Operating instructions and description of the CORADI compensating planimeters

Models available:

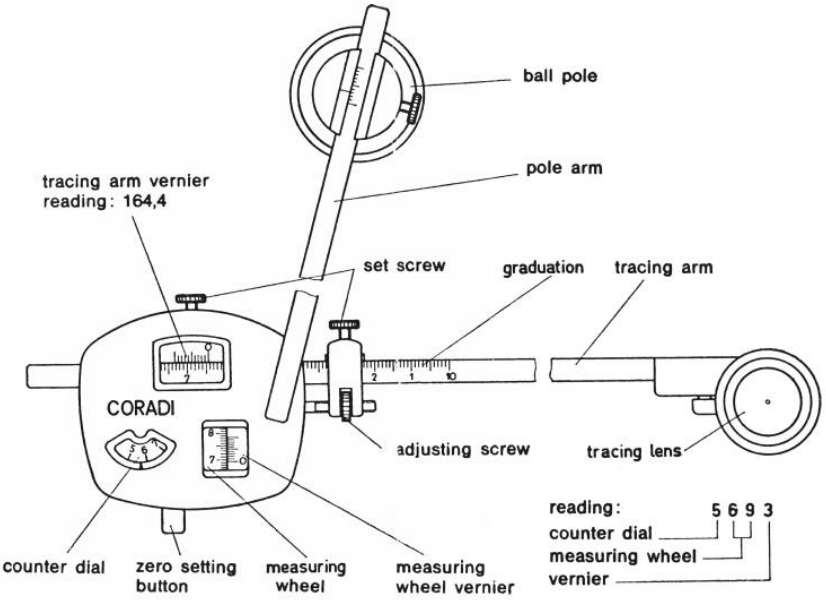
a) CORE-JUNIOR with fixed tracing and pole arm with needle pole.

b) CORA-SENIOR with adjustable tracing and pole arms, optional needle or ball pole and with zero setting device for counter.

Both types can be supplied to order with lens tracer or point tracer.

General design of the Planimeter

1. Measuring Head
2. Tracing Arm
3. Pole and Pole Arm
4. Checking Ruler



Description of planimeter

1. The Measuring Head

This is contained in a dust proof housing and only the rim of the measuring wheel is exposed. The pivots are all shock proof and designed to withstand long hard usage without effecting the adjustment of the measuring mechanism. Above the window at which the reading is taken from the measuring wheel there is a built-in magnifier to facilitate easy reading.

2. The Tracing Arm

The Tracing Arm of the CORA SENIOR model is graduated so that it can be set to any ratio or scale at which the Planimeter is required to operate. Both models i. e. CORE JUNIOR and CORA SENIOR can be equipped with either a tracing lens or point tracer. The lens tracer permits very accurate following of the line due to its high magnification and parallax free viewing. The point tracer permits more rapid operation and gives a better general view of the area which is being measured. A support is provided alongside the point tracer which prevents the latter from scratching the surface of the drawing and this can be adjusted in height according to what clearance is required.

3. Pole and Pole Arm

The Pole acts as a reference point during measurement. The Pole Arm is the connecting link between the Pole, Measuring Head, and Tracing Arm. There are two types of Pole, one with a needle point, and the other a weight and ball. The former is pressed into the surface of the material on which the measurement is to take place whereas the latter rests on the surface and providing that this is horizontal it will not slip as the underside of the weight has an anti-slip surface.

4. Checking Ruler

This is used to carry out checks on the calibration of the Planimeter and is used as follows: A needle point which is situated at one end of the checking ruler is pressed into a flat surface covered with a white drawing paper. If the Planimeter is equipped with a tracing lens this is inserted into the square opening in the ruler. Alternatively if the Planimeter is equipped with a Point Tracer this is placed in the 'V' shaped notch. In the centre of the bevelled edge at one end of the checking ruler is an index mark and before commencing the check, the position of this index should be marked on the surface. Then holding either the tracing lens or tracing point rotate the checking ruler in a clockwise direction until the index mark returns to its original position. The dial of the measuring wheel should be read before and after the above operation and subtracting the first reading from the second should give you the area of the circle circumscribed by the checking ruler in cm^2 or square inches depending on the type of checking ruler used. If the reading is within a tolerance of $\pm$ 5 vernier units the Planimeter can be said to be within an acceptable working accuracy.

Setting up the Planimeter and carrying out measurements

1. Measurement taken with Pole outside the area

a) **Setting Up:** The Planimeter is placed on the plan to be measured which must be flat and horizontal with the Pole und Tracing Arms at right angles to each other. The Tracing Lens or Point Tracer should be placed approximately in the centre of

the area to be measured. You should then run round the area with the tracer to make sure that you can get complete coverage. If not the poles should be moved to a position where this is possible.

b) **Reading:** Every reading should be taken in four digits. These are taken firstly from the measuring wheel revolution counter, which is in thousands, then from the measuring wheel drum, the large divisions being in hundreds, and the small divisions in tens, and the final reading is taken from the vernier which reads in single units.

c) **Measuring:** Before commencing Measurement the dot in the tracing lens or the tip of the point tracer should be placed immediately on the perimeter on the left hand side of the area to be measured. It should be put over an identifying mark so that you can return easely to the same point after the area has been circumscribed. When using the CORA SENIOR Planimeter, the zero setting device should be used to set all the dials to zero. To do this raise slightly the measuring head and depress the zero set button then gently, and when the measuring wheel is in contact with the surface, slowly release the button. If there is any slight movement of the measuring wheel throwing it off zero, this can be corrected by carefully moving the pole a small amount. If you are using the CORE JUNIOR Planimeter, which is not equipped with zero set device, the reading should be taken from the revolution counter, measuring wheel and vernier, and this noted down as being your commencing reading. The perimeter of the area can now be traversed carefully with the tracer, and this must be done in a clockwise direction,and finishing exactly over the point at which the measurement was commenced. The measuring units are now read from the revolution counter, measuring wheel drum, and vernier. With the Planimeter with automatic zeroing this will be the correct reading, but in the case of Planimeters without this feature, the commencing reading should be subtracted from the final one. If however, the final reading is lower than the commencing reading, 10 000 must be added to compensate for the decade step from 9999 to 0000. All the following examples assume traversing in a clockwise direction.

Example 1 (Core-Junior)

Scale 1 : 1	1 vernier unit = 10 mm²
1st reading	2497
2nd reading	6282
A =	3785 vernier units
area =	3785 x 10 = 37850 mm²

If the second reading is lower than the first it must be increased by 10 000 to compensate for the decade step from 9999 to 0000 (see following example).

Example 2 (Core-Junior)

Scale 1 : 1	1 vernier unit = 10 mm²
1st reading	8924
2nd reading	3487 + 10000 13487
A =	4563 vernier units
area =	4563 x 10 = 45630 mm²

d) **Scale Conversions:** In the case of Planimeters with a fixed arm (CORE JUNIOR) the area is always 1 : 1 either in 0,1 cm^2 or 0,1 Sq. In. but with the sliding bar Planimeters (CORA SENIOR) it is possible to change the scale according to the scale of the plan to be measured by adjusting the tracing arm to the appropriate setting. These settings are shown in the lid of the case but we give the following explanation:

If the figure to be measured is represented on a reduced scale 1 : M and if one vernier unit corresponds to an area N, the true area measurement F resulting from reading A is obtained from the following equation:

$$F = A \times M^2 \times N$$

Example 3 (Core-Junior)

Scale 1 : M = 1 : 500

Area per vernier unit N = 0,1 cm^2 = 0,00001 m^2

1st reading 2497
2nd reading 6282

A = 3785 vernier units

Thus area F = 3785 x 500 x 500 x 0,00001 = 9462,5 m^2

Example 4 (Cora-Senior)

Scale 1 : M = 1 : 2500

Tracing arm set as per table in case

Reading 2123 vernier units

Table shows 1 vernier division corresponds to 50 m^2

Area F = 2123 x 50 = 106'150 m^2

2. Measurement taken with Pole inside the area

Where the figure to be measured is so large that it can not be traversed with the pole arm outside the area, the pole can be placed within the area to be measured. The operating of the Planimeter under these circumstances in a manner somewhat similar to when the pole is outside the area and it is essential to remember always to traverse in a clockwise direction. On some occasions the measuring wheel will revolve showing a positive figure and this reading should be added to the constant shown in the lid of the case (see examples 5 and 7). But if the measuring wheel rotates to give a minus reading it will be necessary to adopt a different procedure as follows:

CORE JUNIOR Planimeter: If the cumulative movement of the measuring wheel during measurement is negative, the **second** reading must be subtracted from the first, and the resulting difference then subtracted from the constant shown in the lid of the case. If however, the first reading is smaller than the second, it must be increased by 10 000 to compensate for the decade step from 0000 to 9999 (see example 6).

CORA SENIOR Planimeter: If the cumulative movement of the measuring wheel during measurement is negative, the constant given in the lid of the case is reduced by 10 000 and added to the reading (see example 8).

Examples of measurements with pole within the area

Core-Junior:

Example 5 Instrument constant C = 18546

Cumulative measuring wheel movement positive

1st reading 8896
2nd reading 1 2079
A = 3183

Area F = C + A = 18546 + 3183
= 21729 vernier units

Example 6 Instrument constant C = 18546

Cumulative measuring wheel movement negative

1st reading 1 2079
2nd reading 8896
A = 3183

Area F = C - A = 18546 - 3183
= 15363 vernier units

Cora-Senior:

Example 7 Instrument constant C = 25000

Cumulative measuring wheel movement positive

Reading A = 4020 Area F = C + A = 25000 + 4020
= 29020 vernier units

Example 8 Instrument constant C = 25000

Cumulative measuring wheel movement negative

Reading A = 5740 Area F = C - 10000 + A
= 25000 - 10000 + 5740 = 20740 vernier units

Adjustment of Pole Arm

Calculations in respect of measurements when the pole is inside the area to be measured are made with the CORA SENIOR by using the adjustable pole arm, the length of which can be set so that the constant is a round figure e. g. 25 000. The pole arm setting is given on the table in the case lid. The pole arm setting has no influence on the measurement when the pole arm is outside the area being measured.

Adjustable Tracing Arm

CORA SENIOR Planimeter with adjustable tracing arm enables the area represented by one vernier unit to be altered by means of adjusting the length of the arm. Therefore it is possible to adjust the planimeter so that it will read directly in the scale of the plan, and a table is supplied in the lid of the case which gives you the bar settings for each scale.

Setting the Tracing Arm

1. Release both set screws, then draw the tracing arm to the desired length, approximately in the region of the vernier division marked «o».
2. Tighten the set screw on the fine adjustment device and set the vernier exactly by turning the fine motion screw.
3. Tighten set screw on measuring head.

Calculating the length of Tracing Arm

Settings not given in the table in the case can be derived from the following calculation:

L = longest tracing arm setting
Li = shortest tracing arm setting
N = area per vernier unit corresponding to L at scale 1 : 1
Ni = area per vernier unit corresponding to Li at scale 1 : 1
Lx = required tracing arm setting
Nx = area per vernier unit selected (lying between N and Ni)

$$L_x = L - \frac{(L - L_i)\ (N - N_x)}{(N - N_i)}$$

To check the setting calculated a known area should be measured.

Calibrating the Planimeter

If it is desired to take into account small deviations in the scale of a drawing from the theoretical figure (e. g. as a result of paper shrinkage) this is effected in the case of planimeters with adjustable tracing arm by measuring an area the theoretical content of which is known exactly. The tracing arm length to be set can then be deduced from the theorectical length «Lth» in accordance with the formula

$$L = L_{th} \times \frac{\text{measured area}}{\text{theoretical area}}$$

In spite of inexact scales it is thus possible to obtain results in which the area represented by a vernier unit is a round figure.

Average height of diagrams

The average height of diagrams (especially of indicator diagrams) can easily be determined with the planimeter by dividing the measured area by the length of the diagram

G. Coradi AG.
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CORADI DISC POLAR PLANIMETER

For extremely precise measurements of large figures, the

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especially designed for this purpose, is most useful.

For mapping use **CORADI coordinatographs, model**

CORADOGRAPH

They are available in various working areas ranging from 500 x 500 mm to 1300 x 2000 mm

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To avoid time-wasting manual preparation of maps and plans we recommend the

CORADI CORADOMAT

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The inverted procedure is also possible i. e. the picking up of coordinates for expression in digital form.

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