

# World Calendar

## User's Manual



The PandaWave

## Introduction to World Calendar

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World Calendar allows easy conversion between a variety of calendrical systems used around the world in both modern and historical times. World Calendar also calculates and displays the dates of holidays significant to various cultures and religions. The calendrical systems that World Calendar handles are:

Gregorian	Julian
Coptic	Ethiopic
Islamic	Bahá'í
Hebrew	Mayan Tzolken (Religious)
Persian (Iranian)	Mayan Long Count
Chinese	Mayan Haab (Civil)
Hindu Solar	

In addition to converting between these calendrical systems, World Calendar calculates the local time of the following events anywhere in the world:

### Lunar Events

Moon-rise  
Moon-set  
Full Moon  
New Moon  
First Quarter  
Last Quarter

### Solar Events

Sunrise  
Sunset  
Winter Solstice  
Summer Solstice  
Vernal Equinox  
Autumnal Equinox

Registered users can use World Calendar as a perpetual calendar. The calendar conversions should be accurate from about 3,000BC to 10,000AD.

## Setting up World Calendar

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Since World Calendar is a self-contained executable program, it requires little setup. Simply copy World Calendar into whatever directory suits your needs.

By default, World Calendar comes configured to display seasonal and daily events in Los Angeles, California. In order to display the correct times of the daily and seasonal events for your location, you will need to set the time zone, latitude and longitude. To do this:

- Step 1      Run World Calendar.
- Step 2      Select **Preferences...** from the **File** menu.
- Step 3      In the **Set Location** dialog box, set the latitude and longitude to your current position on the earth. Set the time zone to the number of hours difference between your time zone and Greenwich time. (In the United States, this would be from -5 hours for Eastern Standard Time to -8 hours for Pacific Standard Time.)

Selecting a specific city from the list will automatically set the correct location and time data for that city. If you want to set the values

yourself, choose “Other” from the city list and enter the desired location and time zone information into the dialog box.

**Note:** World Calendar will display the correct seasons for the Northern and Southern Hemispheres.

**Note:** World Calendar does not currently adjust for Daylight Savings Time. If you live in the United States (except in Arizona or Hawaii), you will need to add one hour to the time zone during the summer months. That is, for Pacific Daylight savings Time (PDT), you will need to enter -7. For EDT, enter -4.

Step 4                      Click **OK**.

## Registering World Calendar

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Unregistered versions of World Calendar will only display dates from one year in the past to four years in the future. World Calendar also expires 15 days after the date of installation. To prevent World Calendar from expiring and use it as a perpetual calendar you will need to obtain a **registration key**.

Kagi handles all of our payment processing. You can pay the registration fee and obtain the registration key in one of several ways:

- If you are paying using a **credit card** or with **First Virtual**, you may register World Calendar on-line at <http://www.pandawave.com>
- You may also use your credit card or First Virtual account to pay using the enclosed **Register** program. You may print your payment information and fax it to Kagi, or you may e-mail your information by pressing ‘copy’ and pasting the information into an e-mail message. Kagi can be reached by fax at [+1 \(510\) 652-6589](tel:+15106526589). Their e-mail address is [sales@kagi.com](mailto:sales@kagi.com)
- If you are paying with **Cash** or by **USD Check** you need to print the data using the **Register** application and send it, along with your payment, to the address on the form:

Kagi  
1442-A Walnut Street #392-G9S  
Berkeley, California 94709-1405  
USA

Please note that we will need your e-mail address or postal address so we can send you a registration key.

**A note about registration keys.** The registration key is calculated from the name you provide when you register World Calendar. This registration name is sent to Kagi, our payment processing service, who then forwards your name to us for registration key generation. All names are converted to standard 7-bit ASCII character codes—all diacritical marks, accents and the like are removed. In order to make sure your registration key is generated correctly, you will need to provide your name using standard 7-bit ASCII characters only, without diacritical marks.

Once you have obtained a registration key, you will need to enter the registration key into World Calendar to unlock all of its features. To do this:

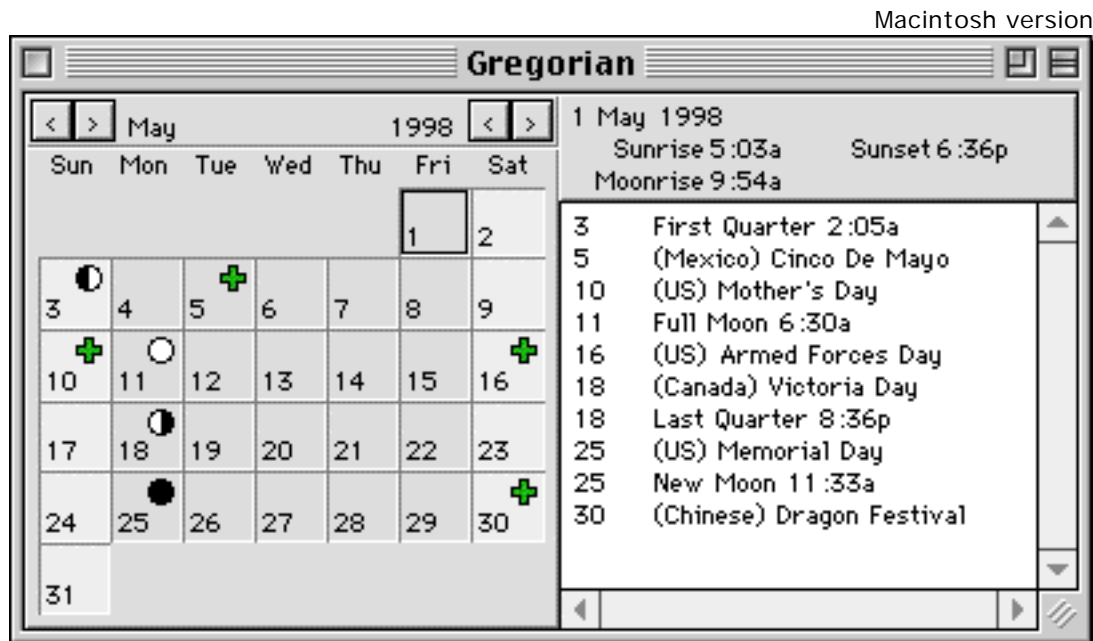
- Step 1            Run World Calendar
- Step 2            (Windows, Linux users) Select **Registration...** from the **Help** menu.  
(Macintosh users) Select **Registration...** from the **Apple** menu.
- Step 3            Enter your name, your company name (optional) and your registration key into the registration dialog box.

**Note:** If World Calendar is registered in your company's name or in the name of your school, please enter the company or school name in the 'name' field, not the 'company' field.

- Step 4            Click **OK**.

## Using World Calendar

When you run World Calendar, you will see a single window showing today's month.



Most of World Calendar's functionality is relatively self-explanatory. You can select the prior month or the next month by selecting the arrows on the upper left. To select the prior or next year, click the arrows to the right of the year.

You can set the current date by selecting **Set Date...** from the **File** menu—the dialog box will allow you to set the year, month and day that you wish to display.

**Note:** Some calendrical systems (the Bahá'í and Mayan calendars) ask for a year count since the "epoch" (or start) of that calendrical system, even though both calendrical systems count years differently. You should use this count as a reference only; the name of the year will be provided in the upper right corner.

## About the calendrical systems handled by World Calendar

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Most calendrical systems are based around a pattern of “months” and “years.” A “month” is approximately the length of time between new moons, while a “year” is the length of time between the onsets of a particular season.

Unfortunately for mankind, the length of a month is about 29 1/2 days, while a year is about 12 1/4 months in length. This makes creating a regular calendrical system around lunar and solar events difficult at best.

Most calendars (the Gregorian calendar, for example) are strictly **solar** calendars. That means that they make no attempt to keep months aligned to the phase of the moon, but instead concentrate on keeping the alignment of the year fixed to the motion of the sun. Generally these calendars introduce leap days to compensate for the fact that a year is 365 1/4 days in length.

A few calendars (the Hebrew calendar, for example) are **luni-solar** calendars; that is, they align the months to the phase of the moon and align the year to the motion of the sun by introducing “leap months” to compensate for the fact that there are about 12 1/4 months in a year.

The Islamic calendar is an example of a **lunar** calendar. Months are strictly aligned to the phase of the moon, while the months themselves eventually drift from season to season.

The Mayans used three different calendrical systems, none of which could really be called “lunar”, “solar” or “luni-solar”—that will be covered in the next section.

There are 11 different calendrical systems that are maintained by World Calendar. Those systems are:

Gregorian	The Gregorian calendar is the most commonly used calendar in the world.
Julian	The Julian calendar was first instituted for use by Julius Caesar in the Roman Empire. It is the predecessor of the Gregorian calendar, and is still used by some Greek Orthodox groups for calculating religious holidays.
Coptic	In use by Christian Copts, this calendar is based on the ancient Egyptian solar calendar.
Ethiopic	The Ethiopic calendar is a variation of the Coptic calendar used in Ethiopia.
Islamic	The Islamic calendar is a lunar calendar used by Muslims and Islamic countries.
Persian	The Persian calendar is currently in use in Iran, and a variant is in use in Afghanistan.

Bahá'í	The Bahá'í calendar is based on the 19-year cycle of the Báb, the martyred forerunner of the Bahá'u'lláh and co-founder of the Bahá'í religious faith.
Hebrew	The Hebrew calendar is the calendar used by the Jewish faith, and is the official calendar of Israel.
Mayan	There are three Mayan calendars. The first, or the “long count” is a strict counting of days used to record events. The second calendar is the “Haab” or civil calendar, used to keep track of day to day events. The third calendar is the “Tzolkin” or religious calendar, which is used for religious or spiritual purposes.
Hindu Solar	There are several Hindu calendars that are in use. This calendar, the Hindu Solar calendar, is used for astrological purposes.
Chinese	The Chinese calendar is the calendar commonly used in China.

## Gregorian calendar

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The Gregorian calendar is a strictly solar calendar consisting of 12 months. Those month names are:

January	February	March
April	May	June
July	August	September
October	November	December

The Gregorian calendar inserts a single leap day at the end of February (the second month) according to a simple year rule, modified from the Julian calendar's leap year rule.

## Julian calendar

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The Julian calendar is a strictly solar calendar consisting of 12 months. The names of those months are identical to the Gregorian calendar.

The Julian calendar is in fact the predecessor to the Gregorian calendar; the only difference between the two calendars is a slight modification of the leap year rule which prevents the summer and winter solstices from drifting relative to the calendar.

## Coptic calendar

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The Coptic calendar is a strictly solar calendar used by Christian Copts, the modern day descendants of the Pharaonic Egyptians. The calendar, based on the Egyptian solar calendar, consists of 12 months of 30 days each:

Tut	Babah	Hatur
Kiyahk	Tubah	Amshir
Baramhat	Baramundah	Bashans
Ba'unah	Abib	Misra

In order to keep the solar calendar aligned to the solar year, an additional “inter-calendarary” period of 5 or 6 days is inserted after Misra. Called “al-Nasi”, this period is treated as a “short month” by World Calendar.

## Ethiopic calendar

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The Ethiopic calendar is identical to the Coptic calendar, except for the months of the names and the year when the Coptic calendar begins. The month names are:

Maskaram	Teqemt	Khedar
Takhsas	Ter	Yakatit
Magabit	Miyazya	Genbot
Sane	Hamle	Nahase

The “short month” or inter-calendarary period is named “Paguemen.”

## Islamic calendar

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The Islamic calendar is a strictly lunar calendar of 12 months. Those months are named:

Muharram	Safar	Rabi I
Rabi II	Jumada I	Jumada II
Rajab	Sha'ban	Ramadan
Shawwal	Dhu al-Qa'da	Dhu al-Hijja

**Note:** As the actual starts of Islamic months are determined by observation of the phase of the moon, the dates provided by World Calendar are only approximate, and may be off by one or two days.

## Persian calendar

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The Persian calendar is a strictly solar calendar consisting of 12 months. Those months are named:

Farvardin	Ordibehesht	Khordad
Tir	Mordad	Shavrvivar
Mehr	Aban	Azar
Dey	Bahman	Esfand

In order to keep the calendar aligned to the solar year, an additional leap day is inserted into the month of Esfand.

## Bahá'í calendar

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The Bahá'í calendar is a strictly solar calendar. Unlike most calendars which use 12 months to represent the year, the Bahá'í calendar uses 19 months of 19 days each—the number 19 having significance to the Bahá'í faith. The names of the months and the names of the days (and their English translations) are:

Baha (Splendor)	Jalal (Glory)
Jamal (Beauty)	Azamat (Grandeur)



Nur (Light)	Rahmat (Mercy)
Kalimat (Words)	Kamal (Perfection)
Asma (Names)	Izzat (Might)
Mashiyyat (Will)	Ilm (Knowledge)
Qudrat (Power)	Qawl (Speech)
Masail (Questions)	Sharaf (Honor)
Sultan (Sovereignty)	Mulk (Dominion)
Ala (Loftiness)	

In order to make the calendar align to the solar year, an additional inter-calendrical period is inserted after the month of Mulk, called “Ayyam-i-Ha.” World Calendar treats this period as an additional “short” month.

Years are also named according to a 19 year cycle. Those names are:

Alif (the letter ‘A’)	Ba (the letter ‘B’)
Ab (Father)	Dal (the letter ‘D’)
Bab (Gate)	Vav (the letter ‘V’)
Abad (Eternity)	Jad (Generosity)
Baha (Splendor)	Hubb (Love)
Bahhaj (Delightful)	Javab (Answer)
Ahad (Single)	Vahhab (Bountiful)
Vidad (Affection)	Badi (Beginning)
Bahi (Luminous)	Abha (Most Luminous)
Vahid (Unity)	

## Hebrew calendar

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The Hebrew calendar is a luni-solar calendar; a calendar with a year aligned to the solar year, and with months aligned to the cycle of the moon. A normal year consists of 12 months:

Nisan	Iyyar	Silvan
Tammuz	Av	Elul
Tishri	Heshvan	Kislev
Teveth	Shevat	Adar

Periodically, an additional 13th month needs to be inserted into the cycle of months in order to keep the overall year aligned to the solar year. When a leap month is inserted, the last month is named “Adar I”, and the leap month, “Adar II.”

While the Hebrew calendar’s months start with the first month as Nisan, the Hebrew new year (or Rosh Hashanah) occurs on the 7<sup>th</sup> month, or the month of Tishri. This is consistent with biblical usage.

Leap days are also inserted into the Hebrew calendar—the length of Heshvan or Kislev may be changed in order to prevent Yom Kippur from falling on Friday or Sunday, and to prevent Hoshana Rabba from falling on Saturday. Additional modifications are made in order to prevent the calendar year from being either too long or too short.

## Mayan calendars

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There are three Mayan calendars. The first, the Mayan long count, is a strict counting of days. The units of this long count are 'baktun', 'katun', 'tun', 'uinal', 'kin', with one kin equal to one day.

1 'uinal' = 20 'kin',  
 1 'tun' = 18 'uinal',  
 1 'katun' = 20 'tun',  
 and 1 'baktun' = 20 'katun'

The long count starts on 6 September 3114 BCE (Julian).

The second calendar is the 'Haab' calendar, commonly used for civil purposes. The 'Haab' calendar closely approximates a solar year (but is not exactly aligned to the solar year) of 365 days, broken into 18 "months" of 20 days each. The months are:

Pop	Uo	Zip
Zotz	Tzec	Xul
Yaxkin	Mol	Chen
Yax	Zac	Ceh
Mac	Kankin	Muan
Pax	Kayab	Cumku

An additional short inter-calendar period of 5 days is inserted after the last month. This short period, called "Uayeb" was considered unlucky by the Mayans, and is treated as a "short" month by World Calendar. "Haab" years are not numbered, unlike other calendar systems.

The third calendar is the "Tzolken" or sacred calendar. This calendar consists of two interlocking cycles—a 13 day count and a cycle of 20 names:

Imix	Ik	Akbal
Kan	Chicchan	Cimi
Manik	Lamat	Muluc
Oc	Chuen	Eb
Ben	Ix	Men
Cib	Caban	Etnab
Cauac	Ahau	

Both cycles increase simultaneously—thus, "4 Ik" is followed by "5 Akbal."

Often dates were referenced by both their "Haab" and "Tzolken" dates simultaneously. Combining these two calendars forms a cycle of approximately 52 years.

## Hindu Solar calendar

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The version of the Hindu Solar Calendar implemented by World Calendar is an astrological calendar, with the names of the months corresponding to the 12 houses of the zodiac.

This calendar is strictly a solar calendar, with month names named after the signs of the zodiac which the sun passes through. The month names are:

Mesha (Aries)	Vrishabha (Taurus)	Mithuna (Gemini)
Marka (Cancer)	Simha (Leo)	Kanya (Virgo)
Tula (Libra)	Vrischika (Scorpio)	Dhanu (Sagittarius)
Makara (Capricorn)	Kumbha (Aquarius)	Mina (Pisces)

The length of each of these months and the total year length is based on the average motion of the sun. The length was estimated at  $1577917500/4320000$  days, accurate to approximately 3 minutes.

(Note that more modern versions of the algorithm for computing the precise days of the solar months exist. They are not currently implemented by World Calendar.)

## Chinese calendar

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The Chinese calendar is a luni-solar calendar with the months and years fixed to the motion of both the sun and the moon.

The Chinese calendar is simply numbered from the first month to the 12th, with the beginning of each month starting on the day of the new moon in Beijing. A year has either 12 or 13 months; a month is considered a “leap month” if that month does not contain a “solar term”—that is, if the longitude of the sun is not a multiple of  $30^\circ$  during the course of that month. (Because the sun passes through  $360^\circ$  in one year, it is impossible for there to be more than one leap month in a given year.)

The year is arranged so that the Winter Solstice lands in the 11th month of the prior year, counting leap months. This makes calculating the day of the Chinese New Year a non-trivial task, one that is easily done by World Calendar.

Note that the positions of the sun and moon are calculated to within a couple of seconds by the algorithms used by World Calendar. This means that it is possible (though unlikely) that World Calendar may incorrectly compute the length of a given month. (This can happen when the new moon is close to midnight in Beijing.) Also, as the calculation of the location of the sun and moon was less accurate at the turn of the century, it is possible that the results given by World Calendar can differ from older Chinese calendars.

## About the Author

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The PandaWave is a service of In Phase Consulting, a software development partnership. Providing top-notch software for 5 years, In Phase Consulting specializes in developing state of the art applications for the Macintosh, Microsoft Windows 95 and Windows NT, Linux and the PalmPilot.

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Software developed by William Edward Woody, using Metrowerks Codewarrior Professional for the Macintosh and Windows versions. Linux versions developed using the GNU tools provided in the Red Hat Linux v5.0 release. MkLinux versions developed using the GNU tools provided in the MkLinux DR2.1r5 release by Apple Computer.

Algorithms are based on those found in the following books:

Dershowitz, Nachum; Reingold, Edward M.; **Calendrical Calculations**, Cambridge University Press, 1997

Duffett-Smith, Peter; **Astronomy With Your Personal Computer**, Cambridge University Press, 1990

The dates for the United States celebration of Thanksgiving were derived from comments from Cecil Adams' **The Straight Dope**.