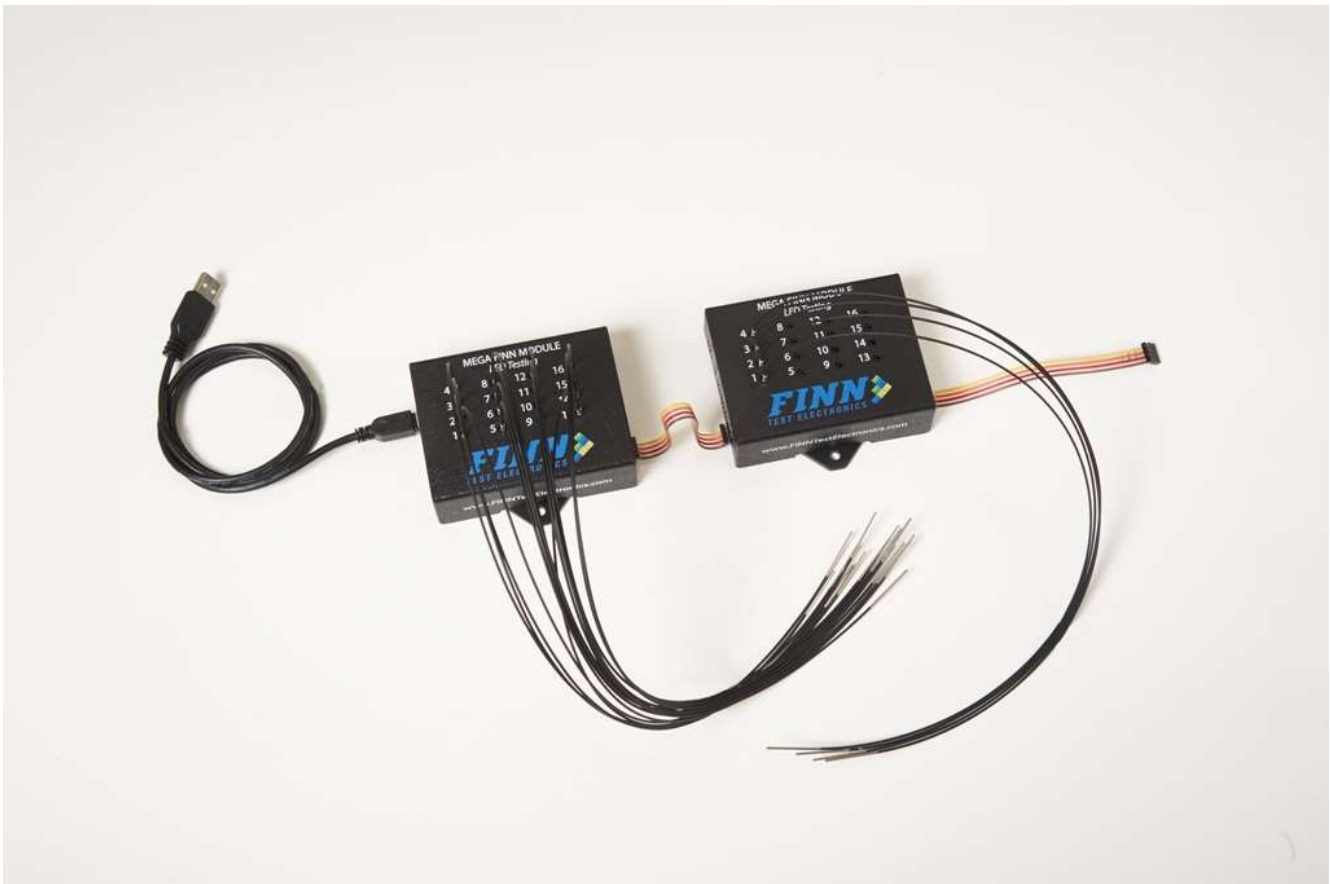


Mega FINN™ MODULE Specification Manual



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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; 7,265,822 and 10094877. Additional patents pending.

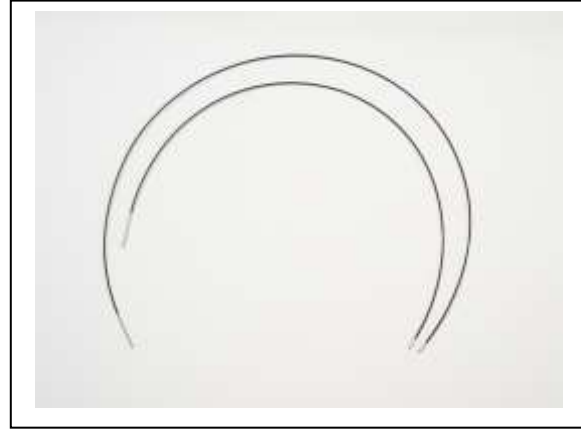
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1. Part Numbers and Descriptions



TC Mega Module



Fiber Optic Cable Assembly

MODULES

<u>Part Number</u>	<u>Description</u>
TCMega_4Mod	4 LED Mega FINN™ Module (tests up to 4 LEDs). Comes with 4 fiber optics cables (18" or 24") and 1 USB cable.
TCMega_8Mod	8 LED Mega FINN™ Module (tests up to 8 LEDs). Comes with 8 fiber optics cables (18" or 24") and 1 USB cable.
TCMega_12Mod	12 LED Mega FINN™ Module (tests up to 12 LEDs). Comes with 12 fiber optics cables (18" or 24") and 1 USB cable.
TCMega_16Mod	16 LED Mega FINN™ Module (tests up to 16 LEDs). Comes with 16 fiber optics cables (18" or 24") and 1 USB cable.

OPTICS

<u>Part Number</u>	<u>Description</u>
TC18_FO	18" Fiber optic cable assembly
TC24_FO	24" Fiber optic cable assembly

2. Principal of Operation

The Mega FINN™ Module utilizes the technology and advanced LED color and intensity measurement capabilities of the Mega FINN™ sensor packaged in an enclosed housing to allow simultaneous testing of multiple LEDs, without having to power up each component individually. This cost effective method of determining the presence, color and/or brightness of LEDs, will enable users to test large quantities while minimizing fixture considerations and lowering per unit cost expense.

3. Method of Operation

The module houses a custom assembly, including multicolor sensors and a microprocessor. Separate optical cables that are comprised of a press fit plug connect to numbered ports on the module and a metal shrouded tip on the opposite end which is placed in front or on top of the LED to be tested. When a command for a specific numbered cable is sent to the module, the module will measure the color and/or intensity of the requested cable and send back the measurement via the chosen interface. Readings may be provided in either frequency (Hz) or in voltage (V) for the LED color and in voltage (V) readings for the LED intensity. The modules may be ordered based on customer requirements, for testing LEDs in quantities of 4, 8, 12 and 16. In addition, modules may be daisy chained together to test greater numbers of LEDs as needed, up to a maximum of 254 LEDs.

4. Applications

- For use in testing large quantities of LEDs
- When test requirements call for the absolute fastest test time possible.
- When quality control demands reliable, unerring accuracy and when clear cut measurements are vital.
- For pulsing, bright to very dim LEDs – visible light from Ultraviolet to near infrared.
- Functional and In-circuit test environments, on any test platform.
- For use in testing multiple LEDs and excellent for large quantities of LEDs.
- Ideal for Functional test set ups and MDA stations where frequency and/or voltage measurements are not possible.
- For close spaced LEDs – 1.28mm spacing

5. Features

- High accuracy of +/- 0.3% and average resolution of
- 0.1nm across the visible spectrum.
- Fast response time – typically less than 3 milliseconds for average to bright LEDs.
- Eliminates the need for additional measuring hardware for
- Frequency or Voltage readings.
- Quick and easy installation with the flexibility of either a USB or Serial connection with built-in overvoltage protection.
- Fiber Optics are 1.28 mm in diameter, allowing for testing of very closely spaced LEDs.
- Compact module is easily mounted in an ICT fixture or
- Functional test station. Only 1 USB or RS232 cable can test up to 254 LEDs

6. Properties

6.1. Module Pinout



Power: External Power Supply

- + : Vin positive voltage ~5.0 -16Vdc
- - : Ground

USB: USB 2.0 Mini Type B connector

RS232: Serial Port: 115k, 8 data bits, 1 stop bit, No Parity

- Rx : Module Rx input (RS-232 Tx DB9 pin 3)
- Tx : Module Tx output (RS-232 Rx DB9 pin 2)
- \perp : Ground (RS-232 Ground DB9 pin 5)

Outputs: Optional Color/Intensity Outputs

- 1 : Output Frequency for color (frequency) and intensity (duty cycle – DC Average) - ~1kHz to ~13.1kHz
- 2 : Output Voltage for intensity - ~0.2Vdc to ~4.7Vdc
- 3 : Output Voltage for color - ~0.2Vdc to ~4.7Vdc
- \perp : Ground

Daisy IN: Daisy Chain Input Connector

- + : Vin positive voltage output
- Rx : Daisy IN Rx input
- Tx : Daisy IN Tx output
- \perp : Ground

Daisy OUT: Daisy Chain Output Connector

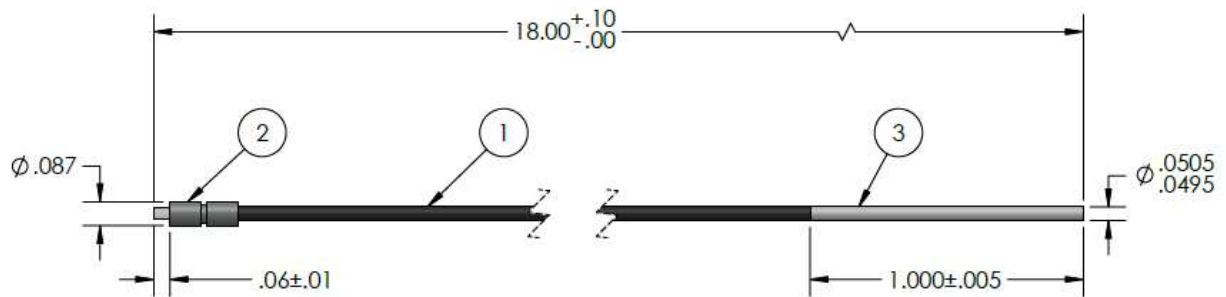
- \perp : Ground
- Rx : Daisy OUT Rx input
- Tx : Daisy OUT Tx output
- + : Vin positive voltage input

6.2. Module Dimensions

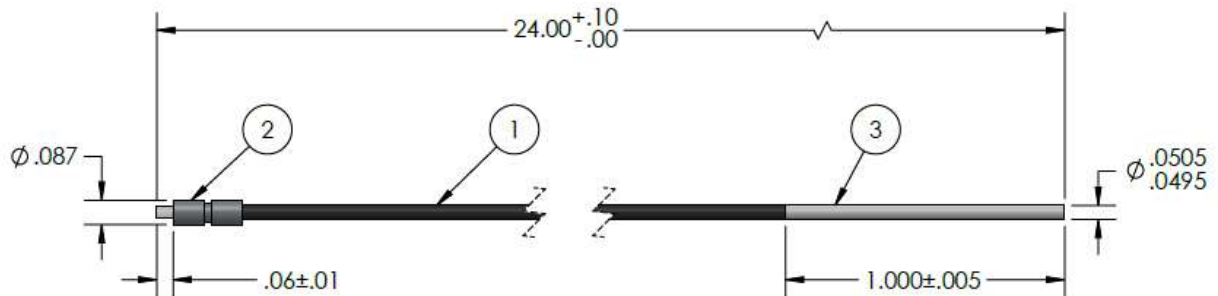


6.3. Fiber Optics Dimensions

18" Fiber optic cable assembly



24" Fiber optic cable assembly



- ① Plastic Fiber Optics. 1.00mm optical fiber core and ~1.3mm OD with jacket. **Minimum bending radius is 25mm.**
- ② Metal tip custom connector that press fit in to the sensor hole on the Module body.
- ③ Metal tip custom connector that is placed in front or over of the LED under test.

6.4. Power Source

The Mega FINN™ Module requires ~5.0-16.0 Volts DC or powered directly from USB cable.

Current is typically ~27 mA for 4 channels version.

Current is typically ~54 mA for 8 channels version.

Current is typically ~81 mA for 12 channels version.

Current is typically ~108 mA for 16 channels version.

When using the USB interface, the module utilizes the 5 volts provided by the USB itself, no external power supply is needed.

If using a USB interface, a maximum of **three** 16channels Modules (total of 48 channels) can be used. If more modules are needed then an external power supply will be needed to power up the modules since the USB port can only handle a max of ~450mA. See [Daisy Chain](#) Section.

6.5. Sensor

Light- to- frequency converter sensors are 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.

6.6. 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.

6.7. Fiber Optic cables

The Mega FINN™ Module has two fiber optic options available – an 18” cable assembly and a 24” cable assembly.

The smaller press fit plug end of the cable assembly fits into corresponding labeled socket in the top of the module body. The longer metal shrouded end of the cable assembly is placed in front of or over the LED being tested. It may be held in place by a drilled 50 mil hole in the top plate, a 50 mil socket, or a drilled block of a fixture so that the opening is centered over the face of LED.

Please note that the minimum bend radius for the custom fiber optics cable is 25mm. Damage to the fiber can occur if minimum bend radius is smaller.

All of the custom fiber optics are properly cut and polished on both ends.

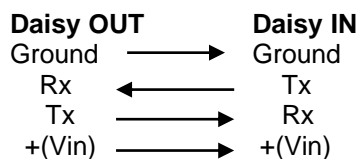
6.8. Daisy Chain

The modules may be daisy chained together to test greater numbers of LEDs as needed, up to a maximum of 254 LEDs. Only one USB or one Serial Cable is needed to test up to 254 LEDs.

The first Module (Master) on the chain will have the USB or Serial Cable connected to it. The Daisy OUT connector on the first Module (Master) should be connected to the Daisy IN connector on the 2nd Module (Slave1). The Daisy OUT connector on the 2nd Module *(Slave1) should be connected to the Daisy IN connector on the 3rd Module (Slave2) and so on.

The Daisy OUT connectors has the Vin output which will be used to power up the next Module. If multiples Module are connected, make sure that there are multiples wires for Power and Ground at the Power connector of every 3rd Module after the first Module to avoid loss meet current requirement.

Connections:



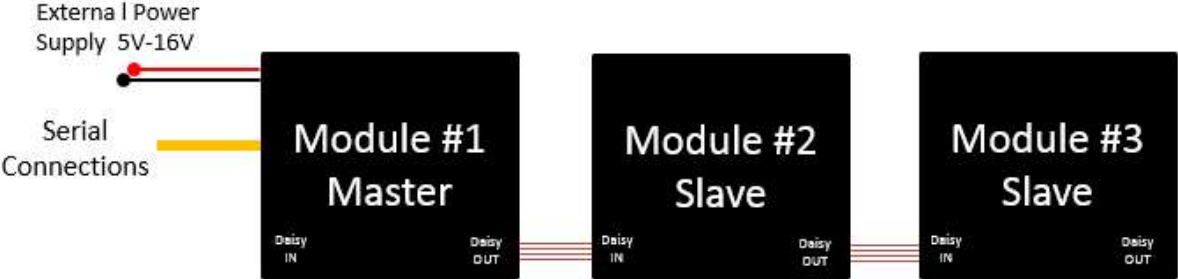
6.8.1. Daisy Chain with USB cable and no power supply - 3 Modules max



6.8.2. Daisy Chain with USB cable and External Power Supply



6.8.1.Daisy Chain with Serial Connection



6.8.1.Daisy Chain with Serial Connection – Multiple Modules



7. Communication Protocol

7.1. USB Port and Driver

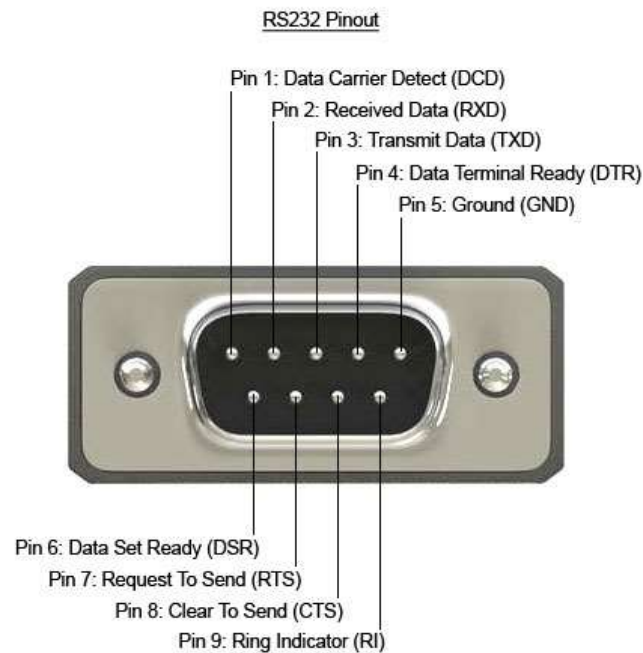
The Mega FINN Module USB Driver is available in the CD that comes with the Module or by contacting FINN Test Electronics. After plugging the Mega FINN Module for the first time to a PC, please use the driver provided to install the Module. **The USB virtual COM port driver causes the USB device to appear as an additional COM port available to the PC.**

The USB virtual COM Driver can be download from here [USB Driver](#) .

7.2. Serial RS-232 Port

When using the serial RS232 interface, an external power supply is needed to power up the module.

- Rx : Module Rx input (RS-232 Tx DB9 pin 3)
- Tx : Module Tx output (RS-232 Rx DB9 pin 2)
- \perp : Ground (RS-232 Ground DB9 pin 5)



7.3. COM Port Settings – USB and RS232

Both interfaces uses the Serial RS232 Communication Protocol with the following settings:

BAUD RATE: 115.2 kbps
 Data Bits: 8 bits
 Stop Bits: 1 bit
 Start Bits: 1 bit
 Parity Error: none
 Flow Control: off

The Module sends and receives data in ASCII format.

7.4. Module Commands

Command	Description
Pxxx	Read Color (Frequency HZ) and Intensity (V)
Yxxx	Read Dominant Wavelength (nm) And Intensity (%)
S	Read Chain Size (total number of fibers connected)
C	Turn On Continuous Sampling
E	Echo last Color (Hz) and Intensify(V) readings
TRIG	Trigger reading request (broadcast) to all of the fibers connected to the entire chain.
DEL xxx	This command is used remove a fiber optic channel from the TRIG command listed above
ADD xxx	This command is used add a fiber optic channel to the TRIG command listed above.

Every command sent to Module must end with a Line Feed <LF>. A Carriage Return <CR> can also be sent but is not needed. The Module will only response to a command after a <LF> is sent.

Line Feed <LF> = 0xA (hex) = 10 (decimal)
 Carriage Return <CR> = 0xD (hex) = 13(decimal)

7.4.1.Read Command - Pxxx

This command is used to read the color and intensity of any fiber optic number connected to the Module itself plus the daisy chain modules if any.

Command: Pxxx <LF> or pxxx <LF> where xxx is the fiber optics channel number from 001 to 254.

Examples: Channel 1 : P001<LF>
 Channel 23 : P023<LF>
 Channel 106 : P106<LF>

The Module will measure the color and intensity of the light in the fiber optic requested and will return a 16 bytes string followed by <LF>

The answer to this command is always a 16 bytes string followed by <LF>.

The Optional Outputs pins will also be updated with the new values.

If the fiber optic number is out of the range the Module will reply: Out of Range<LF>

Answer: Pxxx ; yyyyy ; z.zzz <LF>

xxx is the fiber optics channel requested from 001 to 254.

yyyyy is the frequency (color) reading for the fiber requested in Hz from 00998 to 13100. See [Output Frequency Graph](#) Section.

z.zzz is the voltage (intensity) reading for the fiber requested in Volts from 0.200 to 4.750. See [Intensity / Brightness Readings](#) Section.

The fiber optic channel number, frequency and voltage reading are semicolon delimited so it can be easily decoded.

7.4.2.Echo Command – E

This command is used to re-send the color and intensity of last fiber optic channel requested.

Command: E <LF> or e <LF>

Example: E<LF>

The Module will re-send the last requested measurement of color and intensity. The answer is 16 bytes string including a <LF>

The answer to this command is always a 16 bytes string followed by <LF>.

Answer: Pxxx ; yyyyy ; z.zzz <LF>

xxx is the fiber optics channel requested from 001 to 254.

yyyyy is the frequency (color) reading for the fiber requested in Hz from 00998 to 13100. See [Output Frequency Graph](#) Section.

z.zzz is the voltage (intensity) reading for the fiber requested in Volts from 0.200 to 4.750. See [Intensity / Brightness Readings](#) Section.

The fiber optic channel number, frequency and voltage reading are semicolon delimited so it can be easily decoded.

7.4.3.Chain Size Command – S

This command is used to find out how many fiber optics channels are connected to the entire chain.

Command: S <LF> or s <LF>.

Example: S<LF>

The Module will return the largest fiber optic channel number available in the chain.

The answer to this command is always 3 bytes followed by <LF>

Answer: xxx<LF>

xxx is the maximum fiber optics channel available in the chain from 004 to 254.

7.4.4.Trigger Command – TRIG

This command is used to trigger a reading request (broadcast) to all of the fibers connected to the entire chain.

Command: TRIG <LF> or trig <LF>.

Example: TRIG<LF>

The Module will return the readings for all of the fiber optic channels connected to the entire chain.

The answer to this command is always 16 bytes followed by <LF> for each fiber optic channel.

Answer:

P001 ; yyyyy ; z.zzz <LF>
 P002 ; yyyyy ; z.zzz <LF>
 P003 ; yyyyy ; z.zzz <LF>
 P004 ; yyyyy ; z.zzz <LF>

 Pxxx ; yyyyy ; z.zzz <LF>
 Trigger if Done<LF>

xxx is the last fiber optics channel available in the chain.

yyyyy is the frequency (color) reading for the fiber requested in Hz from 00998 to 13100. See [Output Frequency Graph](#) Section.

z.zzz is the voltage (intensity) reading for the fiber requested in Volts from 0.200 to 4.750. See [Intensity / Brightness Readings](#) Section.

The fiber optic channel number, frequency and voltage reading are semicolon delimited so it can be easily decoded.

7.4.5.Trigger Delete Command – DEL xxx

This command is used remove a fiber optic channel from the TRIG command listed above.

Command: DEL <LF> or del <LF>.

Example: DEL 001<LF>

The fiber optic channel 001 will be removed from the TRIG command.

The answer to this command is always 16 bytes string followed by <LF>

Answer: Pipe XXX Delete <LF>

xxx is the fiber optics channel that was deleted.

7.4.6.Trigger Add Command – ADD xxx

This command is used add a fiber optic channel to the TRIG command listed above.

Command: ADD <LF> or add <LF>.

Example: ADD 001<LF>

The fiber optic channel 001 will be added to the TRIG command.

The answer to this command is always 16 bytes string followed by <LF>

Answer: Pipe XXX Added! <LF>

xxx is the fiber optics channel that was added.

7.4.7.Dominant Wavelength Command – Y

This command is used to read the Dominant Wavelength and Relative Intensity of any fiber optic number connected to the Module itself plus the daisy chain modules if any.

Command: Yxxx <LF> or yxxx <LF> where xxx is the fiber optics channel number from 001 to 254

Examples: Channel 1 : Y001<LF>
 Channel 23 : Y023<LF>
 Channel 106 : Y106<LF>

The Module will measure the color and intensity of the light in the fiber optic requested and will return a max of 25 bytes string including a <LF>

The answer to this command is can be up to 25 bytes string including <LF>.

The Optional Outputs pins will also be updated with the new values.

If the fiber optic number is out of the range the Module will reply: Out of Range<LF>

Answer: Pxxx ; yyy nm ; zz.z % <LF>

xxx is the fiber optics channel requested from 001 to 254.

yyy is the Dominant Wavelength fiber requested in nm from 400 to 700.

zz.z is the relative intensity reading for the fiber requested in Volts from 0% to 100%.

The response message is semicolon delimited so it can be easily decoded.

The Module will send a different messages for White, InfraRed, Ultraviolet, Too Bright, and Too Dim:

White: Answer: Pxxx ; 1 White ; zz.z % <LF>

UltraViolet: Answer: Pxxx ; 2 UltraViolet ; zz.z % <LF>

InfraRed: Answer: Pxxx ; 3 UltraViolet ; zz.z % <LF>

TooBright: Answer: Pxxx ; -2 Too Bright! ; 100 % <LF>

TooDim: Answer: Pxxx ; -1 Too Dim! ; 0 % <LF>

7.4.8. Continuous Sampling Command – C

This command is used to turn on Continuous Sampling Mode. In this mode the Module will continue to measure the selected and update the Output Pin after a 'Pxxx' command is issued.

Command: C <LF> or c <LF>

Examples:

Command	USB/RS232 Response	Frequency Output Pin #1	
C <LF>			
	ON <LF>	350 HZ	
P001 <LF>			
	001;04525;2.500	4,525 Hz	Sample1
		4,628 Hz	Sample2
		4,735 Hz	Sample3
P002 <LF>			
	002;08725;1.7500	8,725 Hz	Sample1
		8,750 Hz	Sample2
		8,735 Hz	Sample3

Answer: ON <LF> The Module will respond 'ON' only the first time the 'C' command is issue after power up. Additional 'C' commands are acceptable but not necessary.

The Module will also update the Frequency Output Pin #1 with a 350 HZ frequency to show that the 'C' command has been successfully turned ON.

7.5. Optional Output Pins

The Optional Output pins will output the readings for color and intensity in different formats.

Output 1 : Outputs a Frequency for color (frequency) and intensity (duty cycle – DC Average) - ~1kHz to ~13.1kHz. See [Output Frequency Graph](#) Section.

In addition, the Output 1 pin can be used for status feedback:

350 Hz	'C' command received
400 Hz	Wrong Command received
500 HZ	Pipe out Range

Output 2 : Outputs a Voltage for intensity - ~0.2Vdc to ~4.70Vdc. . See [Intensity / Brightness Readings](#) Section.

Output 3 : Outputs a Voltage for color - ~0.2Vdc to ~4.70Vdc

Dark:	~0.2V
Blue:	~0.6V to 1.2V
Pure Green:	~1.25 to 1.7V
Green:	~1.75 to 2.2V
Yellow:	~2.25V to 2.9
Orange/Amber:	~3.0V to 3.4V
Red:	~3.5V to 3.9V
White:	~4.3V
Saturation:	~4.7V

Note: The voltages readings are based on Vin from 5.0V to 16V. The Optional Output pins voltages will be lower if Vin in lower.

After a Read Command is sent to the module, the Module will measure the color and intensity and then it will update the Optional Output Pins with the new readings.

When the Module receives another Read Command, all of the Optional Output pins will be driven to zero and when the Module finishes measuring the color and intensity of fiber optic requested, the Optional Output pins will get updated with the new readings.

The Optional Output pins is useful when the test system is able to send RS232 commands but has a hard time reading the data back. On this scenario the test system can send a command to Read a channel and then measure the Optional Output Pins, then send another command to Read another channel and then measure again the same Optional Output Pins.

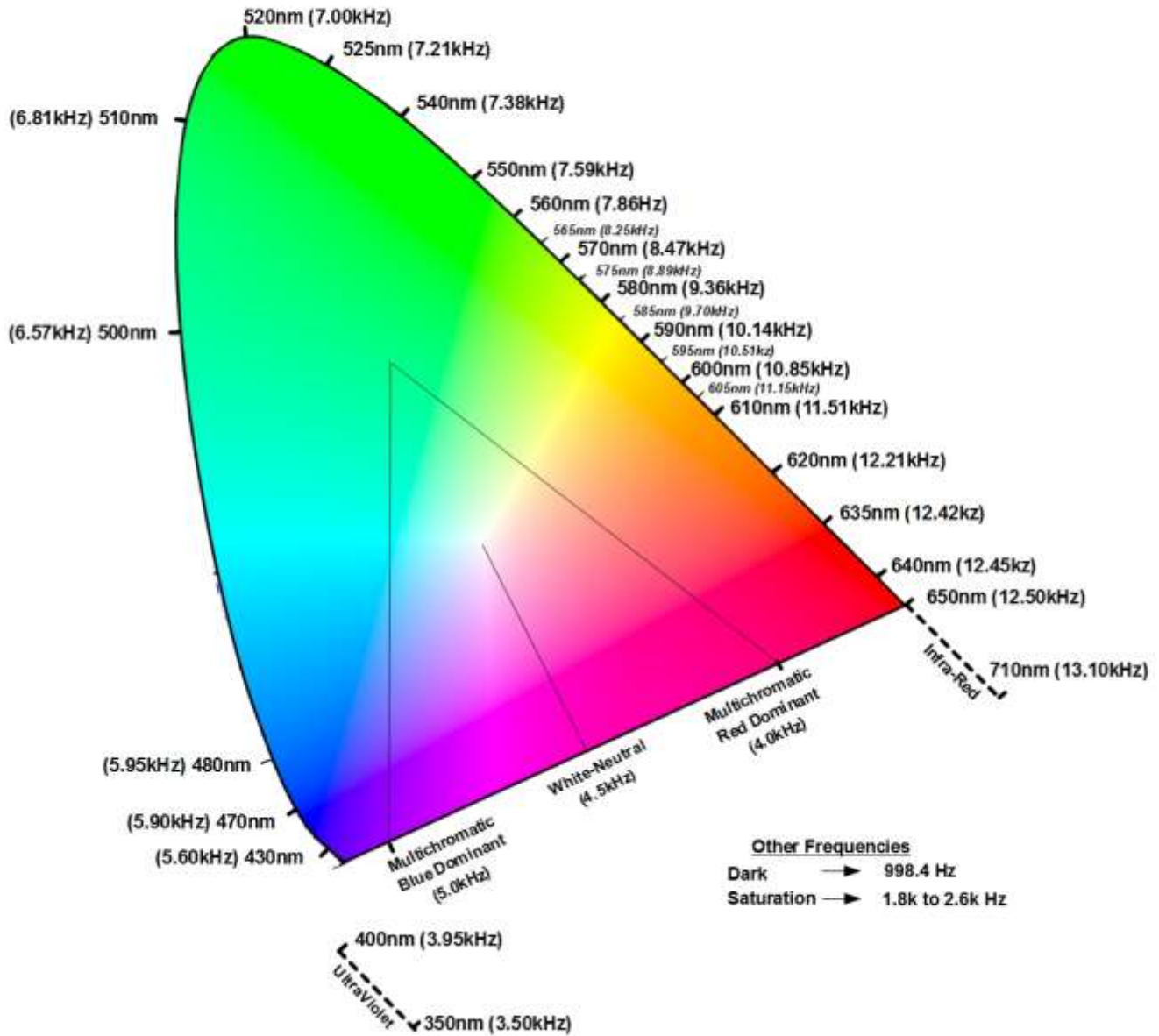
8. Typical Measurements

8.1. Color

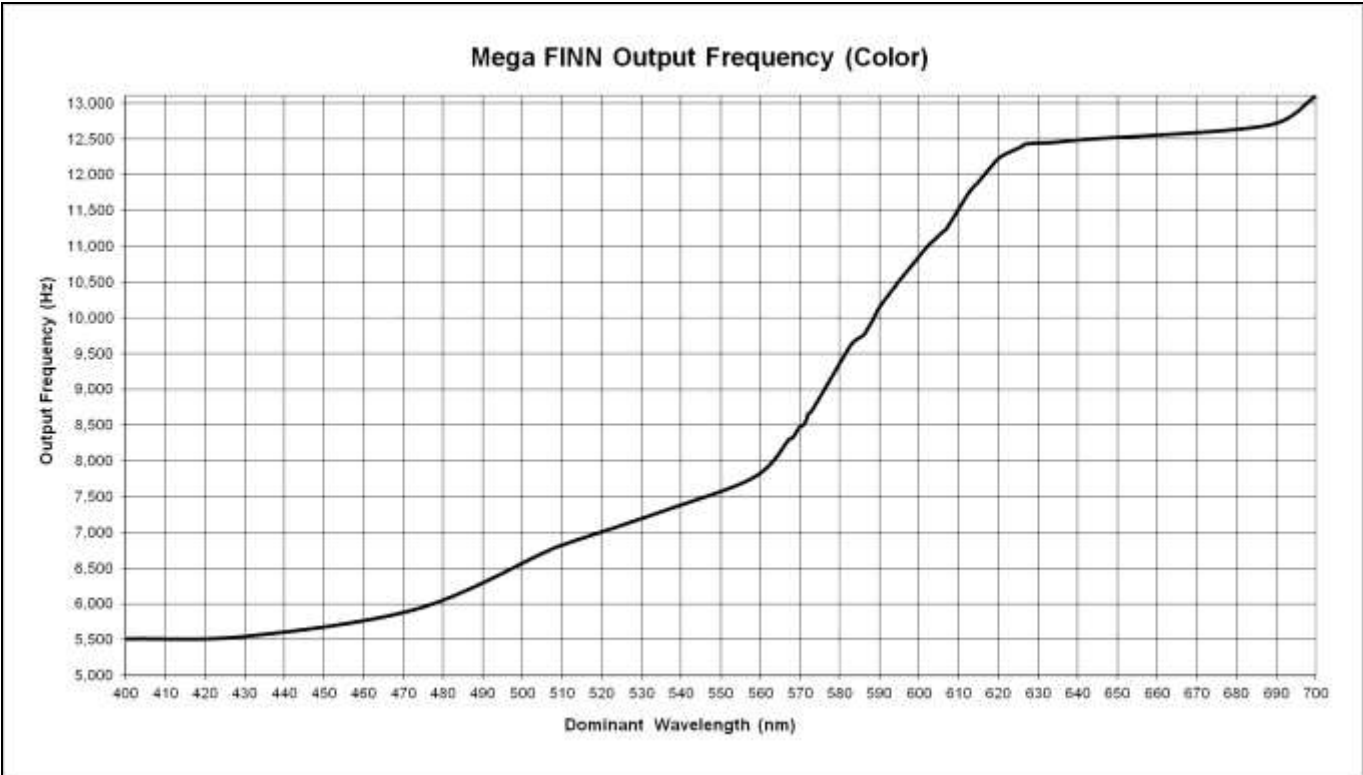
Typical Measurements		
Color	nm	kHz
Red	635	12.42
Amber	608	11.25
Yellow	585	9.70
Green	565	8.25
Pure Green	525	7.21
Blue	470	5.90
Other Measurements		
Infrared	Up to 700	12.5 - 13.1
Ultraviolet	Down to 400	3.5 - 3.95
Fluorescent	multiple	4.2
White (red dominant)	multiple	4.0 - 4.35
White (blue dominant)	multiple	4.4 - 5.0
Saturation	n/a	1.8 to 2.6
Dark	n/a	0.998

8.2. Output Frequency vs Chromaticity

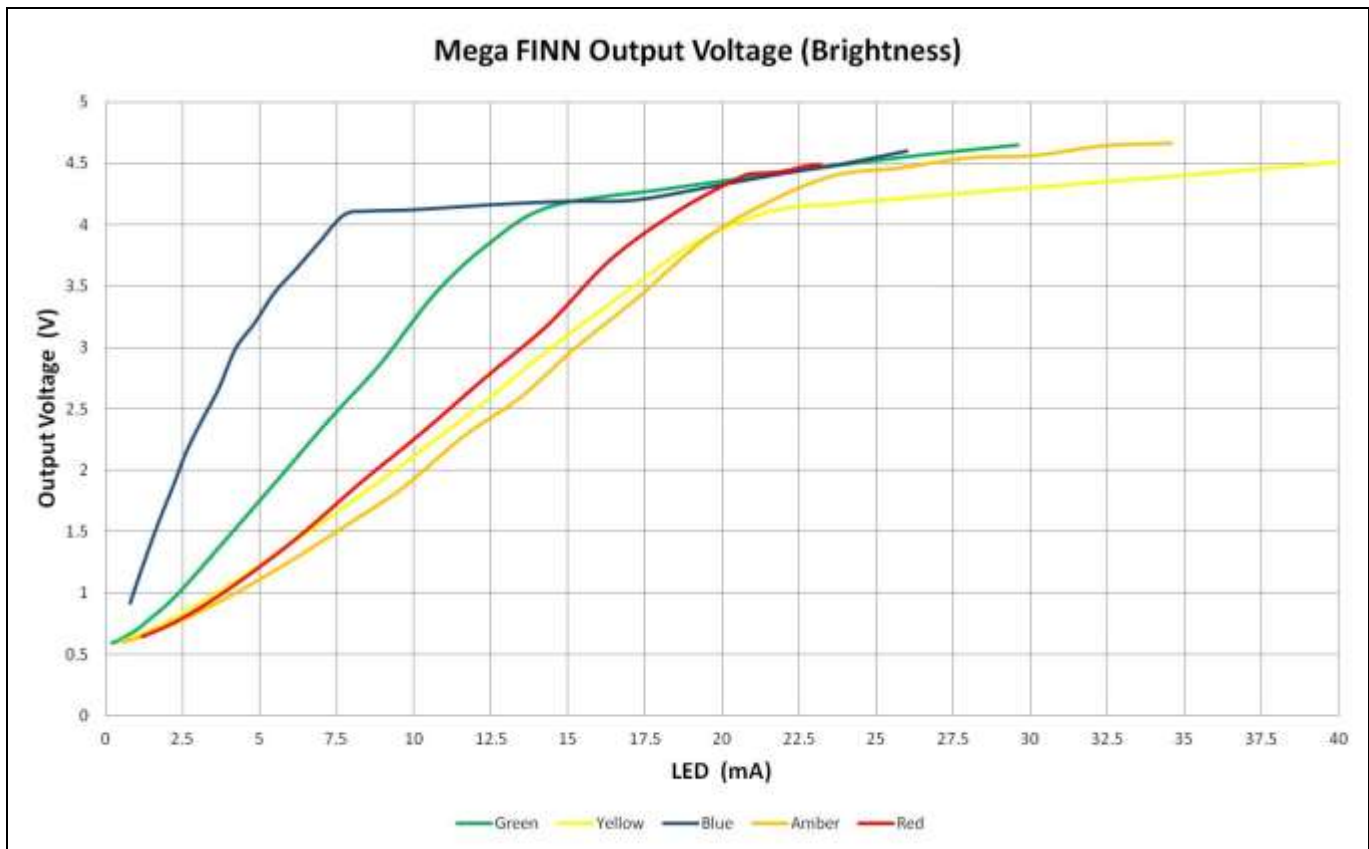
MegaFINN Output Frequency vs Chromaticity Diagram



8.3. Output Frequency Graph



8.4. Intensity / Brightness Readings



Note: This graph is for reference only. The Output Voltage versus LED current will vary for different manufacturer parts.

9. Mega FINN™ Module Timing

Mega FINN™ response is typically 3 milliseconds plus ~1.5ms read back. The response time will decrease for brighter LEDs and will increase for dimmer LEDs and pulsing LEDs.

10. Sources of Error

10.1. Wiring

Special care should be paid to the wiring instructions. 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. Power and Ground is marked on the Module enclosure with a + and – sign. When using the RS232 interface, common mistake is mis-wiring the Rx and Tx signals. Please see [Serial RS-232 Port](#) section.

10.2. Ambient light and adjacent LED's

Light from sources other than the device being tested should be prevented from reaching the tip of the fiber optics cable 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 and non-uniform then the Mega FINN™ uses a sampling algorithm to average out the non-uniform light resulting in longer sampling times.

When the LED being measured is shut off then the ambient light becomes the only light source and the sensor will output the ambient light reading.

10.3. Distance

The further away the tip of the fiber optic cable is from the LED, the lower the voltage response of the sensor. If the LED is dim (20mcd or less), the fiber optic tip be around ~0.05" from the LED. LED's that have medium brightness (20-100mcd) can be placed at a greater distance 0.10" to 0.15". Very bright LED's (100-200mcd) should be placed at 0.15" or greater for best results.

10.4. Vdd other than 5V-16V

The Mega FINN™ Module will not turn on if the supply voltage is lower than ~4.50Vdc. Make sure the supply voltage at the Mega FINN™ Module Power Vin is greater than 4.50Vdc. When using multiples Module together make sure to follow the wiring recommendation on [Daisy Chain](#) section.

10.5. Power loss and current

If multiple Modules are used and daisy chained together, power loss over the wires from Module to Module might occur. To prevent power loss, wire new power and ground wires to every 4th module on the chain to prevent power loss. If the voltage on the Module is lower than 4.5V the Module will not turn on and will not work. Please see [Daisy Chain](#) section for daisy chain power recommendation.

10.6. Saturation

If the output frequency is between 1.8 kHz and to 2.6 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)	16 V
Operating free-air temperature range, TA	0C to 70C
Storage temperature range	-25C to 85C
Maximum current or output	±108 mA (16 channels)

† 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	5.0	5.5	16	V
Operating free-air temperature range, TA	0	25	70	Celsius
Supply current (16 channels)	-	108	-	mA

Note1: Additional loads on optional output pins 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 FINN Test Electronics 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 mis-ordered. 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 – 10,094,877
Additional patents pending



15. Ordering Information

FINN™ parts may be ordered directly by calling 224-662-0383 or by emailing to FINNSales@FINNTest.com.

Distributor phone numbers and addresses can be accessed by clicking on the *distributor link* located on the products 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 A – February 2017

- Initial release

17.2. Rev A1 – August 2017

- Added Broadcast: TRIG, ADD, and DEL Commands

17.3. Rev A2 – January 2018

- Added Dominant Wavelength 'Y' Command

17.4. Rev A3 – October 2018

- Added Continuous Tigger Mode 'C' Command