International Hydrographic Review, Monaco, LVIII (1), January 1981

THE STAR/PLANET DETECTOR

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INTRODUCTION

With the recent major advances in electronic (radio aid) and satellite navigation, we are also witnessing a sharp increase of interest in the modernisation of instruments utilised in the observations and calculations necessary for autonomous (i.e. celestial) navigation, because this time-proven conventional method is still considered essential for checking purposes as a guarantee of safety at sea.

The subject of this article is a device considered to be an indispensable accessory for the exploitation of celestial navigation; that is to say, a "transformer of coordinates" (or "star detector") necessary for the preparation of observations and for the identification of the celestial bodies observed.

The instrument described in this article and designed by the Author has the merit of extreme flexibility in use as there are only two component parts, valid for both hemispheres and for any latitude of the observer.

DESCRIPTION

TRANSFORMATION OF COORDINATES

In view of the analogy between the celestial equator coordinate grid and the alt-azimuthal coordinate grid, the transformation from one to the other may be affected by means of polar coordinates, the origin being the cardinal point, either East or West.

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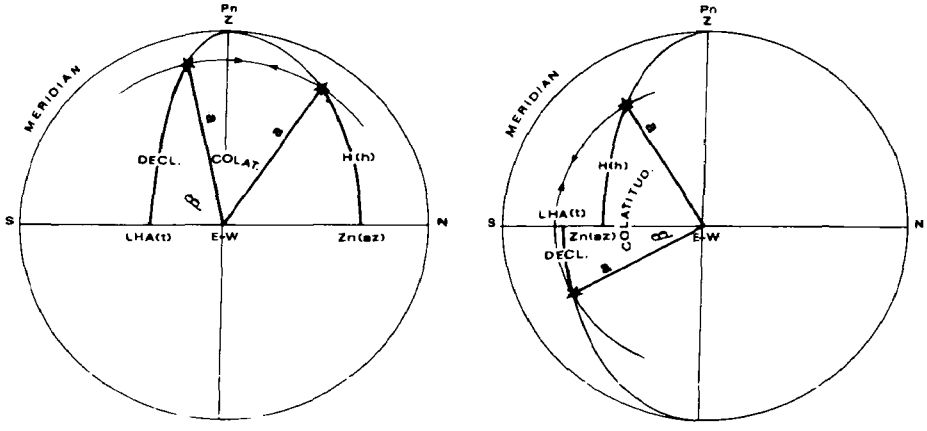


Orthographic projection (North Lat.)

Polar coordinates :

a = Radius vector

β = Angle between the radius vector and either horizon or the equator.

If the radius vector rotates from the star position in equatorial coordinates to its position in horizontal coordinates, it will describe an angle equal to the observer's colatitude.

COORDINATE TRANSFORMER

The coordinate transformer has been laid out on the gnomonic projection.

The stars on the white disc are shown in blue when their declination is North, and in red when their declination is South (*).

Right ascensions are also read from the white disc.

Declinations, altitudes and azimuths for northern latitudes are read from the blue grid and scale of the transparent disc.

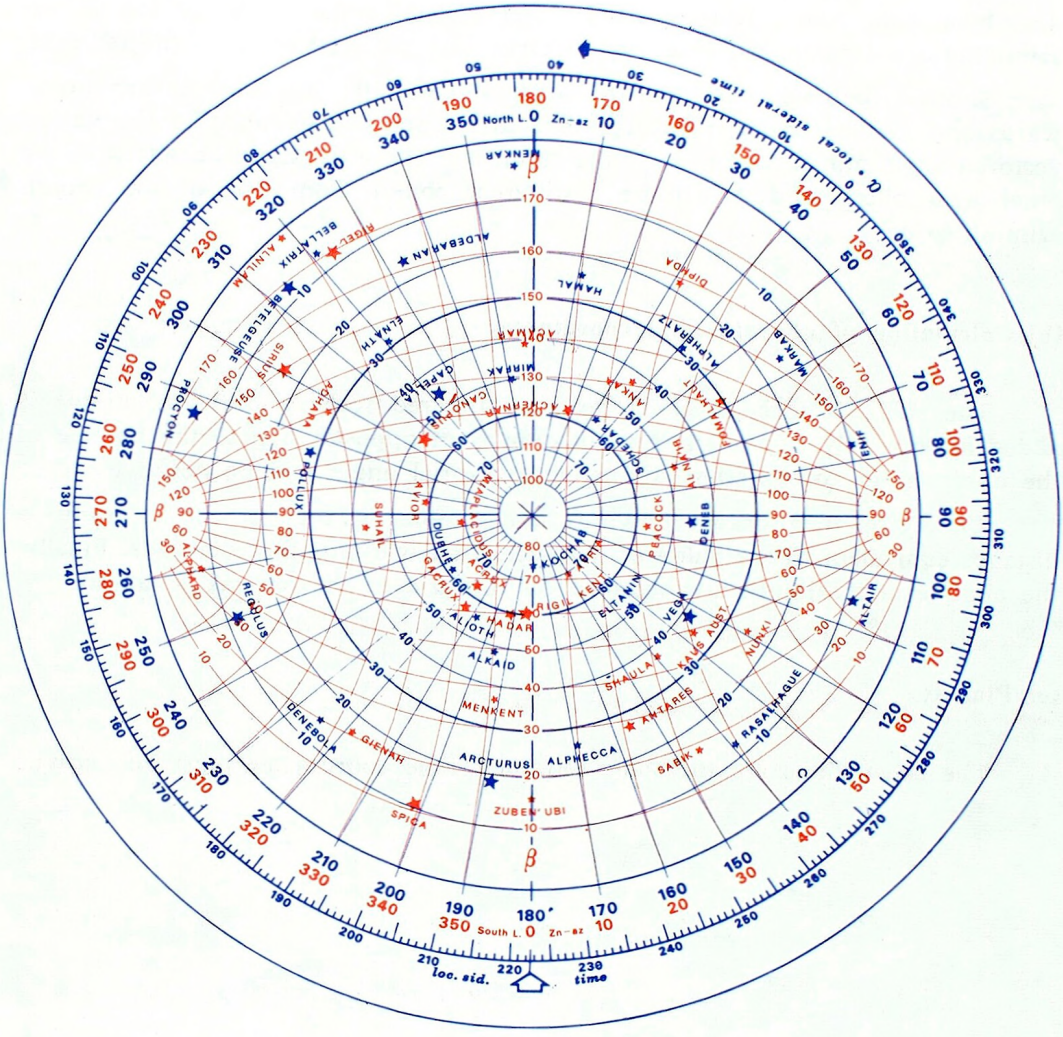
The polar coordinate grid, vectorial angle scales and azimuth scales for southern latitudes are shown in red on the transformer disc.

USE OF THE COORDINATE TRANSFORMER

The oustide arrow on the transparent disc, i.e. the observer's meridian, must be set on the local sidereal time to be read on the blue right ascension scale. The transformer must always be held with the arrow directed upwards, both for northern and southern latitudes.

(*) The stars (57 in number) are those indicated in Nautical Almanacs.

The Star Planet Detector



EXAMPLES — EXEMPLES

(a) **Identificazione delle Stelle** — Tempo sidereo locale :
Identification of Stars — Local sidereal time : 222°,5
Identification des Etoiles — Temps sidéral local :

	Zn az	H h	β	COLAT.	β		
N LAT. **(BLUE)**	1°	41°	(139° – 65°) =	74°	blue	KOCHAB
25° = COLAT. 65°	48°	19°	(153° – 65°) =	88°	blue	DENEB
	100°	50°	(82° – 65°) =	17°	blue	RASALHAGUE
	154°	33°	(36° – 65°) =	– 29°	red	ANTARES
	226°	34°	(43° – 65°) =	– 22°	red	GIENAH
S LAT. **(RED)**	12°	37°	(38° – 65°) =	– 27°	blue	ALPHECCA
25° = COLAT. 65°	52°	35°	(48° – 65°) =	– 17°	blue	RASALHAGUE
	99°	68°	(94° – 65°) =	29°	red	ANTARES
	143°	24°	(151° – 65°) =	86°	red	PEACOCK
	182°	54°	(126° – 65°) =	61°	red	RIGIL KENT

(a) Star identification

Using the transparent disc, with the altitude and azimuth (North latitudes = blue scale, South latitudes = red scale) determine the star's position in alt-azimuthal coordinates, and read the corresponding vectorial angle on the red grid.

Subtract the colatitude from this angle algebraically and draw an arc downwards and parallel to the vertical curves to a distance equivalent to the value: vectorial angle minus colatitude. If the result is of negative sign, the star is in the other hemisphere, and it will be a different colour from that of the chosen azimuth grid.

(b) Calculation of alt-azimuthal coordinates

The star's vectorial angle is read on the red scale, and the colatitude is added algebraically. If the star's declination is of opposite sign to the latitude of the observer (i.e. of different colour) the vectorial angle will be negative.

An arc is then drawn upwards and parallel to the vertical curves to a distance equivalent to the value of the vectorial angle plus the colatitude. Finally, the altitude and azimuth are obtained on the grid of the observer's latitude.

(c) Planets

The calculations are the same but their time coordinates must be known.