



WordClock User Guide



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WordClock User Guide 6/20/23 Version 5.0

Introduction

Word clocks have always been very popular. Most were designed with B7971 Nixie tubes. Prices for these tubes has increased to the point where the cost to purchase them is in the hundreds of dollars, *each*. WordClock uses relatively inexpensive alphanumeric LED displays in either .8" or 2.3" in height, VFD displays or (if you are fortunate enough to have them) B7971 Nixie Tubes. WordClocks are available in 6-, 8- and 16-character displays, depending on the display type.

WordClocks include an English library of thousands of words that are randomly chosen and displayed every five seconds along with the time and date, at optional intervals. An English expletive file is included with words that are also randomly inserted and displayed. Three levels of expletives are available from mild to strong, displayed based on user defined settings. The library has been purged of derogatory references to race, religion, and sexual orientation. New with WordClock Version 4 software is the ability to use an announcements file that will display messages up to 32 characters, on specified days of each year.

Many additional libraries and languages are included, some designed and submitted by WordClock users. Of note is the British Slang library (BritSL.wds), which contains terms that some people may find offensive. Use at your peril. Due to the limitation of the sixteen segment displays, words with extended characters are not included in the library. WordClocks that use 14 segment, B7971 Nixie displays, will not correctly display some fonts. Word groups up to 64 characters long can be displayed. Word groups over six characters will automatically scroll the display.

A Proverbs library displays English Proverbs randomly at user settable frequencies.

Klingon is also included. It uses the English library so English words are transliterated. This means that anyone who can actually read Klingon will announce English words and numbers, or something close.

Additional libraries or partial libraries may also be included and will be added as submitted by users. Check the web site at www.stocksclocks.com for the status of each included library.

All files are stored in plain text, on a removable SD card. Words can be added, deleted, or edited in the word, expletive, announcements, and message files, using a text editor. New library bitmap fonts can be created and added, and messages can be localized for the default library language. Words from up to five libraries can be displayed randomly at user specified intervals.

Additional features of WordClock include:

- Initial setup and configuration are accomplished using a web browser on a PC or mobile device.
- UTC offsets with 30 and 45 minute time differences are supported, for use anywhere in the world.

- Daylight Saving Time (DST) start and end times are supported.
- Connects to a GPS satellite receiver (not included), or Wi-Fi networks (open or WPS password protected).
- Three override modes turn off or dim the display and backlight, optionally switching to time only based on weekdays, weekends, or both.
- Accuracy is approximately one second for NTP, better for GPS.
- Background RGB LED effects are available with a variety of patterns and options. A library indicator option will light the backlight behind LEDs 1-5 in green to indicate a word from *Library 1-5* of the Word file, and red for the Expletive file.
- Up to five libraries or word sets.
- Optional expletive file for each library with three levels, mild->medium->strong. A dedicated button quickly changes levels, and startup level is specified in settings.
- Ability to add and change words easily using a text editor.
- Words or word groups can optionally be included on each row in the word file to a maximum of 64 characters, separated by the pipe (|) symbol. The second word group will be displayed after the first word group. This can be used for any purpose including language learning, as long as both languages can be displayed using the same font file. Example language learning libraries are included, and a Proverbs library.
- Announcements file by month and day, displayed every minute, used for birthdays, anniversaries, etc.
- Inside and outside weather display. Inside temperature and humidity is recorded using a sensor, and outside temperature, humidity, pressure, wind speed and direction, and conditions, are downloaded from Visual Crossing. An account must be created with Visual Crossing, to access weather data.

What's News in Version 5

- Inside and outside weather display. Inside temperature and humidity is recorded using a sensor, and outside temperature, humidity, pressure, wind speed and direction, and conditions, are downloaded from Visual Crossing. An account must be created with Visual Crossing to access weather data. Use this link: [Sign up for Visual Crossing Weather Data & API | Visual Crossing](#)

Quick Start

- Connect a 9-12v DC power supply. The required connector is 2.1mm in diameter, center positive. The clock is reverse voltage protected.
- AP will blink on the display, indicating access point mode.
- From a mobile device or pc, connect to the Wi-Fi network named *WordClock*.
- Enter 192.168.13.1 into the URL field of any web browser (on the same network)
- The default time source is NTP. If using a GPS receiver, (not included), set the baud rate to correspond with the receiver, probably 9600 baud. Otherwise select the Wi-Fi network and enter the password. SSIDs with spaces or control characters, are not supported.
- The default library set on startup or factory reset, is *Library 1*, English. *Library 1* must be present on the SD card until it is changed in setup. Then it can be changed to any library.
- Change other settings as appropriate, referencing this manual.
- Press the *Save* button below the last field, to save selections and start WordClock.
- Library names will be displayed at startup, for all libraries that are enabled and have all required files present.

Operation

General

Words are randomly chosen from the word file on the SD card and displayed every five seconds. Libraries are chosen based on parameters in the configuration settings.

Time and date can be displayed each minute, or several times each minute as specified in the settings.

Indexes

Indexes are used to allow words and phrases of different lengths, to have an equal chance of being selected by the random word selection process. The libraries provided with WordClock include prebuilt indexes. If any changes are made to a word library, that library's index must be reindexed.

To reindex library indexes, hold SW1 while applying power, and release as soon as the word, *Index* appears on the display. WordClock will begin displaying up to 25 library names, each one remaining on the display for 2.5 seconds. To reindex only one word library index, press and HOLD SW1 when that library's name appears on the display. Release when the reindex procedure starts and displays the index function's percentage complete. For small libraries, the reindex function may finish before the display is updated. After the reindex function has completed, the clock will start running.

To reindex all libraries, no library should be selected. After the last library is displayed, the reindex function will run for all libraries. It can take one hour or more to reindex all libraries, depending on how many are on the SD card.

Libraries

WordClock can display up to five libraries. Each library is stored in a folder on the SD card. The name given to each library is the folder name, and each file related to a given library uses the same file name, with an extension related to its function. Names can be no longer than eight characters. Spaces are not allowed. A maximum of 25 libraries will be recognized on each SD card, regardless of the number of libraries on the SD card.

Several library names end in a number. That number represents the maximum length of each word in that library. WordClock transitions between words that are equal to or fewer than the number of displays, without scrolling.

Library 1 is the default library. It must be present for WordClock to operate, and it must be entered in the *Library 1* field, in setup options. Only *Library 1* must have a message file, and each library must have a font file. Each available library is presented in a dropdown, up to 25. No validations are done during library selection.

The percentage of time that libraries 2-5 are mixed with the default library, is set in the *Settings* menu.

Library.wds

The word file name must use the extension *.wds*. The default library is initially set to *English.wds*. This can be changed in *Settings*.

Each word group within a file is on a separate row followed by a carriage return and line feed. A second word group separated by a pipe symbol (|) may be entered on the same row. The second word group will follow the first word group. Both word groups must use the same font file.

Library.fnt

Each library must have a font file included in the same folder. A description of the font file, follows.

Library.msg

A message file is also required, but only for the default, *Library 1*, because all messages are displayed using the default library. The default message file is *English.msg*. If another library is set as the default, *Library 1*, a message file must be created for that library if it does not exist.

Library.xpl

The expletive file is optional. Its file extension is *.xpl*. Each word is followed by the pipe symbol (|) and a level number from 1-3, in order from mild to medium to strong. The default level used when the clock is powered, is specified in *Settings*. The level can be quickly changed by pressing SW1 while WordClock is running.

Library.ano

The announcement file is used to display month and date sensitive announcements each minute.

Library.idx

The index file is used to provide equal access to all words in the word files, regardless of their length. Pre-built index files are included with library releases. When any change is made to a library file, its index must be rebuilt. The complete set of all libraries with indexes, will no longer fit on the original, 64mb SD cards.

Button functions

SW1 – While WordClock is displaying time and words, each short, single press, cycles Expletive Mode between *Off*→*Mild*→*Medium*→*Strong*. The current mode is displayed as the button is pressed. The default mode when the clock is powered, is set in *Settings*. Expletive mode returns to the default setting when SW1 is cycled, or the clock is restarted.

Holding SW1 while applying power puts WordClock in Index mode. See the section on Indexing.

Holding SW2 while applying power puts WordClock in burn-in mode. All segments on all displays are set to full brightness. This mode is disabled on B7971 Nixie clocks because it could potentially burn out the power supplies. It is primarily for VFD clocks as some NOS tubes can take some time to 'burn in' and can vary in brightness. This will have no effect on LED clocks.

SW2 – A single press temporarily cancels override modes, to display the time only. A double press puts WordClock in *Access Point* mode to change *Settings*. A double press while in AP mode, cancels AP mode, except after a factory reset. A triple press activates light sensor calibration mode.

Holding SW1 and SW2 while applying power puts WordClock in *Access Point* mode and resets all settings to their factory defaults. After a factory reset, *English* must be preset on the SD card. Once WordClock is started, the default library can be changed to any language. Required files *.wds*, *.msg*, and *.fnt*, must be present in the default language folder.

Messages

SD Card – The SD Card cannot be mounted. It may not be present, or it may be formatted incorrectly.

Font X – The font file for *Library X* entered in *Settings* is not present. X will be replaced with the library number from 1-5. All libraries must have font files.

Mesg 1 – The message file for *Library 1* cannot be found. Only the default library, *Library 1*, requires a message file because all messages are displayed from the default library.

Word X – The word file for *Library X* is not available on the SD card. X will be replaced with the library number from 1-5. All libraries must have word and font files.

Wi-Fi – While connecting to a Wi-Fi network, this message will be displayed.

NTP – This message indicates that the clock is connecting to an NTP time server, after establishing a Wi-Fi connection. It is displayed quickly or not at all.

WX – The clock is establishing a connection with the weather service.

GPS – While connecting to GPS, this message will be displayed. GPS connections take much longer to resolve than Wi-Fi and NTP connections, so this message may be displayed for a minute or more. If no connection is made after a period of time, check the light on the GPS module to confirm that it is connected to GPS satellites. Also check that the baud rates between WordClock and the GPS receiver match.

AP – This message is displayed while WordClock is in Access Point mode, waiting for *Settings* to be saved.

Off->Mild->Medium->Strong – Displayed when SW1 is single pressed to change Expletive Modes. These messages are only displayed if there is at least one expletive file available in any of the five libraries.

BAD – The software was illegally copied. It is a product copyrighted © 2019 by Mitchell Feig, and is exclusively distributed by StocksClocks LLC.

Index – Displayed on startup after the library, if an index exists for that library. This message can be suppressed in settings.

No Idx – Displayed on startup after the library, if no index for that library exists. This message can be suppressed in settings.

Upper-Left LED - The upper-left LED blinks to indicate that Wi-Fi/NTP or GPS connectivity was lost. WordClock will continue to attempt to establish a connection until successful. This message can be disabled in *Settings*.

Override Modes 1-3

Three override modes can be set based on hourly on/off times. Several options are configurable within each range. For example, WordClock can be set to dim the display and show the time only with no background lighting, between 11:00PM and 7:00AM on weekdays. A second range can be set to dimly display words, and to display time every fifteen seconds on weekends only.

If override mode time ranges overlap, the range with the lowest number, has the highest priority.

Weather

Inside temperature and humidity can optionally be displayed using a commonly available, four pin BME280 sensor attached to the I2C connector on the processor board.

Outside temperature, humidity, pressure, wind direction and speed, and conditions, can optionally be displayed. A free account with Visual Crossing must be created, to access this data. Use this link: [Sign up for Visual Crossing Weather Data & API | Visual Crossing](#)

No headings, short headings, or long headings can be set, for better readability depending on the number of display digits. The display scrolling time is between five and fifteen seconds, depending on what data is displayed, and the headings used. Weather data is displayed at 35 seconds, and it will override time and word display.

Configuration settings

Access Point

A new WordClock will start in AP mode the first time it is powered on. To start in AP mode after WordClock has been running, press SW2, two times. To start in AP mode and reset all settings to factory defaults, hold SW1 and SW2, and apply power.

When AP is displayed, select the Wi-Fi network *WordClock* from a PC or mobile device. After a connection is indicated, enter 192.168.13.1 into the URL line of a web browser. The *Settings* options detailed below will be displayed. Press the Save button after settings are updated.

Do not use question mark, comma, or control characters in any *Settings*.

All hourly settings use 24 hour time regardless of the display setting.

- **Access Point Name** – The name of the access point that appears as the Wi-Fi network when connecting from a pc or mobile phone's browser. The default is WordClock-X, where X is the model.
- **Network SSID** – Available networks are displayed in a dropdown. Select the network to connect to if using NTP as the time source. Although SSIDs with spaces may be displayed, WordClock may fail to connect. No more than 25 characters are recognized.
- **Password** – Enter the password for the Wi-Fi network. Spaces within passwords, and trailing spaces, are not allowed. Maximum length is 25 characters.
- **NTP Server** – If using Wi-Fi to sync time, enter the name of the NTP server. This field defaults to pool.us.ntp.org.
- **Weather Key** – The key provided by Visual Crossing, to access weather data. Create an account at visualcrossing.com to obtain a key. Leave blank if not using weather data.
- **Postal Code or Lat/Lon** – Postal code or latitude and longitude, if using weather data from Visual Crossing. Otherwise leave blank.
- **Country Code** – Two digit country code used for weather reporting.
- **Library 1-5** – Select the library from the dropdown. To activate libraries 2-5, select the *Use Library* percentage below.
- **Time Source** – Select the time reference. To use GPS, an optional GPS receiver must be connected.
- **Time Display** – Select the desired option to display 12 or 24 hour time, or to use verbose time reporting in English.
- **Clock Mode** – This sets how often and whether time is displayed, each minute.

- **Date Display** – This selects the date format, and whether to display the date after the time. If enabled, the date is only displayed after time, at five seconds. Clock only mode will disable date display. Verbose date display in English, is also available.
- **Display Brightness** – Set the default display brightness for the alphanumeric display.
- **Colon Display** – Sets the flashing pattern for the colons when the time is displayed.
- **Backlight Effect** – Select from a variety of default color patterns for the background RGB LED lighting. *Show Library* will use the backlight behind LEDs 1-5 to indicate which library is being displayed. If the word is from the Word file, it will glow green. If it is from the Expletive file, it will glow red.
- **Backlight Brightness** – Set the default backlight RGB LED backlight brightness.
- **Override Start Time 1-3** – Starts the override at the selected hour.
- **Override End Time 1-3** – Ends the override at the selected hour.
- **Override Days 1-3** – Activates override mode for All, Weekdays, or Weekends.
- **Override Brightness 1-3** – Sets the brightness of the display when in override mode.
- **Override Backlight Effect 1-3** – Sets the effect while in override mode.
- **Override Backlight Brightness 1-3** – Sets the backlight brightness when in override mode.
- **Override Clock Mode 1-3** – Sets the clock mode when in override mode.
- **Override Colon Display 1-3** – Sets the flashing pattern for the colons when the time is displayed in override mode.
- **Time Display Override** – A short press of SW2 at any time will display the time only for the amount of time set here.
- **UTC Offset Hours** – Sets the number of hours offset from UTC time.
- **UTC Offset Minutes** – Used for a few time zones worldwide.
- **UTC Offset Direction** – Sets the offset specified to + or -.
- **DST Start Month** – Sets the month that daylight savings time starts.
- **DST Start Week** – Sets the week of the month that daylight savings time starts.
- **DST Start Day** – Sets the day of the week that daylight savings time starts.
- **DST Start Hour** – Sets the hour of the day that daylight savings time starts.

- **DST Offset** – Sets the offset in hours for daylight savings time.
- **DST Offset Direction** – Sets the offset direction specified to + or -.
- **STD Start Month** – Sets the month that daylight savings time ends.
- **STD Start Week** – Sets the week that daylight savings time ends.
- **STD Start Day** – Sets the day that daylight savings time ends.
- **STD Start Hour** – Sets the hour that daylight savings time ends.
- **Light Level Threshold** – Sets the background light level threshold required to change the display brightness to the *Light Level Adjust*, level. Press SW2 three times to display the current threshold. The light level is updated every 10-20 seconds. Setting this option to zero, disables the function.
- **Display Light Level -Adjust** – Adjusts the display to this brightness level setting when the *Light Level Threshold* is below the current light level.
- **Backlight Light Level -Adjust** – Adjusts the backlight to this brightness level setting when the *Light Level Threshold* is below the current light level.
- **GPS Baud Rate** – Sets the baud rate for the GPS receiver. The default setting for most receivers is 9600 baud.
- **Expletive Default** – Sets the default expletive level. This is the level set when the clock starts. The level can be changed quickly by pressing SW1.
- **Expletive Mix** – Sets how often expletives are displayed in relation to other libraries.
- **Library Change Effect** – Sets the change effect between word transitions. *Slides* move from one edge to the opposite edge. *Energize* constructs and deconstructs each character randomly by segment. Only *Slides* are used for time and date. The last option randomly varies the effect.
- **Use Library 2-5** – Sets how often each library is displayed in relation to the first, default library.
- **Time and Date** – Always use the *Library 1* font file, or use the currently selected library. The first option will prevent the time and date from being displayed using an alternate font such as Klingon.
- **Blink on Lost Connection** – When enabled, if the Wi-Fi/NTP or GPS connection is lost, the LEDs behind the first display will always be off.
- **Scroll All Words** – No uses change effects between words equal to or shorter than the number of display characters. Yes scrolls all words regardless of the display size.
- **Time Change Effect** – Sets the *Slide* effect for time changes only.

- [Show Index Status at Start](#) – After each library name is displayed at start, *Index* or *No /dx* is displayed to show its index status.
- [Show Announcements](#) – Date sensitive announcements are displayed every 30 or 60 seconds.
- [Inside Weather Display](#) – Temperature, Humidity.
- [Outside Weather Display](#) – Temperature, Humidity, Pressure, Wind.
- [Current Weather Display](#) – Current Weather on or off.
- [Scale](#) – US or Metric.
- [Inside Temperature Adjust -Offset](#) – Adjust inside temperature sensor.
- [Labels](#) – Use no labels, short labels, or long labels.

Library Files

Check the web site at www.stockscllocks.com for the status of each library included on the SD card. The latest libraries can be downloaded as zip files.

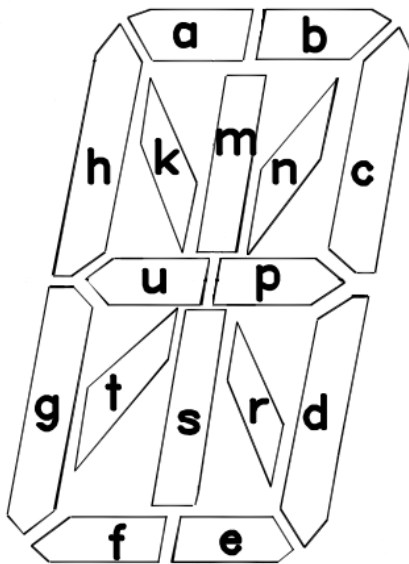
Additional complete or partial libraries may be included on the SD card as they are submitted and added.

Fonts

Fonts are stored in text files. The file name for each font file, from the root of the SD card, is */Library/Library.fnt*. Each line in the plain text file begins with 16 0s and 1s representing each segment in the diagram and order below.

Any ASCII character from 32-255 can be represented in the font file within the limitations imposed by the 16 segment display, in the following order:

u t s r p n m k h g f e d c b a



Segments will be off if 0 is in that segment's position, and on with 1. Comments can be entered after the 16th character on each row. Any text editor that does not add control characters can be used to edit the file, including Notepad on Windows. Notepad++ is a free text editor that offers many additional features. Below is an example from the English font file on the SD card. Its path is */English/English.fnt*.

```
1000100011001111 A
0010101000111111 B
0000000011110011 C
```

Following the 'A' font entry as an example, the segments that will be on include *uphgdcba*. The row position each character is entered on in the file corresponds to its ASCII value starting at 32, which is a space. The font loader supports up to 223 rows (255 – 32).

Words

The word file is located at */Library/Library.wrd*. One or two word groups can be included on each row for a total of 64 characters, separated by a pipe symbol (|). Commas are allowed within word groups.

If two word groups are included, the second word group is displayed after the first word group. A group longer than six characters will scroll the display. The scroll speed is controlled by the size of the group, over five seconds. Long word groups will scroll more quickly. For long groups, insert a pipe symbol to break the group in two, then each group will scroll over five seconds. See the *Proverbs* files for examples.

The first line in the file is a comment line. It will not be selected for display.

Messages

The message file is located at */Library/Library.msg*. Each message file requires the following entries, in this exact order:

Wi-Fi
GPS
NTP
AP
Off
Mild
Medium
Strong
60 Sec
30 Sec
15 Sec
Always
Off
Index
No Idx
WX

These entries can be translated into any language.

Only *Library 1*, the default library, requires a message file, and only the default message file is used to display messages. Each message can be up to the width of the display. Additional characters will be truncated.

Expletives

The expletive file is optional. It is located at */Library/Library.xpl*. The structure of each row is word group, pipe symbol, level from 1-3. The levels correspond to mild, medium, and strong. Spaces between *word*, *pipe*, and *level* are not allowed, but spaces and commas can be used within each word. Higher levels also include lower levels, so level 3 will also include levels 1 and 2. Word groups can be up to 64 characters in length. An example follows:

Word Group Up to 64 characters|1

Word4|2
Wo rd3|1
Wo,rd2|3

Each expletive file has a limit of 125 word groups (rows), and each row can be up to 64 characters long. Rows over six characters will scroll over five seconds. Consider that the scroll speed will be extremely fast for long rows. Words do not have to be in any specific order, but keeping them alphabetized makes maintaining them easier.

The first line in the file is a comment line. It will not be selected for display.

Announcements

The announcement file is optional. It is located at */Library/Library.ano*. The structure of each row is one announcement, with the day at columns 1-2 followed by a dash, the month at columns 4-5, followed by the announcement, up to 32 characters. Entries do not have to be in calendar order. Announcements files are not included with the library distributions. They can be created using any text editor. Up to 50 announcements can be included in the announcement file.

When the month is set to 00, the announcement will be displayed every month on the day specified.

Only one announcement file is allowed, and it must be present in the Library 1 folder. An example follows:

06-20Happy Birthday Melissa
08-19Happy Anniversary Zev and CeeCee
00-12Pay Estimated Taxes (This displays on the 12th of each month)

Indexes

The index file is located at */Library/Library.idx*. It is used to allow all words and phrases regardless of their length, to have an equal chance of being selected by the random word selection process.

The index file is optional. See the section on indexes, to create and maintain index files. Any change to a word file requires the reindexing of that file's index.

Software Updates

Occasional software updates may be provided to improve performance and/or add new features. Carefully follow these instructions to update the software.

Disconnect power from the clock. Connect the microcontroller board to a PC using a cable with a micro-USB connector. In Device Manager, note the COM port.

DO NOT connect the USB cable while the board is powered!

The microcontroller board can be removed from the main board when updating the firmware.

Download and install the Flash Download Tools (ESP8266 & ESP32) from Espressif. A link is provided on the web site at www.stockscllocks.com.

Select *ESP32 Download Tool* from the menu.

Select *SPI Download* tab and enter the following settings:

Download Path Config: Select the file provided by email or the web site by clicking on the box with three dots, on the first line. After “@”, enter address 0x00010000 (four zeros after the one). Check the box to the left of the file name.

DO NOT CLICK *ERASE* or the microcontroller WILL have to be returned for reprogramming.

DO NOT CHECK ANY OTHER BOX IN THE LEFT COLUMN. IF THEY ARE CHECKED BY DEFAULT, UNCHECK THEM.

Additional Settings

Crystal Freq: 40M

SPI SPEED: 40MHz

SPI MODE: QIO

FLASH SIZE: 32Mbit

COM: Port: Enter the port noted in the Device Manager.

BAUD: Select 921600. If the update fails, try a slower baud rate.

DO NOT SET OR CHANGE ANY OTHER SETTINGS. REVIEW TO MAKE SURE ALL SETTINGS ARE CORRECT, ESPECIALLY THE ADDRESS NUMBER AFTER “@.” IF INCORRECT SETTINGS ARE FLASHED, THE MICROCONTROLLER MAY HAVE TO BE RETURNED FOR REPROGRAMMING.

Click *START*. When finished, disconnect the USB cable and disconnect power from the clock for a few seconds.

Notices

A best effort has been made to remove words that are offensive based on race, religion, or sexual preference, as we did not compose these libraries. Please notify us if we missed the removal of offensive words. Let us know the library name, and the offending word, and we will remove it.

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