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Thies CLIMA

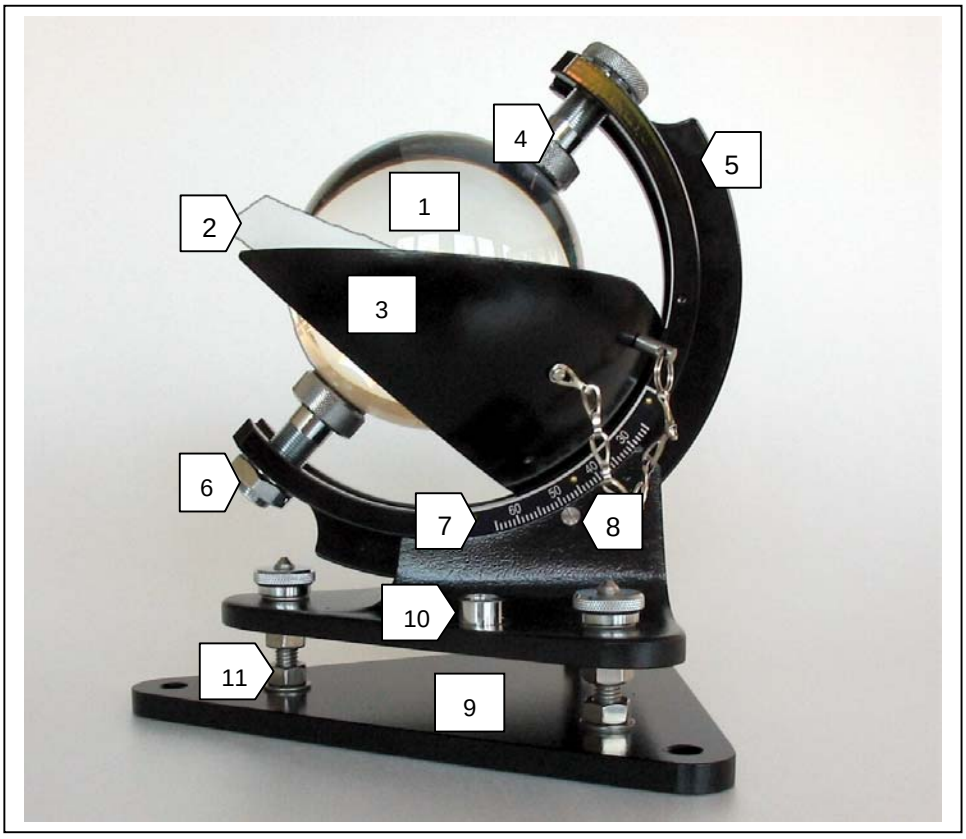
Instruction for Use

020608/07/05

Sunshine Recorder

acc. to Campbell-Stokes

7.1400.10.000
7.1405.10.000



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Contents

1 Models available

Order-No.	Description	Equatorial Region	Dimensions	Weight
7.1400.10.000	Sunshine Recorder acc. to Campbell-Stokes	25 ... 60°	205x 185 x 145 mm	5 kg
7.1405.10.000	Sunshine Recorder acc. to Campbell-Stokes	0 ... 40°	205x 185 x 145 mm	5 kg

2 General

The sunshine recorder acc. to Campbell-Stokes serves for the recording of the sunshine duration.

The sunrays are focussed in the focal point of a massive glass ball (1) and burn a trace into a paper slip (2); this slip (2) being fixed in a metal bowl (3) which is arranged concentrically to the centre of the glass ball (spherical zone). Thus, the way of the focus is recorded in a form of a line corresponding to the apparent way of the sun. The glass ball (1) has a diameter of approx. 96 mm.

The instrument for recording the sunshine duration in Northern and Southern regions (25 ° - 60 °), order-no. 7.1405.10.000, and in the Northern and Southern equatorial region (0° - 40 °), order-no. 7.1400.10.000, are equipped with a different mounting for the glass ball (1), as the focal point is situated below the glass ball when the sun is at its zenith. According to the different mountings of the glass ball (1) the alignment to the latitude of the observation site is effected by adjusting the bearing cap (5). The graduated scale (7) at the side of the instrument serves for the adjustment of the instrument to the latitude. Reference point for the latitude adjustment is a slotted marking screw (8) below the scale.

3 Setting-up the Instrument

When choosing a place for setting up the instrument, care should be taken that it will be freely exposed to the sunrays, all the day long. The stand surface must be a very stable one, so that influences of temperature, wind, and humidity, or vibrations, resp. cannot its levelling. Therefore, wood should be avoided as a foundation, whereas it is advisable to choose stone, solid masonry, or even metal. At first, the instrument is to be adjusted approx. by means of the levelling indicator (10) which is fastened to the base plate (9). The correct adjustment is described in all details in the corresponding paragraph (chapter 6).

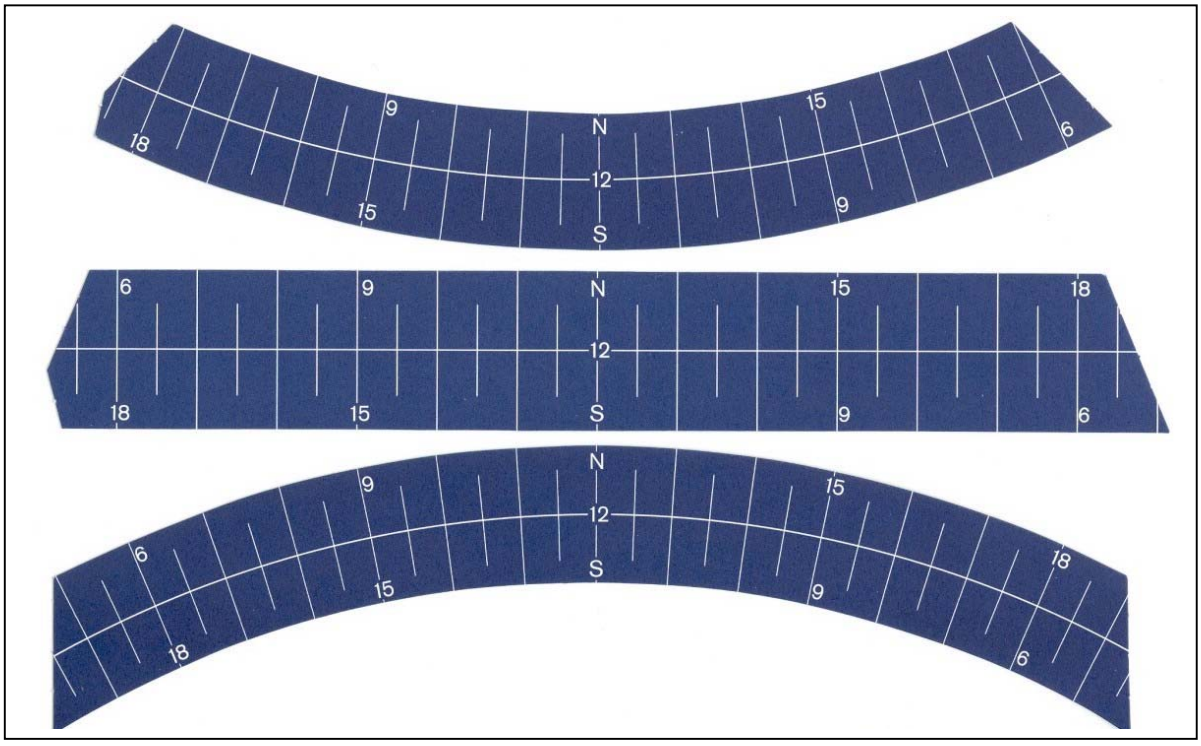
Mounting and alignment of the sunshine recorder is, on account of double base plate (9), very easy. The **lower** plate (9) serves for the rigid fastening of the instrument to the stable stand. The **upper** plate (9) is fixed slightly adjustable to the lower one so that levelling can be effected by means of the levelling indicator (10) which is fixed to the instrument and by the selective movement of the retaining nuts (11). Moreover, for adjustment to the north-south direction the upper base plate (9) may be rotated for ± 5° compared to the lower base plate (9) rigidly fixed to the stand.

4 Putting-in the Paper Slips

The charts (2) are made of dark blue inked cardboard. Provided with divisions into hour and semi-hour they are supplied in different forms according to the seasons.

The straight charts are designed for the centre pair of grooves in the metal bowl (3), the short curved ones for the upper, and the long curved ones for the lower pair of grooves.

- the short curved cards are used from the middle of October until end of February,
- the straight cards from beginning of March until middle of April,
- the long curved cards from middle of April until end of August.



When putting in the charts, care should be taken that the 12-hour-line coincides exactly with the meridian line on the metal bowl (3). At a certain spot the metal bowl is provided with a hole (near the 14 o'clock line) through which the metal pin, which is suspended at the instrument by a chain, is to be inserted to such a depth that it pierces also through the paper chart which is thereby fastened.

In case of sunshine recorders for equatorial latitudes faulty values could be recorded on account of the metal bowl beneath the glass ball, in case the bowl is filled with water after precipitations. The metal bowl is therefore provided with a slit so that rain water can flow out immediately. This slit does not affect the putting in of the chart, if the cut edge of the chart is inserted first.

5 Putting-in the Glass Ball

The glass ball is to be put between the two mountings (4 + 6). Afterwards, the knurled screw of the mounting (4) is to be turned until the glass bowl is held sufficiently. The other mounting (6) is countered by a nut, and should not be displaced, otherwise the centric suspension is not granted.

6 North-South Adjustment and Levelling

At first the instrument is adjusted approximately by means of the levelling indicator (10), which is fastened to the base plate (9). Practically, the adjustment should be effected on a sunny day. After having proved by reading the grade division, whether the instrument is adjusted to the correct latitude of the observation place, north-south adjustment can be made referring to the sun. The surest sign for right placement is a burning trace symmetrical to the 12 o'clock line of the chart (2). In case the extension of the burning trace varies the glass ball (1) was fitted eccentrically. In case the trace is burnt asymmetrically to the 12 o'clock line this is either due to an incorrect levelling or to a wrong north-south adjustment, i.e. the burning trace declines downwards on the right side, if the front of the instrument (opening of the metal bowl) is turned too far eastwards as seen from the south, or of its western part is placed too low, respectively. For an accurate adjustment it should be realised that the instrument after all is a sun-dial, the instantaneous burning trace stating the true solar time. For its orientation the instrument is therefore rotated round its vertical axis until the focus is exactly traced on that point of the duly fastened graduated chart (2), which corresponds to the true solar time.

Local mean time = railway time $\pm$ longitudinal correction

true solar time = local mean time - equation of time

For computing the true solar time (=local apparent time) both the longitudinal correction and the equation of time have to be deducted from the clock time (railway time). The longitudinal correction depends upon the number of meridians, which are between the station and the degree of longitude, corresponding to the local mean time. This number multiplied with 4 = the longitudinal correction in min. It has to be deducted from the clock time, if the place of observation is situated to the west of the time meridian. It must be added if the station is to the east. This correction is indispensable, since the sun reaches the degree of longitude one after another, whereas for large areas the same railway time is valid. E.G. the Central European time i.e. the mean time of the 15th meridian to the east of Greenwich or the meridian of Stargard, respec., is valid for Germany, Göttingen e.g. being 5° to the west of Stargard, the longitudinal correction is in this case 4 x 5 = 20 min. Consequently the local mean time for Göttingen = Central European Time – 20 min.

6.1 Example for the Determination of the True Solar Time

On the 23rd September at 12 o'clock Central European Time a sunshine recorder shall be set up at Göttingen. To what time graduation must the sunrays be focussed for the determination of the local apparent time?

Local apparent time = mean time for Göttingen – equation of time

Local apparent time = 12.00 o'clock -20 min. (-7,3 min)

Local apparent time = 12.00 o'clock -12,7 min.

The focus must therefore be at 11,48 instead of 12 o'clock..

The equation of time is due to the different speed of the earth on its elliptic orbit round the sun. It indicates the difference between the local mean time divided to equal time intervals and the non-uniform true solar time. Consequently the equation of time is local mean time – true solar time. Consequently the equation of time is local mean time – true solar time. Consequently the equation of time is local mean time – true solar time. The equation to time for every fifth day be taken from following table:

7 Table of Equation of Time

(Local mean time – solar time)

Jan.	1. + 3,2	**Febr**.	5. + 14,0	**March**	2. + 12,4	**Apr**.	1. + 4,2
	6. + 5,6		10. + 14,3		7. + 11,3		6. + 2,7
	11. + 7,7		15. + 14,3		12. + 10,1		11. + 1,3
	16. + 9,6		20. + 13,9		17. + 8,7		16. + 0,0
	21. + 11,2		25. + 13,3		22. + 7,2		21. - 1,1
	26. + 12,5				27. + 5,7		26. - 2,1
	31. + 13,4						
May	1. - 2,9	**June**	5. - 1,8	**July**	5. + 4,3	**Aug**.	4. + 6,1
	6. - 3,4		10. - 0,9		10. + 5,1		9. + 5,5
	11. - 3,7		15. + 0,1		15. + 5,7		14. + 4,8
	16. - 3,8		20. + 1,2		20. + 6,2		19. + 3,8
	21. - 3,6		25. + 2,3		25. + 6,4		24. + 2,5
	26. - 3,2		30. + 3,3		30. + 6,4		29. + 1,2
	31. - 2,6						
Sept.	3. - 0,4	**Oct**.	3. - 10,7	**Nov**.	2. - 16,4	**Dec**.	2. - 10,9
	8. - 2,0		8. - 12,2		7. - 16,3		7. - 8,9
	13. - 3,8		13. - 13,5		12. - 15,9		12. - 6,7
	18. - 5,5		18. - 14,6		17. - 15,2		17. - 4,3
	23. - 7,3		23. - 15,5		22. - 14,1		22. - 1,8
	28. - 9,0		28. - 16,1		27. - 12,6		27. + 0,7

The correct standing should then be marked on the stand, it would be better, however, if the instrument is fastened tightly to this standing.

8 Maintenance

Now and then the glass ball should be cleaned from dust and dirt caused by rainfall or snow. With due regard to the details contained in paragraph „Putting in the glass ball" it should be removed, cleaned and set in anew. If a hour-frost is threatening it is advisable to provide the glass ball with an anti-freeze which prevents it from hour-frost or ice coating, without affecting considerably the light transmittance.

9 Accessories / Replacement

Description	Order – No.	
Charts for 7.1400.10.000	205 210	140 sheets. for summer 140 sheets. for winter 100 sheets for spring and autumn
Charts for 7.1405.10.000	205 213	140 sheets for summer 140 sheets for winter 100 sheets for spring and autumn

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