Ultra FINN™
Specification Manual

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In future publications, FTE may make changes to specifications and product descriptions at any time, without notice.

Contact FTE or your distributor to obtain the latest specifications prior to placing your product order.

U. S. Patent Nos: 6,490,037; 7,023,554; 7,227,639 and 7,265,822. Additional patents pending.

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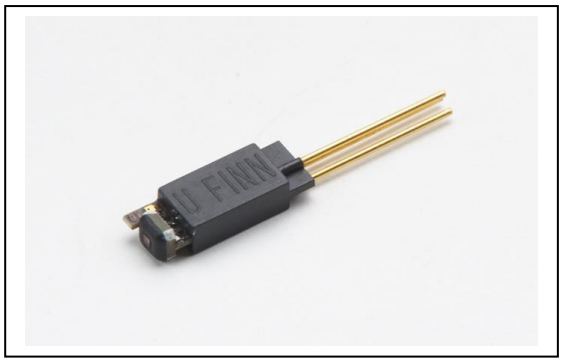
1. Part Numbers and Descriptions

TCUF102SL



TCUF102

Part Number	Description
TCUF102SL	Ultra FINN™ with Sleeve
TCUF102	Ultra FINN™ sensor

2. Principal of Operation

The Ultra FINN™ combines a custom packaged, four-band color sensor with a microprocessor to optimize all the functions necessary to precisely distinguish the color and intensity of a light source or LED. The Ultra FINN™ accurately takes measurements from the sensor, calculates the color and strength of the light being tested, and converts it to an easy to read signal for comparing LEDs and other light sources.

3. Method of Operation

The small, slim packaging of the Ultra FINN™ allows for easy installation directly in front or on top of the LED on a printed circuit board. During test, the light source (LED) is activated and the Ultra FINN™ outputs a frequency in kHz that quantifies the LED's color. The same signal quantifies the brightness of the LED with its pulse-width (average DC voltage). Now, engineers can use anything from simple stand-alone meters to fully integrated equipment in their automated test to implement a quality controlled, extremely reliable method for the test and measurement of light sources, a.k.a. LEDs.

4. Applications

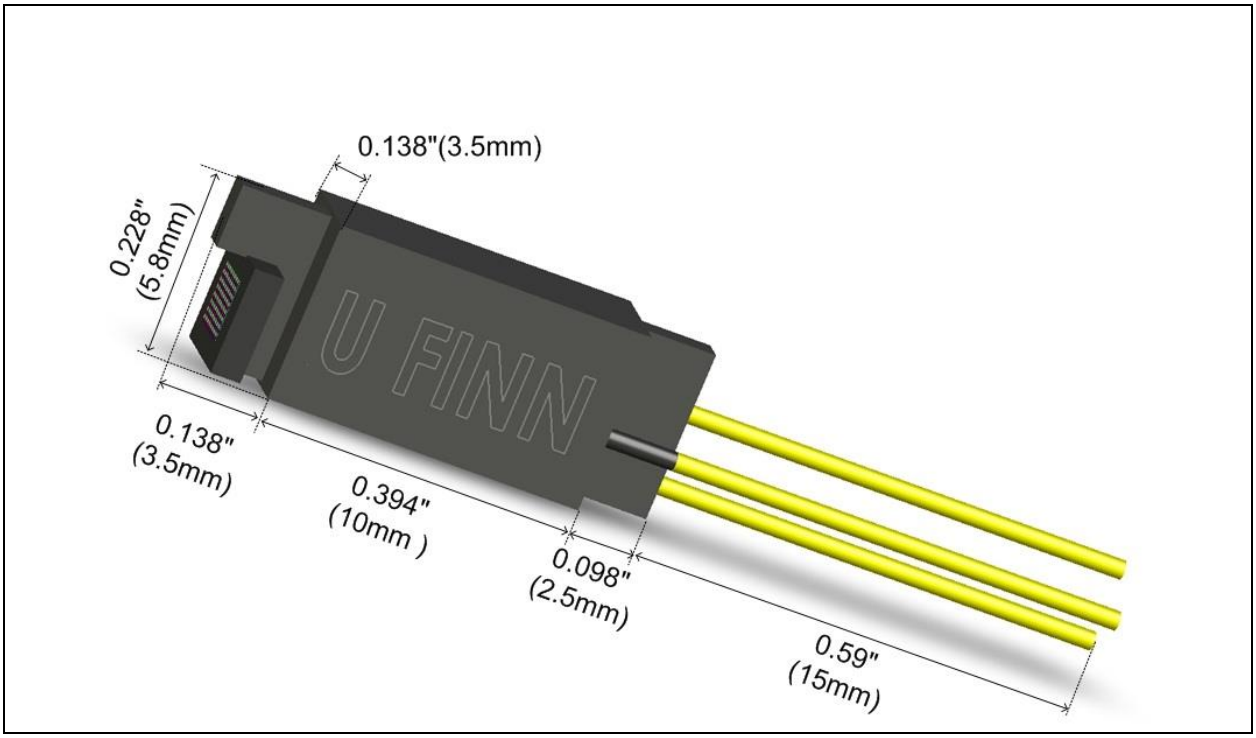
- Automates testing of LEDs for placement, color and brightness
- Used for Functional and In-circuit testing, on any test platform
- Quality control for characterizing and standardizing LED use

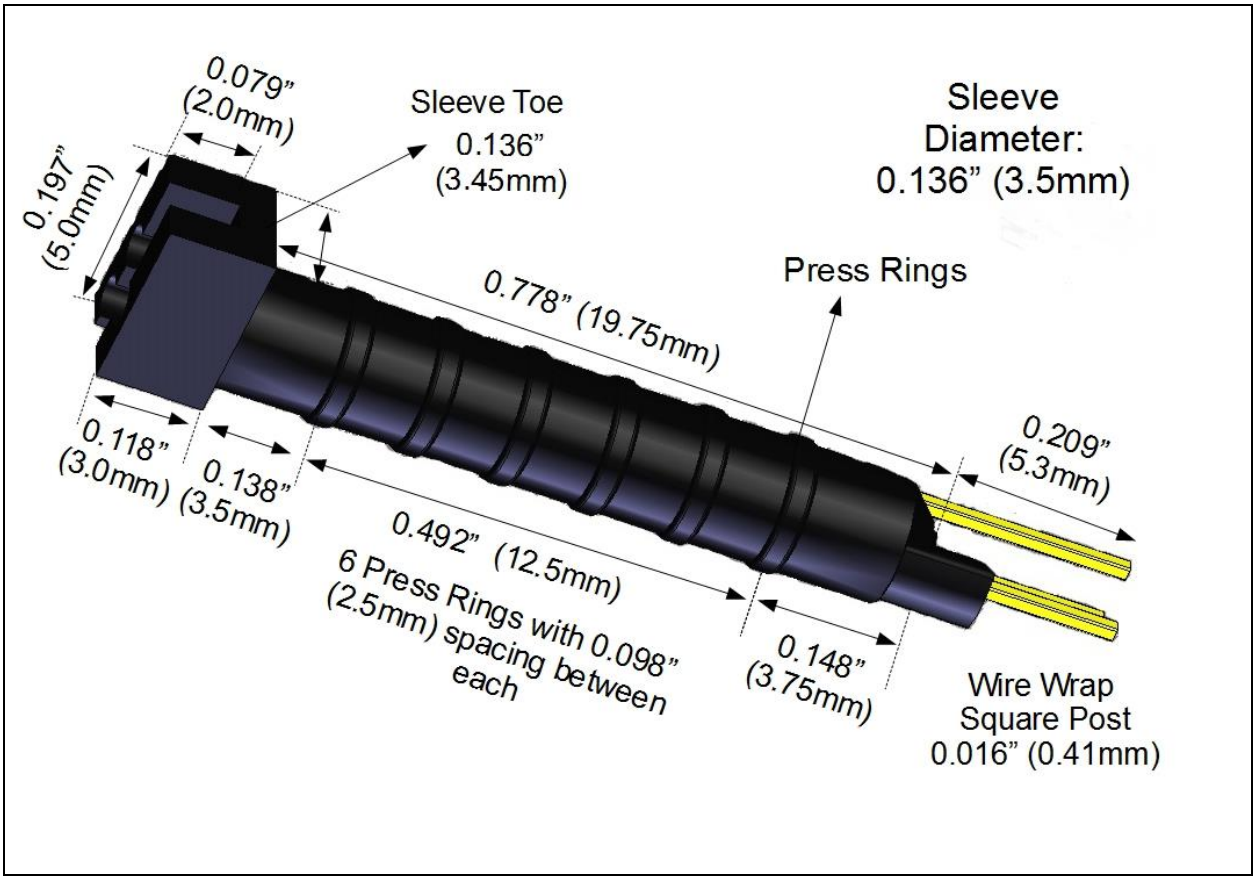
5. Features

- Detects 2000 different hues between Blue (380 nm) and Red (700 nm)
- Increased repeatability and reliability
- Tests most LEDs in less than 10 milliseconds
- Mini package is more than 8 times smaller than the Smart FINN®
- Eliminates the need for light pipes in almost all applications
- Durable package and sleeve protects parts from potential damage during handling
- Covers complete visible spectrum, plus Ultraviolet and Infrared
- Operating voltage of 5.0Vdc
- Color identification determined by the frequency output and intensity indicated by the DC average of the same output (patented feature)
- Works with most types of LEDs on the market today – bright or dim, diffused or non-diffused, and smd or through-hole
- Can identify different types of multichromatic light (such as white, magenta, and purple)
- Fully automated testing
- Custom sleeve allows for easy installation – just drill, press fit, and wire wrap

6. Properties

6.1. Dimensions





6.2. Power Source

The Ultra FINN™ requires 5.0 volts DC. Current is typically 17 mA.

6.3. Pins

Three pins are: Output (signal), Ground, and Power
Pins are spaced 70 mil apart
Sleeve uses standard 16 mil square posts for wire wrapping, 30 gauge wire is recommended. Smaller gauge or thicker wire may cause undue stress on the wire wrap posts.

6.4. Sensor

Light- to- frequency converter sensor comprised of an 8 x 8 array of photodiodes, 16 photo-diodes each of blue, green and red filters and 16 photo-diodes of clear, with no filter.

6.5. Controller

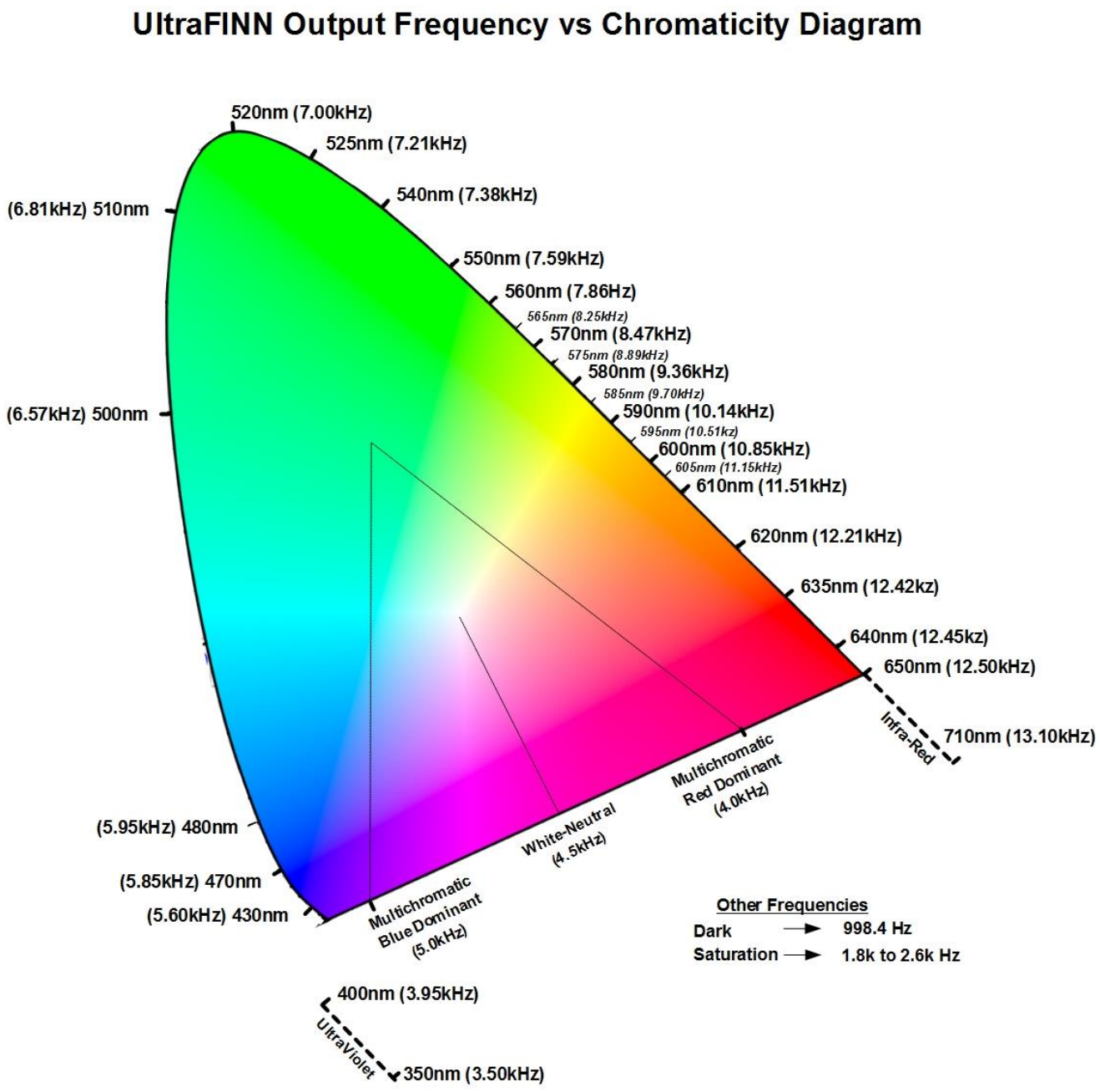
The micro controller in combination with the precision MHz high frequency clock source allows for extremely fast and accurate sampling of the light source under test.

7. Typical Measurements

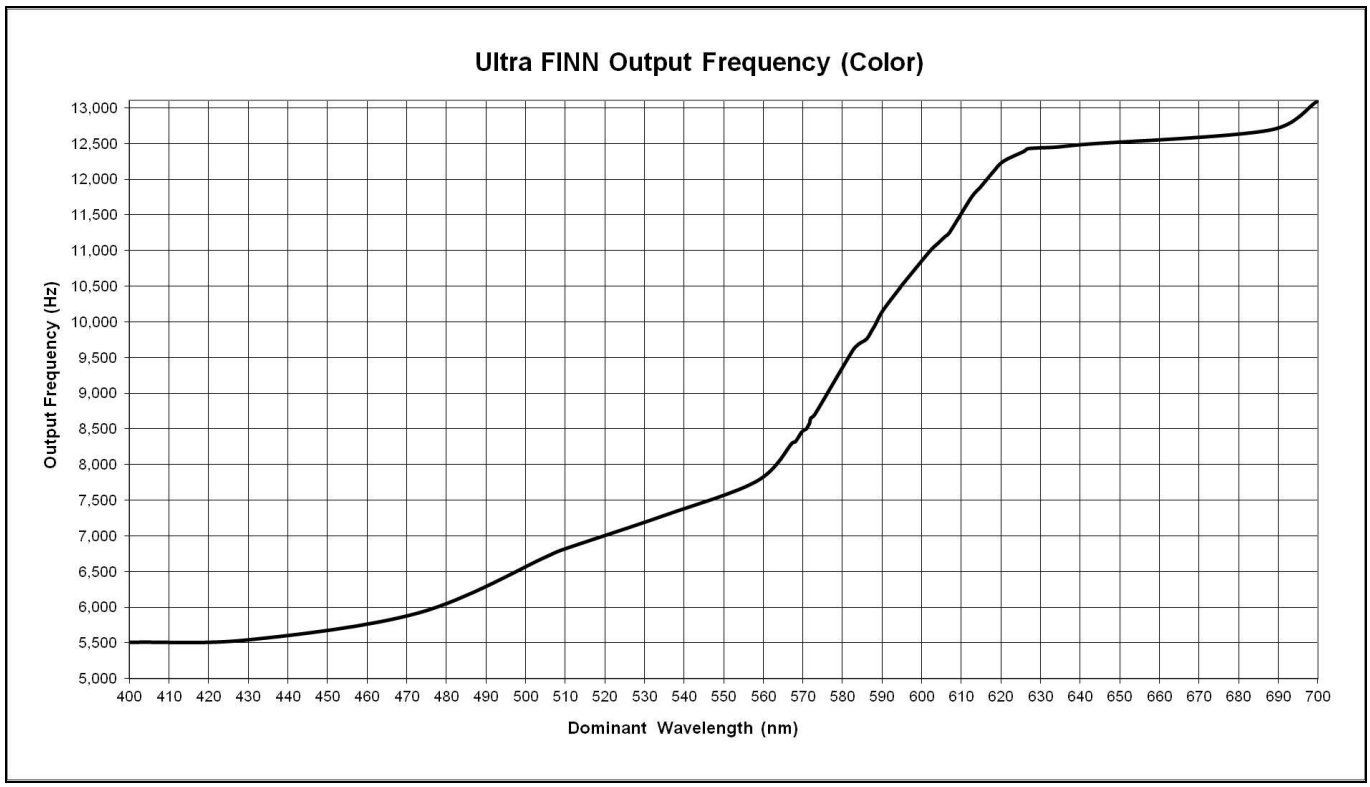
7.1. Color

Typical Measurements		
Color	**nm**	**kHz**
Red	635	12.42
Amber	608	11.25
Yellow	585	9.70
Green	565	8.25
Pure Green	525	7.21
Blue	470	5.90
Other Measurements		
Infrared	Up to 700	12.5 - 13.1
Ultraviolet	Down to 400	3.5 - 3.95
Fluorescent	multiple	4.2
White (red dominant)	multiple	4.0 - 4.35
White (blue dominant)	multiple	4.4 - 5.0
Saturation	n/a	1.8 to 2.3
Dark	n/a	0.998

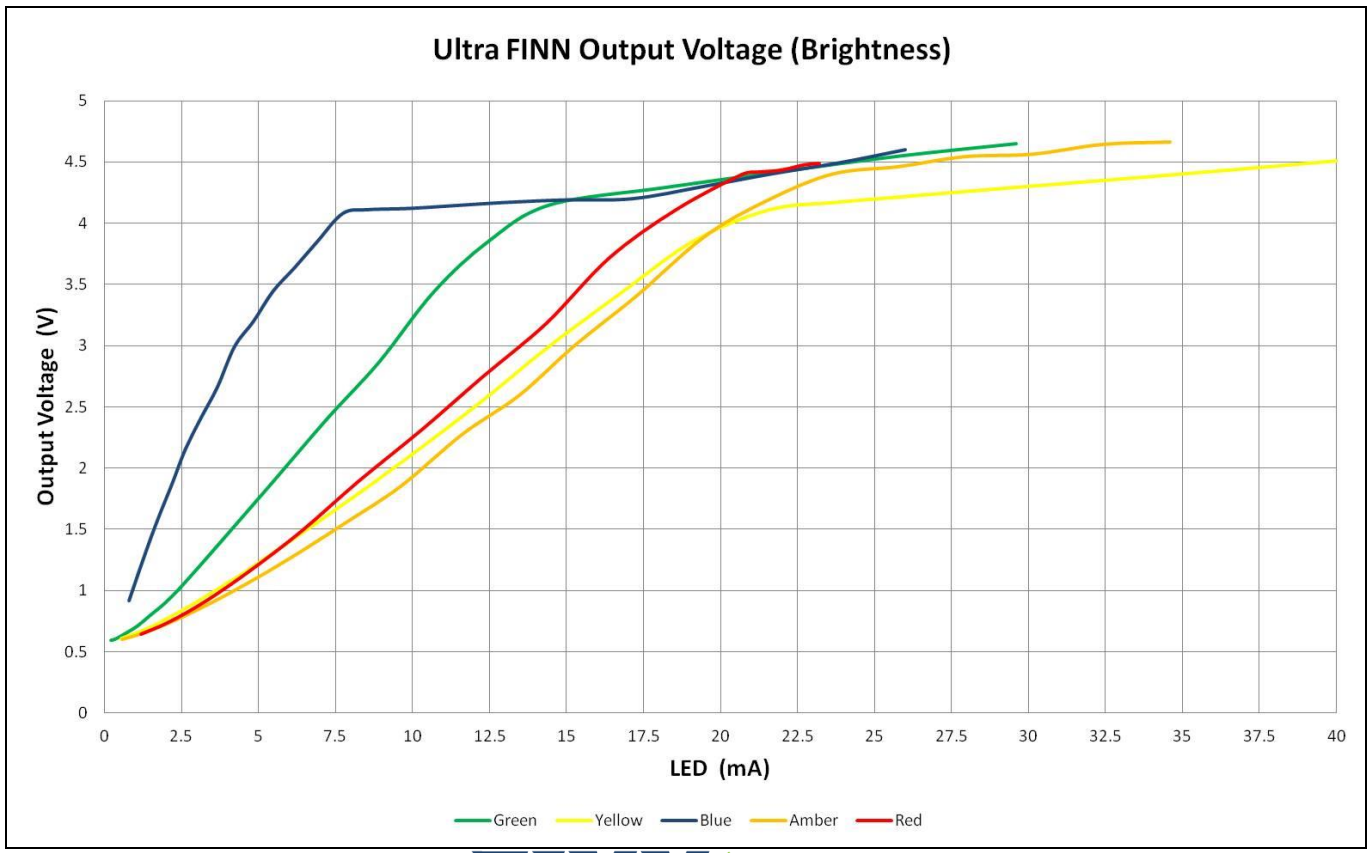
7.2. Output Frequency vs Chromaticity



7.3. Output Frequency Graph



7.4. Output Voltage Graph



8. Ultra FINN™ Timing

UltraFINN™ response is typically less than 10 milliseconds. The response time will decrease for brighter LEDs and will increase for dimmer LEDs.

9. Fixturing Instructions

The Ultra FINN™ sleeve is easy to insert into most of the materials used in fixturing today.

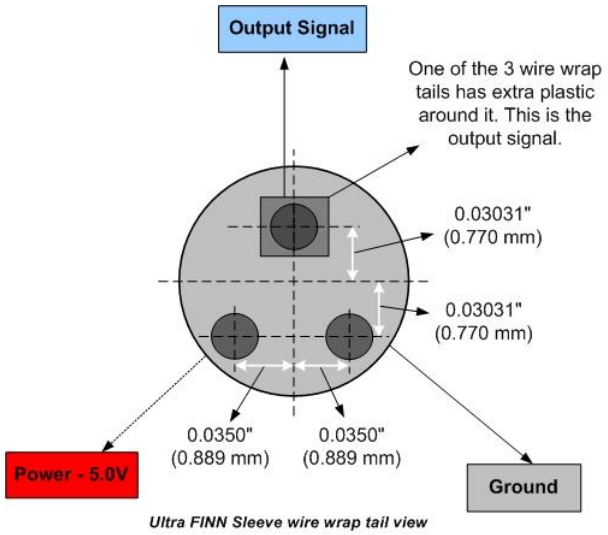
9.1. Installation

How to identify the Power, Ground and Signal Pins:

1) Identify the wire wrap tail that has the extra plastic; this is the **Output** Signal.

2) Move clockwise to the next wire wrap tail; this is the **Ground**.

3) Move clockwise again to the next wire wrap tail; this is the **Power** (5.0V).



Ultra FINN Sleeve wire wrap tail view

Drilling Instructions:

The center of the hole for the sleeve should align with the center of the LED.

Drill Hole	0.1417" (3.6 mm)	-0.002" / +0.0005" (-0.051mm / + 0.012mm)
Sleeve Press Rings	0.145" (3.683 mm)	-0.002" / +0.002" (-0.051mm / + 0.051mm)
Sleeve Diameter	0.136" (3.454 mm)	-0.002" / +0.002" (-0.051mm / + 0.051mm)

Wire Wrapping Instructions:

-The 3 wire wrap tails are 0.016" (0.406mm) square posts.

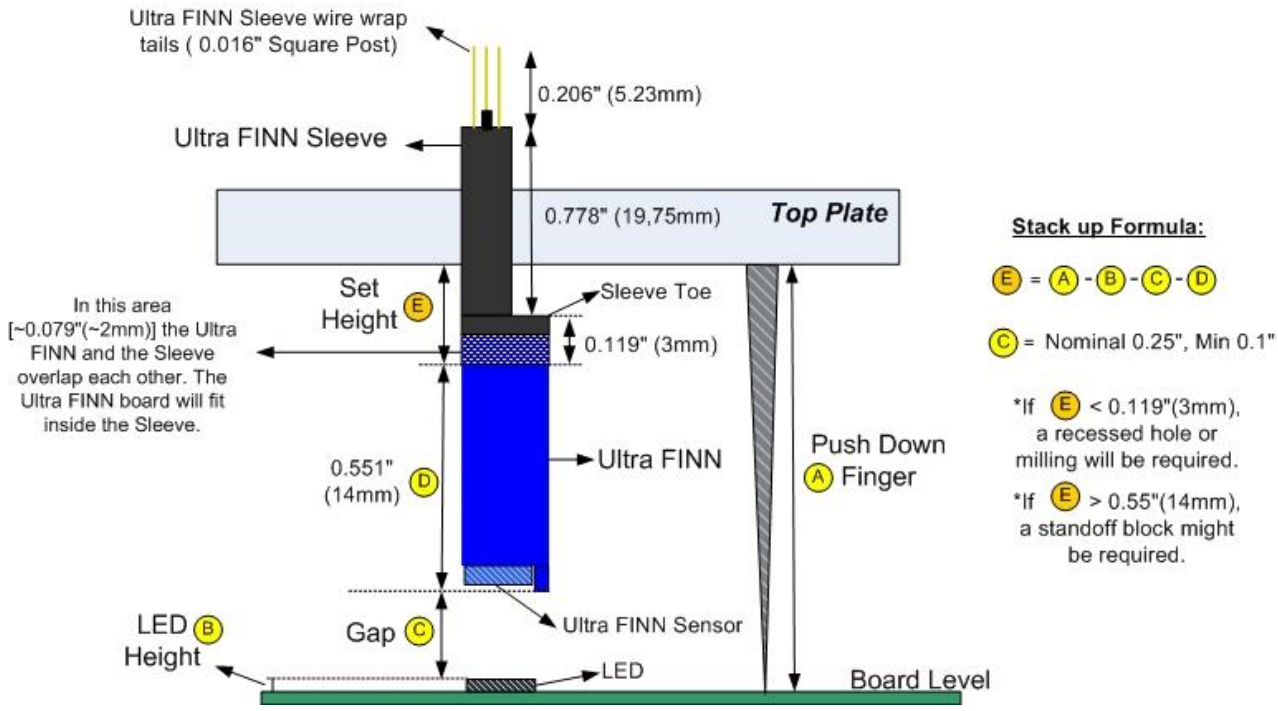
-The posts are spaced at 0.070" (1.78mm) apart.

-We recommend using 30 gauge wire.

Sockets:

If the Ultra FINN Sleeve cannot be used then individual sockets can be used.
The Ultra FINN pins will fit in IDI Part# R-0-WW.016.

9.2. Stack Up Measurements for Ultra FINN™



9.3. Troubleshooting Wiring

In order to troubleshoot the wiring of the Ultra FINN, please check the following items:

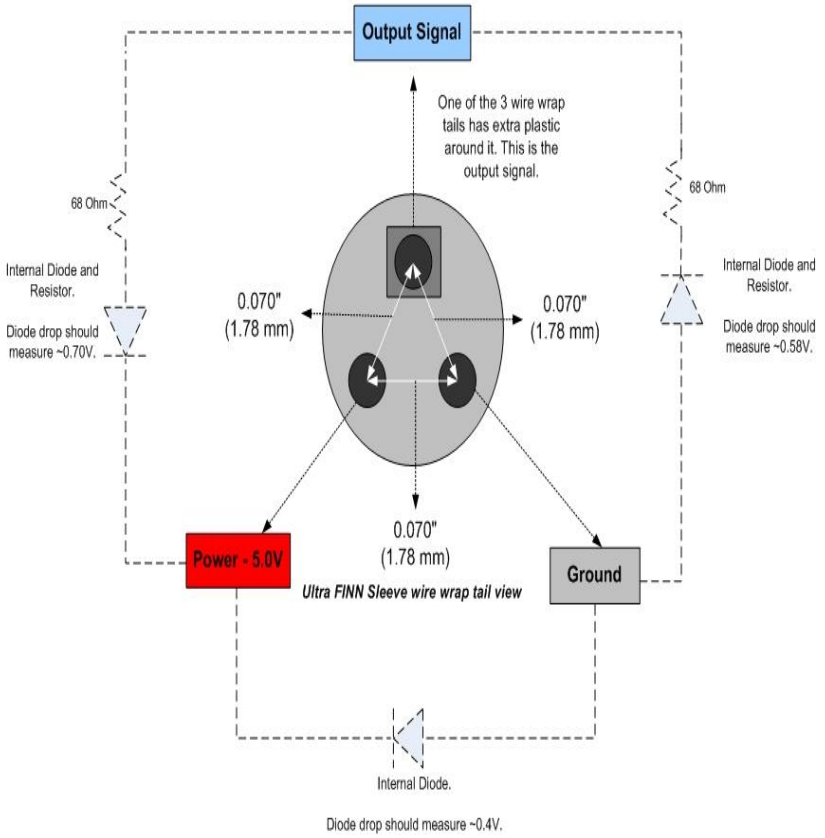
1) Measure the diode drop from Ground to Power. It should measure ~0.40V at 0.5mA.

2) Measure the diode drop from Ground to Output. It should measure ~0.58V at 0.5mA. This diode drop measures a little higher than the Ground to Power because it has an internal 68 Ohm resistor in series.

3) Measure the diode drop from Power to Output. It should measure ~0.7V at 0.5mA. This diode drop measures a little higher because it has the 68 Ohm resistor in series and the actual diode has higher forward voltage drop.

4) Make sure the voltage applied to the Ultra FINN is 5.0V.

5) The Ultra FINN should not draw more than ~30mA of current.



10. Sources of Error

10.1. Wiring

Special care should be paid to the wiring instructions in section 9.1. Improper wiring will result in over-heating and damage to the part. If miss-wiring has occurred, immediate replacement of the damaged part is recommended.

10.2. Ambient light and adjacent LED's

Light from sources other than the device being tested should be prevented from reaching the sensor surface while making measurements. Ambient light entering the sensor's active area will be used to calculate the color and intensity. Typically the ambient light is many orders of magnitude less than the LED and ambient light will have little effect. If the ambient light is significant be sure eliminate the ambient light by using a shroud or heat shrink tubing.

10.3. Distance

The further away the sensor is from the LED, the lower the voltage response of the sensor. If the LED is dim (20mcd or less), the sensor face should be around 0.10" to 0.15" from the LED. LED's that are medium brightness (20-100mcd) can have a greater distance 0.15" to 0.25". And very bright LED's (100-200mcd) should be 0.25" or greater for best results. If using light pipes or light conduit this distance should be measured from the LED lens to the front face of the light pipe with a small gap between sensor and other end of conduit.

10.4. Vdd other than 5V

The UltraFINN™ will not turn on if the supply voltage is lower than 4.70Vdc. Make sure the supply voltage at the UltraFINN™ wire wrap tail is greater than 4.70Vdc, but no more than 5.50V.

10.5. Saturation

If the output frequency is between 1.8 kHz and to 2.3 kHz the sensor is in saturation. Reduce the intensity of the LED if possible. Another way to get out of saturation is to move the sensor further from the LED or switch to a smaller diameter light conduit.

11. Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)†

Supply voltage, VDD (see Note 1)	6 V
Operating free-air temperature range, TA	0C to 70C
Storage temperature range	–25C to 85C
Maximum current or output	±40 mA

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
NOTE 1: All voltage values are with respect to GND lead.

12. Recommended Operating Conditions

	Min	Nom	Max	Unit
Supply voltage, VDD	2.7	5.0	5.5	V
Operating free-air temperature range, TA	0	25	70	Celsius
Supply current	-	17	40 (Note1)	mA

Note1: Additional loads on output pin not included

13. Product Return Policy

All products are inspected and fully tested prior to leaving the FINN Test Electronics facility. If it is believed that a product was shipped damaged, the damaged parts must be shipped back to Test Coach for evaluation. Once received and evaluated, FINN Test Electronics will replace the item in an even part for part exchange only

Any discrepancies in your order must be reported immediately. FINN Test Electronics offers a **thirty (30) day** return/exchange policy on products that have been misordered. The thirty day time limit is determined from the date of purchase. **Damaged, used or altered goods will not be accepted for credit or exchange.**

Please contact FINN Test Electronics for an **RMA number** before returning any product to FINN Test Electronics. Returns sent without an RMA number will not be accepted. Please see our *Warranty and Return Policy* document for a full explanation of our warranty and the appropriate return procedures.

14. Patent Numbers

U.S. Patent Nos. 6,490,037 - 7,023,554 - 7,227,639 - 7,265,822
Additional patents pending

15. Ordering Information

FINN™ parts may be ordered directly by calling 224-662-0383 or emailing to FINNsales@FINNTest.com. Customers located outside of the US who would prefer to place an order locally may contact one of the FINN™ distributors listed below.

15.1. Distributors:

France – Cotelec - www.cotelec.fr

Germany – Fixtest GmbH - www.fixtest.de

Japan - Newly Tsuchiyama Co., Ltd. - www.newly-t.com

Switzerland – SQC AG – www.sqc.ch

Distributor phone numbers and addresses may be accessed by clicking on the *Distributor List* located on the Contact US page at www.FINNTestElectronics.com.

16. Technical Support

Our product engineers are available to assist you with choosing the correct FINN™ product to fit your specific needs as well as to answer any technical questions you may have regarding installation and/or implementation.

Please contact us at:

Email: FINNSales@FINNTest.com

Phone: 224-662-0383

17. Revision History and Control

17.1. Rev D – August 2012

Incorporating customer feedback, Rev D is now faster, more accurate, and easier to use.

To ensure compatibility with Rev Cx the following features have not changed:
- The output Frequencies (color readings) did NOT change from Rev Cx to Rev D0.
- The output Pulse width (intensity) did NOT change from Rev Cx to Rev D0.
- The Rev D hardware has the same dimensions and is compatible with all revision sleeves and existing sockets.

The following improvements will be seen when utilizing Rev D0.
- The typical current consumption was reduced from 25mA to 17mA (Rev D0).
- New sampling algorithms allow the UltraFINN™ to return a more accurate reading even when the LED is slow to stabilize.
- The new revision accurately measures LEDs driven by pulsed signals with frequencies greater than 500Hz without sacrificing performance for steady state (near DC) applications.
- Required delays for measurements can be reduced without sacrificing accuracy. Typical measurement delays will be less than 10msec from LED turn-on time.
- On Agilent projects the C_{pk}^{*} are expected to be over 50.
- Extremely dim LED's can be tested more accurately.

The Ultra FINN™ have the following revision marking on the black molding: "D0".

*C_{pk} is a gauge of measurement repeatability. Typically, a reading of 10 or greater is considered highly reliable.

17.2. Rev C – May 2010

Due to a change in process some of the characteristics for the Ultra FINN™ have changed. The following sections give details on the changes.

- We are introducing a new Sleeve which uses a 0.016" square posts which are more robust than the old 0.025" square post. The 0.016" square posts are 0.050" shorter than the old Sleeve which reduces the amount of clearance needed to install the Sleeve.
- We now recommend that distance from the LED to the sensor face is ~0.300".
- The new sensor also incorporates an Infra Red cut filter which reduces IR effects on the readings.

- The surface area of the new sensor is slightly smaller. To compensate for this, the sensor now includes a diffuser which helps when reading non-diffused LEDs. Another benefit of the diffuser is that the sensor now can measure brighter LEDs without saturating.
- Ambient light from the sides is reduced because the new process has more dark blocking material around the sensor.
- Although the frequency response has changed slightly, the ability of discriminating color is superior to the old revision Ultra FINNs.

The Ultra FINN™ have the following revision marking on the black molding: “C0”.

Below is a chart that highlights the differences in responses from Rev A/B to RevC. Similar information in found in the graph in Appendix A.

To adjust test limits, re-center the limits around the RevC responses.

	Typical Measurements		
Color	**nm**	**Ultra FINN Rev A/B (kHz)**	**Ultra FINN Rev C (kHz)**
Red	650	12.50	12.5
Red	635	12.39	12.42
Amber	608	11.56	11.25
Yellow	585	9.21	9.70
Green	565	7.64	8.25
Pure Green	525	6.54	7.21
Blue	470	5.80	5.90
	Other Measurements		
Infrared	Up to 750	12.5-13.1	12.5 – 13.1
Infrared	750 to 950	12.6-13.1	invalid
Ultraviolet	Down to 380	3.5-3.95	3.5 – 3.95
Fluorescent	multiple	4.2	4.2
White(red dominant)	multiple	4.0-4.35	4.0 -4.5
White(blue dominant)	multiple	4.4-5.0	4.5 – 5.0
Saturation	n/a	1.8 to 2.6	1.8 to 2.6
Dark	n/a	0.998	0.998

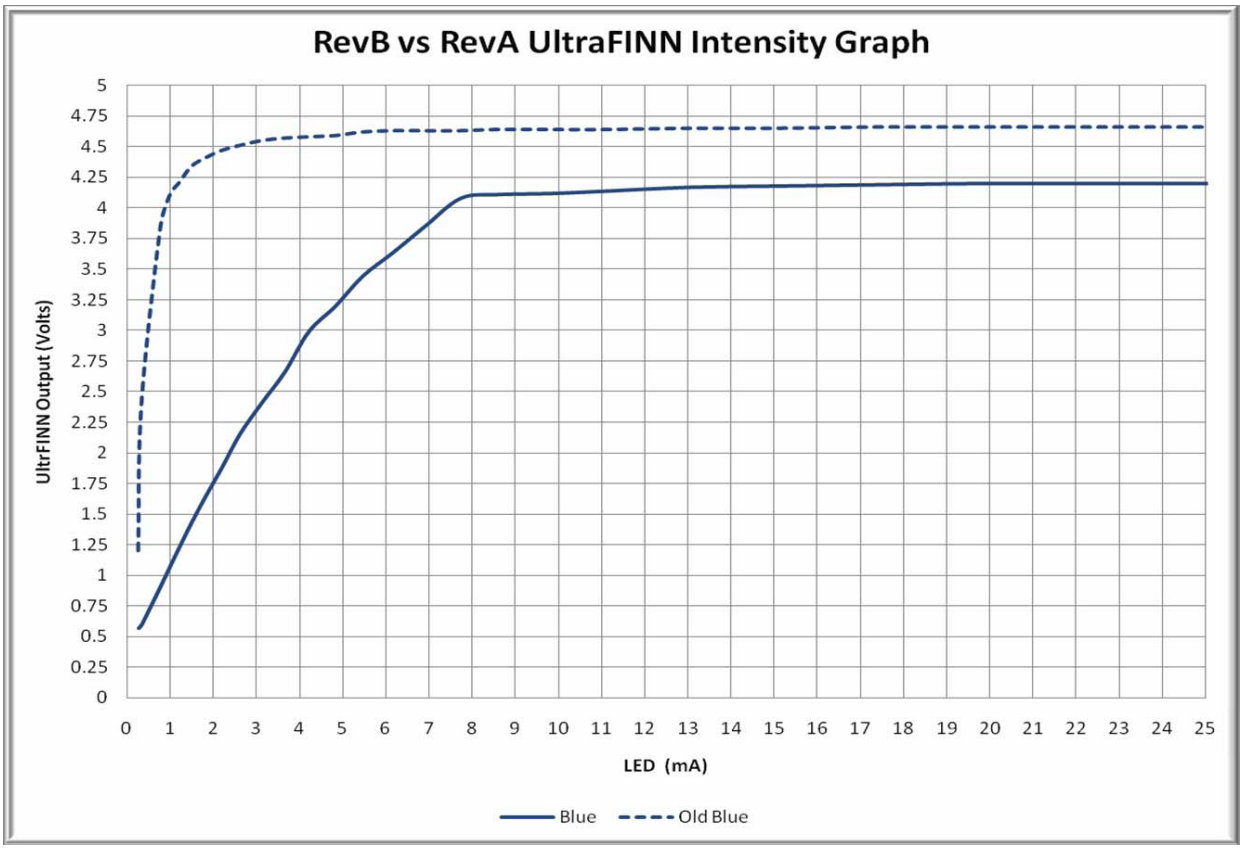
17.3. Rev B – October 2009

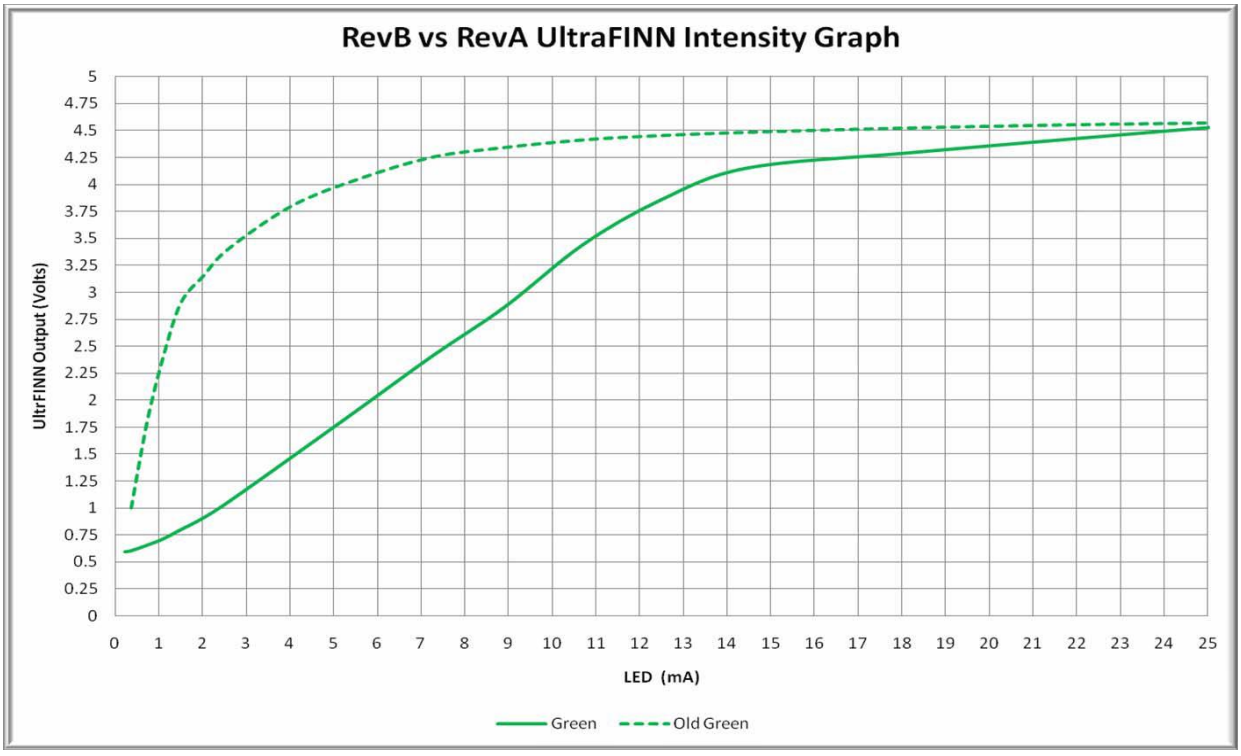
Effective October 26, 2009 the firmware for the Ultra FINN™ has been updated to reflect the following changes:

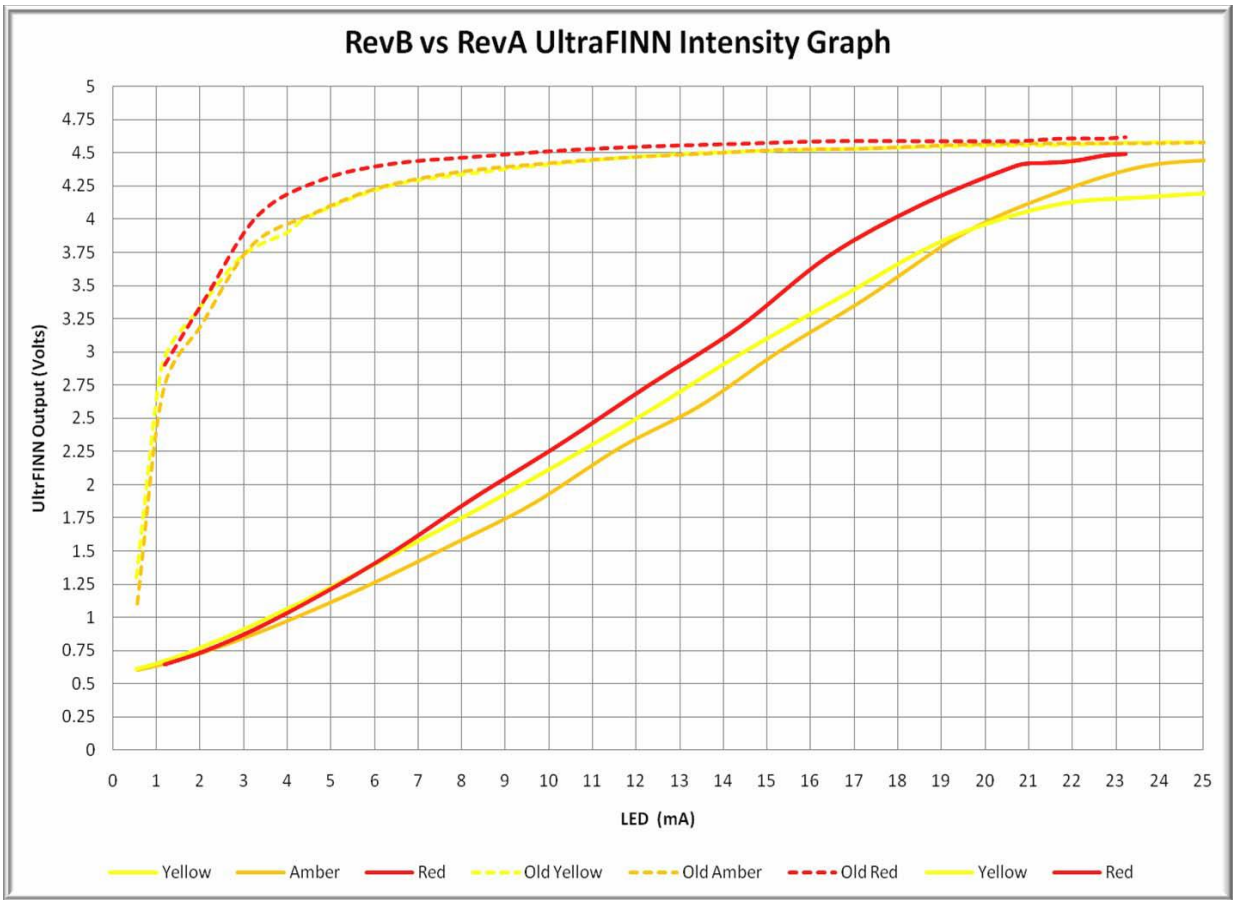
1. Improved intensity readings (output voltages) for all colors LEDs. The output voltage is now linear. Below are some graphs which show the differences in the output voltages between the Rev A Ultra FINN™ and the new Rev B Ultra FINN™.

2. Improved differentiation between blue LEDs. A slight reduction in frequency of blue LEDs may be noticed with the new firmware.

These Ultra FINNs are marked on the black molding as: “B1”.


RevB vs RevA UltraFINN Intensity Graph
UltrFINN Output (Volts)
LED (mA)
Blue
Old Blue


RevB vs RevA UltraFINN Intensity Graph
UltrFINN Output (Volts)
LED (mA)
Green
Old Green


RevB vs RevA UltraFINN Intensity Graph
UltrFINN Output (Volts)
5
4.75
4.5
4.25
4
3.75
3.5
3.25
3
2.75
2.5
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
LED (mA)
Yellow
Amber
Red
Old Yellow
Old Amber
Old Red
Yellow
Red