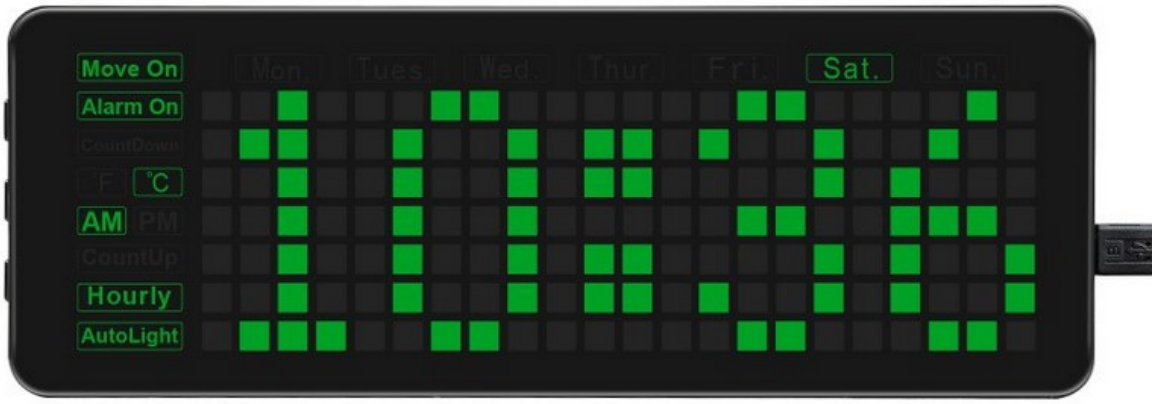
Pico Green Clock



Firmware Version 2.00

User's Guide

Updated March 14th, 2022

IMPORTANT :
This user's guide is about firmware Version 2.00 from Andre St. Louys. Version 2.00 is based on the original Waveshare's Version 1.00 and adds more features to the clock. If you're using the original software from Waveshare, some of the features described in this manual will not apply.

Index

Index 2
Introduction 4
Waveshare Pico Green Clock 4
Clock features 5
Alarms (run-time) 5
Auto-brightness (run-time) 5
Beep types (compile-time) 5
Calendar events (compile-time) 5
Count-down timer (run-time) 6
Count-up timer (run-time) 6
Date scrolling (run-time) 6
Daylight saving time (compile-time) 6
Daytime hourly chime (run-time) 7
Digits 7
Double dots blinking 7
Hour display mode (run-time) 8
Hourly chime (run-time) 8
Keyclick sound (run-time) 8
Language (compile-time) 8
Power supply voltage display (run-time) 9
Temperature display (run-time) 9
Clock setup 10
About clock buttons 11
Entering clock setup mode 11
Clock setup timeout 11
1) Hour setting 11
2) Minute setting 12
3) Month setting 12
4) Day-of-month setting 13
5) Year setting 13
6) Beep setting (keyclick) 13
7) Display scroll setting 14
8) Hour display mode setting 14
9) Hourly chime setting 14
10) Chime ON time 15
11) Chime OFF time 15
Alarm setup 17
About alarm setup 17
Entering alarm setup mode 18
Alarm setup timeout 18
1) Alarm number setting 18
2) Alarm on / off setting 18
3) Alarm hour setting 19

Index

4) Alarm minute setting 19
5) Alarm day setting 19
Timer setup 20
About timer setup 20
Timer OFF 21
Timer Count-up 22
Timer Count-down 23
Other setup 26
1) Temperature unit 26
2) Clock display brightness 26
Firmware 27
Test section 27
Calendar events 27
Alarm numbers 28
Character bitmap 28

Andre St. Louys
(Quebec, Canada)
astlouys@gmail.com

Introduction

Waveshare Pico Green Clock

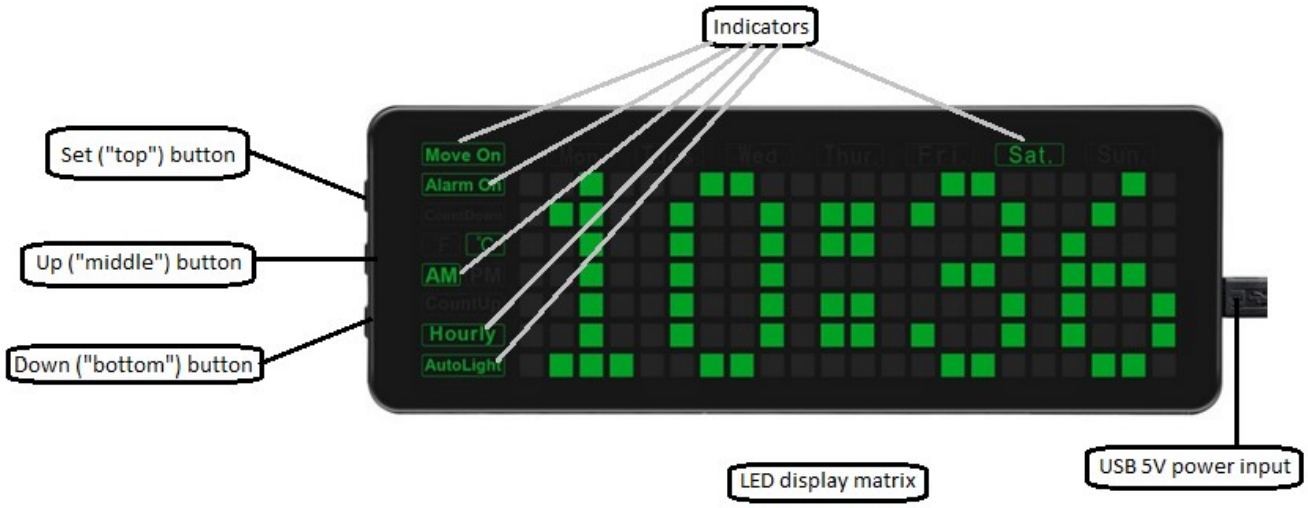
As mentioned on the cover page, this user's guide is about Firmware Version 2.00 from Andre St. Louys. Firmware Version 2.00 is based on original Waveshare's firmware Version 1.00 and adds more features to the clock and tons of comments to the source code which is in C-Language.

The Green Clock uses a Raspberry Pi Pico microcontroller to control most of its functions / features (IMPORTANT: the microcontroller, Raspberry Pi Pico itself is not included with the clock. However, it is relatively cheap – more or less 10 US$). The clock display is made of a matrix of 22 X 7 green LEDs, along with many indicators (for Day-of-week, AM / PM, Alarm On / Off, etc.) See figure below for more details.

There is also a real-time clock integrated circuit with a battery back-up, allowing the clock to keep the correct time in case of a power failure.

Some of the options / features of the clock are configurable at "run-time", while others are configurable only at "compile-time", as indicated in the text that follows. Options that are configurable at compile-time mean that a change must be done in the source code and the firmware needs to be rebuilt and re-flashed to the Pico microcontroller for the option to be active. On the other side, an option that is configurable at run-time means that the user can configure it once the clock is powered on and running.

Keep in mind the name given to the three clock buttons to the left of the clock. They will be used throughout this guide to show how to configure the clock.



Clock features

Alarms (run-time)

There are two alarms available on the clock. They can be independently set at a specific time and day, and they will sound an alarm when the programmed alarm time is reached.

Auto-brightness (run-time)

The auto-brightness feature allows the clock display to be brighter when the ambient light is bright and to dim the clock display when the ambient light is darker (see section on auto-brightness setting later in the guide).

The ambient light detection takes advantage of one of the analog-to-digital converter integrated in the Raspberry Pi Pico.

Beep types (compile-time)

The piezo integrated in the clock has its own integrated oscillator, so it is not possible to change the frequency of the sounds that are produced for the different usages (calendar events, keyclick, hourly chime, alarm, etc…). However, a feature has been implemented in Version 2.00 of the firmware allowing the making of a different number of "beeps" of different duration. This allows distinguishing between a calendar event, hourly chime, button keyclick, etc…

Calendar events (compile-time)

The user can define short strings of text (40 characters maximum) to scroll on the clock display at specific dates. For example, "John's Birthday" would scroll on the display on April 14th, if this date (14-APR) has been defined with the text associated. More than one such calendar event may be programmed for a specific day. However, it must be understood that it takes some time to scroll the strings on the clock display. If there are too many events defined for the same day, there is the risk that the audience will miss part of them.

The calendar events will scroll on the screen during all day at the date defined in the clock configuration at compile time (the firmware must be rebuilt and re-flashed in the Pico). The text will scroll at xxh05 and xxh35 of each hour all day long (that is, every

half hour), and a few warning beeps will also sound during daytime, as defined between "chime on time" and "chime off time" (set by default from 9h00 to 22h00).

A few of these calendar events have been programmed by default to show the user how to program others is desired. For example, "Happy New Year" and "Merry Christmas" are two such events that are programmed by default. Also, every first day of each month, an event called "Calendar event Month 1st" will scroll on clock display (where "Month" will be replaced by the actual month). This is to easily provide a demonstration of the feature without having to remember a specific date.

A maximum of 50 such "calendar events" may be configured in the firmware, at compile time.

Count-down timer (run-time)

A count-down timer can be programmed at run time and set to a specific start value. Once the count-down reaches zero, an alarm will sound (with no respect to "chime on time" and "chime off time").

Count-up timer (run-time)

A count-up timer may be started on the clock at run time. When started, the count-up timer will count from 00h00 and up, until stopped by the user (no alarm sound is associated with this timer).

Date scrolling (run-time)

The user may configure the clock to scroll the date, the ambient temperature and power supply voltage on the display at a predefined frequency (currently every 3 minutes, which is a compile time parameter) (see section on clock setup later in the guide).

With firmware Version 2.00, the date, temperature and voltage are displayed as in "Friday July 6 2022 21.25'c 4.82 Volts" (the temperature and power supply voltage are shown after the date). The letters are made of 5 X 7 character matrix (variable-width).

Daylight saving time (compile-time)

The firmware automatically supports the Daylight Saving Time for most northern hemisphere countries. This feature can be turned off, or other type of time change (for other countries) can be easily implemented as compile-time options.

When the clock is powered up, the current value of the daylight saving time will be quickly scrolled on the display (DST= 0x00 means that Daylight Saving Time is not "On" – that is, current date is not inside the period where daylight saving time is active, while DST= 0xFF means that DST is ON – that is, current date is inside the period during which the daylight saving time is active).

The second Sunday of March at 2h00 in the morning, the time will automatically go forward by one hour. In a similar way, the time will go back by one hour at 2h00 in the morning on the first Sunday of November.

Daytime hourly chime (run-time)

This feature allows the "hourly chime" and "calendar events" to sound a "warning sound" only during the hours configured. This can prevent those alarms to sound during the night, when people are sleeping.

Digits

The digits are built with the LED matrix of the clock. There are 4 X 7 characters and also 5 X 7 characters, making the digits more elegant ("better-shaped") than the usual 7-segments displays that we use to see in other clocks.

Double dots blinking

There are two "dots" in the middle of the clock, between the hours and the minutes (see picture above). Note that software Version 2.00 uses "slim" dots, as opposed to what can be seen on the picture.

When the minute changes (say, from 7h18m59s to 7h19m00s), the top dot begins to blink once a second, from 00s to 19s. Then, the bottom dot will blink from 20s to 39s. Finally, both dots will blink together from 40s to 59s. This allows someone to quickly evaluate (relatively) how "deep" we are in the current minute, and if the minute change will happen soon.

Hour display mode (run-time)

The hour can be displayed in 24-hours format (00h00 to 23h59), or in 12-hours format (00h00 AM to 11h59 AM, then 12h00 PM to 11h59 PM). This can be set at run time (see section on clock setup later in the guide).

Hourly chime (run-time)

Every hour, at xxh00, an hourly chime will sound to indicate that the hour just changed. This feature can be configured: On, Off, or Daytime. If configured for "Daytime", the hourly chime will sound only during predefined hours (set between 9h00 and 22h00 by default) (see section on clock setup later in the guide).

NOTE: If the hourly chime is Off, the "Hourly" indicator on the display will be turned Off. If the hourly chime is ON, the "Hourly" indicator on the display will be turned On with two LED backlights. If the hourly chime is set to "Day", only the left LED behind the "Hourly" indicator will be turned On. It is not easy to see the difference between full-on and only left-on and it will take some practice for the user to make the difference.

Keyclick sound (run-time)

A "keyclick" sound may be turned On or Off to give a positive feedback when the user pushes a clock button. If this option is turned On, a quick "click" will be heard each time a clock button is pressed to give the user a positive feedback that the button pressed has been processed by the clock (see section on clock setup later in the guide).

Language (compile-time)

Two languages have been implemented in the clock firware for date display (French and English). Only one language is available at any one time. This option requires the firmware to be rebuilt and re-flashed to the Pico. Provisions have been made for other languages, so that they could be easily implemented (as long as they use the usual English-like character set). English has been made the default in Version 2.00.

Power supply voltage display (run-time)

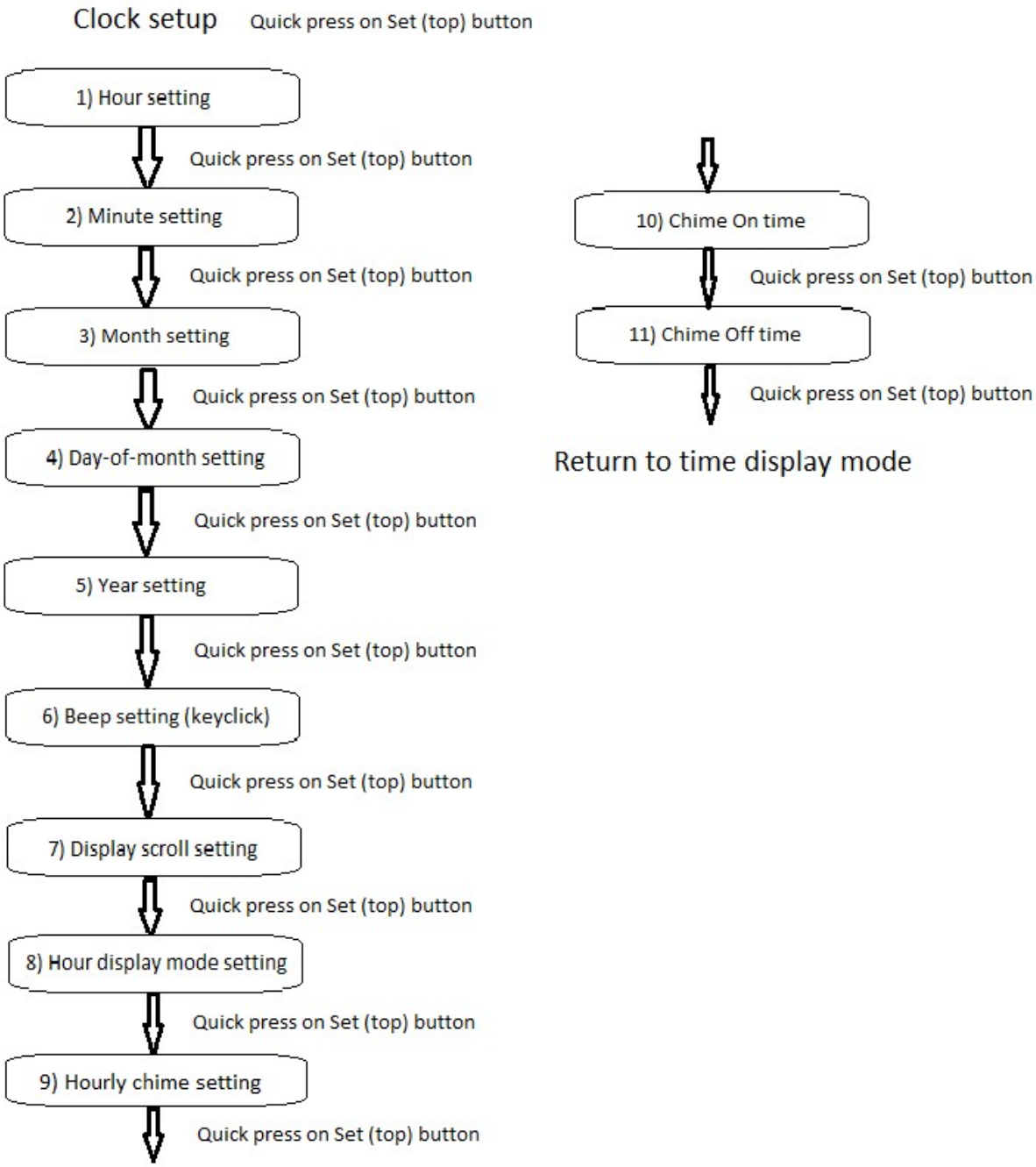
If the display scroll is enabled (see section on clock setup later in the guide), then the actual power supply voltage value will scroll on the display after the date and temperature.

The power supply voltage reading takes advantage of one of the analog-to-digital converter integrated in the Raspberry Pi Pico.

Temperature display (run-time)

The ambient temperature may be scrolled on the display, along with the date and the power supply voltage. The temperature may be shown in Celsius or Fahrenheit. This is a run time option (see section on clock setup – display scroll - later in the guide).

Clock setup



Refer to the paragraph – in the following section - with the number indicated in the box above to get more details about each step of the clock setup.

About clock buttons

Remember the name given to the three clock buttons:

- The Top button is called “Set” button since it is primarily used to proceed with settings.
- The Middle button is called “Up” button since it is primarily used to increase values (like hour setting, minute setting, etc).
- The Bottom button is called “Down” button since it is primarily used to decrease values (like hour setting, minute setting, etc).

When not mentionned, a button press means a “quick” button press, which is less than 300 milliseconds (shorter than one third of a second). In some cases, the clock will handle a “long press” (longer than one third of a second) by performing a different behavior than for a quick press. So, keep in mind the difference between a “quick press” and a “long press”.

Entering clock setup mode

To enter the clock setup mode, make a quick press on the “Set” (top) button while the clock is in the usual “Time display” mode.

Each time you press on the “Set” (top) button, you go through the different clock settings, as illustrated on the diagram above.

To exit clock setup mode, you can wait for a timeout (20 seconds without pressing a button on the clock – see next paragraph), or you can press the “Set” (top) button one more time when reaching the last setup step to return to the time display mode.

Clock setup timeout

If you leave the clock unattended for more than 20 seconds (compile-time option), it will return to the time display mode. Any change that has been made so far during this clock setup session will be saved in the clock settings.

1) Hour setting

While referring to the Clock setup diagram above, press the “Set” (top) button until you reach the “Hour setting” step.

Current hour will blink on the clock display. Press the “Up” (middle) button to increase the hour value, or press the “Down” (bottom) button to decrease the hour value.

Depending on the current “Hour display mode” (12-hour or 24-hour format), hour setting will go from 1 to 12 along with the AM/PM indicator, or from 00 to 23.

Take note that when you complete the clock setup, the integrated real-time clock integrated circuit (“RTC IC”) will be programmed with the new time and date and the seconds will start from zero. This IC is backed-up with a battery and will keep the accurate time in case of a power failure.

2) Minute setting

While referring to the Clock setup diagram above, press the “Set” (top) button until you reach the “Minute setting” step.

Current minute will blink on the clock display. Press the “Up” (middle) button to increase the minute value, or press the “Down” (bottom) button to decrease the minute value.

Take note that when you complete the clock setup, the integrated real-time clock integrated circuit (“RTC IC”) will be programmed with the new time and date and the seconds will start from zero.

3) Month setting

NOTE: Given the difference in the date format between French and English, note that the sequence for setting the month and the day-of-month are reversed when the clock language is set to French (which is a compile-time option, current language is set to English).

While referring to the Clock setup diagram above, press the “Set” (top) button until you reach the “Month setting” step.

Current month will blink on the clock display. Press the “Up” (middle) button to increase the month value, or press the “Down” (bottom) button to decrease the month value.

The day-of-month may be automatically changed in some occasion. For example, if day-of-month is currently set to 31, and you change the month from March to February, the day-of-month will automatically change from 31 to 28 (or 29 on a leap year) to comply with the upmost value for day-of-month in February.

4) Day-of-month setting

NOTE: Given the difference in the date format between French and English, note that the sequence for setting the month and the day-of-month are reversed when the clock language is set to French (which is a compile-time option, current language is set to English).

While referring to the Clock setup diagram above, press the "Set" (top) button until you reach the "Day-of-month" setting step.

Current day-of-month will blink on the clock display. Press the "Up" (middle) button to increase the day-of-month value, or press the "Down" (bottom) button to decrease the day-of-month value.

The day-of-month will not allow you to go higher than the upmost value for any given month. So, you may have to adjust the month before adjusting the day-of-month. For example, if you want to change the date from February 14th to March 31st, day-of-month will not allow you to go higher than 28 (or 29) as long as the month is set to February.

5) Year setting

While referring to the Clock setup diagram above, press the "Set" (top) button until you reach the "Year setting" step.

Current year (last two digits) will blink on the clock display. Press the "Up" (middle) button to increase the year value, or press the "Down" (bottom) button to decrease the year value.

Even if only the last two digits of the year are blinking, the year will go from 2000 down to 1999 and / or from 2099 up to 2100 as we would expect. However, if there is a power outage, when the power goes back on, the high part of the year (first two digits) will revert to "20". (Which shouldn't a problem, except if you plan to install the Pico Green Clock in the next Electric De Lorean to go back in 1845 or forward in 2187 !!).

6) Beep setting (keyclick)

While referring to the Clock setup diagram above, press the "Set" (top) button until you reach the "Beep setting" step.

"BP" (for "beep") will be displayed on the clock, along with the value "ON" or "OF" (for OFF) blinking. The value can be changed by pressing either on the "Up" (middle) or "Down" (bottom) button.

This setting controls the "keyclick sound" produced when the user presses a clock button. ON allows the keyclick to be heard each time the user presses a button (to give a positive feedback) whereas OFF makes no sound when a button is pressed.

7) Display scroll setting

While referring to the Clock setup diagram above, press the "Set" (top) button until you reach the "Display scroll setting" step.

"DS" (for "display scroll") will be displayed on the clock, along with the value "ON" or "OF" (for OFF) blinking. The value can be changed by pressing either on the "Up" (middle) or "Down" (bottom) button.

This setting controls if the clock will scroll the date, temperature and power supply voltage on the display every 3 minutes. (The setting can be "ON" or "OFF". Changing the 3 minutes frequency is a compile-time option).

8) Hour display mode setting

While referring to the Clock setup diagram above, press the "Set" (top) button until you reach the "Hour display mode setting" step.

"HD" (for "hour display") will be displayed on the clock, along with the value "12" (for 12-hour format) or "24" (for 24-hour format) blinking. The value can be changed by pressing either on the "Up" (middle) or "Down" (bottom) button.

If 12-hour format is selected, indicator AM or PM will show-up on the clock to complete the time information.

9) Hourly chime setting

While referring to the Clock setup diagram above, press the "Set" (top) button until you reach the "Hourly chime mode setting" step.

"HC" (for "hourly chime") will be displayed on the clock, along with the value "ON", "OF" (for OFF) or "OI" (for ON Intermittent) blinking. The value can be changed by pressing one or more times on the "Up" (middle) or "Down" (bottom) button.

Hourly chime is a sound made of a few beeps that will be produced each time the hour change from xxh59 to xxh00. The ON and OFF configurations are self-explanatory, but the OI ("On Intermittent") means that the sound will be heard only during daytime (so that people in the house can sleep without being disturbed by these sounds every hour during the night). The settings (On, Off, OI) are run-time options, along with starting and ending time (see next two settings).

There is an indicator on the clock display that will light up when hourly chime is ON. Behind this indicator, there are two LEDs that will turn on. When the option is set to "OI" (daytime only), only the left LED will turn on. It is not easy to make the difference between one LED On or two LEDs On and it may take some time for the user to see the difference between both settings from the indicator.

10) Chime ON time

While referring to the Clock setup diagram above, press the "Set" (top) button until you reach the "Chime ON time setting" step.

"ON" (for "chime on time") will be displayed on the clock along with the current value blinking. The value can be changed by pressing the "Up" (middle) button to increase it, or the "Down" (bottom) button to decrease it. The default value for chime on time is 9h00 in the morning.

The chime on time is the time at which the hourly chime will begin to sound during the day. See also the chime off time in the next paragraph. Note that the sound for the calendar events also complies with the chime time settings.

Note: The hourly chime setting must be set to "Daytime" (that is: "OI" for "On Intermittent" on the clock display) for the Chime on time setting to take effect. Also, in case of a power failure, Chime on time and Chime off time will revert to their default values (respectively 9h00 and 22h00 – 10h00PM).

11) Chime OFF time

While referring to the Clock setup diagram above, press the "Set" (top) button until you reach the "Chime OFF time setting" step.

“OF” (for “chime off time”) will be displayed on the clock along with the current value blinking. The value can be changed by pressing the “Up” (middle) button to increase it, or the “Down” (bottom) button to decrease it. The default value for chime off time is 22h00 (10h00 PM).

The chime off time is the last time at which the hourly chime will sound during the day. See also the chime on time in the previous paragraph. Note that the sound for the calendar events also complies with the chime time settings.

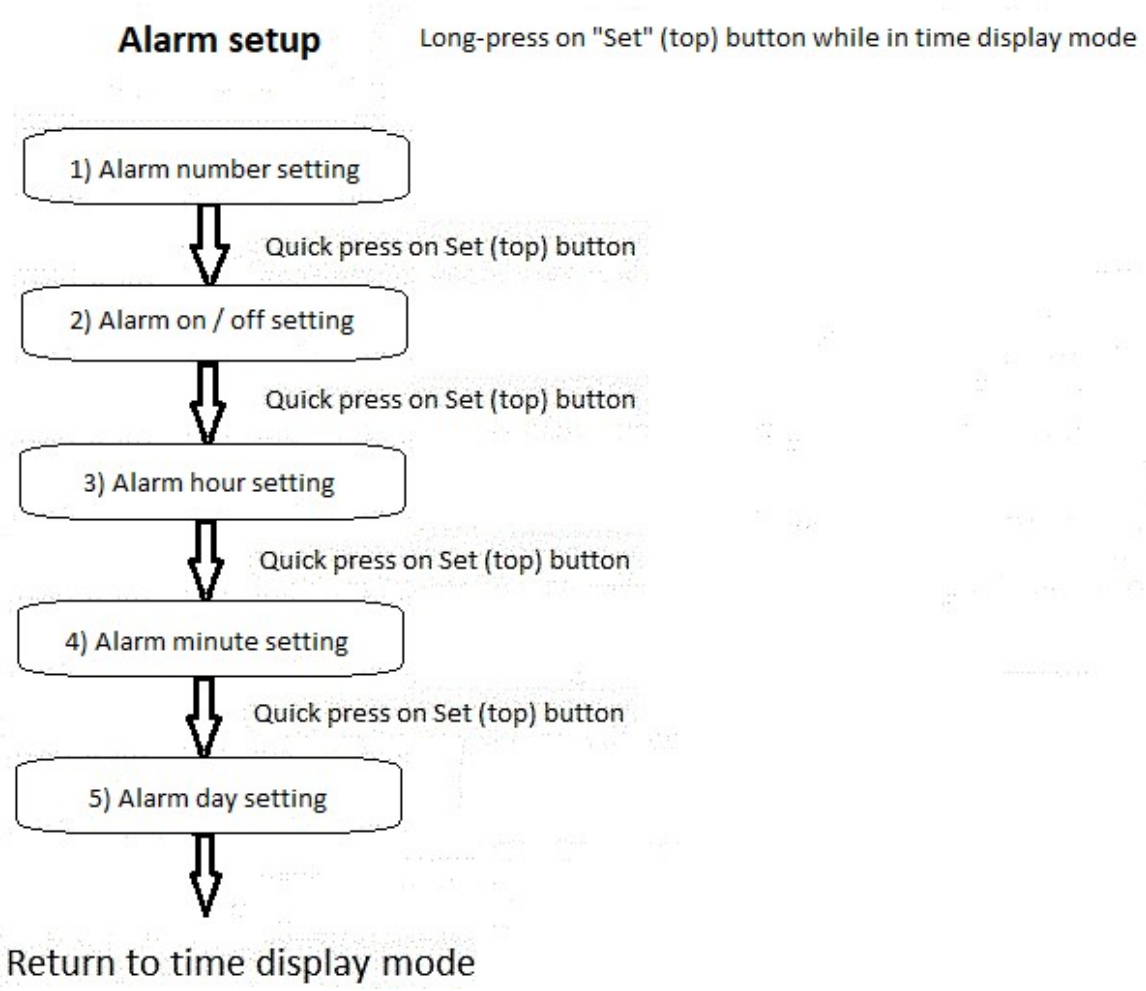
Note: The hourly chime setting must be set to “Daytime” (that is: “OI” for “On Intermittent” on the clock display) for the Chime off time setting to take effect. Also, in case of a power failure, Chime on time and Chime off time will revert to their default values (respectively 9h00 and 22h00 – 10h00PM).

So, for example, if you set the chime on time at 8h00 in the morning and the chime off time to 23h00 (11h00 PM), the hourly chime will sound every day (each time the hour changes from xxh59 to xxh00) from 8h00 in the morning up to (and including) 23h00 (11h00 PM). The warning sound associated with the calendar events will also comply with the same on and off times. By default, the on and off times are set to 9h00 in the morning up to (and including) 22h00 (10h00 PM) in the evening. (Obviously, this assumes that “Hourly chime setting” is set to (“OI” – On Intermittent).

Alarm setup

About alarm setup

There are two independent alarms that can be set on the Waveshare Green Clock (Alarm 1 and Alarm 2).



Refer to the paragraph – in the following section - with the number indicated in the box above to get more details about each step of the alarm setup.

Entering alarm setup mode

To enter the alarm setup mode, make a long press (longer than one third of a second) on the “Set” (top) button while the clock is in the usual “Time display” mode.

Then, each time you press on the “Set” (top) button, you go through the different alarm settings, as illustrated on the diagram above.

To exit alarm setup mode, you can wait for a timeout (20 seconds without pressing a button on the clock), or you can press the “Set” (top) button one more time when reaching the last setup step to return to the time display mode.

Alarm setup timeout

If you leave the clock unattended for more than 20 seconds (compile-time option), it will return to the time display mode.

1) Alarm number setting

While referring to the Alarm setup diagram above, press the “Set” (top) button until you reach the “Alarm number setting” step.

Press the “Up” (middle) button or the “Down” (bottom) button to alternate between alarm number 1 and alarm number 2 (as mentioned earlier in the manual, there are two independent alarms available in the Waveshare Green Clock).

The proposed choice will blink on the display until the user presses the “Set” (top) button to select the choice displayed and to proceed with next step.

2) Alarm on / off setting

While referring to the Alarm setup diagram above, press the “Set” (top) button until you reach the “Alarm on / off setting” step.

Once the alarm number (1 or 2) has been selected in the previous step, press the “Up” (middle) button or the “Down” (bottom) button to turn On or Off the selected alarm.

The proposed choice will blink on the display until the user presses the “Set” (top) button to select the choice displayed and to proceed with next step.

When an alarm is turned on, the indicator “Alarm On” will turn on, on the clock display.

3) Alarm hour setting

While referring to the Alarm setup diagram above, press the “Set” (top) button until you reach the “Alarm hour setting” step.

While the proposed hour blinks on the display, press the “Up” (middle) button to increase the proposed hour, or the “Down” (bottom) button to decrease the proposed hour. The display will follow the time “Display mode setting” to display the alarm in 12-hours or 24-hours display mode.

4) Alarm minute setting

While referring to the Alarm setup diagram above, press the “Set” (top) button until you reach the “Alarm minute setting” step.

While the proposed minute blinks on the display, press the “Up” (middle) button to increase the proposed minute, or the “Down” (bottom) button to decrease the proposed minute.

5) Alarm day setting

While referring to the Alarm setup diagram above, press the “Set” (top) button until you reach the “Alarm day setting” step.

At this point, you can select the day-of week for the selected alarm. The proposed day-of-week will be light up (but does not blink). Press the “Up” (middle) button to go to the next day-of-week, or the “Down” (bottom) button to go to the previous day-of-week.

Then make a quick press on the “Set” (top) button to return to the time display mode. If the selected alarm has been turned On, the alarm indicator on the clock display will have been turned on.

Timer setup

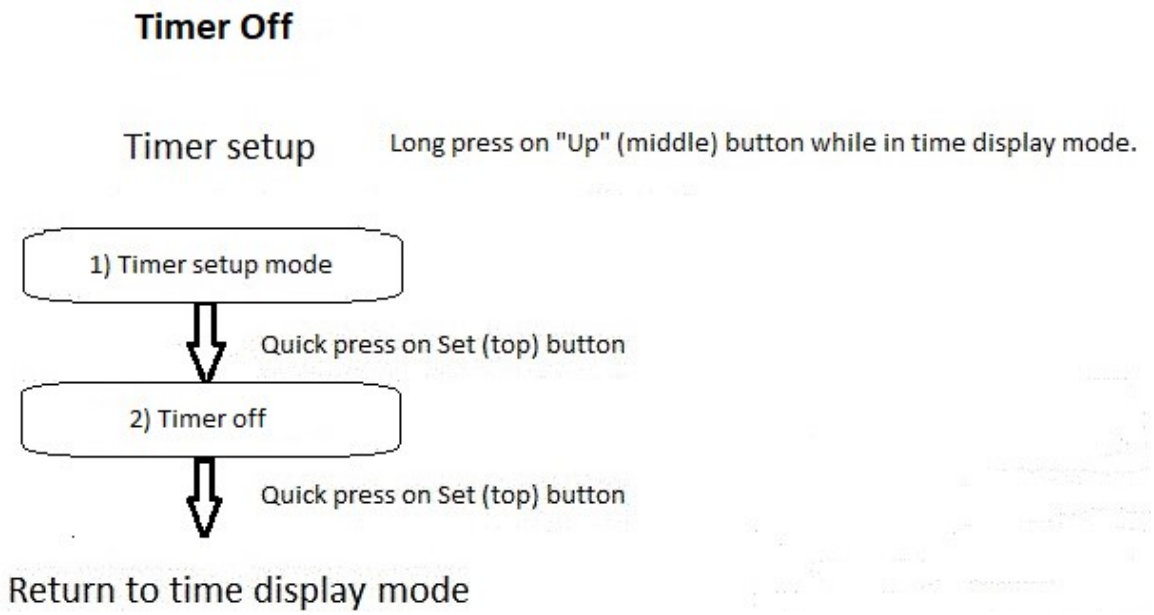
About timer setup

The Pico Green Clock features two timers. One is a “count-down” timer. Basically, you enter a start time (in minutes and seconds) and the timer begins to count down, toward zero. When it reaches zero, it beeps an alarm.

The “count-up” timer is different since we logically expect a count-up timer to start from zero. So, when started, the count-up timer begins counting up from zero until it is stopped by the user. There is no alarm associated to this timer.

To enter the timer setup mode, make a “long press” on the “Up” (middle) button. A long press means to hold the button for more than one third of a second.

Timer OFF



Refer to the paragraph – in the following section - with the number indicated in the box above to get more details about each step of the timer off setup.

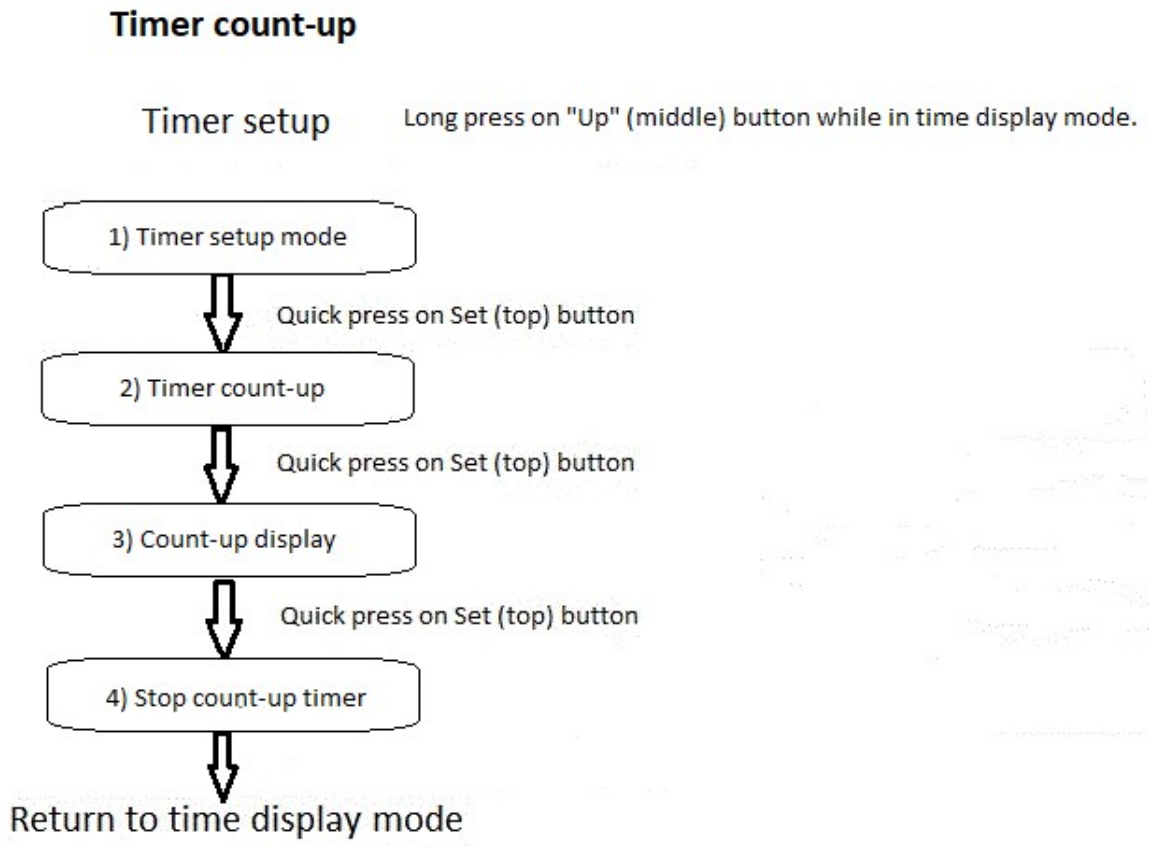
1) To turn off the timers, refer to the diagram above for “Timer off” and proceed as follow. First, make a long press on the “Up” (middle) button to enter the timer setup mode.

   Then, using the “Up” (middle) or “Down” (bottom) button, press until “OF” (for off) blinks on the clock display and press on the Set (top) bottom to select this choice. Choices are “OF” (for off), “DN” (for count-down timer), or “UP” (for count-up timer).

2) When pressing the “Set” (top) button, “OF” will stop blinking on the display to show that you made that selection.

   Press on the “Set” (top) button once again to return to time display mode while the timers have been turned off.

Timer Count-up



Refer to the paragraph – in the following section - with the number indicated in the box above to get more details about each step of the timer count-up setup.

1) To start the count-up timer, refer to the diagram above for “Timer count-up” and proceed as follow. First, make a long press on the “Up” (middle) button to enter the timer setup mode.

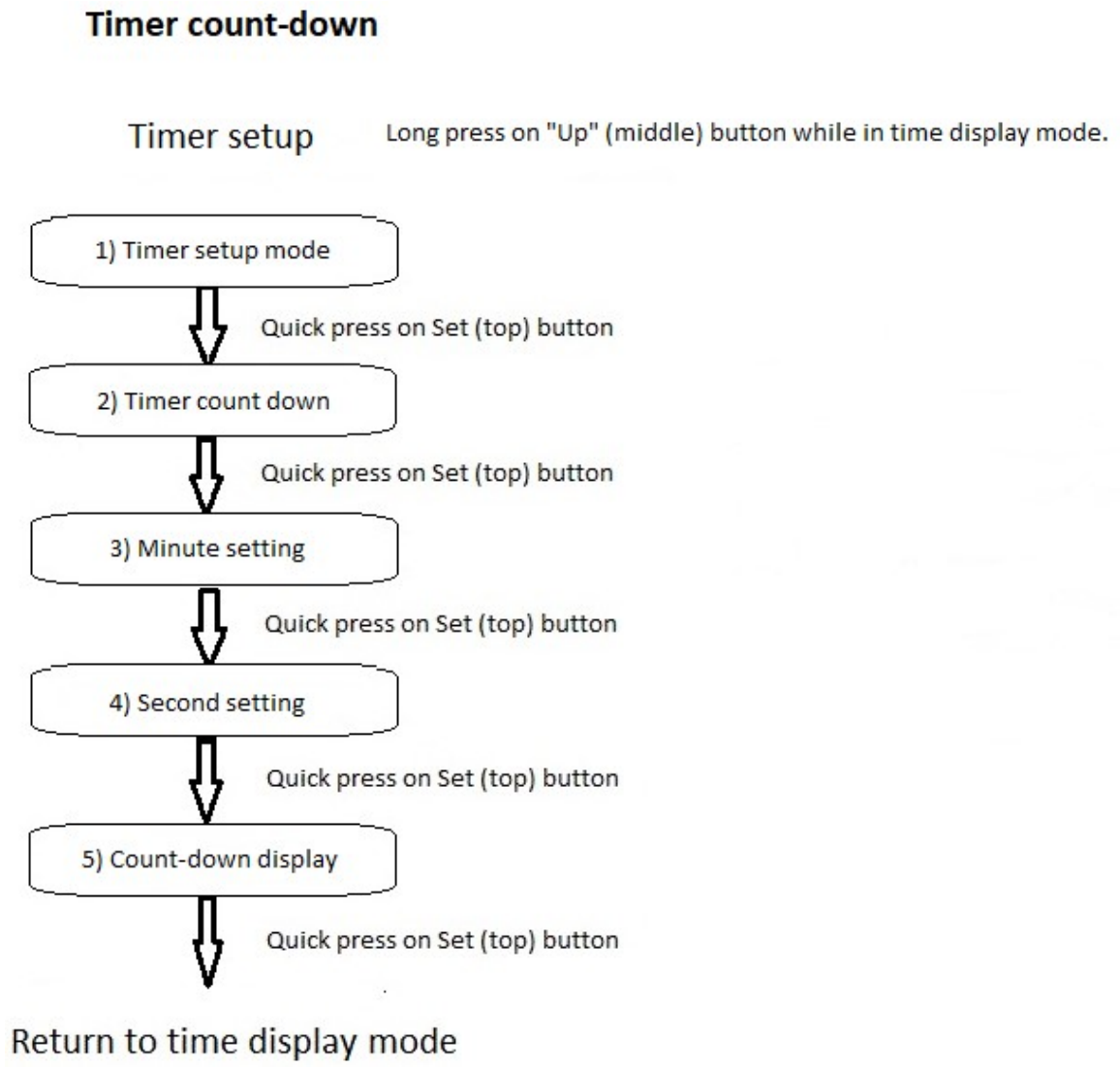
   Then, using the “Up” (middle) or “Down” (bottom) button, press until “UP” (for count-up timer) blinks on the clock display and press on the “Set” (top) bottom to select this choice. Choices are “OF” (for off), “DN” (for count-down timer), or “UP” (for count-up timer). The corresponding indicator on the clock display will follow the proposed choice (Off / Count-up / Count-down).

2) When pressing the “Set” (top) button, “UP” will stop blinking on the display to show that you made that selection.

3) Press on the “Set” (top) button once again to see the count-up timer starting to count the time from 00m00s.

4) The count-up timer will count until the user press on the “Set” (top) button to stop it. At this point, user may press on the “Set” (top) button again to return to the time display mode, or wait for a time-out to return to the time display mode.

Timer Count-down



Refer to the paragraph – in the following section - with the number indicated in the box above to get more details about each step of the timer count-down setup.

1) To start the count-down timer, refer to the diagram above for “Timer count-down” and proceed as follow. First, make a long press on the “Up” (middle) button to enter the timer setup mode.

   Then, using the “Up” (middle) or “Down” (bottom) button, press until “DN” (for count-down timer) blinks on the clock display and press on the “Set” (top) bottom to select this choice. Choices are “OF” (for off), “DN” (for count-down timer), or “UP” (for count-up timer). The corresponding indicator on the clock display will follow the proposed choice (Off / Count-up / Count-down).

2) When pressing the “Set” (top) button, “DN” will stop blinking on the display to show that you made that selection.

   Press on the “Set” (top) button once again and the clock will display the count-down starting value with minutes blinking.

3) Press on the “Up” (middle) or “Down” (bottom) button to adjust the minutes of the count-down timer. Press the “Set” (top) button when done and the minutes will stop blinking as the seconds begin to blink.

4) Press on the “Up” (middle) or “Down” (bottom) button to adjust the seconds of the count-down timer. Press the “Set” (top) button when done and the count-down timer will start the count-down until reaching zero minute and zero seconds.

5) At this point, you can leave the clock like this to see the count-down actual value at any time. When reaching zero, an alarm sound will be heard to warn you that the count-down value is over and the clock will automatically return to time display mode.

   Alternately, you can press the “Set” (top) button to return to the time-display mode while the count-down timer continues its work. The count-down timer will proceed to count until zero (as can be seen by the indicator “count-down” light-up on the display). Even if you are in the time display mode, an alarm will be heard when the count reach zero. The “count-down” indicator on the clock display will turn off when the count-down is over.

   It must be noted that the chime on time and the chime off time have no impact on the count-down timer alarm. The alarm will sound even if we are currently outside of the chime defined hours.

Timer setup

Other setup

1) Temperature unit

To change the temperature display from Celsius to Fahrenheit (or vice-versa), press the “Up” (middle) button on the clock, while in time display mode. The indicator will toggle between Celsius and Fahrenheit.

2) Clock display brightness

There are two different settings available for the clock display brightness: Full brightness and Automatic brightness.

When the setting is set to “automatic brightness”, the display will be in full brightness mode when the ambient light is bright and the clock display will become dim when the ambient light becomes darker.

To toggle the setting, make a quick press on the “Down” (bottom) button while in time display mode. When in “Automatic brightness”, the corresponding indicator (“Auto light”) will turn on, on the clock display.

Firmware

This section gives general information about different subjects related to the source code and will be of interest for those who want to work on the code. The information is given below, without specific or logical order of presentation.

The author of this document is interested in receiving your comments and ideas about features that you have added to the Pico Green Clock (email address given after the Index of this document).

Test section

To keep the firmware as small as possible, a conditional compile option has been configured so that test code may or may not be included in the executable. (see "#ifdef TEST_MODE").

Many chunks of test code have been left in the source code to help any programmer add new features to the clock or proceed with more tests.

Those chunks of test code must be considered as such: test code ! It should help you with the implementation of new functions / features, but it must not be considered as "debugged" and "fool-proof" code ! Use it at your own risk and efforts !

Calendar events

Calendar events are compile time options that may be configured before rebuilding the firmware. Basically, a "calendar event" is made of three elements:

1) A day-of-month (from 1 to 31).
2) A month (from 1 to 12).
3) A text (maximum of 40 characters).

When the specific date is reached (say, 15th of August), the text that has been defined in the source code will be scrolled on the clock display during 24 hours (the 15th of August in our example), twice an hour, at xxh05 and xxh35. Time as been chosen so that it will not interfere with the hourly chime (every xxh00).

Up to 50 calendar events may be configured. It must be noted that no validation is done on the day-of-month and month configured in the source code. If invalid values are entered, the corresponding string will simply never be scrolled.

Alarm numbers

It has been seen in the user guide that two different alarm numbers are available. They have been numbered 1 and 2 to be more “natural” for the clock user. However, in the code, these alarms are numbered 0 and 1.

Character bitmap

Original software Version 1.00 proposed the 4 X 7 character set (a few characters were base on a 5 X 7 bitmap anyway). It may be observed that the 4 X 7 character bitmap itself is not implemented in the intuitive way we would expect. This is because the lowest bit is on the left side of the LED matrix, while the lowest bit is on the right side of the byte when we manipulate the bit positions.

In order to build on a more intuitive bitmap character set, the 5 X 7 character bitmap uses the function “reverse_bits()” allowing the character bitmap to be based the way we expect it to be.