

## ERD - Phase 1 - Planning and Specifications

08 August 2025

Circuit ~~key~~ Design needed:

- (1) Pure tone detection
- (2) Touch sensor
- (3) SPI connection for 2 ESP (for display).
- (4) Current needed from supply
- (5) Send bridge A bridge done in phase 0.

Looking into Pure Tone detection:

Pure Tone audio input indicates what hearing threshold in dB is required to perceive a tone at different frequencies.

QTP 3 → assigned frequency is 2800 Hz.

↳ Similar to a radio station tuned in "2.8 kHz radio channel".

Need something to convert sound to electrical signal

↳ need a microphone for this.

Pure tone must still trigger reliably when tone generator is set to 60 dB and held 10cm from the MIC.

### ① Sound Transducer

↳ Options:

→ Piezoelectric Disc / Buzzer: Create a voltage when vibrated by sound waves.

Has reduced sensitivity not optimal for  $\geq 60$  dB SPL.

→ Analog MEMS Microphone: Capacitive MEMS sensor changes capacitance with sound

No ~~WAV~~ design. SMD soldering required

Ind design. Needs trial and filter

ERD 320 - Phase 1 - Pure Tone Microphone.

08 August 2025

→ Contact vibration pickup: picks up vibrations directly from surfaces.

↳ limited frequency response.  
Does not seem reliable at 2800 Hz.

→ Contact vibration pickup: picks up vibrations directly from surfaces.

↳ won't detect uneven tones / won't work.

→ Electret microphone capsule: uses permanently charged material

↳ collects electrons to pick up sound via capacitive implementation.

### ISSUE:

MFB vs. SallenKey

↳ has only 2 options for  $\pm 40$  dB roll-off

Independent of the gain.

↳ Grind says max 60 dB

Working alone says above 60 dB

↳ Electret microphone capsule max is about 60 dB

↳ this is okay for goods will work

Will use a CMIC (condenser, specifically the electret microphone capsule).

→ only one available online and local.

Communication bus has to be R 12.48 with specs:

S range: 20 - 12 kHz → very much inadequate.

Impedance: 150 - 5K  $\Omega$  - operating voltage: 1.5 - 10 V → within paper range.

-60 dB sensitivity = How effective a device converts electrical signals from sound.

↳  $1 \text{ V}/\text{Pa} = 4 \text{ mV}$   $\therefore 60 \text{ dB SPL} = 0.02 \text{ Pa}$

$\therefore 0 \text{ dB SPL} = 20 \mu\text{Pa}$

$\therefore \text{Vout} = (1 \text{ mV}/\text{Pa}) \times 0.02 \text{ Pa}$

= 20 mV at 1 kHz.

08/08/2025