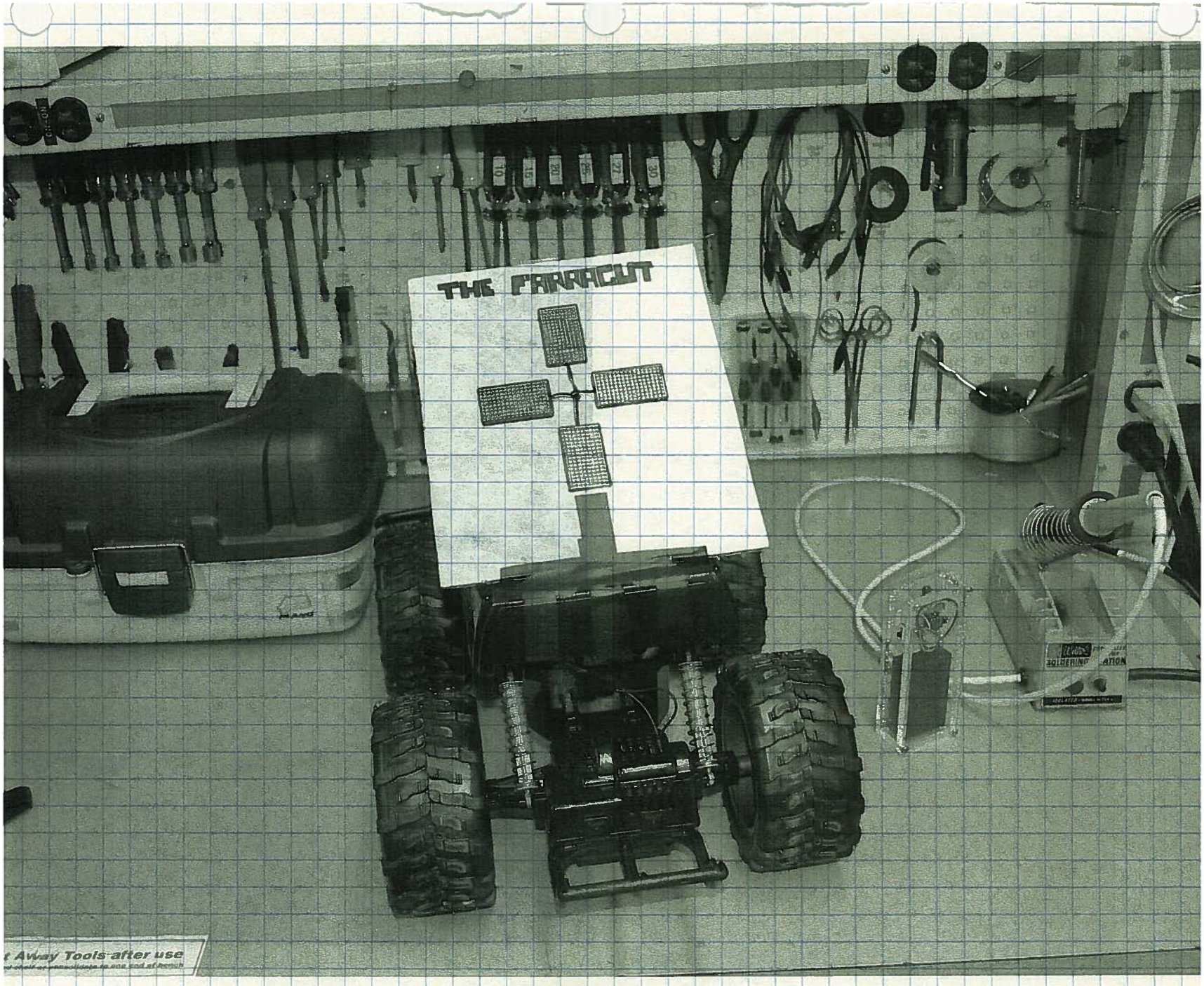
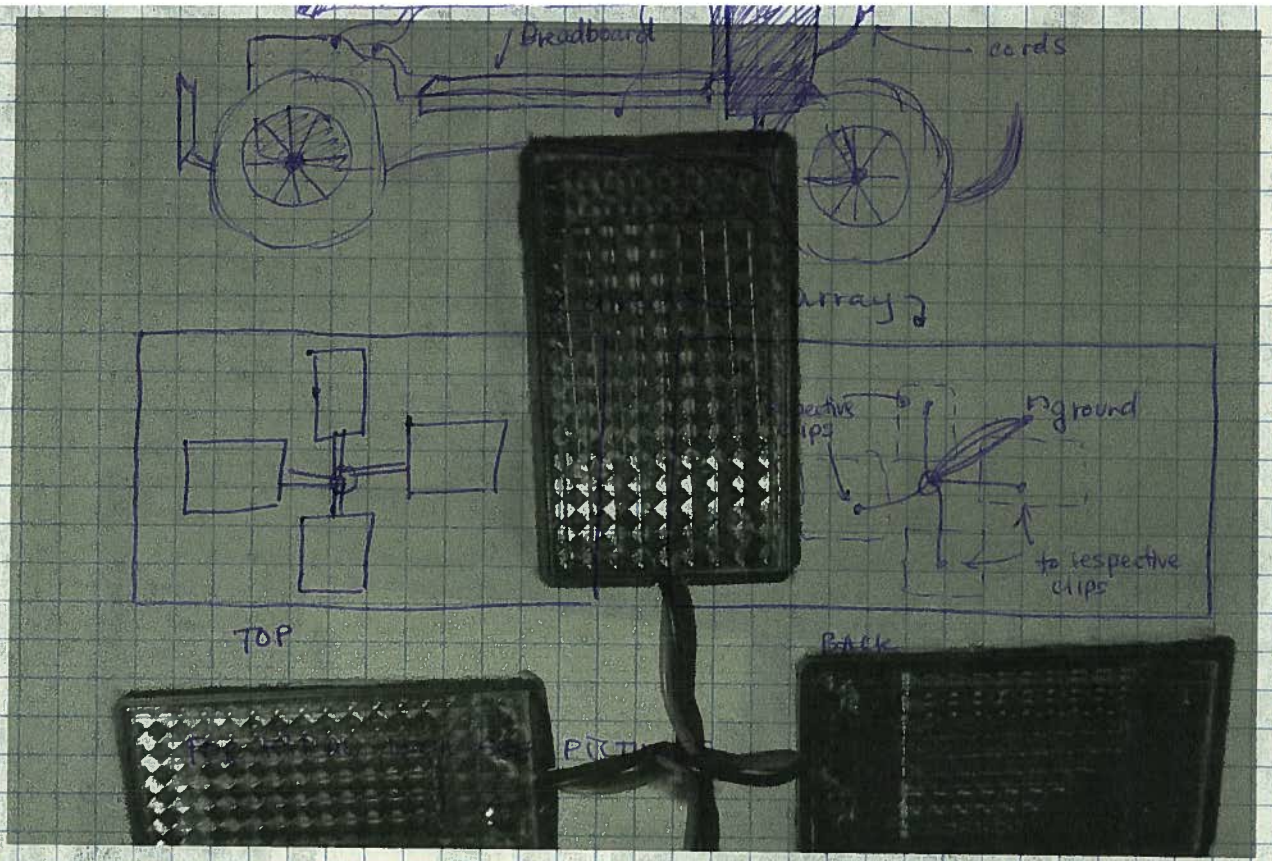
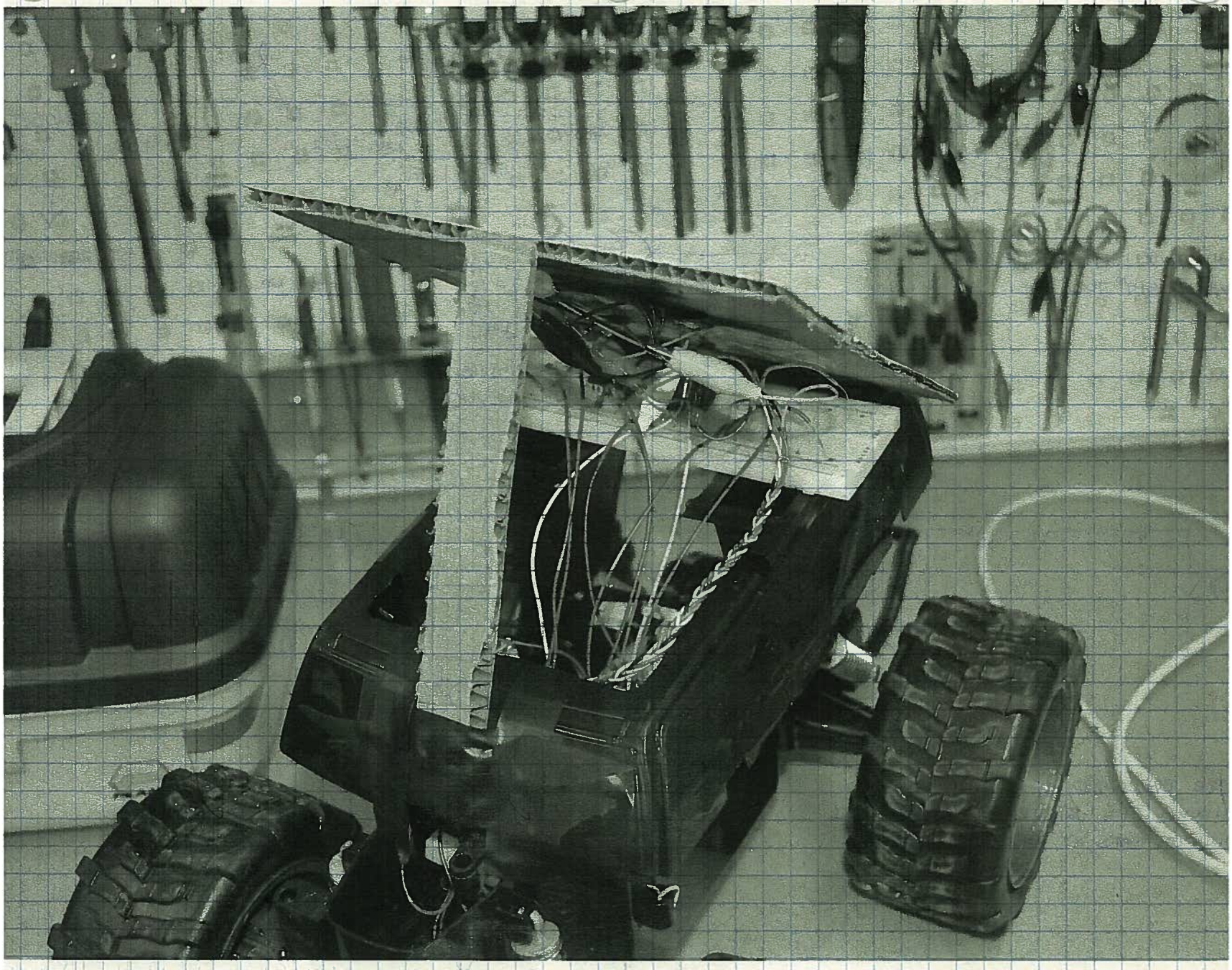
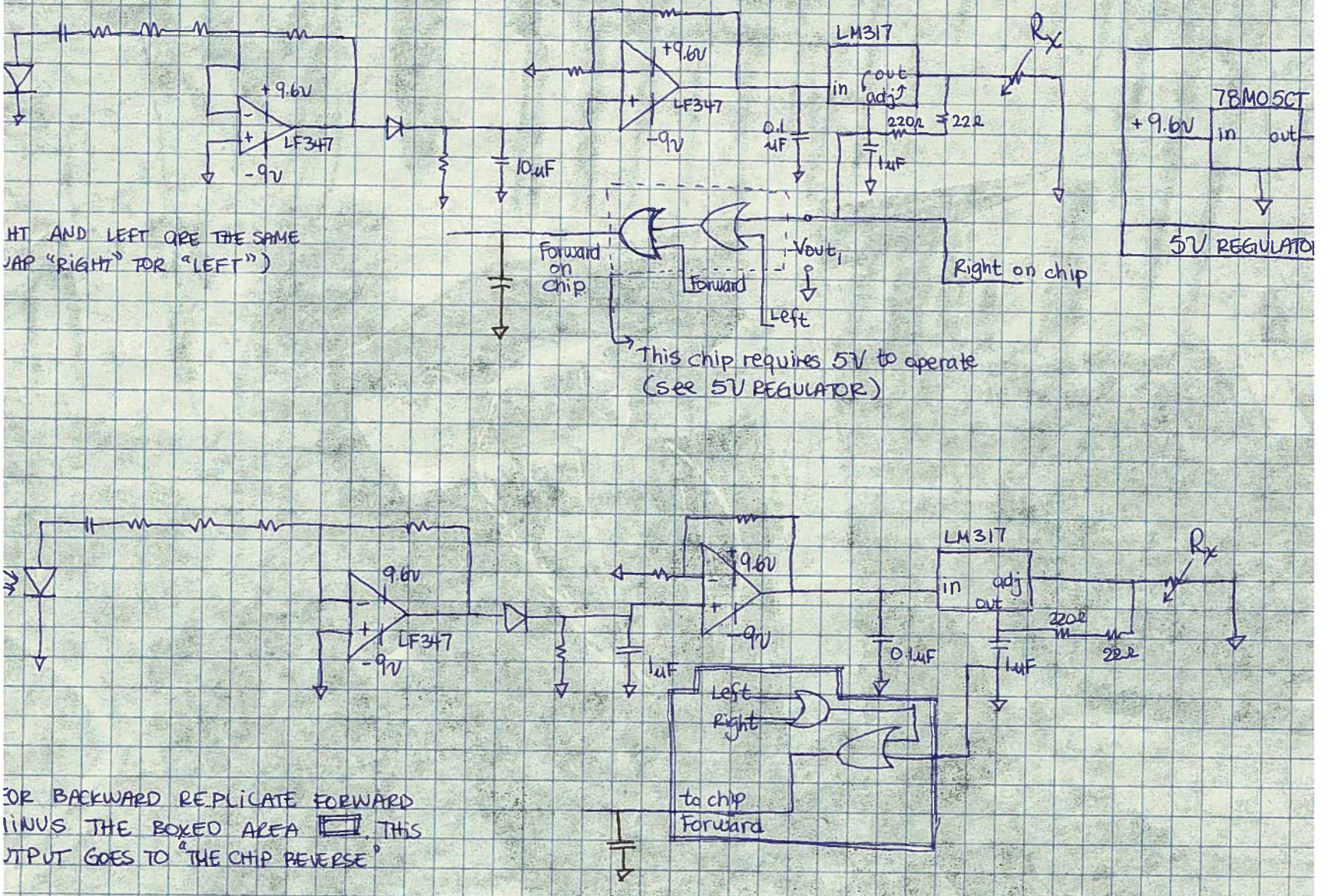
Todo for 2.0

New H-Bridge
Regulate the battery from 9.6V to 8V
power opamps off of 9.6V and 1.5V (2 double(AA) batteries)


THE PARACUT
t Away Tools after use


Breadboard
cords
Array 2
ground
to respective clips
TOP
BACK




+9.6V
LF347
-9V
10uF
+9.6V
LF347
-9V
LM317
in
out
adj
Rx
0.1 uF
220Ω
22Ω
1uF
78M05CT
+9.6V
in
out
5V REGULATOR
Forward on chip
Forward
Vout1
Left
Right on chip
This chip requires 5V to operate
(see 5V REGULATOR)
HT AND LEFT ARE THE SAME
AP "RIGHT" FOR "LEFT")
9.6V
LF347
-9V
1uF
+9.6V
-9V
LM317
in
adj
out
Rx
220Ω
22Ω
0.1uF
1uF
Left
Right
to chip
Forward
OR BACKWARD REPLICATE FORWARD
INUS THE BOXED AREA. THIS
UTPUT GOES TO "THE CHIP REVERSE"
Rx needs adjusted to output between ≈1.7V and <3.0
if this exceeds 3.0V the car will burn out it's ir
circuitry.
Consider a capacitor (shown in black) to fi
any spikes in voltage.

To make it sustain right and left (about 2 seconds)

	Left	0V
	Forward	1.6V
	Reverse	0V

2.1 - 1.6 = 0.5
≒ 23%

LEFT

Right	0V
Left	3.24V
Forward	0.84V
Reverse	0V

3.24 - 0.84 = 2.4
≒ 74%

FORWARD

Right	0V
Left	0V
Forward	2.28V
Reverse	0V

WRONG! lost our 9V battery

~~REVERSE~~ ~~LEFT~~

Right	0V
Left	0V
Forward	0V
Reverse	1.50V

VOLTAGES @ OPAMP OUT (@ Regulator out)

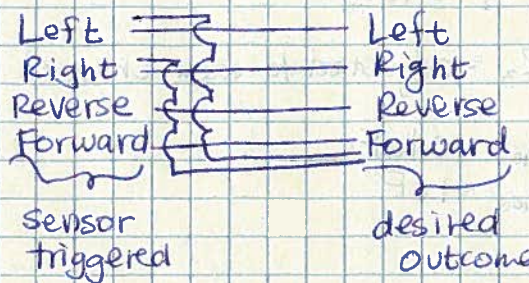
RIGHT	Ri	5.69V	2.0V	THIS TRIGGERS JUST FINE
	L	0.06V	0.0V	
	F	0.03V	1.55V	THIS DOES NOT
	Re	0.0V	0.0V	
LEFT	Ri	0.10V	0.0V	
	L	~~0.06V~~ 4.63V	3.13V	THIS TRIGGERS FINE
	F	0.03V	0.79V	THIS DOES NOT
	Re	0.01V	0.0V	
REVERSE	Ri	0.10V	0.0V	
	L	0.05V	0.0V	
	F	0.03V	0.0V	THIS TRIGGERS JUST FINE
	Re	~~6.40V~~ 7.36V	1.50V	
FORWARD	Ri	0.10V	0.0V	
	L	0.05V	0.0V	
	F	6.71V	2.15V	THIS TRIGGERS JUST FINE
	Re	0.0V	0.0V	

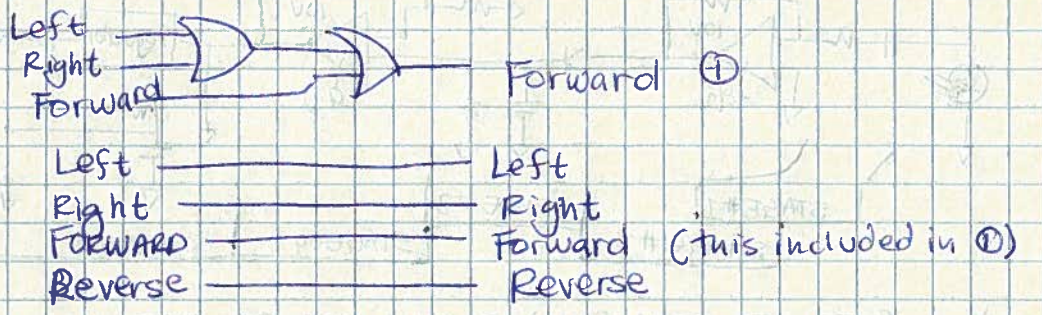
THIS SHOWS THAT OUR DIODE SYSTEM DOES NOT WORK CORRECTLY. WE NEED SOME SIMPLE DIGITAL LOGIC

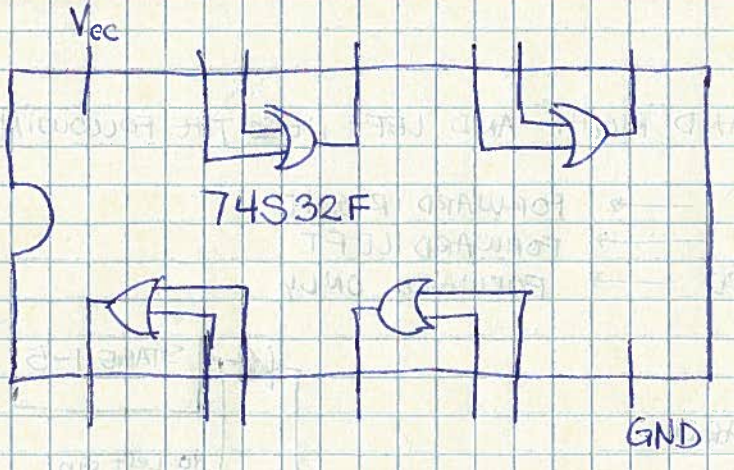
TO DO BOTH FORWARD AND A TURN. (see voltage tables to right)

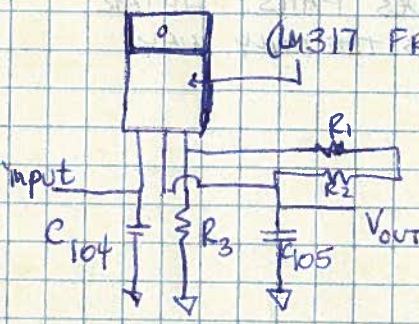
THE AFORE MENTIONED SYSTEM OF DIODES FAILS. AFTER RESEARCH IT APPEARS DIGITAL LOGIC IS THE ONLY WAY

LOGIC TREE









NOTE: THESE ARE GIVEN AS FREE SAMPLES TO PEOPLE WITH VALID REASONS. MINE WAS "STUDENT"

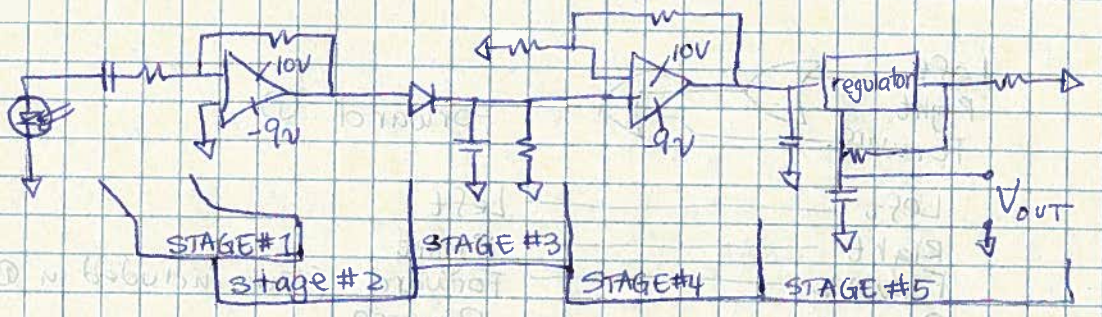
$R_1 + R_2 = 242\Omega$

R_3 = adjusted to each channel

$C_{104} = 0.1\mu F$

$C_{105} = 1\mu F$

THEREFORE ONE CHANNEL:

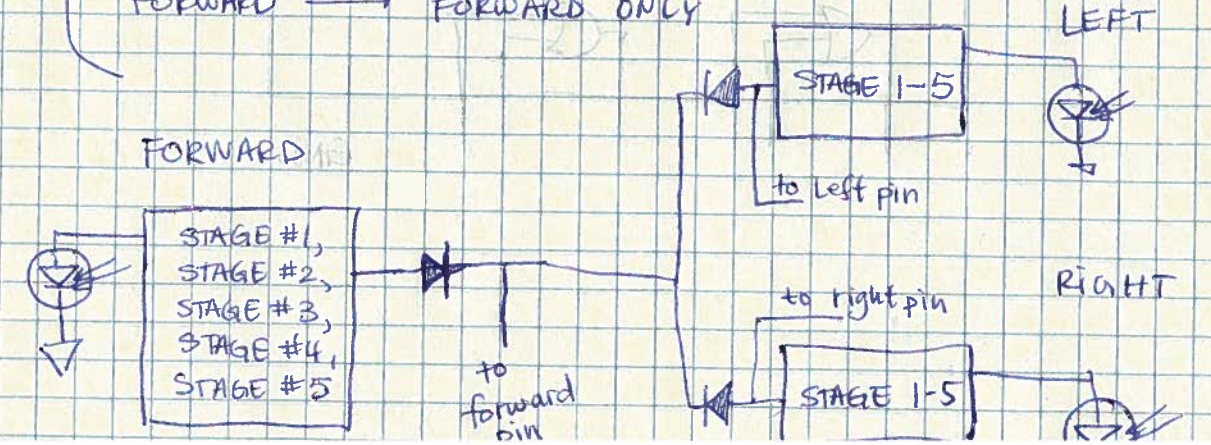


V_{OUT} GOES INTO EACH PIN INTO OUR ~~OUR~~ RC CAR.

PROBLEM:

FORWARD AND RIGHT AND LEFT NEED THE FOLLOWING RELATIONSHIP:

WHEN { RIGHT ⟶ FORWARD RIGHT
LEFT ⟶ FORWARD LEFT
FORWARD ⟶ FORWARD ONLY



DISTANCE FROM SENSOR NEEDS TO NOT CHANGE [illegible] OUR TWO STAGES. IS THIS SO?

QUESTION: WHAT ARE THE OPERATING CONDITIONS OF THE RECIEVER? IE. WHAT RANGE CAN THE SIGNAL BE? 2.5V-3V? OR 3V-3.3V? NEED TO KNOW. SET OUTPUT TO THE MIDDLE OF THIS RANGE OR UPPER 2/3'S, SO WHEN BATTERY DRAINS IT STILL WORKS.

ANSWER: IT APPEARS THAT THE DATASHEET SHOWS

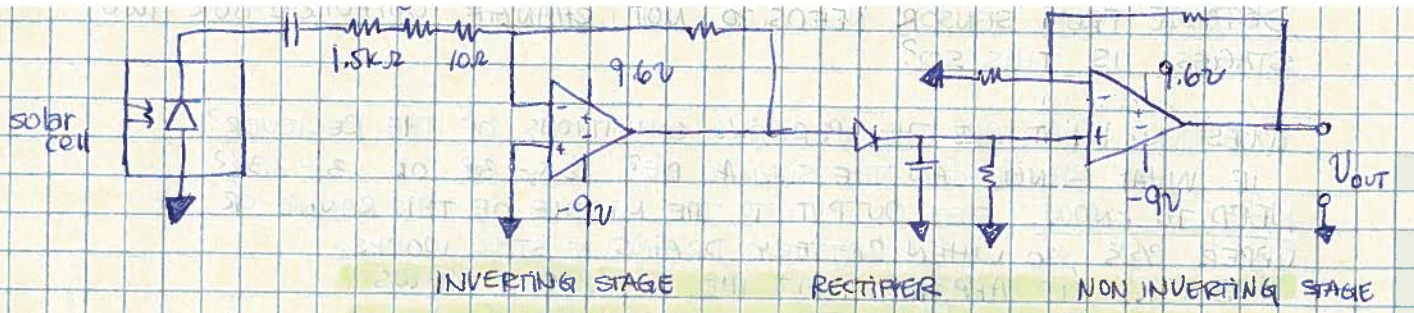
V_{OUT} =	2.7V ↔	2.7V ↔	2.7V	2.5V	2.8V	3.1V
I_{OUT} =	???	0.2mA	10mA	???	0.8mA	???
	MIN	~~MAX~~ TYPICAL	MAX	MIN	TYP	MAX

??? = unlisted

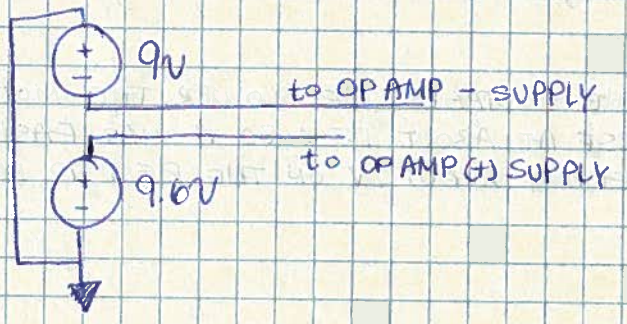
NO DC-DC CONVERTER | DC-DC CONVERTER

FULL SPEC SHEET @
http://instructables.com/files/orig/FWW/CD13/GV525G0X/FWWCD13GV525G0X.pdf
OR SEARCH TX2 RX2 datasheet

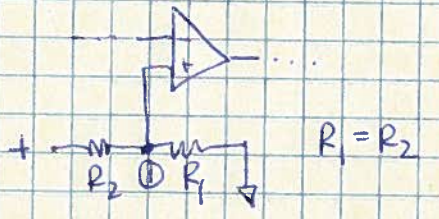
AS IT TURNS OUT, THE LOWER THE VOLTAGES, THE SLOWER THE MOTORS GO. I INTENTIONALLY PUT REVERSE AT ABOUT 1.5V SO IT WAS EASIER TO CONTROL. I AM ALSO CONSIDERING ABOUT 2V ON THE REST TO MAKE STEERING EASIER.



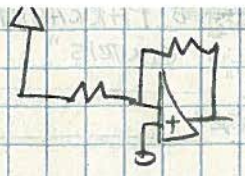
NOTE THAT THE OPAMP HAS TWO DIFFERENT SUPPLYS. THIS IS NOT ACCIDENTAL. THE -9V SUPPLY COMES FROM A 9 VOLT BATTERY, WHERE AS THE +9.6V COMES FROM THE CAR BATTERY ITSELF. THIS WIRING CONFIGURATION IS SHOWN BELOW



THIS IS NECESSARY BECAUSE WE NEEDED TO DECOUPLE THE OUTPUTS OF THE OPAMP. WITH THE SETUP WITH AN ARTIFICIAL GROUND:



WHEN THE ~~SIGNA~~ SIGNAL WAS ON NONE OF THE CHANNELS, THERE WAS NO PROBLEM. HOWEVER, WHEN A SIGNAL WENT HIGH ON ONE OF THE FOUR CELLS, ALL THE OUTPUTS WENT HIGH. AFTER EXTENSIVE TESTING I NOTICED THAT UPON TRIGGERING A SIGNAL, THE VOLTAGE AT ① CHANGED. FOR THIS TO BE A GROUND, THIS CAN NOT HAPPEN. THEREFORE THERE NEEDS BE A CHANGE, OR DECOUPLING OF THE GROUND. THE ONLY WAY TO DO THIS WAS TO REMOVE THE OPAMP POWER SUPPLY FROM THE MIX OF IT ALL. THUS WE HAVE THE OUTCOME SHOWN.



DOES NOT WORK
CAN'T GET OUR SOLAR CELL TO ACT AS A DIODE.
UNKNOWN REASON

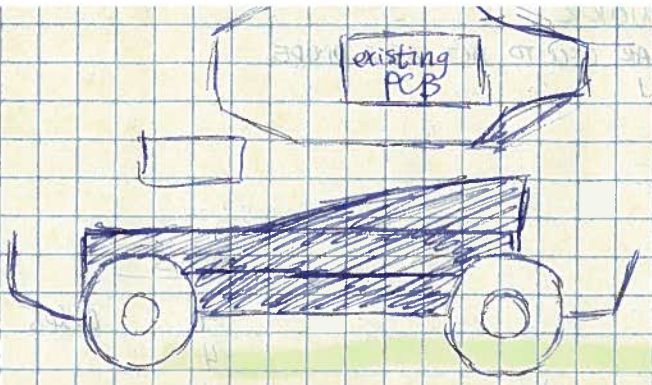
PARTS LIST

				TOTALS	
✓	✱ solar cells			4	4.45
✓	10Ω			4	
✓	82Ω	U	filter x4	4	
✓	1.5kΩ	U		4	
✓	0.01μF	100pF U		4	
✓	1μF	U	stage 2 x4	4	
✓	IN4148	diode U		4	
✓	1kΩ	U		4	
✓	47kΩ	U		4	
✓	560k	U	stage 1 x4	4	
✓	10k	U → ground	stage 2 x4	8	
	10k	U	Voltage divider x2		
	10k	U			
✓	LF347	U	x2	2	0.45

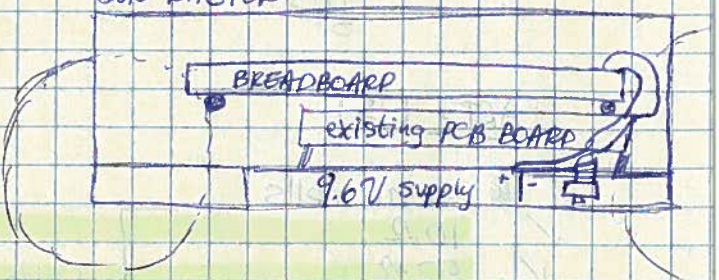
$0.04 each = 32 x 0.04 = $1.28
$0.1 each = 8 x .1 = $0.80

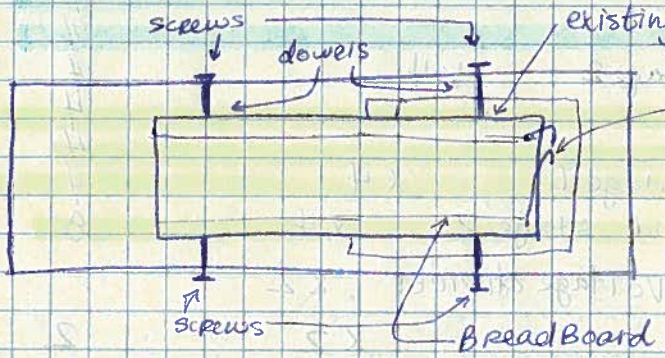
17.8 (solar)
0.9 LF347
0.8
1.28
$20.78

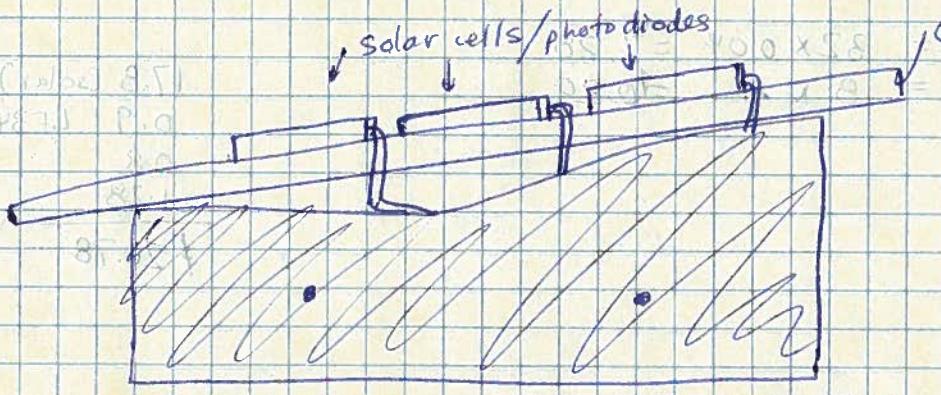
THE FOLLOWING MUST BE REPEATED FOUR TIMES TO HAVE



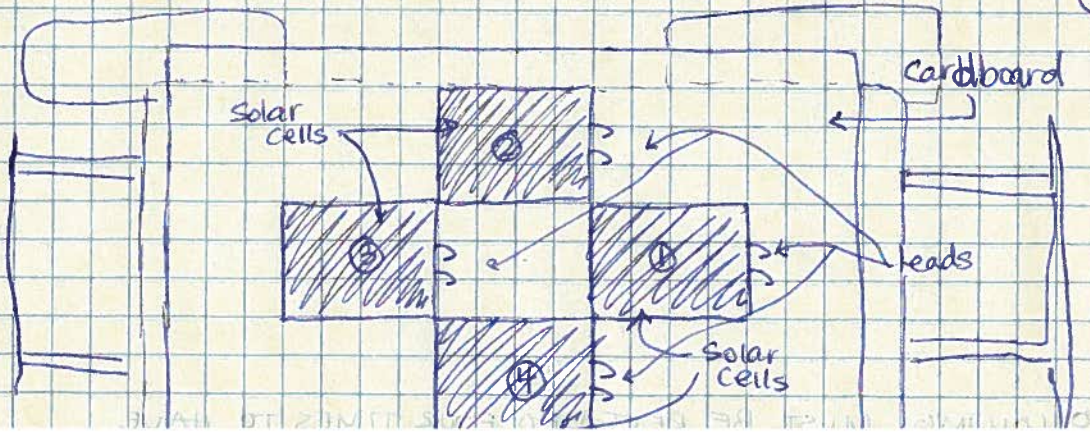
Oriental [redacted] THRAGUT
"COPERNICUS CENTRIS"
"MODEL HZ"
"SUN RACYER"



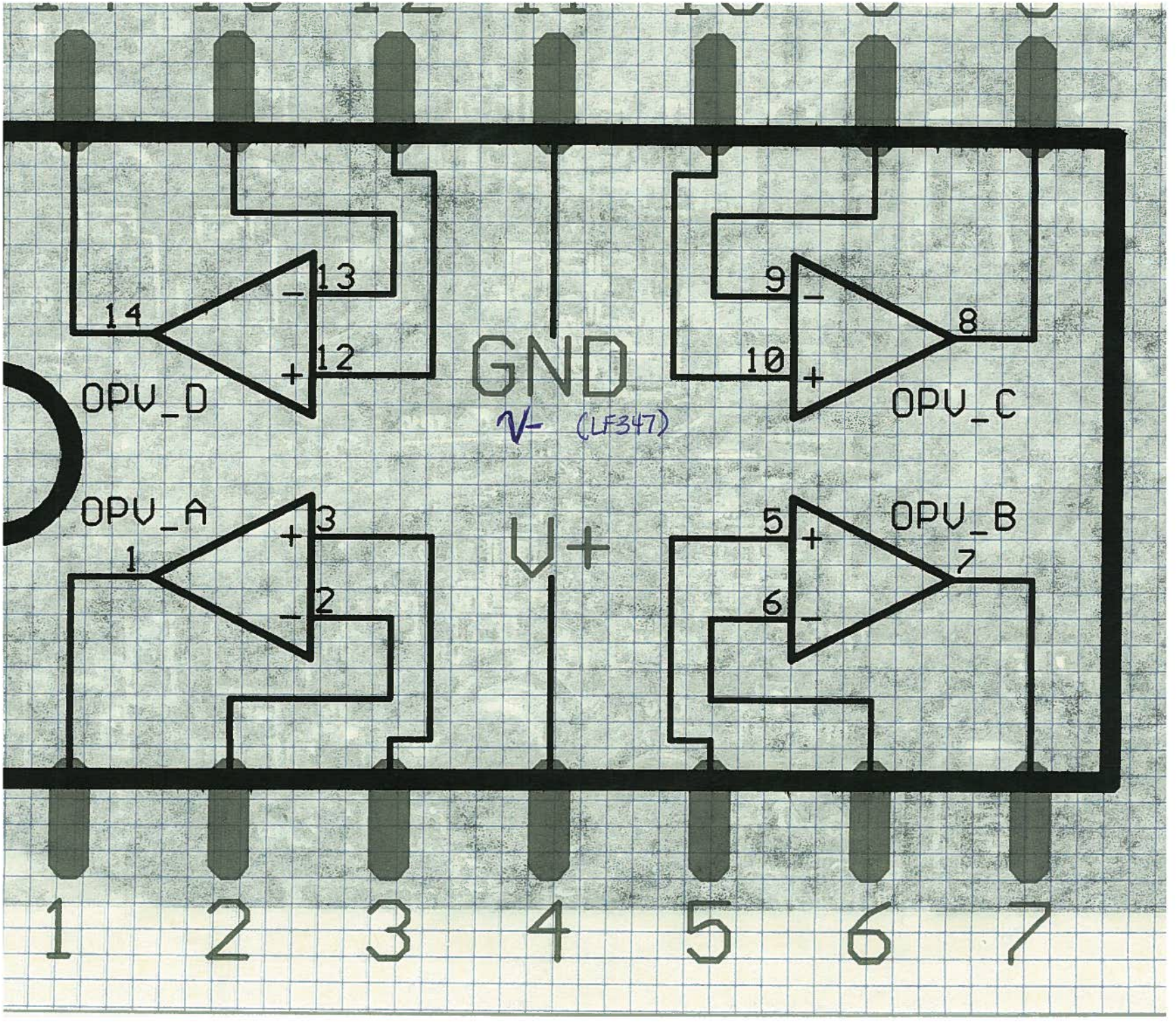




① FORWARD
② FORWARD LEFT
③ REVERSE
④ FORWARD RIGHT

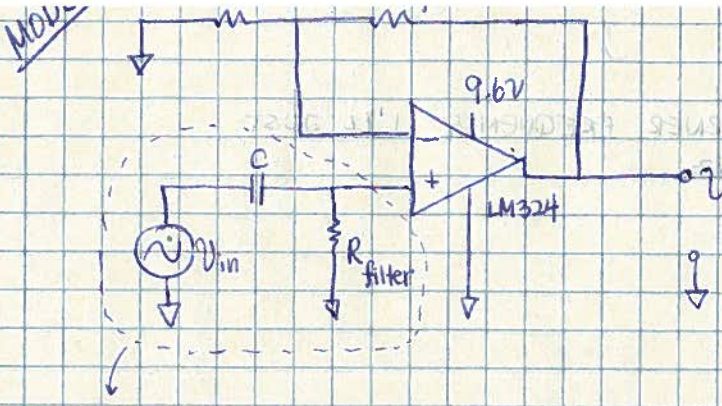


470
© 2007
NEW BRIGHT
R288-2
220
25V
222
101
HY1DB
HP5YB
ANT
GND


OPV_D
14
13
12
OPV_C
9
8
10
GND
V- (LF347)
OPV_A
1
3
2
V+
OPV_B
5
7
6
1
2
3
4
5
6
7

INFRARED ≈ 10^{15}

THIS DOES NOT AFFECT OUR CORNER FREQUENCY. I'LL JUST LEAVE IT AS DESIGNED @ 10KHz.



$A_{MB} = \frac{R_f + R_2}{R_2}$ (SHOULD BE AS CALCULATED PREVIOUSLY)

THIS IS OUR HIGH PASS FILTER. IT SHOULD HAVE NO PROBLEM B/C IT HAS NO AFFECT ON GAIN. IT SHOULD BE PURLY A FILTER.

WHICH is CORRECT? MODEL 1 OR MODEL 2 OR BOTH?

PREDICTION: MODEL #2 WILL BE MORE STABLE BECAUSE C IS NOT COUPLED TO OUR OTHER RESISTORS OR OUR OUTPUT.

$180k = R_f$

$184 = \frac{180k + R_2}{R_2}$

$184R_2 = 180k + R_2$

$183R_2 = 180k$

$R_2 = 180k / 183 = 983.6\Omega$

$\approx 820 + 150$

983
−820
163
−150
13

UNUSED

$180k = R_2$

$184 = \frac{R_f + 180k}{180k}$

$(184)(180k) = R_f + 180k$

$(184)(180k) - 180k = R_f = 32.9\ M\Omega$

$F = \frac{R_2}{R_2 + R_f} = \frac{970}{970 + 180k} = 0.00536$

$f_{H_i} = GBW * F \qquad GBW = 1\ MHz$

$= 1MHz\,(0.00536) = 5360\ Hz$

712mV 1.168V

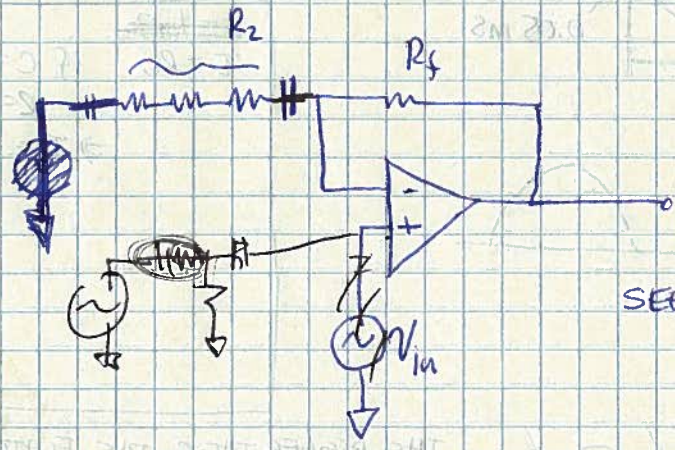
NEITHER MODEL SEEMS TO WORK. I'M GOING BACK TO TRY THE LF347.

0.010V

$1592(184-1) = R_f$

$(183)(1592) = 292928$

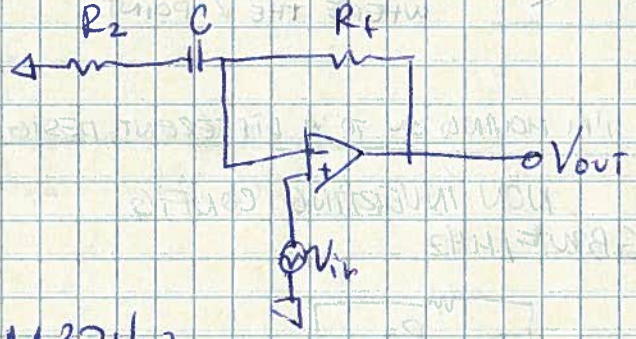
$= 293\ k\Omega$ ≈ 270k + 22kΩ



$GAIN = 1 + \frac{R_f}{R_2}$

SEE NEXT PAGE

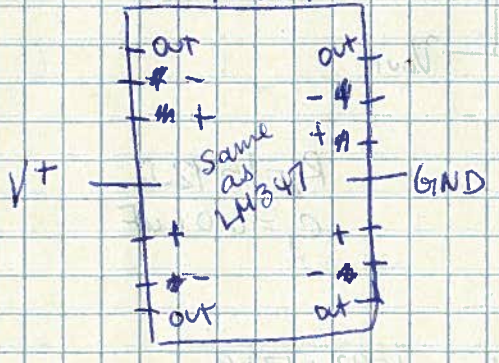
MODEL 1



$Gain = 1 + \frac{292k\Omega}{1592\Omega}$

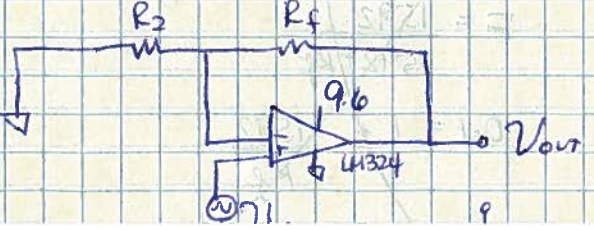
$= 184\ V/V$

LM324N



3/8/13

As shown above I've not had success with. So I'm going to attempt a simple version of this with just a simple gain, no filters.



$A_{MB} = \frac{R_2 + R_f}{}$

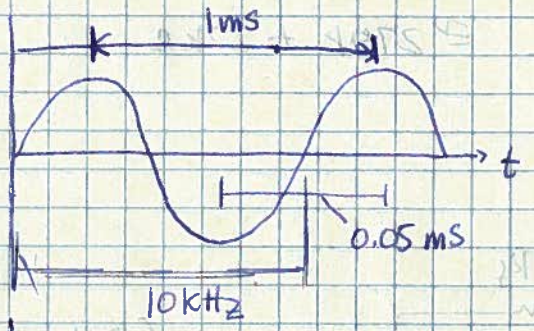
10kHz → $\frac{1}{10\text{Hz}}$ = period = 0.0001 s

1ms

THEORY

$\tau = RC$ time constant

$e^{-t/\tau}$ is the decay of (↓) on $V_{OUT(DC)}$



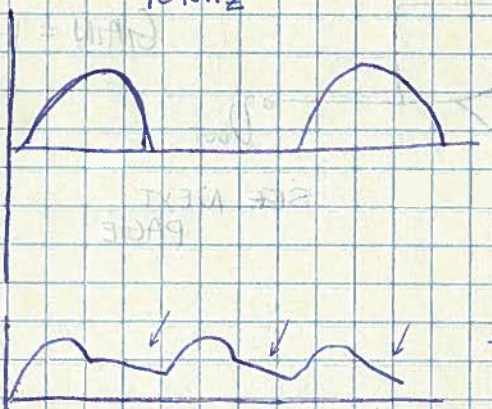
~~t = 1ms~~

$\tau = RC$ if C = ~~1uF~~ 100uF ?

R = 1kΩ ?

→ $\tau = 0.1$

①



$V_{OUT(DC)}$

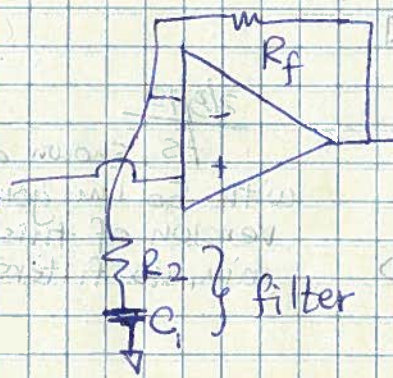
THE BIGGER THE C, THE FLATTER THE SLOPES WHERE THE ↓ POINT.

I CAN'T FIX OUR DIODE PROBLEM, SO I'M MOVING ON TO A DIFFERENT DESIGN

LM324N $0.74 31248 NON INVERTING CONFIG

↳ GBW = 1MHz

$F = \frac{R_2}{R_2+R_f}$ $A_{MB} = \frac{R_2+R_f}{R_2}$



$f_H = GBW * F$

$\frac{10\text{kHz}}{1\text{MHz}} = F$

$0.1 = F$

$R_2 = 1592\Omega$

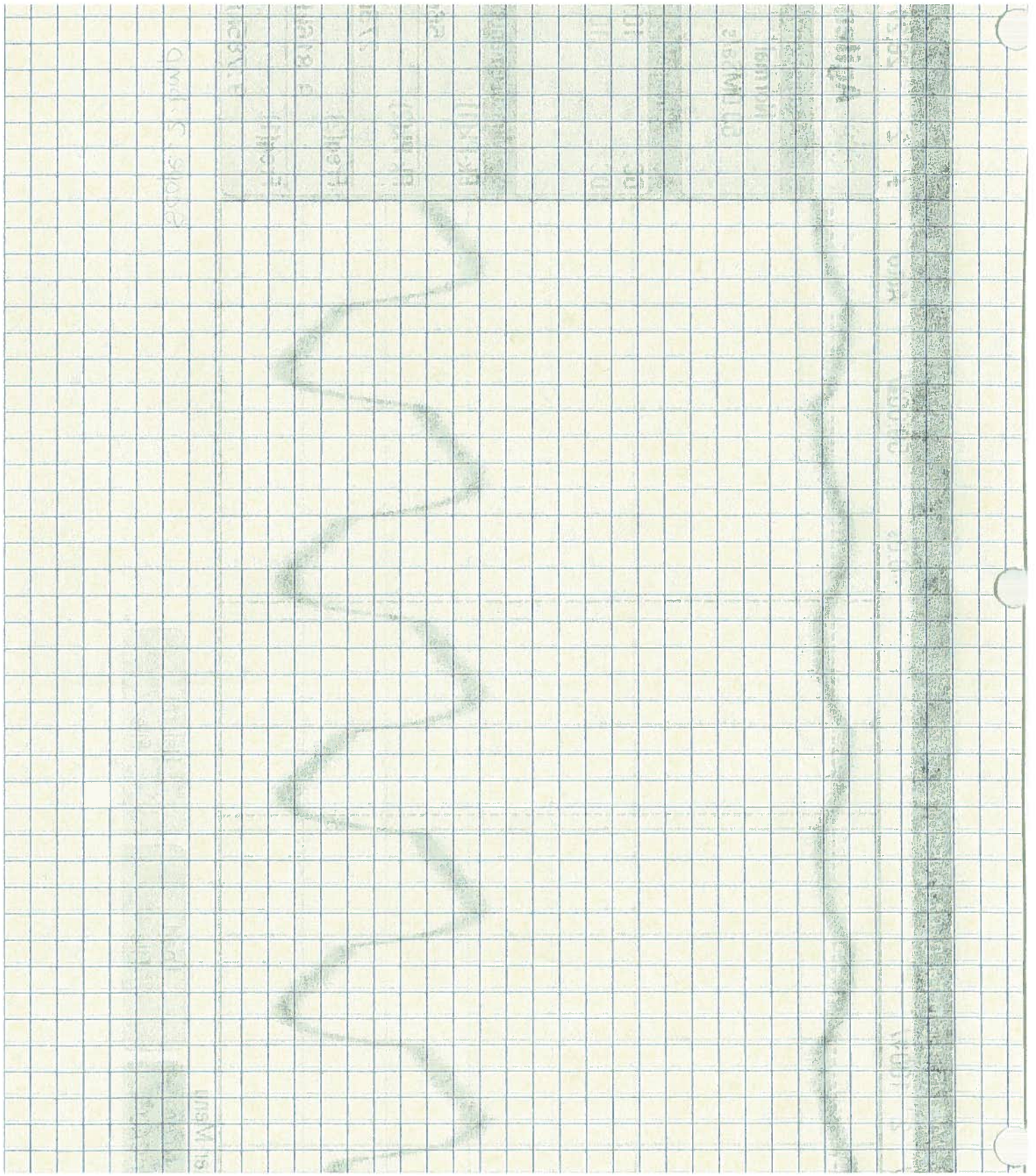
$C_1 = 0.01\mu F$

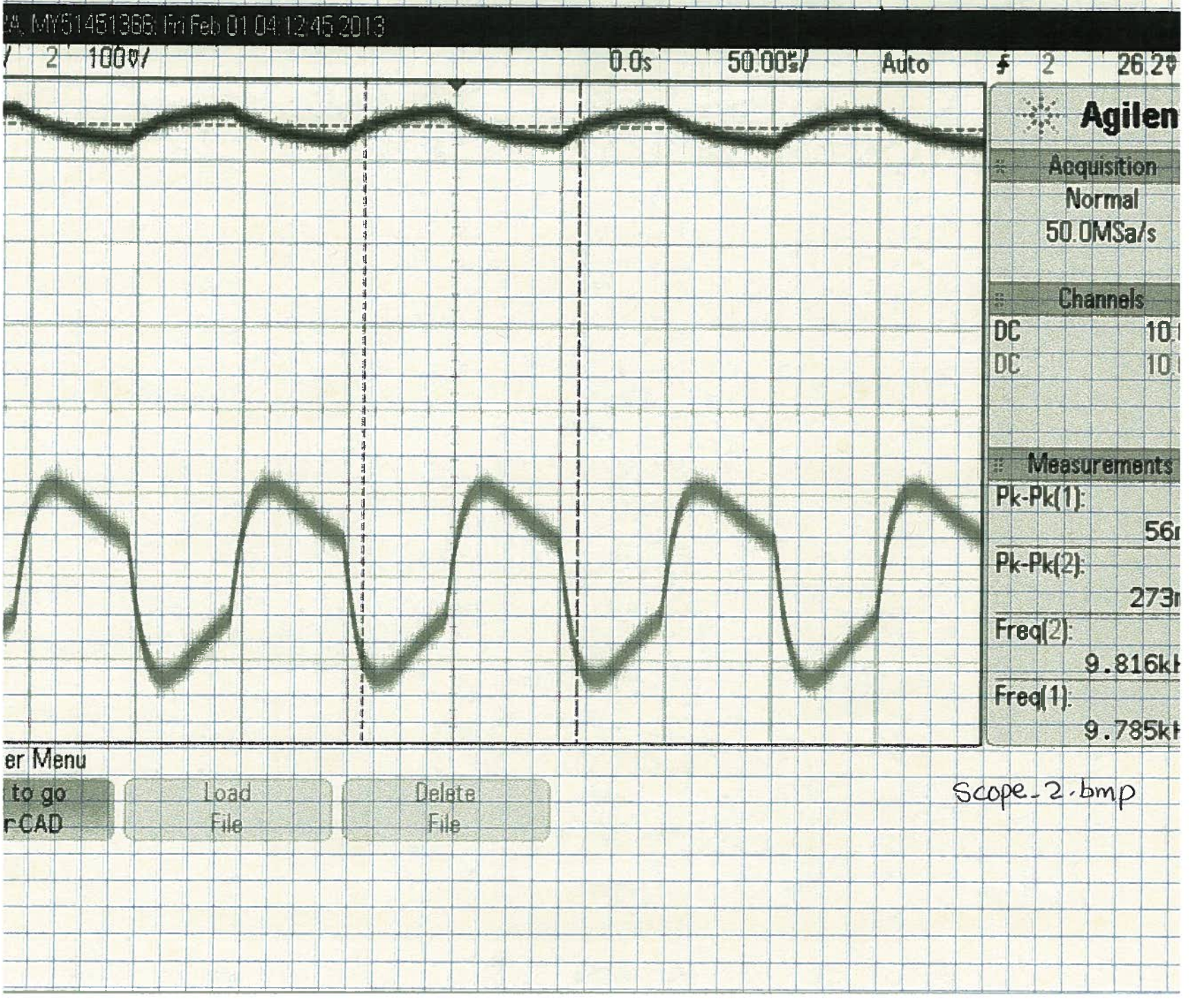
$F = \frac{1592}{1592+R_f}$

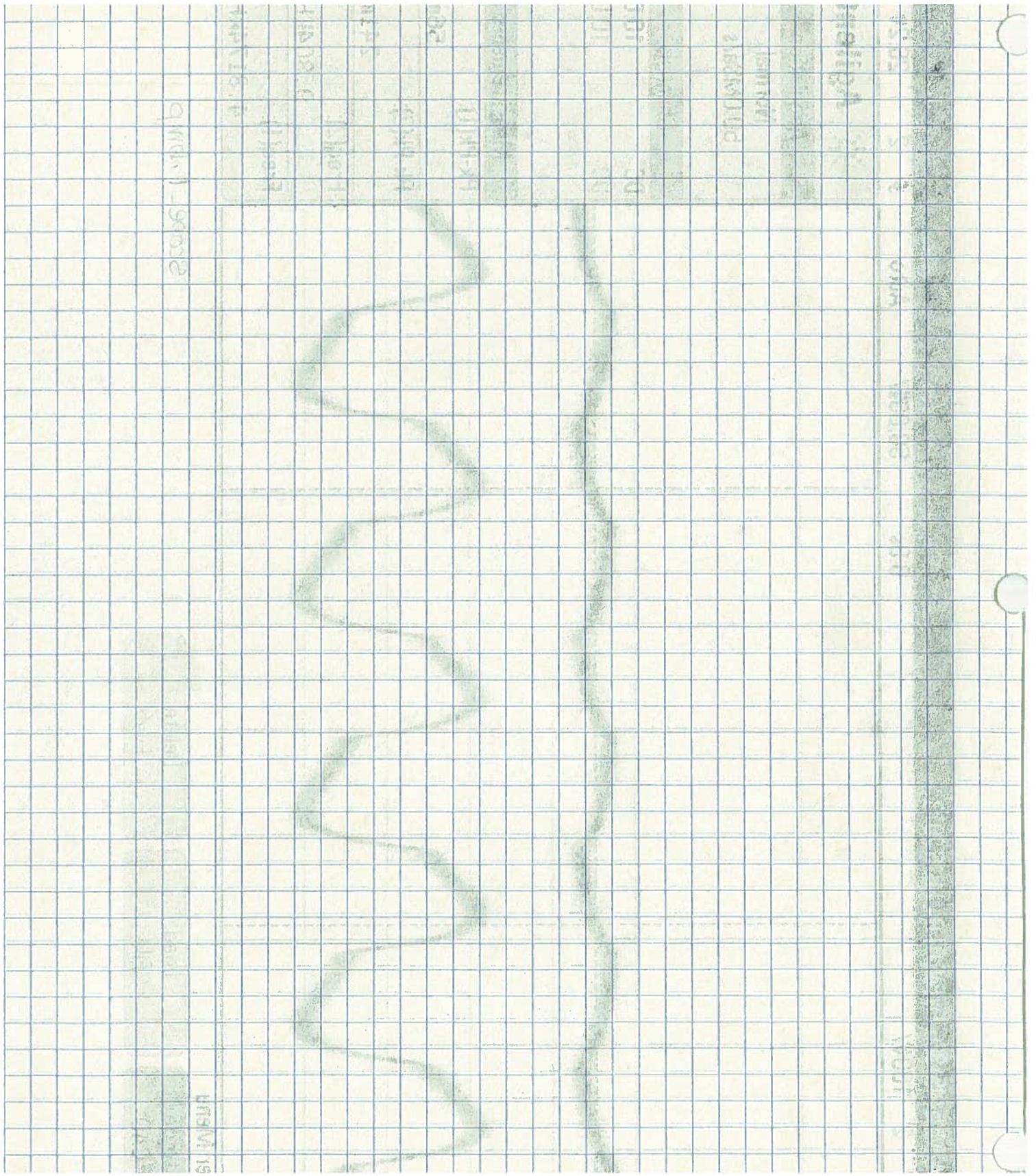
$0.1 = 1 + \frac{1592}{R_f}$

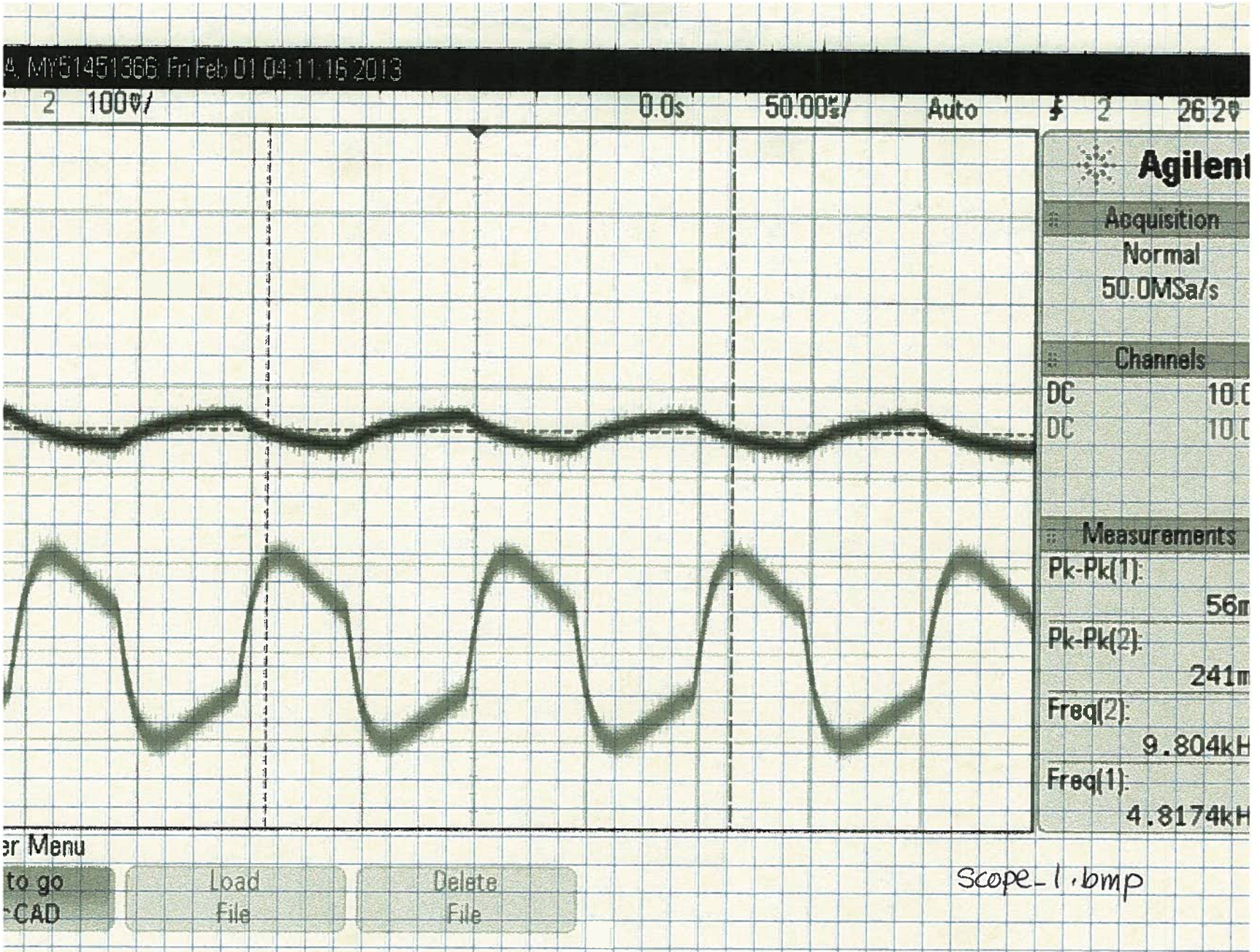
~~$A_{MB} = \frac{1592+1769}{1592}$~~

$A_{MB} = \frac{1592}{} + \frac{R_f}{}$

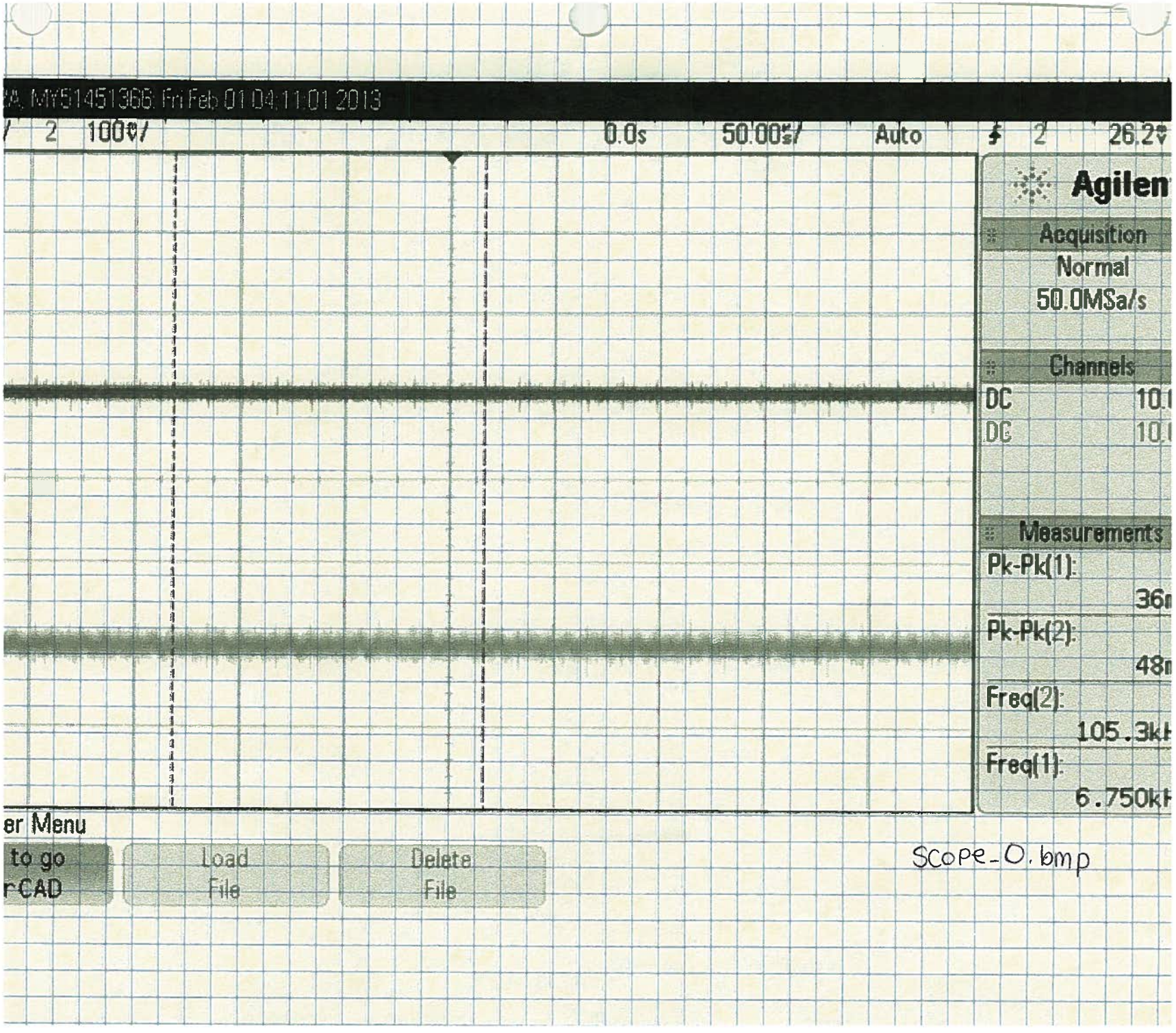



MY51451366: Fri Feb 01 04:12:45 2013
2 100mV/
0.0s
50.00ns/
Auto
2 26.2
Agilen
Acquisition
Normal
50.0MSa/s
Channels
DC 10
DC 10
Measurements
Pk-Pk(1):
56
Pk-Pk(2):
273
Freq(2):
9.816k
Freq(1):
9.785k
er Menu
to go
rCAD
Load
File
Delete
File
Scope_2.bmp

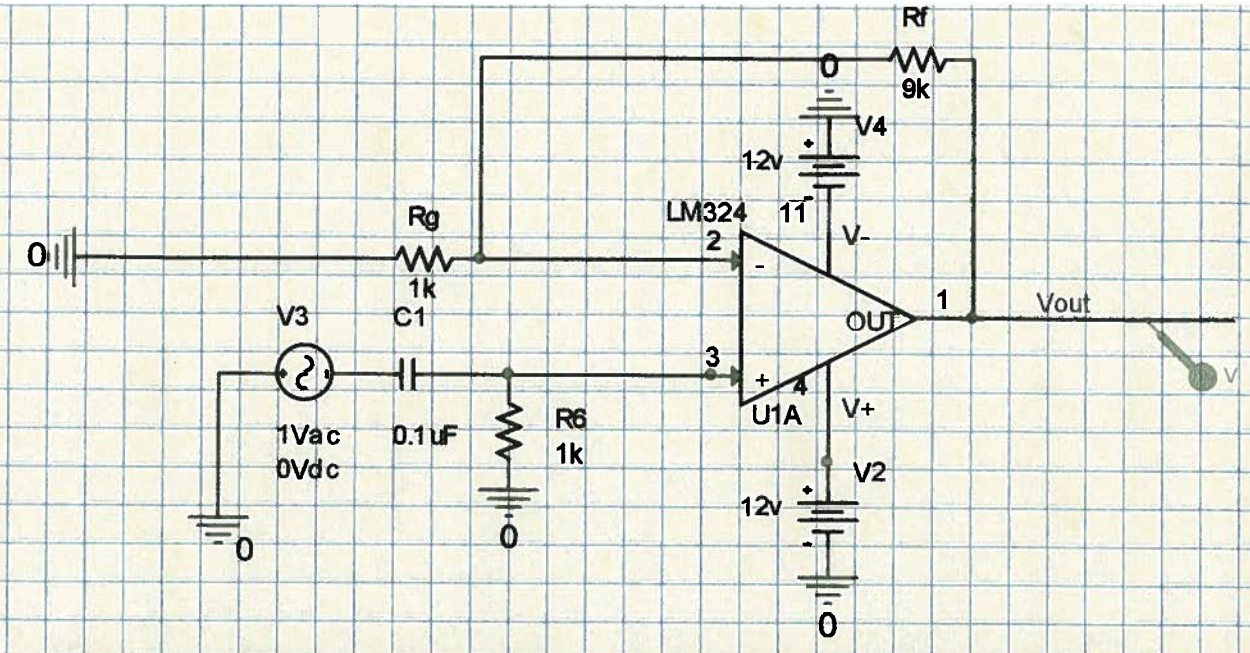


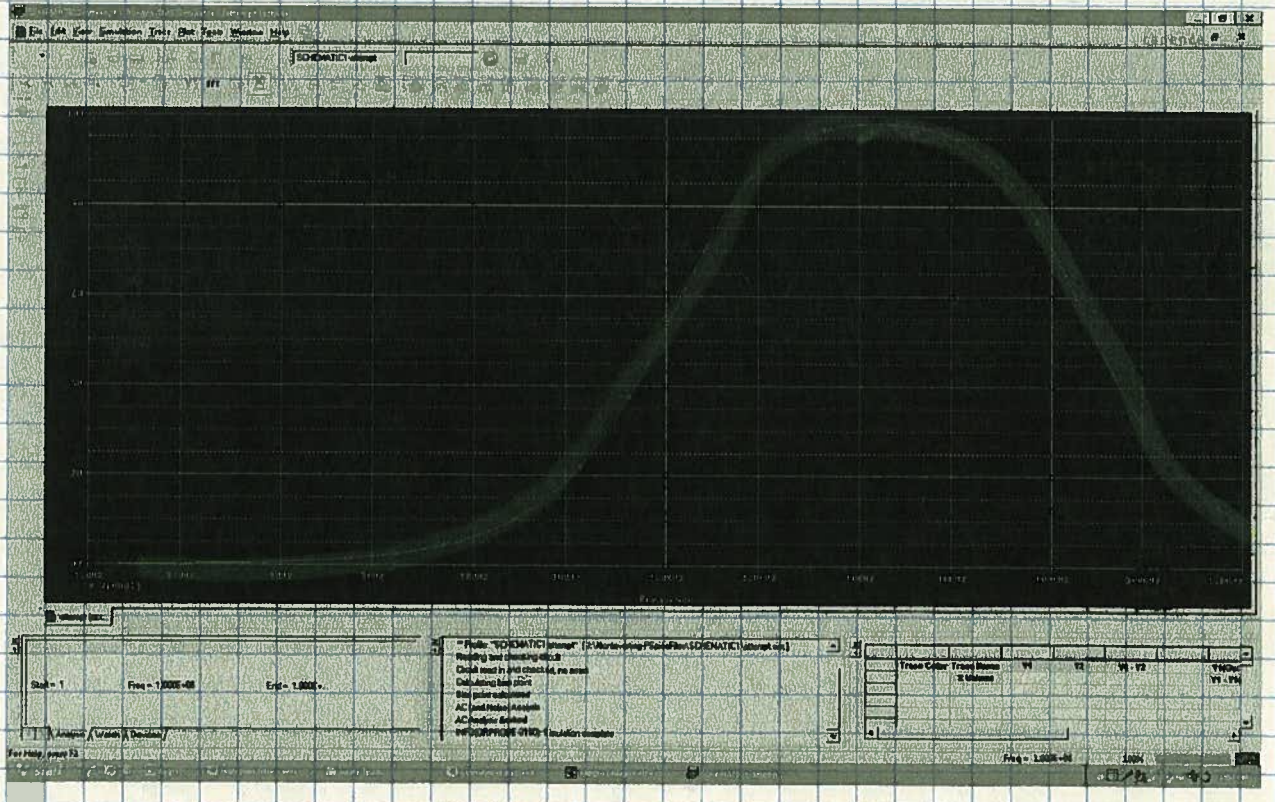

MY51451366 Fri Feb 01 04:11:16 2013
2 100mV/
0.0s
50.00ns/
Auto
2 26.2mV
Agilent
Acquisition
Normal
50.0MSa/s
Channels
DC 10.0
DC 10.0
Measurements
Pk-Pk(1):
56m
Pk-Pk(2):
241m
Freq(2):
9.804kH
Freq(1):
4.8174kH
er Menu
to go
-CAD
Load
File
Delete
File

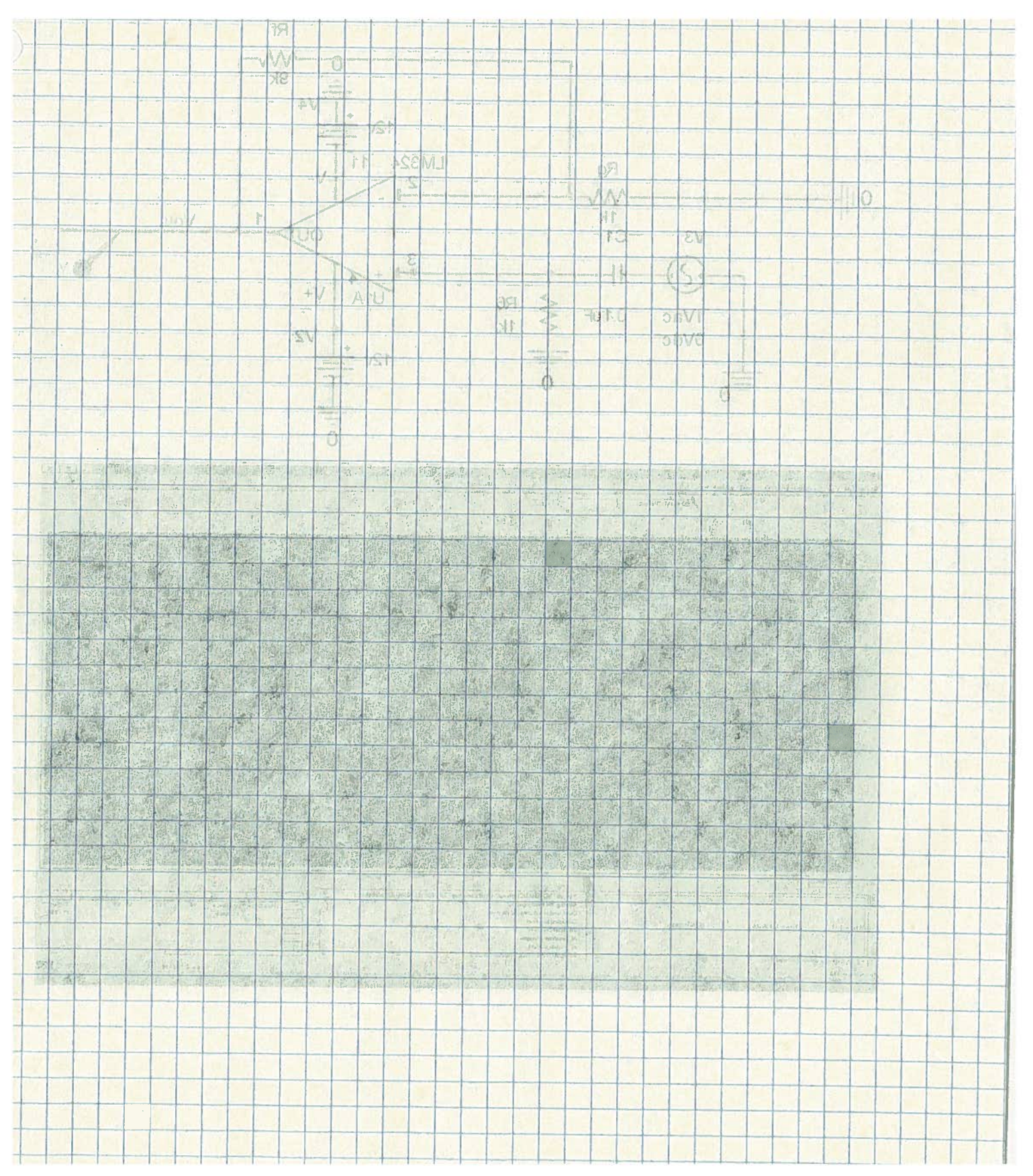
Scope_1.bmp


A,MY51451366,Fri Feb 01 04:11:01 2013
2 100mV/
0.0s
50.00ns/
Auto
2 26.2mV
Agilen
Acquisition
Normal
50.0MSa/s
Channels
DC 10.
DC 10.
Measurements
Pk-Pk(1):
36
Pk-Pk(2):
48
Freq(2):
105.3k
Freq(1):
6.750k
er Menu
to go
r CAD
Load
File
Delete
File

Scope_0.bmp


Rf
9k
0
V4
12v
LM324
11
V-
2
-
Rg
1k
0
V3
C1
1
OUT
Vout
3
+
4
U1A
V+
1Vac
0Vdc
0.1uF
R6
1k
V2
12v
0
0
0





$(244.5 * 1592) = K_f$

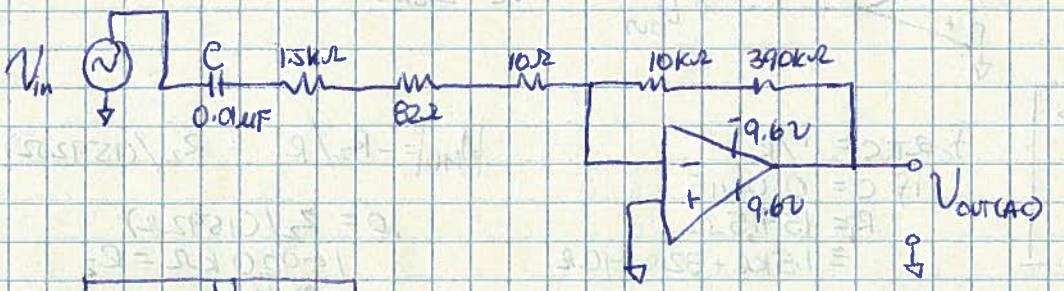
$389244 = R_f$

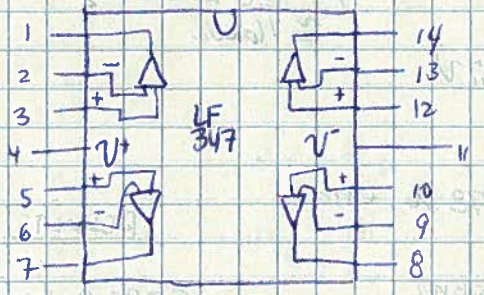
$\approx 400\ k\Omega$

STANDARD VALUE RESISTORS

① $390\ k\Omega + 10\ k\Omega = 400\ k\Omega$

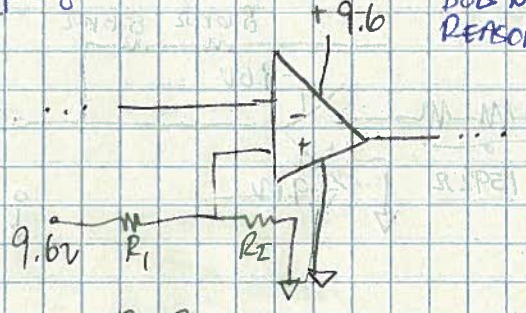
② $470\ k\Omega = 470\ k\Omega$





NOTE

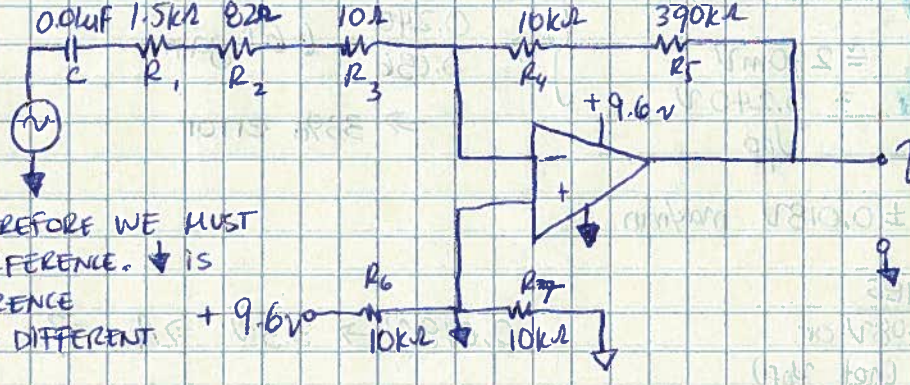
THIS PORTION WORKS VERY WELL, EVEN WITH THE SOLAR CELL (A NON PERFECT SOURCE). BUT WHEN COUPLED WITH THE DIODE IT DOES NOT WORK WELL, FOR UNKNOWN REASONS



$R_1 = R_2$ TRY $R_1 = 10k\Omega = R_2$

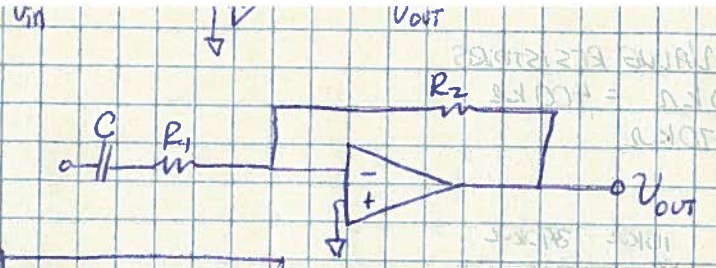
NOTE:

THIS SET UP BECAUSE BATTERY AS NO (-) S LABLED (-) A GROUND. THEREFORE WE MUST EATE A NEW REFERENCE. ↓ IS HAT NEW REFERENCE OINT (WHICH IS DIFFERENT FROM ↓)



STILL W/Resistors @ gain for 10V/V but with only +9.6V (perfect source)

$\frac{4.2V}{460mV} = 9.13\ V/V$ gain



$f_c = \frac{1}{2\pi RC}$

DESIRED OUTCOMES

$f_c \approx 10\,kHz$

$A_{MB} \approx 10\,V/V$

$f_c 2\pi C = 1/R_1$

if $C = 0.01\,\mu F$

$R_1 = 1591.5\,\Omega$

$\cong 1.5k\Omega + 82\Omega + 10\Omega$

$|A_{MB}| = -R_2/R_1 = R_2/(1592\,\Omega)$

$10 = R_2/(1592\,\Omega)$

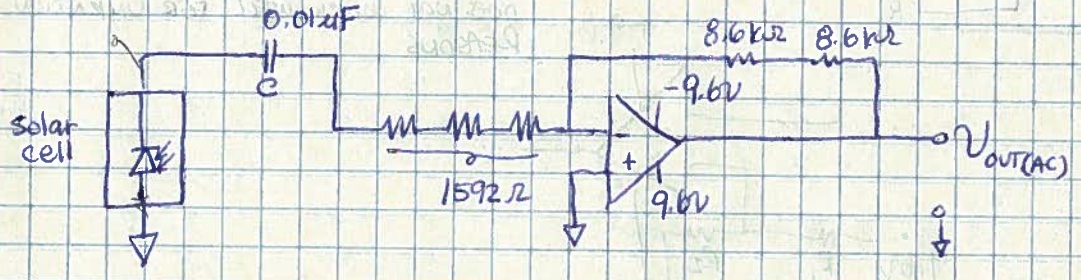
$15.920\,k\Omega = R_2$

$\cong 16k\Omega$

470 mV → Gain 10 V/V ⇒ 0.47V expected = 4.7V

3.3V = measured

$\frac{4.7-3.3}{3.3} = 42\%$ error $\quad \frac{3.3-4.7}{4.7} = 29.78\%$ error



RESULTS

SCOPE_0.bmp
→ ambient light

SCOPE_1.bmp
⇒ signal
(-) input
(+) ground

SCOPE_2
⇒ signal
(+) input
(-) ground

OUTPUT W/MODULATED LASER

BEFORE GAIN	AFTER GAIN
$\cong 0.036V$	$\cong 240mV$
$= 36mV$	$= 0.240V$
V_{pp}	V_{pp}

$\Rightarrow \frac{0.240}{0.036} = 6.67$ gain

⇒ 33% error

$0.036\,V_{pp} = \pm 0.018V$ max/min

DESIRED OUTCOMES

A_{MB} makes 1.08V or greater on V (not V_{pp}) for micro controller

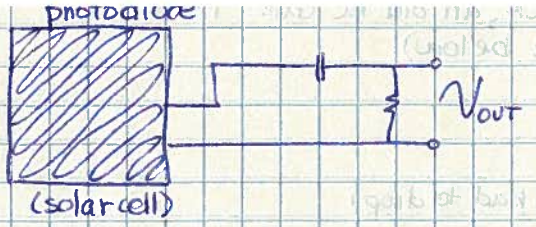
OR

3.3V $V_{OUT(AC)}$ NOT V_{pp} w/out micro controller.

$0.018V \rightarrow 3.3V \Rightarrow A_{MB} = ?$

$\frac{3.3V}{0.018V} = 183.33\,V/V = A_{MB}$ GAIN

$\frac{6.6V}{0.036V} = 183.33\,V/V = A_{MB}$ GAIN



$f_c = \frac{1}{2\pi\tau}$ $\tau = RC$

desired 10kHz = $1/2\pi RC$ $\pi = 3.14159265358979$

$f_c = 10kHz$

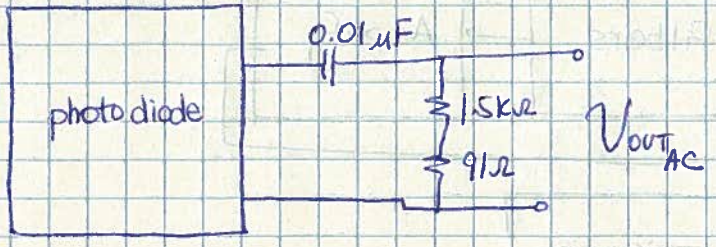
$(2\pi)(10kHz) = \frac{1}{RC}$

$(2\pi)(10kHz)C = 1/R$

C =			= R
100μF	①	0.15195	
10μF	②	1.5195	
1μF	③	15.915	
0.1μF	④	159.15	
0.01μF	⑤	1591.5	
0.001μF	⑥	15915.0	
100pF	⑦	159150.0	

①&②&③ are too small to work with (with respect to R)

STANDARD RESISTOR VALUES	error (%)
ⓐ 15 + 1.0 = 16Ω	0.53 %
ⓑ 150 + 9.1 = 159.1Ω	0.06 %
ⓒ 1.5k + 91 = 1591.0Ω	0.009 %
ⓓ 15K + 910 = 15910Ω	0.03 %
ⓔ 150k + 9.1k + 051 = 159151Ω	0.0006 %



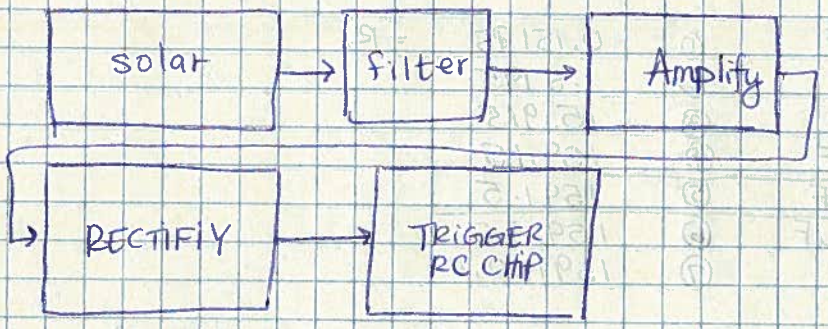
10 KHz modulated laser drives a truck, an old RC car. There are several ideas for approaching this. (see below)

CONSTRAINTS

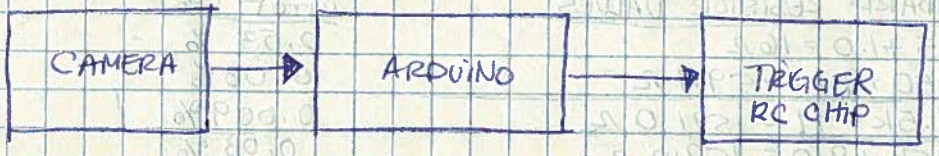
- $25 max spending limit
- no new motors
- no new power sources (this one I had to drop)

IDEA ① "All Analog" / "Solar cell Method"

USE 4 solar cells, filter out unwanted AC signals and use this to trigger to existing circuit of the RC car.



IDEA ② "Image processing"



IDEA ③ "Modulation Method"