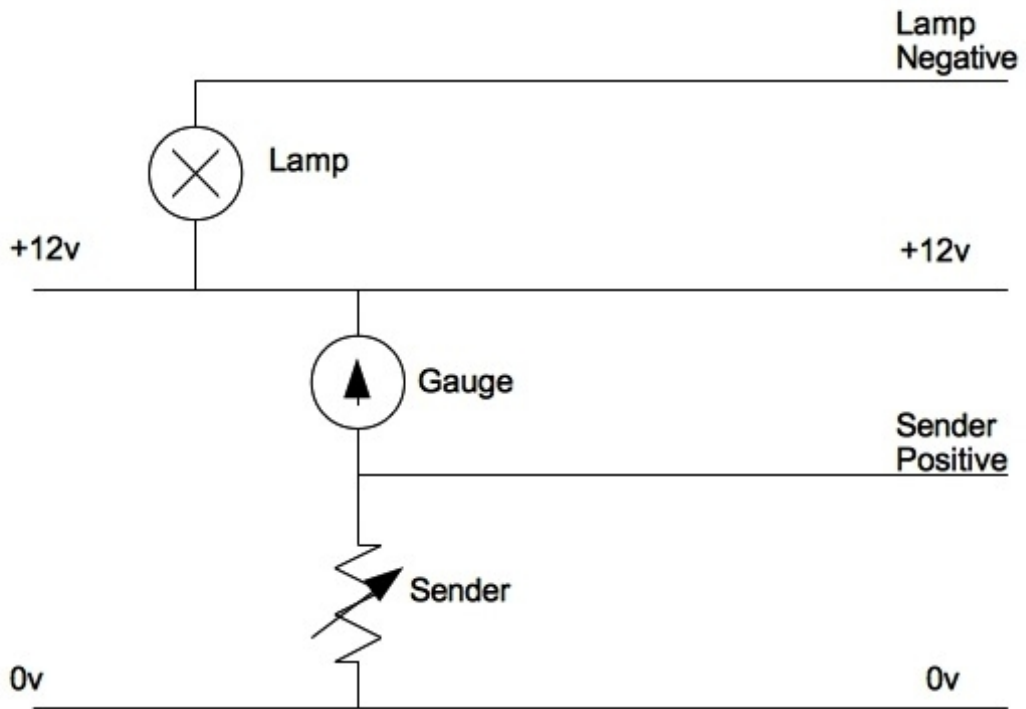


Inputs to Circuit



Sender Input Range

Fuel Gauge Resistance = 142 Ω

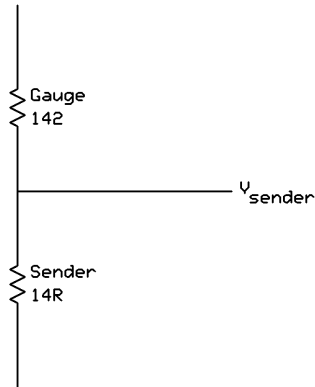
Fuel Sender Resistance = 14 Ω Full, 264 Ω Empty

Nominal warning level = 1/8th of Tank

Nominal adjustment range approximately +/- 25%

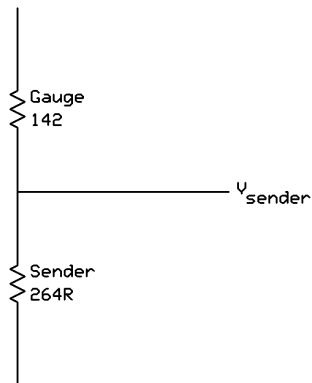
Supply = 12 volts

Full Tank:



$$\frac{14}{(142 + 14)} \times 12 = \frac{14}{13} = 1.08\text{v}$$

Empty Tank:



$$\frac{164}{(142 + 264)} \times 12 = \frac{1584}{203} = 7.8\text{v}$$

Warning Level

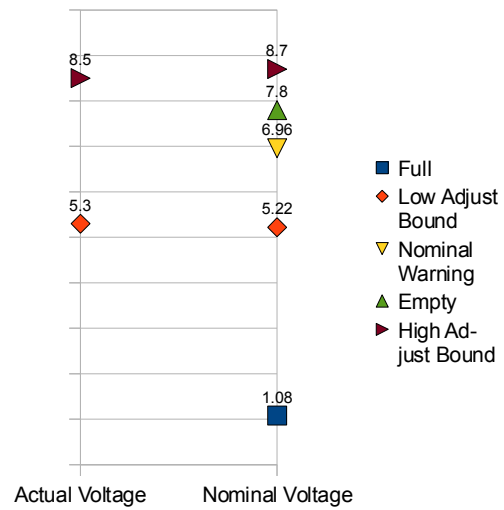
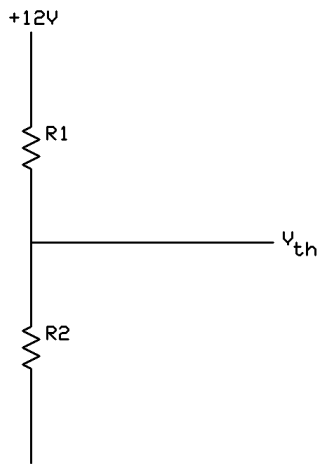
Sender voltage range = 7.8v - 1.08v = 6.2v

1/8th of range = 0.84v

Therefore 1/8th of range from empty voltage = 7.8v - 0.84v = 6.96v

Warning Level Adjustment Range

Nominal level = 6.96v, so adjustment range (approximately +/- 25%) = 5.22v to 8.7v



At $V_{th} = 5.22v$:

$$\frac{R_v}{R_1 + R_v} = \frac{5.22}{12} = 0.435$$

$$\frac{R_1}{R_v} + 1 = \frac{1}{0.435}$$

$$\frac{R_1}{R_v} = 1.3$$

If $R_1 = 1K5$, $R_v = 1154\Omega$

At $V_{th} = 8.7v$:

$$\frac{R_v}{R_1 + R_v} = \frac{8.7}{12} = 0.725$$

$$\frac{R_1}{R_v} + 1 = \frac{1}{0.725}$$

$$\frac{R_1}{R_v} = 0.38$$

If $R_1 = 1K5$, $R_v = 3947\Omega$

Difference = 2793Ω

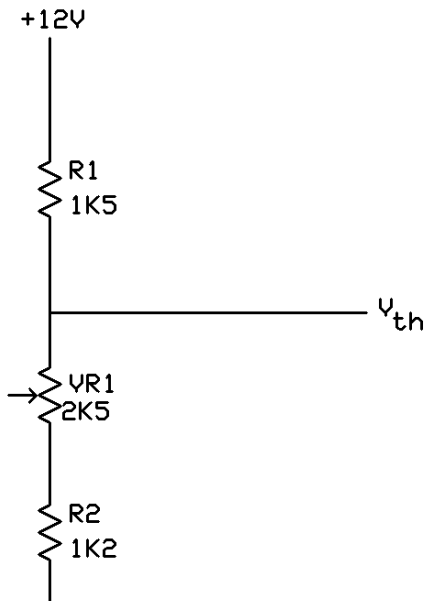
So use:

$R_1 = 1K5$ Resistor

$R_2 = 1K2$ Resistor

$VR1 = 2K5$ Potentiometer (Chosen as readily available value potentiometer)

Check:



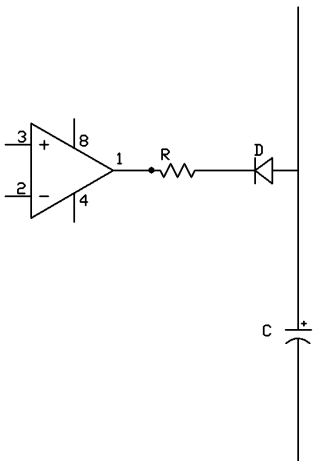
$$V_{th}(min) = \frac{1200}{1200 + 1500} \times 12 = 5.33v$$

$$V_{th}(max) = \frac{2700}{2700 + 1500} \times 12 = 8.5v$$

Min VR1 + R2 = 1200Ω
 Max VR1 + R2 = 2700Ω

Off Delay

Time off delay 't' = 0.1
 Capacitor C = 330uF



$R \times 330 \times 10^{-6} = t$, so $R = 303\Omega$. Therefore value of R should be 330Ω (nearest standard value of resistor)

Output Stage

Assume lamp has 2W rating

With a 12v supply $i_{bulb} = \frac{2}{12.5} = 160mA$

For Q1, $h_{fe} \approx 50$ and $base\ current \approx \frac{0.16}{50} = 3.2mA$ (round up to 4mA)

Therefore, set $R = \frac{9 - 0.6}{0.004} = 2100$ or 2K2

