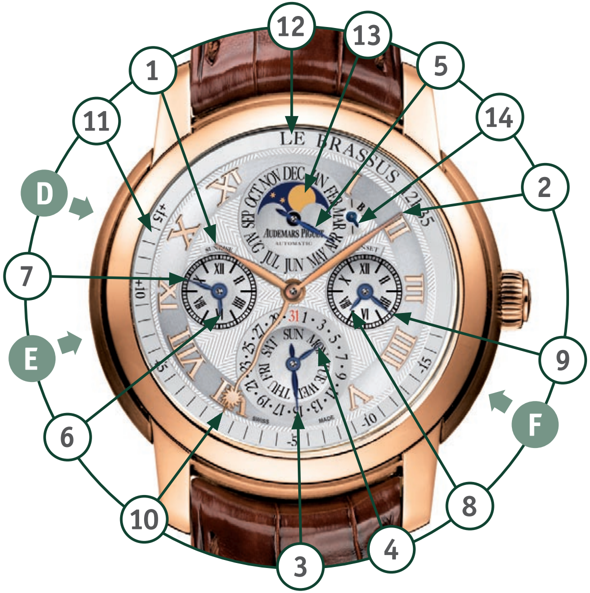
Instructions for use
Mode d'emploi

Equation of Time

Calibre 2120/2808
Selfwinding

AP
Audemars Piguet
Le maître de l'horlogerie depuis 1875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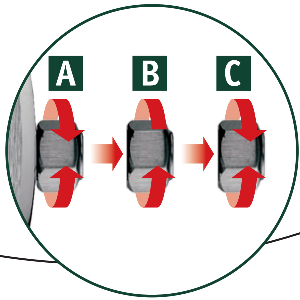
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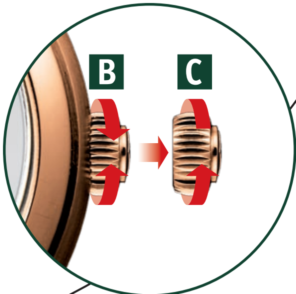
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English

Quick-link contents page.

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The Manufacture Audemars Piguet

The Vallée de Joux: cradle of the watchmaker's art

In the heart of the Swiss Jura, around 50 kilometres north of Geneva, nestles a landscape which has retained its natural charm to this day: the Vallée de Joux. Around the mid-18th century, the harsh climate of this mountainous region and soil depletion drove the farming community settled there to seek other sources of income. With their high degree of manual dexterity, inexhaustible creativity and enormous determination, the inhabitants of the valley, known as Combiers, were naturally drawn to watchmaking.

Due to their high quality, the movements they produced acquired great popularity with the Geneva firms which used them to create complete watches.

From 1740 onwards, watchmaking developed into the principal industry of the Vallée de Joux. This region was thus transformed, as an 1881 chronicle put it, “into a land of milk and honey, in which poverty has rapidly disappeared”.

Two names for a great adventure

In 1875, two young men passionate about Haute Horlogerie — Jules-Louis Audemars and Edward-August Piguet — decided to pool their skills to design and produce watches with complications in the Vallée de Joux, the cradle of Haute Horlogerie. Determination, imagination and discipline led them to instant success. A branch in Geneva was their next move in about 1885 and new commercial links were forged at the 1889 Paris World Exposition, where they exhibited complication pocket watches. The Audemars Piguet factory continued to expand as the years went by. Its creations represented major milestones in the history of Haute Horlogerie, like the first minute repeater wristwatch in 1892 and the smallest five-minute repeater movement ever made in 1915.

From 1918 onwards, the founders passed the reins of the business onto their sons, who in turn perfected their expertise in manufacturing men's and ladies' wristwatches as well as designing new sophisticated, ultra-thin movements. Perseverance and initiative were the watchwords: while the Wall Street crash in 1929 was a bitter blow, the company directors were soon designing so-called skeleton watches before embarking on chronograph production.

But this new momentum was abruptly interrupted by the Second World War. Re-organisation was necessary in the aftermath of the conflict. The factory focused on creating top-of-the-range items in keeping with its tradition of innovation. A strategy that would prove its worth, especially since it was backed by outstanding creative daring.

Audemars Piguet continued to build on its now international reputation with creative designs. 1972 saw the launch of the *Royal Oak*, the first, immediately successful high-quality sports watch in steel, followed in 1986 by the first ultra-thin tourbillon wristwatch with automatic winding. The creative spirit of the Manufacture has not faltered since, offering aesthetically original timekeepers with outstanding movements. Thus it brought watches with complications back into fashion at the end of the 1980s, launching its extraordinary *Tradition d'Excellence* collection in 1999. All the signs of a bold spirit rooted firmly in tradition and auguring well for the future.

Generality

The very nature of highly complex watches is not to reveal all their secrets and their subtleties at first glance. What the most ingenious master-watchmakers have taken years to develop cannot be easily grasped, even by the keenest minds. Understanding an exceptional timepiece, penetrating its mechanical genius and realising all its attractions calls for a certain amount of effort.

Ranked among the greatest of all watch complications, the Equation of Time represents an astonishing compendium of human craft and technical skill.

What we call the equation of time is the difference between apparent solar time and mean solar time. If one knows the value for the equation of time and the local longitude, one can determine precisely when the sun reaches its zenith at a given point on the globe. Audemars Piguet has thus chosen to go beyond all the equation of time models that have been created throughout horological history. The Equation of Time is the only watch able to thus indicate precisely when the sun reaches its highest point (apparent noon) in the locality in which you find yourself.

This feat has been made possible by drawing on the historic know-how of the Manufacture in Le Brassus in the field of perpetual calendars. Right from its founding in 1875, Audemars Piguet presented a pocket-watch with a perpetual calendar. One hundred and three years later, the Manufacture distinguished itself by presenting the first ultra-thin perpetual calendar to appear on a selfwinding wristwatch. The Equation of Time descends from a line of illustrious ancestors. Its perpetual calendar is programmed to mechanically reproduce the complex leap-year cycle. Corrections are made automatically for months with 28, 29, 30 or 31 days. The wearer will only have to make one manual correction by pressing the corrector twice on the evening of February 28, 2100.

The Equation of Time is an absolutely unique timepiece for several reasons in addition to the remarkable complexity of its movement, the Calibre 2120/2808. Unique in its extreme degree of customisation, since every watch matches exactly the precise coordinates of the purchaser’s chosen location.

The transparent case back of The Equation of Time reveals the oscillating weight of the self-winding movement. The weight may be openworked and engraved with a personalised motif as preferred by the owner, within available technical resources.

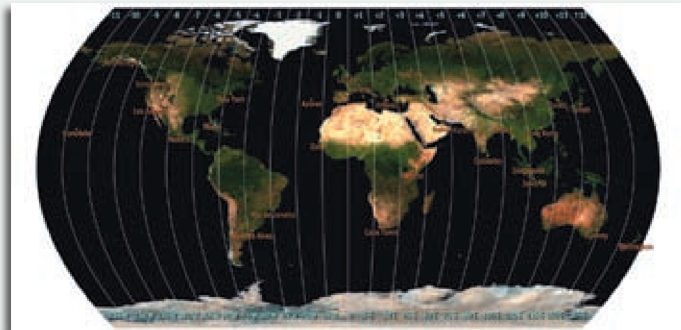
By integrating this touch of emotion and personalisation within one of the most prestigious horological mechanisms, Audemars Piguet is opening up whole new vistas in the history of “Haute Horlogerie”. The Equation of Time has written one of its first chapters.

Times-zones

At a given place on Earth, it is solar noon when the sun is in the meridian plane for that locality. In other words, in any other place in the world, solar noon (when the sun reaches its highest point) occurs at some other moment. If you move from east to west or vice-versa, you would have to constantly reset your watch if you wanted it to always display apparent solar time (true local time).

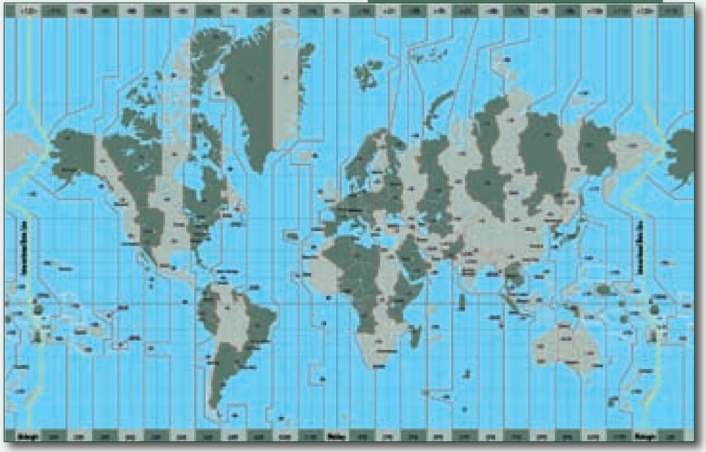
Apparent solar time does not lend itself very well to human relations, because it differs from one location to the next. It also varies slightly according to the time of year.

That is why an international system of meridians at 15° intervals has been adopted. It is used to measure an average for apparent solar time, referred to as mean solar time. The earth was divided into 24 time zones (see map, below) with a central meridian.



The 24 time zones

Time zones follow political borders



In 1884, at the International Meridian Conference in Washington, D.C., it was decided to set up a global system of time zones. The meridian passing through Greenwich in Great Britain was chosen as the prime meridian, i.e. the reference axis for Coordinated Universal Time (UTC or GMT) on which all time zones would be based.

Theoretically, all of the points on the globe with the same longitude should be in the same time zone. In reality, each country has defined its time zone(s) as a function of political borders, among other considerations (see the map of time zones based on political borders).

The units of time

Apparent noon (culmination of the sun)

Apparent noon occurs when the sun reaches its highest point (in the tropics, it is even at its zenith) and enters the plane of the meridian. This also corresponds to midday, or noon. Shadows are shortest at this moment of the day.

Apparent solar day

The apparent solar day is the time that elapses between two, successive culminations of the sun at the longitude of a given place, in other words, the time elapsed between one apparent noon and the next.

Apparent solar time (LAT, local true time)

Apparent solar time is based on the apparent solar day: at the moment when the sun reaches its highest point, it is exactly 12 noon LAT (local true time).

Mean solar time (MST, the time displayed by watches)

The duration of the true solar day is irregular; this is because the terrestrial orbit is an ellipse and the Earth's axis is tilted in its orbit. The apparent solar day cannot be used as a unit of constant time.

The length of the mean solar day – exactly 24 hours – is the annual average of all apparent solar days. The mean solar day is based on mean solar time.

The equation of time

The equation of time is the difference, for a given day, between mean solar time and apparent solar time. This difference is shown in a graph (known as an analemma).

Central European Time (CET)

Central European Time is the mean solar time measured in the time zone whose meridian is 15 degrees east of the prime meridian in Greenwich. This is the time shown on our watches.

Local time difference

Mean midday corresponds to 12.00 o'clock plus or minus the local time difference, which can be read off the watch bezel. In Le Brassus, for example, mean midday is at 12:35 hours every day. To calculate true midday from the local mean midday, you need to add (or subtract) the figure given by the equation of time hand. It can be read in the middle of the day when the equation of time hand coincides with the minute hand.

On 15th April in Le Brassus true noon is at 12:35 (equation of time 0 min.). Mean noon and true noon coincide.

On 11th February in Le Brassus true noon is at 12:49 pm (equation of time +14 min.).

2. About time English

The calendars

The Julian calendar

The Julian calendar takes its name from Julius Caesar who established it 45 years before Christ. It is based on 365.25 days, generally accepted as the average length of a year. It allows three consecutive years of 365 days, followed by one leap year to which one day is added in February. A leap year occurs if the millesimal can be divided by 4.

The Gregorian calendar

The Gregorian calendar takes its name from Pope Gregory XIII who made a change to the Julian calendar. The solar year is actually shorter than the Julian year by approximately 11 minutes, or 3 days in 400 years.

In 1582, the Julian year was already ten days behind the solar year. Pope Gregory XIII corrected the error and that year the 4 October was followed by the 15 October. To keep this from happening again, he ordered that, in future, years evenly divisible by 100 would not be leap years unless they were divisible by 400.The remaining error is just 1 day in 3000 years.

Leap years

A leap year is a year divisible by four (a year when the month of February has 29 days).

For example : 1916, 1920 ... 2008, 2012, 2016 and 2020.

The years that are evenly divisible by 100 are not leap years, unless they are also evenly divisible by 400.

For example : 1600, 2000 and 2400.

The earth's coordinates

The meridian

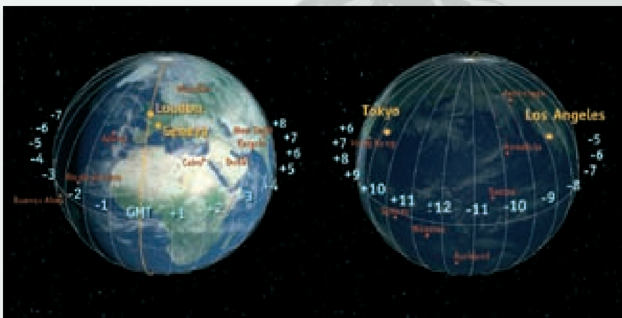
A meridian is a great circle that goes through a given location and both poles of the earth. In 1884, the meridian going through the observatory of Greenwich (GMT) in England was fixed as the prime meridian.

Longitude

Longitude is the angle between the local meridian and the Greenwich meridian. It is measured in degrees. The position is shown as being east (E) or west (W) of Greenwich.

Latitude

Latitude is the angular distance of a place from the equator, measured in degrees. The position is shown as being north (N) or south (S) of equator.



Views of the movement

Calibre 2120/2808

Bridge side

Dial side

Movement technical data

Thickness of the basic movement: 2.45 mm

Total thickness: 5.35 mm

Total diameter: 28.40 mm

Frequency: 19,800 vibrations/hour (2.75 Hz)

Number of jewels: 41

Minimal power reserve: approx. 40 hours

Bidirectional automatic winding

21 carat gold rotor turning on 4 ruby runners

Balance with variable inertia blocks

Flat balance-spring

Mobile stud-holder

Number of parts: 425

Specificities

Extra-thin movement

Suspended barrel

Height end-shake for oscillating weight provided by a peripheral ring and four bridges fitted with jewel bearings, all of which provide this automatic system with globally-unique efficiency, durability and tone

Manual finishing of the bridges (côtes de Genève, polished bevels, satinbrushed edges, perlage on the recesses)

Hand crafted decorative engravings on gold segments and weight supports

Moonphase made with Physical Vapor Deposited metal onto sapphire

Equation of time, sunrise and sunset can be customised according to the location

Oscillating weight can be custom decorated upon customer's request

Watch indications and functions
(see figure on the inside cover)

1. Hour hand
2. Minute hand
3. Date hand
4. Day of the week hand
5. Month hand
6. Sunrise hour indicator hand
7. Sunrise minute indicator hand
8. Sunset hour indicator hand
9. Sunset minute indicator hand
10. Time equation indicator hand
11. Time equation indicator sector
12. Sector indicating the reference city for sunrise and sunset as well as the moment at which the sun reaches its highest point
13. Moon phase indicator
14. Leap-year hand

D Corrector for the date, day of week, month, leap year cycle, sunrise and sunset, and equation of time

E Moon phase corrector (exclusively)

F Day of the week corrector (exclusively)

Your watch has a two-position or three-position crown:

A Crown in "screwed down" position (Royal Oak models only)

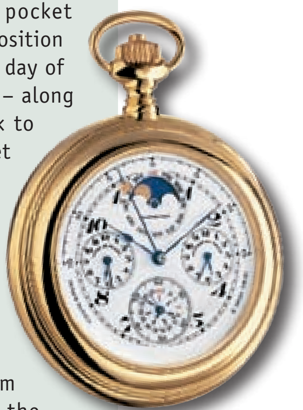
B Crown in position for winding movement manually

C Crown in position for setting the time

Caution: On Royal Oak models, the crown must be unscrewed to access the different settings. Afterwards, carefully screw it back into position **A** to ensure water resistance.

The perpetual calendar

Taking inspiration from the 1925 pocket watch, Audemars Piguet decided to position the indications – perpetual calendar, day of week, date, month and moon phases – along an axis running from twelve o'clock to six o'clock. The first Audemars Piguet watch to feature this design was presented in 2006.



Theoretically, there is no need for date corrections before the beginning of March 2100, at which time the wearer will press one of the corrector pushbuttons to bring the date and day hands forward from February 28 to March 1. This keeps the watch in line with the Gregorian calendar.

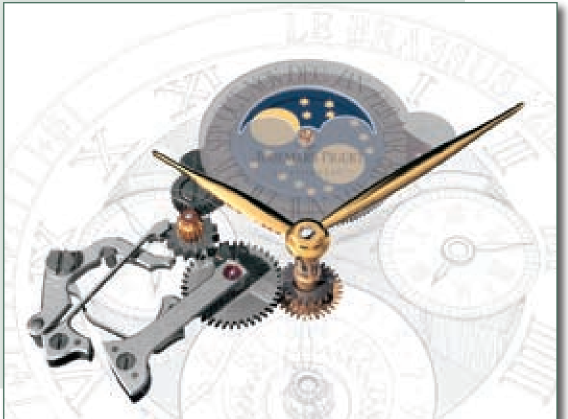
Perpetual calendar and leap year cycle

The perpetual calendar is easy to read: all of the indications are aligned along an axis running from twelve o'clock to six o'clock. The month and moon phase are indicated at twelve o'clock, and the date and day of week at six o'clock. The perpetual calendar drives all the other complications.

The leap year hand gradually completes one quarter-turn between January 1 and December 31. In the example below, the leap year is indicated when the hand is located in sector B.

The astronomical moon

The moons usually found on the perpetual calendar mechanism require correction every two years and seven months. With this watch, the technicians at Audemars Piguet introduced an ultra-precise moon phase mechanism that only needs to be adjusted every 122 years and 44 days. It is corrected by pressing the corrector twice.



Astronomical moon mechanism

Phases of the moon (in the Northern Hemisphere)

The new moon is when it is invisible (1).

It is waxing if partially visible in the left-hand side of the aperture (2).

When centred, this shows a full moon (3).

It is waning if partially visible in the right-hand side of the aperture (4).

The duration of a lunation is 29 days 12 hours 44 minutes and 2.8 seconds.

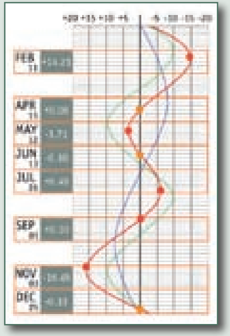
The time equation

The equation of time is the difference, for a given day, between mean solar time (MST) and apparent solar Time (LAT).

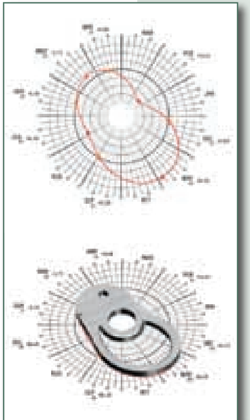
Apparent solar time (LAT), which is only displayed on sun dials, varies from one day to the next, because the earth follows an elliptical orbit and its axis of rotation is tilted. Mean solar time(MST) disregards these parameters: time is divided mathematically into minutes with exactly 60 seconds. Four times a year, 15 April, 13 June, 1 September and 25 December, these two times are the same. Between these dates the variance changes from minus 16 min. and 45 sec. on 3 November, to plus 14 min. and 21 sec. on the 11 February. The Equation of Time hand, centred in the dial, gives a precise reading of the daily variation to be added or subtracted from the mean time to obtain true solar time.

Equation of time mechanism

Variations of the equation of time may be obtained by using a cam shaped like a kidney bean. The equation is based on two of the famous laws of planetary motion formulated by Johannes Kepler (1571-1630) and on a principle whose influence was fundamental: that of the inclination of the Earth's axis of rotation in relation to the plane of its orbit (23.44°).



- Kepler's first law (the so-called "Law of Orbits"): Planets move in elliptical orbits with the sun at one focus of the ellipse.
- Kepler's second law (the "Law of Areas"): A line connecting a planet to the sun sweeps out equal areas during equal intervals of time.



The cam radius varies between 1 and 3 mm. This difference of some 2 mm sets a 31 min. and 16 sec. travel for the equation hand (-16 min. and 45 sec. to +14 min. and 21 sec.), i.e. in the order of one second per thousandth of a millimetre.

In the Equation of Time mechanism, the cam is identical regardless of location; only the hand-fitting and the indication on the graduated ring are adjusted differently for each longitudinal coordinate.

The time shown always relates to the universal concept of winter time.

True noon and mean noon

You can see a tremendous difference when observing the exact time on a wristwatch at which **true noon** occurs for several days in a row. Over the entire year, **true noon** occurs sometimes at the **mean noon**, sometimes earlier, sometimes later. This positive or negative difference between **mean noon** and **true noon** is called the equation of time.

The "Equation du temps" indicates **true noon** accurately. The **mean noon** at Le Brassus (6°12'0) is indicated on the engraved bezel of the equation of time, at 12.35 CET (Central European Time). The equation of time hand adds or subtracts the value of the equation of time corresponding to the day of the year to indicate **true noon**. The sun's culmination corresponds to the moment when the minute hand is superimposed on the equation of time hand. **True noon** is when solar time corresponds to noon, local time.

Let us now turn to **true noon** at different times of year. When solar time indicates that the sun is in its culmination at Le Brassus on 11 February, it is 12.49 CET (Central European Time). The minute hand is superimposed on the equation of time hand and an equation of time value of +14 minutes is noted.

On 15 April, **true noon** occurs at 12.35 at Le Brassus (equation of time 0 min.). **True noon** and **mean noon** (indicated on the equation of time bezel) coincide.

On 3 November, **true noon** occurs at 12.19 CET (Central European Time) at Le Brassus. The equation of time value is -16 minutes.

On 11th February in Le Brassus true noon is at 12:49 pm

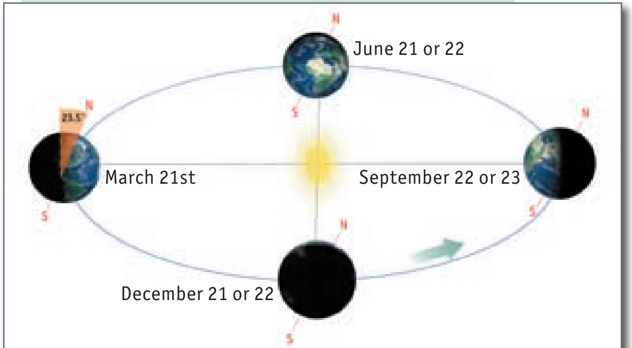
On 15th April in Le Brassus true noon is at 12:35

On 3rd November in Le Brassus true noon is at 12:19

Indication of sunrise and sunset times

The length of days and nights varies according to the season, except at the equator.

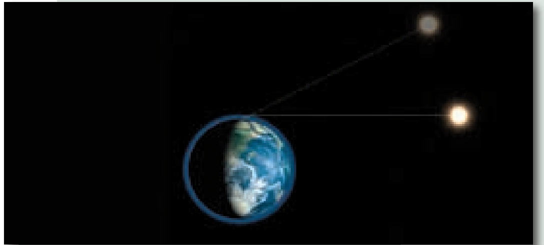
At the spring and autumn equinoxes (March 21st and September 22 or 23), day and night are of equal length. In the Northern Hemisphere, the shortest night of the year occurs at the summer solstice (June 21 or 22), and the longest at the winter solstice (December 21 or 22).



The equinoxes and the summer and winter solstices

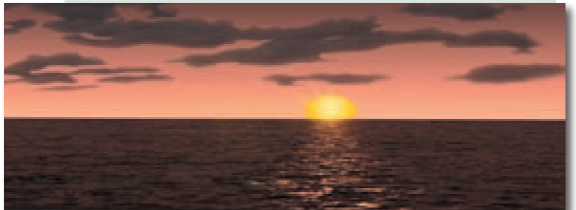
Our perception of sunrise and sunset on the ocean horizon is misleading.

Distorted by the atmospheric refraction of light, a sun dipping beyond the sea horizon is in fact already completely hidden beneath the sky line. The humidity and air temperature levels may cause this refraction to vary.



Atmospheric refraction curve of the sun's rays

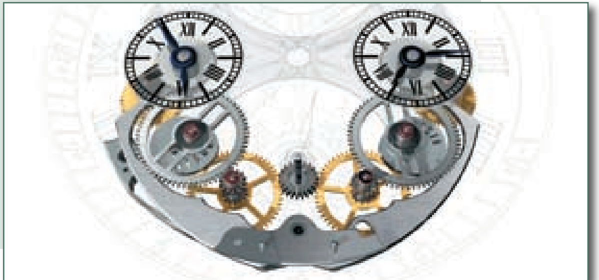
The indication on your watch corresponds to actual sunrise and sunset times at sea level. If the observer's horizon is cut off by mountains, the true height of the sun when rising or setting is increased, which may modify the sunrise or sunset times by several minutes to as much as several dozen minutes.



Moment of true sunrise as displayed on the dial

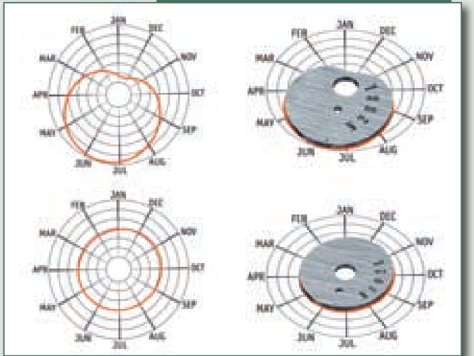
Located at 9 o'clock and 3 o'clock, the subdials of The Equation of Time watch indicate the actual times of sunrise and sunset throughout the year, for an altitude of zero meters (sea level) and for the latitude of the city for which the watch is set and whose name is inscribed on the dial ring. For these periods, the legal time is always displayed.

The position of the sunrise and sunset hands indicates the time, to within 2 or 3 minutes, when the sun will appear on or disappear from the horizon. These hands therefore move imperceptibly day by day, clockwise or anti-clockwise. These indications rely on the longitude and latitude of the location and are calculated individually for every place on earth,



Sunrise and sunset time mechanism

Sunrise cams - Moscow and Nairobi



provided the chosen location lies between the 56th parallel North and the 46th parallel South.

The hands on the sunrise and sunset dials are driven by two cams machined to a thousandth of a millimetre. This precision is necessary to correct the times displayed for each day.

Standard cams, calculated for the latitude and longitude of Geneva, can be replaced by cams made to order for each locality (with limits in terms of latitude at 56° North and 46° South). In this way, a watch can be adjusted to the individual needs of its wearer (see examples showing two cams used to indicate sunrise in Moscow and Nairobi).

Setting the time

On Royal Oak models, always unscrew the crown before use.

Pull the crown to position **C**. You may now set the time by winding in either direction without risk of damaging the movement. Recommendation : make sure to set the time precisely by carefully moving the hands forward to the time desired.

Warning : do not confuse noon and midnight.

Time-zone adjustments

Time zone differences can be corrected without risk of harming the mechanism or indications.

If it is necessary to move the hands back after midnight, the date and the day of the week will remain one day ahead. This difference is temporary and does not require correction. The indications will be correct again on the next day.

Caution : when you travel, the times indicated for sunrise, sunset and the culmination of the sun (apparent solar time) are only valid for the city for which your watch was set.

Winding the watch

On Royal Oak models, always unscrew the crown before use. The unscrewed crown will automatically position itself at **B** .

Turn the crown at least 30 times (in position **B**) to wind the watch. The movements of the wearer's wrist will activate the automatic system and keep the watch running.

On Royal Oak models, always screw the crown back to position **A** to ensure water-resistance.

Adjusting the perpetual calendar indications

Preliminary notes

Indication settings may be disturbed if the correctors are not used properly. These correctors should only be used when necessary and following the instructions below closely.

Corrections if the watch has stopped for less than 3 days

On Royal Oak models, always unscrew the crown before use.

With the winding crown in position **C**, turn the hands clockwise until the correct date is reached. All the other dials are synchronised.

N.B. : If the dials are ahead by one or two days by accident, it is recommended that you allow the watch to stop during this time lapse rather than using the correctors.

Corrections if the watch has stopped for more than 3 days

Precautions

On Royal Oak models, always unscrew the crown before use.

Before using the correctors, place the crown in position **C**, turn the hands until the date indicator jumps a day and, still turning clockwise, move both hands to 3 a.m. In this position the mechanism is at rest and the correctors may be activated with no risk of damaging the calendar mechanism.

Use the correctors with great care (use the setting stylus delivered with the watch). Press on them until the adjustment has been completed.

Procedure for corrections (at 3 a.m.)

Correct and set the following indicators, in order:

1. Date, day, month and leap year cycle using corrector D at 10:00.

N.B.: It may be necessary to correct one or more years for the leap year indicator.

2. The moon phase using corrector E at 8:30.

Caution: Press the corrector twice to change the lunar indication.

Method for adjusting the moon phase:

a) Position the moon indicator at the centre of the aperture in the full moon phase.

b) Determine the date of the last full moon. Move the corrector twice for each day between the date of the last full moon and the present day.

3. The day using corrector F at 04:00.

4. Sunrise, sunset and the equation of time,

There is no operation to be carried out to adjust these indications. These three dials are synchronised when the perpetual calendar date is adjusted.

5. Setting the time:

If the actual time (before midnight) is earlier than the time shown on the watch (3 a.m.), then you will notice, when you want to set your watch, that the date and day of the week are one day fast. This difference is temporary and you do not need to correct it. The indications will be accurate again at the start of the following day. To set the time accurately, we advise using the crown to move the hands forward to the desired position.

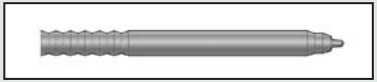
Caution: when you travel, the times indicated for sunrise, sunset and the culmination of the sun (apparent solar time) are only valid for the city for which your watch was set.

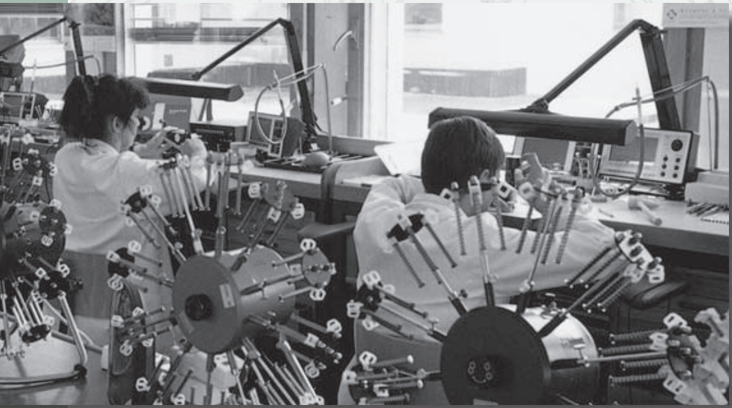
Rotating presentation case

To ensure that your watch is rewound on a continuous basis, it comes with a watch winder, powered by two batteries, that winds the watch by means of rotational movement.

Setting stylus

Important: the only instrument that you should use to adjust your watch is the stylus delivered with it.





Guarantee and care

All details concerning the guarantee and instructions on caring for your watch are provided in the enclosed certificate of origin and guarantee.