GE INDUSTRIAL DESIGN AMERICAS

title	IDO Sound Guide
version	V2.5
date	Friday, August 9, 2013
designer	David C. Bingham, david.c.bingham@ge.com

IDO Sound Guide

This is an interactive PDF, best opened within the latest version of Adobe Acrobat Reader. Clicking the play icon next to each function will produce a sample of the sound, though Acrobat will prompt you to trust the document. Be sure to turn on you speakers and raise the volume to a decent listening level.

To ensure that you have the most recent version of this document, please visit this GE Folder's link:
http://libraries.ge.com/download?fileid=414802744101&entity_id=19963383101&sid=101

Introduction

The IDO Sound Guide is a toolbox of interaction and notification sounds related to each of GE's 4 major appliance brands. Each brand's sound stems from an over-arching sound track designed to capture the auditory personality of the brand. From that sound track, interaction and notification sounds were derived around a framework of common product control patterns such as "touch", "increase", "feature on", "cancel", etc. This document covers the design of these sounds to educate those interested in adding an audio personality to products.

The first half reviews the brands, sound tracks, and structure developed in collaboration with various business disciplines. Knowledge of this background information isn't critical to executing programs, but provides the groundwork for all projects wishing to implement sound interactions. Large-scale revisions to GE's brand structure or control technologies may cause revisions, but this information should remain consistent from program to program.

The second half targets the process and steps needed to successfully design a control with sound through to a product sound specification. These steps are intended primarily for teams consisting of product management, design, and engineering representatives. Using the established toolbox of sounds and outlined steps should result in consistent sound associations representing the desired product functionality and technical details needed to execute.

3 • Audience
4 • Brand
5-8 • Sound track: Artistry, GE, Café, Monogram
9 • Interactions, Alerts
10 • Sound Comparisons
11 • Quality
12 • Levels
13-15 • Buzzer: Design, Examples, Specifying

16 • Brand Association
17-30 • Product Sounds: Artistry, GE, Café, Monogram
31 • Control Layout
32 • Prototype Associations
33-34 • Components: Buzzer, Speaker
35 • Example Specification

36 • Credits

Audience

Engineering
For technology-focused individuals, this document includes considerations for engineering and delivering quality sounds, tuning levels, and selecting qualified components. Following these recommendations will not only save time in executing your program, but will also simplify development and increase product quality.

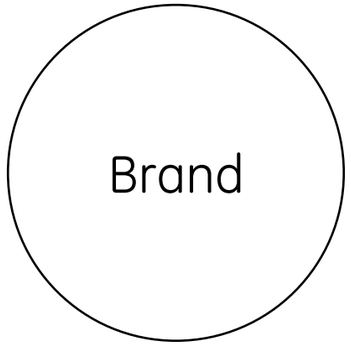
Product Design
Sound is described throughout this document as an extension of our product brand language and a user experience differentiator. IDO designers can gain a greater appreciation of GE's 4 major brands and understand the process to associate sound to an appliance control concept, prototype, and iterate to a final design specification.

Product Management
To simplify decision making, speed time to market, and add differentiation, this document includes a sound toolbox and program development plan. The first section covers developmental building-blocks, while the application section helps streamline deliverables and specs amongst your technology and design team.

Advertising & Public Relations
As consumers learn about our product offerings, these sounds can provide a branded commercial or background track that will carry into the lived experience. Full two to three minute sound tracks are composed for this use as well as deriving interaction and alerting sounds.

Web & App Design
The experience halo surrounding GE's products and brands certainly includes the web and mobile apps. This toolbox of sounds is designed for small speakers and provides an often missed quality to screen-based interfaces with a tie back to the physical appliance in both interaction and notification sounds.

Brand



Cues
Terms or images of design attributes that help translate the brand values into artifacts.

Values
Terms (typically adjectives) that describe the emotional or motivational characteristics of the brand.

Artifacts
Images of products, locations, interfaces, services, or other brands, that personify the cues and values of the brand.

A series of “bulls eyes” abstract and translate brand meaning amongst different audiences. This framework allowseachbrandtocomprehensively present its personality is a rich visual manner. Different audiences relate to certain parts of the bulls eye while being simultaneously absorbing the greater context and gestalt.

The following pages present the completed brand bulls eyes. Each were used as inspiration and development reference when creating a 2 to 3 minute sound track for each brand. The sound tracks are playable if you’re viewing this document in Acrobat Reader.

Artistry

Sound Track:

The sound track for Artistry highlights the brand's simple, youthful, fun, and sensible style. The basic rock instruments and the major key convey a youthful feeling, while the brisk tempo (~144bpm) keeps it fun and energetic. The time signature (4/4) and the harmonies are uncomplicated, and the repetition in the bass guitar and double notes played in the guitar melodies keep the sounds simple, leaving space for you to nod your head to the rhythm and enjoy the energy of the piece.



Download the Artistry sound track: http://libraries.ge.com/download?fileid=421942564101&entity_id=19963383101&sid=101

GE

Sound Track:

GE brand appliances are defined by the phrase “Living Innovation.” These devices hold up a tradition of purposeful and authentic design while delivering a fresh look and modern set of features. In the sound track for GE, we settled on using the mixture of the human breath and fine craftsmanship that is realized in the sounds of wind instruments to convey a sense of authenticity. The 5/4 time signature, and electric synths that enter halfway through the piece to swell in and out of the background, provide a sense of developing modernism and innovation. Finally, the open harmonies underlying the sound track express a sense of open space, telegraphing an uplifting and aspirational feeling hopefully reminiscent of some of Aaron Copland’s compositions.



Download the GE sound track: http://libraries.ge.com/download?fileid=421941911101&entity_id=19963383101&sid=101

Café

Sound Track:

In the Café sound track, we used recorded mechanical sounds to create an underlying beat, then composed several expressive melodic and harmonic lines to be played by layers of synthetic instruments. The mechanical sounds are intended to convey the confident, professional, and state-of-the-art capabilities and personality of the Café brand. The rich layers of synths smooth out the rough edges of the mechanical sound design so as to mimic the polished surfaces and feature-rich nature of Café's devices.



Download the Café sound track: http://libraries.ge.com/download?fileid=421943326101&entity_id=19963383101&sid=101

Monogram

Sound Track:

Monogram is the most sophisticated of the GE appliance brands. The architecture of Monogram devices is refined and timeless. They are of the highest quality and promise the highest performance. In the Monogram sound track, the classic sounds of piano and stringed instrumentation provide the feelings of timelessness and richness. A determined piano melody, further developed by plucked strings and harp, conveys a sense of refinement and distinction singular to the Monogram brand. Finally, the 6/8 time signature weaves a feeling of structure throughout the piece so as to mimic the refined architecture of the Monogram devices.



Download the Monogram sound track: http://libraries.ge.com/download?fileid=421941593101&entity_id=19963383101&sid=101

Interaction & Alert List

Touch
Basic tone generically used to denote an interface interaction.

Unavailable Touch
The product is in a cycle or state that disallows the particular control.

Select
A confirming tone to let the user know of a successful interaction (opposite Cancel).

Cancel
A slightly negative or unsuccessful tone (opposite Select).

Increase
Adjust a value or control magnitude up (opposite Decrease).

Decrease
Adjust a value or control magnitude down (opposite Increase).

On
Accompanies a product function being turned on (opposite off).

Off
Accompanies a product function being turned off (opposite On)

Press & Hold On
Similar to On, this sound emphasizes the extended interaction and engaging a feature.

Press & Hold Off
Similar to Function On, this sound emphasizes the extended interaction and engaging a feature.

Power On
The product's startup tone to confirm operational.

Power Off
The product's shut-down tone.

Alarm Low
The least urgent alarm sound that loops to get people's attention.

Alarm Mid
A looping, moderate priority sound to call people to the product.

Alarm Urgent
A looping, highly urgent sound to get people's attention immediately.

Notification
A single event notifying the user to perform periodic maintenance or other product needs.

Cycle Pre
Related to Cycle Complete hinting at an immanent process completion.

Cycle Complete
Plays once when a process cycle is complete.

Cycle Post
A patient, ongoing tone after Cycle Complete to remind that the process is over.

Sound Comparison

*under development

Control interactions are similar across brands, but the personality is intentionally different. The full set for each brand is later in this document.







*

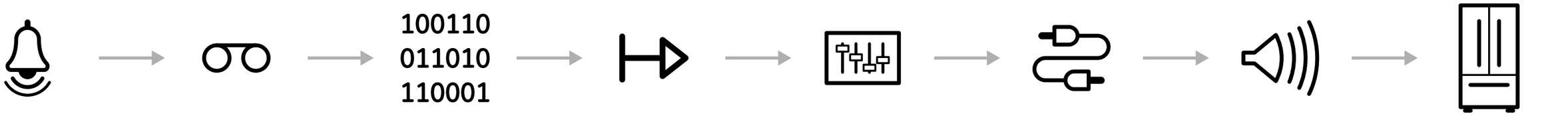


Select	▶	▶	▶	▶
Increase	▶	▶	▶	▶
Decrease	▶	▶	▶	▶
On	▶	▶	▶	▶
Off	▶	▶	▶	▶
Press and Hold On	▶	▶	▶	▶
Power On	▶	▶	▶	▶
Alarm Low	▶	▶	▶	▶
Alarm Urgent	▶	▶	▶	▶

Quality

The musician designing the sounds provides their talents, training, and guidance towards audio objectives.

The listener depends on their hearing abilities, proximity from speaker, and familiarity to sounds.



Instrument

Once designed, the playback of any audio through an instrument sets the initial quality level. This also includes modulation hardware and digital tools.

Recording

Instrument playback is captured in a digitized recording system. If picked up through microphones, ambient noise should be minimized and levels should be set to prevent clipping.

Storage

Source digital recordings should stereo with at least a 44,100 hertz sample rate. Use an uncompressed, 16 bit format like .wav or .aif. Blank recording space can be deleted from the beginning or end of a file, but always keep an original copy.

Conversion

A copy of the original audio file is converted to a format compatible with the playback environment. Considerations may be a single mono speaker, on-board storage or bandwidth, and electronics platform file type support.

Amplification

The stored audio files are pushed through a digital audio conversion chip and amplification system before being sent to the speaker. The amount of amplification should be paired to the speaker and desired end-user volume level. Providing too little or too much can damage components or introduce distortion.

Transmission

Single, less-frequent event notifying the user to add rise-aid, change filter, or other periodic maintenance.

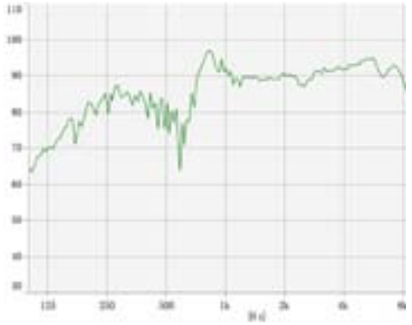
Speaker

Single, less-frequent event notifying the user to add rise-aid, change filter, or other periodic maintenance.

Environment

Single, less-frequent event notifying the user to add rise-aid, change filter, or other periodic maintenance.

Levels



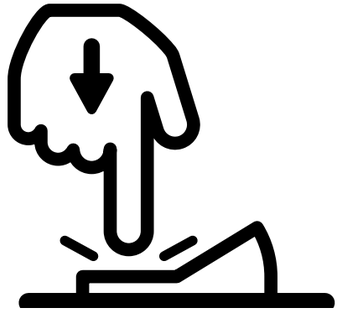
Tune to Response

The response curves of the buzzer and speaker provide a boost at some frequencies and a limit at others. Designing sounds within this response curve provides a natural increase in playback volume. If a different speaker is selected for a program, make sure the speaker playback range captures these frequencies.



Normalize

The audio files for speaker-based sounds should be normalized across the set. They should be recorded at a level just below clipping, then adjusted up or down as needed within waveform editing software. Individual sound volume levels should be set within the file and not adjusted in the end-software.



User Location

Volume levels should respect the location and interactions of the user. Sounds played with button presses can be lowered knowing that the user is standing at the control. Alarm sounds may need to be set louder to get the user's attention.



Environment

The speaker placement, product enclosure, materials, and mechanical or environmental noise can all affect volume levels. With new product development, be sure to playback sounds within the actual product and adjust levels accordingly. Make sure speaker is mounted securely and component rattle is reduced. Placement of speaker within the product will affect volume and frequency response.

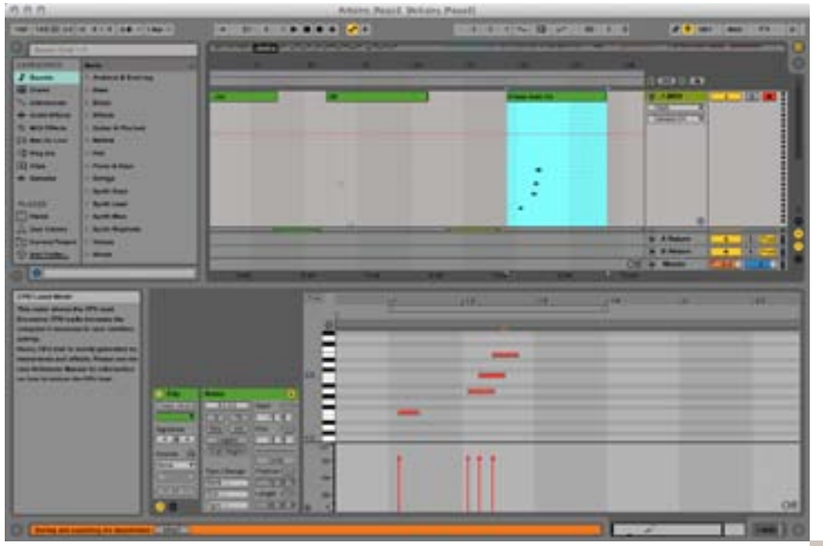


User Control

Adjusting volume and muting sounds should be included in all product controls. Advanced interfaces such as LCDs and mobile devices could allow more discrete control, but a minimum of mute, low, mid, high should be allowed.

Buzzer: Design

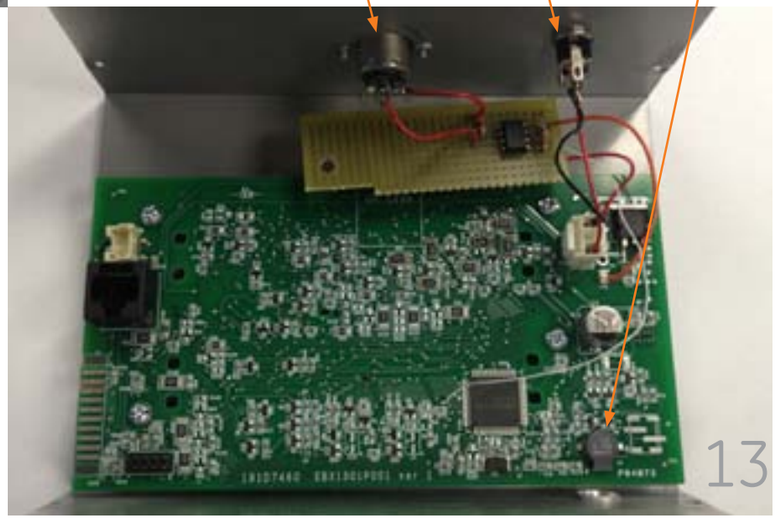
Buzzer sound design is facilitated through a hacked GE wall-oven electronics board connected via MIDI to a laptop running Ableton Live audio software. The hack exposes Attack, Decay, Sustain, Release (ADSR) and a number of other musical “levers” typically used in the world of video game chip tunes such as pitch bend, velocity, and pulse width modulation. Familiar creative software connected to a clearly understood set of musical abilities provides a well constrained design space. Experimentation and tweaking happens in real time with high confidence that the sounds being designed will be the same sounds played back in the production product.



Ableton Live Audio Software



MIDI USB Cable



Buzzer: “Lever” Examples

Attack
Measured in milliseconds, attack is the time taken for initial run-up of level from nil to peak, beginning when the key is first pressed.

Decay
Measured in milliseconds, decay is the time taken for the subsequent run down from the attack level to the designated sustain level.

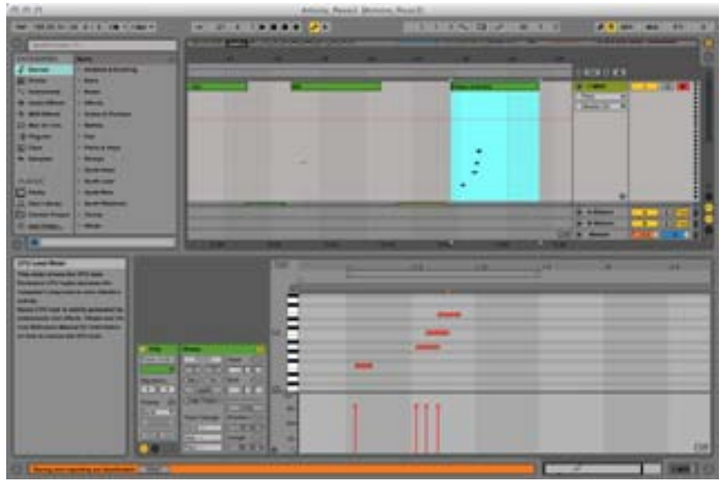
Pitch Bend
Pitch bending adjusts the frequency of a sound wave in real time. This parameter can be adjusted to make smooth transitions between two different pitches.

Pulse Width
Adjustments to pulse width alter the duration of the square waves produced by the piezo buzzer. This parameter can be used to affect the timbre of the emitted sound.

Rapid Notes
In conduction with short attack and decay values, rapid sequences of notes can be used to make sounds that mimic harmonic chords.

Velocity
The velocity parameter adjusts the peak attack volume. Varying the velocity of notes in a sequence provides dimensionality of volumes. Used in certain ways, variations in velocity of note sequences can give the illusion of reverb.

Buzzer: Specifying



Buzzer sound design is performed in desktop audio software (previous page). When complete, each sound is exported as an individual MIDI file.



GE_Select.midi

Each midi file contain all the sound data needed to play back within appliance electronics hardware. These files are put through a translator tool that either breaks the data into a table of values for each note, or a creates C-code for software inclusion.

GE_Select sound table

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Re
1	392	0	100	0	
2	523.25	0	680	0	



GE_Select.c

The table of values can be manually entered into software or provided to sourced product suppliers to design their own playback circuits. The C-code file is the most easily transferable specification, especially within GE's embedded software group.

Associations









Buzzer

Buzzer-based sounds have been developed for Artistry & GE brands. Users will enjoy an audio branded experience while not requiring the cost of a speaker.

Speaker

High-fidelity sounds have been designed for all brands, though teams should especially strive to provide that experience in Monogram, Cafe, and GE products.

Artistry Sound Comparison





Select	▶	▶
Increase	▶	▶
Decrease	▶	▶
On	▶	▶
Off	▶	▶
Press and Hold On	▶	▶
Power On	▶	▶
Alarm Low	▶	▶
Alarm Urgent	▶	▶



Artistry (speaker-based)

Interactions:

- Touch
- Unavailable
- Select
- Cancel
- Decrease
- Increase
- Off
- On
- Press and Hold Off
- Press and Hold On
- Power Off
- Power On

Alerts:

- Alarm Low
- Alarm Mid
- Alarm Urgent
- Cycle Complete
- Cycle Post
- Cycle Pre
- Notification











Download the Artistry set (19 files, stereo, wave-format): http://libraries.ge.com/download?fileid=304936080101&entity_id=19963383101&sid=101

Artistry (buzzer-based)

*under development

Interactions:

Touch*

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Unavailable*

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Select

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)
1	392	0	100	0	0	80	0	46
2	523.25	0	680	0	0	80	0	46

Cancel

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Decrease

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Artistry (buzzer-based)

Interactions:

- Increase

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

- Off

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

- On

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

- Press and Hold Off

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

- Press and Hold On

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Artistry (buzzer-based)

Interactions:

- Power Off

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

- Power On

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Alerts:

- Alarm Low

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

- Alarm Mid

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

- Alarm Urgent

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Artistry (buzzer-based)

Alerts:

- Cycle Complete

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

- Cycle Post

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

- Cycle Pre

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

- Notification

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

GE Sound Comparison

*draft samples





*

Select	▶	▶ ▶
Increase	▶	▶
Decrease	▶	▶
On	▶	▶
Off	▶	▶
Press and Hold On	▶	▶
Power On	▶	▶
Alarm Low	▶	▶ ▶
Alarm Urgent	▶	▶ ▶



GE

Interactions:

- Touch
- Unavailable
- Select
- Cancel
- Decrease
- Increase
- Off
- On
- Press and Hold Off
- Press and Hold On
- Power Off
- Power On

Alerts:

- Alarm Low
- Alarm Mid
- Alarm Urgent
- Cycle Complete
- Cycle Post
- Cycle Pre
- Notification



Download the GE set (19 files, stereo, wave-format): http://libraries.ge.com/download?fileid=3049356621O1&entity_id=19963383101&sid=101

GE (buzzer-based)*

*draft samples

Interactions:

Touch

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Unavailable

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Select

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Cancel

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Decrease

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

GE (buzzer-based)*

*draft samples

Interactions:

Increase

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Off

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

On

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Press and Hold Off

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Press and Hold On

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

GE (buzzer-based)*

*draft samples

Interactions:

Power Off

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Power On

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Alerts:

Alarm Low

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Alarm Mid

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Alarm Urgent

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

GE (buzzer-based)*

*draft samples

Alerts:

Cycle Complete

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Cycle Post

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Cycle Pre

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Notification

Note	Freq (Hz)	Attack (ms)	Decay (ms)	Sustain (ms)	Release (ms)	Peak Vol (%)	Sustain Vol (%)	Ducy Cycle (%)

Café

Interactions:

- Touch*
- Unavailable*
- Select*
- Cancel*
- Decrease*
- Increase*
- Off*
- On*
- Press and Hold Off*
- Press and Hold On*
- Power Off*
- Power On*

Alerts:

- Alarm Low*
- Alarm Mid*
- Alarm Urgent*
- Cycle Complete*
- Cycle Post*
- Cycle Pre*
- Notification*



*under development

Monogram

Interactions:

- Touch
- Unavailable
- Select
- Cancel
- Decrease
- Increase
- Off
- On
- Press and Hold Off
- Press and Hold On
- Power Off
- Power On

Alerts:

- Alarm Low
- Alarm Mid
- Alarm Urgent
- Cycle Complete
- Cycle Post
- Cycle Pre
- Notification



Download the Monogram set (19 files, stereo, wave-format): http://libraries.ge.com/download?fileid=304936553101&entity_id=19963383101&sid=101

Control Layout

Before selecting and associating sounds, the product team should design the overall product control. This starts with consumer insights and business interest in product type, brand association, and desired functionality. These should be discussed amongst product management, engineering, and design to begin initial control concepts. A rough feature list will direct the control development and eventual sound associations.

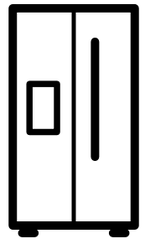
Features are combined with visual and behavioral brand standards to sketch initial control layouts. These concepts should be reviewed in terms of aesthetics, usability, and technical feasibility. Sketches are refined in CAD with accurate colors, fonts, icons, and mechanical dimensions. The team iteratively reviews and tests layouts until a selection of prime candidates emerge.

Specific functionality within the concept should be generalized to correspond with interaction types. Sounds are mapped to control elements representing these interactions. Rarely will all sounds be used within a single product. Choose only those that best relate to the functionality of the control. Critique and scenarios may be discussed within the team to refine these associations before moving on.

Brand



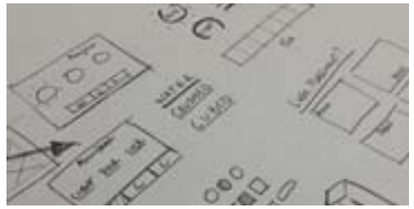
Product



Features

- Dispenser Light
- Control Lock
- Water/Crushed/Cubed
- Door Alarm

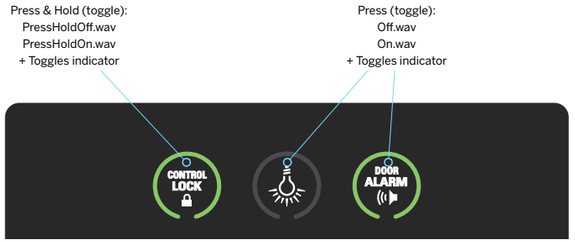
Sketch



Layout



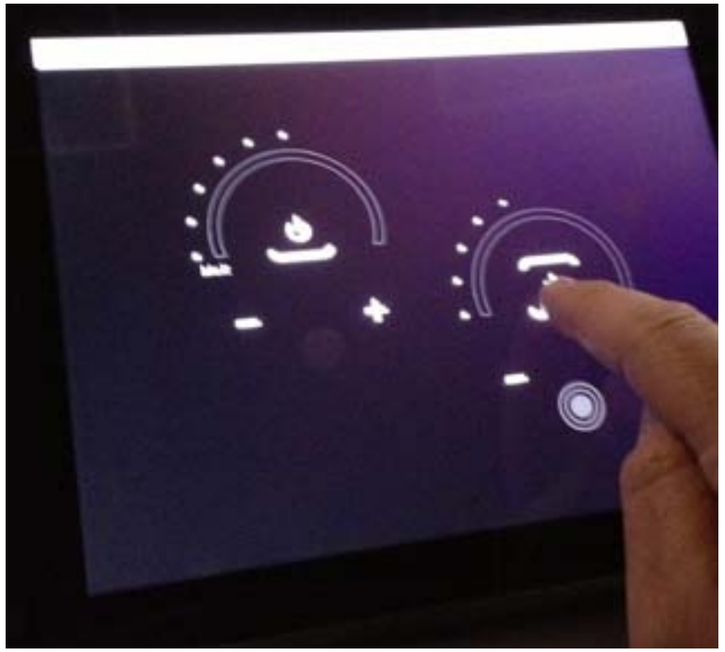
Associate



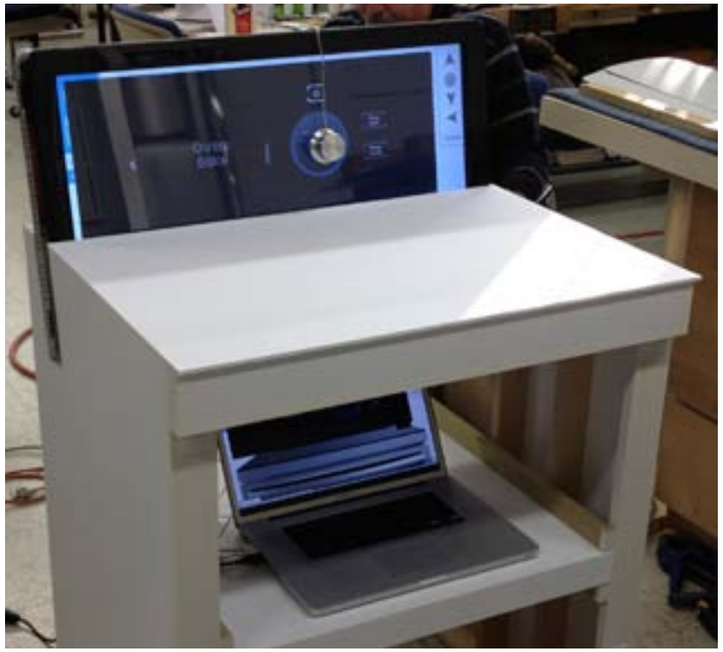
Prototype Associations



HTML based prototypes are quick to build and provide a basic association of sounds to control functions. They can be widely distributed for feedback, but still require a computer/mouse interaction to simulate control interactions. Some touch & drag or multi-key press interactions may be difficult to implement.



Tablets allow for native applications with rich gestural interactions. More complex designs can be created with multi-channel sound and very quick response. Built-in, small scale speakers are similarly constrained in frequency range and volume. The size and portability allow integrating the tablet into other, more complex models.



Appliance-scale prototypes can be created with LCD touchscreens driven by a laptop. The software driving the prototype can be anything able to run on the computer, including HTML, Flash, or native app. Speakers can be placed in within the model for honest volume and frequency response during very realistically simulated experiences.

Components: Speaker

A speaker provides a much richer auditory experience due to the wider range of playback frequencies. This comes at the expense of more complex circuitry, though a technical component standard should allow knowledge and cost sharing across programs.

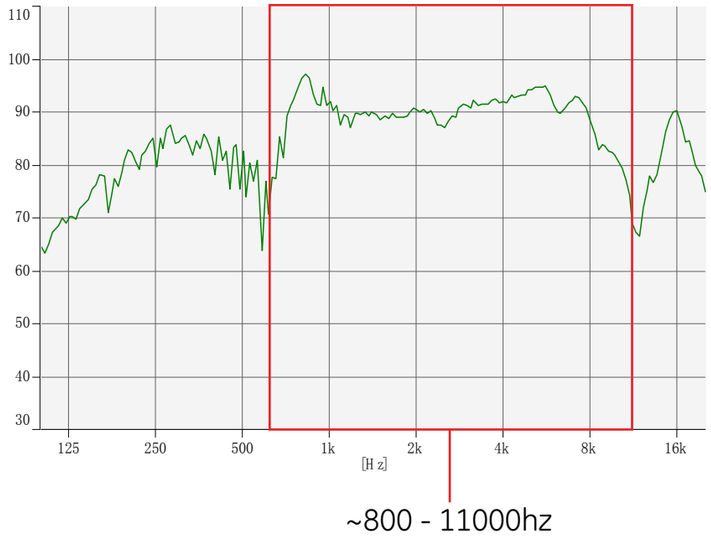
The major components to consider are:

• Flash memory: Sound files are stored in memory until needed by the system. Alternatively, some micros may have enough ROM to store these files. Trimming blank space, mixing down to mono, and using compressed sound formats can all reduce memory footprint. Ensure the crystal clock frequency between the micro and audio processor are matched, otherwise an external clock is required.

• Digital audio processor: This processor needs to match the audio format for decoding sound files and sending to the power amplifier. Some variations of this may include a power amplifier.

• Power amplifier: The audio processor signal is received and boosted by the power amplifier then sent to the speaker. Ideally, amplification wattage should pair with the speaker spec to not distort or damage the system.





• Speaker: The speaker itself includes the cone driver, sealed enclosure, and wiring harness. Choose a speaker that matches the frequency range of the sound set. If finding a new component, remember that accelerated life testing must be performed adding an additional +10-11 weeks to the program.

GE Speaker Part#: 206C2229P002

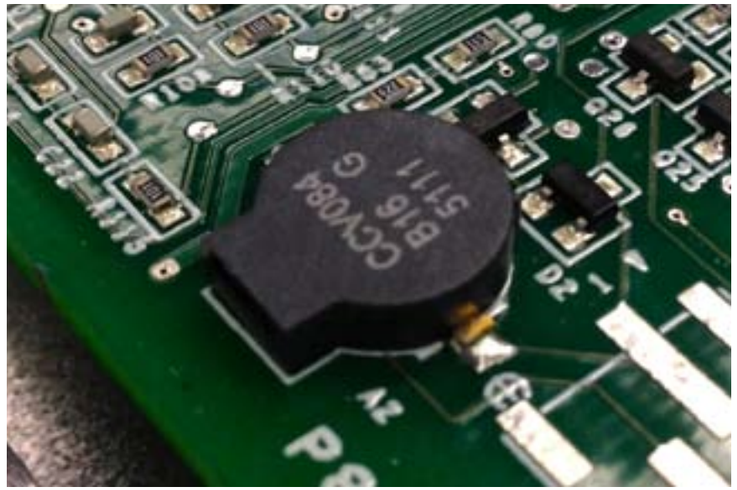
Download the speaker data sheet: http://libraries.ge.com/download?fileid=421922166101&entity_id=36798038101&sid=101

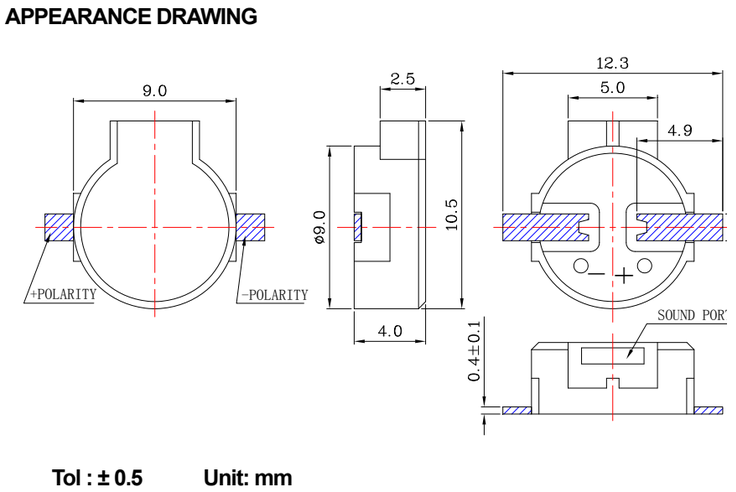
Download the amplifier circuit data sheet: http://libraries.ge.com/download?fileid=421922563101&entity_id=36798038101&sid=101

Components: Buzzer

The majority of appliance products produce sounds via piezoelectric buzzer. They are inexpensive, take up very little space, and require a relatively less complex set of additional circuitry. When voltage is applied, the buzzer oscillates at a specific frequency to produce a sound. The range of potential sounds from a buzzer is much more limited than that of a cone driver (speaker), but a number of musical “levers” have been exposed to provide more creative options.

A master list of buzzer technical components will be made available in windchill. A link to the buzzer data sheet is available below.



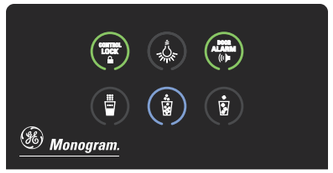


Download the buzzer data sheet: http://libraries.ge.com/download?fileid=421922912101&entity_id=36798038101&sid=101

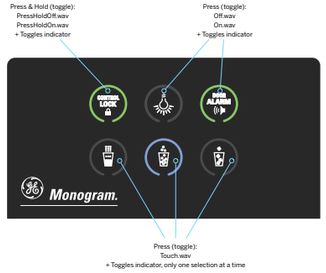
Example Specification



Components
The speaker or buzzer circuit technical specifications. This includes part testing qualifications, data sheets, part quantities, and overall cost for the program.



Artwork
The source graphic artwork for the control including colors, fonts, icons, logos, layout and any other manufacturing information.



Associations
A general description of sounds associated with the control. Call outs can be made to the artwork, but more complex interactions may need to be communicated through the prototype.

- Touch
- Off
- On
- Press and Hold Off
- Press and Hold On

Sounds
The subset of sounds used for this particular control. No interfaces are expected to use all sounds.



Prototype
For testing associations and communicating complex interactions, the prototype should be included in the set of specification deliverables.

Credits

Some important people contributed to this project and can help teams through this document and process.

Sound Design:	David Chow
Consumer Insights:	Karen Williams
Buzzer Circuit Engineering:	Tim Gillespie
Speaker Circuit Engineering:	Mo ElGhrawi
Brand Guidance:	Steve Hopmann
Prototyping:	Lauren Bowers & Chen Lu
Aesthetic Feedback:	IDO Team