now be transmitted to control the unit and query its status. The communication protocol can be found in **Appendix A**.

7.4 USING THE SugarCUBE SOFTWARE/GUI

The software is a graphical user interface (GUI) that mimics the physical front control panel of the SugarCUBE and offers more information about the unit. A user will be able to turn on and off the unit, adjust the LED illumination, look up information about the unit, etc.

Note: The SugarCUBE software is compatible with a PC running Windows 10 operating system with Java version 18. Other Java versions may work but have not been confirmed.

7.4.1 HARDWARE SETUP

1. Connect the SugarCUBE RS232 port (on back of unit) to a PC DB9 serial port. This cable needs to be a DB9 to RJ9 cable adapter. An adapter can be purchased from Ushio, part number: 38000-M03-020.

   Note: A PC USB port may be used. A DB9 to USB adapter or RJ9 to USB cable must be used. The USB port must be specified as COM 1 for it to work with the SugarCUBE software. This can be changed in Window's Device Manager.
2. The SugarCUBE should be in the standby mode when connecting to the software. The illumination set point may be adjusted while the unit is in standby mode.

7.4.2 SOFTWARE SETUP

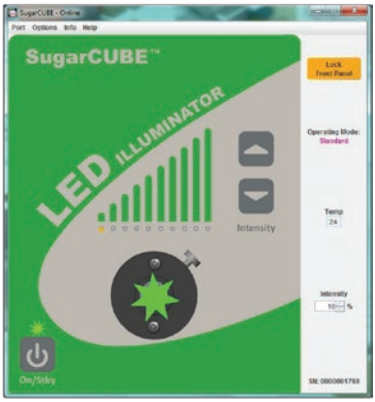
Unzip the SugarCUBE software v01.03.00.zip file to any location on the PC.

7.4.3 GENERAL USAGE OF THE SOFTWARE

1. Double click the “38000-F01-002.exe” to start the software. The following screen will appear:

2. Click “Port” and choose “Com 1” – this will connect the software to the SugarCUBE.

   Note: the software will detect the SugarCUBE version and update the GUI. The following images depict a SugarCUBE with green output.



3. Turn on the output by clicking the “On/Stby” button. A star will appear on screen informing that output is occurring.
4. Use the up and down arrow, or percent input box, to increase or decrease the intensity. The software and unit will show what level of intensity is being used.

5. The “Temp” information box informs what temperature the LED is currently at.
6. To lock the physical SugarCUBE front panel buttons and only allow the software to control the SugarCUBE, press the “Lock Front Panel” button. To unlock the SugarCUBE front panel, press the “Unlock Front Panel” button.

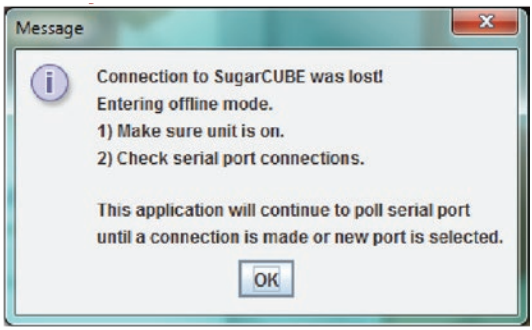
7.4.4 OPTIONS AND INFORMATION

The “Options” menu will provide an “Always on top” option. If clicked, the software will remain on top of all other windows.

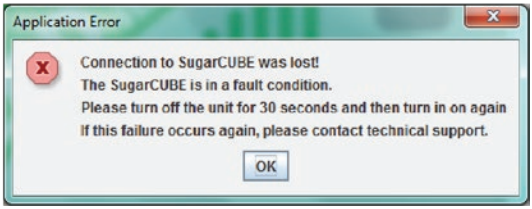
The “Info” menu will provide information about the SugarCUBE unit and software: GUI version, Firmware version, LED ID, and unit serial number.

7.4.5 TROUBLESHOOTING

If the SugarCUBE and PC are disconnected, this message box will appear:



If the SugarCUBE has a power failure during operation, this message box will appear:



TROUBLESHOOTING

The SugarCUBE software creates a log, “SugarCUBE_log.text” that may help with troubleshooting in case of a failure. This log resides in the same folder as the 38000-F01-001 executable program file.

Fault	Operation
SugarCUBE will not power on. (Power Indicator LED not illuminated.)	**Check** Ensure the AC power cord is firmly seated in the receptacle and connected to an appropriate wall outlet. **Check** Ensure the Main Power ON/OFF (I/0) switch is in the ON (I) position. **Check** Ensure AC power is available at the wall outlet the unit is connected to. **Contact** Contact customer service for further instructions.
No LED light output. (Power Indicator LED flashes approx. once per second and one of the Intensity Indicator LEDs is on.)	**Check** The unit may be in Standby Mode. Press the On/Stby button to turn the LED on. **Contact** Contact customer service for further instructions.

Fault	Operation
No LED light output. (Power Indicator LED flashes rapidly.)	The LED has exceeded its maximum allowable temperature. **Check** Ensure the unit has 4” of clearance on all sides. **Check** Ensure the vent holes are not blocked. **Check** Ensure the LED heat sink is not blocked by dust or debris. Refer to Section 6.2 for proper cleaning instructions. **Check** Ensure the LED heat sink cooling fan is running. Refer to Section 6 for top cover removal warnings and instructions. **Check** Ensure the power supply cooling fan is running. Refer to Section 6 for top cover removal warnings and instructions. **Check** Ensure the ambient air temperature is below 102°F (40°C) and/or improve air circulation. **Check** Allow the unit to cool to room temperature. **Contact** Call customer service for further instructions.

Normal Operation	
Unit Status	**Operation**
On/Stby AND Intensity Adjustment buttons enabled. (Unit in Standby Mode)	• One Intensity Indicator LED is active. • Power Indicator LED pulses once per second. • Fans will be OFF.
On/Stby AND Intensity Adjustment buttons disabled. (Unit in Standby Mode)	• One Intensity Indicator LED is active. • Power Indicator LED pulses twice per second. • Fans will be OFF.
LED On	• One Intensity Indicator LED is active. • Power Indicator LED is continuously illuminated. • LED cooling fan will be ON. • Power supply cooling fan will be either on or off.
Overheat Condition	• One Intensity Indicator LED is active. • Power Indicator LED pulses rapidly. • After the unit cools, the user must toggle On/Stby button to clear the overheat lockout. • Alternatively, the user can toggle the Main Power switch to clear the overheat lockout. • Fans will be off.

SECTION 9

REPLACING THE FUSES

No user-changeable fuses are included. Consult factory.

LIMITED WARRANTY

The SugarCUBE has a 12-month warranty from the date the unit is shipped. Ushio America, Inc. will repair or replace, at its discretion, any defective unit within this 12-month period. This warranty is void if the unit in question has been visibly damaged by accident or misuse, if the unit has been serviced or modified by anyone other than an authorized representative of Ushio America, Inc. or if any warranty seal has been broken. This is the only warranty expressed or implied by Ushio America, Inc. Specifically excluded from this warranty is damage resulting from improper installation or neglect in the operation of the unit or misunderstanding of the properties of the unit.

The LED has an expected life span of at least 60,000 hours with 70% lumen maintenance. Use of light guides without the authorized light guide adapter will void this warranty.

Please contact Ushio America, Inc. for a Return Material Authorization (RMA) prior to returning your unit for warranty service.

Ushio America, Inc.'s liability to the customer is limited to the replacement of the SugarCUBE unit.

TECHNICAL DATA

SugarCUBE 38000-M03-XXX	
Width:	16.0cm (6.3 inches)
Height:	20.3cm (8 inches)
Depth:	18.0 cm (7.1 inches) w/o light guide adapter 19.1 cm (7.5 inches) with Light guide adapter
Weight:	3.72 kg (8.2 lbs)
Operating Mode:	Continuous
Main Cable:	10A/250V
Power Cord Jack:	IEC 320/C13
Power supply:	100-240V, 50/60 Hz, 5/2A Full Range
Fuse:	Internal, No Access
LED Life	≥60,000 Hours w/ ≥70% Lumen Maintenance
Cleaning:	Surface Cleaning with Mild Detergent
RJ11 Communications Connection (Computer Interface via RS-232 Protocol)	
Wiring:	Refer to Section 7.3 above
Ambient Conditions For Operation	
Temperature:	10° to 40°C (50° to 102°F)
Rel. Humidity:	30% to 95% Non-Condensing
Air Pressure:	700 hPa to 1060 hPa
Ambient Conditions For Storage (In Shipping Packaging)	
Temperature:	-20° to +50°C (-4° to 122°F)
Rel. Humidity:	0% to 100%, Non-Condensing

REGULATORY COMPLIANCE

Fig. 1 shows the label that is attached to the rear panel of the SugarCUBE and indicates compliance with the regulatory standards listed.

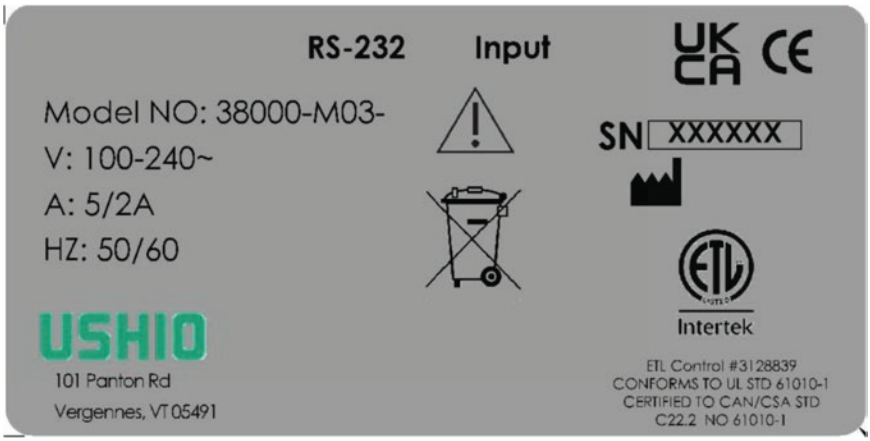


Fig. 1

APPENDIX A - RS-232 COMMANDS AND COMMUNICATION

Set serial communication settings to:

Baud Rate:	19200		
Data Bits:	8	Parity:	None
Stop Bits:	1	Flow Control:	None

RS-232 commands can use upper or lower case characters.

For firmware version 01.04.00 all commands described here are valid.

For firmware version 01.01.00, all commands described here are valid.

For firmware version 01.00.00, all commands except '^' and "v" are valid.

Command	Response	Description
nnn[cr]	None if Ok. "Bad" is returned if the number is invalid.	Adjusts intensity to the number entered. To change the LED intensity, enter '**nnn**' where '**nnn**' is an LED intensity from 10 – 100 with a trailing carriage return; leading 0 is optional.
^	None	Increases intensity to next 10% level. This will have the same effect as pressing the Increase Intensity button on the front panel (if the unit is in the unlocked state). This command is not functional with firmware v01.00.00
v	None	Decreases intensity to next 10% level. This will have the same effect as pressing the Decrease Intensity button on the front panel (if the unit is in the unlocked state). This command is not functional with firmware v01.00.00

Command	Response	Description
s	###xyz	Returns the status of the SugarCUBE. ### - LED intensity (with leading 0's if necessary) x: + Indicates the LED is on. – Indicates the LED is off. y: u - Indicates overlay buttons are unlocked. l - Indicates overlay buttons are locked. z: Unit type: 1 - White LED 2 - Red LED 3 - Green LED 4 - Blue LED 5 - Quad White LED 6 - Lensed White LED 7 - Ultra
t	x[cr]	Indicates the LED case temperature in °C.
c	x[cr]	Returns a temperature reading every second in °C. This command is a toggle, so the first time a "c" is received, the temperature starts reporting. The second time a "c" is received, the temperature stops reporting.
+	None	Turns the LED on.
-	None	Turns the LED off.
lock[cr]	None	Disables overlay buttons.
unlock[cr]	None	Enables overlay buttons. [default]
?	v##.##.##	Returns the firmware version
#	nnnnnnnnnn<cr>	Returns 10 digit serial number of unit with leading zeros.
All other characters	The unit may be rendered unusable.	Choosing other characters or character combinations is not recommended as it may cause the unit to cease functioning.

SECTION 14

MANUFACTURER CONTACT INFORMATION

Manufactured and Serviced by:

Necsel IP, Inc.,
an Ushio Group company

101 Panton Road
Vergennes, VT 05491 USA

Tel: +1.802.877.2182

Customer Service: vermontinfo@ushio.com

Website: www.ushio.com

NOTES

USHIO

101 Panton Road, Vergennes, VT 05491

Form No. SugarCUBE/0722