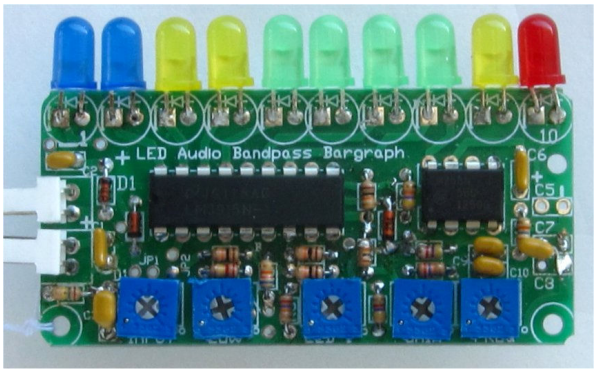
Audio Bandpass Spectrum Display Meter

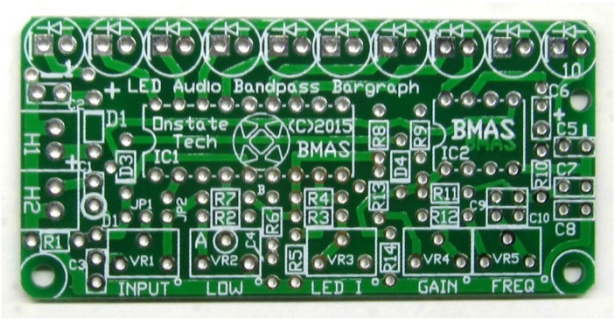


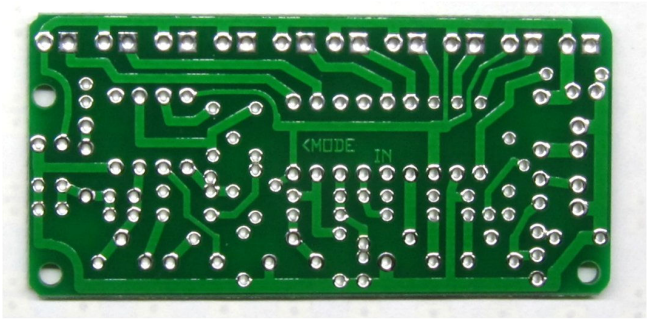
The BMAS is a 10-LED bargraph display module with an op-amp bandpass circuit and a bargraph display driver for audio applications. The audio signal is first amplified then passed through a Sallen-Key bandpass filter circuit and then DC-filterd to the bargraph display driver for signal level display. Multiple display modules can be stacked together to make a real-time analog audio spectrum analyzer display meter.

Technical Specifications:

Typical LM3915 module.

Operating voltage:	12-15V DC, up to 30V with optional LM7812 regulator.
Dimension:	2.50"x1.20", 2x 95mil holes at 2.325".
PCB:	1/16" FR4, ROHS, HASL, double-sided, plated holes,
Input signal range (nominal):	0.0-2.5V, VR divider adjustable.
Standby current (LEDs off):	7mA
Maximum current (BAR mode):	150mA
Main parts:	LM3915N, LM258/358, 5mm LEDs, trimmer resistors.





Control Adjustments:

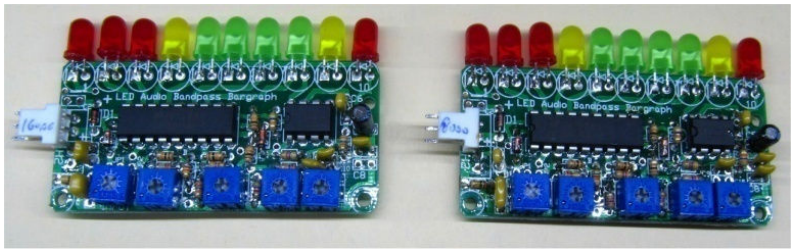
INPUT	Adjusts the maximum input level (10th LED).
LOW	Adjusts the minimum start level (first LED).
LED I (BRIGHTNESS)	Sets the minimum brightness level of the display.
GAIN	Op-Amp gain (amplification) control.
FREQ	Sallen-Key frequency trim.

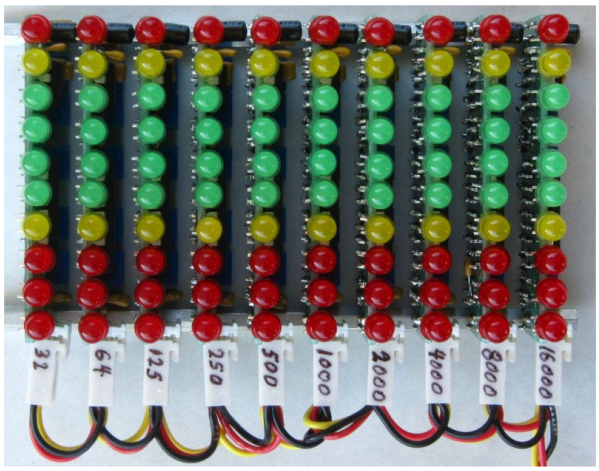
Basic Setup

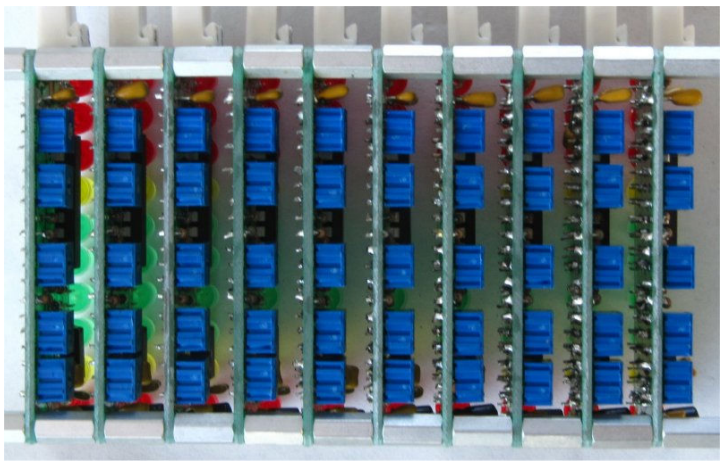
Basic LED bargraph display without op-amp circuit.

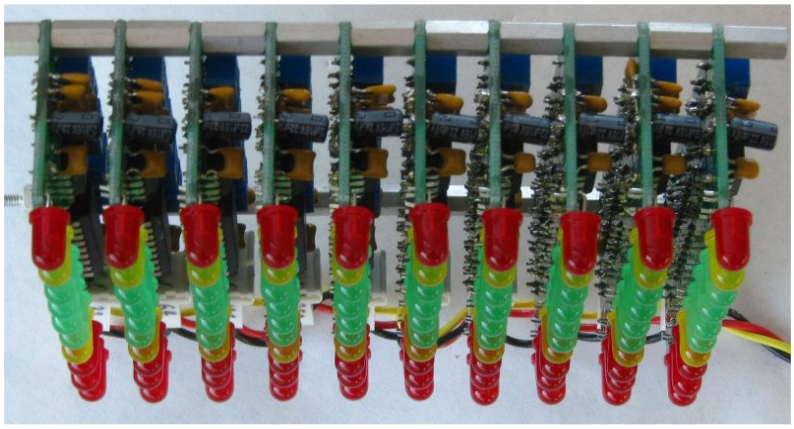
1. Connect 12V power (H1) and signal to input (H2). Set VR1/VR3 to center, VR2 to CW (clock-wise).
2. Apply high signal for 10th LED display. Adjust VR1 until LED10 is on.
3. Apply input signal for low display. VR2 (LOW) full clock-wise (CW) is 0V. Adjust VR1 until LED1 is off or on. Apply high signal and trim VR1 for LED10 off or on.
4. VR3 is LED brightness adjustment. CW is increasing brightness. The display driver will get warm at high input voltage and on bargraph mode.

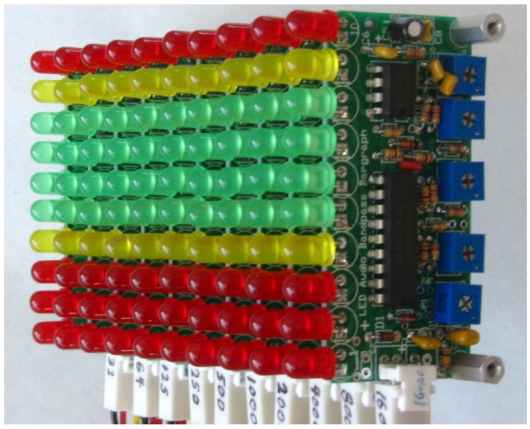
10-Channel LED Audio Spectrum Analyzer











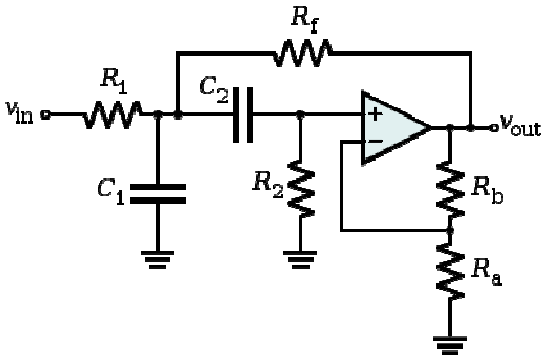
Equipment Parts:

1. 12V DC power supply. 1.0-2.0A.
2. DMM with DC voltmeter and frequency display.
3. Function signal generator or 555 timer or similar signal generator circuit.
4. Soldering iron and soldering accessories.
5. Necessary electronic components for assembly.
6. Excel spreadsheet to calculate Sallen-Key frequency bands or calculator.
7. Oscilloscope (optional).

Note: 20-30 hours assembly time for 10 modules.

Assembly

1. Calculate Sallen-Key bandpass filter frequencies. Fill values in table list.



$$f_0 = \frac{1}{2\pi}\sqrt{\frac{R_f + R_1}{C_1 C_2 R_1 R_2 R_f}}$$

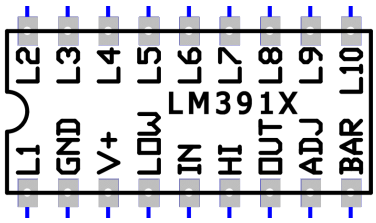
$$Q = \frac{\sqrt{(R_1 + R_f)R_1 R_f R_2 C_1 C_2}}{R_1 R_f (C_1 + C_2) + R_2 C_2 (R_f - \frac{R_b}{R_a} R_1)}$$

Gain=1+R_b/R_a too high gain will cause oscillation. G<3.
R_1=R10, R_f=R11, R_2=R12+VR5, R_b=VR4, R_a=R13, C_1=C7+C8, C_2=C9+C10
R11, R12, R13 are fixed resistor values.
Standand 10 band values are (Hz):32, 64, 125, 250, 500, 1.0k, 2.0k, 4.0k, 8.0k, 16.0k

2. Insert and solder all necessary components. Trim component leads to IC level. Check for component alignment and shorted or loose solder joints.

3. Set VR2 to CW, VR3/VR5 to center, and R4 to CCW.

4. Apply 12V power. Measure DC voltage at IC1 OUT pin (>3V), IC1 HI pin (>1.5V), and IC1 IN pin (0-0.2V).



5. The bargraph display lower LEDs should be lit. Measure IC1 LOW pin. Adjust VR2 until LOW pin is IC1 IN pin plus 10mV (V_{IN}+10mV). The lower LEDs should shut off.

6. Apply sine wave signal into +SIG input (H2) from function generator at required bandpass frequency. Measure AC amplified signal at C6 (C6 label). Adjust input AC signal until measurement is 1.0V AC with DMM. Use oscilloscope to check waveform and accurate measurement. If no function generator available, use a 555 timer or similar circuit or download a function generater app. There may also be a computer program available for generating audio signals from the computer sound board. Measure IC1 IN DC voltage with DMM. Adjust VR4 (gain) until output voltage is ~1.0V. Do an input frequency sweep to check for peak DC voltage. Adjust VR5 (freq) slightly to vary the center bandpass frequency. Sweep input frequency slightly for peak output DC voltage (IC1 IN pin). Repeat if necessary. Set input signal to center bandpass frequency. Measure IC1 HI pin. Adjust VR4 (gain) until output voltage is 20-50mV above IC1 HI. LED10 should be on.

7. Stack LED modules together. Hold with #2 standoff spacers. Apply audio input into 1k pot. Use the 1k pot as the main input adjustment into all LED modules.