

Storm & Storm X Controller Manual

Welcome to your new Storm PWM Controller. Please familiarize yourself with the features of your new controller as described in this user manual. We've put a lot of care into the design of every aspect of your Storm Controller, and we're confident that it will provide you with many years of trouble-free service.

Features:

- 16x2 Character LCD Display
- 6-Channel 8-Bit PWM (Storm), 16-channel 12-bit PWM (Storm X)
- 256 Dimming Levels (Storm), 4096 Dimming Levels (Storm X)
- Real-Time Clock Module
- Manual Sunrise/Sunset Time
- Geolocated Sunrise/Sunset
- Staggered Sunrise/Set Delays
- Intuitive Wheel Interface
- SmoothRamp Dimming
- SmoothRamp Clouds
- Cloud Channel Clustering
- Lightning Storm Effects
- Moon Phase Simulation
- Upgradeable via FTDI
- Arduino Compatible
- Auto-dimming LCD (Storm X only)

Specifications:

- Input supply: 9V-12V 5.5mm x 2.1mm barrel-jack, center-positive
- PWM output: 0-5V PWM from 0% to 100% duty cycle
- Max PWM current per pin : 40mA (Storm), 10mA (Storm X)
- Integrated header for DS18B20 Temperature Probe (4.7k pullup on-board)
- Mounting dimensions: 3mm holes @ 92mm x 37mm footprint
- Board dimensions: 98mm x 43mm
- Coin cell: CR1220 compatible
- Extra pins Storm: A6 (input only), A7 (input only), D12 (DS18B20 header)
- Extra pins Storm X: D6 (LCD Dim), D8, D9 (8-bit PWM), D10 (8-bit PWM), D13, D11 (8-bit PWM), D12 (DS18B20 header), A6 (input only), A7 (input only)

Board Layout: Storm X PWM LED Controller



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Navigation

The click-wheel system is designed to be as intuitive as possible. All menu items can be accessed via a combination of four basic control movements: Right turn, left turn, short press, and long press.

Main Menu

By short pressing the knob, the main menu cycles through four settings.

Auto: The place where you'll normally be is at the home setting where the status message is either Day, Night, Sunrise, or Sunset depending on the time of day. This is the automatic mode with set-it and forget-it functionality. Be sure to return to this mode after any tinkering in the other modes.

Sim Mode lets you simulate your sunrise-sunset settings. Simply jog through the percentage indicator to see how your settings will appear. It depicts your lighting settings from Night (0%) to Day (100%) and everything in between. [This feature introduced in Firmware 2.2]

Manual Mode allows you to control the brightness manually with the knob. This is not limited by the settings and rather increments and drives ALL of the PWM channels by the same amount. On the Storm X, you'll have fine control over the lower range of brightness, and coarse control at higher brightness levels to facilitate scrolling through the 4096 levels.

Dark Mode forces the PWM outputs to assume your nighttime settings.

Off Mode turns off all PWM outputs, a 0% duty cycle.

Setup Menu - The setup menu may be accessed by pressing and holding the knob (long press) from any of the main menu screens.

Set PWM (Day) - Here you'll set the full brightness that you want your LEDs to attain. The values are given out of 255 for the Storm controller, and out of 4095 for Storm X.

Set PWM (Night) - Same as above, but the brightness at nighttime.

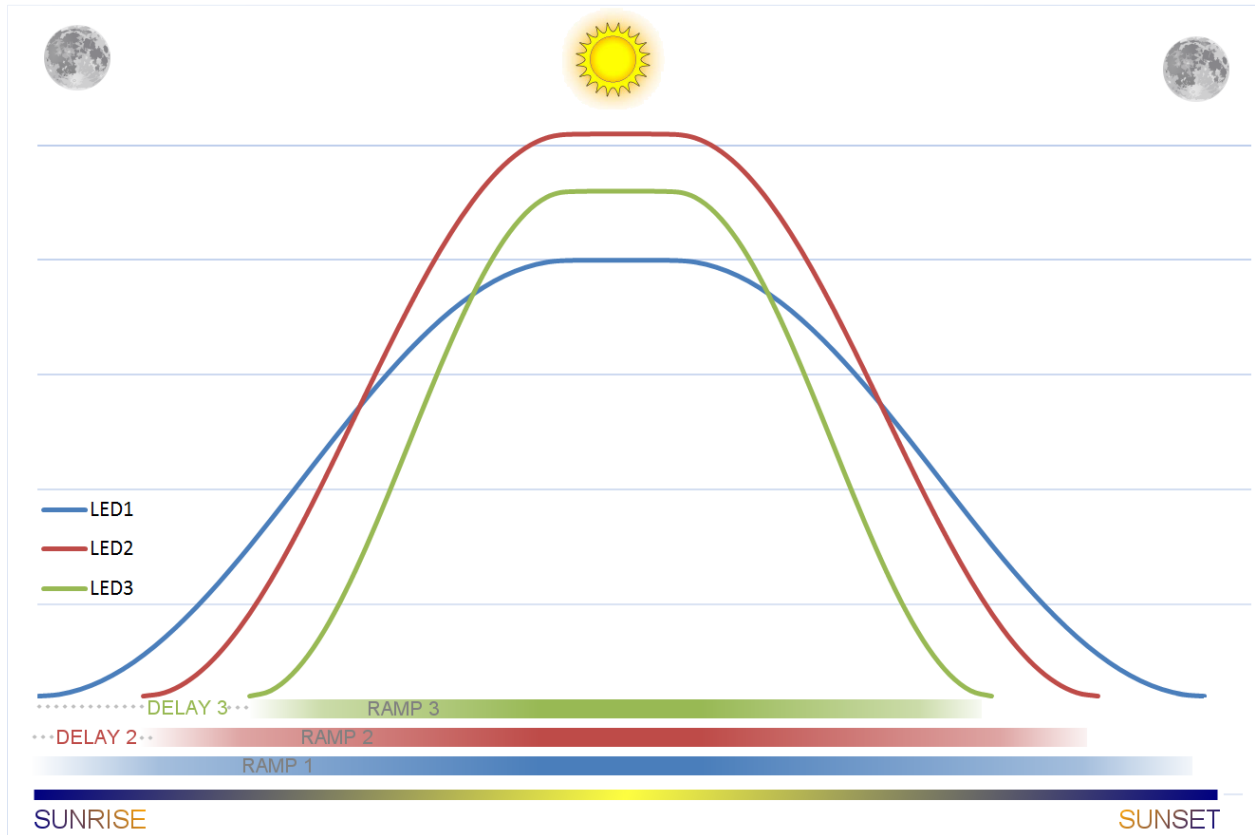
Set Sunrise Mode [Auto/Manual] - In Auto mode, the Storm will calculate the sunrise and sunset times for the latitude and longitude of your location of choice. Yes you can simulate the length of day of your aquarium's natural habitat, or simply have it pegged to your local sunrise and sunset. In Manual mode, you set the sunrise/sunset times.

Set Sunrise Time - The time at which the controller transitions from night to dawn.

Set Sunset Time - The time at which the controller transitions from dusk to night.

Ramp Time - Both sunrise and sunset will be of this duration. Can use this to create light zones and cross-fade dusk-dawn effects.

Ramp Delay - Allows you to delay (sunrise and sunset times) certain PWM channels by a specified amount, allowing the phase in of different banks of LEDs at different times. Useful for fine-tuning your sunrise and sunset profiles.



The controller uses SmoothRamp Dimming, following a sinusoidal dimming profile for sunrise/sunset and cloud effects. This closely mimics nature's natural sunrise and sunset profiles.

Cloud Frequency [0-10] - Simulates the passing of an overhead cloud, resulting in a temporary reduction of light output. Follows SmoothRamp profile to simulate a soft-edged cloud. Setting this to 0 will turn off cloud effects for all channels. 1: Cloud every 0-10 minutes, 2: Cloud every 0-9 minutes, ... 10: Cloud every minute.

Cloud Channels - Allows grouping of LED strings under a common channel so that the LEDs on that channel are linked to the same cloud events. Suppose you have three LED strings over half your tank, and three over the other half. Then you could either go for a single channel to make

the whole tank experience clouds simultaneously, or you could go with two channels so that each half behaves independently.

Lightning Freq(uecy) [0-10] - Randomly generated lightning effects. This effect is linked to the cloud intensity and only appears when a cloud is overhead. Setting this to 0 turns off lightning effects, and a value of 10 maximizes lightning effects.

Moonphase Adjust [On/Off] – Simulates the phases of the moon. Turning this setting on will adjust your nighttime PWM settings [Set PWM (Night)] by an amount that corresponds to the current phase of the moon. For example, if it is a full moon then your night lights will shine at full brightness as set in [Set PWM (Night)]. If it is a new moon, the night time illumination level will be zero. The intensity of night lights will vary between these two extremes in accordance with the real phases of the moon, geolocated to coordinates programmed in the Storm/X.

Note that to take advantage of the full resolution of this setting, your nighttime PWM settings should be at least 30 so that there can be a different illumination level for each night of the month. This means that you may need to have a dedicated low-brightness moonlight channel.

Set Lat/Long/GMT - The coordinates that determine the sunrise/sunset times calculated by the automatic sunrise mode. An easy way to find out is to google "san francisco latitude longitude" which tells you 38 deg N, 122 deg W, which translates to settings of 38/-122. The GMT is Greenwich Mean Time offset *during non-daylight-savings*. For San Francisco, it should be set at -8 (as opposed to the DST value of -7).

Zone	GMT Offset
PST	-8
MST	-7
CST	-6
EST	-5
AKST	-9
HST	-11

Temp Display [C/F] (Firmware 2.0 and above) - If you have a DS18B20 temperature probe hooked up to the header, you can adjust whether it displays in Celsius or Fahrenheit units.

Fan Control (Firmware 2.0 and above) - On the base model Storm, enabling this option will change the function of CH4 and CH5 to operate a speed controlled PC fan (4-pin fan). Technically speaking it increases the PWM frequency from 490 Hz which is good for driving LED drivers, up to 25 KHz which is what PC fans expect. The fan must have its own 12V power supply separate from the Storm, with the Storm providing the PWM input to Pin4 on the fan. The pin-

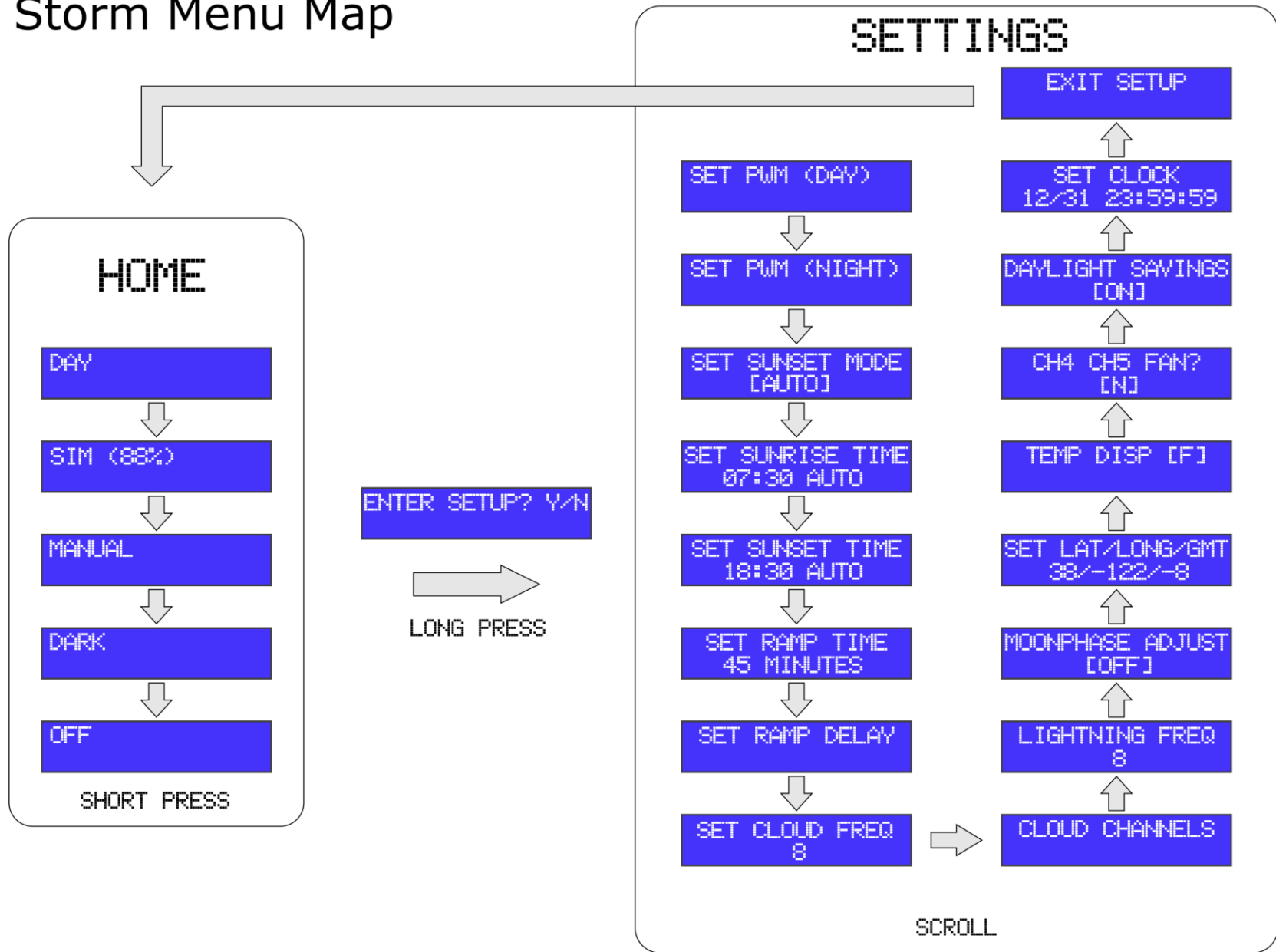
out of such 4-pin fans is described here by Intel (<http://www.intel.com/support/motherboards/desktop/sb/cs-012074.htm>). Note that enabling this option on the storm effectively sacrifices CH4 and CH5.

On the Storm X, you have the option of setting the minimum speed and maximum speed of the fan. The outputs are on the D9 and D10 pins of the Storm X. The D9 pin will follow the Min and Max settings, while the D10 pin will act as a digital output, turning on (5V) during the day, and off at night/sunrise/sunset. This does not sacrifice any of the 16 LED control channels. See appendix for a more detailed description of the fan function.

Daylight Savings [On/Off] - If on, it will shift sunrise & sunset times appropriately for DST. The clock does not automatically adjust, so you will have to manually correct the clock.

Set Clock - Set the time and date.

Storm Menu Map

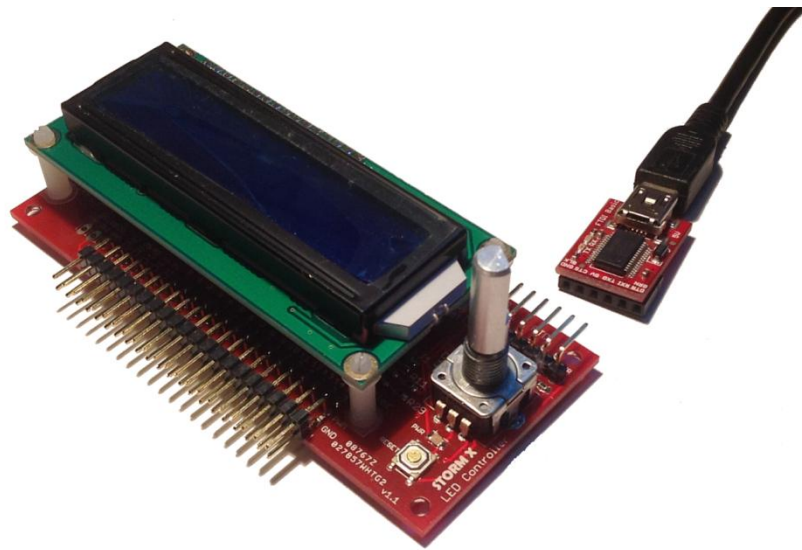


Firmware Updates

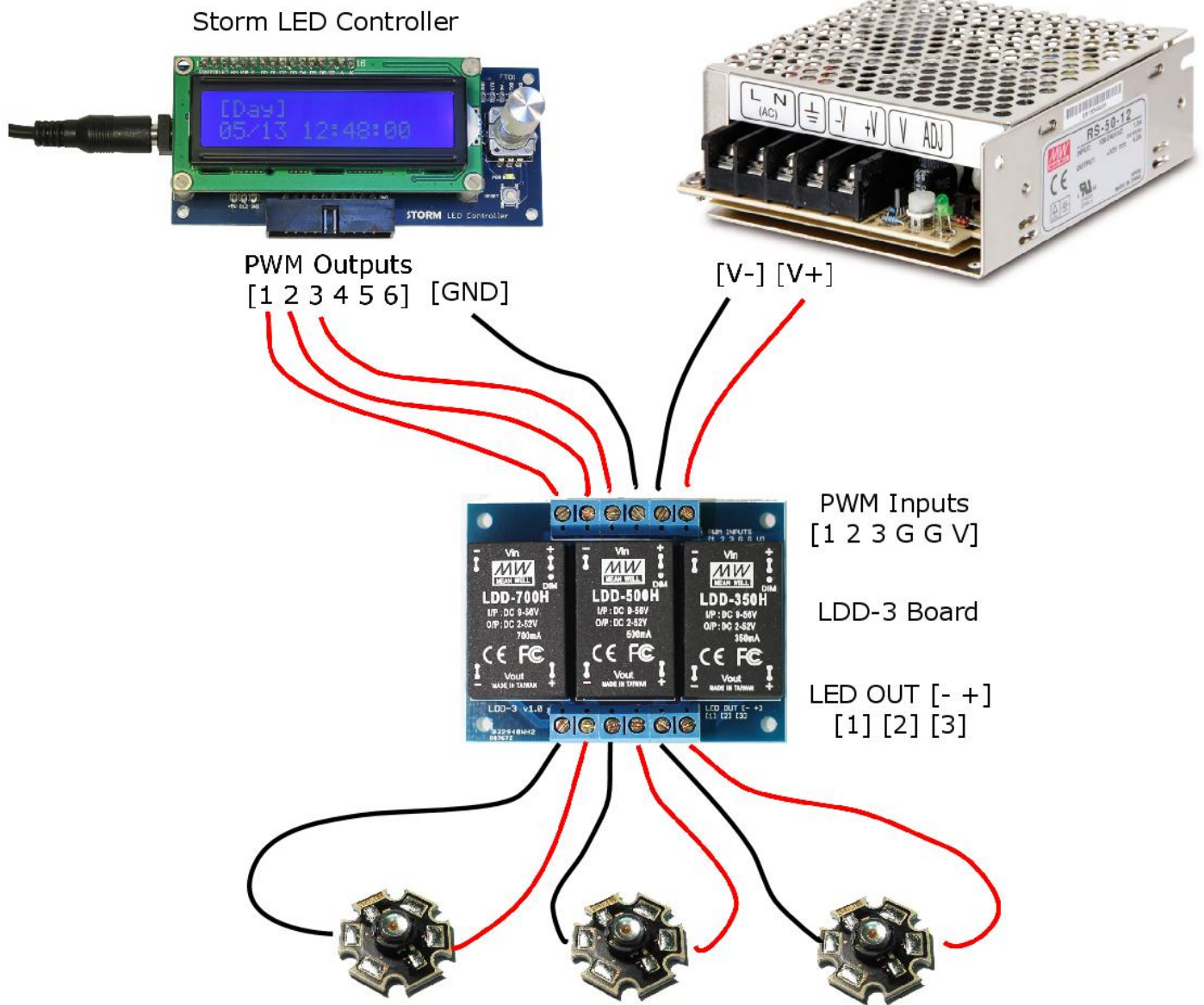
The firmware can be updated via a user-supplied FTDI cable. Download the latest firmware and libraries and load them onto the board using an FTDI cable and the Arduino IDE. Make sure that the power supply is not plugged in - the board will be powered via the FTDI cable.

For a complete video tutorial on the firmware upgrade procedure, see:

<http://www.youtube.com/watch?v=bKBewlF2cpk>



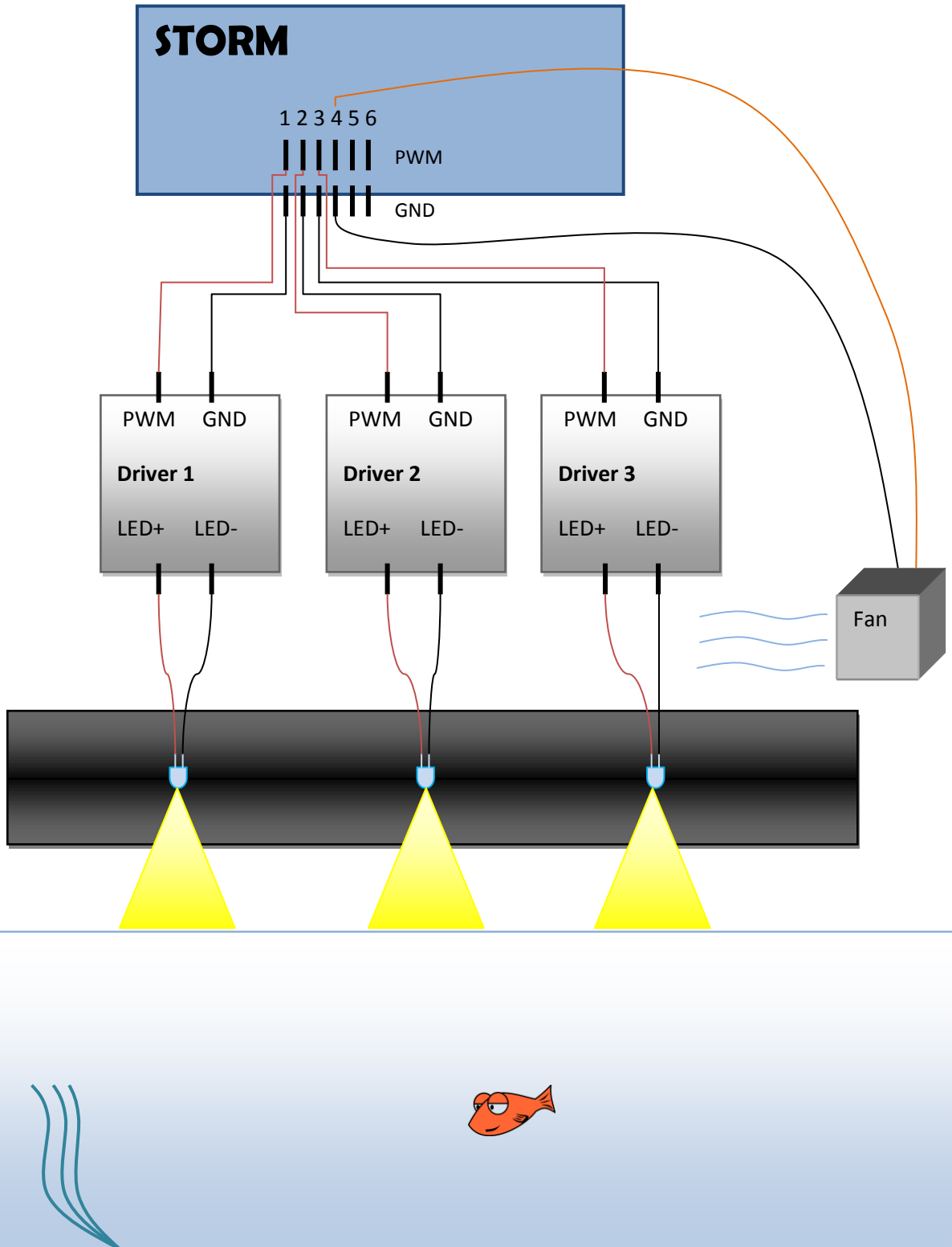
Typical Connection Diagram



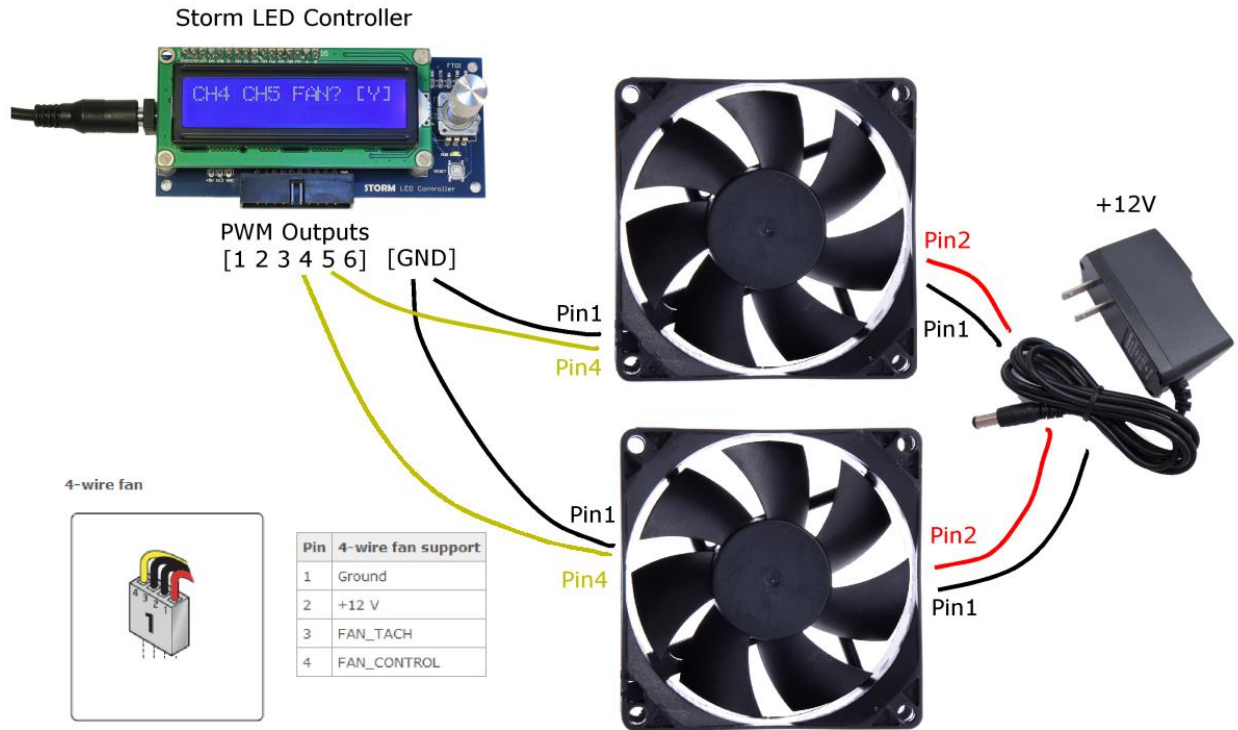
Note: The GND connections on the Storm and Storm X are common, so only one GND connection is necessary to the Driver or Driver Board to establish the common GND connection. Size wires to accommodate your current requirements.

Connection Diagram (Schematic)

Driver & Fan Power Supplies Not Shown



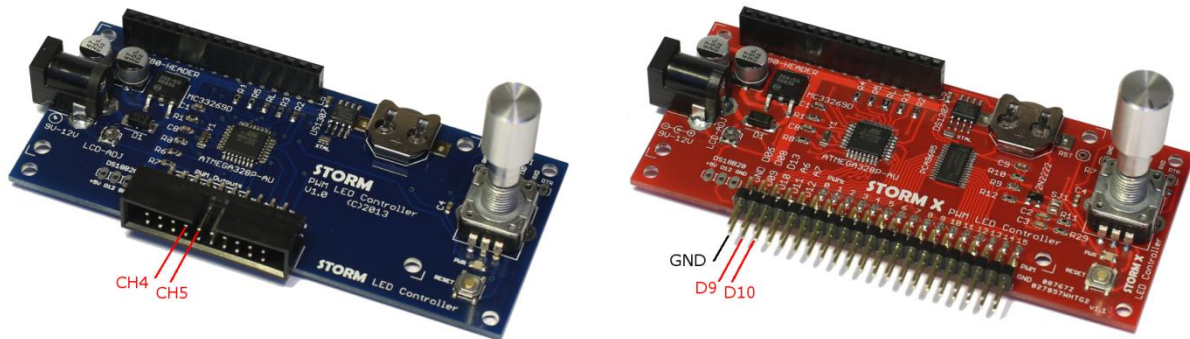
Typical Connection Diagram (Fan Control)



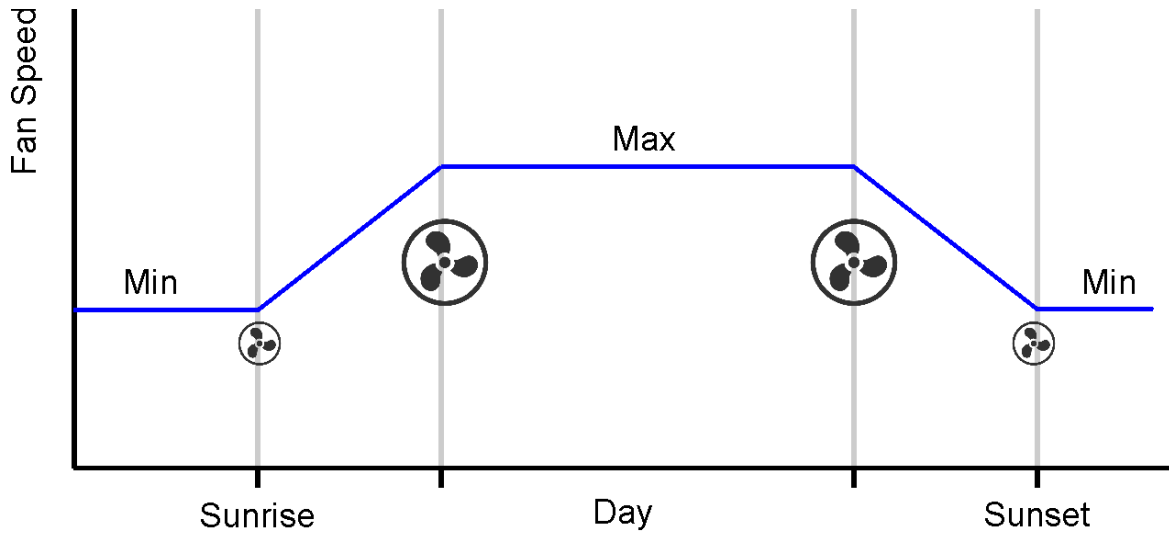
Storm X: The Storm X has a slightly different implementation of fan control. It allows you to set the fan minimum and maximum PWM duty cycles (speed), and will output these settings on pin D9. The output will be the minimum value at Night, and the maximum value from Sunrise-Day-Sunset.

Pin D10 operates as a digital output, providing at 0V signal at Night & during Sunrise and Sunset, and a 5V during the Day. This can be used in conjunction with a relay to provide on/off control to devices that you only want to be on during the day. Take note that D10 should *not* be used to operate cooling fans because it will turn off the fan(s) during the Sunrise and Sunset periods when cooling is still necessary.

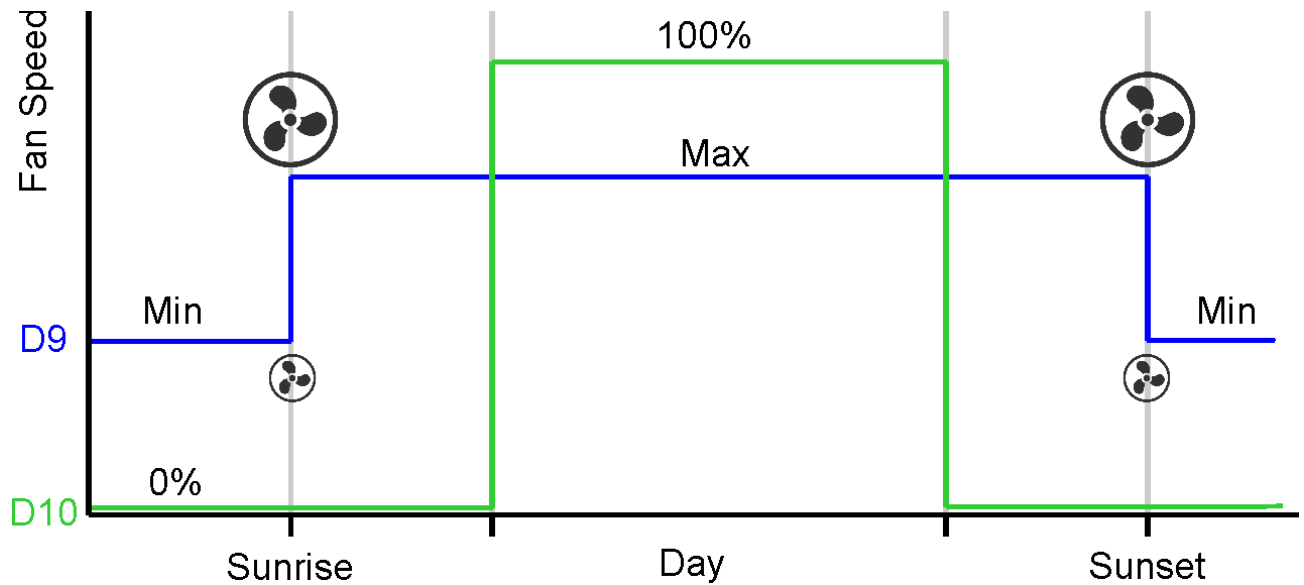
Storm: You'll see a menu that reads "CH4 CH5 Fan? [Y/N]" which allows you to toggle between controlling fans or not. It is important to note that this setting specifically affects CH4 and CH5 on the controller and those are the pins that you should use to control your fans if enabled. Once [Y] is selected, the CH4 and CH5 channels will output 25 KHz PWM signals in accordance with the settings set in the "Set PWM Day/Night" dialogue. Therefore the signal will ramp between the two values, and you'll want to pay attention that the fan ramps up with your lights so that nothing overheats during sunrise/sunset.



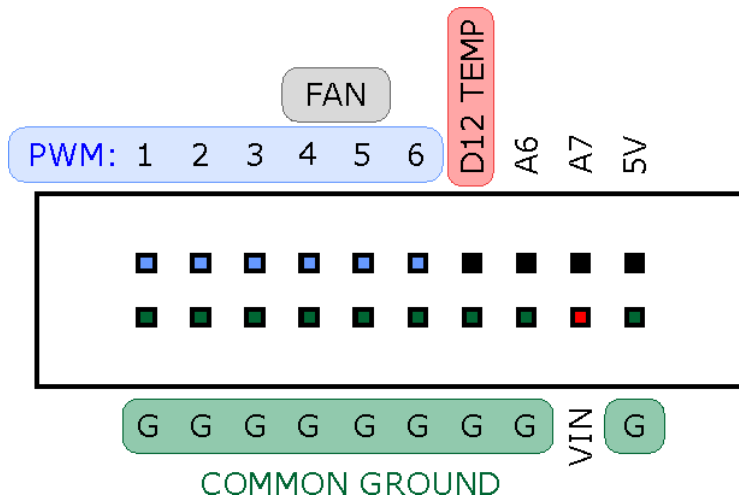
Storm Fan Speed Diagram (CH4 & CH5 w/ Fan Mode ON)



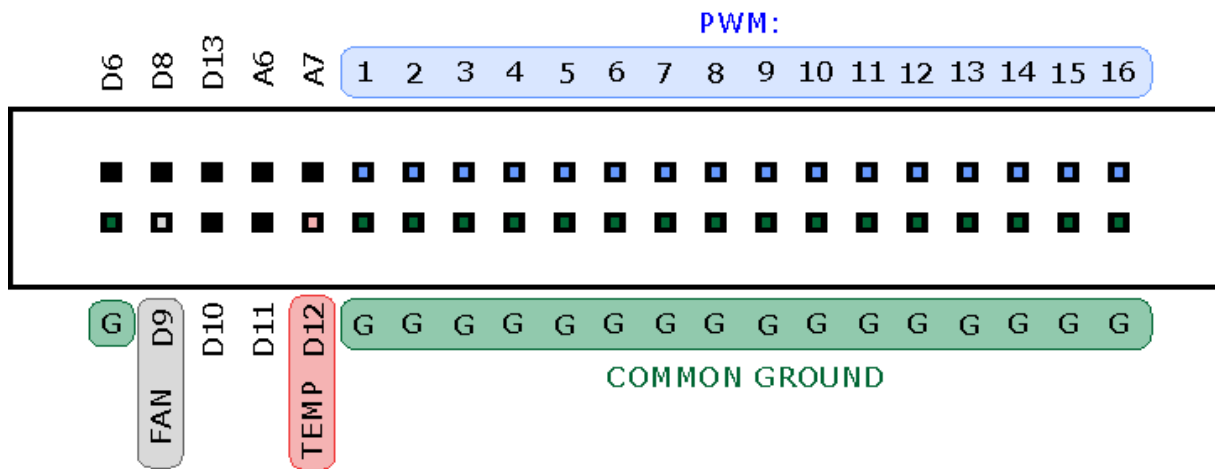
Storm X Fan Speed Diagram (Pins D9 Fan & D10 Accessory)

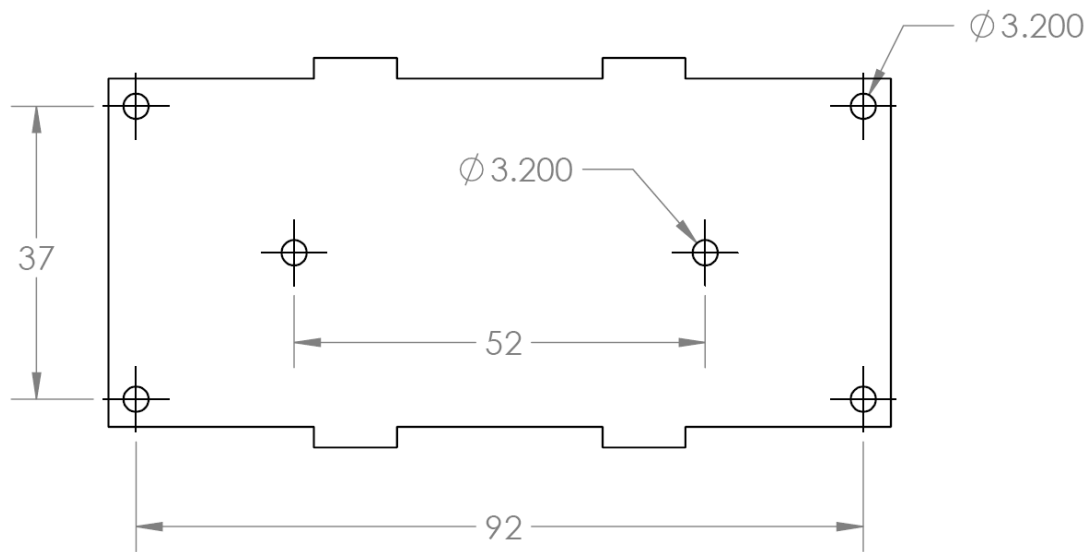


Storm Pin Diagram



Storm X Pin Diagram





Storm & Storm X Mounting Template. Central two holes are for mounting optional acrylic case. Millimeter units.