8. Opto-Preamplifier and ambient light filtering **Draft 1.3**

UFO Doctor, Sept .15th, 2014

1. Introduction

This Preamplifier should amplify the very weak 850/940nm (IR) 15.6kHz Mama Duck signal by a factor of 50, but ignoring ambient light such as sunlight and 2x50Hz or 2x60Hz household illumination sources.

2. Circuit

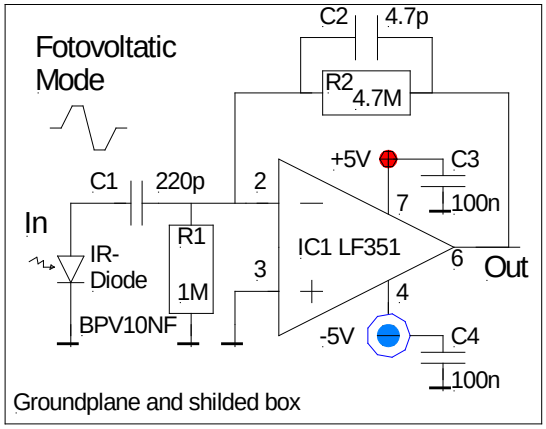

Fig. 1. Preamplifier Circuit
Ground-Plane and shielded box needed!

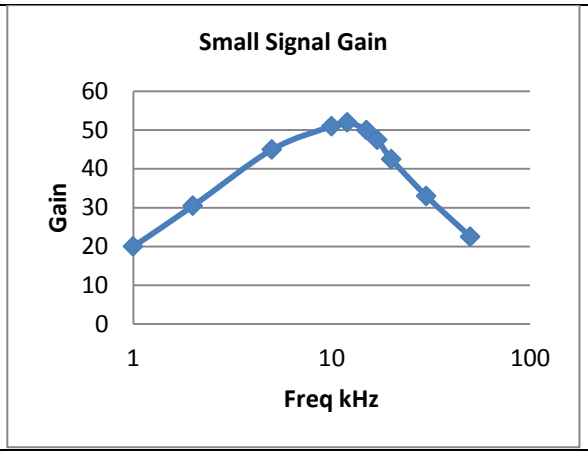

Fig. 2. Gain Characteristics
Max Gain 50 at 15.6kHz, Input: 1mV at C1

3. Simulation

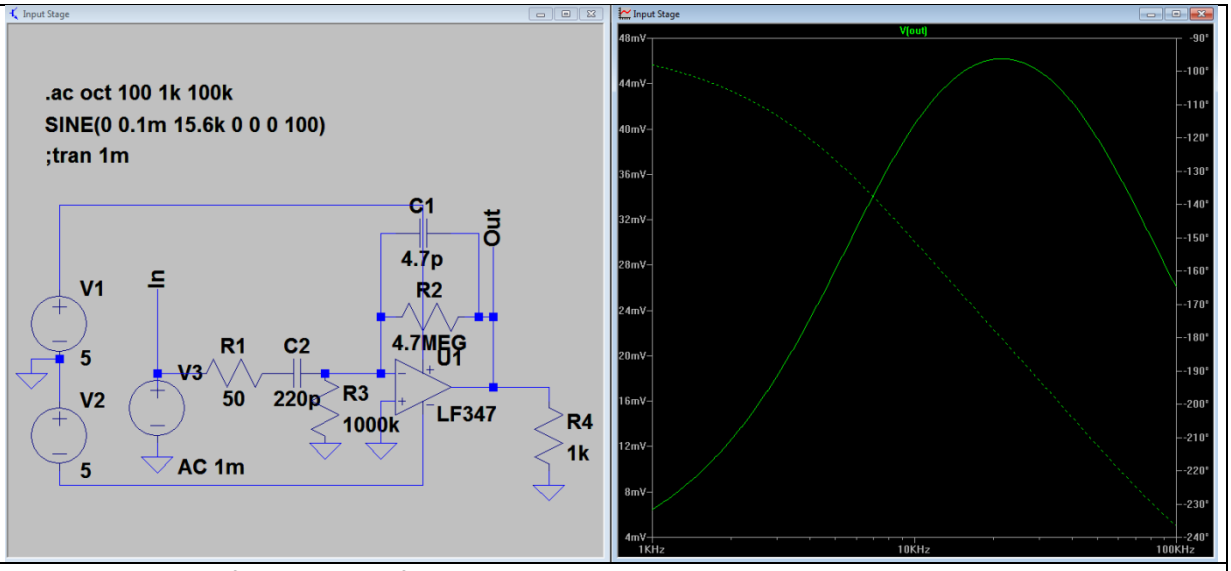

Fig. 3. Simulation of the preamplifier, max Gain 47 at 15.6kHz

Comment: Good match of simulation with experiment!

4. Effect of Ambient Light on IR-Signal amplitude

4.1. Test Setup

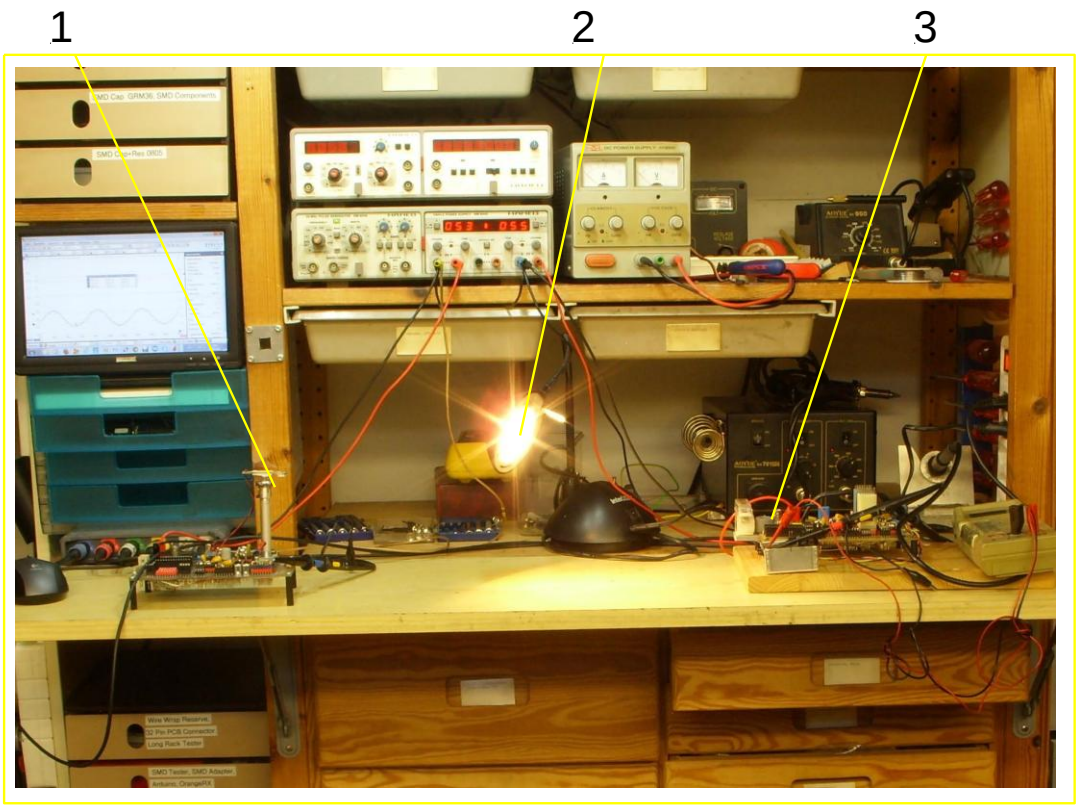

Fig .4. Test Setup for strong ambient light experiment
1: Mama Duck with VSMG10850 IR-LED, 88mA peak, 50% Duty Cycle, 15.6kHz
2: Ambient Halogen light, variable distance and incident angle
3: Baby Duck with BPV10NF IR Diode, distance 0.5m

4.2. Experimental Results

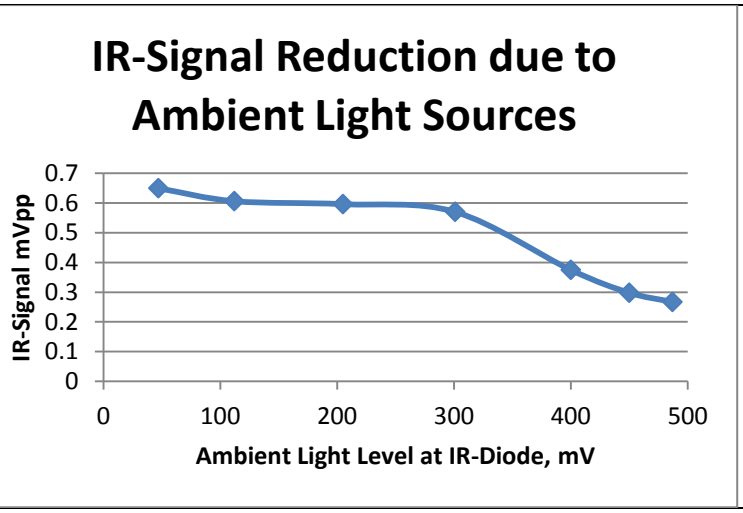

Fig.5.
IR-Signal Reduction due to strong ambient light sources

50% reduction at 400mV ambient light

4.3. Comment

Ambient light sources such as sunlight attenuate the IR-Signal, if the ambient light generates a photo voltage >300mV!
Thus, we search for filters reducing the ambient light influence below this limit!

5. Outdoor experiments with daylight attenuation filters (work still in Progress!)

This preamplifier operates perfectly outdoors in the morning and in the evening, but not at full sunshine at noon, because the IR-Diodes get saturated to about 0.5Volts.

5.1. Material and Method

A. Daylight attenuation filters

A1	No Filter, only intrinsic red filter of D1
A2	Black garbage bag, thickness 0.015mm
A3	Black Heat shrinking plastic tube, thickness 0.25mm
A4	NIR Filter 940DF20, 11.5x3.2mm by omegabob2

Fig. 6a. Filter Adapter Material
BPV10NF, Case Adapter, NIR Filter, O-Ring D9x2

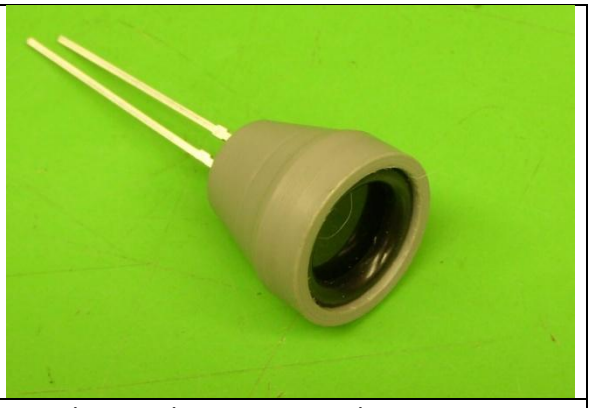

Fig. 6b. NIR Filter 940DF20 Adapter
D14x13

B. Light sources outdoors, clear sky, Sept 7th, 15.00 and Sept 15th, 2014

B1	0 Degree to full Sun
B2	90 Degree to full Sun
B3	180 Degree to full Sun

C. Light Sources indoors

	LED	Wavelength	Rad intens	Half Angle	Peak cur
C1	VSMG10850	850nm	5mW/sr	+/- 75 Deg	0.13A
C2	VSLY5850	850nm	600mW/sr	+/- 3 Deg	0.1A
C3*	SFH4233	940nm	170mW/sr	+/- 60 Deg	1A

*C3 not checked, since not delivered

D. Light detector

	Diode	Wavelength	Sensitivity	Half Angle	Rise/Fall
D1	BPV10NF	750-1150nm	0.55A/W	+/- 20 Deg	2.5ns

6. Test Results

Note: Signal Attenuation Data of Fig.8 has been calculated, but not tested in practice yet!

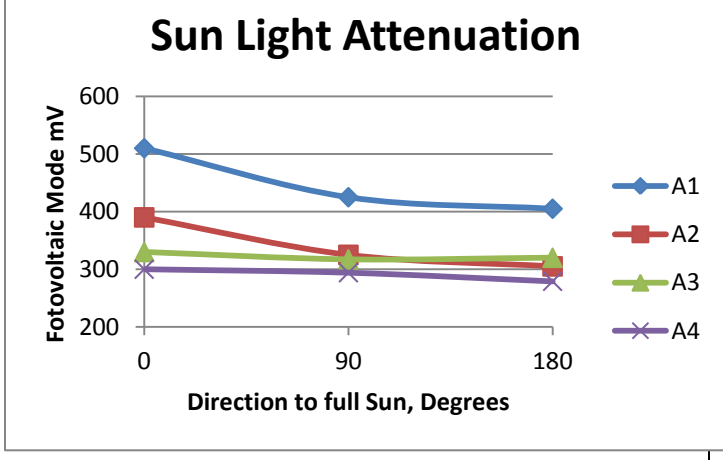

Fig. 7. Sun Light attenuation

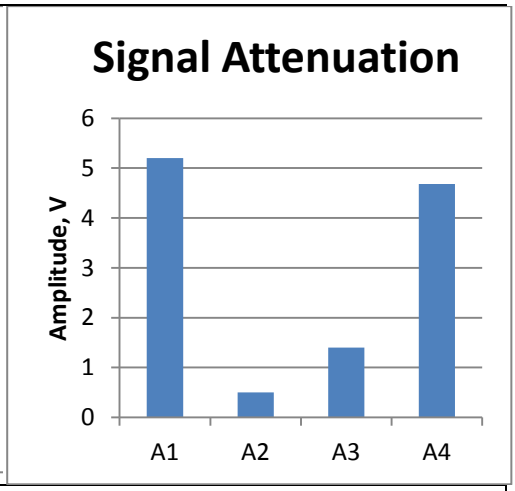

Fig. 8. IR Signal with 70 dB amplification
A4: extrapolated data from data sheet

7. Comment

The black Heat Shrinking Plastic Tube A3 is helpful, but not enough.

The best results we got with the state of the art Interference Filter NIR Filter 940DF20.

8. Drawing Filter Adapter

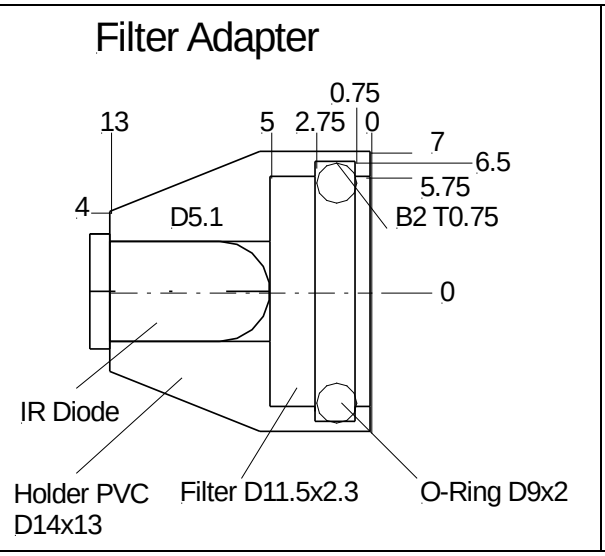

Fig. 9
Sketch of the Filter Adapter