



User Manual

DCS-400E

DCS-800E

Quad Controller Series

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Hardware Overview

The DCS400 and DCS800 Quad Lighting Controller is a multi-channel controller for Advanced Illumination LED illuminators. With multi-channel control, this controller is ideal for applications such as photometric stereo, high-resolution color and bright-field / dark-field combination lighting.

This controller family is not limited to computational imaging and can be used as a general-purpose controller for a wide range of applications in both **continuous** and **strobe** modes of operation.

DCS-400E, Quad Controller

Single Output, 4 Channels

Ethernet 10/100

x2 digital trigger input

x2 trigger outputs

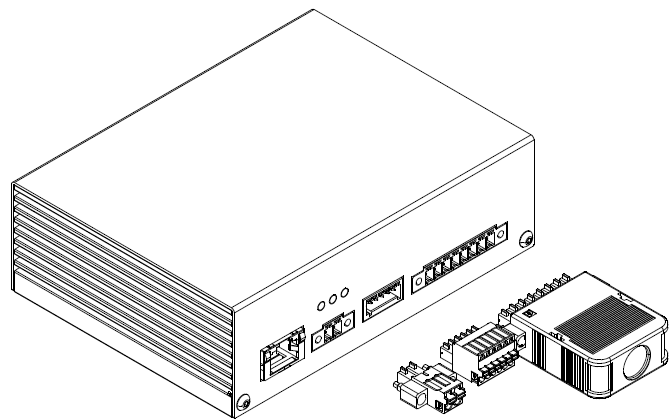


Figure 1

DCS-800E, Quad Controller x2

Dual Output, 8 Channel

Ethernet 10/100

x2 digital trigger inputs

x2 trigger outputs

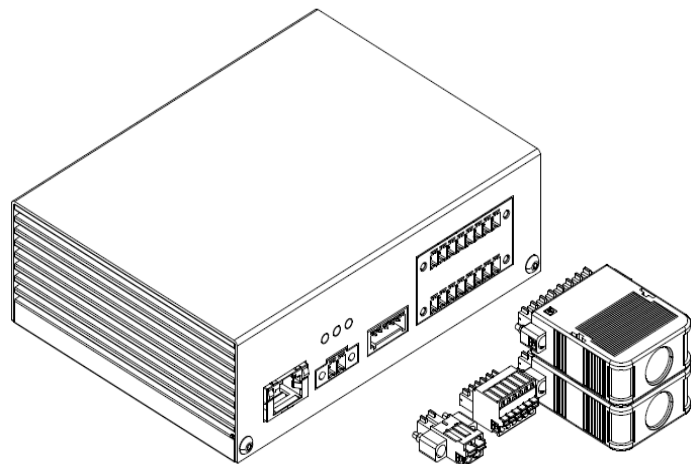


Figure 2

Installation Model

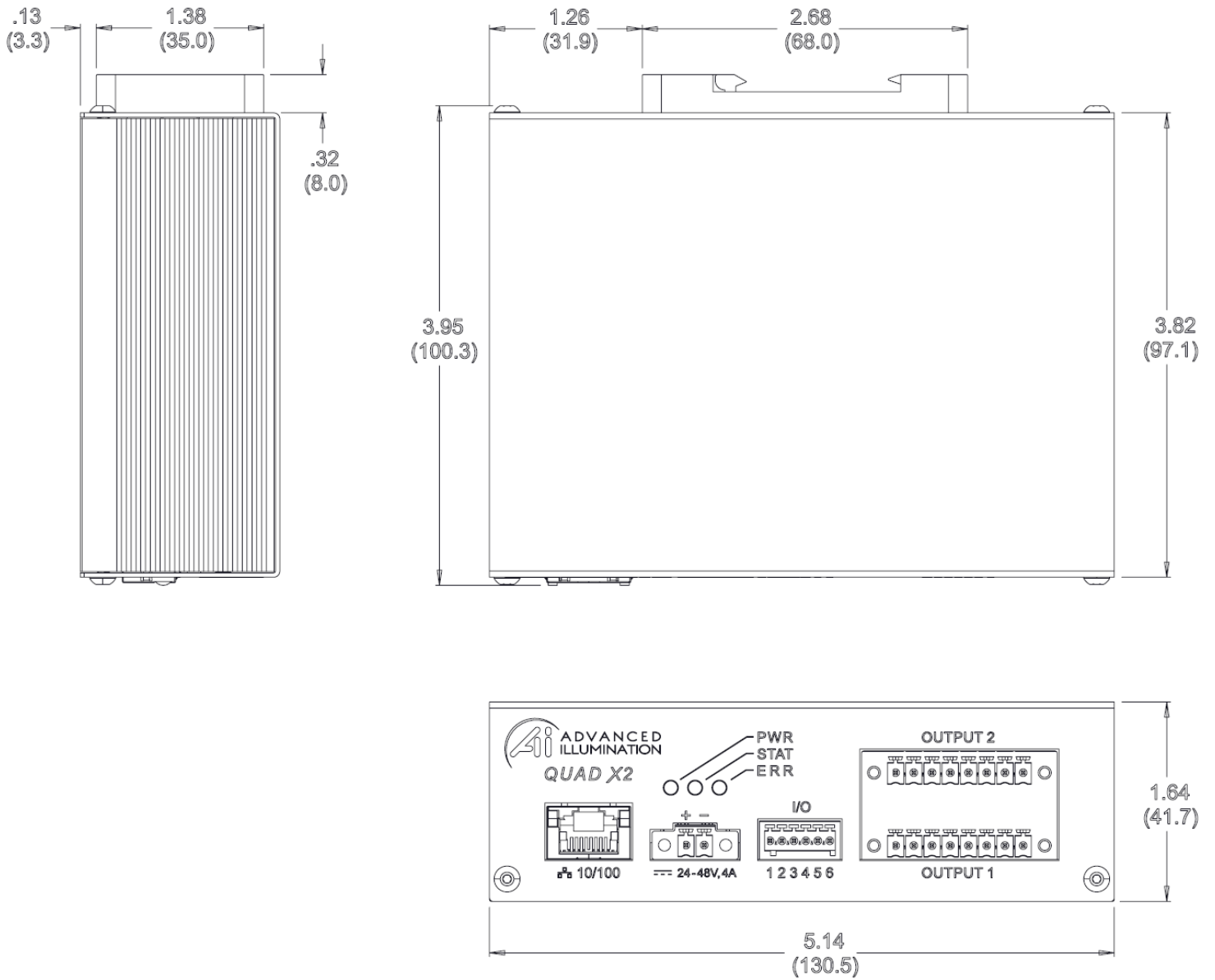


Figure 3

General Specifications

Controller Style	Discrete Control System (External, Detachable)
User Interface	Software GUI, Web Browser
Operating Modes	Sequence, Pulse (Overdrive Strobe), Continuous
Lighthead Connection	Via Proprietary 8-Post Header Block with Embedded EEPROM on Lighthead Cable (Q1 or Q4)**
Input Supply Requirements	24V DC Nominal, 4.5A Recommended 21V Min - 48V Max; Power Inputs Reverse-Polarity Protected
Output Channels (DCS-400)	Number of Outputs: 1 Number of Channels per Output: 4
Output Channels (DCS-800)	Number of Outputs: 2 Number of Channels per Output: 4
Output Power	Continuous: 15W per Channel Pulsed: 120W Peak per Channel*
Output Current	Continuous: 0.5A per Channel Pulsed: 10A per Channel
Output Voltage	Continuous: $V_{in} - 1V$, Channel Independent Pulsed: 45V Max*, Channel Independent
Trigger Signal	TTL Compatible 3.7V Min - 30V Max, $\leq 5mA$
Trigger Protection	Protected up to 30V
Trigger Delay	20 μs + 10us LED rise-time
Trigger Frequency Limit	2 KHz
Pulse Width Range	30 μs - 3600 ms
Programmable Pulse Delay	1 μs - 1000 s
Duty Cycle Range	Typical <1% for high current overdrive, up to 15% Dependent on the limitations of the connected light
Dimming Range	0% - 100%, 1mA Increments via Software Settings
Status Indicator LEDs	Green: Power Yellow: Communication Red: Error
Communication	10/100 Ethernet Standard TCP-IP, UDP .NET Library Compatible w/ C#, F# and VB

Operating System Software Support	GUI: Windows 7+ (requires .NET Framework 4.5+)
Operating Temperature Range	0°C to +55 °C
Storage Temperature Range	-25°C to +85 °C
IP Rating	Not Rated
Dimensions	4.20" x 1.63" x 5.14" (106.6mm x 41.5mm x 130.6mm)
Weight	1.03lb (467g)
Mounting	DIN Rail
Case Material	Aluminum and Steel
Warranty	5 yrs
Compliance	CE, RoHS

***Values shown are based on controller component limitations. Actual limitations will vary depending on the limits set for the connected lighthouse. These limits are determined using Advanced Illumination's proprietary SignaTech™ (Signature Technology) in order to ensure safe peak performance.**

**** Various lighthouse configurations available, including 1 x 4-channel quadrant (Q1) control or multiple single lighthouses (Q4) per block.**

Front Panel

DCS-400E

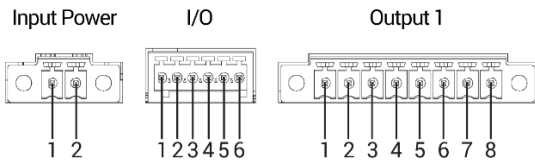


Figure 4

DCS-800E

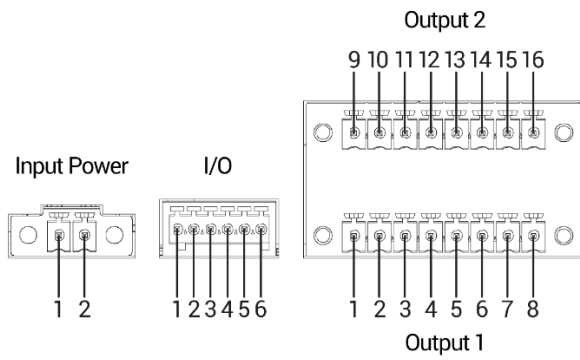


Figure 5

Refer to the tables on the next page for connection info

Front Panel Descriptions

Table 1 - Input Power, P1

Pin	Description	Note
1	24-48VDC	Reverse polarity protected
2	DC GND	

Table 2 - Indicator LEDs

	Color	Behavior	Function
LED 1	Green	On	Main Power Indicator
LED 2	Amber	Heartbeat / Blink	Flashes once per second heartbeat while light is connected. Flashes when commands are received.
LED 3	Red	Blink Code	Error code—Long / Medium / Short flashes indicate an error code

Table 3 – IO Connector, P2

Pin	Description	Note
1	TRIGGER-IN1	ACTIVE-HIGH – pull high to activate (Channels 1-4)
2	TRIGGER-IN2	ACTIVE-HIGH – pull high to activate (Channels 1-4 for DCS-400E, Channels 5-8 for DCS-800E)
3	TRIGGER-OUT1	Frame Start—output signal, occurs at the beginning of each channel pulse
4	TRIGGER-OUT2	Frame Stop—output signal, occurs at the end of each channel pulse
5	TRIGGER GND	Same as DC ground
6	TRIGGER GND	Same as DC ground

Table 4 – Output Connector P3 & P4

<i>Output 1 (P3)</i>		<i>Output 2 (P4)</i>		<i>Notes</i>
<i>Pin</i>	<i>Description</i>	<i>Pin</i>	<i>Description</i>	
1	SignaTech™ GND	9	SignaTech™ GND	Reserved
2	SignaTech™	10	SignaTech™	SignaTech™ Light Protection – NOT USER SERVICEABLE
3	CH3 & CH4 -	11	CH7 & CH8 -	LED Cathode (common)*
4	CH4 +	12	CH8 +	LED Anode
5	CH3 +	13	CH7 +	LED Anode
6	CH1 & CH2 -	14	CH5 & CH6 -	LED Cathode (common)*
7	CH2 +	15	CH6 +	LED Anode
8	CH1 +	16	CH5 +	LED Anode

Important Information

*LED Cathode pins, pin 1 and pin 9 are COMMON and may be tied together.

This controller requires SignaTech to operate correctly. SignaTech is **included** with lights purchased from Advanced Illumination. It is not possible to drive a non-SignaTech protected light source without explicit instruction from Advanced Illumination.

Connector Information

Power Input (P1)

Phoenix Contact, 1748354, 18-24 AWG



Trigger Input (P2)

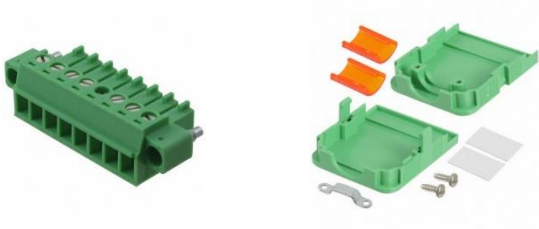
Phoenix Contact, 1881367, 22-26 AWG



Light Output (P3, P4)

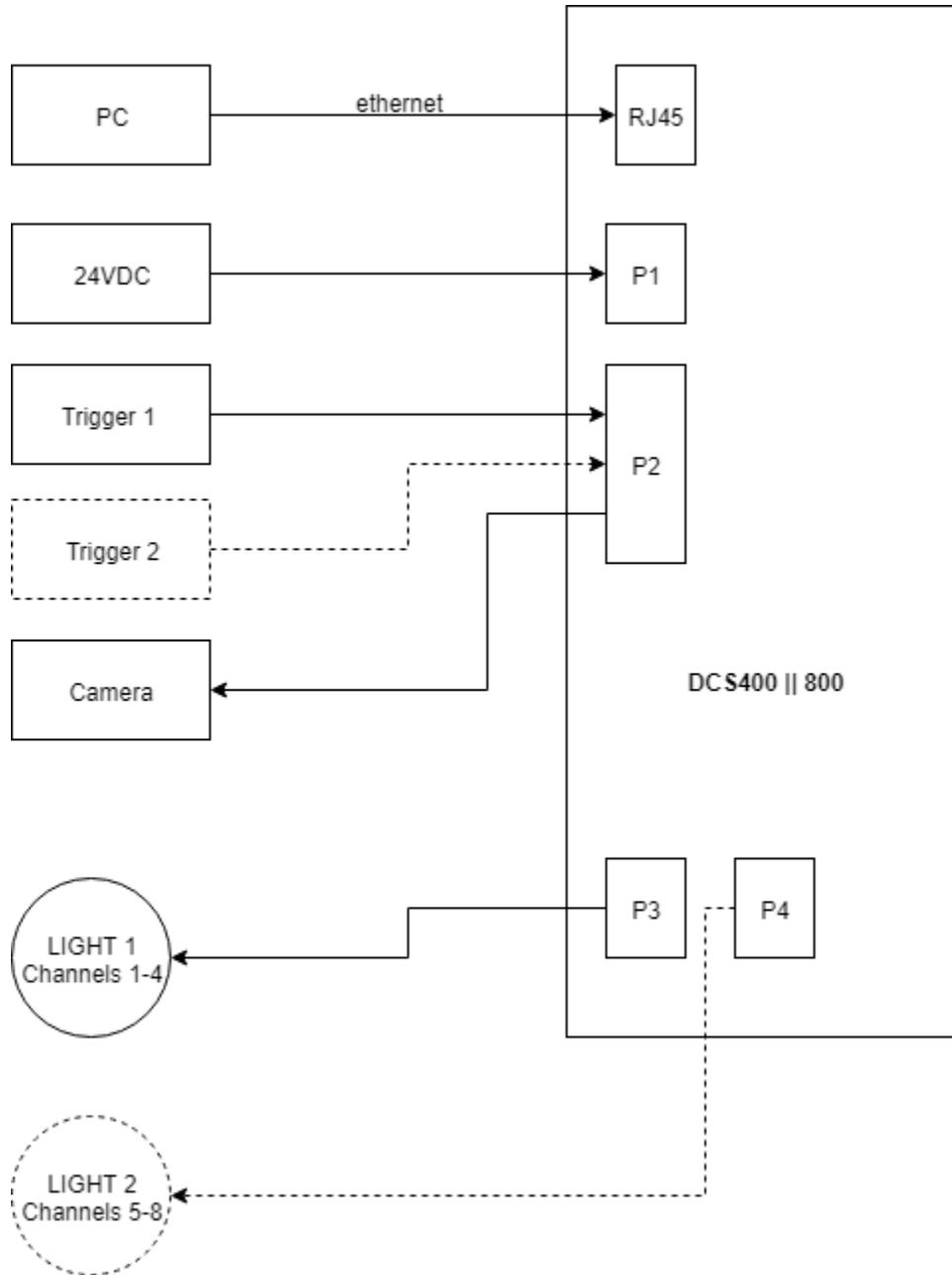
Plug: Phoenix Contact, 1827761

Strain Relief: Phoenix Contact, 1834408, 18-24 AWG



Quick-Start

General Connection Diagram



NOTE; *Trigger 2 and Light 2 only apply to DCS800**

Figure 6 – General Wiring Example

Modes of Operation

Continuous

Each channel is capable of up to 1A output in **standard mode**. Continuous mode is not possible in **sequence mode**; in sequence mode, DC can be simulated by using long pulse widths.

Note: Depending on the load and power dissipation, not all channels may operate at 1A simultaneous. The controller must maintain a safe power dissipation, so channel currents may be throttled.

Each channel has an operating power limit of 10W, so the controller may throttle the power depending on the load that is connected.

Pulsed

Pulsed mode illumination is triggered by an external signal.

Pulse widths and delay are available from 10 to 4,290,000,000 microseconds and can be applied independently to any channel.

Note: Trigger Input 1 and Trigger Input 2 are for Outputs 1 and 2 respectively

Sequence

Channels settings are organized into **events**. The event could be considered a pre-set, or recipe, that stores the behavior when a trigger is received.

Programming multiple **events** allows the controller to sequence through pre-determined recipes. Each external trigger edge will advance the sequence to the next event.

Standard vs. Sequenced

Standard mode acts like a traditional strobe controller, where all channels that are enabled are triggered at the same time.

Sequenced makes each trigger signal progress the saved sequence once event at a time.

Trigger Input & Outputs

Simplified Input Diagram (P2 pins 1 & 2)

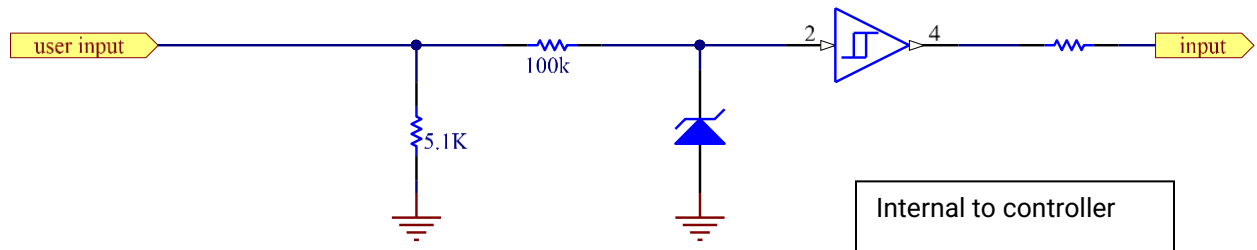


Figure 5

Outputs – Frame Start/Stop (P2 pins 3 & 4)

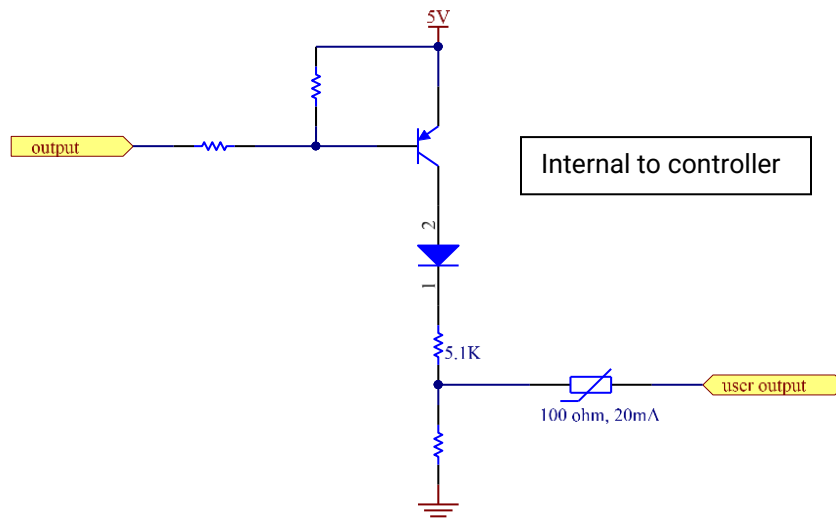


Figure 6

Frame-start (Pin 3) is a 5V output trigger signal that occurs at the beginning of each channel pulse. This signal can be used to trigger an external device, or camera.

For example: by using the **frame-start** signal, it is possible to synchronize a camera exposure to capture each channel as they flash in a sequence. This is useful in photometric stereo applications where the camera needs to be carefully synchronized to capture multiple flashes

Frame Stop (pin 4) – Similar to **frame-start** except the stop signal begins at the end of each light pulse. This signal can be used to determine when the last channel pulse has ended and is useful for controlling system timing more accurately.

Software Setup

Default Ethernet Settings

The Controller uses standard Ethernet protocol (TCP-IP and UDP) to communicate. The DCS control user interface can be used to communicate, or other software may be used to send data packets directly from the host to the controller.

Table 5

Setting	Value
Typical Port Settings	UDP, port 7777 TCP, port 777
DHCP	Enabled by default
Default IP Address	192.168.0.5 *Controller will use default IP if DHCP fails upon power up, or if an Ethernet cable is not connected
User Assigned IP Addresses	User can assign a new IP address by sending a command or entering a new IP address in the “manage devices” window of the GUI. If a user assigned IP address is used, the controller will not begin using that IP address until the controller power is toggled.

This controller uses DHCP to automatically acquire an IP address. **If directly to a PC Ethernet port, you will need to set up the PC to use a static IP address in the range of 192.168.0.x**

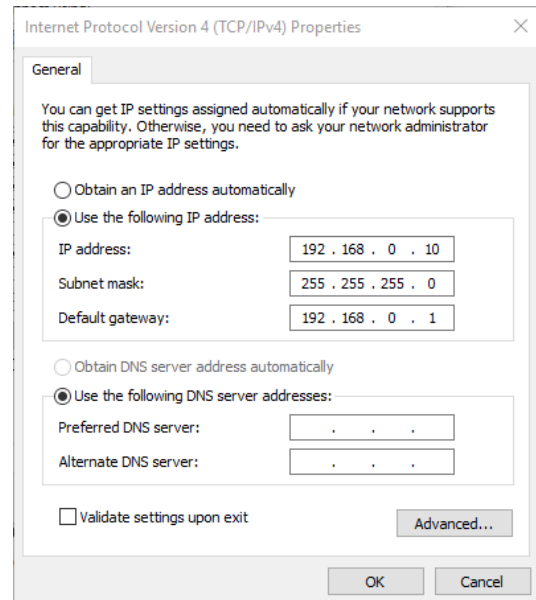


Figure 7 - Example PC settings

User Interface (GUI)

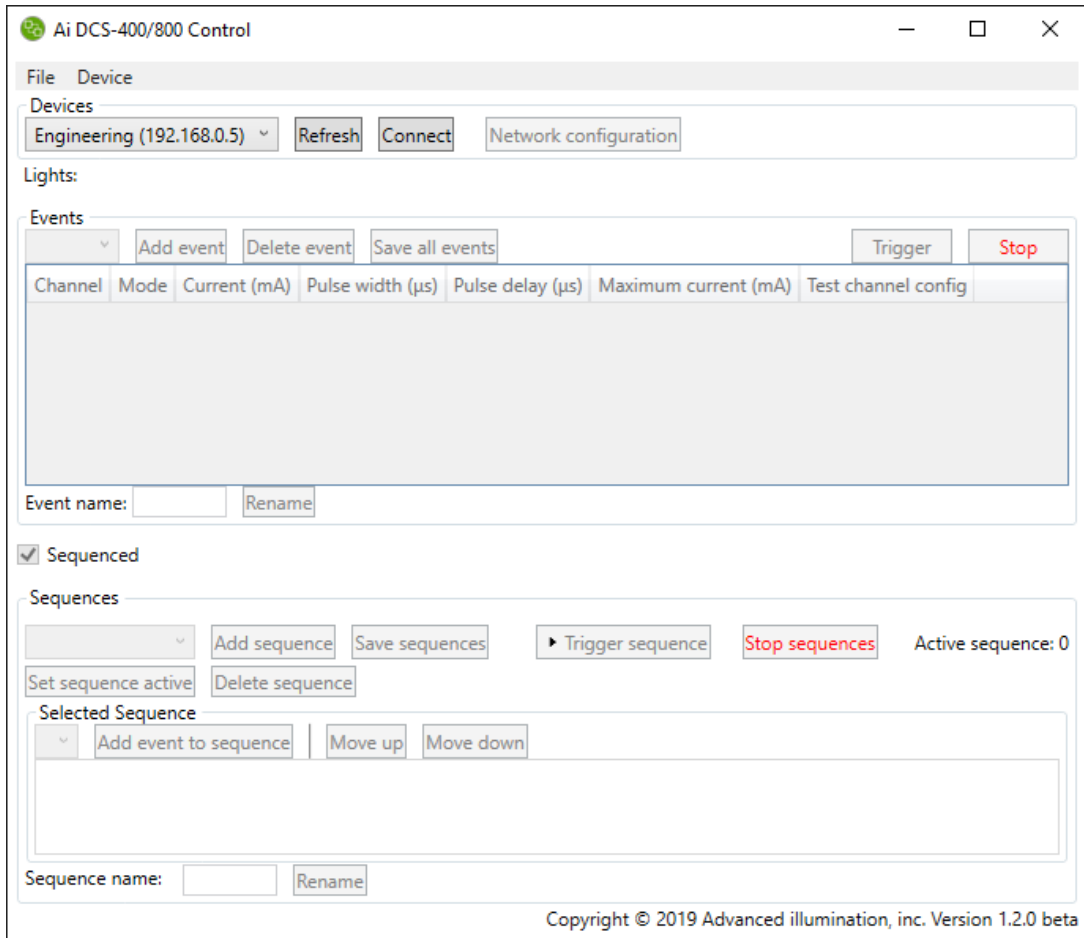


Figure 8 – Control GUI

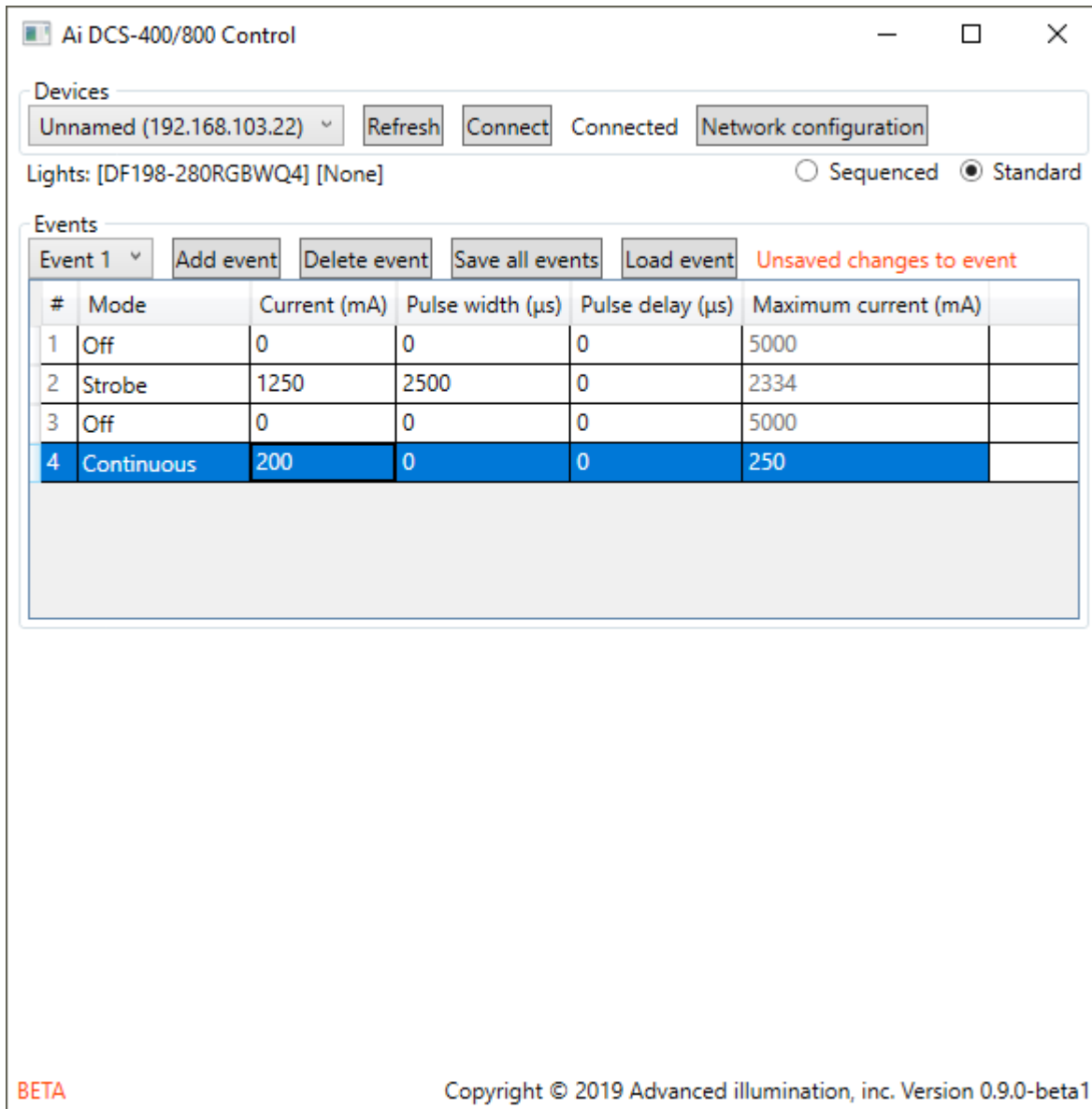
Table 6 – Control GUI functions

<i>Software Item</i>	<i>Description</i>
File	Save and Load recipes to the controller
Device	Additional options, clear saved settings
Refresh	Re-scans the network for devices
Connect	Connects to the device highlighted in the dropdown
Network Configuration	Edit and view network settings for the connected device
Events	Contains all the channel settings (current, pulse width, delay, etc.)
Add Event	Creates a new blank event to be configured by the user
Delete Event	Removes the event from the list
Save all events	Commits the events to controller memory and saves changes
Load event	sets the focused event as “active”
Trigger	Simulates a hardware trigger, activating the focused event
Stop	Stops all channels. Useful if the pulse or delays are set to very long values and must be interrupted
Event name	Rename the focused event
Sequenced	Enables sequenced mode
Sequences	List of sequences saved to the controller
Add Sequence	Creates a new sequence
Set Sequence Active	Sets this sequence to be the actively triggered sequence
Trigger Sequence	Simulates a hardware trigger, triggers the sequence one event at a time (does not trigger the entire sequence at once)
Stop Sequence	Halts the sequence, stopping any long channel pulses or delays
Selected Sequence	Choose the sequence to view or edit
Add Event to Sequence	Adds the selected event in the dropdown to the sequence. Event can then be arranged in any order

Software Usage

Overview

The Ai DCS-400/800 software must connect to a device before it can be used. The Refresh button (see Figure 9) refreshes the list of available DCS-400/800 devices on the local network. Either select a device from the list or type an IP address (in dotted-quad, e.g. “XXX.XXX.XXX.XXX” format) and click connect.



Devices

Unnamed (192.168.103.22) Refresh Connect Connected Network configuration

Lights: [DF198-280RGBWQ4] [None] Sequenced Standard

Events

Event 1 Add event Delete event Save all events Load event Unsaved changes to event

#	Mode	Current (mA)	Pulse width (µs)	Pulse delay (µs)	Maximum current (mA)
1	Off	0	0	0	5000
2	Strobe	1250	2500	0	2334
3	Off	0	0	0	5000
4	Continuous	200	0	0	250

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Figure 9: Software main window example

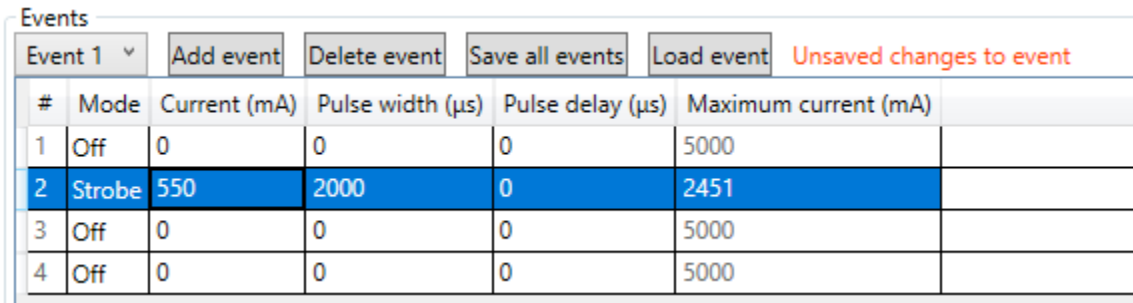
Software Modes

Standard Mode

The standard mode allows using a DCS-400 or DCS-800 like a traditional 4- or 8-channel controller. Operation in **Standard Mode** starts by putting the controller in **Standard Mode** and adding an Event (See **Error! Reference source not found.**).

Adding an Event

Once an event is added, you can set configurations (current, channel mode, etc.) on each channel and they will be immediately reflected on the controller. Note that the event itself is not auto-saved: if you power down the controller the configuration will be lost unless you click “Save all Events”. The warning shown in Figure will inform you if you have unsaved edits.



Events						
Event 1 ▾						
<input type="button" value="Add event"/> <input type="button" value="Delete event"/> <input type="button" value="Save all events"/> <input type="button" value="Load event"/> Unsaved changes to event						
#	Mode	Current (mA)	Pulse width (μs)	Pulse delay (μs)	Maximum current (mA)	
1	Off	0	0	0	5000	
2	Strobe	550	2000	0	2451	
3	Off	0	0	0	5000	
4	Off	0	0	0	5000	

Figure 10

Other events you add must be loaded with the Load Event button to be applied to the device. Loading an Event will set that Event active on the device, and it will be auto-loaded next time the device is powered on. If no Event is loaded when the device is power cycled, it will load the first available saved Event. Saving channel configurations as an Event allows you to easily recall the configurations later, much like the Profiles in Advanced illumination’s DCS-100 and DCS-103 controllers.

Sequenced Mode

Sequenced mode allows the controller to automatically cycle through a predefined series of Events with a hardware trigger (currently only Trigger Input 1). This allows the controller to, for example, flash alternate sides of a right light with only one a continual stream of trigger pulses and no further input from the software/SDK.

Events

Creating an Event is the same as in Standard Mode, except for two points:

1. Event changes are not immediately updated on the device.
2. An Event cannot be loaded directly while in Sequenced Mode, only Sequences can.

Sequences

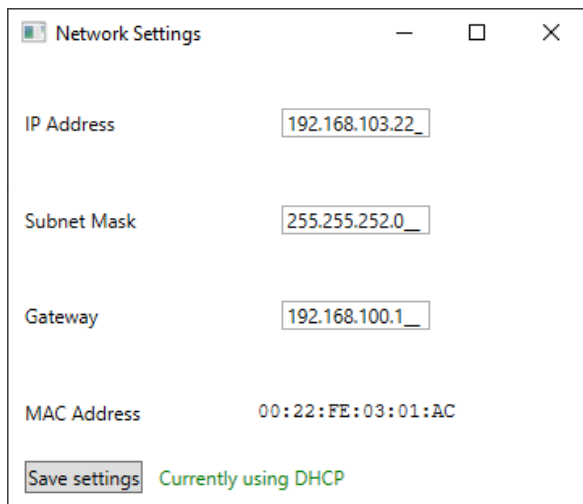
A Sequence is, at its simplest, a list of Events. When a Sequence is loaded, a hardware trigger causes the controller to start the first Event in the list, the next trigger starts the next event, and so on. When the last Event in the Sequence is reached, it starts over from the first Event.

Clicking “Add Sequence” adds a new sequence, which appears inline below the other sequences in the list. On any Sequence, you can select an Event from the dropdown in the Sequence and click “Add selected event” to add that event to the Sequence. You can have multiple of the same Event in the Sequence; however, you are limited to 10 Events per sequence.

Once you have a Sequence defined, click “Save sequences” to save all defined Sequences to the controller. You can then make load a Sequence on the controller by clicking “Set as active” on a sequence. The “Run sequence” button allows you to simulate a trigger pulse to ensure that sequence is working as intended. Be aware that this button sends an HTTP POST message to the controller, so there will be network delay between the click and the pulse.

Network Configuration

Network Configurations are viewed by clicking the “Network Configuration” button on the main window when connected to a device. Network Configurations opens in its own window, as shown in Figure 7 below.



The screenshot shows a window titled "Network Settings" with the following fields and values:

IP Address	192.168.103.22_
Subnet Mask	255.255.252.0_
Gateway	192.168.100.1_
MAC Address	00:22:FE:03:01:AC

At the bottom, there is a "Save settings" button and the text "Currently using DHCP".

Figure 73: Network Configuration example in DHCP Mode

Static IP configuration

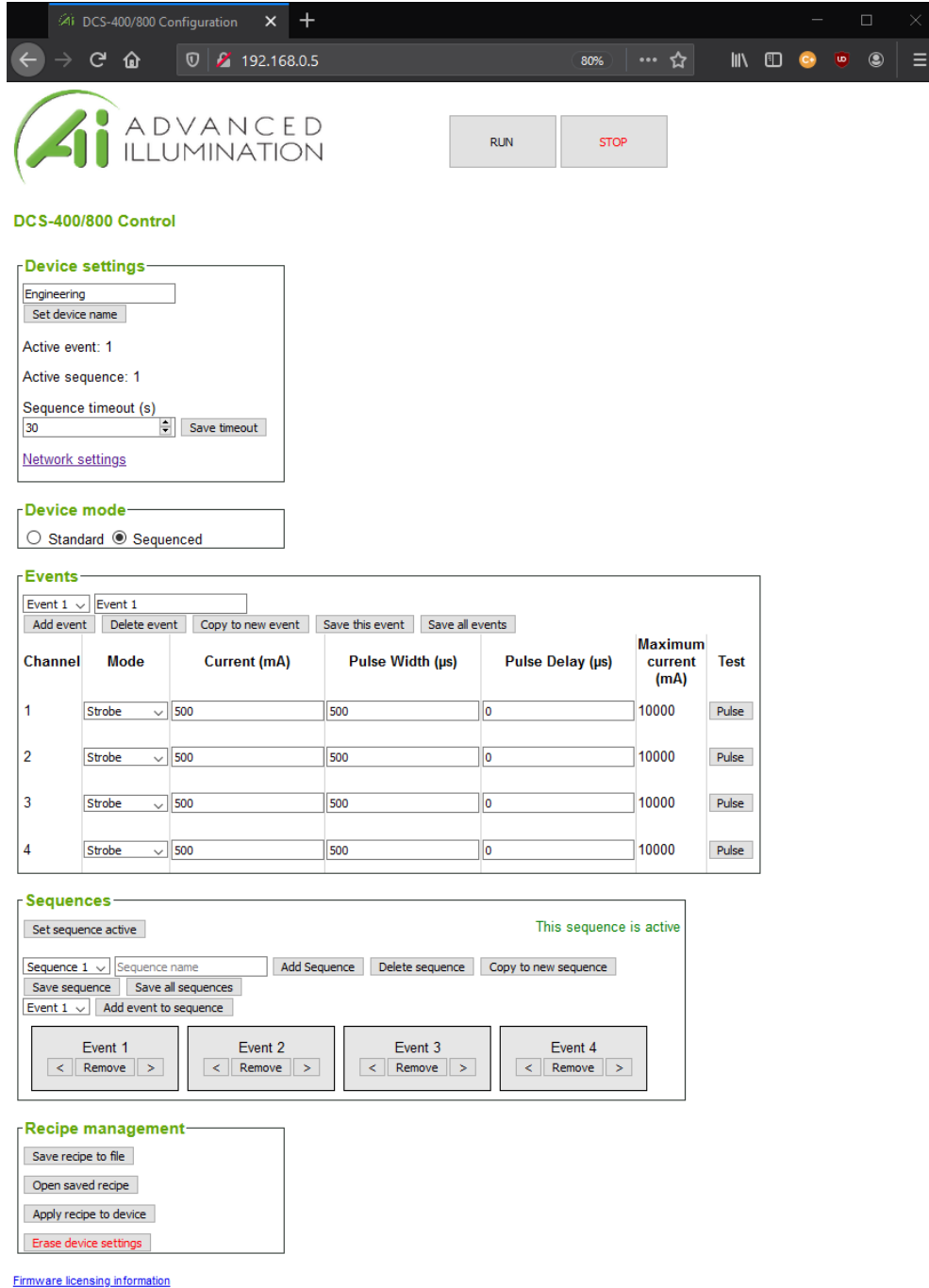
A static IP address is set by entering an IP address, subnet mask, and Gateway address in the boxes provided. Note that the window displays the current value of all settings, even if it’s using DHCP. Settings are saved by clicking the “Save Settings” button. If settings are saved unchanged from the values displayed from DHCP, then the device is assigned a static IP address configuration matching those values.

Resetting to DHCP

Network configuration can be reset back to DHCP mode by clicking the red text “Reset to DHCP” button, which will replace the green DHCP message when the device is using a static address. The device should then be power cycled for it to use its new settings.

Web Browser User Interface

Entering the device IP address into a web browser (Chrome, Firefox, Edge) will open the controller web browser.



DCS-400/800 Control

Device settings

Engineering
 Set device name

Active event: 1
 Active sequence: 1
 Sequence timeout (s)
 30 Save timeout
[Network settings](#)

Device mode

Standard Sequenced

Events

Event 1 Event 1
 Add event Delete event Copy to new event Save this event Save all events

Channel	Mode	Current (mA)	Pulse Width (µs)	Pulse Delay (µs)	Maximum current (mA)	Test
1	Strobe	500	500	0	10000	Pulse
2	Strobe	500	500	0	10000	Pulse
3	Strobe	500	500	0	10000	Pulse
4	Strobe	500	500	0	10000	Pulse

Sequences

Set sequence active This sequence is active

Sequence 1 Sequence name Add Sequence Delete sequence Copy to new sequence
 Save sequence Save all sequences
 Event 1 Add event to sequence

Event 1 Event 2 Event 3 Event 4
 < Remove > < Remove > < Remove > < Remove >

Recipe management

Save recipe to file
 Open saved recipe
 Apply recipe to device
 Erase device settings

[Firmware licensing information](#)

Figure 14

Software Command and Control Interface

Command Structure

The DCS400/800 uses an SCPI-like interface where commands are a series of readable strings with parameters separated by commas. The strings must be terminated by a semicolon (;) for proper operation.

Commands can be sent in an ASCII format by specifying the IP Address and correct port number for either TCP/IP or UDP.

Commands with a parameter

Commands that require a parameter have it separated by a comma.

Example: "SET:PULSE:WIDTH:CHANNEL1, 100;"

Where "SET:PULSE:WIDTH:CHANNEL1," is the command and "100" is the parameter.

Commands without a parameter

If the command has no parameter, the command simply ends with a semicolon.

Example: "*IDN?;"

Commands are case sensitive, and must be entered exactly as shown

Command Table

Table 7

COMMAND	DESCRIPTION	RETURNS
SET:CURRENT:CHANNELc,nnnn;	Sets the current in milliamps c = 1 - 8 (channel number) nnnn= 0-8000 (strobe)	
SET:PULSE:WIDTH:CHANNELc,nnnn;	Sets the pulsewidth in usec c = 1 - 8 (channel number) nnnn = 0 - 4290000000 (us)	INFO: Channel "c" pulse width set to "nnnn" us
SET:PULSE:DELAY:CHANNELc,nnnn;	Sets the pulse delay in usec c = 1 - 8 (channel number) nnnn = 0- 4290000000 (us)	INFO: Channel "c" pulse delay set to "n" microseconds.
PULSE:CHANNELc;	Software triggers the channel c = 1-8	
SET:MODE, [SEQUENCED] [STANDARD];	Sets the controller in either sequence (mode 0) or standard (mode 1) Note: can use the number 0 or 1 instead of "sequenced" or "standard" in the command	INFO: Set mode to 'n'
SAVE:CONFIG, [1-10]	Saves the active channel settings to the given event number (standard mode only)	
*IDN?;	Gets device information: firmware, hardware, etc..	Advanced illumination "DCS-100: (fw version, hw version)"
*CHANNEL:INFO?;	Gets device channel information	

SET: IP: ADDRESS, xxx;	Sets static IP address. Xxx = IP address in dotted-quad format (XXX.XXX.XXX.XXX)	INFO: Set IP address to XXX.XXX.XXX.XXX. Reboot for it to take effect.
SET: GATEWAY: ADDRESS, xxx;	Sets gateway IP address. Xxx = IP address in dotted-quad format (XXX.XXX.XXX.XXX)	INFO: Set Gateway address to XXX.XXX.XXX.XXX. Reboot for it to take effect.
SET: SUBNET: MASK, xxx;	Sets subnet mask. Xxx = subnet mask in dotted-quad format (XXX.XXX.XXX.XXX)	INFO: Set subnet mask to XXX.XXX.XXX.XXX
ERASE: SETTINGS;	Erases device settings.	
STOP: SEQUENCE;	Stops running sequence. Immediately aborts all long-running pulses and shuts off all channels.	INFO: Running sequence aborted
RUN: SEQUENCE;	Runs the currently active sequence. Imitates a hardware trigger in sequenced mode.	INFO: Running event X on Sequence X X is event/sequence number

Warranty Information

Every Advanced illumination, Inc. (Ai) product is thoroughly inspected and tested before leaving the factory. Products are warranted to be free of defects in workmanship and materials for a period of five years from the original date of purchase. Should a defect develop during this period, please contact Ai Customer Service or your Ai distributor for a Return Merchandise Authorization (RMA), and return the complete product, freight prepaid, to Ai. Please provide a detailed description of the problem if possible. If a defect is found, Ai will - at our discretion - repair or replace the product without charge. Ai claims no liability for any implied warranties, including “merchantability” and “fitness for a specific purpose.”

Customer Support and Product Information

Standard Product Information: www.advancedillumination.com

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