Lab 1 discussion

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BEE 233 Fall 2015 Section AA

The whole point of Lab 1 is to familiarize you with the instruments.

Resistors

You probably discovered resistance measurements are only good to about 3 digits.

Resistance goes up as they heat up, even with just the tiny current from the ohmmeter.

My own results measuring 5 resistors

Resistor	Measured	% Error	Abs(% Error)
1	987	-1.30	1.30
2	975	-2.50	2.50
3	984	-1.60	1.60
4	982	-1.80	1.80
5	979	-2.10	2.10
Average	981	-1.86	1.86

They’re supposed to be 5% resistors, so in this small sample, it looks like we got what we paid for.

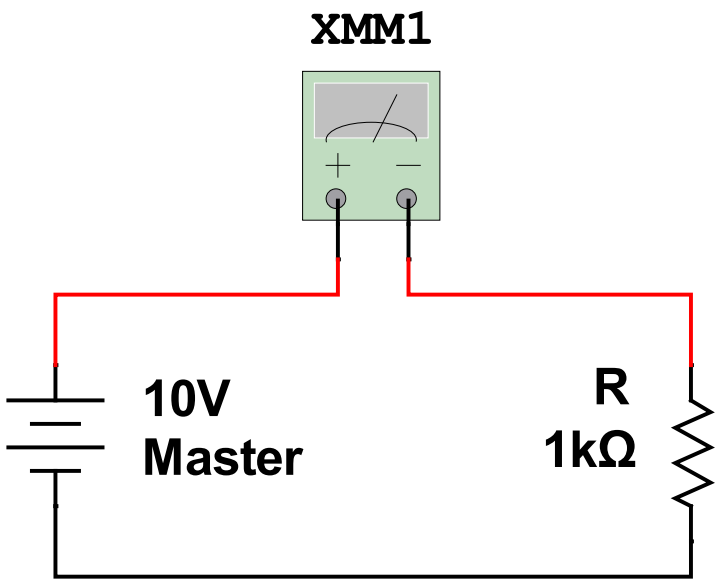
Power supplies at 5 V

Probably discovered that the Tek PS is slightly more accurate.

My own results:

	Setting	Displayed	Measured
Tek PWS 4205	5.000	5.001	5.0010
RSR HY3002-3		5.0	5.0287

Current limit

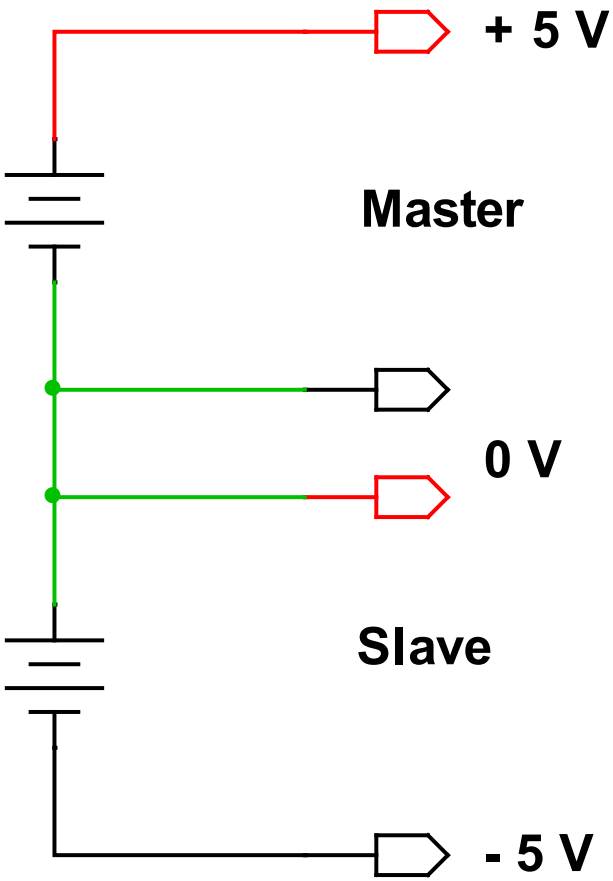


At max current, my results:

	Nominal	Measured
PS	10.0 V	10.069 V
R	1 KΩ	975 Ω
I	10 mA	10.35 mA
I * R	10.0 V	10.091 V

As the current knob was turned CCW, it hit a point where current and voltage began dropping quickly to about 1 mA and 1 V.

Series mode



As you change the master, you change the slave.

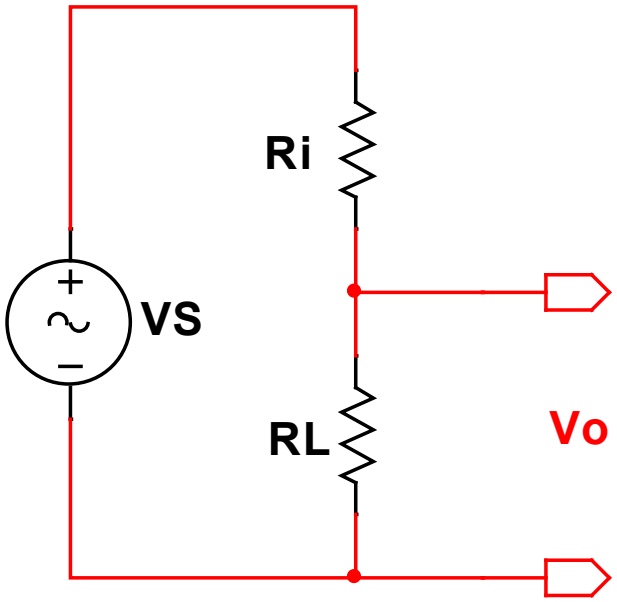
Function generator and oscilloscope

1. Sine wave 5.0 Vpp at 20 KHz with +1.0 V DC offset with measurements of Vpp, frequency and mean.

2. Pulse 2.0 Vpp at 100 Hz 80% duty cycle with measurements of Vpp and frequency and cursors to measure the duty cycle.

Hopefully, everyone was able to do this.

Function generator output resistance



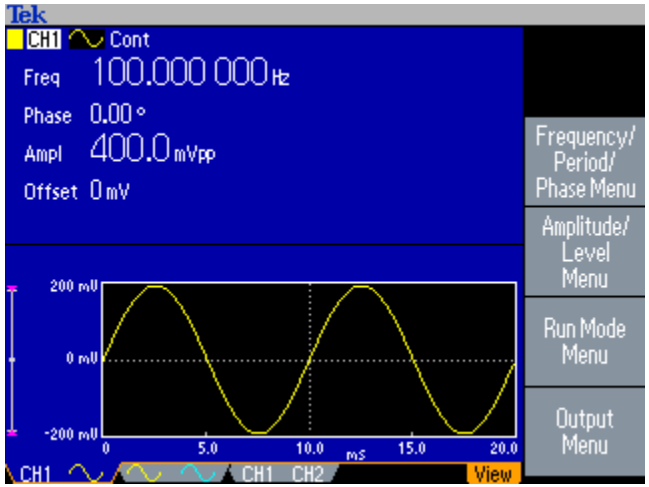
Function generator
Set for 400 Vpp @ 100 Hz
Either High Z or 50 Ω output

RL is either 51 Ω or 27 KΩ

Four combinations

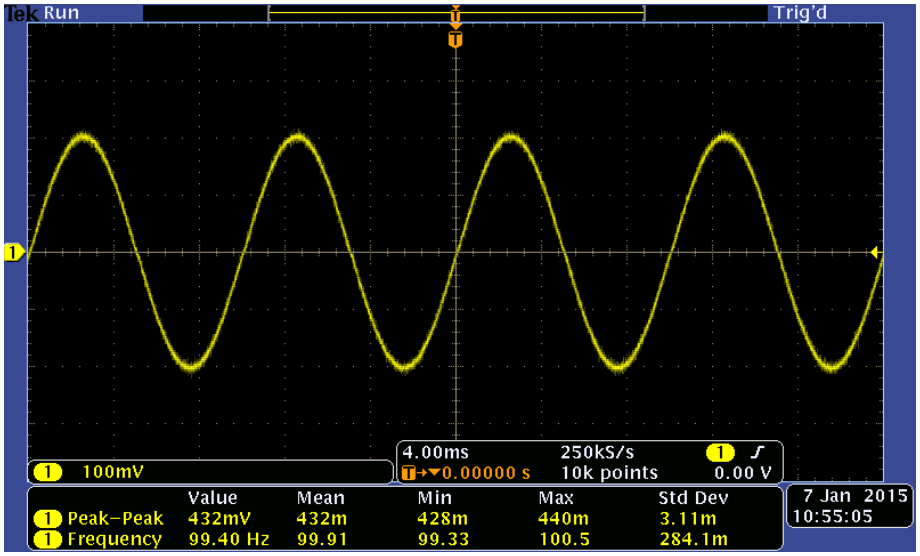
1. 50 Ω output and 51 Ω load
2. 50 Ω output and 27 KΩ load
3. High Z output and 51 Ω load
4. High Z output and 27 KΩ load

50 Ω output

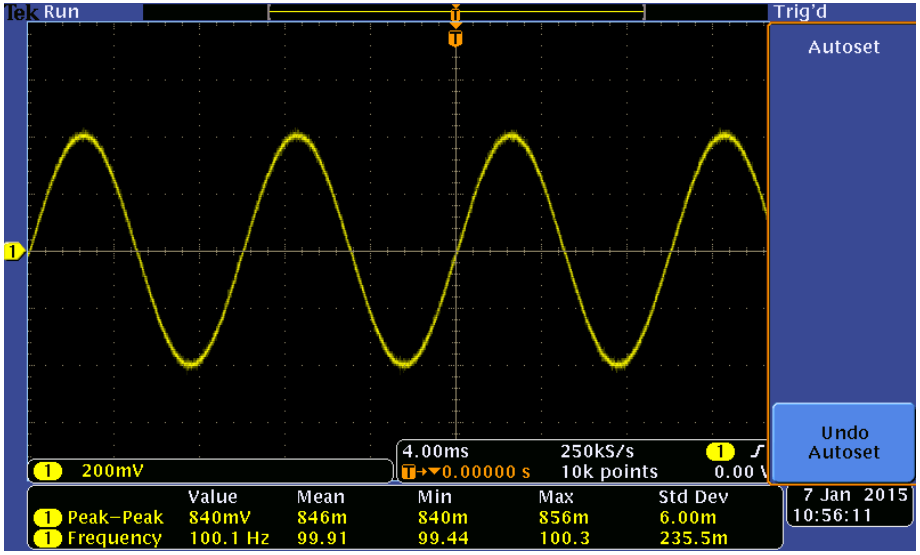


400 mVpp

100 Hz

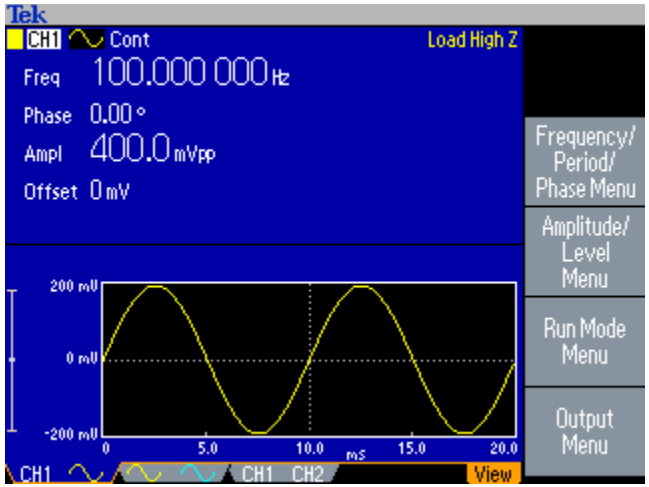


RL1 = 50.46 Ω, Vo1 = 432 mVpp



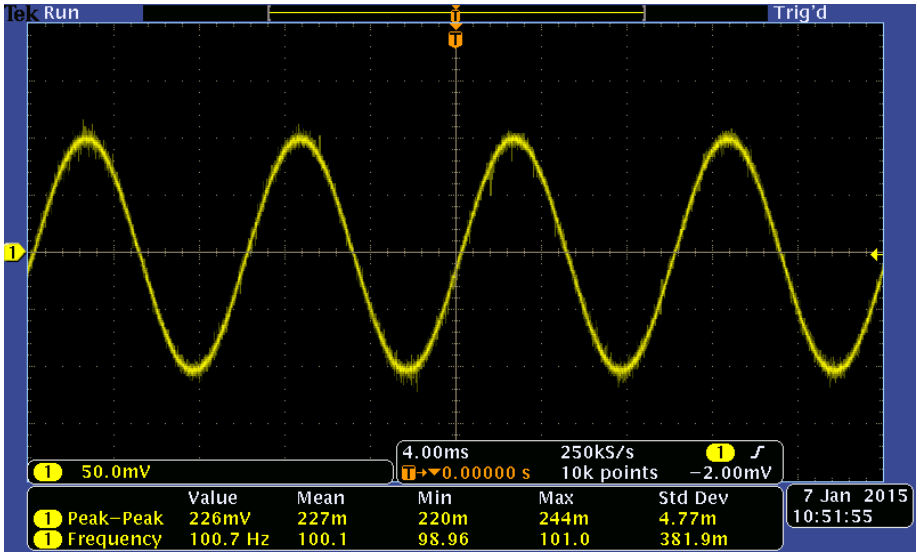
RL2 = 26.51 KΩ, Vo2 = 840 mVpp

High Z output

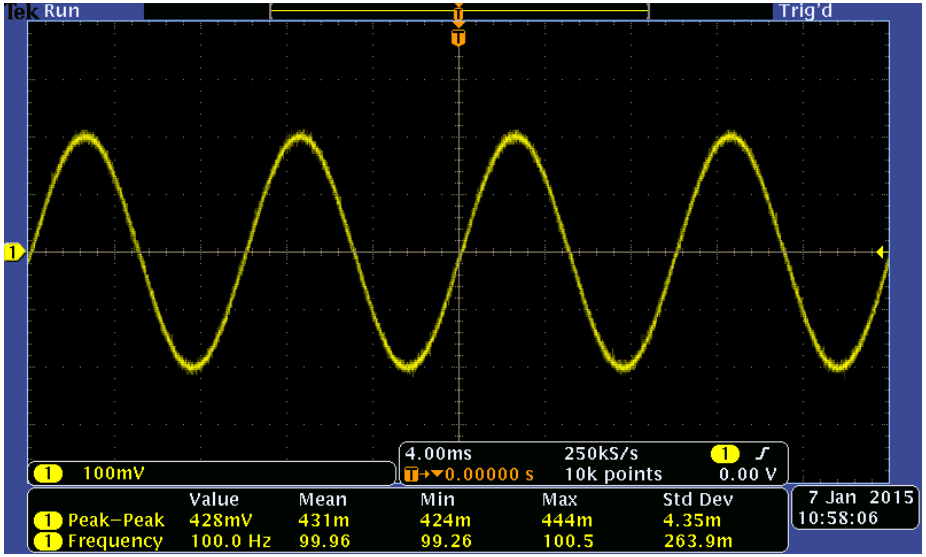


400 mVpp

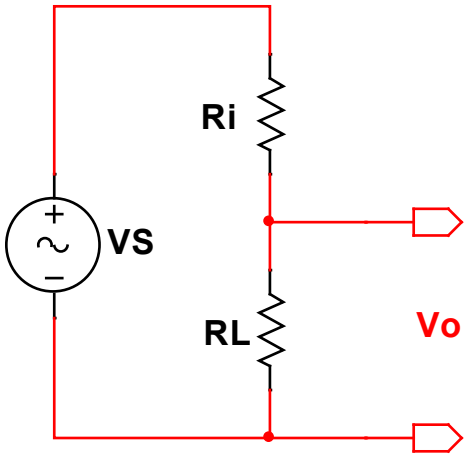
100 Hz



RL1 = 50.46 Ω, Vo1 = 227 mVpp

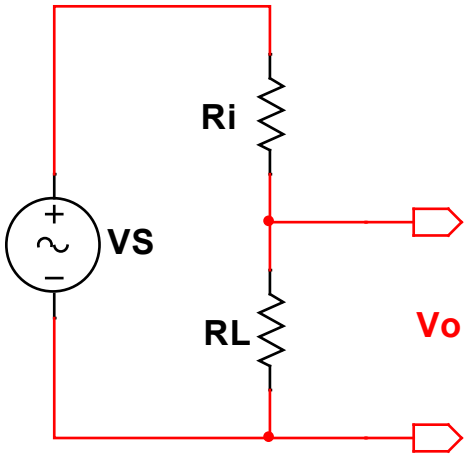


RL2 = 26.51 KΩ, Vo2 = 431 mVpp



Finding Ri

This is a bit of trick question because you don't actually have enough data.



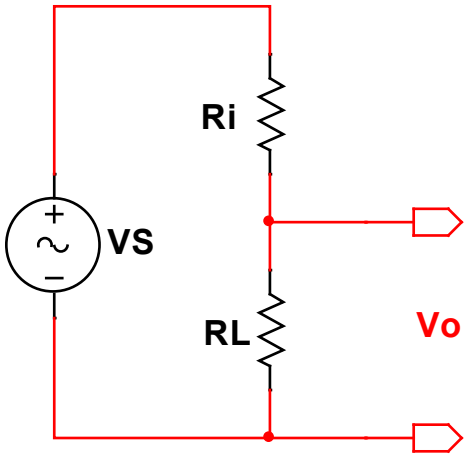
Finding Ri

Let's assume the function generator does indeed have something close to the claimed 50 Ω output resistance.

With RL = 27 KΩ

$$Vo = \frac{27e3}{50 + 27e3} * VS = .9982 * VS$$

So let's approximate VS ≅ Vo2.



$$Vo1 = \frac{RL1}{Ri + RL1} * VS$$

$$Vo1 * (Ri + RL1) = RL1 * VS$$

$$Vo1 * Ri + Vo1 * RL1 = RL1 * VS$$

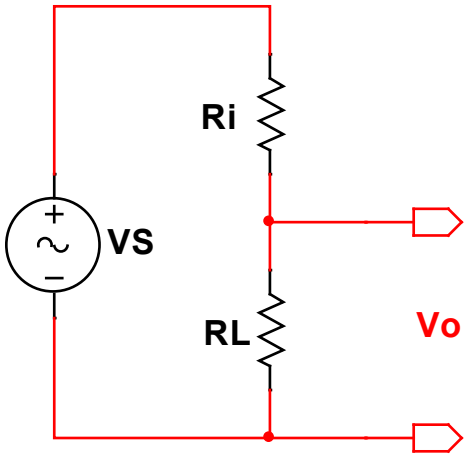
$$Vo1 * Ri = RL1 * VS - Vo1 * RL1$$

$$Vo1 * Ri = RL1 * (VS - Vo1)$$

$$Ri = \frac{RL1 * (VS - Vo1)}{Vo1}$$

Assuming VS ≅ Vo2

$$Ri = \frac{RL1 * (Vo2 - Vo1)}{Vo1}$$



$$Ri = \frac{RL1 * (Vo2 - Vo1)}{Vo1}$$

My own results

RL1 = 50.46 Ω

For 50 Ω output

Vo1 = 432 mVpp
Vo2 = 840 mVpp
Estimated Ri = 47.7 Ω

For High Z output

Vo1 = 227 mVpp
Vo2 = 431 mVpp
Estimated Ri = 45.3 Ω