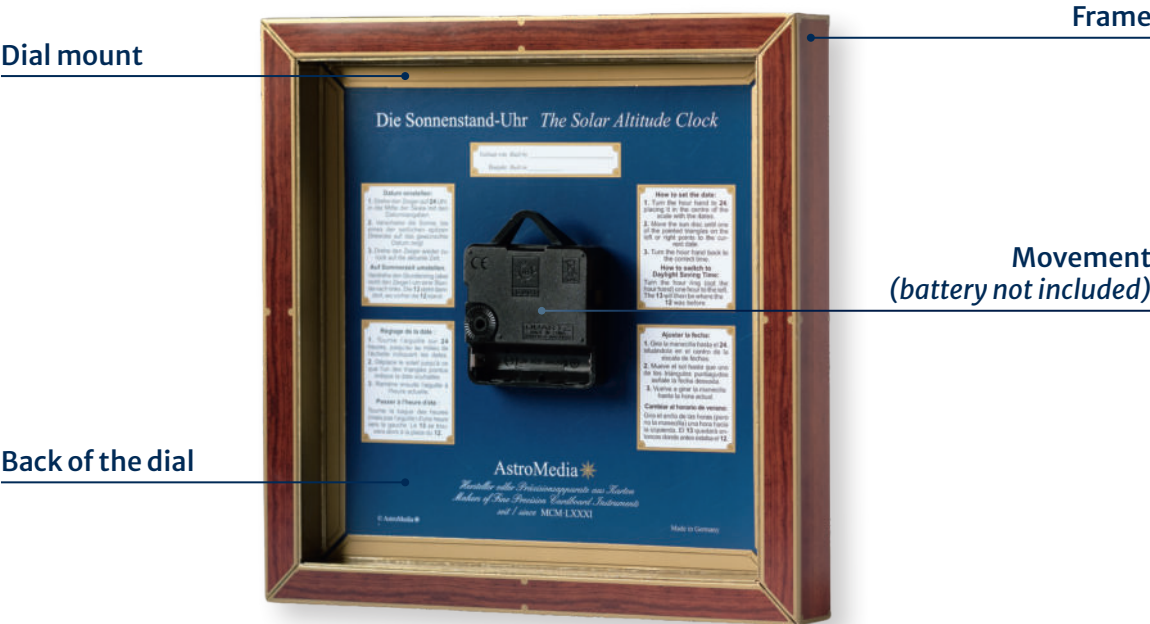


Assembly Instructions

The Solar Altitude Clock



AstroMedia

Hands-on Science

The Solar Altitude Clock

Astronomical clocks displaying the Sun's course through the heavens

The sundial is the mother of all astronomical clocks. The shadow cast by the Sun moves across the dial over the course of the day. In doing so, it indicates three important astronomical details: the time, the Sun's direction, and its altitude above the horizon (because the higher the Sun is in the sky, the shorter the shadow becomes, and vice versa). The fact that the hands of our mechanical clocks move from left to right ("clockwise") is derived from the movement of the shadow on sundials.*

Viewed in this light, any analog watch with a 24-hour dial is essentially an astronomical timepiece. Astronomical clocks that display the position of the Sun always require such a dial—as does this Solar Altitude Clock. A 12-hour dial, found on almost all watches today, cannot display astronomical phenomena, because the hand completes two full rotations per day.**

However, there have also been—and still are—special mechanical clocks featuring a sun disc that moves across the dial, tracing arcs of varying lengths depending on the season. These include some famous medieval astronomical clocks installed in churches and on town halls.

A well-known example is the Prague Astronomical Clock, dating back to 1410. These technical masterpieces and the skill of the astronomers and clockmakers of 600 years ago command our utmost respect.

Even today, astronomical wall clocks and even wristwatches are still being produced. They are very labour-intensive to manufacture and are therefore also very expensive.

AstroMedia's Solar Altitude Clock follows in the tradition of these astronomical timepieces, as it illustrates the Sun's movement just as clearly, albeit at a much lower price. This is made possible by its design as a kit and by replacing highly complex mechanics with a manual tracking mechanism.



The dial of the **Prague Town Hall Clock**. The sun symbol is clearly visible. Everything else displayed on it is explained in detail on Wikipedia.

What does AstroMedia's Solar Altitude Clock show?

The Solar Altitude Clock features a battery-operated 24-hour movement with a single hour hand capable of showing the time with an accuracy of just a few minutes. On top of this sits a small sun disc, which moves in a full circle with the hour hand over the course of 24 hours, just like the Sun in the sky. It shows where and when the Sun rises on the eastern horizon, reaches its highest point (culminates) at 12 o'clock, and sets on the western horizon. You can even track its journey beneath the horizon using the dark blue "night disc" on the clock face; this disc is cut to match your specific location and secured to the dial using the movement's mounting fixture. You can choose from numerous locations across the northern hemisphere, ranging from the north pole to the equator.

The sun disc is repositioned on the hand depending on the season: in summer, it is placed at the outermost point so that it traces a wide arc, just like the real Sun. In winter, it is shifted inwards, tracing a smaller arc. The scale with date markings at the bottom of the dial allows you to set the position with near-daily precision.

Change to summer time

When clocks are switched to daylight saving time in the summer, you normally just move the hour hand forward by one hour. However, that doesn't work with an astronomical clock like this one, because it would then show everything—sunrise, the Sun reaching its highest point, and so on—an hour too early. The switch to summer time doesn't actually change what happens in the sky; we're simply changing the way we count the hours.

That is why the Solar Altitude Clock has a special feature: the hour numerals are arranged on a ring that you can rotate one hour to the left at the start of daylight saving time. This places the number 13 at the top instead of the 12. The result is the same as rotating the hand one hour to the right, but with one difference: the astronomical display of the Sun's position remains accurate.

Good to know: Further information, including details on the Sun's variable speed of movement and the resulting accuracy of the Solar Altitude Clock can be found in the **"Questions and Answers"** section at the end of the assembly instructions.

* Incidentally, had the first mechanical clocks been invented not in the Northern Hemisphere but, for instance, in South Africa, South America, or Australia, their hands would most likely have moved from right to left—that is, "anti-clockwise" by our standards. The Sun rises in the east and sets in the west there too, but at midday it is in the north, not in the south as in the northern hemisphere. Its daily path runs from right to left, and so does the shadow on a sundial.

** This dates back to the division of the day into a light half and a dark half of 12 hours each, a practice that originated in ancient Egypt.

This kit contains:

- 4 die-cut sheets made of 0.4 mm thick construction cardboard
- 1 sheet for cutting out the night disc
- 1 piece of sandpaper
- 24-hour clock movement incl. rubber retaining washer, brass washer, and nut; operates on
- a standard AA battery (not included)
- 1 hour hand



Please read before commencing:

Tips for successful assembly

1

These assembly instructions are broken down into 35 small steps. While it may look like a lot of text at first glance, it makes the assembly process clear and ensures a successful build. At the end, you'll be holding a homemade Solar Altitude Clock that you can be proud of!

2

Each part is labeled with its name and a part number consisting of a letter and a number, eg, [A2]. The letter indicates the construction stage, while the number indicates the sequence within that stage.

3

It is best to only remove the die-cut pieces from the cardboard sheets as you need them. You can cut through the small tabs connecting the pieces to the sheet with a sharp knife before removing them, or trim off any remaining bits after popping them out.

4

Areas where adhesive is applied are printed in light grey. There are symbols like this on these glue areas: [A2]. It indicates which other part should be glued here. The symbol [P] shows you that the part is being glued to itself. On the four frame parts, each glue symbol also has a number in a circle, e.g. ③. It shows you the order in which the areas are to be glued. Note: The grey glue areas are usually slightly smaller than what is being stuck on them, so that there are no unwanted "flashes" (narrow protruding colour edges).

5

The grooved lines are folded. Folding "forwards" means folding towards you when looking at the front of the cardboard, while folding "backwards" means folding away from you. You can reinforce the folds with a bone folder or a small spoon to create crisp, sharp creases.

6

Do you know this crafting tip for quickly bonding small surfaces? Apply a reasonably thick layer of all-purpose glue to one side and press the parts together so that the adhesive spreads to both surfaces. Then pull the parts apart, remove any glue strings, and blow on them a few times. When you press the parts firmly together, aligning them precisely, the bond holds immediately.

What else you need for assembly:

- A firm, flat work surface with a cutting base – such as a self-healing cutting mat* (where cuts close up again)
- A sharp knife* or scalpel* (e.g., for cutting the tabs holding the parts in the cardboard sheets)
- A pair of sharp scissors*
- A bone folder* or a small spoon for reinforcing sharp crease lines
- A good all-purpose glue* (e.g. UHU All-Purpose Glue). Solvent-based all-purpose glue is better suited than water-based, solvent-free glue: it dries faster and does not cause the cardboard to warp. A small precision glue bottle* for refilling is also handy.
- A ruler* or set square* (helpful for scoring long, straight lines, among other things)
- A few rubber bands and/or some masking tape to hold parts in place while the glue dries
- Combination pliers or an 11mm spanner to tighten the nut on the clock mechanism's threaded shaft

Optional: Black* and gold* felt-tip pens for colouring the cardboard edges

* Also available at www.astromedia.de/Bastelutensilien

7

You can press larger glued areas while they dry, for example by placing a few books on top of them on a flat surface, to prevent the pieces from warping.

8

The word “*Option*” marks instructions that you can carry out but are not required to.

Assembly Instructions

Please read through each step completely before commencing. Take your time – that way, it’s more fun.

Section A: The Dial

The dial is assembled from two layers. The back consists of a square piece, the front consists of a frame and a middle part, between which a ring-shaped slot remains. The movable hour ring is then fitted into this slot in the next section.

Step 1

Detach the dial rim [A1], the hour ring [B1], and the dial centre [A2] from sheet 1. Be careful to avoid creating creases in the narrow sections.

Once assembled, the hour ring must be able to rotate freely within the gap between the rim and the centre of the dial. To ensure this, you need to lightly sand down its edges, as well as the edges of the adjacent parts:

Step 2

Place the hour ring [B1] upright on your work surface and hold it firmly at the very bottom. Then, run sandpaper evenly along the lower inner edge until some white dust appears; this indicates that the cardboard is actually being sanded down. Rotate the ring slightly and sand that section, repeating the process until you have lightly sanded the entire inner edge.

For the outer edge, it is best to hold the ring at the bottom and drag it across the sandpaper lying on your work surface, rotating the ring slightly as you do so. Continue until the entire outer edge has been evenly and lightly sanded. Then, sand the outer edge of the dial centre [A2] in the same way.

Step 3

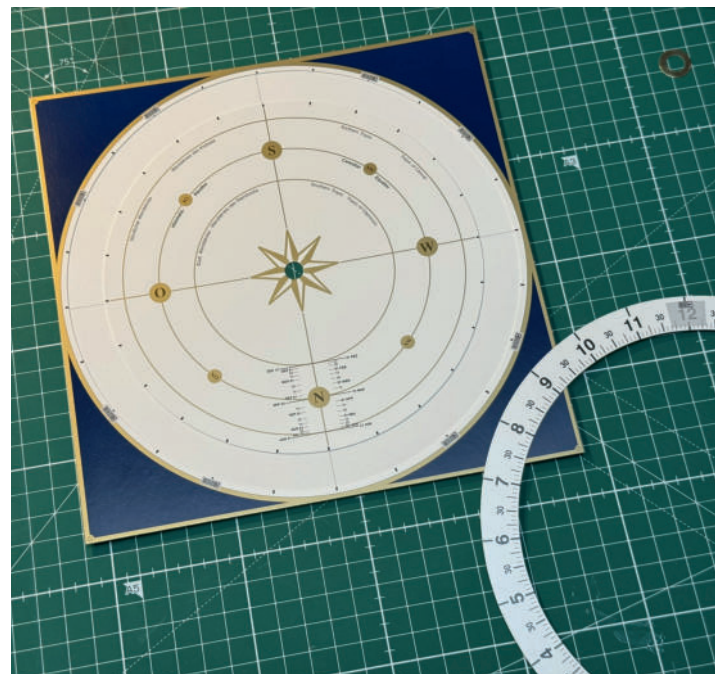
Sand the inner edge of the dial rim [A1] in a similar way to the inner edge of the hour ring. Be particularly careful, as it has some very thin areas.

Step 4

Remove the dial rear side [A3] from sheet 2 and place it on your work surface with the coloured printed side facing down. Glue the edge of the dial rim [A1] onto it. **IMPORTANT:** *Make sure that all symbols, including those on the back, have the same orientation or reading direction and that the outer edges of the two parts are exactly flush. Wipe away any excess glue on the round inner edge of the dial edge so that the hour ring can rotate freely later. Leave to dry thoroughly.*

Step 5

Position the dial face in front of you so that the bottom edge faces you and the top edge faces away (you can identify the top and bottom by looking at the back). Then, place the hour ring into the dial face so that the 12 is at the top and the hour marks on the ring align perfectly with their extensions on the outer part of the dial. Next, as a test fit, place the disc-shaped dial centre [A2] in the centre. The “South” mark should point upwards towards the 12, and the hour marks should align seamlessly with those on the hour ring. The central holes should line up exactly. This is how the disc is to be glued in place in the next step.



Step 6

Hold the centre disc firmly so it cannot rotate, and remove the hour ring again (since it is not glued down). In the gap intended for the hour ring, you will see thin lines at the top, bottom, right, and left. Note where these thin lines meet the thick hour marks; this will help you align the centre disc when gluing it, even without the hour ring in place. Apply glue to the back of the centre disc, but stop just short of the edge to prevent any glue from seeping into the hour ring's gap. Glue it back in place just as you tested in the previous step.

Tip: If you would like to write your name and the year of construction on the clock, now is a good time to do so.

Section B: The Hour Ring

To allow you to move the hour ring when switching to daylight saving time, it needs two handles on opposite sides so you can grip it. It also requires eight small retaining tabs to keep it from falling out.

Step 7

Detach hour ring handle 1 [B2] + [B3] and handle 2 [B4] + [B5] from sheets 3 and 4. Glue them together as shown, aligning the edges precisely. You now have two handles.

Step 8

Glue the two handles onto the centre of the **12** and **24** marks on the hour ring, ensuring they are equidistant from the edges. The 5-minute marks will help you to position them accurately. Leave them to dry thoroughly.

Now it is time to check that the hour ring turns smoothly in its slot:

Step 9

Insert the hour ring into its slot so that the **12** is at the top of the dial and the **24** is at the bottom. Does it require force to press in, or does it not fit properly? If so, sand down the edges a bit more and try again. Once the resistance at the edges of the slot has been reduced sufficiently, the ring will be able to rotate; turning it back one hour and then forward again is sufficient.

Step 10

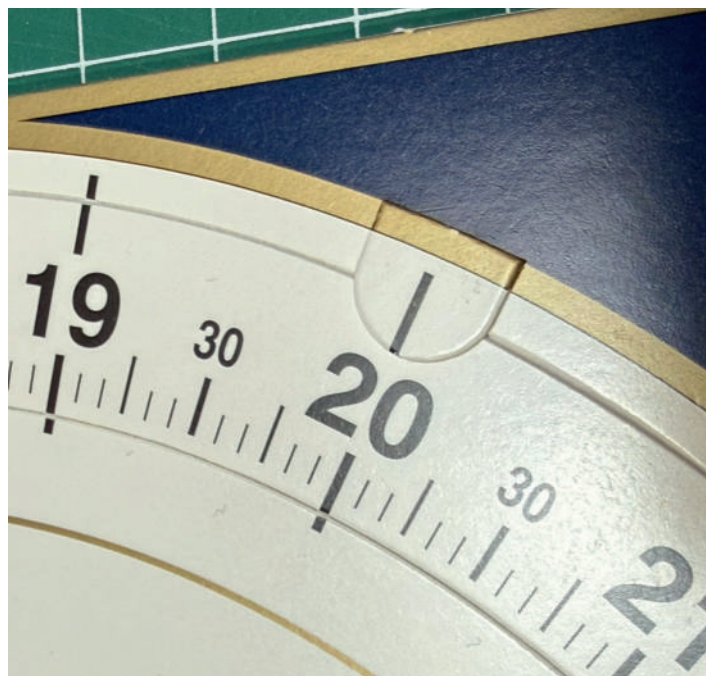
Detach the 8 upper sections of the retaining tabs [B6 to B13] from sheet 3 and the 8 lower sections [B14 to B21] from sheet 4. Glue each upper section onto a lower section, aligning the edges precisely. Allow to dry thoroughly.

Option: Colour the edge gold in the upper area of the mounting tabs, where they are printed in gold.

Step 11

Glue the retaining tabs onto the 8 marked spots on the edge of the dial. Align their gold edge flush with the gold edge on the dial, and ensure the black line aligns perfectly with the mark on the hour ring. Allow to dry thoroughly.

IMPORTANT: The glue must only be applied to the edge of the dial, not to the hour ring! The ring needs to be able to rotate. If any residual glue sticks it in place, you can carefully slide a knife under the retaining tabs to free it. Check that the ring still rotates smoothly.



The dial is now finished. The night disc will be attached later, along with the movement.

Section C: The Frame

The frame consists of four parts: [C1 + C2, sheet 3] and [C3 + C4, sheet 4]. They are glued together at their ends to form a square, using a combination of glue tabs and corner connectors. The assembly sequence is indicated by the circled numbers ① through ⑳ on the grey glue areas.

Note: To utilise the full width of the cardboard sheet, the frame parts extend to the edge of the sheet. However, for technical reasons, die-cutting is not possible in that area. Therefore, you will need to make 4 small cuts where the scissor symbols are located.

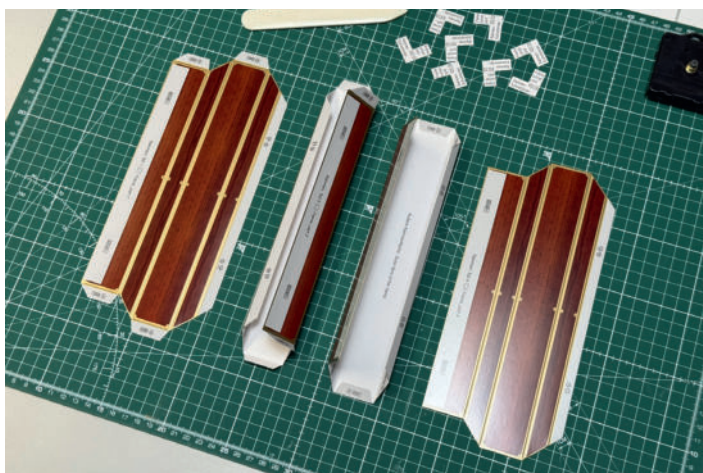
Step 12

Remove the frame parts **[C1 and C2, sheet 3]** and **[C3 and C4, sheet 4]** from the cardboard. Fold the glue tabs with the circle numbers ⑤, ⑥, ⑦ and ⑧ on them forwards and all other fold lines backwards.

Option: Colour all cut edges gold where the gold print goes all the way to the edge. The edges cut at a 45° angle will meet exactly and therefore remain invisible.

Step 13

Detach the eight identical frame corner joints **[C5 to C12, sheets 3 and 4]** from the cardboard. These are needed for the back of the frame sections, where the edges that are die-cut at a 45° angle meet directly.



Step 14

Place frame parts **[C1]** and **[C2]** on your work surface with the coloured side facing downwards, and locate the gluing areas marked with the number ① on both. The edges next to the gluing areas have no glue tabs and are die-cut at a 45° angle. Push these edges tightly together so that the frame parts are positioned exactly at a right angle to each other. Then glue one of the corner connectors over the joint.

IMPORTANT: No gap should be visible on the front.

Step 15

Position the frame parts **[C1]** and **[C4]** against each other so that the 45° edges marked with ② meet without a gap. Glue a corner connector over the joint here as well.



Step 16

Do the same with parts **[C4]** and **[C3]**: glue a corner connector over the edges marked ③. Then align the final 45° edges of parts **[C3]** and **[C2]** (marked ④) and glue a corner connector over them as well. Allow to dry thoroughly, weighing the pieces down if necessary.

This establishes the basic square structure of the frame. In the next steps, you will glue the inner frame panels together, then the outer ones, and finally the rear frame panels.

Step 17

Position the four inner frame panels so that they stand vertically. Fold the glue tabs ⑤ and ⑥ on frame part **[C1]** sharply forwards. Then glue them onto the gluing areas ⑤ and ⑥ of the adjacent frame parts **[C2]** and **[C4]**.

Step 18

Fold the glue tabs ⑦ and ⑧ on frame part **[C3]** sharply forwards and glue them onto the gluing areas ⑦ and ⑧ of frame parts **[C2]** and **[C4]**. You can already clearly see the shape of the frame taking form.

Step 19

Fold the four outer frame panels to a vertical position. Then firmly fold the four glue tabs ⑨, ⑩, ⑪ and ⑫ again and glue them, in order one by one, onto the grey areas marked with the corresponding numbers.

Step 20

Glue a corner joint halfway onto each of the glue areas ⑬ and ⑭ of the frame part **[C1]**. Allow to dry well.

Step 21

Apply a generous amount of glue to the long glue tab ⑮. Then slide it behind the opposite edge, where the grey area is also marked ⑮. Make sure that this edge and the framesurface are flush.

Step 22

Repeat the same process on the opposite side: glue one corner joint halfway onto each of the glue areas ⑯ and ⑰ of frame part **[C3]**. Allow them to dry, then glue the glue tab ⑱ behind the opposite edge.

Step 23

Bend all four protruding corner connectors slightly upwards. This way they will connect better to the last two rear frame panels.

Schritt 24

Apply a generous amount of glue to the long glue tab ⑲, as well as to the protruding corner connectors next to the tab. Then tuck them behind the opposite edge; this ensures that the rear frame section adheres to the corner joints. Press the 45° edges together so that they meet with as little gap as possible. Hold the frame in this position until the glue sets. **Tip:** You can also use a piece of masking tape or wrap a rubber band around the frame until the glue is dry.

Step 25

Repeat the same process with the glue tab ⑳ and the last remaining corner joints.

Step 26

Detach the four dial mounts [D1–D4] from sheets 1 and 2 and fold each one sharply forwards along the grooved line. **Option:** Colour the edges gold.

Step 27

Glue the mounts onto the four grey areas on the inside of the frame. The angled glue tabs where the clock face will be attached, will then be positioned roughly in the middle of the frame sections facing inwards. Their long bottom edge aligns flush with the rear edge of the frame.

Step 28

Glue the dial onto the bevelled tabs of the four mounts.

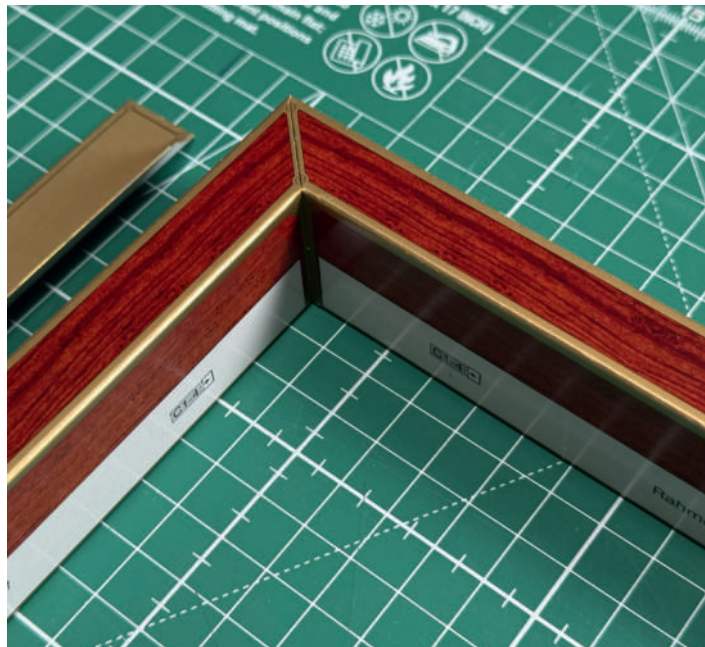


Section E: The Night Disc And The Assembly Of The Movement

The night disc [E1 or E2, sheet 5] shows when and where the Sun rises and sets, and how long it travels beneath the horizon during the night. However, sunrise and sunset times vary not only with the season but also with a location's geographic latitude. That is, whether it lies further south or north.

For this reason, the night disc is not included in the kit as a pre-cut piece; instead, you cut it out by hand to suit your chosen location. For locations at mid-latitudes (between 35° and 60°), such as most European countries or the USA, there is a specific night disc for every second degree of latitude; this provides sufficient reading accuracy.

The cut-out lines are located on the back of the sheet. To ensure they are not spaced too closely together, they have been distributed across two night discs. The night disc is not glued in place but simply clamped beneath the movement nut, allowing you to swap it for a different one if desired.



The frame is now complete. In the next step we will fit the dial.

Section D: The Dial Mounts

The dial is glued to the frame using four dial mounts. This increases the stability of the frame considerably.



Step 29

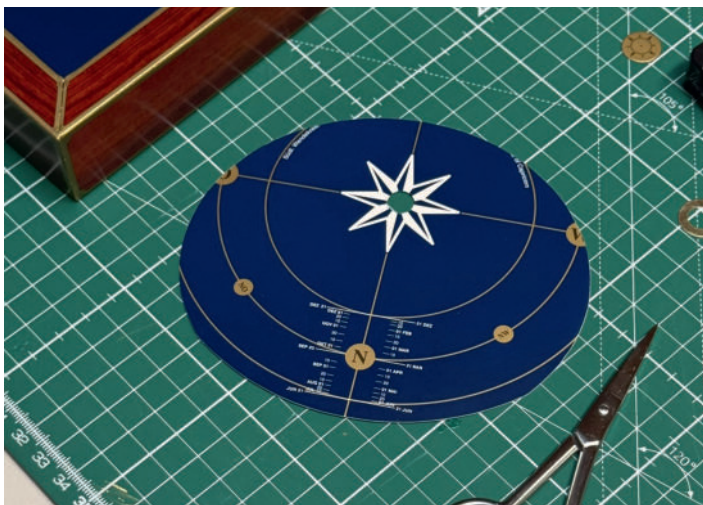
Find the latitude of the location for which you want to cut out the night disc. You can find this information for any location listed on Wikipedia or Google Earth. Then choose the cutting line closest to your latitude, either on night disc 1 [E1] or 2 [E2].

Tip: You can trace the latitude line beforehand with a coloured pen; this will make cutting easier and more precise.

Step 30

Carefully use scissors to cut along the latitude line on the back of the sheet. Also cut out the hole for the movement's threaded shaft—ideally using a sharp knife.

Next, place the night disc onto the clock face to test the fit. Everything it covers is also printed on the disc itself, so nothing is hidden from view. Carefully rotate the disc until the lines, circles, and text along its edge align seamlessly with those on the clock face. This is the position in which the night disc should be aligned when you tighten the movement nut in the next step. **Tip:** If the hole in the night disc isn't quite big enough, you can enlarge it slightly. The washer for the movement nut will cover that area anyway.



Step 31

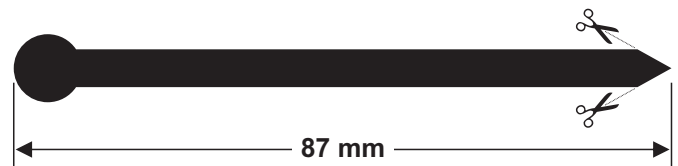
Insert a battery into the movement (matching the direction of the battery with the symbol in the compartment). Then slide the rubber locking washer over the threaded shaft protruding from the movement, the side with the cutout facing downwards. This washer prevents the movement from turning when the brass nut is tightened. Next, insert the threaded shaft through the back of the clock face and the night disc, slide the brass washer onto it from the front, and screw on the nut. Initially, tighten the nut only by hand and double-check that the night disc is positioned correctly. Once everything is aligned properly, you can fully tighten the nut using combination pliers or a spanner.

Section F: The Sun And The Hour Hand

Before the sun disc can be attached to the hour hand, the hand must first be shortened to the correct length and furnished with a point.

Step 32

Place the hand on the printed template and first trim the front end straight across to the specified length. Then shape the point with two angled cuts and remove the protective film if present.

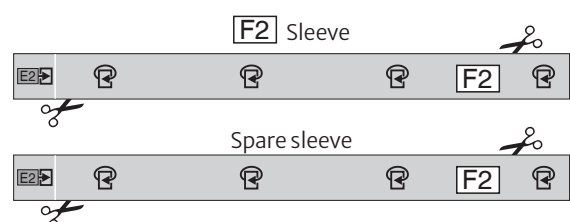
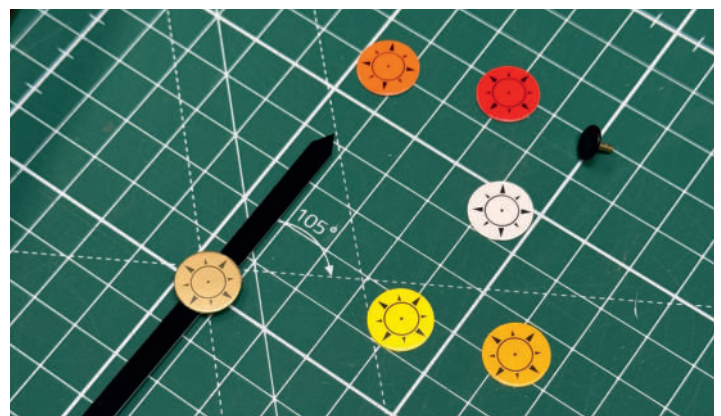


Step 33

Cut out the sleeve for the sun disc [F2, below] and wrap it tightly around the hand without using glue to form a sort of very flat ring that can slide along the hand. Then glue the ends of the sleeve together to secure it, ensuring no glue touches the hand itself. Once dry, check that the sleeve can slide but isn't too loose; it should not slip off the hand on its own. If the fit is too loose, simply cut a new strip of paper and make a new one.

Step 34

Choose the sun disc [F1a-f, die-cut sheet 3+4] you like best from the six alternatives. The disc features four larger and four smaller points arranged around the central sun symbol. Align the larger points precisely lengthwise and crosswise relative to the hand. Glue the disc onto the sleeve. **Tip:** You can swap your sun for another one at any time if you want to switch colours. It is easy to make a new sleeve.





Step 35

Place the hour hand onto the hour shaft of the movement. It simply slots on and should be easy to adjust. **Tip:** It is best to hold the hand where it attaches to the movement. First set it to 24, then move the sun disc so that its left or right point aligns with the correct date. Once the sun disc is in the correct position, set the time using the gear on the movement. Also set the hour ring correctly: during winter time, the 12 is positioned above South (S), during summer time, the 13 is in that position. You can find more information on switching to summer time in the Q&A section below.

Your Solar Altitude Clock is now finished. Congratulations! You have built a very special astronomical clock with your own hands—one that cannot be bought anywhere else.

Some Questions And Answers:

?!

What information can I read from the Solar Altitude Clock?

- First of all, of course, the time – accurate to within a few minutes.
- The Sun's Path:
 - From 21st March to 23rd September, it is positioned above the celestial equator—the middle one of the three golden rings.* This is the summer half of the year. It rises further to the northeast and sets further

to the northwest. Around 21st June, it traces its highest and longest diurnal arc (above the horizon, i.e., outside the night disc) and its shortest nocturnal arc (below the horizon, across the night disc). This is the day of the summer solstice.

- From 23rd September to 21st March (the winter half of the year) it is positioned below the celestial equator. During this time, it rises further to the southeast and sets to the southwest. Around 21st December, it traces its lowest and shortest diurnal arc and its longest nocturnal arc. This marks the winter solstice.**
- Around 20th March is the spring equinox and around 23rd September is the autumnal equinox. On these dates, day and night are of equal length. The Sun then runs exactly on the celestial equator and rises exactly in the east and sets in the west. By the way, this applies to every place on earth.**
- The Sun's highest point: The hand then points straight up at the 12 (or at the 13 after the switch to daylight saving time; see below).
- The location and time of sunrise and sunset, which change from day to day. The sun disc is then positioned exactly on the horizon line, the edge of the night disc.
- The compass direction in which the Sun is currently positioned.

* On the dial, it appears to be moving outside the celestial equator. This is due to the twodimensional representation of the celestial sphere.

** The exact dates may vary slightly from year to year but can easily be looked up online, for example at www.in-the-sky.org or other websites.

How do I set the Sun to the correct date?

Set the hand to the lowest position, in the middle of the date scale. Then move the sun disc until the tip on the right or left side points to the desired date, and return the hand to its original position. This is usually necessary only once a week. However, the sun disc needs to be adjusted somewhat more frequently around the equinoxes, and less often around the summer and winter solstices. (Alternatively you can simply wait until midnight, in which case you do not need to move the hand.)

?!

When do I have to switch the clock to daylight saving time?

Turn the movable hour ring one hour anti-clockwise during the night before the last Sunday in March. The number 13 will then be positioned where the 12 was before. On the night before the last Sunday in October, you turn it back again. This is the rule that has been in effect in the EU since 1996, although it may be subject to change.

Sometimes the display on the Solar Altitude Clock does not exactly match the Sun's path across the sky. Why is that?

There are indeed differences between the movement of the Solar Altitude Clock and the movement of the Sun across the sky; this is inevitable. These differences vary throughout the year but are usually not very noticeable. There are two reasons* for this:

One reason is the division the Earth into time zones, which determines the time we use today. The other is the natural seasonal variation in the Sun's path. (You can also adjust the Solar Altitude Clock to the actual position of the Sun in the sky; this is explained in the next question.)

- Time zones have only existed since the late 19th century. Until then, people used to set their clocks according to the Sun. However, because the Sun moves around the Earth from east to west**, it rises earlier in locations further east than in those further west, and reaches its highest point—solar noon in the south—earlier there as well. Consequently, dif-



ferent times were used in different locations. This time, determined solely by the course of the Sun, is called “Apparent Solar Time” or “True Solar Time”. The time difference between two locations separated by one degree of longitude in an east–west direction is four minutes. Conversely, locations situated north or south of one another—and thus on the same line of longitude—always share the same True Solar Time.***

- There is also a little-known characteristic of the Sun: compared to a highly accurate clock, it slows down twice a year and then speeds up again (as viewed from Earth). Consequently, a solar day can be up to 29 seconds longer or shorter than a standard 24-hour clock day. That may not sound like much, but the seconds add up, meaning a sundial can lag behind a clock by as much as 14½ minutes (on 12th February) or run ahead by up to 16 minutes (on 3rd November). One could therefore say that time as paced by the Sun expands and contracts twice over the course of the year; True Solar Time, so to speak, breathes.

At an early stage, steps were taken to mathematically smooth out these fluctuations over the course of the year to arrive at a “Local Mean Time” (LMT). The difference between the True Solar Time shown by a sundial and Local Mean Time is known as the equation of time.

- With the advent of the railway, it became necessary to create timetables. This required a uniform time standard, applicable across long distances. Consequently, a system of 24 time zones was introduced worldwide towards the end of the 19th century. Within each time zone, the Local Mean Time (LMT) of a specific meridian applied uniformly.

For Central European Time (CET), this is the 15th meridian east, on which the Danish island Bornholm, for example, is located. Its Local Mean Time serves as the uniform time for the entire Central European time zone. This applies even to countries as far apart as Poland and Spain, despite the fact that the difference in their True Solar Time can be up to 2¼ hours.

It is therefore due to your location’s east–west position within your time zone—as well as the Sun running ahead or lagging behind—that the reading on your Solar Altitude Clock does not always match the Sun’s actual position.

* It is not the movement’s fault: according to the manufacturer, it has a deviation of just ±30 seconds per month (at 25°C).

** “The Sun circles the Earth from east to west”. This is correct from the perspective of an observer on Earth. For them, the Earth

is stationary and the Sun is moving. However, you could just as well say: “The Sun is stationary and the Earth rotates from west to east.” That is equally true, but from the perspective of an observer in space.

*** This is because the Sun takes 24 hours—or 1,440 minutes—to complete a full orbit around the Earth (or for the Earth to complete one full rotation in relation to the sun), during which time it travels 360 degrees of longitude. That works out to 4 minutes per degree. For example, Cardiff is located 3°11’ west of Greenwich, while Norwich is 1°18’ east. The difference of (about) 5 degrees, multiplied by 4 minutes, results in 20 minutes. That is how much later true noon occurs in Cardiff than in Norwich.



Can I set my Solar Altitude Clock to True Solar Time? Would the sun disc on the clock then move exactly like the real Sun?

Yes, if the Solar Altitude Clock is set to True Solar Time, the Solar Altitude Clock and the Sun will align. It would no longer show our standard time, of course, but you probably have other clocks for that. Since the movement runs at a constant rate while the actual Sun does not, you have to adjust the Solar Altitude Clock’s hand slightly every few days – depending on the difference between, say, 12:00 pm standard time and 12:00 pm True Solar Time (true noon). Many websites provide this information*, but you can also do it analog-style using a Calculation Disc, available as a simple kit from AstroMedia.** You simply set your location, the date, and the current time on the disc to read off True Solar Time.

* Go to www.timeanddate.com and search for “True noon in “name of your town”?”

** www.astromedia.de/Die-Wahre-Zeit-Uhr



Can I swap the night disc for another one?

It’s easy to do: just cut out the night disc you require. Pull the hand off the movement, unscrew the nut, and remove the washer. Swap the night disc and align it precisely with the elements on the clock face. Place the washer and nut back onto the threaded shaft of the movement and tighten them. Do you need an extra sheet of night discs – perhaps to see how the Sun moves at the Arctic Circle or in the tropics? You can find one here: www.astromedia.de/Ersatzbogen-einzeln

?!

Does the Solar Altitude Clock also work in the Southern Hemisphere, for example in South Africa?

No, it only works in the northern hemisphere. For the southern hemisphere, you need a 24 hour movement whose hour hand moves anticlockwise.

?!

Are there any other astronomical clocks from AstroMedia?

Yes, for example, the Moon Clock featuring a black and white sphere that rotates once every 29-plus days by a highly geared-down movement, continuously displaying the current moon phase. Additional mechanical clocks with astronomical displays – such as the Sun Position Clock – are currently in development.

In addition there are kits available for sundials, including specialised timepieces such as the Ring Sundial, the Compass Sundial, and the Digital Sundial.

This watch runs according to the moon.



*And like the moon, this **astronomical clock** also moves very slowly. It takes 29 days, 12 hours and 44 minutes for the moon sphere to show all its phases, which is exactly the average time from one new moon to the next.*