

8. First PLL Experiments on Duck Project at 8kHz

V1.2

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1. Introduction

Here you will see the first results about the answer of Baby Duck on signals from Mama Duck. I know, the whole stuff it is not easy to understand, but I try it here:

- Mama Duck sends an (acoustic) FSK Signal synchronized with the Aile TX-Pulse:
8 kHz permanently
8.845 kHz during 2 msec starting with the Aile-Synchrony TX-clock pulse
- Baby Duck receives:
 - FSK signal (acoustically, here in this experiment directly by wire)
 - Aile-Synchrony TX-pulse
- Baby Duck decodes the FSK signal by means of a PLL (Phase Lock Loop) IC
 - The (acoustic wave propagation) delay is a measure for the distance from Mama Duck to Baby Duck
 - The experimental data below shows the signal processing (without acoustic delay by wave propagation, because wired directly!)

2. Related documents:

http://ufo-doctor.ch/descriptions/A_The%20Duck%20Project/04.%20Tutorial%20PLL%20Design%20%28in%20German%29.pdf

and

http://ufo-doctor.ch/descriptions/A_The%20Duck%20Project/05.%20EXCEL%20PLL%20Calc%20for%20FSK%20at%2040kHz.xlsx

3. Preliminary Test Results

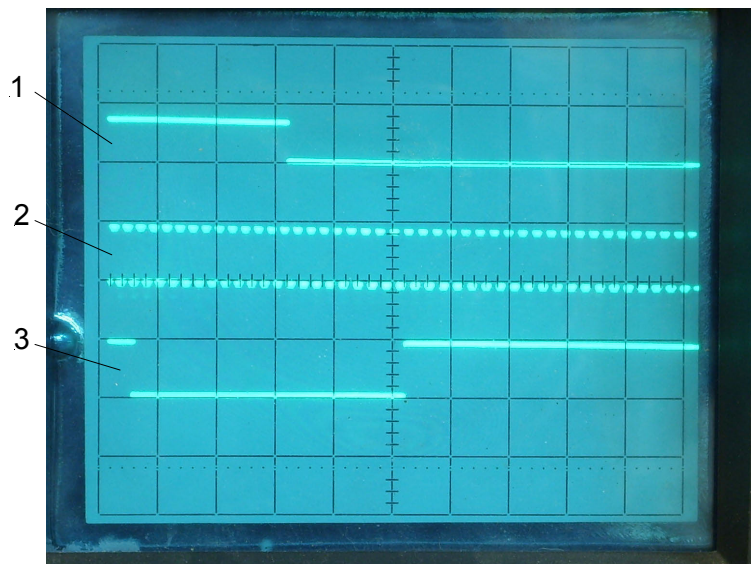


Fig.1.
Experimental Data

Osci Settings:
5V/Div; 0.5msec/Div

1: TX Aile Signal
(at RX Receiver
ORANGERX)

2: FSK-Signal 8/8.845 kHz
(Provided by Miru with his
program quak.c v0.05)!

3.PLL response

4. Discussion

- The PLL EXAR 2211 reacts within 0.25msec to the FSK sent by Mama Duck,
Thus this is ok for distance and distance difference calculations by Miru!
- The PLL EXAR 2211 is stable within 25⁰ to 50⁰ degree Celsius

5. Acoustic Experiments

Material:

High Woofer Loudspeaker:

TW 5 NG from VISATON, 8 Ohm, 60W, 3.5 to 30 kHz, Diameter 80mm, Hight 27mm

Audio Power Amplifier:

N-FET IRZI34N (same circuit as for PWM motors)

Signal source:

FSK at Arduinio Nano, program provided by Miru with Quak rev. 005

Microphone:

From a toy crap, manufacturer unknown, tested with loudspeaker above:

5kHz: 50mV; 10kHz: 15mV; 15kHz: 12mV; 20kHz: 18mV; 25kHz:8mV; 30kHz: 5mV

6. Experimental results

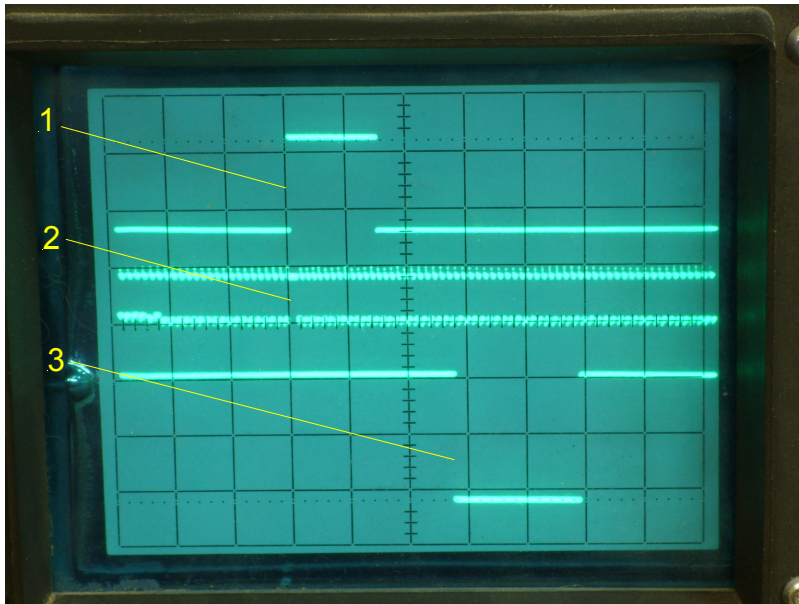


Fig. 2.
Acoustic experimental
data

Osci Time Setting:
1msec/Div

1: TX Aile Signal
(at RX Receiver
ORANGERX)

2: FSK-Signal 8/8.845
kHz, Miru program
quak.c v0.05,
measured at
loudspeaker terminal

3.PLL response

7. Discussion on this Acoustic Experiment

The distance between loudspeaker and microphone was about 0.65 m on the test bench in the laboratory

The response of the PLL (2.8 msec) tells us a distance of 0.94 m

This is ok at for a first experiment!

But there are some EMC-problems with the Arduinio, the Speaker and the PLL circuit on the same PCB.

There is a noise on the FSK signal, if TX and loudspeaker is switched on

Many Quaks!