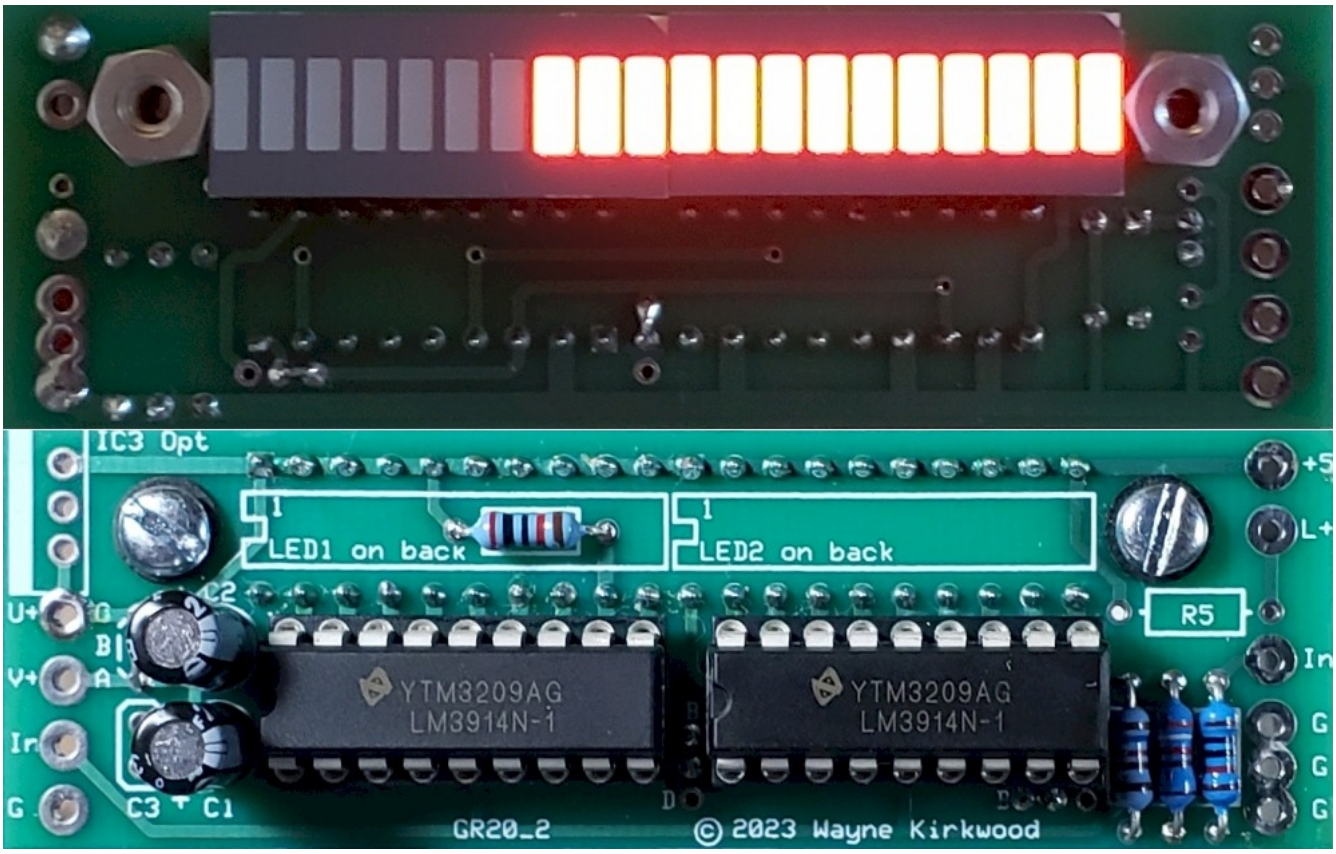
Assembly Instructions for the KA Electronics GR20 Gain Reduction Meter

8-5-2025



GR20 Gain Reduction Meter PC Board

Before you begin assembly

The GR20 has sockets loaded on both sides of the PC board. The "component," or top side of the board, has the silkscreen. The "back," or LED side of the board, has sockets for the LEDs and jumper wires to configure dot or bar mode. Unless otherwise instructed install all components on the top side of the board.

The meter is designed to move from right to left. If a left to right display is needed the meter can be mounted upside down.

The meter may operate in either Dot or Bar mode with multiple powering options determined by wire links. Read ahead in this document to determine which options are best for the application before beginning assembly.

Install resistors

Install **one 20KΩ** 1% resistor at R1. Save the trimmed leads.

Install **one 1K69Ω** 1% resistor at R2.

Install **one 3K92Ω** 1% resistor at R3.

Install **one 10KΩ** 1% resistor at R4.

R5 is an optional current limiting resistor for a front panel Power LED. The value depends on the LED supply voltage and desired current. R5 is user-supplied and not in the Project Manager BOM. Note that the pad marked "+5V" is actually Vled when calculating R5.

Install LED Sockets

The LED sockets are installed on the back side of the PC board. This is the side without a silkscreen. Pin 1 has a square pad and the number "1" below it.

Install **two** 20 pin IC sockets on the PC board at LED1 and LED2.

Install Jumper Wires for Bar/Dot Display

Most users prefer dot mode to reduce "light pollution" from having a large number of flickering LEDs lit at the same time.

Bar mode consumes a large amount of current. 20 LEDs lit along with the operating current of the LM3914s consumes about 160 mA. When bar mode is used either an external 5V supply or on-board 5V regulator for 15V supplies is suggested to reduce LM3914 power dissipation.

Dot mode current is about 20 mA total. Dot mode permits the LM3914 and LEDs to be powered from the +15V audio supply.

If a switchable dot/bar display is desired a DPDT switch can be used instead of wire links.

To permanently link the meter display mode:

Using a cut resistor lead bent in a "U" shape, form two 0.05" loops of resistor lead wire. Install these loops from the center pad to either the "B" (bar) or "D" (dot) pads on the back side of the PC board. (The side without a silkscreen.) The locations for these pads are shown on the silkscreen near pin 9 of IC1 and IC2. Leave enough height on the loop so that it can be snipped with a pair of diagonal cutters in case you change your mind. Trim the excess lead and re-flow the joints on the top silkscreen side of the PC board.

Install Sockets for IC1 and IC2

Install **two** 18 pin IC sockets on the PC board at IC1 and IC2.

Install the Jumper for External LED Supply and Optional On-board Regulator

The GR20 has multiple powering options.

For Dot displays the operating current is low and the on-board regulator is usually not necessary. The LM3914 has a maximum supply voltage of 25V. If operation from a 24V supply is required a 7812 or 7815 regulator should be used for IC3.

For Bar displays the maximum operating current at full scale is quite high, typically 160 mA. If a 5V supply is available it should be used. An onboard regulator is not required. For higher supply voltages it is necessary to limit power dissipation in the LM3914. Install a 7805 regulator at IC3.

Whenever a regulator is installed at IC3, C3, 220 nF, must be installed.

Do not install the regulator, IC3, or C3 at this time.

Jumper options:

To power the GR20 from the V+ terminal without a regulator link connections A and B on the PC board. The LEDs and the LM3914s are powered by the V+ terminal. The "5V" pad is actually V+.

To power the LM3914s and LEDs from the on-board regulator use the U+ terminal, install a regulator at IC3 and a link from connections A to B. The regulated voltage is available on the V+ and "5V" pads.

To power the LM3914s separately from the LEDs do not link any connections at A, B or C. The LM3914s are powered by the V+ terminal. The LEDs are powered by the U+ terminal and an installed 7805 regulator. The "5V" pad is 5V.

Install the jumpers now.

Install Capacitors

Install **two** 10 uF 25V capacitors at C1 and C2. The square pad is positive. Observe proper polarity.

Install **one** 220 nF capacitor at C3. If a regulator is not going to be used this step may be omitted.

Install Optional Regulator

Install **one** 7805, 7812 or 7815 regulator if required.

Install ICs and LEDs

Install **two** LM3914N at IC1 and IC2.

Install **two** LTA-1000E LED bar graphs into sockets on the backside of the PC board. This may require a significant amount of insertion force. Pre-position the LED in the socket. To complete insertion until it's flush with the socket, pinch the assembly with your thumbs on the LED and your index fingers on the component side of the board. Be careful when handling the meter both during after installation to prevent the gray paint on the LEDs from being scratched.

Quick Functional Test

The following assumes that the meter is configured for Dot mode and is powered using the V+ terminal with a link from point A to B. If the meter is assembled using other powering options apply power at the proper points.

Apply a source of DC power. The meter can be run in Dot mode from +5 to >18V. Use whatever supply voltage is convenient as long as it is below the +25V absolute maximum of the LM3914.

With no lead connected to the "In" connection all LEDs should be off.

The following steps use the internal 1.25V reference pins of the LM3914 to check meter operation. IC1 pin 7 has +1.25V relative to ground. IC2 pin 7 is at +2.5V because it is referenced to the +1.25V of IC1.

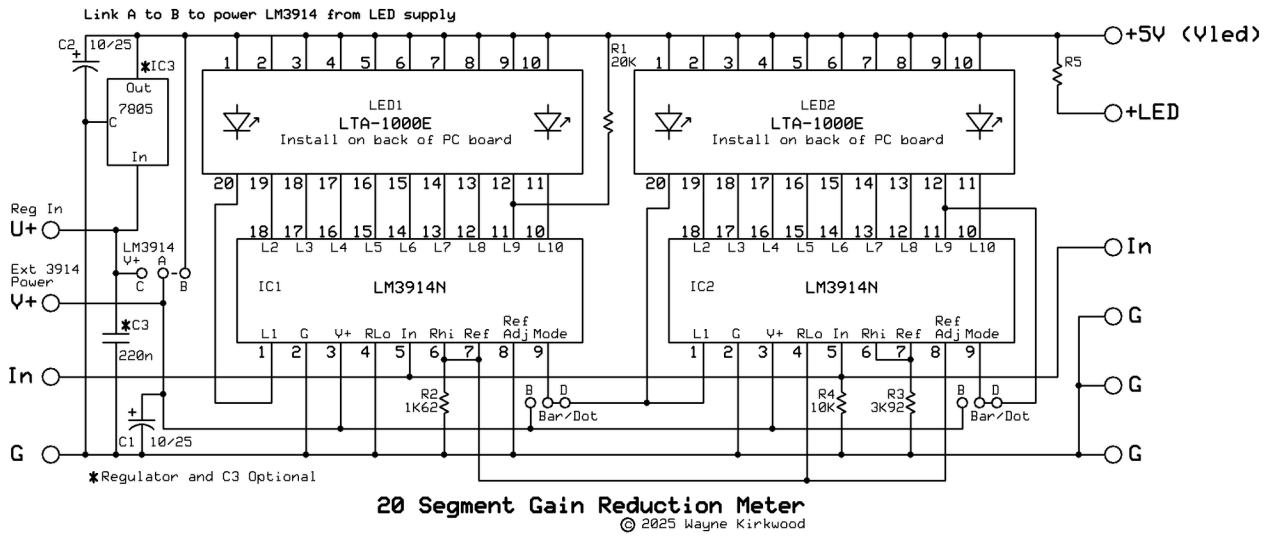
Touch a clip lead or short wire from the "In" connection to pin 7 of IC1. The tenth LED should light.

Move the clip lead to pin 7 of IC2 while it is connected to "In." The top-most LED should light.

To optionally check the intermediate LEDs connect a 10K pot to the V+ connection and ground. The wiper connection should be connected to "In."

Note that the meter "swings" from right to left. To reverse direction mount the meter upside-down.

In Dot mode the first LED will be dimly lit when the "pointer" of the meter is greater than the first LED. When the pointer exceeds the eleventh LED it will also light dimly. This is a characteristic of the LM3914 which draws approximately 100 µA through the LED at those positions. In Dot mode this provides a convenient zero and mid-scale marker.



20 Segment Gain Reduction Meter

Rockmore-Labs		
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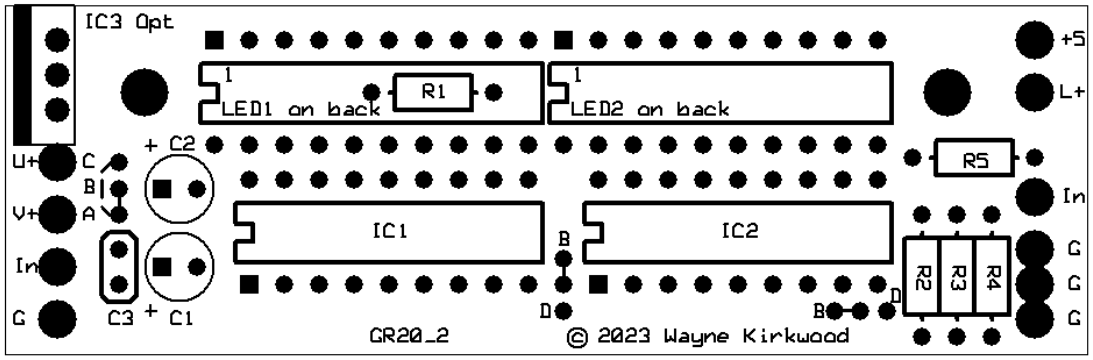
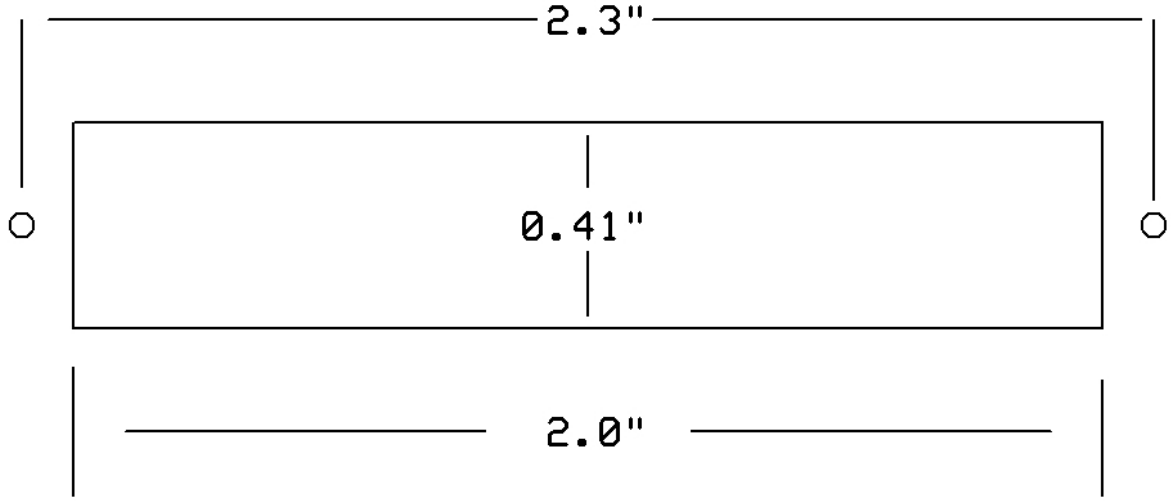


GR20 Layout



GR20 Panel Cutout

Detailed Parts List

A complete bill of materials is available from Mouser Electronics:

GR-20 Meter:

https://www.mouser.com/ProjectManager/ProjectDetail.aspx?AccessID=eb09cb240b

Other Resources

Pro Audio Design Forum Build Thread:

https://proaudiodesignforum.com/forum/php/viewtopic.php?t=1340

Data Sheets:

https://ka-electronics.com/images/pdf/LM3914_NSC_Data_Sheet.pdf

https://ka-electronics.com/images/pdf/LTA-1000E.pdf

For more information or technical support contact: sales@ka-electronics.com