Hardware Engineering User Manual

for versions 1.x

Content

2 The nature of this document

This document should serve as an introductory tutorial to the controls of Hardware Engineering for the new-coming players, as well as a reference and presentation of new features for the experienced users. A completely exact language is avoided in order to ensure that the document is easy to read. Any incorrectly use of terminology is purely intentional and because of that this document should by no means be taken as a technical reference or document of any kind. The same applies for the game itself and the contents of the tutorials there located.

2.1 Mistakes and errata

If you happen find a mistake, incorrect or outdated peace of information, please let us know at hwengame@gmail.com.

Errata

Document/Game ver.	Date	Subject
Empty	*9/11/16*	*Empty*

3 Overview

3.1 About

Hardware Engineering is a design-and-simulate game that sets its goal to present concepts of digital circuit engineering as close to the reality as possible while still reserving certain simplifications, so that the game remains playable for the wide public despite its technical content.

Users can take advantage of serveral game modes and detailed tutorials present in the game and pick up the topic, challenge oneself with simulation of real life conditions by meeting the budget and complexity limits or compete against other players online.

The learning curve of Hardware Engineering (HWE) is rather steep when compared to other games of the genre. This learning requires lots of reading and thinking effort and it is therefore recommended to play this game only when feeling well and ready to play something new. It most certainly isn't a game for straight several-hours-lasting gameplay. Our best estimate of a proper learning plan consists of a daily completion of one level only, possibly combined with competing online.

3.2 System requirements

Equipment	Requirement
Operating System	Windows with .NET 4.5+
Processor	Intel Core 2 Duo E4500, Equivalent or Better
Graphics	Intel HD Graphics or Better
Memory	1 GB or More
Disk Space	250 MB
Sound	Optional
Internet	Requires a stable internet connection

3.3 The background of system requirements

UI and executive code of Hardware Engineering is stored on our servers. The game therefore requires a stable internet connection in order to be played. Our decsion is such because of the complexity of some simulations that are performed in the game, with the frequency of their occurence rising as user proceeds to later levels. Without server-side simulations our system requirements would be much higher and that we wanted to avoid.

We may from time experience a heavy load on our servers and we ask for your patience. Your latency to our servers may be higher at some hours during the day, but unless your request was lost, it will eventually be processed.

Our simulation time limit is set to 60 seconds. If you don't get the results of your simulation in one minute, retry and check your internet connection / connection to our servers.

The game will not inform you if the connection to our servers has been lost. We encourage you always wait out the 1-minute period before reconnecting. If the connection to server is lost, your work progress is stored locally until the game process is closed, which makes in-game reconnections possible (without penalty in case of competetive matches).

3.4 Bugs, Feedback and Feature requests

We hate bugs but we love bug reports. Every craft contains some flaws, and you are the one who can help us eliminate them. When in-game, you can file a bug report through the *Actions* window. Please, make your bug reports as detailed as possible!

Positive feedback encourages us, negative feedback motivates us. Consider sending a feedback when appropriate.

It's hard to think of new features. If you have an idea that could make our game better, send us an e-mail or feature request. We'll be happy to hear from you. Feel confident enough? Consider becoming a modder. More on modding can be found in the separate "Hardware Engineering Modding Manual".

4 Gameplay

When entering one of the available game modes, the game screen becomes a one scrollable design “table” with many options and features available. This chapter defines most of them clarifies their meaning.

4.1 Game Controls

Function	Controls
Choose Component	LMB click in Components window
Place Component	LMB click on Design “Table”
Move Component	LMB press to drag, LMB release to drop
Delete Component	RMB click on the desired component
View Configuration	Hover / Double Click on the desired component
Start Wire	LMB press on Design “Table” after enabling the Wire Placement Mode with **W**
End Wire	LMB release on Design “Table” before disabling the Wire Placement Mode with **W**
Delete Wire	RMB click on the desired wire
Create Node	Connect 3 or more wires
Delete Node	RMB click on the desired node, will delete connected wires
Show Grid	Press G key

4.2 Game Windows

4.2.1 Window actions

Windows can be closed. They can be reopened again by clicking on a color strip representing the window closed in the Actions window.

Windows can be minimized. Minimized windows preserve their state when closed. Minimizing windows is useful when running out of space while designing a complicated circuit.

Windows can be moved. Most of the windows preserve their new location even when closed and reopened. Minimized windows can be moved.

4.2.2 Component Window

The Component Window contains a list of components that can be chosen and placed as a part of the circuit.

Bottom part of the window contains circuit budget and complexity stats, optionally with a progress bar showing the state of resources. Once the resource limit is reached, no more components can be added.

Top part of the window is occupied by a list of components. Components are divided into pages, each one consisting of one or more component categories.Once a component is chosen it is displayed under the window and can be moved with cursor to the desired location. Components can be placed using the Left Mouse Button, and moved using LMB drag and drop. If you don’t want a component to be in your circuit, simply RMB click on the component you wish to remove.

4.2.3 Tasks & Hints Window

Any tasks related to the completion of a level as well as tasks for one’s practice can be found in the Tasks & Hints Window. A detailed description of behavior wanted from the final device may however be located in the Information window.

Tasks and hints are divided into categories, which are then assigned to pages.

4.2.4 Information Window

Tutorial and level-related information can be found in the Information Window. This window may then from time to time contain a more-detailed description of the device that

must be designed in order to complete the current level. If so, a reference to this window is located in the Tasks & Hints Window.

Use of this window is purely optional. Images present are mostly illustrational.

4.2.5 I/O Window

The I/O window has two parts. The one to the bottom serves as the control panel for simulation and testing. Tests can be Started (or Restarted), Stepped trough (if breakpoints or single-step testing is used) and Stopped. Reports from the simulation as well as the simulation progress is clearly visible.

Upper part of the window contains a list of inputs and outputs, which is display after the fist server-side simulation and updated after every consecutive simulation executed.

When a connection is closed or a fatal error occurs, the step progress (usually orange in color) may get stuck. Retry and check your internet connection. If connected to internet, save your work and send us a bug report. It will be highly appreciated. Yeah, it will.

Every adjustment to the circuit requires the simulation to be run again from the beginning.

4.2.6 Actions Window

Actions window is always the “last man standing”. It can be minimized but can not be closed. Every closed major window is represented as a colored strip on the top-bar of Actions Window. A bug **report** can be sent and **settings** can be set when respective windows are opened using buttons within the window. **Leaving the game** happens through here, too.

4.2.7 Saves Window

Slots for saving game saves can be found in Saves Window. There are currently 3 slots available for each user. We are planning to add more in the future.

4.2.8 Tests Window

No tests are provided when in Sandbox mode. One must define tests on his own, and for this purpose, Tests Window can be opened and used via a button in I/O Window.

4.3 Game Modes

4.3.1 Tutorial Mode

Tutorial Mode is the easiest mode available. The budget is unlimited, but the choice of components, their quantities and count is limited. No time limits are present. New players are encouraged to start playing in this mode.

It is recommended to read the tutorials always present in the Information Window.

4.3.2 Design Mode

Design mode adds a little more difficulty into playing the game and makes it a little more realistic. All components are available for use, but the total budget is limited. Also, the remaining budget is carried to the next level. It may happen that by unwise choices made earlier in the game you won’t be able to complete the advanced levels and will be forced to return and rethink.

4.3.3 Sanbox Mode

Sandbox is useful when trying to analyse and explore behavior of individual components or instructions. The nature of testing mechanism involved, however, makes it rather impractical for toying more sophisticated circuits. It is recommended to use Custom Testbenches Instead (see Hardware Engineering Modder Tutorial for more information).

4.3.4 Competetive Mode

The skill-based competetive mode is currently in Alpha testing phase. User will be allowed to send a test pass when completing demonstrating sufficient knowledge by completing specified levels. More information about the Alpha-testing of HWE Competetive Mode together with Alpha application form can be displayed in menu.

5 Typical Design Flow

An excerpt from the tutorials:

The standard circuit design flow of you, as an engineer, consists of a few steps.

1. ***Review the input and output*** *list first. This will give you the minimum insight and help you plan out your design "table" to avoid moving circuit´s parts due to insufficient space.*
2. ***Define the core functionality****. Is it going to be addition? Data processing? Memory mapping? Whatever it is, you need to find it out first by analysing the task given in the Tasks & Hints window on your left.*
3. ***Notice any required signal conversion****. Oftentimes device´s inputs don't match inputs of your core components. They are either their negation, or come in at slightly different widths and clocks.*
4. *Although the last step may seem too obvious, clear* ***wire connections*** *are half of the success. You (almost) never get it right for the first time, and debugging a mess of wires is a terrible experience... A terrible experience, everyone had to go through.*

I know that you will ignore #4, so why am I still mentioning it? Just be ready for the "TOLD YA" moment.

6 Final Remarks

This manual has by no means grasped the advanced features of the game or provided a reference to the individual components and instructions. These are described in the corresponding levels of the game.

If you have any questions related to the game or to this manual, mail them to hwengame@gmail.com.