

INSTRUCTIONS FOR USE



AVIAT

610 • 613 • 615 • 617 • 618

AVIATJET

647



ARISTO-WERKE • DENNERT & PAPE KG • HAMBURG

E

INSTRUCTIONS FOR USE

ARISTO

AVIAT

610 · 613 · 615 · 617 · 618

AVIATJET

647

ARISTO-WERKE · DENNERT & PAPE KG · HAMBURG

E

Treatment and Adjustment of the ARISTO AVIAT and ARISTO AVIATJET

This precision instrument is a valuable aid to navigators and deserves careful treatment. The scales should be protected from dirt and scratches in order to preserve their perfect readability. Dust infiltrations under the rotary hands or the transparent disks are best removed with a strip of paper or soft cloth passed and re-passed between the two surfaces. If this procedure fails, the disks can also be taken apart. Reassembly, however, entails scale adjustments which take some time.

Excessively tight or slack movement of the compass ring on the rear face of computers 613, 617, 618 and 647 can be corrected after loosening the four connecting screws.

Do not leave the ARISTO-AVIAT on heated surfaces and, above all, protect it from direct sun rays in the cockpit. Deformations will result from temperatures higher than 60 °C (140 °F). Computers damaged through these causes will not be exchanged free of charge.

Contents

	Page
1. Preface	5
2. The Scales	5
3. Everyday Arithmetic	10
3.1 Reading the Scales	10
3.2 Multiplication	11
3.3 Division	11
3.4 Combined Multiplication and Division	11
3.5 Proportions	11
4. Conversions between Metric and British/US Standards	12
4.1 Conversion of Lengths and Distances	12
4.2 Conversion of Liquid Measures	13
4.3 Calculation of Weights from Liquid Measures	13
5. Time and Speed Conversions	13
5.1 Conversion of Times	14
5.2 Conversion of Speeds	14
6. Distance-Time-Speed Problems	14
6.1 Time or Rate of Climb and Descent	14
6.2 Distance-Time-Speed Problems	15
7. Fuel Consumption	17
8. Pressure Pattern Flight	17
8.1 Calculation of Cross-wind Component V_h from Pressure Comparison	17
8.2 Calculation of Beam Displacement (Z_0)	18
8.3 Calculation of Drift from V_h or Z_0	19
9. Air Speed Calculations	19
9.1 Using ARISTO-AVIAT-Models 610, 613, 615, 617, 618	19
9.1.1 Calculation of True Air Speed (T.A.S.)	19
9.1.2 Calculation of Rectified Air Speed (R.A.S.)	20
9.1.3 Compressibility Correction	20
9.1.4 Calculation of Speed of Sound and Mach Number	21
9.2 Air Speed Calculations with ARISTO-AVIATJET 647	22
9.2.1 Calculation of True Air Speed (T.A.S.)	22
10. Altitude Calculations	23
10.1 Calculation of True Altitude	23
10.2 Calculation of Density Altitude	24
11. Graphic Solution of Triangles with ARISTO-AVIAT 613, 617 and 618	25
11.1 Wind Triangle Problems	25
11.2 Departure Problems	27
11.3 Finding the Conversion Angle (C.A.)	27
12. Trigonometrical Solution of Triangle Problems with ARISTO-AVIAT 610, 615	38
12.1 Solution of Triangle Problems in General	38
12.2 Wind Triangle Problems	38
12.3 Calculation of Departure	44
12.4 Calculation of Conversion Angle (C.A.)	45
12.5 Calculation of True Bearings	45
13. Glossary of Navigational Terms	46

All rights reserved, including that of translation

© 1956 by ARISTO-WERKE · DENNERT & FAPE KG · HAMBURG · Printed in Germany

O/SJL/RR · Berek 6426

1. Preface

All ARISTO Aviat Navigation Computers are applicable to a wide variety of practical navigational problems. Derived from earlier instruments, known as the Kneeyer system of triangle computers, the devices have been further developed to meet current needs in International Air Navigation. The several models are differentiated by the methods used to solve triangle problems and, in the ARISTO AVIATJET, the method of calculating air speed. With the ARISTO AVIAT models 613, 617 and the AVIATJET, a simple and straight-forward graphical solution of wind triangles is provided. ARISTO AVIAT models 610 and 615 use the sine rule to obtain strictly mathematical solutions.

The front faces of all models are identical and can thus be described together. Only in the ARISTO AVIATJET 647 is the scale arrangement changed, to facilitate calculation of the true air speed with respect to the compressibility of the air.

The ARISTO AVIAT 610 is the smaller version of model 615, and model 613 is a pocket-size version of 617.

In addition to the scales for the usual distance-time-speed problems, fuel consumption and wind triangle computations, all models have scales for rapid conversion between British/US and Metric units of measurement, as well as for liquid measures, at various specific gravities, to their equivalents in pounds weight or kilos. Special scales or marks are provided for the determination of true air speed, true altitude and density altitude, speed of sound and Mach number, as well as for the solution of problems in pressure pattern navigation.

So that the Navigation Computers shall be suited to use internationally, and in recognition of the fact that English is one of the I.C.A.O. agreed languages in air travel, used the world over in log-book forms, route handbooks and flight control services, the scales are coded and annotated in English.

2. The Scales

The ARISTO AVIAT is a disk calculator with scales arranged as concentric circles. Colour tinting clearly distinguishes the various scales and a transparent, rotating cursor, with index line, simplifies setting and reading between graduations.

On the front face, passing inwards from the fixed outer scale, are the following:

On the stationary Outer Rim

- (a) Two short scales, labelled Sp. G., and divided to specific gravities 0.65 to 0.95 for gas and oil for conversions of capacities in Litres, Imp Gallons or US Gallons to Kilograms or Pounds.
- (b) A continuous logarithmic "slide rule" scale in circular form, labelled DISTANCE, T.A.S. and T.ALT. Marks are furthermore interspersed in the graduation for conversions between

Kilometers	—	Nautical Miles	—	Statute Miles	(red)
Meters	—	Yards	—	Feet	(black)
Litres	—	Imp Gallons	—	US Gallons	(blue)

On the Rotating Center Disk

- (c) A full circle logarithmic scale, coded as R.A.S., QNH ALT., and MIN. This is the counterpart of scale (b) and has gauge marks for the conversion ft/min to m/sec. It is simultaneously a time scale, divided in minutes between 6 and 60, from the hour mark Δ as origin. The mark "sec" at 36 in conjunction with the hour mark provides for the conversion between minutes and seconds. The mark $\varrho = 57.3$ is occasionally needed to convert between degree and radian measure, whilst the mark $\pi = 3.14$ is used in problems involving the circle.

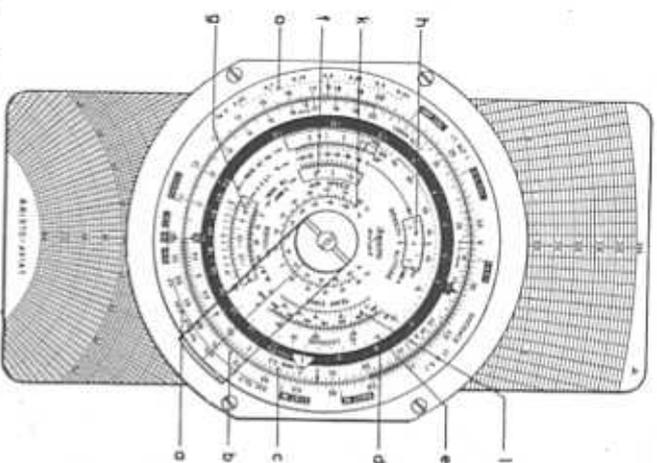


Fig. 1a. Front face of ARISTO AVIAT 613, 617, 618

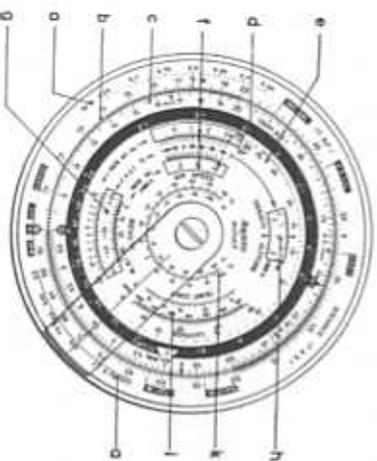


Fig. 1b. Front face of ARISTO AVIAT 610, 615

- (d) An hour scale on a black band, 1 to 10 hours on the upper edge of the black band and 10 to 20 hours on the lower edge. This scale links up with the minute scale (c) at the hour mark **A** furnishes the equivalent in the other time unit.
- (e) A scale LATITUDE, 15° to 90°, for pressure pattern problems.

- (f) Two concentric scales in red color inside their respective "window", labelled AIR SPEED for air speed calculations, with a third scale on the intervening strip, for corrected outside temperature (C.O.A.T. °C) + 50° to -80°. The pressure altitude scale (PRESS. ALT.) in km from -0.6 to + 20 km appears in the upper window frame and in thousands of feet from - 2 to 65 (thousand feet) in the lower window. The marks M (km/h) and M (kt) serve for calculating Mach Numbers and Speed of Sound.
- (g) A "window" with blue scales and numeration labelled ALTITUDE for altitude calculations. The scale immediately above the cutout is the pressure altitude scale in km from -0.5 to + 10.7 and the scale below is the pressure altitude scale in thousands of feet from -2 to + 35.2. The terminal lines apply to all altitudes from 10.7 to 25 km, or, respectively, 35,200 to 80,000 ft. The corrected outside temperature (C.O.A.T. °C) appears within the cutout numerated from -70° to + 50° C.
- (h) Aperture scales, graduated in km -2 to + 14.6 and in thousands of feet -6 to 48, are for finding DENSITY ALTITUDE, related to the air speed by means of a red arrow.

In the Central Part of the Rotary Disk

- (i) Paired scales, TEMP.CORR. for correction of the outside temperature of high altitudes and at high speeds (400 to 1000 km/h or 200 to 550 knots).
- (k) A concentric temperature scale, for conversions, Fahrenheit ↔ Celsius (Centigrade).

Modifications: ARISTO AVIATJET

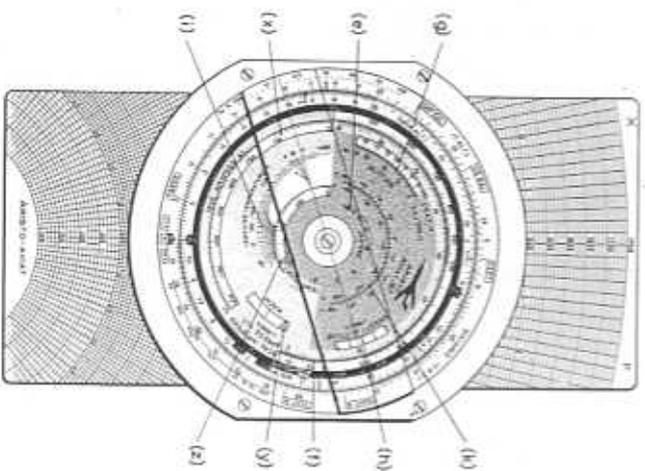


Fig. 1c. Rear face of ARISTO AVIATJET

In the scale-field tinted grey-yellow, certain scales are differently arranged and new scales have been introduced. As far as possible, scale identifications, for scales of like function, are retained. All data are given in kt, ft and °C units.

- (e) A sine scale, identified as **LATITUDE**, figured for parallels of latitude between 15° and 90°. This is for use in problems in pressure pattern navigation.
- (f) Two contra-progressive scales, marked **CAL. AIR SPEED kt** and **PRESS. ALT. X 1000 ft.**, serving for high air-speeds, 100 to 1850 kt and aircraft altitudes, 0 to 80 000 ft.
- (g) An aperture scale, **ALTITUDE**, divided and figured in blue, for computing true height, in association with scales (b) and (c). At the lower edge is a scale for pressure altitude, **PA, X 1000 ft.**, between -2 and 35.2, the terminal mark being valid for heights up to 80 000 ft. In this aperture is also a scale for the correction of the outside temperature **C.O.A.T. °C**, between -70° and +50°.
- (h) The aperture scale **DENSITY ALTITUDE X 1000 ft.**, divided and figured in red between -5 and 50, associated with the red figured temperature scale, -80° to +50°, located in the un-graduated section of the **CAL. AIR SPEED** scale (f).
- (i) A family of curves for setting the **INDICATED TEMPERATURE** in °C, associated with the reference spiral in the base disk.
- (k) A temperature conversion scale, Fahrenheit ↔ Celsius (Centigrade).
- (x) Scale for true air speed **T.A.S., 100 to 1750 kt.**
- (y) Window, for heading Mach numbers 0.25 - 3.5, with cursor line, on the underlying scale.
- (z) Window, for scale of temperature rise, **TEMP. RISE**, between 5 and 400° C.

The Rear Face of the Models ARISTO AVIAT 613, 617, 618 and ARISTO AVIATJET 647

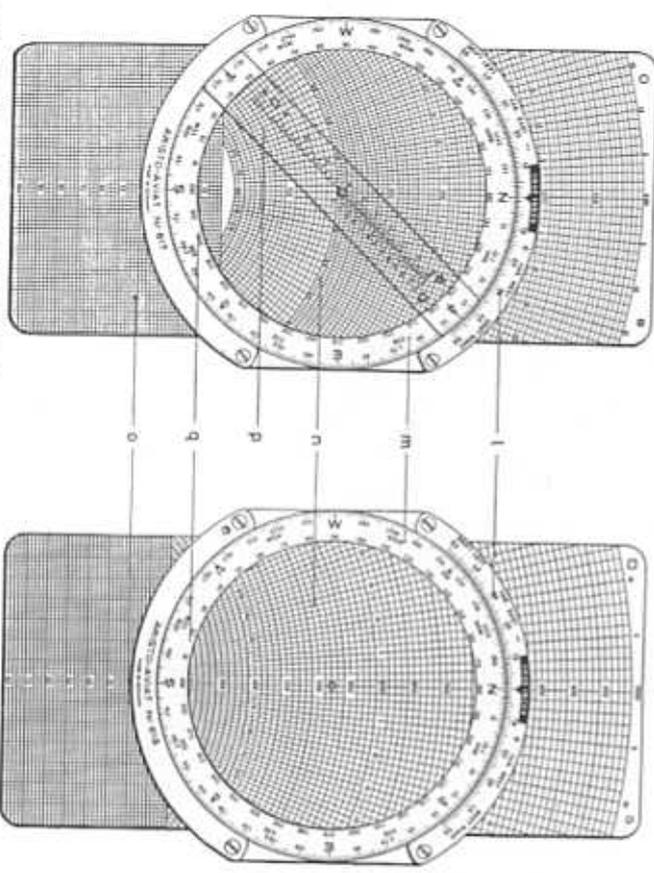


Fig. 2a Rear Face of ARISTO AVIAT 613 · 617 · 647 Fig. 2b Rear Face of the ARISTO AVIAT 618

On the Stationary Arc

- (l) A circular arc divided each single degree, 0° to 50°, to right and left of the **TRUE INDEX**. The labels **DRIFT LEFT** - **DRIFT RIGHT**, **VAR. EAST** - **VAR. WEST**, supplemented by plus and minus signs, are self-explanatory.

On the Rotary Circle Limb

- (m) An azimuth graduation, 0° to 360°, including a 16-point compass rose. The wind directions are set on the red azimuth graduation.
- (n) A matt, transparent plotting surface.
- (o) A diagram slide moves in a slot beneath the plotting surface. Both sides of the diagram slide are ruled with concentric speed arcs cut by radiating rays for the drifts.
- (p) **ARISTO AVIAT** models 613, 617 and 647 have a rotating indicator (q), which moves over the plotting surface. The indicator has three scales of wind velocity, associated with the curves of the diagram slide. The indicator- and diagram wind scales are marked Δ , \circ , \square and \times for use in pairs.

The following diagram slides are available:

- A for speeds 60 to 300 Δ
- B for speeds 100 to 500 with a rectangular grid numerated 0 to 100 \circ
- D for speeds 100 to 1000 \square
- F for speeds 300 to 1750 \times
- G for speeds 300 to 1000 with a rectangular grid numerated 0 to 80 \square
- H for speeds 40 to 250 with rectangular grid numerated 0 to 80 \square
- K for speeds 150 to 750 Δ

In accordance with the air speed ranges, the air speed arcs of the several diagram slides have different intervals and figuring, identified by the symbols Δ , \circ , \square and \times . All air speeds are given in knots or km/h.

The diagram slides are interchangeable, but as it is convenient to have all frequently needed speeds on one slide, the following combinations, assembled from experience, have data on both faces, for the commonly used speeds:

- AB Diagram slide with ranges A and B
- AD Diagram slide with ranges A and D
- AG Diagram slide with ranges A and G
- AK Diagram slide with ranges A and K
- BD Diagram slide with ranges B and D
- BF Diagram slide with ranges B and F
- BH Diagram slide with ranges B and H

The corresponding diagrams are distinguished, in the pocket model **ARISTO AVIAT 613**, by the small letters *ab*, *ag*, *ak*.

The **Rear Face** of the models **ARISTO AVIAT 610** and **615** contains the following scales from the rim inward:

- (r) A logarithmic scale (red) labelled "**SPEED**" and numbered from 5 through 100 up to 1500.
- (s) A logarithmic sine scale (blue) labelled " χ sin" numbered from 1° to 90° and in the opposite direction from 90° to 179°.
- (t) An azimuth graduation (blue) from 0° to 360° including a 16-point compass rose.
- (u) A circle graduated from 0° to 180° to left and right of an index in the shape of an aircraft silhouette, with a second numeration continued from 180° to 360°, reading clockwise.