

User Manual
&
Operational Guide

Ver. 1.1.0

Important Safety, Legal, and Operational Disclaimers

LAST UPDATED: August 2026

1. Supplementary Navigation Aid Only

Vincenta is an electronic celestial navigation application designed solely to assist trained navigators in performing astronomical calculations and related computational functions used in celestial navigation. It is intended **strictly as a supplementary computational aid** and must never be relied upon as the sole or primary means of vessel navigation.

Vincenta is not a substitute for proper navigational knowledge, prudent seamanship, professional maritime judgment, or compliance with applicable international and national maritime laws, regulations, and accepted navigational practices.

2. Statutory & Carriage Limitations

Vincenta has **not** been evaluated, certified, or approved as navigational equipment under the *International Convention for the Safety of Life at Sea (SOLAS)* by any flag state, classification society, maritime administration, or governmental authority. It is not approved for use as primary navigation equipment or as equipment required to satisfy any statutory carriage or safety requirement.

3. Operational Limits & User Responsibility

Vincenta performs mathematical and astronomical calculations and related computational functions only. It does **not**:

- Determine whether celestial observations are appropriate or accurate.
- Assess environmental hazards, sea state, or weather conditions.
- Evaluate navigational hazards, shoal waters, or grounding risks.
- Detect collision risks or make navigational decisions on behalf of the user.

Although every reasonable effort has been made to ensure the mathematical accuracy of the calculations performed by Vincenta, no software can be guaranteed to be free from defects, computational errors, or unforeseen faults. The accuracy of any calculated position depends upon many factors beyond the control of the software, including (but not limited to):

- The quality and accuracy of sextant altitude observations.
- The physical condition, alignment, and index error calibration of the sextant.
- The accuracy of the shipboard time source / chronometer.
- Atmospheric refraction anomalies caused by unrecorded temperature and pressure extremes.
- The correctness and completeness of all data entered by the user.

Navigators are strictly responsible for independently verifying all observations, calculations, and navigational decisions using official paper nautical charts, nautical almanacs, sight reduction tables, and, wherever practicable, alternative navigational methods (such as radar, visual bearings, and satellite positioning). The user remains solely responsible for the safe navigation of the vessel and for every navigational decision made using, or in conjunction with, Vincenta.

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- Celestial Navigation in the GPS Age by John Karl. References to this work, its described computational methods, and the reconstructed data points from its worked examples are provided exclusively for educational attribution, methodological clarity, and benchmark testing.
- "The Direct Fix of Latitude and Longitude from Two Observed Altitudes" by Stanley W. Gery (Neptune Power Squadron, Huntington, NY), published in NAVIGATION: Journal of The Institute of Navigation, Vol. 44, No. 1, Spring 1997. References to this paper, its spherical trigonometric formulations, and direct 2-body fix algorithms are provided for educational attribution, mathematical clarity, and benchmark software validation.
- The Nautical Almanac 1999 (and related ephemeris publications) published jointly by the United States Naval Observatory (USNO) and Her Majesty’s Nautical Almanac Office (HMNAO / UKHO). Reference to published astronomical examples is for educational testing, historical reference, and algorithm validation only.

- "Lunar Distance Navigation" by Wendel Brunner (StarPilot). References to this online publication, the iterative reduction methodology described therein, and its mathematical formulations are used solely for educational attribution, algorithmic explanation, and benchmark verification.
- Lunar distance navigation methodology by Eric Romelczyk (Cambridge University Press). References to this publication and its associated mathematical formulations are provided exclusively for educational attribution, methodological clarity, and software validation.

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Software Licensing Policy & Terms of Use

LAST UPDATED: August 2026

Overview

Vincenta software is licensed by Vincenta Ltd (Company No. 17407840, registered office at Suite A, 82 James Carter Road, Mildenhall, IP28 7DE) on a perpetual, per-calculator basis. Each licence is permanently linked to the unique hardware Product ID of one compatible TI-Nspire™ CX or TI-Nspire™ CX II calculator. Once activated, Vincenta operates entirely offline and does not require an Internet connection or computer connection for normal marine use.

There are no recurring subscriptions and no annual renewal fees.

Personal Licence Scope

A **Personal Licence** permits the installation and use of Vincenta on one compatible TI-Nspire™ CX calculator. Your purchase includes:

- Vincenta software package (`vincenta_x_x_x.tns` document file).
- A personal, device-specific 16-character activation key.
- Installation and operational documentation.
- Free maintenance updates within the purchased major version.
- Software licensing support.

Licence Activation

Before purchasing, you must provide the last eight characters of your calculator's **Product ID** (found on your TI-Nspire™ handheld under **Home ➔ Settings ➔ Status ➔ About**).

Following purchase, Vincenta generates a personalised activation key specifically tied to that Product ID. The activation key is unique to your calculator and cannot be used to activate any other handheld device. Activation is required only once upon initial launch.

Additional Calculator Licences

If you own more than one compatible TI-Nspire™ CX calculator (for example, a primary bridge calculator and a backup handheld), an **Additional Calculator Licence** may be purchased for each extra device at a reduced price. Because every calculator possesses a unique Product ID, each device requires its own distinct activation key.

Educational & Institutional Licences

Educational establishments, sailing schools, yacht clubs, commercial maritime training providers, and naval institutions requiring Vincenta for multiple calculators may obtain **Educational or Institutional Licences**.

These licences are offered under individually tailored terms to reflect the number of calculators, intended organisational use, and required support levels. Institutional arrangements may include volume licensing, instructor training packs, and automated classroom deployments. Please contact Vincenta directly to discuss institutional requirements prior to purchase.

Software Updates & Major Upgrades

Maintenance releases—including bug fixes, performance optimisations, and minor compatibility updates—are provided **free of charge** within the purchased major version of Vincenta.

Future major versions introducing significant new features or navigational capabilities may be offered as optional paid upgrades at a reduced price. Upgrading is entirely optional; your existing licensed version will continue operating indefinitely on the calculator for which it was originally activated.

Replacement Calculator Hardware Policy

Vincenta licences are intended for permanent use on the calculator for which they were originally purchased.

If your calculator suffers a **genuine hardware failure**, Vincenta will issue a replacement activation key after reviewing reasonable evidence that the original device is no longer operational. Examples of accepted evidence include:

- Photographs showing physical damage or an unrecoverable screen failure.
- Service documentation or repair receipts from an authorised technician.
- Manufacturer warranty exchange documentation.

Routine replacement of a working calculator, voluntary hardware upgrades, device resale, or transferring software to a colleague's calculator are not covered under the replacement policy. In these situations, an Additional Calculator Licence is required. Replacement keys are issued at the discretion of Vincenta Ltd.

Fair Use & Intellectual Property

Each activation key is issued solely for the individual calculator whose Product ID was registered during purchase. Activation keys must not be published, shared, resold, redistributed, or used to activate unauthorised calculators.

A Vincenta licence grants permission to use the software under these Terms of Use. It does not transfer ownership of the software, mathematical algorithms, visual layouts, or associated intellectual property.

Licensing Support

For assistance with activation keys, hardware replacements, or institutional licensing inquiries, please contact Vincenta support via email using the contact details published on the official Vincenta website.

Overview & Chapter Guide

- **Chapter 1: Getting Started & User Interface Layout**
  - *Covers application startup, licence key activation, screen layout anatomy, handheld keypad controls, and the complete system menu tree.*
- **Chapter 2: System Configuration & User Preferences**
  - *Covers configuring global navigational defaults—including unit selection (m/ft, °C/°F), Height of Eye, Index Error, default DR coordinates, algorithm precision, high-contrast themes, and system placeholders.*
- **Chapter 3: Celestial Sight Reduction & Result Visualisation**
  - *Covers performing individual celestial sight reductions for the Sun, Moon, planets, and stars, reviewing intercept/azimuth outputs, viewing the 3D PZX navigation triangle, and plotting 2D Lines of Position.*
- **Chapter 4: Celestial Phenomena, Body Identification & Star Database**
  - *Covers predicting rise, set, transit, and twilight times, identifying unknown celestial bodies from sextant observations, and browsing or searching the 59-star catalogue.*
- **Chapter 5: Interactive Sky Chart & Triad Sight Finder**
  - *Covers rendering interactive 2D stereographic and polar sky charts, measuring angular distances between celestial bodies, and utilising the automated Triad Sight Finder to identify optimal 3-body configurations for multi-sight fixes.*
- **Chapter 6: Sight Folder Management & Digital QR Export**
  - *Covers organising sight reduction records into named storage folders, managing stored sights, and exporting single or batch sight data via optical QR codes.*
- **Chapter 7: Electronic Navigation Logbook & Dead Reckoning**
  - *Covers creating and managing digital vessel logbooks, entering DR, EP, and FIX entries, and automatically calculating dead-reckoning track advances with leeway and tidal current drift.*
- **Chapter 8: Multi-Sight Celestial Running Fixes & Uncertainty Ellipses**
  - *Covers computing multi-sight running fixes across vessel tracks, reviewing iterative least-squares convergence data, and plotting multi-LOP charts featuring 95% statistical confidence uncertainty ellipses.*
- **Chapter 9: Direct Computation Fixes Without Assumed Position**
  - *Covers calculating direct 2-body position fixes using Stanley W. Gery's spherical triangle method, evaluating the four mathematical intersection candidates, and recording the selected fix into a navigation log.*
- **Chapter 10: System Utility: Full System Backup & Restore via Clipboard**
  - *Covers full database backup and restore via system clipboard.*

- **Chapter 11: Advanced Utilities: Sight Analysis**
    - *Covers analysing rounds of sights via interactive altitude-vs-time plots to exclude outliers from a round of single-body sights, and solve for Local Apparent Noon.*
- **Chapter 12: Advanced Utilities: Lunar Distances Using the Wendel Brunner Method**
    - *Covers clearing lunar distances using the Wendel Brunner method to compute watch time error.*
- **Chapter 13: Optical QR Scanner App**
    - Covers air-gapped data transfer via optical QR codes, installing and configuring the Progressive Web App (PWA) on mobile devices, scanning sights and logbook entries from the calculator screen, inspecting detailed reduction data, and exporting CSV files for external logbooks and spreadsheets.
- **Chapter 14: Customer Support, Bug Reporting & Continuous Development**
    - Covers obtaining technical support, reporting calculation anomalies or unexpected software behaviour, submitting feature requests, and contributing to the ongoing development of Vincenta.

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Chapter 1: Getting Started & User Interface Layout

Welcome to **Vincenta**, a comprehensive celestial navigation suite designed specifically for the TI-Nspire™ CX graphing calculator. Vincenta transforms your handheld into an electronic marine navigation desk, capable of performing complete celestial sight reductions, generating lines of position, calculating running and direct fixes, predicting celestial phenomena, plotting interactive sky charts, and maintaining digital navigation logs.

This chapter provides an operational overview of the software, detailing how to launch the application, navigate the interface using physical handheld keys, and understand the visual layout on screen.

1.1 Launching the Application & Licence Activation

Launching Vincenta

To launch the application on your TI-Nspire™ CX or TI-Nspire™ CX II calculator:

1. Turn on your TI-Nspire™ handheld by pressing the **[On]** key.
2. From the Home screen, select **My Documents** (or press **[2]**).
3. Navigate to the folder where you stored the Vincenta document file (`vincenta_x_x_x.tns`).
4. Highlight the file and press **[Enter]** or click the centre of the touchpad.



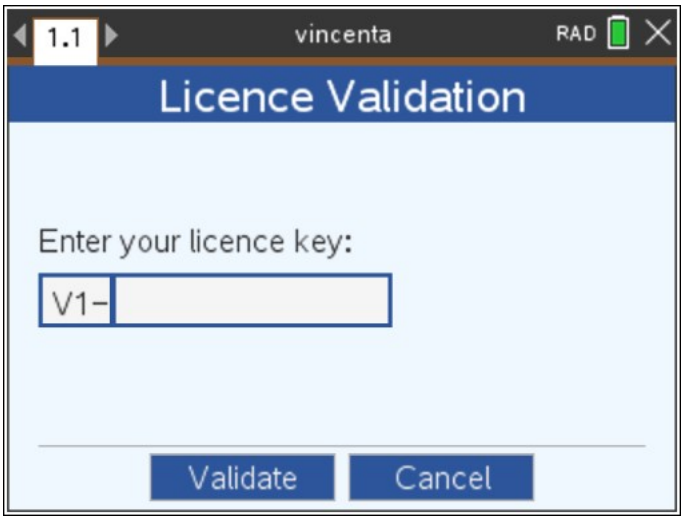
Vincenta splash screen.

After a brief 3-second display (or instantly upon pressing any key or clicking the touchpad), the system automatically checks your software activation status:

- If the software is already licensed on your device, it proceeds directly to the **Main Menu**.
- If launching for the first time on an unlicensed device, the software displays the **Licence Validation Screen**.

Licence Activation

Vincenta uses a permanent, device-specific activation key tied to your handheld's unique hardware ID.



***Licence validation screen**. Enter your activation key with the format V1-XXXX-XXXX. The second dash is optional and Vincenta capitalises letters automatically.*

1. Use the physical alphanumeric keypad to type your 12-character licence key with the format V1-XXXX-XXXX into the entry field. The second dash is optional and Vincenta capitalises letters automatically.
2. Press **[Enter]** or navigate to the **[Validate]** button and press **[Enter]**.
3. If valid, a confirmation dialogue appears. Press **[Enter]** or **[Esc]** to proceed to the **Main Menu**.

Important Note on Data Persistence (RAM vs. Flash ROM)

When you save a celestial sight, log entry, folder modification, or system setting within Vincenta, the changes are written immediately to the calculator’s volatile working memory (RAM). To permanently commit these updates to non-volatile Flash ROM memory—ensuring your navigational records and custom preferences are preserved when the calculator is powered off—you must save the document file by pressing **`[Ctrl]`** + **`[S]`** on the TI-Nspire™ keypad.

Exiting the Application & Preserving Document Data

To exit the Vincenta software package (`vincenta_x_x_x.tns`) at any time, press **`[Ctrl]`** + **`[W]`** on the TI-Nspire™ keypad. If any new observations, log entries, or settings have been added

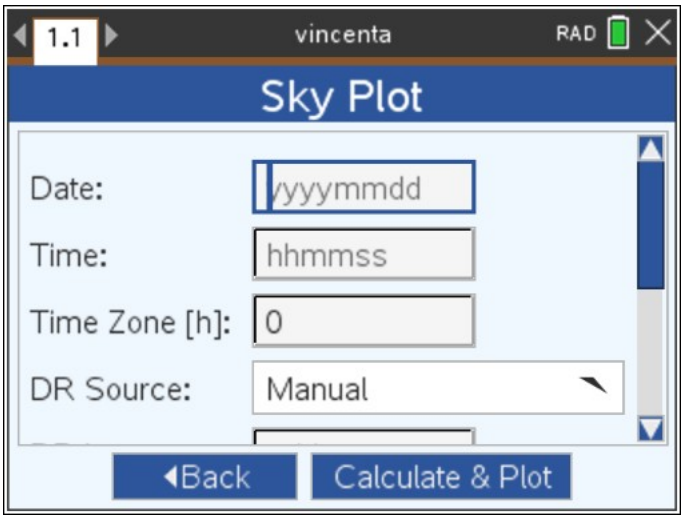
or modified since your last manual save, the TI-Nspire™ operating system will display a prompt asking whether you wish to save changes to the document before closing. Select **Yes** to ensure all session data is permanently written to Flash ROM memory before the application quits.

1.2 Application Screen Architecture & Functional Screen Types

Vincenta's user interface is built upon a modular three-tier architecture designed to provide a consistent and intuitive workflow across all navigational tasks. Every screen in the software falls into one of three functional types:

Input & Form Screens

- **Purpose:** Serves as the primary data entry interface for collecting navigational parameters, sextant observations, logbook entries, and system preferences.
- **Key Features & Behaviour:** Contains interactive controls including recessed text fields, drop-down selection menus, and action buttons. Focus moves sequentially through fields using **`[Tab]`** or **`[▲]`** / **`[▼]`**. Accepts shortcut keys for rapid data entry submitting data, or activating action buttons. On submission of data the screen validates all entries and transitions immediately to the corresponding Results screen.

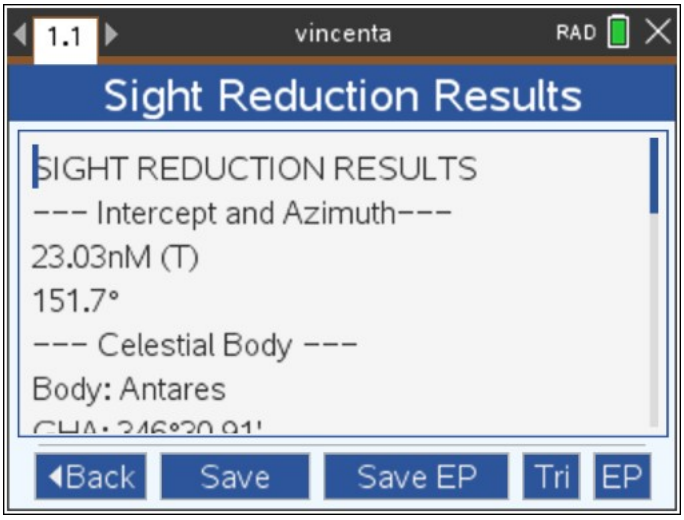


Typical input screen: Sky Plot data entry.

Results Display & Visualisation Screens

- **Purpose:** Presents computed navigational outputs, ephemeris data, reduction summaries, or interactive graphical plots (such as 2D LOP charts, 3D PZX spheres, or polar sky charts).
- **Key Features & Behaviour:** Operates in a view-only state to protect calculated data from accidental modification. Provides contextual action buttons—such as **`[Save]`** (to record data to a folder), **`[Save EP]`**, **`[Plot]`**, **`[Tri]`**, or **`[Copy]`** (to transfer text results to the

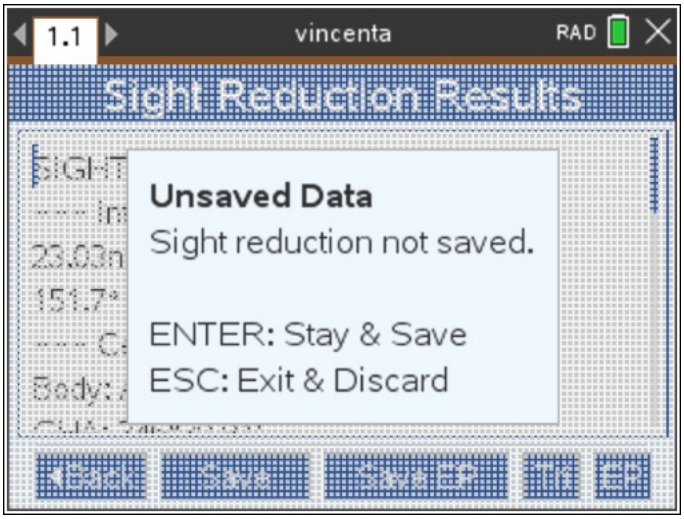
clipboard). Pressing **[Esc]** returns you directly to the preceding input form with your original parameters preserved.



Sight Reduction Results screen. *A typical screen displaying calculations.*

Modal Overlay Screens (Dialogues & Confirmations)

- **Purpose:** Temporarily interrupts the normal screen flow to deliver critical system alerts, request operational confirmation (e.g., unsaved changes warnings, folder deletion prompts), present quick-reference keypad help (**[H]**), or configure specialised sub-settings (e.g., Triad Sight Finder parameters).



Sight Reduction Unsaved Data modal screen. *A typical modal screen displaying alerts.*

- **Key Features & Behaviour:** Rendered as a centred pop-up window layered over a dimmed workspace background. Modal dialogues capture all keypad input until confirmed or

dismissed. Pressing **[Enter]** or clicking inside the dialogue box confirms the action, while pressing **[Esc]** or clicking outside the dialogue box cancels the prompt and restores control to the underlying screen.

1.3 Primary Screen Layout & Visual Anatomy

Vincenta features a standardised user interface designed for high legibility under varying lighting conditions at sea, supporting both **Day Mode** and high-contrast **Night Mode** (the **Vincenta Theme**), which can be combined with normal or bold text font. Every operational screen follows a structured, three-tier vertical layout:

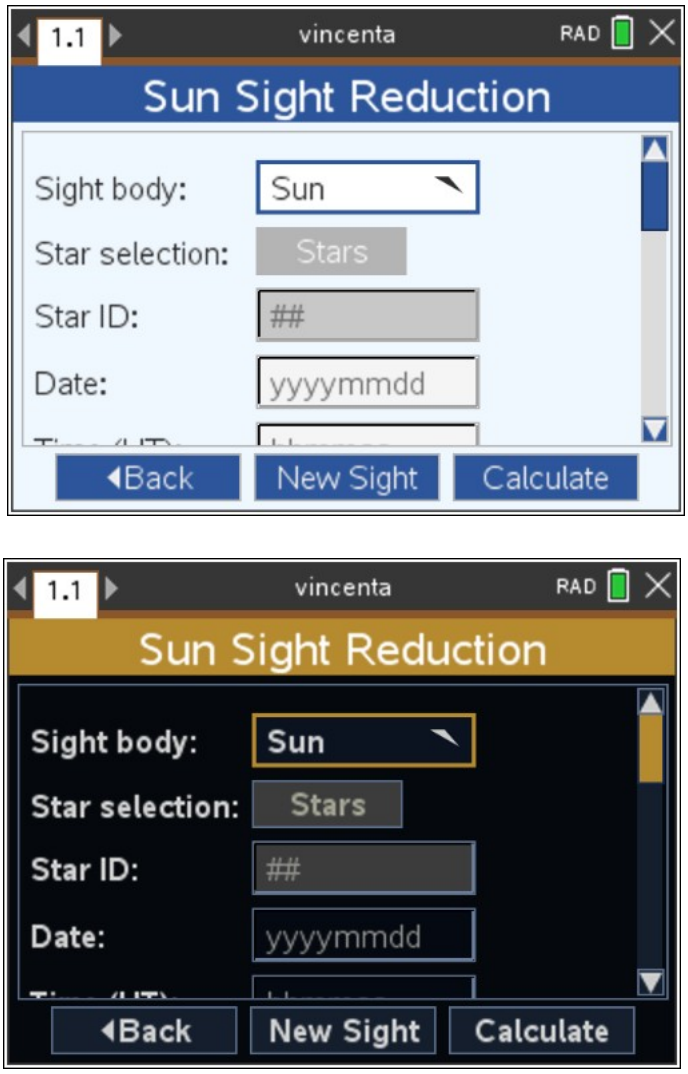
Top Header Bar

Located at the very top of the screen, this solid accent bar displays the current screen title (e.g., **Sun Sight Reduction**, **Body Phenomena**, **User Settings**) in bold, centred white text. It provides instant context as you navigate through submenus and sub-screens.

Main Workspace & Input Container

The central portion of the display serves as the interactive workspace:

- **Labelled Fields**: Input labels appear on the left, right-aligned against a virtual centre boundary, while the corresponding entry controls appear on the right.
- **Recessed Input Boxes**: Text fields feature a light-recessed background with a subtle border, making entry boundaries immediately obvious.
- **Text Input Areas**: Large input fields accepting general text. They take most of the screen space and are used to input notes in sight reductions and log records.
- **Drop-Down Menu Boxes**: Selectors that allow to choose an option from an expandable list of options. They are distinguishable from the input boxes by not having a recessed effect, and by having an accent mark to the top right of the box.
- **Focus Highlighting**: The currently active (selected) input field or control is enclosed in a bold, prominent **blue border** (**gold border** in Night Mode).
- **Inline Validation Errors**: If an invalid entry is made (such as typing minutes greater than 59.99 or an out-of-range date), a red error message appears directly beneath the offending input box. The focus is then given to the first input field that has triggered an error and, if necessary, the screen scrolls automatically to bring it into view.
- **Automatic Vertical Scrolling**: On screens with more inputs than can fit vertically on the 320×240-pixel screen, an integrated scrollbar appears on the right edge, accompanied by top and bottom scroll arrow buttons (**[▲]** and **[▼]**). As the cursor is moved through the input fields with the up and down touchpad arrow keys (see the next section for keypad controls and navigation through the user interface), the workspace automatically scrolls to keep the currently focused input field visible.



Sight Reduction input screen. *A typical input screen, in Day Mode and Night Mode (the Vincenta Theme).*

Footer Action Bar & Status Bar

Located at the bottom of the screen:

- **Action Buttons**: Contains contextual control buttons (e.g., **[◀Back]**, **[Calculate]**, **[Save]**, **[New Sight]**, **[Reset]**).
- **Footer Status Line**: Displays helpful descriptions of menu items or operational modes, e.g., `Manage celestial sight folders` in **Main Menu** with **Sight Folders** item highlighted, or `Ascending ID` in the **Star List** screen (see further down in the related chapter).

1.4 Physical Touchpad Controls & Operational Guide

Vincenta is fully optimised for the capacitive touchpad on the TI-Nspire™ CX handheld. Located at the top centre of the keypad, the touchpad allows you to glide a finger across its surface to control an on-screen mouse pointer just like a laptop trackpad.

Pointer Visibility & Dual-Mode Center Click Key

To keep the display clear and unobstructed while working through data entry forms, the pointer follows an automatic visibility rule:

- **Automatic Fade**: On all form and list screens, the pointer appears as soon as your finger glides across the touchpad. After approximately 5 seconds of inactivity, the pointer automatically disappears.
- **When Pointer is Visible (Mouse Left-Click)**: Pressing the centre **[Click]** key acts as a standard mouse left-click. Clicking an input box gives it focus, clicking a drop-down expands its menu, and clicking a button activates its command.
- **When Pointer is Hidden ([Enter] Key Mode)**: When the pointer is invisible, pressing the centre **[Click]** key acts as the physical **[Enter]** key (activating the command of a focused button, or committing a highlighted list option).
- **Pointer in Plot Screens**: In all plot screens the pointer is always visible, and the **[Click]** key always acts as a mouse click. **Note**: in screens that are opened from a plot screen and that contain buttons, the pointer revert to its automatic fade behaviour.

Touchpad Tapping & Direct Drag-Panning

If the touchpad tapping feature is enabled in your handheld's system preferences (**Home ➔ Settings ➔ Handheld Setup**):

- **Single Tap**: Tapping the touchpad surface performs the same action as pressing the centre **[Click]** key.
- **Tap-and-Hold Dragging**: Tapping, holding, and dragging your finger across the touchpad allows you to pan across graphical charts (such as the *Estimated Position Plot*, *Celestial Running Fix Plot*, or *Sight Analysis Plot*) directly, without needing to activate the **[P]** panning shortcut key.

Touchpad Edge Directional Arrows

The four directional arrows (**[▲]**, **[▼]**, **[◄]**, **[►]**) built into the outer edge of the touchpad do **not** move the mouse pointer. Instead, they serve as dedicated navigation keys to jump focus between input fields, scroll list choices, and adjust parameters, as detailed in the sections below.

Field Navigation & Focus Control

- **[Tab]** or **[▼] (Down Arrow)**: Moves the focus highlight forward to the next input field, drop-down menu, or button.
- **[Shift] + [Tab]** or **[▲] (Up Arrow)**: Moves the focus backward to the previous control.
- **[T]**: Instantly jumps the focus back to the **Top** (first) field on the active screen and scrolls the workspace back to the top.

Interacting with Drop-Down Menus

1. Navigate focus to the drop-down menu using **[Tab]** or up and down arrow keys.
2. Press **[►] (Right Arrow)** or click the drop-down to expand the option list.
3. Use **[▲] / [▼]** to highlight an option, or click the option.
4. Press **[Enter]** or click the option again to select it and collapse the menu.
5. Press **[Esc]** or **[◄] (Left Arrow)** at any time to collapse the menu without changing the selection.

Quick Submission Tip: On screens with drop-down menus, if a drop-down menu is closed (collapsed) and focused, pressing **[Enter]** automatically triggers the primary screen button (e.g., **[OK]** in the screen to rename a sight folder – see further down in the related section), saving you from having to navigate down to the button.

Editing & Clearing Input Fields

- **[Backspace]**: Deletes the character to the left of the text cursor in an input field or a note input area.
- **[◄] / [►]**: Moves the text cursor position left or right within an input box or a text input area.
- **[▲] / [▼]:** Moves the text cursor up or down within a text input area.
- **[B] (Blank Field)**: Clears all text from the *currently focused* input field.
- **[W] (Wipe All)**: Clears text from *all* input fields across the entire active screen, resetting the form.

Pre-Filling Default Values & Sample Data

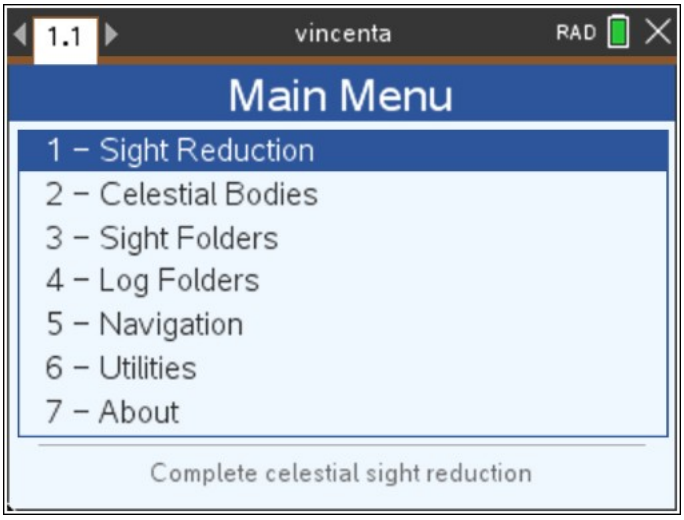
Vincenta includes intelligent shortcuts to accelerate data entry at sea:

- **[D] (Default)**: Populates the *currently focused* field with your saved user default setting (such as your standard Height of Eye, Index Error, or DR Position).
- **[U] (User All)**: Populates *all* fields on the current screen with your saved User Settings in a single keystroke.

- **[X] (Sample Data)**: On the **Sight Reduction** screen, pressing **[X]** fills the form with a complete, verified textbook sample sight taken from John Karl's *Celestial Navigation in the GPS Age* (useful for training and verification).

Primary Actions & Screen Navigation

- **[C] / [I] (Calculate / Identify)**: Triggers the main calculation, reduction, or body identification routine on the current screen, always associated with a corresponding action button at the bottom of the screen.
- **[Enter]**: Activates the currently highlighted button or commits a drop-down menu option selection.



***Main Menu screen**. All Vincenta's features are accessed from this menu.*

- **[Esc]**: Cancels the current action, closes open dialogue boxes, or navigates **Back** to the previous menu/screen. It is always associated with the **[◀Back]** button when present on the screen. **Note: The [Esc]** key is the only back navigation option in menus and sub-menus, which have no buttons on their screen**.**
- **[H] (Help)**: Displays a pop-up help dialogue listing all available keyboard shortcuts for the active screen.

1.5 Complete Menu Hierarchy & Navigation Map

To navigate through Vincenta, select an option from the **Main Menu** by highlighting it with the arrow keys and pressing **[Enter]**, or by pressing the numeric key (**[1]** through **[7]**) corresponding to the option position in the menu, or even by clicking on it to highlight it, and clicking again to commit it.

Below is the exhaustive, multi-level visual navigation map detailing every screen, option, action button, keyboard shortcut, and modal branch in the software:

- **Main Menu**
    - **1: Sight Reduction**
        - Pathway: **Main Menu ➔ 1: Sight Reduction**
        - *Primary form for single-body celestial sight reductions.*
        - Controls & Actions:
            - **Star Selection List**: Press **[Stars]** button (active only if `Star` is selected in **Sight Body** drop-down) ➔ Opens **Star List** in selection mode ➔ Populates selected Star ID in **Star ID** input field.
            - **Sight Notes**: Press **[Notes]** button ➔ Opens **Sight Notes** text editor.
            - **Form Shortcuts**: **[N]** New Sight (clears form), **[B]** Blank field, **[W]** Wipe all fields, **[D]** Default field, **[U]** User all fields, **[X]** Load sample data, **[H]** Help dialogue.
            - **Body Shortcuts**: Press the following shortcut keys to select an option in the **Sight Body** drop-down: **[S]** (Sun), **[L]** (Moon, for **L**una), **[V]** (Venus), **[M]** (Mars), **[J]** (Jupiter), **[R]** (Saturn, for **R**inged Planet), or **[E]** (Star, for **E**strella).
        - Sub-screens:
            - **Reduction Results**: Press **[Calculate]** button or key **[C]**
                - Pathway: **Sight Reduction ➔ [Calculate]**
                - Actions & Branchings:
                    - **Save Sight to Folder**: Press **[Save]** or key **[S]** ➔ **Select Folder (Sight Mode)** ➔ Saves sight record.
                    - **Save Calculated EP to Log**: Press **[Save EP]** or key **[E]** ➔ **Select Folder (Log Mode)** ➔ Saves EP record to log.
                    - **View 3D Navigation Triangle**: Press **[Tri]** or key **[T]** ➔ **Navigation Triangle 3D** (Rotate with **[◄]/[►]**, tilt with **[▲]/[▼]**, reset with **[R]**).
                    - **View 2D Intercept & LOP Plot**: Press **[EP]** or key **[P]** ➔ **Estimated Position Plot** (Zoom with **[+]/[-]**, pan with **[P]** or tap and hold the touchpad then drag the touchpad, view LOP info with **[L]**, view Sight info with **[I]**, toggle LOP selection with **[1]**).
                    - **Copy Results**: Press key **[C]** ➔ Copies results text to clipboard.
                    - **Help Dialogue**: Press key **[H]**.

- **2: Celestial Bodies Submenu**
    - Pathway: **Main Menu ➔ 2: Celestial Bodies**
    - Sub-menu Options:
        - **1: Phenomena**: **Main Menu ➔ 2: Celestial Bodies ➔ 1: Phenomena**
            - *Calculates Rise, Set, Transit, Twilights, and LHA Aries.*
            - Actions: Press **[Calculate]** or key **[C] ➔ Results Text Display** (View full phenomena text).
            - Shortcuts: **[E]** Star lookup, **[S]** (Sun), **[L]** (Moon), **[V]** (Venus), **[M]** (Mars), **[J]** (Jupiter), **[R]** (Saturn), **[P]** (Planets), **[E]** (Star), **[B]** Blank, **[W]** Wipe, **[D]** Default, **[U]** User All, **[H]** Help.
        - **2: Sky Plot: Main Menu ➔ 2: Celestial Bodies ➔ 2: Sky Plot**
            - Configures date, time, time zone, DR position, height of eye, index error, and magnitude/altitude filters.
            - Actions: Press **[Calculate & Plot]** or key **[C] ➔ Interactive Sky Chart**
                - **Projection Toggle:** Press **[M]** to switch between **Stereographic Mode** (default bridge panoramic view) and **Polar Mode** (all-sky dome).
                - **Stereographic Navigation:**
                    - Press **[◄] / [►]** to rotate central azimuth left or right in 5° steps.
                    - Press **[▲] / [▼]** to tilt central altitude up or down in 5° steps (0° to 90°).
                    - Press **[+] / [-]** to narrow or widen the Field of View (FOV) in 5° steps (15° to 180°).
                    - Press **[N]**, **[E]**, **[S]**, or **[W]** to snap view directly North, East, South, or West.
                    - Press **[Z]** to snap view straight up to Zenith (Alt 90°, all-sky FOV=180°).
                    - Press **[Space]** or **[Enter]** to centre the view directly on any hovered celestial body.
                - **Polar Navigation:**

    - Press **[+] / [-]** to zoom in or out centred on the pointer position.
- **Pan:** Press **[P]** and drag the touchpad to pan across the sky dome.
- **Reset View:** Press **[R]** to reset zoom, pan, orientation, and view centre to default.
- **View Settings Dialogue:** Press **[V]** to open the View & Projection Settings Modal (adjust projection, centre coordinates, FOV, and grid/horizon/cardinal toggles).
- **Display Toggles:** Press **[F]** to toggle Full-Screen view; press **[I]** to toggle Body Info pop-up boxes; press **[C]** to toggle constellation lines.
- **Time Advance / Step:** Press **[1]** (-0.5 h), **[3]** (+0.5 h), **[4]** (-1.0 h), or **[6]** (+1.0 h) to recalculate and step the sky in real time.
- **Visible Bodies List:** Press **[L]** ➔ **Text Display Screen** (lists all visible bodies with altitude, azimuth, and magnitude).
- **Angular Distance Measurement:** Click on any two bodies sequentially on the chart ➔ Opens **Angular Measurement Dialogue**.
- **Triad Sight Finder:**
    - Press **[T]** to toggle the automated Triad Sight Finder ON or OFF.
    - Press **[O]** to toggle the Triad Info overlay panel ON or OFF.
    - Press **[7] / [9]** to cycle backward or forward through candidate triads.
    - Press **[5]** to centre chart view on the active triad.
    - Press **[G]** to open the **Triad Finder Settings Modal** (configure altitude limits, magnitude cut-off, step size, tolerances, and weights).
    - Press **[X]** to view the **Top 10 Triads List** in a text window.

        - **3: Body Identification**: **Main Menu ➔ 2: Celestial Bodies ➔ 3: Body Identification**
            - *Identifies unknown bodies from observed altitude and bearing.*
            - Actions: Press **[Identify]** or key **[I] ➔ Results Text Display** (Shows ranked matching bodies with confidence %).
            - Shortcuts: **[B]** Blank, **[W]** Wipe, **[D]** Default, **[U]** User All, **[T]** Top field, **[H]** Help dialogue.
        - **4: Star List**: **Main Menu ➔ 2: Celestial Bodies ➔ 4: Star List**
            - *Interactive 59-star catalogue.*
            - Actions:
                - Sorting Keys: **[I]** Star ID, **[N]** Name, **[M]** Magnitude, **[R]** Right Ascension, **[D]** Declination, **[+]/[-]** Ascending/Descending.
                - Load Star for Sight Reduction: Press **[Load]**, key **[L]**, or **[Enter] ➔ Sight Reduction** (Pre-loads star).
                - Help Dialogue: Press **[Help]** or key **[H]**.
- **3: Sight Folders Submenu**
    - Pathway: **Main Menu ➔ 3: Sight Folders**
    - *Manages stored sight reduction records.*
    - Folder List Actions:
        - Press **[New]** or key **[N] ➔ Folder Name Input** (Create folder).
        - Press **[Rename]** or key **[R] ➔ Folder Name Input** (Rename folder).
        - Press **[Copy]** or key **[C] ➔ Folder Name Input** (Duplicate folder).
        - Press **[Delete]** or key **[D] ➔ Confirm Delete Dialogue** (Delete folder).
        - Key **[O]**: Toggle alphabetical sort order (A-Z / Z-A).
        - Keys **[+] / [-]**: Move selected folder up or down in list.

          Note: All folder list actions cannot be undone automatically.
    - Sub-screen Options:
        - **Sight Folder Content**: **Main Menu ➔ 3: Sight Folders ➔ [Enter] on Folder**
            - View Stored Sight: Highlight sight + **[Enter] ➔ Reduction Results** (View-only mode).

- Load Sight for Editing: Press **[Load]** or key **[L]** ➔ **Sight Reduction** (Pre-loads sight parameters).
- Copy Sight: Press **[Copy]** or key **[C]** ➔ **Select Folder (Sight Mode)** ➔ Copies sight to target folder.
- Delete Sight: Press **[Delete]** or key **[D]** ➔ **Confirm Delete Dialogue**.
- Move Sight: Press **[▲]/[▼]** or **[+]/[-]** to re-order sights.
- Single QR Export: Press key **[Q]** ➔ **QR Code Display** (Renders single optical QR code for a highlighted folder entry).
- Batch QR Export: Press key **[S]** ➔ **QR Code Display** (Sequentially displays QR codes for all sights in folder).

  Note: All sight actions cannot be undone automatically.

- **4: Log Folders Submenu**
  - Pathway: **Main Menu ➔ 4: Log Folders**
  - *Manages electronic vessel logbooks.*
  - Log List Actions:
    - Press **[New]** / **[Rename]** / **[Copy]** / **[Delete]** (same as Sight Folders).

      Note: All log list actions cannot be undone automatically.
  - Sub-screen Options:
    - **Log Folder Content**: **Main Menu ➔ 4: Log Folders ➔ [Enter] on Log**
      - View Log Entry: Highlight entry + **[Enter]** ➔ **Log Record Details** (View-only mode).
      - Add New Entry: Press **[Add]** or key **[A]** ➔ **Log Record Entry**.
      - Edit Entry: Press **[Edit]** or key **[E]** ➔ **Log Record Entry** (Edit mode).
      - Load Entry Template: Press key **[L]** ➔ **Log Record Entry** (Pre-loads entry as template).
      - Copy Entry: Press **[Copy]** or key **[C]** ➔ **Select Folder (Log Mode)**.
      - Delete Entry: Press **[Delete]** or key **[D]** ➔ **Confirm Delete Dialogue**.

- Move Entry: Press **[▲]/[▼]** or **[+]/[-]** to re-order entries.
- Single QR Export**:** Press key **[Q] ➔ QR Code Display** (Renders single optical QR code for highlighted log entry).
- Batch QR Export**:** Press key **[S] ➔ QR Code Display** (Sequentially displays QR codes for all log entries in folder).
- Log Entry Input Form (**Log Record Entry**):
    - Edit Notes: Press **[Notes]** button ➔ **Sight Notes**.
    - Shortcuts: **[B]** Blank, **[W]** Wipe, **[D]** Default, **[U]** User All, **[T]** Top field, **[H]** Help dialogue.
    - Calculate & View Track Advance: Press **[Calculate]** or key **[C] ➔ Log Record Details** (Displays calculated DR / Course OG / Speed OG / Track Advance with comparison to previous entry).
        - Save Entry: **Log Record Details ➔ [Save & Exit]** or key **[S] ➔** Saves entry to log.
        - Discard Entry: **Log Record Details ➔ [Discard]** or key **[D]** / **[Esc]**.

Note: All log entry actions cannot be undone automatically.

- **5: Navigation Submenu**
    - Pathway: **Main Menu ➔ 5: Navigation**
    - Sub-menu Options:
        - **1: Celestial Running Fix**: **Main Menu ➔ 5: Navigation ➔ 1: Celestial Running Fix**
            - *Selects a Log folder and a Sights folder to compute an advanced running fix.*
            - Actions: Press **[Calculate]** or key **[C] ➔ Celestial Fix Results**
                - Save Fix to Log: Press **[Save]** or key **[S] ➔ Select Folder (Log Mode) ➔** Saves FIX record to log.
                - View Fix & Uncertainty Ellipse Plot: Press **[Plot]** or key **[P] ➔ Celestial Fix Plot**
                    - Zoom / Pan: Press **[+]/[-]** to zoom; press **[P]** or tap and hold touchpad, then drag touchpad to pan; press **[R]** to reset view.
                    - Feature Toggles: Press **[F]** (FIX point), **[D]** (DR point), **[1]-[9]** (Individual LOPs), **[0]** (Deselect all LOPs), **[A]** (Select all LOPs).

- View Uncertainty Ellipse: Press key **[E]** ➔ **Uncertainty Ellipse Dialogue** (Displays Semi-major axis A, Semi-minor axis B, and Orientation angle).
- View LOP / Sight Summaries: Press **[L]** (LOP list) or **[I]** (Sight list).
- Save Manual Pointer Fix: Press **[S]** ➔ Saves manual pointer position as FIX to log.

- **2: Direct Calculation Fix**: **Main Menu ➔ 5: Navigation ➔ 2: Direct Calculation Fix**
  - *Calculates a 2-body direct fix without an assumed position (Stanley W. Gery's method).*
  - Actions: Press **[Calculate]** or key **[C] ➔ Select Fix Solution**
    - Choose Solution: Highlight 1 of 4 mathematical solutions + press **[Save Selected]** or key **[S]** or **[Enter]** ➔ Saves selected FIX solution to target log.

- **6: Utilities Submenu**
  - Pathway: **Main Menu ➔ 6: Utilities**
  - Sub-menu Options:
    - **1: Settings**: **Main Menu ➔ 6: Utilities ➔ 1: Settings**
      - *Configures units (m/ft, °C/°F), default Height of Eye and Index Error, DR defaults, algorithm parameters, and screen modes.*
      - Buttons: **[◀Back]**, **[Reset]**, **[Reload]**, **[Save]**.
      - Keyboard Shortcuts:
        - **[S]**: Save all settings to handheld memory.
        - **[R]**: Reset all settings fields to factory defaults.
        - **[T]**: Jump focus to the top field (**H. of Eye Unit**) and scroll workspace to top.
        - **[Esc]**: Exit screen (triggers **Unsaved Changes** confirmation dialogue if settings were modified).
    - **2: Backup / Restore**: **Main Menu ➔ 6: Utilities ➔ 2: Backup / Restore**
      - *Backs up or restores all sight folders, logbooks, and user settings via the TI-Nspire™ system clipboard for 100% offline data preservation and software upgrades.*
      - Buttons: **[◀Back]**, **[Execute]**.

- Keyboard Shortcuts:
    - **[E]** or **[C]**: Triggers backup to system clipboard or executes data restore with interactive confirmation.
    - **[T]**: Jump to top field (Action).
    - **[H]:** Help dialogue.
    - **[Esc]**: Return to Utilities menu.

- **3: Sight Analysis: Main Menu ➔ 6: Utilities ➔ 3: Sight Analysis**
    - Transposes a round of 3 or more sights of the same body to a common DR reference position and evaluates observational quality.
    - Setup Actions: Press **[Analyse]** or key **[A]** ➔ **Sight Analysis Plot**
    - **Sight Analysis Plot Shortcuts & Interactive Features:**
        - **Zoom & Pan:** Press **[+] / [-]** to zoom in or out; press **[P]** (or tap and hold touchpad, then drag) to pan; press **[R]** to reset view, un-exclude all sights, and restore initial state.
        - **Curve Shift Controls:** Press **[▲] / [▼]** to shift the theoretical curve vertically in 0.1' altitude increments; press **[◄] / [►]** to shift time horizontally in 6-second (0.1') increments.
        - **Optimal Alignment:** Press **[C]** to recompute the optimal mathematical least-squares offset fit to all active sights.
        - **Display Toggles:** Press **[Q]** to toggle theoretical Hc(t) curve visibility ON/OFF; press **[I]** to toggle the hover info box ON/OFF; press **[F]** to toggle the LAN peak vertex marker ON/OFF (active only during meridian passage rounds).
        - **Sight Exclusion:** Move the pointer over any anomalous sight dot and press **[E]** (or click touchpad centre key) to toggle inclusion/exclusion (dynamically recalculates the fit and RMS residual).
        - **Synthetic Sight Generation:** Place pointer on the fitted curve at any desired timestamp and press **[X]** ➔ Opens confirmation dialogue to generate and save a

noise-filtered, zero-intercept synthetic sight record to a chosen Sight Folder.

- **Target Sight Selection & Saving:** Hover over any non-excluded sight dot and press **[S]** to flag or unflag it for saving (dot turns green); press **[O]** ➔ Select Folder (Sight Mode) to save all flagged sights to a clean folder.
- **LAN Fix Determination & Saving:**
    - Press **[L]** to calculate and view Estimated LAN Position from the curve peak vertex ➔ Press **[Back]** to select a Navigation Log folder and save the resulting FIX.
    - Move pointer to any point along the curve and press **[A]** to calculate a Touchpad Hovered LAN Position ➔ Press **[Back]** to select a Navigation Log folder and save the resulting FIX.
- **Data Inspection Windows:** Highlight a sight dot and press **[V]** ➔ View full original sight reduction details; press **[D]** ➔ View reference DR log record.
- **Help Dialogues:** Press **[H]** for quick shortcut help; press **[M]** ➔ Opens comprehensive full-screen mathematical and operational guide.
- **[Esc]:** Return to Sight Analysis setup screen.

- **4: Lunars by Distance**: **Main Menu ➔ 6: Utilities ➔ 4: Lunars by Distance**
    - *Reduces lunar distance sights using the Wendel Brunner method to compute watch time error and longitude.*
    - Actions:
        - Star Selection: Press **[Stars]** button ➔ **Star List** (Selection mode).
        - Reduce Lunar Distance: Press **[Reduce]** or key **[R]** ➔ **Results Text Display** (Displays cleared distance, watch time error, and corrected longitude).
        - Form Shortcuts: **[B]** Blank, **[W]** Wipe, **[D]** Default, **[U]** User All, **[T]** Top, **[H]** Help.

- **7: About**
    - Pathway: **Main Menu ➔ 7: About**

- *Displays software version and credits screen.*

Chapter 2: System Configuration & User Preferences

The **User Settings Screen** allows you to configure essential background parameters required by Vincenta's calculation and display engines, as well as establishing optional vessel templates to streamline routine data entry.

Vincenta manages two distinct categories of user settings:

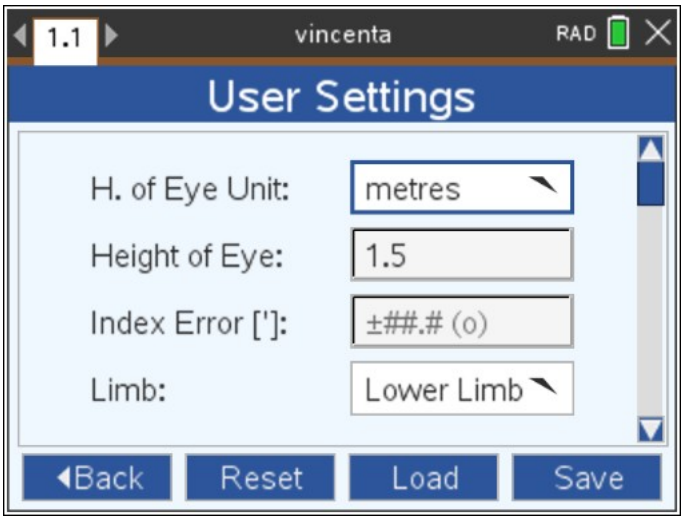
- **Compulsory Algorithm & System Parameters (Essential)**
  Settings that are strictly required for the software's iterative solvers, search algorithms, chart filters, and visual presentation to function—such as *Max Fix Iterations*, *Fix Distance Threshold*, *Plot Altitude/Magnitude Limits*, *Body Identification Tolerances*, and *Visual Themes*. These parameters **cannot be entered on individual calculation forms** and must be configured here for the software's background engines to operate properly.
- **Optional Form Pre-Fill Templates (Convenience Only)**
  Settings that store your vessel's standard baseline parameters—such as *Height of Eye*, *Index Error*, *Default Date*, *Default Time*, and *DR Latitude/Longitude*. Configuring these fields is entirely optional, as they can always be typed directly onto individual calculation forms or imported from logbooks. However, defining them here allows you to instantly pre-fill active entry forms using keypad shortcuts (**[D]** to fill the currently focused field, or **[U]** to fill all fields on the screen at once), eliminating repetitive typing during sight reductions, body identification, and logbook entries. Optional settings have an *(o)* at the end of the corresponding input field placeholder.

2.1 Accessing the User Settings Screen

To open the system configuration manager, navigate through the device menus as follows:

Main Menu ➔ 6: Utilities ➔ 1: Settings

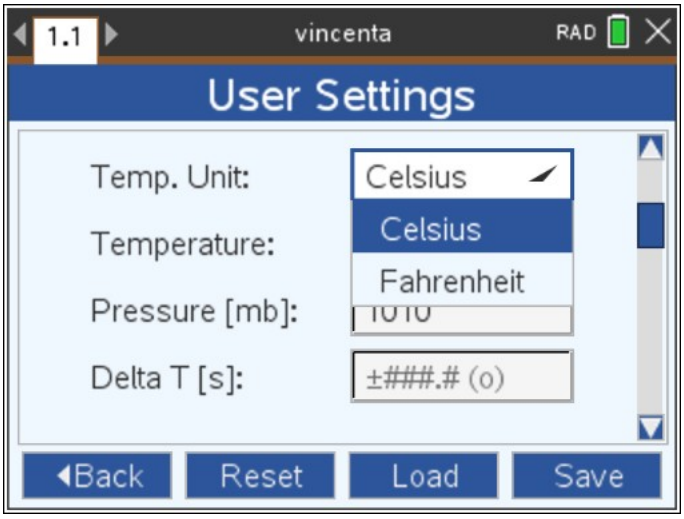
The **User Settings Screen** is arranged as a single, vertically scrolling form. Use **[Tab]** or **[▼] (Down Arrow)** to move forward through the settings, or **[Shift] + [Tab]** / **[▲] (Up Arrow)** to move backward. Pressing key **[T]** at any time instantly jumps focus back to the top field on the screen.



User Settings Instrument & Environmental first section. *Note the optional indicator in the empty* ***Index Error*** *input field placeholder.*

2.2 Instrument & Environmental Vessel Defaults

Celestial observations taken with a marine sextant require initial corrections to convert the raw angle read off the sextant arc—the **Sextant Altitude (Hs)**—into the angle measured relative to the true horizon. Vincenta automates these corrections using your vessel defaults.



User Settings Instrument & Environmental second section. *Here it is displayed with the drop-down option list expanded.*

Real-World Celestial Context: Why These Inputs Matter

- **Index Error (IE)**: Every sextant suffers from a small mechanical misalignment where the index mark does not align perfectly with 0º 00.0' when the horizon mirror and index mirror are parallel. This constant error must be added or subtracted from every reading.

- **Height of Eye (Dip Correction)**: Because a navigator stands above sea level on a ship's deck or bridge wing, the visible sea horizon dips below the true astronomical horizon. The higher your eye is above the water, the greater this **Dip** angle, making observed bodies appear artificially higher than they actually are.
- **Atmospheric Refraction**: Light rays from celestial bodies bend as they pass through Earth's atmosphere. Standard refraction tables assume a sea-level air temperature of 10 ºC/50 ºF and atmospheric pressure of 1010 hPa. Deviations in temperature and barometric pressure expand or compress the density of the air column, directly altering the bend of the light ray.

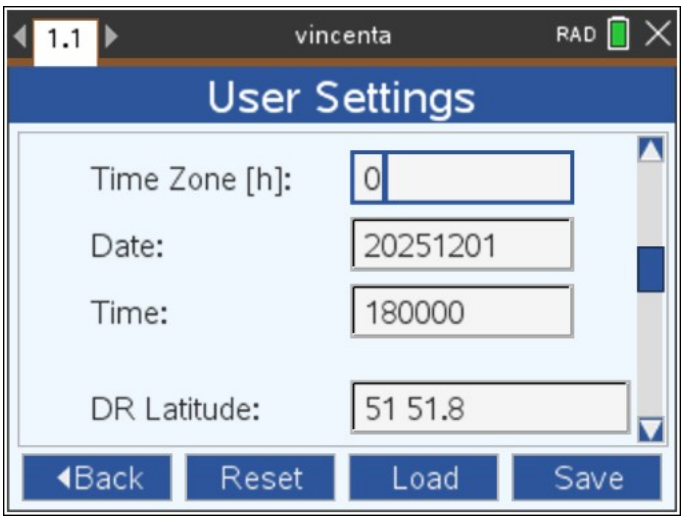
Field-by-Field Settings Guide

1. **H. of Eye Unit** *(Drop-down: `metres` or `feet`)*
    - Selects your preferred measurement unit for bridge height above sea level.
2. **Height of Eye** *(Numeric Text Entry, optional)*
    - Enter your vessel’s standard height of eye above the waterline in the unit corresponding to the previous setting.
3. **Index Error [']** *(Numeric Text Entry, supports negative values, optional)*
    - Enter your sextant's constant index error in arcminutes (').
    - Vincenta algorithms add the index error to the sextant altitude. Hence, enter a negative value for "on the arc" error, or a positive value for "off the arc" error. For example, typing `-2.4` represents 2.4' on the arc.
4. **Limb** *(Drop-down: `Lower Limb`, `Center`, `Upper Limb`)*
    - Sets the default tangent contact point when observing the sun or moon. Sailors almost universally observe the **Lower Limb** to bring the bottom edge of the Sun down to touch the horizon.
5. **Temp. Unit** *(Drop-down: `Celsius` or `Fahrenheit`)*
    - Selects your preferred temperature scale for atmospheric refraction calculations.
6. **Temperature** *(Numeric Text Entry, supports negative values, required)*
    - Enter the typical ambient air temperature at your vessel's position in the unit corresponding to the previous setting. Maximum range allowed is [-50, 60] Celsius or [-58, 140] Fahrenheit.
7. **Pressure [mb]** *(Numeric Text Entry, required)*
    - Enter the typical sea-level barometric pressure in millibars / hectopascals. Maximum range allowed is [800, 1100].
8. **Delta T [s]** *(Numeric Text Entry, optional)*
    - Sets a manual value for **Delta T** (DT) in seconds—the cumulative time difference between **Terrestrial Time (TT)** used in ephemeris predictions and **Universal Time (UT)** kept by clocks. Leaving this field blank, the most common option, causes

Vincenta to automatically calculate DT for the given date using NASA polynomial algorithms.

2.3 Navigational & Geographical Defaults

When powering on the handheld or beginning a new sight reduction, you can fill your starting time zone and estimated position.



***User Settings Navigational & Geographical setting section**. All fields displayed in the screenshot are optional. Vincenta is shipped with Time Zone = 0, as we at Vincenta recommend always operating in Universal Time (UT).*

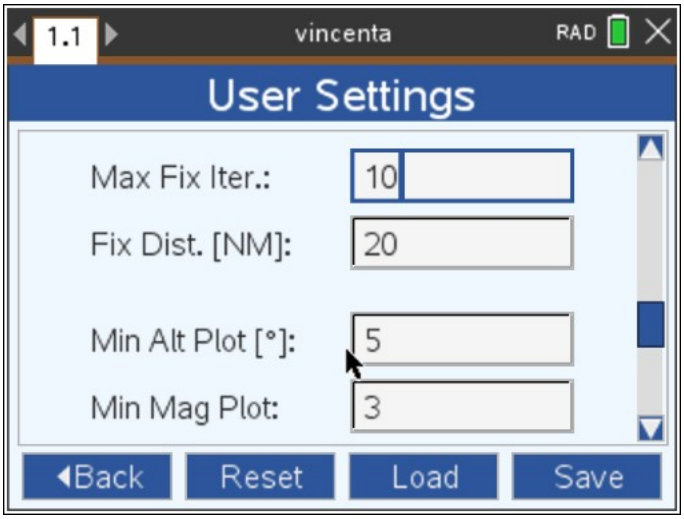
1. **Time Zone [h]** *(Numeric Text Entry, supports negative values, optional)*
    - Enter your local vessel time zone offset from Universal Time (`UT`) in hours. Valid range is -15 to +15 hours (e.g., `-5` for US Eastern Standard Time, `+1` for Central European Time, or `0` for Greenwich Mean Time).
    - **Navigational Recommendation**: Navigators are strongly advised to keep shipboard timekeeping and calculations in **Universal Time (UT)** to eliminate time-conversion errors during sight reduction. Consequently, Vincenta ships with the default Time Zone set to `0`.
    - **Scope of Application**: The Time Zone offset is used on two operational screens—**Sky Plot** and **Body Phenomena**—to display predicted rise, set, transit, and twilight events in local watch time. In these screens, if there is a value for Time Zone in User Settings, the Time Zone input field is pre-populated with the set value. All sight reduction forms, fixes, saved sights and navigation logbooks operate strictly in Universal Time (UT).
2. **Date** *(Numeric Text Entry: `YYYYMMDD`, optional)*

- Enter a default date in 8-digit format (e.g., `20250615` for June 15, 2025). This can be left blank if you prefer to type the date manually during each sight.

3. **Time (UT)** *(Numeric Text Entry: `HHMMSS`, optional)*
    - Enter a default Universal Time in 6-digit format (e.g., `120000` for 12:00:00 UT).
4. **DR Latitude** *(Angle Text Entry: `±DD MM.MM`, optional)*
    - Enter your default Dead Reckoning (DR) latitude. Type a value without `+` for North, or a value with – for South (e.g., `3 5.4` for N 3º 5.4', or `-41 20.0` for S 41º 20.0').
5. **DR Longitude** *(Angle Text Entry: `±DDD MM.MM`, optional)*
    - Enter your default Dead Reckoning (DR) longitude. Type a value without `+` for East, or a value with – for West (e.g., `-64 50.2` for W 64º 50.2', or `142 10.5` for E 142º 10.5').

2.4 Advanced Algorithm & Display Preferences

Vincenta allows you to fine-tune iterative calculations, chart plotting filters, and visual presentation themes.

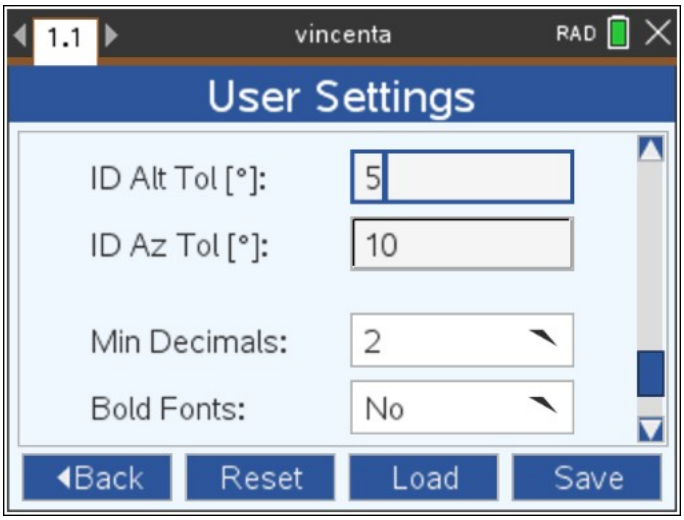


***Advanced Algorithm first section**. All the fields are required for the related algorithm to function.*

1. **Max Fix Iter.** *(Numeric Text Entry, required)*
    - Sets the maximum number of mathematical iterations the multi-sight **Running Fix** engine performs to converge on a position fix (default is `10` iterations).
2. **Fix Dist. [nm]** *(Numeric Text Entry, required)*
    - Sets the convergence distance threshold in nautical miles. If successive fix iterations move by less than this distance, the calculation terminates (default is `20.0 NM`).
3. **Min Alt Plot [°]** *(Numeric Text Entry, required)*

- Sets the minimum altitude threshold in degrees for celestial bodies displayed on the interactive **Sky Chart**. Bodies below this altitude are hidden (default is `5.0`º).

4. **Min Star Mag** *(Numeric Text Entry, supports negative values, required)*
   - Sets the brightness cut-off for stars plotted on the **Sky Chart**. Only stars brighter than or equal to this magnitude appear (e.g., `3.0` displays bright and medium navigational stars; `-1.0` displays only the brightest objects like Sirius or Canopus). **Note**: visible planets are always plotted even if their magnitude is below the set minimum star magnitude.

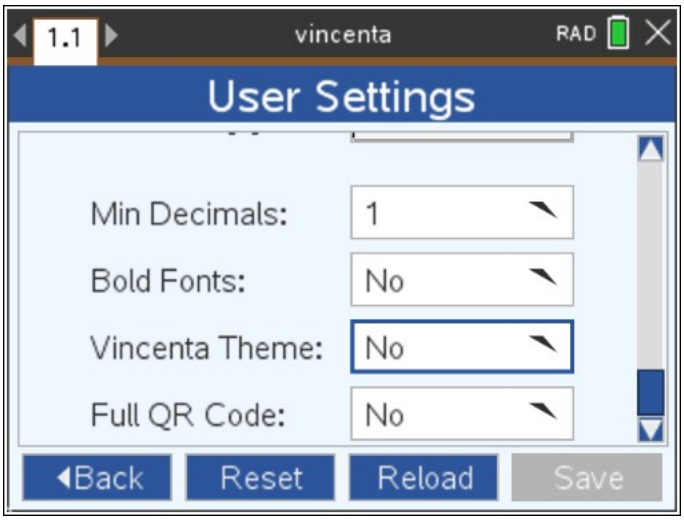


Advanced Algorithm second section. *All fields here are also required.*

5. **ID Alt Tol [°] & ID Az Tol [°]** *(Numeric Text Entry, required)*
   - Sets the matching tolerance windows (in degrees) used by the **Body Identification** calculator when searching for unknown objects based on measured altitude and bearing (5.0° altitude tolerance and 10.0° azimuth tolerance).

6. **Min Decimals** *(Drop-down: `0`, `1`, `2`)*
   - Controls the rounding precision for displayed arcminute values (‘) across all calculation results screens and log summaries (e.g., selecting `2` displays minutes as `14.32'`; `1` displays `14.3'`).

7. **Bold Fonts** *(Drop-down: `Yes` or `No`)*
   - Toggles bold text weight across input labels, field headers, and list items. While enhancing contrast in direct sunlight, bold text is particularly recommended when operating in Night Mode (Vincenta Theme) to eliminate anti-aliasing artifacts and sub-pixel bleeding on the TI-Nspire™ LCD screen when rendering bright white text against dark backgrounds.



***Display Preferences section**. Bold fonts is useful for high contrast if using the Vincenta Theme (Night Mode).*

8. **Vincenta Theme** *(Drop-down: `Yes` or `No`)*
    - Controls screen contrast and night vision preservation:
        - **`Yes` (Night Mode – Vincenta Theme)**: Switches the display to a high-contrast, dark-navy and Vincenta Gold palette designed to protect night-adapted vision at the chart table.
        - **`No` (Day Mode)**: Uses a bright ocean-blue and white background optimised for direct sunlight in the wheelhouse.
9. **Full QR Code** *(Drop-down: `Yes` or `No`)*
    - Controls the data density of generated optical QR codes:
        - **`Yes`**: Encodes full, human-readable CSV text containing complete sight inputs, calculated results, and notes.
        - **`No`**: Encodes an ultra-compact numeric string containing only essential parameters for faster rendering by the TI Nspire™ CX.

2.5 Saving, Reloading, and Resetting Settings

At the bottom of the Settings workspace, four command buttons control settings storage:

- **[Save]** (Shortcut **[S]**): Validates all inputs and saves your settings to the TI-Nspire™'s volatile memory. A success message confirms the save.

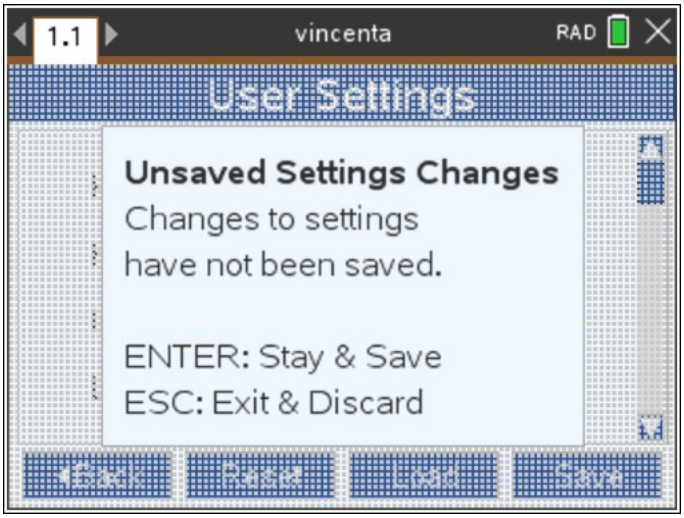
    Operational Note: Saving settings commits the data to active RAM. Remember to press **`[Ctrl]`** + **`[S]`** before turning off the calculator or **`[Ctrl]`** + **`[W]`** and answering **Yes** to the prompt that appears when quitting Vincenta to permanently preserve your records in Flash ROM.

- **[Load] (**Shortcut **[L]**): Re-reads your previously saved settings from memory, discarding any un-saved changes made during the current session.
- **[Reset]** (Shortcut **[R]**): Resets all fields on the screen to factory defaults.
- **[◀Back]** (Shortcut **[Esc]**): Exits the settings screen. If you modified any settings without saving, Vincenta intercepts the exit request and displays an **Unsaved Changes** confirmation dialogue.



*Footer button bar on User Settings Screen. Note: If no changes have been made to the current settings, the **[Save]** button is disabled.*

- Press **[Enter]** to stay on the screen and save your changes.
- Press **[Esc]** to discard changes and return to the Utilities menu.



Unsaved Settings Changes notification screen.

Form Command Shortcuts

- **[B] (Blank Field)** / **[W] (Wipe All)**: Clears the focused field or all fields.
- **[T]**: Jumps focus back to the top field.
- **[H]**: Displays a help pop-up.

2.6 How User Settings Work in Vincenta

Vincenta classifies user settings into two main operational categories, along with a special pre-populated exception for environmental controls:

Automatic System & Engine Settings (Background Control)

These settings directly govern the software's internal calculation engines, iterative solvers, chart display filters, and visual presentation themes. Once configured on the Settings screen, they are utilised automatically by the system in the background without requiring re-entry on other forms.

> **Operational Exception (On-Screen Overrides):**
> To provide maximum operational flexibility at sea, certain key parameters—specifically **Temperature** and **Pressure** on the *Sight Reduction* screen, as well as **Min Star Mag** and **Min Alt** on the *Sky Plot* screen—are included directly as interactive input fields pre-populated with your saved defaults. This design allows you to quickly override your standard settings for a specific observation or planning scenario (such as abnormal atmospheric refraction or poor horizon clarity) without the inconvenience of exiting your workflow to return to the Settings screen.

- **Examples**: *Max Fix Iterations*, *Fix Distance Threshold*, *Body ID Tolerances*, *Min Decimals Rounding*, *Bold Fonts*, *Vincenta Theme*, and *Full QR Code Format*.

Form Pre-Fill Defaults (Shortcut-Activated)

These settings store your vessel's baseline parameters to eliminate repetitive typing. To maintain complete flexibility during data entry, these settings do **not** force themselves onto an active form automatically. Instead, they serve as convenient templates that you can instantly insert using dedicated keypad shortcuts:

- **[D] Key (Default Field)**: Instantly populates the *currently focused* input box with its corresponding saved setting value.
- **[U] Key (User All Fields)**: Instantly populates *all* input fields across the active screen with your saved settings in a single keystroke.
- **Examples**: *Height of Eye*, *Index Error*, *DR Latitude & Longitude*, *Time Zone*, and *Default Date/Time*.

Chapter 3: Celestial Sight Reduction & Result Visualisation

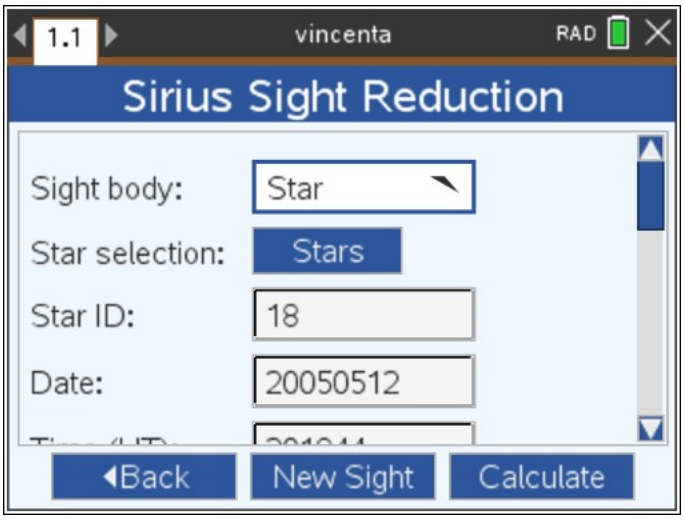
At the core of celestial navigation is **Sight Reduction**: the mathematical process of converting a sextant altitude measurement of a celestial body into a line on a nautical chart upon which your vessel must lie. Vincenta uses the ubiquitous Marcq St. Hilaire intercept method.

This chapter guides you step-by-step through entering a celestial observation into Vincenta, reading the calculated reduction outputs, and exploring the graphical visualisations—including the **3D Navigation Triangle** and the **2D Intercept Plot**.

3.1 Step-by-Step Guide: Entering a Celestial Sight

To access the Sight Reduction entry form, navigate from the main screen as follows:

Main Menu ➔ 1: Sight Reduction



***Sight Reduction screen**. Here `Star` reduction has been selected and the **Star selection** button and **Star ID** input field are enabled. The title of the screen changes to include the name of the celestial body being reduced (Sirius, Star ID 18).*

Step 1: Select the Celestial Body

1. Highlight the **Sight body** drop-down menu.
2. Press **[►]** to expand the list and select the body you observed: `Sun`, `Moon`, `Venus`, `Mars`, `Jupiter`, `Saturn`, or `Star`.
3. **Quick Key Shortcuts**: You can select a body instantly from anywhere on the screen by pressing single key shortcuts:

    - **[S]**: Sun | **[L]**: Moon | **[V]**: Venus | **[M]**: Mars | **[J]**: Jupiter | **[R]**: Saturn | **[E]**: Star

4. **Selecting a Star**:
    - If you select `Star`, the **Star selection** button and **Star ID** field become active.
    - Press **[Enter]** on the **[Stars]** button to open the interactive **Star List Catalog**ue. Highlight your observed star and press **[Enter]** to automatically load its ID number (1 to 59).
    - Alternatively, if you know the star's index number, type it directly into the **Star ID** box.

Step 2: Enter Date & Time of Observation

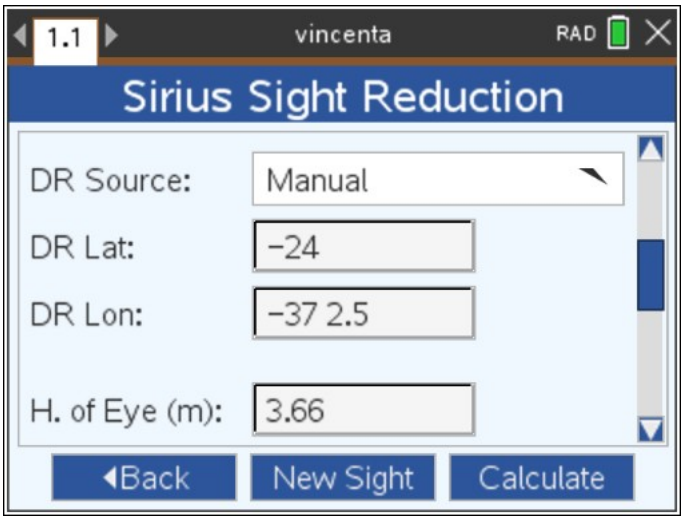
Celestial observations require accurate Universal Time (UT).

- **Date**: Enter the observation date in 8-digit format: `YYYYMMDD` (e.g., `20250511` for May 11, 2025).
- **Time (UT)**: Enter the exact time of sight in 6-digit format: `HHMMSS` (e.g., `181939` for 18:19:39 UT).

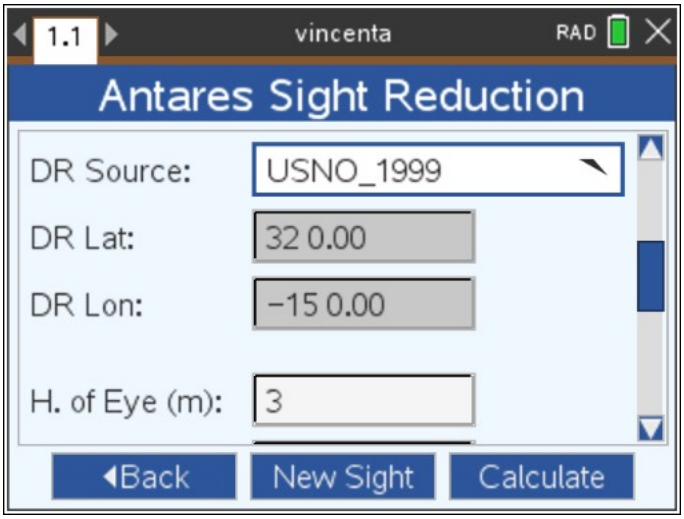
Step 3: Specify the Assumed / Dead Reckoning (DR) Position

Vincenta needs a starting position to calculate where the celestial body *should* be.

1. Highlight the **DR Source** drop-down menu.
2. Select `Manual` to type custom coordinates, or select the name of a previously saved **Navigation Log** folder to automatically import your vessel's latest logged position.
3. If `Manual` is selected, enter your position:
    - **DR Lat**: Type degrees and decimal minutes (e.g., `24` or `24 00.0` for N 24º 00.0', or `-34 3.0` for S 34º 3.0').
    - **DR Lon**: Type degrees and decimal minutes (e.g., `-153 49.4` for W 153º 49.4', or `61 43.0` for E 61º 43.0').



***DR Source selection and coordinate input**. Here **Manual Mode** is selected and the latitude and longitude input fields are enabled.*



***DR Source selection and coordinate input**. Here a **Navigation Log** is selected; hence, the latitude and longitude input fields are disabled and populated with the last record of the selected log.*

Step 4: Enter Instrument Corrections & Sextant Altitude

- **H. of Eye**: Enter your bridge height above sea level in meters or feet (e.g., `3.14`).
- **Index Error [']**: Enter your sextant's index error in arcminutes. Type `-3.2` for 3.2' on the arc, or `1.5` for 1.5' off the arc.
- **Hs (Sextant Altitude)**: Type the uncorrected angle read off your sextant arc in degrees and minutes (e.g., `59 6.9` for 59º 6.9').

- **Limb**: Active only when observing the Sun or Moon. Select `Lower Limb`, `Center`, or `Upper Limb`.

Step 5: Enter Environmental Data & Optional Notes (Optional)

- **Temp. / Press.**: Pre-filled with user settings values. Modify these if observing under extreme weather conditions to refine atmospheric refraction. Maximum temperature range allowed is [-50, 60] Celsius or [-58, 140] Fahrenheit, and maximum pressure range allowed is [800, 1100].
- **[Notes] Button**: Press **[Enter]** on the **[Notes]** button to attach custom multiline notes to the sight (e.g., *"Clear horizon, moderate swell"*).

Form Control Shortcuts

- **[C] (Calculate)**: Computes the sight reduction immediately.
- **[X] (Sample Data)**: Fills the form with a verified sample sight for testing.
- **[N] (New Sight)**: Resets all fields for a new observation.
- **[W] (Wipe All)** / **[B] (Blank Field)**: Clears all fields or the focused field.
- **[U] (User All)** / **[D] (Default Field)**: Fills all fields or the focused field from saved User Settings.

3.2 Interpreting the Reduction Results Screen

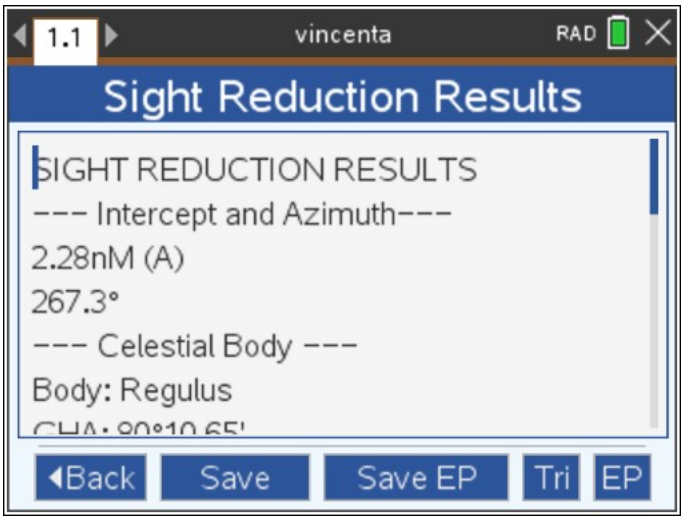
Once you press **[Calculate]** or key **[C]**, Vincenta performs full ephemeris, refraction, dip, parallax, and semidiameter calculations, presenting the outputs on the **Sight Reduction Results** screen.

Key Mathematical Outputs

Intercept & Direction

The most important output for the navigator. It compares your true observed altitude against your calculated altitude:

- **Intercept Value**: Displayed in nautical miles (NM) to the number of decimals specified in User Settings screen.
- **Direction: T (`Toward GP`) vs A (`Away from GP`)**
    - **Toward GP (Ho > Hc)**: Your true position is *closer* to the body's Geographical Position than your DR position by the intercept distance.
    - **Away from GP (Ho < Hc)**: Your true position is *further away* from the body's GP than your DR position.



Sight Reduction Results screen. *The top section of the results is displayed here. Full results are below.*

```
SIGHT REDUCTION RESULTS                  Date: 1999-07-04
--- Intercept and Azimuth---             Time (UT): 20:39:23
2.28nM (A)                               DR Lat: N32°0.0'
267.3°                                   DR Lon: W15°0.0'
--- Celestial Body ---                   Height of Eye: 3.00 m
Body: Regulus                            Index Error: 0.00'
GHA: 80°10.65'                           Limb: -
Dec: 11°58.28'                           Temp: 10.0°C
--- Observed Altitude ---                Pressure: 1010 hPa
Hs: 27°18.90'                            --- Notes ---
Ho: 27°13.95'                            From USNO 1999 Almanac.
Hc: 27°16.23'                            END OF RESULTS
--- Input Data ---
```

Azimuth

- Displayed in degrees true (000º to 359.9º), to one decimal regardless of user settings. This is the exact true compass bearing from your DR position toward the body's Geographical Position (e.g., `Az: 135.2°`).

Ephemeris Data

- **GHA (Greenwich Hour Angle)**: The body's longitude equivalent on the celestial sphere at time of observation.
- **Dec (Declination)**: The body's current latitude equivalent on the celestial sphere at time of observation.

Altitude Chain Summary

- **Hs (Sextant Altitude)**: Uncorrected angle from sextant.
- **Ho (Observed Altitude)**: True altitude after applying Index Error, Dip, Refraction, Parallax, Earth Oblateness, and Semidiameter (for Sun and Moon).
- **Hc (Calculated Altitude)**: Theoretical altitude predicted at your DR position.

Input Data Summary

The results include at the end all the input data.

Result Screen Command Buttons

- **[◀Back]** (Shortcut **[Esc]**): Returns to the input form.
- **[Save]** (Shortcut **[S]**): Opens the folder selector to save this sight record into a named sight folder.

  > *Operational Note:* Saving a sight commits the data to active RAM. Remember to press **`[Ctrl]`** + **`[S]`** before turning off the calculator or **`[Ctrl]`** + **`[W]`** and answering **Yes** to the prompt that appears when quitting Vincenta to permanently preserve your records in Flash ROM.

- **[Save EP]** (Shortcut **[E]**): Calculates an **Estimated Position (EP)** by advancing your DR position along the intercept vector, then opens the folder selector to record an EP entry in your **Navigation Log**.

  > *Operational Note:* Saving a log entry commits the data to active RAM. Remember to press **`[Ctrl]`** + **`[S]`** before turning off the calculator or **`[Ctrl]`** + **`[W]`** and answering **Yes** to the prompt that appears when quitting Vincenta to permanently preserve your records in Flash ROM.

- **[Tri]** (Shortcut **[T]**): Opens the **3D Navigation Triangle** visualiser.
- **[EP]** (Shortcut **[P]**): Opens the **2D Intercept & Line of Position Plot**.
- **[C]**: Copies the complete text results to the TI-Nspire™ clipboard.
- **[H]**: Displays a help pop-up dialogue listing all available shortcuts.

3.3 Exploring the 3D Navigation Triangle Screen

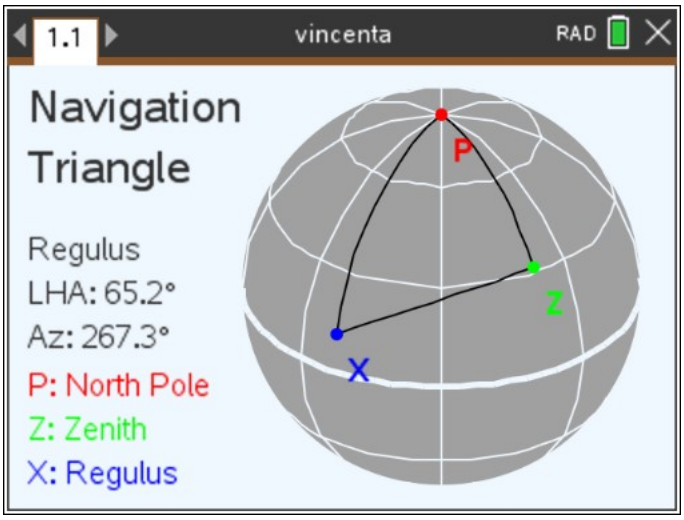
To visualise the spherical geometry behind your sight reduction, press **[Tri]** or key **[T]** on the results screen.

Visual Features

The handheld renders an interactive 3D celestial sphere:

- **North Pole (P)**: Represented by a bright **red dot**.

- **Observer's Zenith (Z)**: Represented by a **green dot** directly above your DR position.
- **Celestial Body GP (X)**: Represented by a **blue dot** directly beneath the observed body.
- **Spherical Arcs**: Thick lines connect P, Z, and X to form the PZX Navigational Triangle.
- **Graticule Grid**: Faint latitude and longitude arcs wrap around the globe to illustrate orientation.
- **Data Overlay**: Displays the exact **Local Hour Angle (LHA)** and **Azimuth (Az)** for the observation.



***Navigation Triangle screen**. Here displayed is the triangle relative to the sight reduction results screen in the previous screenshot.*

Interactive Keypad Controls

- **[▲] / [▼] (Up / Down Arrows)**: Tilts the 3D globe up or down.
- **[◄] / [►] (Left / Right Arrows)**: Rotates the globe around its vertical axis.
- **[R]**: Resets the 3D view to default orientation.
- **[H]**: Displays a help pop-up.
- **[Esc]**: Returns to the **Reduction Results** screen.

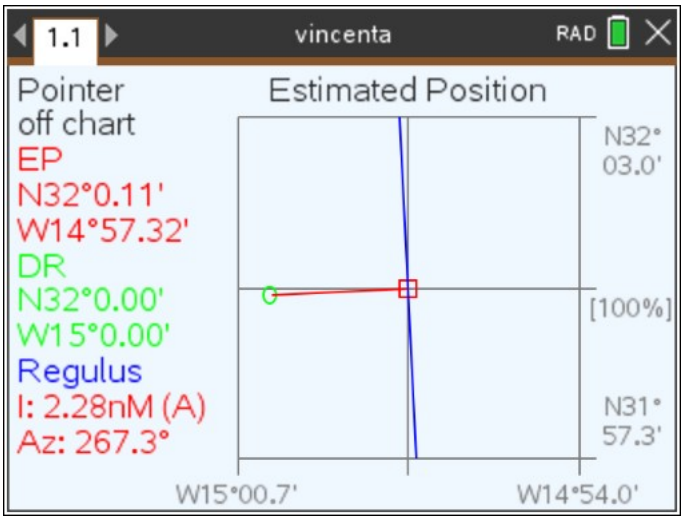
3.4 Interpreting the 2D Intercept & Line of Position Plot

To view your calculated Line of Position plotted on a local navigational chart, press **[EP]** or key **[P]** on the results screen.

Chart Anatomy & Legend

- **Dead Reckoning Position (DR)**: Rendered as a **green circle**.

- **Intercept Vector Line**: Rendered as a **red line** extending from the DR position along the body's Azimuth bearing (Az).
- **Estimated Position (EP)**: Rendered as a **red square** at the terminus of the intercept vector.
- **Line of Position (LOP)**: Rendered as a **solid blue line** passing through the EP, drawn perpendicular (Zn ± 90°) to the azimuth vector.
- **Left Data Panel**: Displays numerical details for the active LOP, Intercept (I), Azimuth (Az), and coordinates for DR and EP.
- **Chart Grid & Margins**: Labelled latitude and longitude grid lines bound the chart viewport.



***Estimated Position plot**. Here displayed is the plot relative to the sight reduction in the sight reduction results screenshot above.*

Interactive Keypad Controls

- **[+] / [-]**: Zooms the chart in or out centred on the touchpad pointer position.
- **[P]** or touchpad **[Click Key]** pressed for one second: Toggles pan mode. Drag the touchpad pointer to move the chart viewport in any direction.
- **[R]**: Resets chart zoom and panning to default.
- **[1]**: Toggles visual selection highlighting on the LOP line.
- **[L]**: Displays a pop-up window with detailed **LOP Info** (Intercept and Azimuth).
- **[I]**: Displays a pop-up window with **Sight Info** (Body name, Date, and Time).
- **[H]**: Displays a help pop-up.
- **[Esc]**: Returns to the **Reduction Results** screen.

Pointer hover

Hovering the individual plotted components with the pointer by dragging the touchpad, highlights that component and its associated values.



***Estimated Position plot**. When the intercept vector line is hovered by the pointer, it is highlighted, and the related intercept and azimuth values are rendered in bold. EP, DR, and LOP are also highlighted when hovered.*

Chapter 4: Celestial Phenomena, Body Identification & Star Database

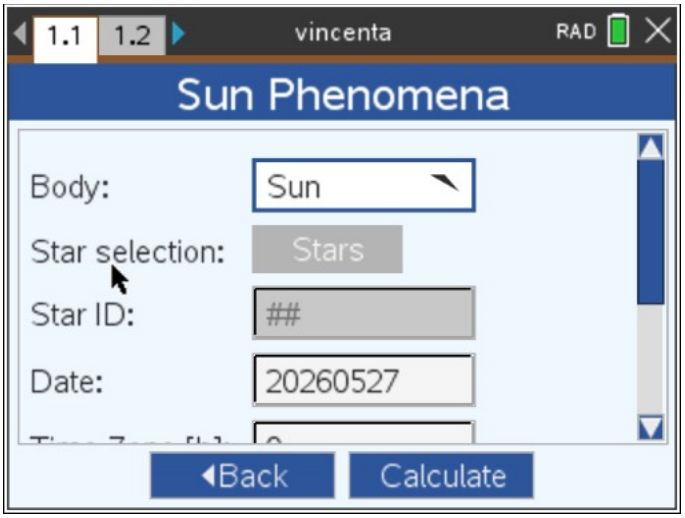
A skilled navigator plans observations well in advance. Knowing precisely when twilight begins, when celestial bodies cross your meridian, and how to identify an unknown star through a break in the clouds transforms celestial navigation from a reactive task into a structured routine.

This chapter covers three essential tools in Vincenta: predicting daily astronomical phenomena, identifying unknown celestial bodies, and browsing the built-in 59-star catalogue.

4.1 Planning Observations: The Celestial Phenomena Screen

To plan your morning or evening star sights, navigate to the Phenomena screen:

Main Menu ➔ 2: Celestial Bodies ➔ 1: Phenomena



***Phenomena Screen top data entry section**. Sun is selected in the drop-down.*

Entering Phenomena Parameters

1. **Body Selection**: Highlight the **Body** drop-down menu and select the target object: `Sun`, `Moon`, `Venus`, `Mars`, `Jupiter`, `Saturn`, `Planets` (calculates all four planets sequentially), or `Star`.
    - *Quick Shortcuts*: Press **[S]** (Sun), **[L]** (Moon), **[V]** (Venus), **[M]** (Mars), **[J]** (Jupiter), **[R]** (Saturn), **[P]** (Planets), or **[E]** (Star).
2. **Star Selection** (if `Star` is selected): Select **[Stars]** to pick a star from the catalogue, or type its number into **Star ID**.
3. **Date**: Enter the target date in 8-digit format: `YYYYMMDD` (e.g., `20250615`).

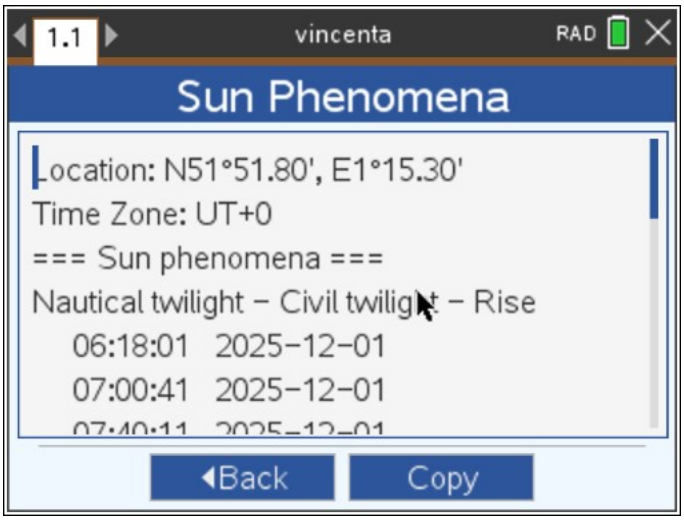
4. **Time Zone [h]**: Enter your local time zone offset from Universal Time in hours (e.g., `-5` or `+1`). Phenomena times are displayed in your local watch time. If you want times displayed in Universal Time, set Time Zone to 0. If there is a value in user settings, this is pre-populated in the input field.
5. **DR Source**: Select `Manual` or choose a saved **Navigation Log** folder to auto-populate your vessel's position with latitude and longitude from the last record of the selected log.
6. **DR Lat & DR Lon**: When `Manual` is selected, enter your estimated position for the target date.
7. **Calculate**: Press **[Calculate]** or shortcut **[C]** to generate the report.

Reading the Phenomena Output Report

Depending on the body selected, Vincenta displays a detailed text report:

Sun Phenomena Report

- **Nautical Twilight (AM & PM)**: Time when the Sun passes through 12º below the horizon.
- **Civil Twilight (AM & PM)**: Local watch time when the Sun passes through 6º below the horizon.
- **Sunrise & Sunset**: Time when the upper edge of the Sun aligns with the visible horizon.
- **Local Apparent Noon (LAN) / Transit**:
    - **Transit Time**: Time when the Sun crosses your local meridian.
    - **Transit Height**: Maximum Sun altitude at LAN.
    - **Transit Azimuth**: True bearing at transit.
    - **Equation of Time (EoT)**: Difference between apparent solar time and mean solar time (in minutes and seconds).
- **LHA Aries**: Local Hour Angle of Aries at the middle of morning and evening nautical twilights—useful for planning star sight reductions.

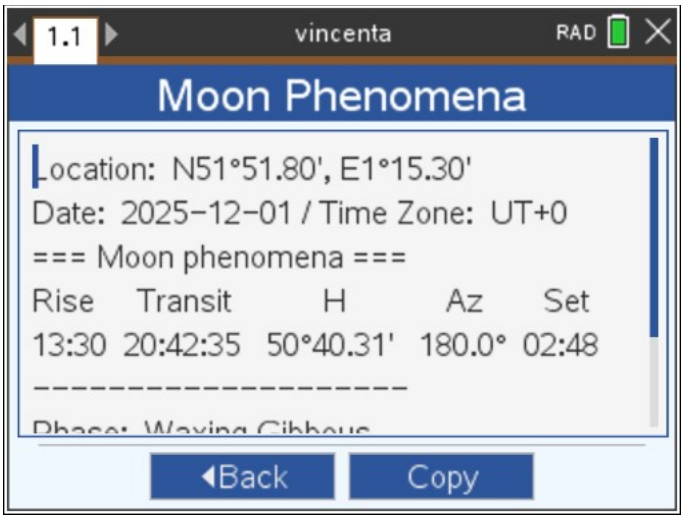


Sun Phenomena results screen. *Top part of the results. Full results below.*

```
Location: N51°51.80', E1°15.30'
Time Zone: UT+0
=== Sun phenomena ===
Nautical twilight – Civil twilight –
Rise
     06:18:01   2025-12-01
     07:00:41   2025-12-01
     07:40:11   2025-12-01
Set – Civil twilight – Nautical
twilight
     15:47:38   2025-12-01
     16:27:08   2025-12-01
     17:09:47   2025-12-01
LAN – Equation of Time – Transit
height
     11:44:05   2025-12-01
     10m 53s
     16° 18.68'
Azimuths: Rise – LAN – Set
     125.8°
     180.0°
     234.2°
LHA Aries morning twilight
     06:39:21   2025-12-01
     171° 28.4'
LHA Aries evening twilight
     16:48:27   2025-12-01
     324° 10.1'
```

Moon Phenomena Report

- **Moonrise & Moonset**: Local watch times for lunar horizon events.
- **Meridian Transit**: Time, maximum altitude, and azimuth at lunar transit.
- **Lunar Phase Summary**: Phase name (e.g., *Waxing Crescent*, *Full Moon*), Illumination percentage (%), Moon age in days, and days remaining until the next major phase.

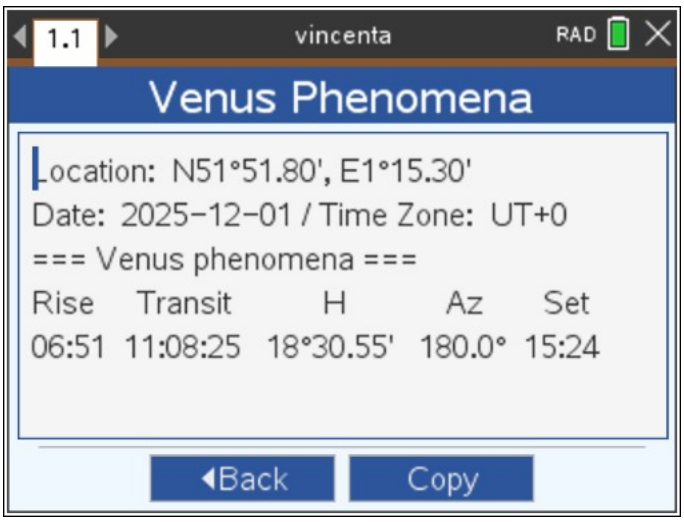


***Moon Phenomena results screen**. Rise, transit, and set section. Full results below.*

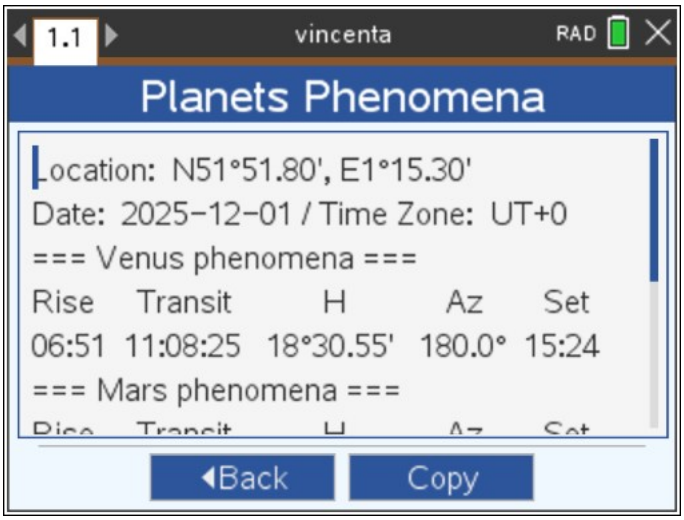
```
Location:  N51°51.80', E1°15.30'
Date:  2025-12-01 / Time Zone:  UT+0
=== Moon phenomena ===
Rise     Transit      H         Az     Set
13:30  20:42:35   50°40.31'   180.0°  02:48
--------------------
Phase:  Waxing Gibbous
Illumination:  78%
Age:  10.1 days
Next:  Full Moon in 4.6 days
```

Planet & Star Reports

- **Rise, Set & Transit**: Time, maximum transit altitude, and transit azimuth for individual planets or stars, or all four planets sequentially when `Planets` is selected.

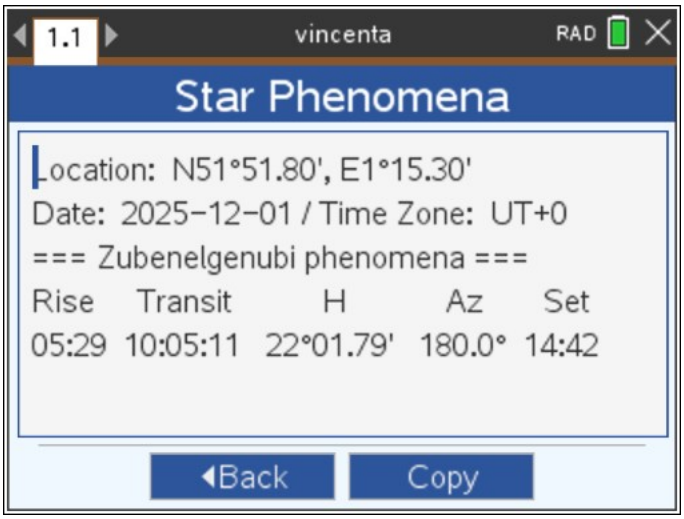


Single planet Phenomena results screen.



Planets Phenomena results screen. *Phenomena for all navigational planets are displayed in the same screen. Full results below.*

```
Location:  N51°51.80', E1°15.30'
Date:  2025-12-01 / Time Zone:  UT+0
=== Venus phenomena ===
Rise    Transit       H         Az     Set
06:51  11:08:25   18°30.55'   180.0°  15:24
=== Mars phenomena ===
Rise    Transit       H         Az     Set
08:38  12:27:42   14°29.31'   180.0°  16:16
=== Jupiter phenomena ===
Rise    Transit       H         Az     Set
18:53  03:00:14   59°30.48'   180.0°  11:03
=== Saturn phenomena ===
Rise    Transit       H         Az     Set
13:16  18:57:26   34°04.10'   180.0°  00:43
```



Star Phenomena results screen.

4.2 Real-World Context: Twilight Definitions & Navigational Timing

Sextant observations of stars and planets require two conditions simultaneously:

1. The celestial body must be bright enough to be seen.
2. The sea horizon must be sharp and clearly visible to bring the body down to touch it.

This narrow operational window occurs only during **Twilight**:

TWILIGHT PHASES

Sun Position	Phase Name	Navigational Use
0° to -6°	Civil Twilight	Horizon clear; sky too bright for most stars.
-6° to -12°	Nautical Twilight	GOLD STANDARD: Horizon sharp; bright stars & planets clear.
-12° to -18°	Astronomical Twilight	Sky pitch dark; horizon lost; faint stars visible.

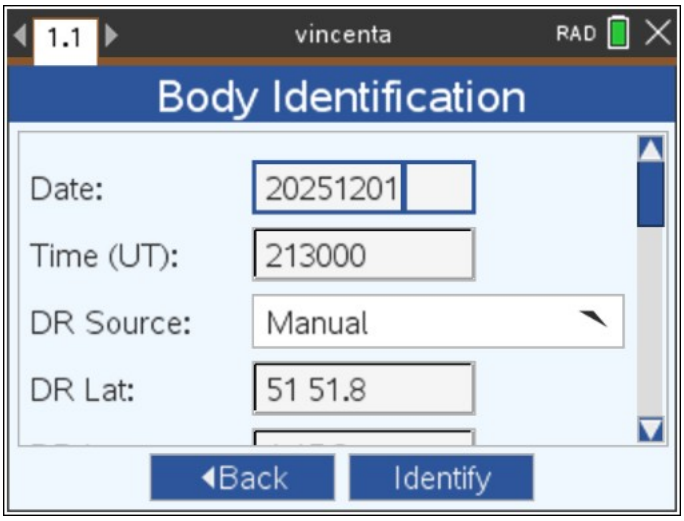
- **Civil Twilight (0° to -6° Sun Altitude)**: The sky remains bright. While the horizon is crisp, only the extremely bright objects (like Venus or Jupiter) are visible.
- **Nautical Twilight (-6° to -12° Sun Altitude)**: **The Gold Standard for Navigators**. The sea horizon is well-defined, and all 59 primary navigational stars become clearly visible. Morning twilight begins when the Sun reaches -12°; evening twilight ends when the Sun sinks below -12°.
- **Astronomical Twilight (-12° to -18° Sun Altitude)**: The sky becomes completely dark. While faint stars appear, the sea horizon dissolves into darkness, making sextant observations impossible without an artificial horizon.

4.3 Identifying Unknown Bodies: The Body Identification Tool

At sea, clouds often obscure major constellations, revealing only a single bright star or planet through a rift. If you observe an unknown body's altitude and compass bearing, Vincenta can reverse-solve the navigational triangle to identify the object.

To access the Body Identification tool:

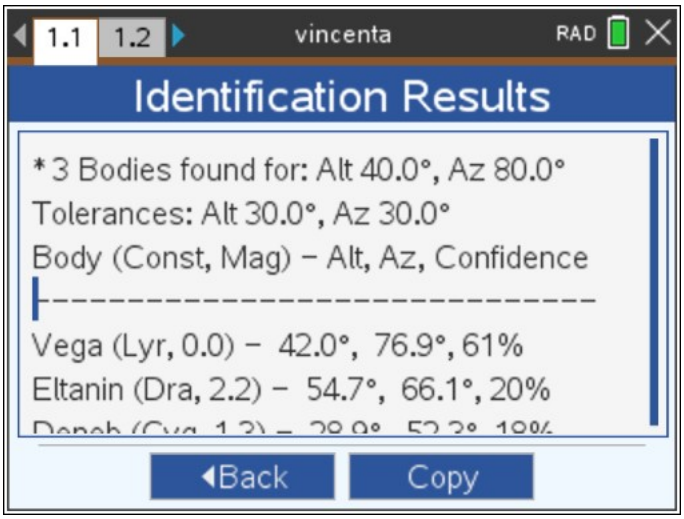
Main Menu ➔ 2: Celestial Bodies ➔ 3: Body Identification



Body Identification screen.

Step-by-Step Body Identification Guide

1. **Date & Time (UT)**: Enter the exact date (`YYYYMMDD`) and time (`HHMMSS`) of the observation.
2. **DR Position**: Select a **DR Source** or manually enter your estimated Latitude and Longitude.



Identification Results screen. *Reports the identification parameters and a list of possible candidate bodies.*

3. **Observation Data**:
    - **Sextant Alt (Hs)**: Type the measured sextant altitude (e.g., `62 30.0`).
    - **Index Error [']**: Type your sextant's index error (e.g., `0.0`).
    - **H. of Eye**: Type your bridge height of eye (e.g., `3.0` meters).

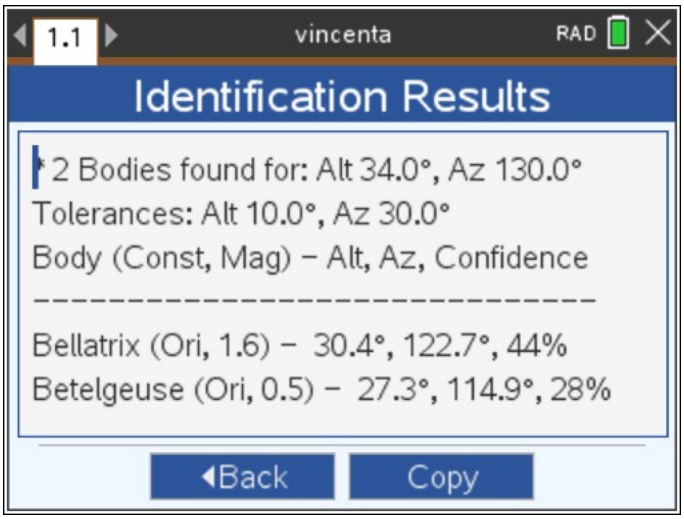
- **Bearing**: Type the observed true compass bearing / azimuth (Zn) to the body in degrees (0º to 359º, integers only).

4. Press **[Identify]** or shortcut **[I]**.

Interpreting Identification Results

Vincenta calculates ephemerides for planets and the 59-star database, testing all objects above the horizon. Then it **excludes all objects that have an altitude and a magnitude below that set in User Settings**. The software ranks matching candidates in a summary window:

- **Candidate Ranking**: Lists matches in descending order of confidence percentage (%).
- **Object Details**: Displays the Body Name, Constellation, and Magnitude.
- **Coordinate Comparison**: Displays the candidate's exact predicted Altitude (Alt) and Azimuth (Az) alongside your observation for comparison.



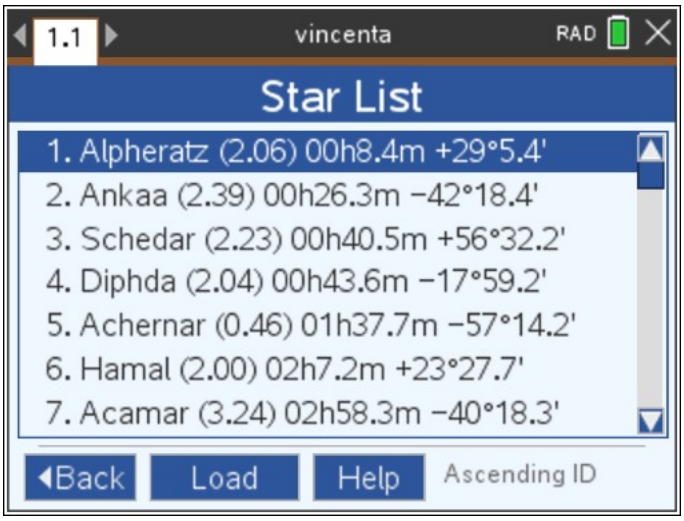
***Body Identification results screen**. The possible candidates are listed in order of decreasing confidence*

4.4 Browsing & Searching the 59-Star Catalogue

Vincenta contains an internal astronomical database of the 59 primary navigational stars defined in international nautical almanacs, complete with precessional proper motion, magnitude, and celestial coordinates.

To open the star catalogue. in browsing mode:

Main Menu ➔ 2: Celestial Bodies ➔ 4: Star List



***Star List screen**. Here stars are listed by the default ascending star ID number.*

Catalogue Browsing Controls

- **[▲] / [▼] (Up / Down Arrows)**: Scroll line-by-line through the 59 stars.
- **[9] / [3]**: Scroll page-up or page-down.

Multi-Criteria Sorting Shortcuts

Press any of the following keys to instantly apply a sorting mode to the catalogue.:

- **[I]**: Sort by **Star ID Number** (1 to 59, including Polaris and Scheat).
- **[N]**: Sort alphabetically by **Star Name** (i.e., Acamar, *Achernar*, …, Zubenelgenubi).
- **[M]**: Sort by **Visual Magnitude**.
- **[R]**: Sort by **Right Ascension**.
- **[D]**: Sort by **Declination**.
- **[+] / [-]**: Toggle between **Ascending** and **Descending** sort order for all sorting modes.

The sorting mode and direction are saved during the whole active session. After closing Vincenta and re-opening it, the sorting is set back to the default ascending star ID number.

Loading a Star Directly into Sight Reduction

When browsing the catalogue:

1. Highlight any star in the list.
2. Press **[Load]** (or press **[Enter]**).
3. Vincenta automatically transfers you to the **Sight Reduction** screen with that star pre-selected and ready for data entry.

Chapter 5: Interactive Sky Chart & Triad Sight Finder

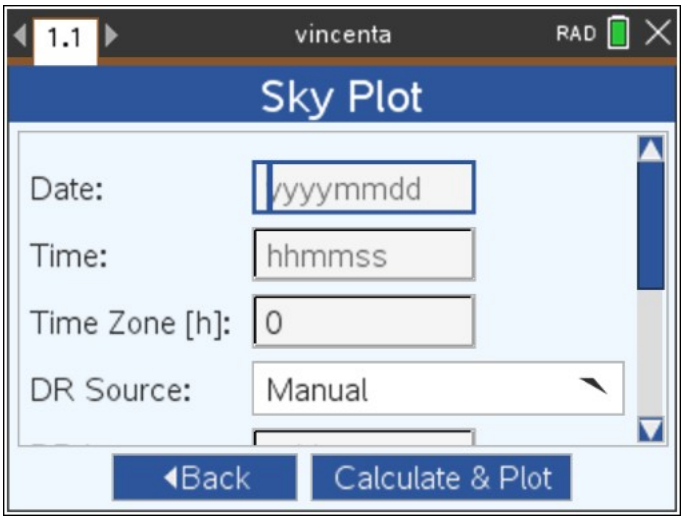
The **Sky Chart** is one of the core pillars of Vincenta. It transforms your TI-Nspire™ CX handheld into an interactive planetarium and observation planner, rendering a 2D polar projection of the visible night sky above your vessel.

Beyond visual sky mapping, Vincenta features an automated **Triad Sight Finder**—an advanced optimisation engine that scans the entire sky to identify and rank the mathematically ideal 3-body star combinations ("triads") for taking multi-sight fixes.

5.1 Overview & Chart Setup

To configure and launch the interactive Sky Chart, navigate from the main menu:

Main Menu ➔ 2: Celestial Bodies ➔ 2: Sky Plot

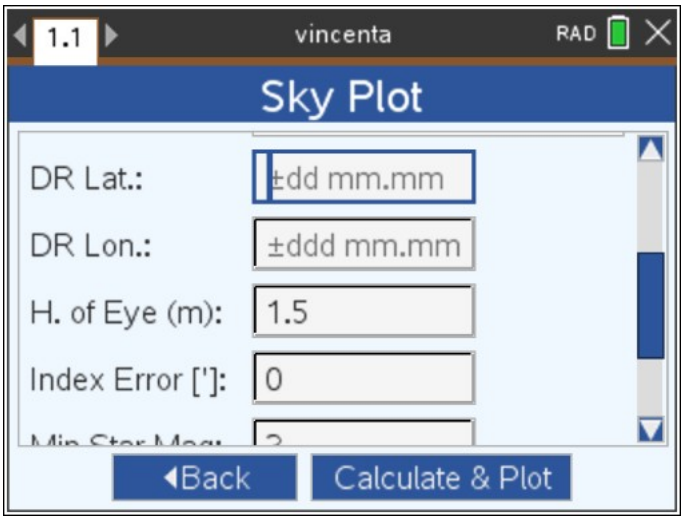


***Sky Plot screen**. Top section of the data entry screen.*

Configuring Sky Plot Filters

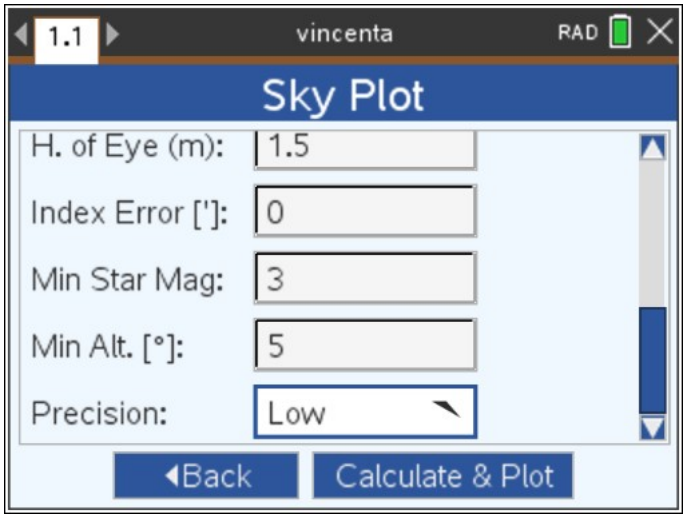
Before rendering the sky, set your observation parameters:

1. **Date & Time**: Enter your target date (`YYYYMMDD`) and time (`HHMMSS`).
2. **Time Zone [h]**: Enter your local time zone offset (e.g., `-5` or `0`). Enter 0 to work in Universal Time. If there is a value in user settings, this is pre-populated in the input field.
3. **DR Source**: Choose `Manual` or select a saved **Navigation Log** folder to auto-populate your vessel's position from the last entry of the selected log.



***Sky Plot screen**. Middle section of the data entry screen.*

4. **DR Source**: Choose `Manual` and manually enter your estimated Latitude and Longitude, or select a saved **Navigation Log** folder to auto-populate your vessel's position from the last entry of the selected log.
5. **H. of Eye (m/ft):** Enter your bridge height of eye above the waterline in the active measurement unit (meters or feet). This value is pre-populated from User Settings. Entering Height of Eye enables Vincenta to calculate dip correction and predict the raw sextant reading (Hs) for visible bodies.
6. **Index Error ['):** Enter your sextant's index error in arcminutes. This value is pre-populated from User Settings. Entering Index Error enables Vincenta to predict the uncorrected sextant altitude (Hs) on the chart.



***Sky Plot screen**. Bottom section of the data entry screen.*

Functionality note: Populating Height of Eye and Index Error allows the Sky Chart hover engine to calculate and display the predicted sextant reading (**Sext (Hs)**) and semidiameter (**SD**) in real time for hovered bodies. This allows to use the plot to pre-set the sextant to the indicated altitude, compare angular distance measurements between bodies, and correcting for semidiameter when measuring distance from limb.

7. **Min Star Mag**: Set the brightness cut-off (e.g., `2.0` for only the brightest navigational stars). It is pre-populated with the value in User Settings.
8. **Min Alt. [°]**: Set the horizon altitude limit (e.g., `5.0°` to hide bodies obscured by sea haze or deck structures). It is pre-populated with the value in User Settings.
9. **Precision**: Select `Low` (for ultra-fast rendering) or `High` (for maximum ephemerides accuracy).
10. Press **[Calculate & Plot]** or shortcut **[C]**.

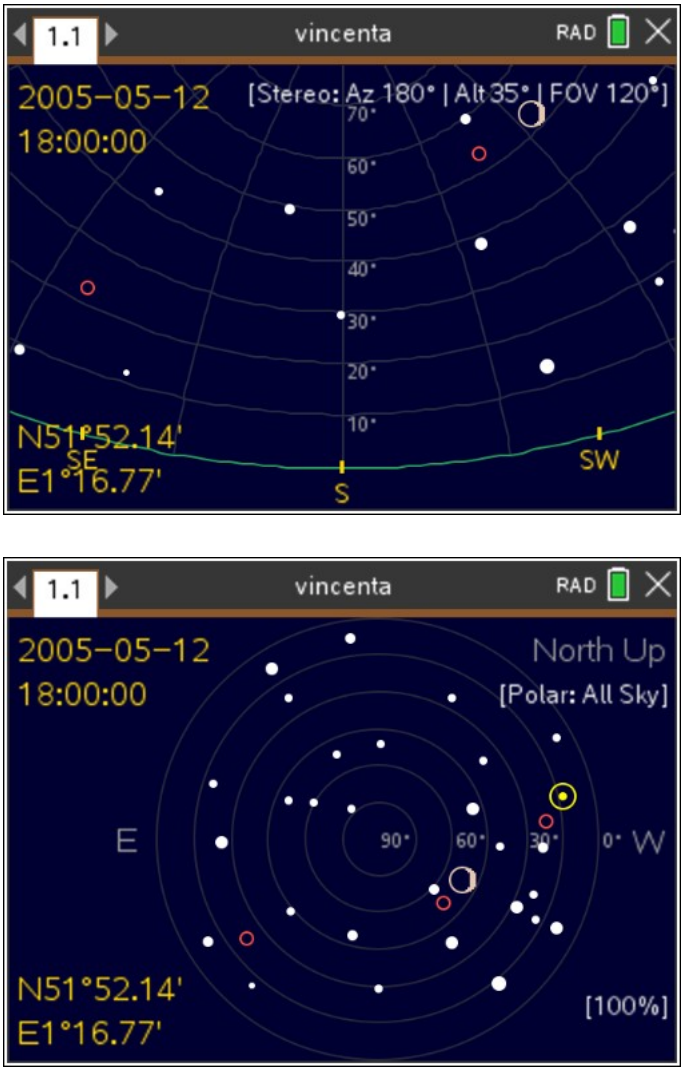
Vincenta calculates the astronomical ephemerides and opens the **Interactive Sky Chart**.

5.2 Operating the Interactive Sky Chart

Dual Projection Modes

Vincenta features two distinct, mathematically rigorous visual projections of the celestial sphere:

1. **Stereographic Projection (Default View):**
    - Projects the sky dome conformally from a perspective viewpoint onto a planar bridge window.
    - Conformal geometry preserves true angular shapes and relative star constellation profiles without radial stretching.
    - Launches by default looking due **South (Azimuth 180°)**, elevated at **35° Altitude**, with a natural panoramic **120° Field of View (`FOV`)**.
    - Renders an emerald-green true horizon line (Alt=0°), concentric altitude arcs (Almucantars), vertical azimuth circles radiating from Zenith, and gold cardinal and inter-cardinal horizon marks.
2. **Polar Projection (All-Sky View):**
    - Renders the complete hemispherical dome overhead in an equidistant polar projection.
    - **Zenith (Center):** The exact centre of the circular chart represents your Zenith (90° altitude, directly overhead).
    - **Horizon (Outer Circle):** The outer boundary circle represents the true horizon (0° altitude).



Stereographic and Polar Sky Plot screens. *Here they show Moon (with realistic phase), Sun, and the visible planets among stars up to the set magnitude limit. A star diameter is proportional to its brightness.*

- **Altitude Rings:** Concentric dashed circles mark 15° altitude increments (15°, 30°, 45°, 60°, 75°), labelled along the West axis every 30°.
- **Cardinal Orientations:** Labelled **North Up** (top, 000°), **E** (left, 090°), and **W** (right, 270°). East appears on the left and West on the right because you are looking UP at the sky from below.

Press **[M]** on the keypad at any time to switch instantly between **Stereographic Mode** and **Polar Mode**.

Stereographic Panoramic Controls & Key Shortcuts

When operating in Stereographic Mode, use the following dedicated controls to direct your gaze around the horizon:

- **Field of View (FOV Zoom):**
    - Press **[+]** to narrow the Field of View (zoom in) by 5° (minimum FOV=15°).
    - Press **[-]** to widen the Field of View (zoom out) by 5° (maximum FOV = 180°).
- **Touchpad Edge Directional Arrows:**
    - Press **[◄] / [►]** (Left / Right Arrows) to rotate your central viewing azimuth left or right in 5° increments (0° to 355°).
    - Press **[▲] / [▼]** (Up / Down Arrows) to tilt your central viewing altitude up or down in 5° increments (from 0° horizon up to 90° zenith).
- **Cardinal Direction Snap Keys:**
    - Press **[N]** to snap central azimuth instantly to **North** (000°).
    - Press **[E]** to snap central azimuth instantly to **East** (090°).
    - Press **[S]** to snap central azimuth instantly to **South** (180°).
    - Press **[W]** to snap central azimuth instantly to **West** (270°).
    - Press **[Z]** to look straight up at the **Zenith** (sets Altitude to 90° and widens FOV to 180° so the entire circular horizon surrounds the display).
- **Centre on Celestial Objects:**
    - Move the touchpad pointer over any celestial body until it highlights, then press **[Space]** or **[Enter]**. Vincenta instantly re-centers the viewing azimuth and altitude directly onto that object.

Polar Mode Touchpad Navigation, Panning & Zooming

When operating in Polar Mode, use the standard chart navigation controls:

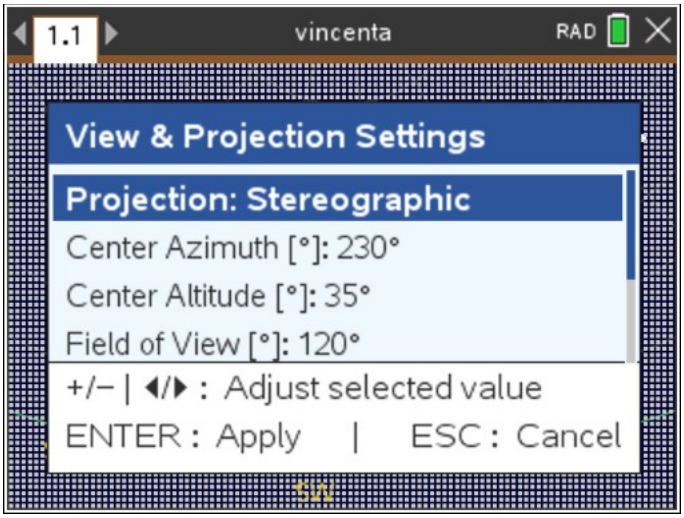
- **Pointer Navigation:** Move your finger across the TI-Nspire™ touchpad to move the selection pointer across the sky chart.
- **Zooming:**
    - Press **[+]** to zoom in on a cluster of stars.
    - Press **[-]** to zoom out.
    - Zooming centres dynamically on the current touchpad pointer position.
- **Panning (Dragging the Chart):**

    - Press **[P]** or click and hold briefly the touchpad centre key to activate Pan Mode (indicated by **[Pan]** in the lower-right corner).
    - Move the touchpad pointer to drag the sky dome across the screen.
    - Press **[P]** or the touchpad centre key again to lock the view.
- **Resetting View:** Press **[R]** at any time to reset zoom, panning, and viewing orientation back to default settings.
- **Full-Screen View:** Press **[F]** to toggle Full-Screen Mode, hiding header and footer data overlays for maximum chart visibility.

View & Projection Settings Modal ([V] Key)

To configure fine-grained display parameters for the chart:

1. Press **[V]** on the Sky Chart. Vincenta opens the **View & Projection Settings** dialogue box.
2. Use **[▲] / [▼]** to highlight a setting, and use **[◄] / [►]** or **[+] / [-]** to modify its value:
    - **Projection:** Toggle between **Stereographic** and **Polar**.
    - **Center Azimuth [°]:** Set centre bearing from 0° to 355° in 5° increments (Stereo only).
    - **Center Altitude [°]:** Set centre elevation from 0° to 90° in 5° increments (Stereo only).
    - **Field of View [°]:** Set angular width from 15° to 180° in 5° increments (Stereo only).



***View & Projection Settings Modal**. By scrolling through the available parameters and modifying their values, different projection settings can be specified.*

- **Show Grid Arcs:** Select **YES** or **NO** to display or hide altitude/azimuth grid arcs.
- **Show Horizon Line:** Select **YES** or **NO** to display or hide the emerald-green horizon ring.
- **Show Cardinal Marks:** Select **YES** or **NO** to display or hide gold compass marks along the horizon.

3. Press **[Enter]** to apply settings and update the chart, or press **[Esc]** to cancel.

Real-Time Time-Stepping Controls

Plan your observation window without leaving the chart:

- **[1]**: Step time **backward 30 minutes** (-0.5 hours).
- **[3]**: Step time **forward 30 minutes** (+0.5 hours).
- **[4]**: Step time **backward 1 hour** (-1.0 hour).
- **[6]**: Step time **forward 1 hour** (+1.0 hour).

Every time-step automatically updates all body positions, Moon phases, and constellation lines in real time.

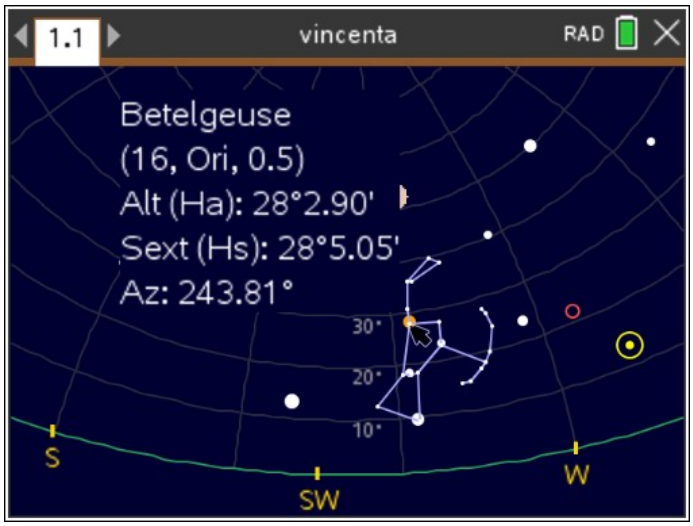
5.3 The Interactive Hovering Engine

As you move the touchpad pointer over the chart, Vincenta's hovering engine detects nearby celestial objects and highlights them.

Hover Data Pop-up Box

When the pointer passes near a celestial body, the object highlights in bright orange, and a high-contrast information box appears displaying:

- **Object Name:** (e.g., Aldebaran, Venus, Moon).
- **Star Catalogue ID & Constellation:** For stars, displays the official ID number, three-letter constellation abbreviation, and magnitude (e.g., (10, Tau, 0.9)).
- **Visual Magnitude:** Displays calculated apparent magnitude for planets and stars (e.g., mag -1.9).



***Stereographic Sky Plot screen**. Hovering on a star, with all info options toggled active, displays the star data and an outline of its constellation. Here the plot is in full screen mode, which hides several labels and status indicators.*

- **Moon Phase Data:** For the Moon, displays current lunar age in days and illumination percentage (e.g., (mag -11.7, age 10.1d, ill 78%)).
- **Apparent Altitude (Alt (Ha)):** Predicted apparent altitude corrected for atmospheric refraction in degrees and decimal minutes (e.g., Alt (Ha): 42°15.42').
- **Predicted Sextant Altitude (Sext (Hs)):** When Height of Eye and Index Error are supplied on the setup form, displays the predicted raw angle to preset on your sextant arc (e.g., Sext (Hs): 42°18.50').
- **Semidiameter (SD):** For the Sun and Moon, displays the topocentric semidiameter in arcminutes to your configured decimal precision (e.g., SD: 16.2').
- **Azimuth (Az):** True compass bearing to the body in degrees (e.g., Az: 135.25°).

Constellation Overlay & Display Toggles

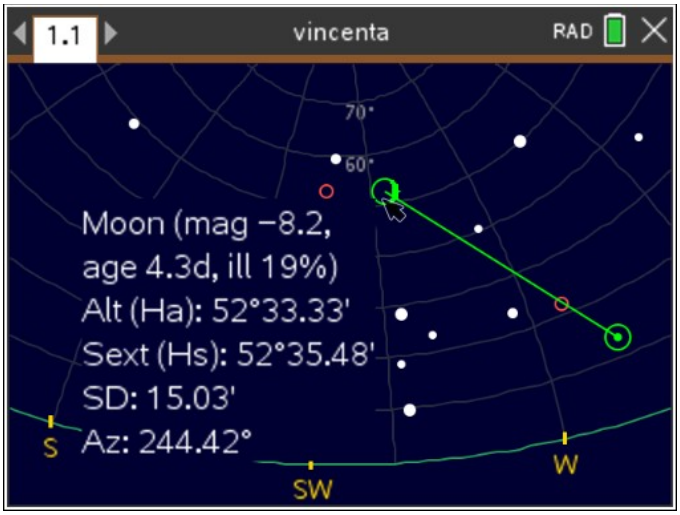
- **Constellations Toggle ([C] Key)**: Press **[C]** to toggle official constellation stick-figure lines ON or OFF. When enabled, hovering over any star automatically draws its parent constellation's connecting lines across the sky in soft blue.
- **Body Info Toggle ([I] Key)**: Press **[I]** to hide or show hover pop-up boxes.
- **Visible Bodies List ([L] or [X] Keys)**: Press **[L]** or **[X]** to open a full text summary listing every body currently visible above your horizon, including Altitude, Azimuth, Magnitude, and Constellation.

5.4 Measuring Angular Distance Between Celestial Objects

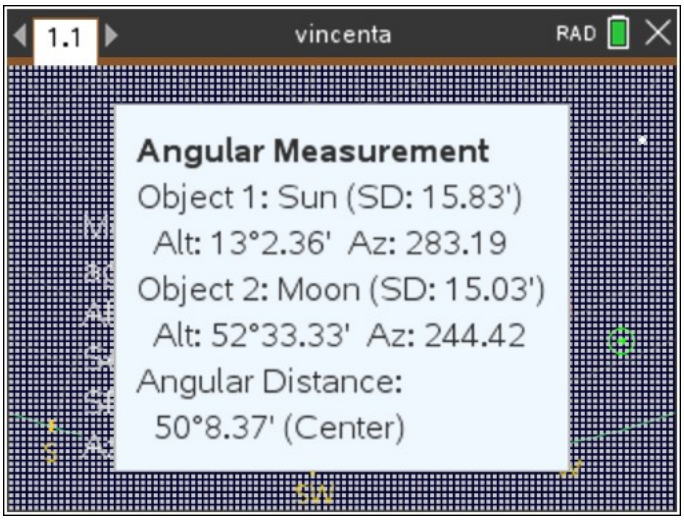
Navigators frequently measure the angular distance between two stars or between the Moon and a star (for lunar distance navigation, checking sextant calibration).

Step-by-Step Distance Measurement Guide

1. Move the touchpad pointer over the **first celestial body**.
2. Click the centre of the touchpad. The body highlights with a **bright green selection circle**.
3. Move the pointer toward a **second celestial body**. A dynamic green measuring line extends from the first body to the pointer.
4. Click the touchpad on the second body.



***Stereographic Sky Plot screen**. Selection of two objects for angular distance measurement. The feature works identically in the polar plot.*



Stereographic Sky Plot screen. *Modal screen displaying the angular measurement results.*

5. Vincenta opens the **Angular Measurement Dialogue**, displaying:
    - **Object 1**: Name, Altitude, and Azimuth.
    - **Object 2**: Name, Altitude, and Azimuth.
    - **Angular Distance**: The exact great-circle angular separation between the two objects in degrees and decimal minutes (e.g., `48° 22.4'`).
6. Press **[Enter]** or **[Esc]** to dismiss the dialogue and clear the selection.

5.5 The Automated Triad Sight Finder

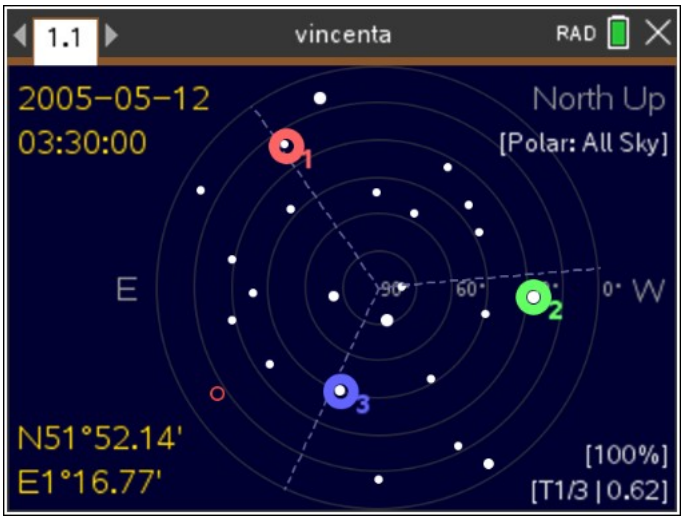
Real-World Celestial Context: Why Triad Geometry Matters

When taking a single celestial sight, you obtain one Line of Position (LOP). Taking two sights yields an intersection point, but any uncorrected systematic error—such as an unnoticed index error, incorrect height of eye, or abnormal atmospheric refraction—shifts both LOPs equally, introducing undetected position errors.

To eliminate systematic errors, navigators observe **Three Bodies separated by approximately 120º in Azimuth** (a **Triad**). When three LOPs intersect at 120º angles, systematic errors expand or shrink the resulting triangle symmetrically, placing your true position at the geometric centre.

Activating the Sight Finder

1. On the Sky Chart, press **[T]** to toggle the **Triad Sight Finder** ON or OFF.



***Triad Sight Finder tool**. Upon activation, it display the first and best triads found. To the bottom right of the screen, the label `[T1/3 | 0.62]` shows that this is the first triad of 3 found, with score 0.62. Triads are ordered by descending score. Here the polar plot is shown, but this feature is available also in the stereographic plot.*

2. When activated, Vincenta scans all visible bodies and identifies optimal 3-body combinations, rendering grid alignment lines and body numbered highlights on screen. The calculations are performed only once at first press of the **[T]** key, and are not repeated at every toggling on, unless the time of the sky plot changes from that of the last calculations.
3. At first activation, the triad finder displays the first, highest ranking triad found.

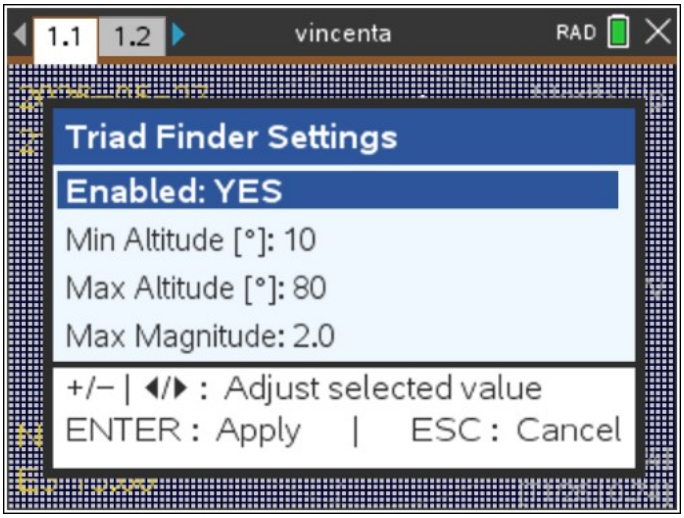
Configuring Triad Search Criteria

Press **[G]** on the Sky Chart to open the **Triad Finder Settings Modal** (Note: Key **[S]** in Stereographic mode is reserved to orient view South; use **[G]** for Grid/Triad configuration):

Use **[▲] / [▼]** to highlight a setting, and press **[+] / [-]** or **[◄] / [►]** to adjust values:

- **Enabled:** Toggle YES or NO (Shortcut **[T]** on chart).
- **Min Altitude [°]:** Minimum allowable body altitude in degrees. Defaults to 10.0°, avoiding dense surface refraction anomalies.
- **Max Altitude [°]:** Maximum allowable altitude in degrees. Defaults to 80.0°, avoiding steep sextant angles near zenith.
- **Max Magnitude:** Brightness cut-off. Defaults to 2.0, restricting candidate stars to primary navigational stars.
- **Grid Step [°]:** Search grid rotation resolution. Defaults to 7° steps around the horizon.

- **Azimuth Tolerance [°]:** Maximum allowable angular deviation from ideal 120° grid lines. Defaults to 14.0°.
- **Grid Weight / Mag Weight / Altitude Weight:** Relative weighting factors (0.0 to 1.0) balancing geometric alignment, star brightness, and similarity of altitudes.
- Press **[T]** while inside the modal to toggle the optimiser enabled status.



***Triad Finder Settings modal screen**. By scrolling through the available parameter and modifying their values, different triad search criteria combinations can be specified.*

- Press **[R]** while inside the modal to reset all parameters to factory defaults.
- Press **[Enter]** to apply settings and trigger the search, or press **[Esc]** to cancel.

Interpreting Triad Search Results on Chart

Once computed, Vincenta highlights the top-ranked Triad directly on the Sky Chart:

- **120° Grid Lines**: Three soft-dashed lines radiate from Zenith toward the horizon separated by 120° in azimuth.
- **Numbered Circle Highlights**: The three chosen stars are enclosed in thick circles labelled **1**, **2**, and **3**, and coloured **Red**, **Green**, and **Blue** respectively.
- **Top-Right Info Panel:** Displays candidate rank, total triads found, composite score, and individual body names with Altitudes and Azimuths (e.g., `Triad 1/14 | Score: 0.88`).
- **Bottom-Right Triad Indicator**: Displays the currently active triad and its overall score (e.g., `[T1/26 | 0.74]`). The triad score is always less than or equal to `1`.
- **Cycling Triads**: Press **[9]** (Next) or **[7]** (Previous) to cycle through all candidate triads.

- **Toggle Info Overlay**: Press **[O]** to hide/show the top-right info panel.



Triad Finder tool information box. *The triad info box displays the approximate height and azimuth of the selected triad bodies (in this example, the second triad is selected).*

  - **Note**: The info overlay box data can be also viewed without displaying the overlay itself. The active triad number and the total number of triads found can be read off the bottom-right triad indicator, remaining visible whenever the triad finder is enabled, regardless of the info overlay being hidden. The triad objects data can be viewed in the usual manner, by hovering each object with the screen pointer. This allows, for example, to inspect each body Hs and set the sextant accordingly prior to taking each body sight.

- **View Full Triad List**: Press **[X]** to open a text summary listing the top 10 ranked triads.



Top Sight Triads screen. *Top of the list screen reporting the first 10 top ranking triads. All triads found are listed below.*

```
TOP SIGHT TRIADS (Ranked by Score)
Total found: 3

#1 | Score: 0.62
   1. Mirfak mag 1.8 | 21.1° @ 33°
   2. Arcturus mag -0.0 | 27.4° @ 267°
   3. Altair mag 0.8 | 45.5° @ 160°

#2 | Score: 0.57
   1. Mars mag 0.5 | 11.3° @ 123°
   2. Capella mag 0.1 | 10.2° @ 17°
   3. Arcturus mag -0.0 | 27.4° @ 267°

#3 | Score: 0.56
   1. Capella mag 0.1 | 10.2° @ 17°
   2. Arcturus mag -0.0 | 27.4° @ 267°
   3. Altair mag 0.8 | 45.5° @ 160°
```

Chapter 6: Sight Folder Management & Digital QR Export

Keeping a clear, structured record of celestial observations is a fundamental requirement of good seamanship. Vincenta provides a digital filing system where you can organise celestial sights into custom folders, review previously reduced observations, re-order or edit sight parameters, and transfer navigation data wirelessly to mobile devices using on-screen **Optical QR Codes**.

This chapter covers folder management, sight list operations, and exporting sight data to external mobile devices.

6.1 Real-World Context: Navigational Logbooks & Sight Folders

Historically, navigators maintained physical leather-bound logbooks containing raw sextant observations, chronometer times, and calculated intercept values. These records served two critical purposes:

1. **Verifying Dead Reckoning**: They provided an auditable paper trail to justify position adjustments made to the vessel's dead reckoning track.
2. **Re-Reduction & Analysis**: If a chronometer error was discovered later, or if an assumed position needed adjustment, having the raw observation data preserved allowed the navigator to re-reduce the sights accurately.

In Vincenta, **Sight Folders** fulfil this exact role digitally. You can organise sights by voyage leg, date, watch period, or star round (e.g., `Passage_Leg1`, `2025-06-15_AM`, `Sun_Sights`).

6.2 Managing Sight Folders

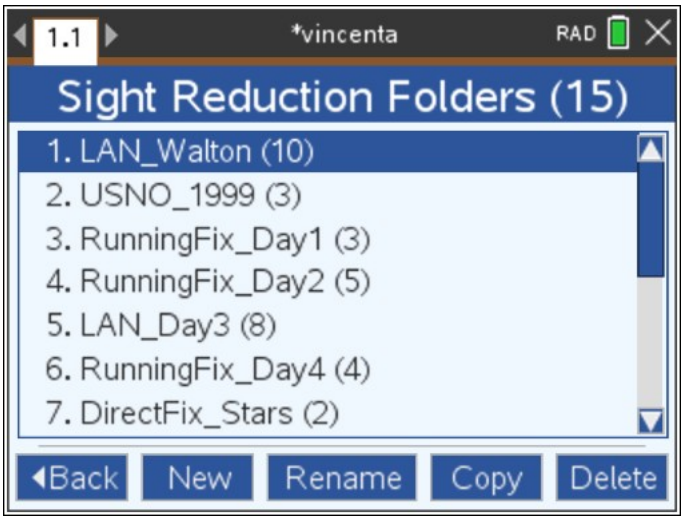
To access the Sight Folders directory from the main menu, navigate as follows:

Main Menu ➔ 3: Sight Folders

The **Sight Folders Directory** displays a numbered list of all folders stored in your TI-Nspire™ memory, showing the folder name and the number of contained sights in parentheses (e.g., `1. LAN_Day3 (8)`).

Folder Directory Commands & Key Shortcuts

- **Create New Folder**: Press **[New]** (or key **[N]**). Type a folder name up to 15 characters (e.g., `Morning_Stars`) into the pop-up input box and press **[Enter]**.
- **Rename Folder**: Highlight a folder and press **[Rename]** (or key **[R]**). Type a new name and press **[Enter]**.



***Sight Folders**. Top of the list of all the sight folders currently stored within Vincenta.*

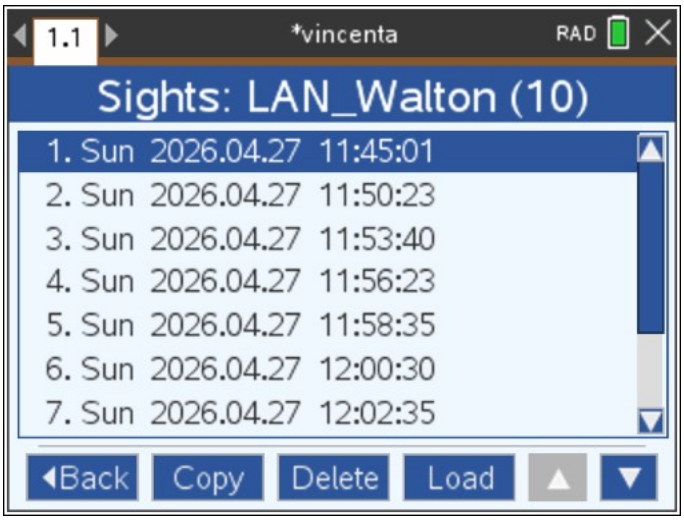
- **Duplicate Folder**: Highlight a folder and press **[Copy]** (or key **[C]**). Enter a name for the duplicated folder.
- **Delete Folder**: Highlight a folder and press **[Delete]** (or key **[D]**). A confirmation dialogue appears showing the folder name and total record count. Press **[Enter]** to confirm deletion, or **[Esc]** to cancel.
- **Re-Order Folders**: Press **[+]** or **[-]** to shift the highlighted folder up or down in the directory list.
- **Toggle Alphabetical Sorting**: Press **[O]** to instantly sort the folder directory alphabetically, toggling ascending and descending.
- **Open Folder**: Highlight a folder and press **[Enter]**.

Important Note: The following naming conventions apply for sight folders: 15 alphanumeric characters including the underscore '_' are allowed. Folder names are case insensitive, i.e., `Morning_Stars` is considered a duplicate of `morning_stars`.

> *Operational Note:* Changes to sight folders commit the data to active RAM. Remember to press **`[Ctrl]`** + **`[S]`** before turning off the calculator or **`[Ctrl]`** + **`[W]`** and answering **Yes** to the prompt that appears when quitting Vincenta to permanently preserve your records in Flash ROM.

6.3 Working Inside a Sight Folder

Opening a folder displays its contained sight reduction records in the order in which they were saved or subsequently rearranged.



***Sight Folder Content**. Top of the list of a sight folder content screen.*

Each entry displays the sight index number, celestial body name (or star name), observation date, and Universal Time (e.g., `1. Sun 2025.05.11 18:19:39` or `2. Sirius 2025.05.12 20:18:44`).

Reviewing, Re-Reducing, and Editing Sights

- **View Full Reduction Results**: Highlight a sight and press **[Enter]**. This opens the **Reduction Results** screen, displaying the full reduction results and options. See the previous section on Sight Reduction results.
- **Load Sight for Editing / Re-Reduction**: Highlight a sight and press **[Load]** (or key **[L]**). Vincenta transfers you directly to the **Sight Reduction** screen with all parameters (time, DR position, sextant altitude, index error, height of eye) pre-loaded into the form, allowing you to modify inputs and re-calculate.
- **Copy Sight to Another Folder**: Highlight a sight and press **[Copy]** (or key **[C]**). Select a target folder from the list to copy the record across.
- **Delete Sight**: Highlight a sight and press **[Delete]** (or key **[D]**). A confirmation dialogue appears showing the sight number, body name, date, time, position, and notes summary. Press **[Enter]** to delete or **[Esc]** to cancel.
- **Re-Order Sights**: Use **[▲] / [▼]** buttons or the **[+] / [-]** keys to shift the selected sight record up or down within the folder list.

6.4 Wireless Optical Export via QR Codes

Vincenta features an **Optical QR Export Tool** that allows you to transfer sight records wirelessly from your TI-Nspire™ screen to a smartphone, tablet, or laptop without needing cables, Bluetooth, or an active internet connection.

The Optical Bridge: Air-Gapped Architecture & Wireless Export

The TI-Nspire™ CX hardware ecosystem is engineered as a self-contained, air-gapped, and reliable computing platform. To maintain strict operating system integrity and system stability, direct digital file extraction traditionally requires Texas Instruments' proprietary desktop software (such as TI-Nspire™ Student or Teacher Software).

To bridge this hardware isolation without requiring tethered USB cables, specialised computer drivers, or desktop software dependencies on the chart table, Vincenta introduces an innovative **Optical QR Export System**.

By transforming the handheld's high-contrast display into a dynamic optical transmitter, Vincenta encodes full navigational sight records into high-density 2D QR matrices. This creates a secure, air-gapped, and instant wireless bridge to any camera-enabled smartphone, tablet, or laptop. Using the companion *Vincenta Web Mobile Scanner*, navigators can instantly transfer sight records, log entries, and reduction outputs directly into digital vessel logbooks, spreadsheets, or modern Electronic Charting Systems (ECS)—combining the rock-solid hardware reliability of the TI-Nspire™ with seamless mobile connectivity. For instructions on how to operate the QR scanner see Chapter 13.



***QR Code Export**. Typical QR Code encoding of a sight data, generated from the containing sight folder.*

Single Sight Export

1. Inside a sight folder, highlight the sight you wish to export.
2. Press key **[Q]**.
3. Vincenta generates and displays a high-contrast 2D **QR Code** in the centre of the TI-Nspire™ screen.
4. Point your mobile device camera at the calculator screen to scan the code.

5. Press **[Enter]** or **[Esc]** on the handheld to close the QR screen.

Sequential Batch Folder Export

To export an entire folder of sights in a single rapid scanning session:

1. Inside a sight folder, press key **[S]** (Batch Export).
2. Vincenta displays the QR code for the **first sight** in the folder.
3. Scan the code with your mobile device.
4. The QR code will be captured almost instantly, and after a 1-second timer, Vincenta will advance to the next log entry. You can press **[Enter]** or click the touchpad to advance manually.
5. Hold the mobile scanner app towards the TI Nspire™ screen until all records in the log folder are scanned. Press **[Esc]** at any point to abort the batch export.

Configuring QR Code Density Settings

In **User Settings** (**Main Menu ➔ 6: Utilities ➔ 1: Settings**), you can set the **Full QR Code** preference:

- **`Yes` (Full CSV record)**: Encodes complete, human-readable text containing folder name, body name, body ID, date, time, DeltaT, DR position, Height of Eye, Index Error, Limb, Sextant Altitude, Temperature, Pressure, Observed Altitude, Calculated Altitude, Intercept, Azimuth, GHA, Declination, Aries, and user notes.
- **`No` (Compact CSV record)**: Encodes an ultra-compact string containing essential parameters and a **Modified Julian Date (MJD)** value, producing a lower-density QR code. This can be useful should low-lighting or rolling sea conditions prevent a successful decoding of the QR code.

Chapter 7: Electronic Navigation Logbook, QR Code Export & Dead Reckoning

A continuous, accurately maintained **Dead Reckoning (DR)** track is the backbone of safe marine navigation. Vincenta includes an **Electronic Navigation Logbook** that records historical vessel entries and automatically projects your position forward over time, accounting for vessel heading, speed, leeway, and ocean/tidal currents.

This chapter details how to manage logbook folders, enter routine navigation records, configure environmental drift vectors, and review calculated track advances.

7.1 Real-World Context: Dead Reckoning & The Celestial Symbiosis

Dead Reckoning (DR) is the process of estimating your current position by advancing a previously known position using estimated course and speed. In marine navigation, celestial navigation and dead reckoning exist in a continuous symbiotic relationship:

1. **DR Enables Sight Reduction**: With the Marcq St. Hilaire intercept method you cannot calculate the expected altitude (Hc) or azimuth (Zn) of a celestial body without a starting **Assumed / DR Position**.
2. **Celestial Sights Correct the DR**: Over time, wind leeway, ocean currents, helmsman error, and steering inaccuracies cause a DR position to drift away from the vessel's true location. A celestial position fix or a sequence of successive estimated point calculations periodically resets the DR track back to reality.

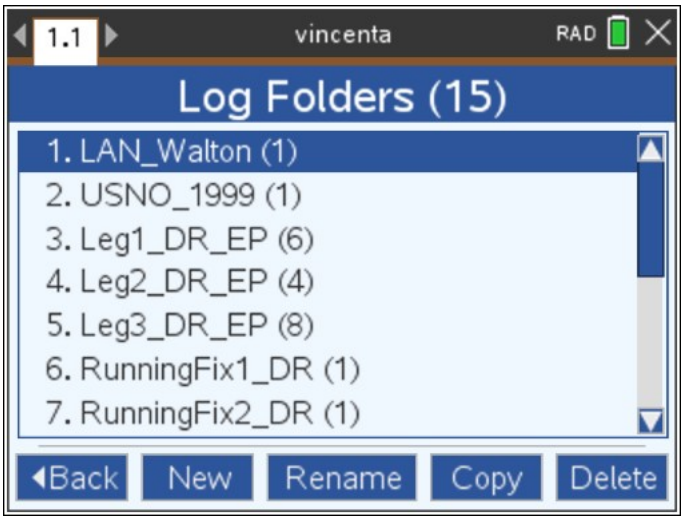
Maintaining an active, updated logbook in Vincenta ensures you always have an accurate DR position ready for instant sight reduction.

> **Note**: With a calculator it is possible to bypass the need for a DR through a different method. The **Direct Calculation Fix** chapter further below describes how Vincenta can calculate your position from two sights taken close enough in time relative to the vessel speed, and each taken from a different body, without the need of a DR.

7.2 Navigating the Electronic Logbook System

To open the Navigation Log directory from the main menu, navigate as follows:

Main Menu ➔ 4: Log Folders



***Log Folders**. Top of the log folder list.*

The **Log Folders Directory** displays all log folders stored in Vincenta memory (e.g., `2. Leg1_DR_EP (6)`).

Log Directory Commands & Key Shortcuts

- **Create New Log**: Press **[New]** (or key **[N]**). Type a log name up to 15 characters (e.g., `Log_Leg1`) and press **[Enter]**.
- **Rename Log**: Highlight a log folder and press **[Rename]** (or key **[R]**).
- **Duplicate Log**: Highlight a log folder and press **[Copy]** (or key **[C]**).
- **Delete Log**: Highlight a log folder and press **[Delete]** (or key **[D]**). Confirm deletion when prompted.
- **Re-Order / Sort Logs**: Use **[+] / [-]** to move log folders up or down, or press **[O]** to toggle alphabetical sorting.
- **Open Log Folder**: Highlight a log and press **[Enter]**.

The following naming conventions apply for log folders: 15 alphanumeric characters including the underscore '_'are allowed. Folder names are case insensitive, i.e., `Leg_1` will be considered a duplicate of `leg_1`.

7.3 Wireless Optical Export for Log Entries via QR Codes

Vincenta extends its air-gapped optical transfer system to the Electronic Navigation Logbook, allowing navigators to wirelessly export vessel log records, Dead Reckoning (DR) tracks, Estimated Positions (EP), and observed Fixes directly from the calculator screen to an external mobile device or computer via its scanner web app.

System Architecture & Settings:
The underlying air-gapped optical bridge architecture, mobile scanner setup, and QR density options (**Full QR Code: Yes / No**) are fully detailed in **Section 6.4 (Wireless Optical Export via QR Codes)** and in **Chapter 13**. The same operating principles and user settings apply when exporting logbook records.

Single Log Entry Export

To export an individual log record from a log folder:

1. Open the target log folder (Main Menu ➔ 4: Log Folders ➔ [Enter] on folder).
2. Use the arrow keys or touchpad to highlight the log entry you wish to export.
3. Press key **[Q]**.
4. Vincenta generates a high-contrast 2D QR matrix in the centre of the display, with the folder name and record index displayed beneath the code (e.g., *Folder: Leg1_Log, Log: 3/12*).
5. Point your mobile device camera running the **Vincenta Web Scanner** at the screen to capture the entry.
6. Press **[Enter]** or **[Esc]** on the handheld to close the QR screen.



***QR Code Export**. Typical QR Code encoding of a log record, generated from the containing log folder.*

Sequential Batch Logbook Export

To rapidly export an entire logbook folder for voyage archiving or spreadsheet import:

1. Inside the active log folder, press key **[S]** (Batch Export).
2. Vincenta renders the QR code for the first record in the log folder.
3. Scan the code with your mobile scanner app.

4. The QR code will be captured almost instantly, and after a 1-second timer, Vincenta will advance to the next log entry. You can press **[Enter]** or click the touchpad to advance manually.
5. Hold the mobile scanner app towards the TI Nspire™ screen until all records in the log folder are scanned. Press **[Esc]** at any point to abort the batch export.

Exported Logbook Data Structure

Depending on your **Full QR Code** setting in User Settings (Main Menu ➔ 6: Utilities ➔ 1: Settings), log entries encode the following data fields:

- **Full CSV Record (`Full QR Code: Yes`):**
  Encodes a complete, human-readable record including folder name, record type (*DR*, *EP*, *FIX*), UT date and time, latitude, longitude, true heading, run distance, vessel speed, leeway, tidal current set and drift, calculated Course Over Ground (COG), Distance Over Ground (DOG), Speed Over Ground (SOG), and attached log notes.
- **Compact CSV Record (`Full QR Code: No`):**
  Encodes an ultra-compact string containing record type, Modified Julian Date (MJD), position, and key course/speed vectors, generating a lower-density matrix optimised for rapid scanning in low-light or rolling sea conditions.

7.4 Adding & Managing Log Entries

Opening a log folder displays its contained entries in the order they were saved. However, in general, the entries would be in chronological sequence.



***Log folder content**. Shows all its contained records. The button **[Add]** allows to add a new record below the last record in the folder.*

Each line displays the entry index number, record type, date, time, and coordinates.

Viewing Log Records and Log Records Entry Action Commands

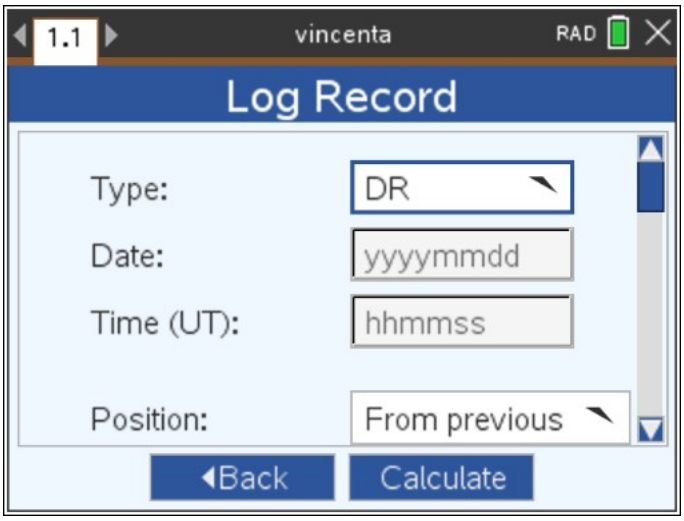
- **View Entry Details**: Highlight an entry and press **[Enter]** to view full record details in view-only mode.



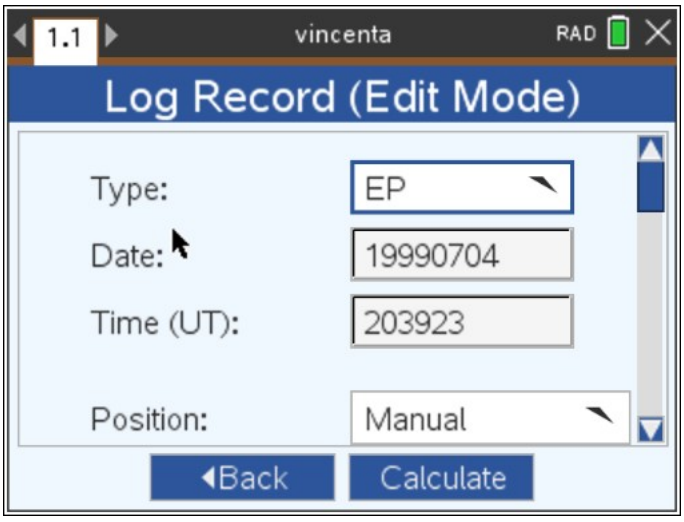
***Log Record Details**. Here the record for the USNO 1999 Almanac worked example is shown in view only mode. Full data below.*

```
LOG RECORD DETAILS                          Vessel Speed: 20kt
--- Basic Information ---                   Leeway: -
Type: DR                                    Tide Speed: -
Date: 1999-07-04                            Tide Direction: -
Time: 21:00:00                              Course OG: 325°
--- Position ---                            Distance OG: -
Latitude: N32°0.00'                         Speed OG: 20kt
Longitude: W15°0.00'                        --- Notes ---
--- Navigation Data ---                     USNO 1999 Almanac Celestial Running
Heading: 325°                               Fix worked example.
Distance: -                                 END OF LOG RECORD
```

- **Add New Entry:** Press **[Add]** (or key **[A]**). Opens a blank entry form with the screen title **Log Record**.
- **Edit Existing Entry:** Highlight an entry and press **[Edit]** (or key **[E]**). Opens the entry form in edit mode with the screen title **Log Record (Edit Mode)**. The record being edited is updated with the new changes upon saving.



***Log Record entry screen**. Here in the common mode for adding new records.*



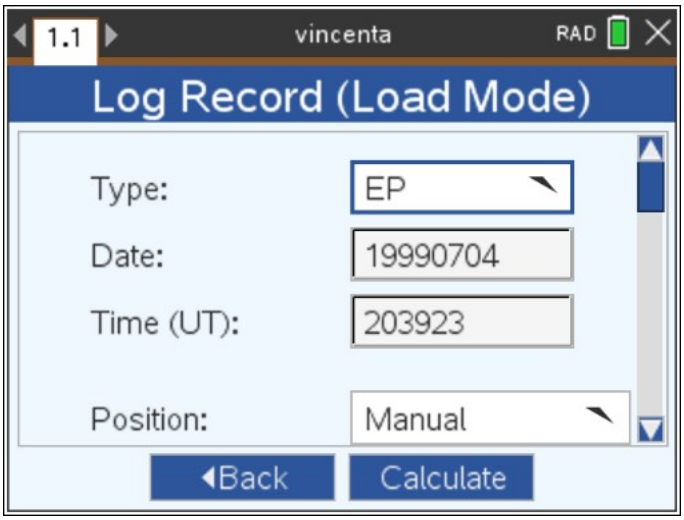
***Log Record entry screen**. Here in **Edit Mode**.*

- **Load Entry as Template:** Highlight an entry and press key **[L]**. Pre-loads the entry's parameters as a starting template to create a new record with the screen title **Log Record (Load Mode)** without altering the original record.
- **Copy Entry**: Press [Copy] (or key [C]) to copy the entry into another log folder.
- **Delete Entry**: Highlight an entry and press **[Delete]** (or key **[D]**). Confirms deletion.
- **Re-Order Entries**: Use **[▲] / [▼]** buttons or **[+] / [-]** to re-order entries.

  Operational Note 1 (Memory Saving): Changes to log folders commit data to active RAM. Remember to press **[Ctrl] + [S]** before turning off the calculator or **[Ctrl] + [W]** and answering **Yes** to the prompt that appears when quitting Vincenta to

permanently preserve your records in Flash ROM. You can also press **[Ctrl] + [S]** at any time when using Vincenta.

Operational Note 2 (Error Clearing): Toggling the Position Source drop-down menu (between Manual and From Previous) automatically clears all active inline validation errors across the form, providing a clean slate if you switch position modes.



***Log Record entry screen**. Here in **Load Mode**.*

7.5 Step-by-Step Guide: Creating a Log Entry

When you press **[Add]** or press the keys **[E]**, or **[L]** Vincenta opens the **Log Record Entry** form.

Step 1: Select Record Type & Enter Timestamp

1. **Type:** Select **DR** (Dead Reckoning), **EP** (Estimated Position), or **FIX** (Observed Position Fix).
2. **Date:** Type the date in 8-digit format: `YYYYMMDD` (e.g., `20250511`).
3. **Time (UT):** Type the Universal Time in 6-digit format: `HHMMSS` (e.g., `180000`).

Step 2: Choose Position Source & Understand Field Behaviour

Highlight the **Position** drop-down menu and select your position mode:

- **Manual Mode (Custom Observed / Logged Position)**
  Use this mode when logging an independent GPS position, visual fix, or a fix obtained outside Vincenta:
    - **Required Fields:** Date, Time (UT), Latitude, and Longitude.



Log Record entry screen in `Manual` mode. *Routinely, log record are added from scratch. This is done in the standard add mode. The input screen is set to "Manual", meaning that latitude and longitude are not calculated, but inserted manually. This function can be used to record a FIX obtained outside Vincenta.*



Log Record entry screen in `From previous` mode. *In this instance, the input screen is set to "From previous". This means that latitude and longitude will be calculated from a previous DR, EP, or FIX and from the vessel cruising parameters.*

- **Distance Disabled:** The Distance field is automatically greyed out and disabled, as no previous position baseline is being advanced.
- **Heading & Speed Co-dependency:** Heading and Vessel Speed are optional, but mutually dependent. If Heading is entered, Vessel Speed is required; if Vessel Speed is entered, Heading is required.

    - **Unrecorded Vectors:** Leaving Leeway, Tide Speed, or Tide Direction blank records their values as unrecorded (`"-"`) rather than zero.
    - **Navigational Tip (Celestial Running Fix Reference):** Entering Heading, Vessel Speed, Leeway, and Tidal Current in Manual Mode allows Vincenta to calculate Course Over Ground (COG) and Speed Over Ground (SOG). This is particularly valuable when setting up a reference DR entry for a **Celestial Running Fix** procedure, enabling the fix engine to advance older celestial observations accurately over ground during multi-sight reductions.
- **From Previous Mode (Automatic Track Advance)**
  Use this mode to let Vincenta project your vessel's position forward from the last entry in the active log folder:
    - **Position Lock:** Latitude and Longitude fields automatically populate with the coordinates of the previous entry and lock (grey out).
    - **Required Fields:** Date, Time (must be chronologically after the previous record), and Heading.

Step 3: Enter Engine & Sailing Vectors (Mutual Field Exclusion)

- **Heading:** Type your vessel's true compass heading in degrees (`0°` to `359.99°`). Required in "From Previous" mode.
- **Mutual Field Exclusion (Distance vs. Vessel Speed):** In "From Previous" mode, you must supply either Distance OR Vessel Speed (minimum value `0.01` for either):
    - Entering a Distance (NM) automatically greys out and disables the Vessel Speed field. Vincenta computes vessel speed behind the scenes (Speed = Distance / Time).
    - Entering a Vessel Speed (kt) automatically greys out and disables the Distance field. Vincenta computes run distance behind the scenes (Distance = Speed / Time).
    - Leaving both fields blank keeps both enabled so you can choose which parameter to type.
- **High-Precision Rounding:** All calculated or entered speeds and distances are rounded to 2 decimal places as actual variables in memory.

Step 4: Configure Environmental Drift Vectors (Compass Limits & Co-dependencies)

To achieve accurate track calculations, you must account for wind and ocean current effects:

- **Compass Angle Limits (`0°` to `359.99°`):** Heading and Tide Direction strictly enforce compass angles from `0°` to `359.99°`. Entering `360°` will trigger an inline validation error (`0 to 359.99°`). To represent due North, type `0`.

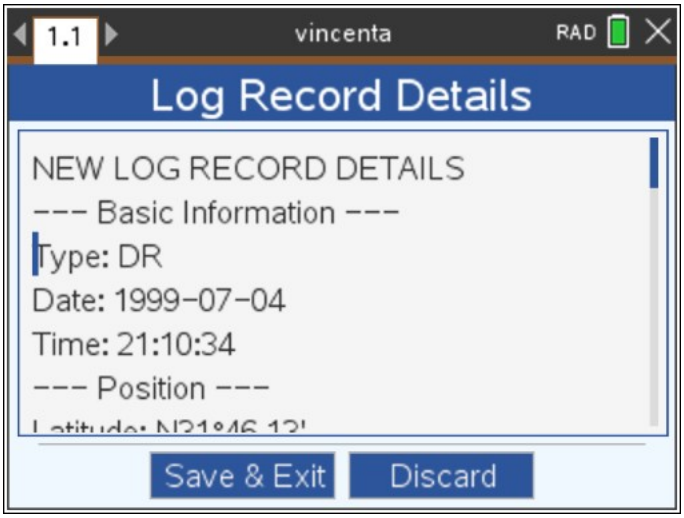
- **Leeway:** The angular deflection caused by wind pushing against the vessel's hull and rigging. Type the leeway angle in degrees (`-90°` to `+90°`). Enter a positive value for wind pushing the vessel to starboard, or a negative value for wind pushing to port. If left blank, Leeway is recorded as `"-"`.
- **Tidal Current Co-dependency (Tide Speed & Tide Direction):**
  - If Tide Speed (Current Drift) is entered (minimum `0.01` kt), Tide Direction (`0°` to `359.99°`) is required.
  - If Tide Direction (Current Set) is entered, Tide Speed is required.
  - If both fields are left blank, Vincenta sets current drift to unrecorded (`"-"`) and solves the vector advance using vessel speed and leeway alone.

Step 5: Attach Log Notes (Optional)

Press **[Enter]** on the **[Notes]** button to attach custom notes (e.g., `"Engine at 1800 RPM, sea state slight, wind NW force 4"`).

7.6 Reviewing Calculated Track Advance & Log Summaries

Once all inputs are typed, press **[Calculate]** (or key **[C]**). If vessel motion values have been filled in, Vincenta solves the vector equations and opens the Log Record Details screen.



Track advance calculation results screen. *Full displayed data below.*

```
NEW LOG RECORD DETAILS                    (DR Calculation Base)
--- Basic Information ---                 --- Basic Information ---
Type: DR                                  Type: EP
Date: 1999-07-04                          Date: 1999-07-04
Time: 21:10:34                            Time: 20:45:47
--- Position ---                          --- Position ---
Latitude: N31°46.13'                      Latitude: N31°39.35'
Longitude: W14°53.46'                     Longitude: W14°47.90'
--- Navigation Data ---                   --- Navigation Data ---
Heading: 325°                             Heading: -
Distance: 8.26NM                          Distance: -
Vessel Speed: 20kt                        Vessel Speed: -
Leeway: -                                 Leeway: -
Tide Speed: -                             Tide Speed: -
Tide Direction: -                         Tide Direction: -
Course OG: 325°                           Course OG: -
Distance OG: 8.26nm                       Distance OG: -
Speed OG: 20kt                            Speed OG: -
--- Notes ---                             --- Notes ---
USNO 1999 Almanac Celestial Running       EP from Antares sight. DR: N31°56.1'
Fix worked example with DR/EP method.     W14°58.4'. Intercept: 18.96nM (T),
======================                    Azimuth: 151.7°
PREVIOUS RECORD DETAILS                   END OF LOG RECORD
```

Interpreting Calculated Outputs

1. **Advanced DR Position:**
   Displays the new Latitude and Longitude advanced over the elapsed time interval using WGS-84 rhumb line geometry. Minutes of arc are formatted with central carry-over protection (e.g., a calculated longitude of 39º 60.00' automatically rolls over to 40º).
2. **Vector Track Over Ground:**
   - **Course OG (COG):** True course over ground in degrees, combining vessel heading, leeway, and current set. If a calculated COG reaches 360.00º, Vincenta automatically normalises the display and saved variable to 0.00º.
   - **Speed OG (SOG):** Net speed over ground in knots, rounded to 2 decimal places.
   - **Distance OG (DOG):** Total actual distance travelled over the ground in nautical miles, rounded to 2 decimal places.
3. **Comparative History Section:**
   The lower portion of the screen displays an Original / Previous Log Record Details panel, allowing you to visually verify the previous position baseline and check time differences. This data is not saved in the log record, and it is provided only for verification and error proofing at the point of track advancing.

Saving or Discarding the Entry

- **Save Entry:** Press **[Save & Exit]** (or key **[S]**) to permanently write the entry to the active log folder. A confirmation dialogue appears, and the log directory updates.
- **Discard Entry:** Press **[Discard]** (or key **[D]** / **[Esc]**). An unsaved changes dialogue prevents accidental loss.

7.7 Navigational Rationale: Estimated Positions, Running Fixes & The John Karl Perspective

In celestial navigation, an **Estimated Position (EP)** and a **Running Fix (R. Fix)** are two distinct methods used to update a vessel's position when simultaneous lines of position (LOPs) are unavailable.

In his landmark book *Celestial Navigation in the GPS Age*, author and physicist **John Karl** brought modern estimation theory and rational reasoning to marine navigation. By analysing how errors accumulate across moving vessels, Karl demonstrated that traditional plotting methods often introduce unjustifiable assumptions.

Vincenta incorporates both **Sequential EP Tracking** (in Sight Reduction and Log Entries) and an **Automated Running Fix Engine** (in the Navigation menu) to handle the two fundamental types of multi-time observations: the **Long-Run Fix** and the **Short-Run Fix**.

The Two Spectrum Ends of Navigational Sights

When a vessel is moving, observations taken at different times occur at different geographic locations. The relationship between Dead Reckoning (DR) accuracy and LOP accuracy determines which mathematical approach is rational:

Accuracy Spectrum of Celestial Sights

Navigational Feature	**Long-Run Fix** ***(Hours Between Sights)***	**Short-Run Fix** ***(Minutes Between Sights)***
Typical Example	Morning & Afternoon Sun sights	Dusk or dawn Star / Planet round
Accuracy Relationship	**LOP Accuracy > DR Accuracy**	**DR Accuracy > LOP Accuracy**
Error Characteristic	DR position error grows large over hours of travel.	Minimal DR position error during the short interval.
Optimal Solution	**Sequential EP Updates** *(Sight Reduction With Current DR ➔ `[Save EP]`)*	**Motion-Adjusted Running Fix** *(Navigation ➔ `Celestial Running Fix`)*

1. **The Long-Run Fix (Hours Between Sights):** Occurs when hours elapse between observations (such as a morning Sun line followed by an afternoon Sun line). Over several hours, DR uncertainty can grow to many miles, whereas a celestial LOP remains accurate to within 1–2 NM. Here, **LOP accuracy trumps DR accuracy**.
2. **The Short-Run Fix (Minutes Between Sights):** Occurs during a round of star sights, or sights of the Sun, Moon, and Venus taken within 10 to 30 minutes. Over a short 15-minute interval, a vessel travelling at 10 knots covers only 2.5 NM; a 1-knot speed estimate error introduces a mere 0.25 NM error—far smaller than the inherent optical and atmospheric noise of a sextant observation. Here, **DR accuracy trumps LOP accuracy**.

The Long-Run Problem: Flaws of the Traditional Running Fix

Historically, navigators attempted to solve long-run Sun sights by physically advancing the morning LOP parallel to itself along the estimated DR track to intersect the afternoon LOP.

John Karl exposed two major flaws in this traditional construction:

- **Disregarding Valid DR Information:** The traditional running fix completely ignores the vessel's known location along the first LOP. Any estimated track with the same perpendicular component to LOP1 produces the exact same "R. Fix", discarding valuable real-world information about where the ship actually was.
- **Contradictory Error Assumptions:** The traditional running fix assumes that the DR track component *perpendicular* to LOP1 is 100% exact, while assuming the track component *parallel* to LOP1 can have unlimited error. For narrow crossing angles, this mathematical contradiction actually **magnifies DR errors**, pushing the calculated "Fix" miles away from the vessel's true position!

Traditional Running Fix vs. Estimated Position (EP)

Feature & Geometry	**Traditional Running Fix *(R. Fix)***	**Estimated Position *(EP)***
Geometric Construction	Advanced LOP1 is shifted parallel to itself to intersect new LOP2.	A perpendicular line is dropped from DR1 to LOP1 to establish EP1.
Handling of DR Information	**Disregards** all DR information parallel to LOP1.	**Retains** all uncontradicted DR track information parallel to LOP1.
Error Behaviour	Assumes perpendicular DR component is exact; **magnifies DR errors** for narrow crossing angles.	Constrains position strictly perpendicular to LOP1; **consistently improves** DR accuracy.

The Rational Solution: The Estimated Position (EP) Running Fix

To avoid these contradictions, Karl advocated for the **EP Running Fix**:

1. When LOP1 is observed, drop a perpendicular line from your DR position (`DR1`) to LOP1 to obtain `EP1`. This fully honours the new, highly accurate LOP constraint while retaining all uncontradicted DR information parallel to it.
2. Advance your DR track from `EP1` to the time of the next sight (`DR2`).
3. When LOP2 is observed, again drop a perpendicular line from `DR2` to LOP2 to obtain `EP2`.

Because dropping a perpendicular always places `EP2` closer to your best position estimate than the traditional `R. Fix`, **sequential EP updates continuously improve your position without magnifying DR errors**, even when LOP crossing angles are narrow.

Historical Example: Navigators of old used this exact logic during Local Apparent Noon (LAN). When they observed the Sun at transit, they updated their latitude to the new observation, but retained their dead-reckoned longitude—dropping a perpendicular to an East-West LOP.

The Short-Run Fix: Motion Compensation for Multi-Body Rounds

For a dusk star round or rapid multi-body sights, the short time interval means the vessel's motion between sights is known with high precision. In this scenario, the logic of combining LOPs into a true Position Fix is mathematically valid and highly desirable.

Rather than forcing the navigator to manually draw and shift LOP lines on paper, Vincenta automates this short-run motion compensation behind the scenes:

Vincenta calculates the component of the vessel's velocity in the direction of each celestial body's azimuth along the vessel's true course over ground. By multiplying this velocity component by the elapsed time between each observation and a chosen reference time, Vincenta transposes all intercept distances to a single, motion-compensated instant.

This allows the **USNO Iterative Least-Squares Engine** (Chapter 8) to reduce all sights simultaneously, resolving a tight multi-LOP Fix and rendering its 95% statistical confidence uncertainty ellipse.

Operational Summary: When to Use EP vs. Running Fix in Vincenta

Vincenta provides tailored tools for both estimation strategies, allowing the sailor to apply the correct logic depending on observation conditions:

Navigational Scenario	**Time Interval & Accuracy**	**Recommended Vincenta Workflow**	**Operational Outcome**
Single Observation (e.g., Morning Sun sight or single star through cloud rift)	Single sight at a discrete time.	Sight Reduction with Current DR ➔ **`[Save EP]`**	Generates a single LOP and saves an **EP entry** to your logbook, updating your DR baseline without introducing unverified assumptions.

Navigational Scenario	Time Interval & Accuracy	Recommended Vincenta Workflow	Operational Outcome
Long-Run Sequence (e.g., Morning Sun line followed hours later by Afternoon Sun line)	Hours between sights. DR error > LOP error.	**1.** Reduce morning sight ➔ **`[Save EP]`** **2.** Logbook ➔ **`From Previous`** track advance. **3.** Reduce afternoon sight ➔ **`[Save EP]`**.	Performs **Sequential EP Tracking**. Each new LOP constrains the position perpendicular to itself while preserving non-contradicted DR track data.
Short-Run Multi-Body Round (e.g., Dusk Star round or Sun-Moon-Venus round)	5 to 30 minutes between sights. DR accuracy ≥ LOP accuracy.	**Navigation ➔ `1: Celestial Running Fix`**	Runs the **USNO Motion-Compensated Fix Engine**. Transposes all sights to a common time vector, solves an iterative least-squares fix, and plots a 95% uncertainty ellipse.
Emergency / No-DR Survival (e.g., Total electrical blackout, zero track history)	2 sights from different bodies taken near-simultaneously.	**Navigation ➔ `2: Direct Calculation Fix`**	Solves **Stanley W. Gery's 3D Direct Fix** (Chapter 9) by calculating the intersection of two equal-altitude circles directly on the terrestrial sphere without requiring any DR position.

Chapter 8: Multi-Sight Celestial Running Fixes & Uncertainty Ellipses

While a single celestial sight yields a Line of Position (LOP), determining your exact location on the ocean requires intersecting multiple LOPs to obtain a Position Fix.

In real-world marine navigation, celestial sights are rarely acquired at the exact same instant. Even during a rapid twilight star round, several minutes elapse as you observe different bodies across the horizon. As established in **Section 7.6 (The John Karl Perspective)**, when sights span a short-run time interval, compensating for vessel motion between observations is mathematically essential to eliminate position skew.

Vincenta's **Celestial Running Fix** engine automates this short-run motion compensation, advancing all observations within a sight folder to a common reference time using your vessel's active logbook track. It then applies the official U.S. Naval Observatory (USNO) iterative least-squares algorithm to compute your position fix and evaluate its 95% statistical confidence uncertainty ellipse.

Benchmark Verification: USNO 1999 Multi-Sight Test Problem

To independently verify the numerical precision and algorithmic integrity of Vincenta’s Celestial Running Fix engine, the software was benchmarked against the official 1999 U.S. Naval Observatory (USNO) multi-sight test dataset. Vincenta’s calculated fix coordinates, iterative convergence path, and 95% statistical confidence uncertainty ellipse demonstrate mathematical correspondence with the original USNO publication. Throughout this chapter, all numerical data, example outputs, and chart screenshots correspond directly to this verified USNO benchmark dataset.

8.1 Real-World Context: Motion Compensation & Multi-Sight Geometry

Simultaneous Fixes vs. Running Fixes

- **Simultaneous Fix (Idealised):** Multiple sights taken at the exact same second. Because the vessel does not move between observations, all LOPs cross at a single point. In practice, true simultaneous sights are a theoretical ideal.
- **Running Fix (Motion-Compensated):** Sights taken at different times across an observation round or watch. To intersect these lines of position accurately, older observations must be advanced along your vessel's true track over ground to the timestamp of the reference sight.

Automatic Motion Compensation (Short-Run Vector Advance)

Vincenta eliminates manual chart plotting and paper LOP shifting by performing automatic motion compensation.

When you execute a Running Fix (**Main Menu ➔ 5: Navigation ➔ 1: Celestial Running Fix**), the engine:

1. Reads your reference Dead Reckoning entry from the selected **Navigation Log**.
2. Extracts your course over ground (COG and speed over ground (SOG), incorporating engine speed, leeway, and tidal current vectors.
3. Automatically transposes each observation's intercept distance forward to the timestamp of the final sight using precise WGS-84 rhumb line geometry.

Fix Type	Time Span	Motion Compensation Method	Primary Application
Short-Run Multi-Body Fix	Minutes *(e.g., 5–30 min twilight star round)*	Vincenta transposes intercepts forward to the final sight time using active logbook COG and SOG.	Eliminates time-skew errors during multi-star or Sun-Moon-Venus rounds.
Long-Run Sequential Track	Hours *(e.g., Morning to Afternoon Sun lines)*	Handled via **Sequential EP Tracking** *(Section 7.6)*, advancing DR from EP to EP.	Prevents error magnification across long time intervals.

Navigational Flexibility: Running Fixes Across Long Time Intervals

While sequential EP tracking (Section 7.6) is recommended for sights taken hours apart to prevent error magnification, navigators who prefer traditional running fixes can still perform them in Vincenta across any time interval. If you store a morning Sun sight and an afternoon Sun sight in the same folder and execute a Celestial Running Fix, Vincenta will advance the morning sight along your vessel's track over ground across the entire multi-hour interval and compute the classic running fix intersection.

8.2 Setting Up a Celestial Running Fix

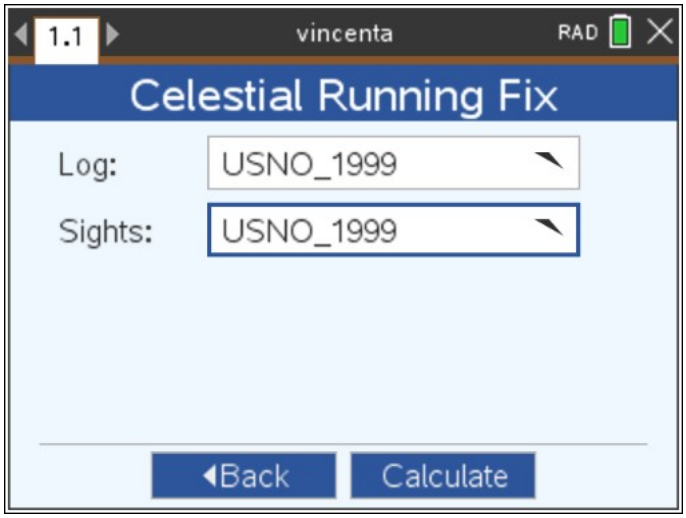
In Vincenta it is straightforward to set up and run a multi-sight celestial fix. To start with, navigate from the main menu as follows:

Main Menu ➔ 5: Navigation ➔ 1: Celestial Running Fix

Configuring Fix Parameters

1. **Log**: Highlight the **Log** drop-down menu and select the **Navigation Log** folder containing the record you want to use as reference DR. Vincenta uses the last entry of this log to establish your initial starting position, and course and speed over ground.

2. **Sights**: Highlight the **Sights** drop-down menu and select the **Sight Folder** containing the celestial observations you wish to combine into a fix (must contain two or more reduced sights). Vincenta will work to combine all the sights in the folder.
3. Press **[Calculate]** or key **[C]** to run the fix engine.



***Celestial Running Fix**. The setup screen is straightforward.*

8.3 Operational Logic: The USNO Iterative Least-Squares Engine

When you trigger a fix calculation, Vincenta processes your sights using the official **U.S. Naval Observatory (USNO)** multi-body position fix algorithm.

How the USNO Algorithm Operates

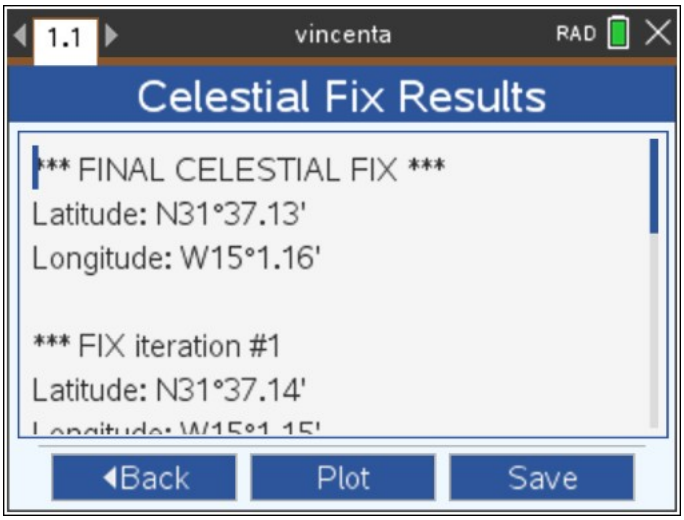
1. **Simultaneous Processing**: Rather than calculating arbitrary pairs of sights, the USNO algorithm evaluates **all selected sights simultaneously** (3, 4, 5 or more sights).
2. **Initial Intercept Evaluation**: Starting at your logged Dead Reckoning (DR) position, the algorithm calculates the intercept distance and azimuth for every sight in the folder.
3. **Iterative Position Shifting**:
    - If observation errors cause the LOPs to form a small triangle ("cocked hat") rather than intersecting at an exact point, the algorithm calculates an optimal spatial shift.
    - It moves the estimated position toward the geometric centre of the lines of position.
    - It re-evaluates all intercepts from this new position and repeats the process.
4. **Convergence & Termination**: The algorithm uses the parameters set in User Settings. It continues shifting the position iteratively until the shift between steps is smaller than your

configured distance threshold **Fix Dist**, or until it reaches your maximum iteration limit **Max Fix Iter**.

Note: if there are only two sights in the selected sight folder, the method of fix calculation is not iterative, and the algorithm above does not apply. Vincenta will provide as fix solution the **intersection** of the two LOPs.

8.4 Interpreting Numerical Fix Results

Once the USNO algorithm completes its iterations, Vincenta opens the **Celestial Fix Results** screen.



***Celestial Running Fix results**. Full results are below.*

```
*** FINAL CELESTIAL FIX ***
Latitude: N31°37.13'
Longitude: W15°1.16'

*** FIX iteration #1
Latitude: N31°37.14'
Longitude: W15°1.15'
Range: 22.88NM
Bearing: 182.4°
*** FIX iteration #2
Latitude: N31°37.13'
Longitude: W15°1.16'
Range: 0.02NM
Bearing: 226.1°
*** Input DR data
Date: 1999-07-04
Time: 21:00:00
Course OG: 325°
Speed OG: 20NM
Latitude: N32°0.00'
Longitude: W15°0.00'
```

Reading the Numerical Summary Report

The summary report provides a step-by-step audit of the calculation:

1. Final Fix Coordinates

The final fix coordinates match those in the last iteration step, and are displayed at the top of the results:

- **Latitude**: Your true calculated fix latitude.
- **Longitude**: Your true calculated fix longitude.

2. Iteration History

Lists each step the algorithm performed to reach convergence:

- **Iteration Number**
- **Shifted Coordinates**: The updated Latitude and Longitude at that step.
- **Range Shift**: The distance in nautical miles the position moved during that step.
- **Bearing Shift**: The true direction of the position shift.

3. Input DR Reference Baseline

Summarises the starting Dead Reckoning position, date, time, vessel course, and speed imported from your logbook for verification.

Results Action Buttons

- **[Save]** (Shortcut **[S]**): Opens the folder selector to save this calculated `FIX` entry directly into a **Navigation Log** folder.
- **[Plot]** (Shortcut **[P]**): Opens the interactive **Multi-LOP & Uncertainty Ellipse Plot**.
- **[◀Back]** (Shortcut **[Esc]**): Returns to the setup screen. If the fix has not been saved, Vincenta prompts you to confirm before discarding data.
- **[C]**: Copies the complete text results report to the TI-Nspire™ clipboard.

8.5 Mastering the Interactive Multi-LOP & Uncertainty Ellipse Chart

To visually inspect your lines of position, review sight geometry, and evaluate position confidence, press **[Plot]** or key **[P]** on the results screen.

Visual Chart Elements & Legend

- **Fix Point**: Rendered as a **red circle with a solid central dot** at the centre of the chart.
- **Dead Reckoning Position (DR)**: Rendered as a **green circle** at your starting log position.
- **Lines of Position (LOPs)**: Rendered as **solid blue lines** representing the advanced lines of position for all observed celestial bodies.

- **Intercept Vector Lines**: Rendered as **solid red line segments** extending from the DR position along each body's azimuth toward its respective LOP. Intercepts are rendered when the mouse pointer is hovered on the respective LOP, and the numerical intercept and azimuth are displayed in the lower left corner of the screen.
- **95% Statistical Confidence Uncertainty Ellipse**: Rendered as a **dashed gold ellipse** surrounding the calculated Fix Point.



Celestial Running Fix plot screen. *In this instance, the plot is displaying the USNO 1999 benchmark worked example. Hovering the pointer over an LOP automatically highlights the position line, renders the associated intercept line, and displays the sight number, body name, intercept distance, and azimuth in the overlay panel.*

Interpreting the 95% Statistical Confidence Uncertainty Ellipse

In real-world navigation, no sextant observation is 100% perfect. Random human observation errors, ship motion, and minor environmental variations mean there is always a small degree of uncertainty surrounding a position fix.

Vincenta calculates a **95% Confidence Uncertainty Ellipse** based on the statistical residual variance across all your sights:

- **What it Represents**: The area enclosed by the ellipse represents the geographical region where your true vessel position lies with a **95% statistical probability**.
- **Evaluating Ellipse Shape**:
    - **Small, Circular Ellipse**: Indicates excellent sight geometry (bodies well-distributed around the horizon) and high observation consistency. Your fix is extremely reliable.
    - **Large, Elongated Ellipse**: Indicates weak geometry (sights observed from similar bearings) or a higher degree of random error in one sight. The long axis of the ellipse shows the direction of greatest position uncertainty.

Keypad Controls & Display Toggles

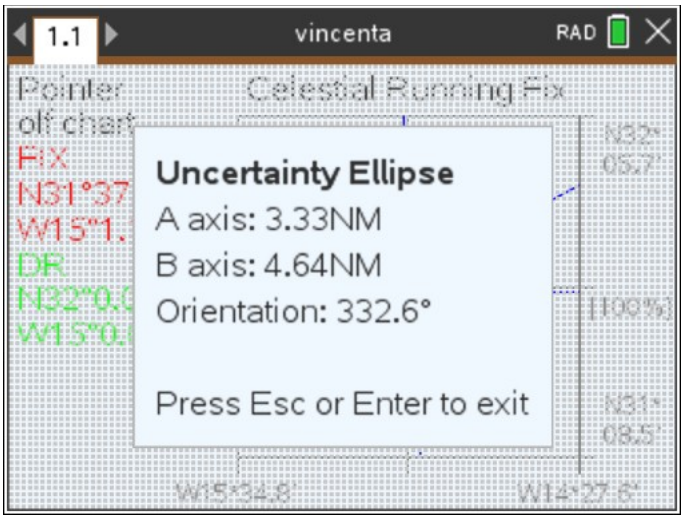
The Multi-LOP Chart offers an extensive suite of interactive controls and shortcuts:

Chart Navigation (Zooming & Panning)

- **[+] / [-]**: Zooms the chart in or out centred on the touchpad pointer.
- **[P] (Pan Mode)** or **Touchpad Drag**: Toggles pan mode. Click and drag the pointer across the screen to move the chart viewport.
- **[R]**: Resets zoom, panning, and view centre to default.

Feature Visibility Toggles

- **[F]**: Toggles the **FIX point** display ON or OFF.
- **[D]**: Toggles the **DR point** display ON or OFF.
- **[E]**: Displays the **Uncertainty Ellipse Data Dialogue**, showing:
  - **A Axis**: Length in nautical miles of the error axis aligned with the ellipse orientation.
  - **B Axis**: Length in nautical miles of the error axis orthogonal to the orientation.
  - **Orientation**: True compass bearing of the A axis in degrees.



Uncertainty ellipse parameters.

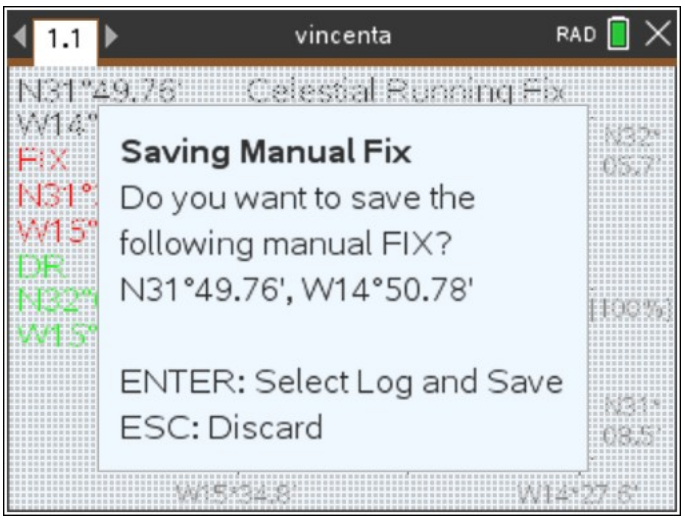
LOP Line Selection & Inspection

- **[1] through [9]**: Toggle highlighting of individual LOPs line on the chart in bold blue, and display the same details as if the LOP had been hovered with the pointer, that is, highlight the LOP, render the associated intercept line, and display the sight number, body name, intercept distance, and azimuth in the overlay panel.

- **Touchpad Hover**: Move the pointer near any LOP line to highlight it and display a pop-up box showing the body name, sight index, Intercept, and Azimuth. The intercept corresponding to that LOP is also drawn, as noted above.

Summary Dialogues & Manual Fix Export

- **[L]**: Displays the **LOP Summary List Dialogue**, showing intercept distances and azimuths for all sights.
- **[I]**: Displays the **Sight Summary List Dialogue**, showing body names, dates, and observation times.
- **[S] (Save Pointer Fix)**: If you wish to manually select a fix point on the chart (for example, at a specific LOP intersection), move the pointer to that location and press **[S]**. Vincenta prompts you to save those exact pointer coordinates as a `FIX` entry in your navigation log.



__Manual FIX__. This modal screen, called with key __[S]__, displays the coordinates of the current pointer position, and gives the option to save them as a manual FIX.

- **[H]**: Displays the complete chart help dialogue.
- **[Esc]**: Returns to the **Celestial Fix Results** screen.

Chapter 9: Direct Calculation Fixes Without Assumed Position

Every classic celestial sight reduction method—including the Marcq St. Hilaire intercept method used in Chapter 3—relies on a fundamental assumption: you must already know your position fairly well. Traditional methods use an **Assumed Position** or **Dead Reckoning (DR) Position** to calculate expected altitudes and draw linear Lines of Position (LOP).

However, what happens when all historical tracking data is lost? If a vessel suffers a total electrical blackout, if logbooks are lost, or if a navigator takes over a watch with zero prior tracking history, traditional sight reduction fails because the intercept distances become too huge for linear approximation.

Vincenta includes a dedicated **Direct Computation Fix** engine based on the method illustrated by **Stanley W. Gery's** in his peer-reviewed 3D spherical method (published in NAVIGATION, 1997). This tool calculates your position directly from two celestial sights **without requiring an assumed position or Dead Reckoning track**.

9.1 The "No-DR" Advantage: Survival & Emergency Navigation

The Problem with Traditional Reduction Without a DR

Traditional sight reduction approximates a small segment of a massive circle of equal altitude as a straight line on a chart. This approximation works brilliantly if your Assumed Position/Dead Reckoning is within 30-50 nautical miles of your true position.

If your DR position is wrong by hundreds of miles, the curvature of the Earth causes these straight lines to warp, producing massive errors or rendering the lines completely useless.

TRADITIONAL INTERCEPT METHOD *(Requires Accurate DR Position)*	**GERY DIRECT FIX METHOD** *(Zero DR Needed)*
Assumed DR Position	**3D Circle Intersection**
• Requires an assumed Dead Reckoning (DR) position. • Assumed position must be within ~20–30 NM of the true position. • Otherwise, LOP curvature distorts the linear intersection and requires iteration.	• Zero DR needed (ideal for survival / lost DR scenarios). • Directly computes the 3D spherical intersection of two circles of equal altitude. • Calculates true position directly on the globe without planar approximation. • Excellent for resetting or verifying the DR when position accuracy is in doubt.

Why resetting or validating an uncertain DR is a key operational use case:

1. **Accumulated DR Drift:** After prolonged periods of bad weather, strong unknown currents, or steering errors, the accumulated DR error can easily exceed 30–50 NM.
2. **Failure of Traditional Intercept:** When the DR error is large (`>30 NM`), the traditional Marcq St. Hilaire intercept method produces huge intercept distances where LOP curvature introduces significant distortion, requiring slow iterative loops to converge.
3. **Independent DR Reset:** The Stanley W. Gery Direct Fix computes the exact 3D spherical intersection of two circles of equal altitude without taking any DR input. This provides an independent, un-biased position that the navigator can immediately use to **reset or verify the DR** before running further sights or navigating near hazards.

The Stanley W. Gery Direct Fix Solution

The Direct Computation Fix engine solves the geometric intersection of two 3D circles of equal altitude directly on the terrestrial globe.

It provides an **independent navigation tool**:

- **Zero DR Required**: You do not need to enter a latitude, longitude, or previous log track.
- **Completely stand-alone**: It computes your position purely from the observed altitudes and exact timestamps of two celestial bodies.
- **Operational Requirement**: The two sights must be taken close enough together in time that vessel movement between observations is negligible. In most practical situation, this is rarely a problem. Otherwise, two navigators with one sextant each, and each taking a sight simultaneously of different bodies is always an excellent option.

9.2 Setting Up a Direct 2-Body Fix

To access the Direct Computation Fix setup screen, navigate from the main menu:

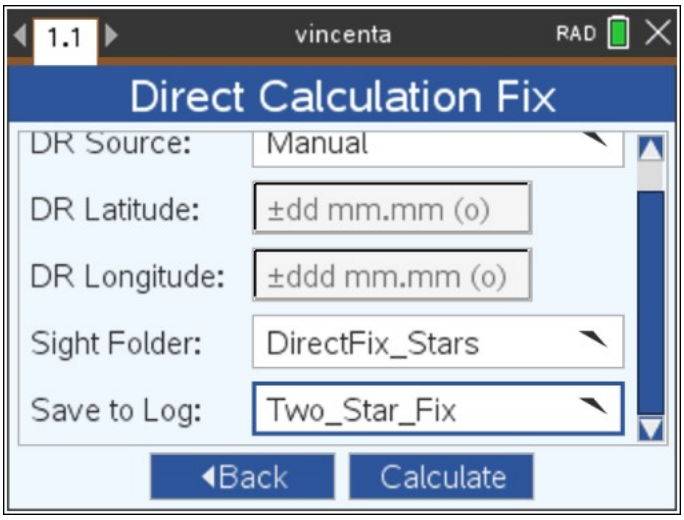
Main Menu ➔ 5: Navigation ➔ 2: Direct Calculation Fix

Step-by-Step Setup Guide

1. **DR Source**: Select `Manual` or choose a log folder.
2. **DR Latitude & DR Longitude (Optional)**:
    - **With DR**: If you have a rough estimate of your position, type it into these boxes (or import it from a log). Even a very crude guess helps Vincenta automatically highlight the correct solution.

- Pure Independent Mode (No DR): Leave both DR fields completely blank! Vincenta will process the sights in pure mathematical mode without using any position baseline.

3. **Sight Folder**: Highlight the drop-down menu and select the **Sight Folder** containing your two observed sights (e.g., a folder containing a Sun-Moon pair or a Jupiter-Venus pair). If the folder has multiple sights, the last two sights in the folder will be used for the calculations.



Direct Calculation Fix input screen. *All controls are shown in this screenshot.*

Operational Note: Preparing Sights for Direct Fix (The "Dummy DR" Workflow)

Because Vincenta is engineered for maximum speed and efficiency on the TI-Nspire™ handheld, the Direct Calculation Fix engine reuses the existing **Sight Reduction** screen and **Sight Folders** rather than forcing you to re-type instrument corrections (Height of Eye, Index Error, Temperature, Pressure) on a separate form.

When preparing your two observations in a survival or "lost DR" scenario:

1. **Enter the Two Sights Normally:** Reduce each of your two celestial observations on the **Sight Reduction** screen (**Main Menu ➔ 1: Sight Reduction**).
2. **Use Any Placeholder DR Position:** If your true position is unknown, simply enter **0°** Latitude and **0°** Longitude (or a crude guess) as the DR position during data entry.
3. **Ignore Initial Intercept Results:** The resulting Intercept (I) and Azimuth (Zn) displayed on the individual Sight Reduction Results screens can be completely ignored.

Why This Works:

The Direct Computation Fix engine extracts only the raw observation data—specifically the observed altitudes (Ho), declinations (Dec), and Greenwich Hour Angles (GHA)—and discards the initial intercept calculations.

Post-Fix Full-Circle Verification Workflow:
Once Vincenta solves the Direct Fix and writes the verified Latitude and Longitude as a new entry in your Navigation Log folder, you can perform an optional verification step:

- Return to your Sight Folder, load each of the two sights, and change the **DR Source** drop-down to point to the navigation log where you saved your new **Navigation Log entry**.
- Re-calculate both sights. Because the new DR position is derived from the true 3D intersection of those exact observations, both reduced sights will yield **zero or near-zero intercepts (I ≈ 0.00 NM)**, providing complete mathematical confirmation of your position!

4. **Save to Log**: Select the destination **Navigation Log** folder where you want the verified fix saved.

   Design Note

   Unlike other features in Vincenta—where folder selection occurs after viewing the final calculation results—the Direct Computation Fix requires selecting the target log folder upfront on the input screen.

   This approach is specifically designed for high-stress or emergency navigation scenarios (e.g., survival situations or lost DR), where rapid workflow is essential:

   1. **Streamlined Decision-Making:** Because the Direct Fix method solves the 3D spherical intersection of two circles of equal altitude, it produces up to four mathematical candidate solutions. The navigator's primary task on the selection screen (Section 9.3) is evaluating and choosing the correct candidate.
   2. **Immediate One-Click Commit:** By pre-specifying the target log folder on the input screen, Vincenta eliminates extra folder-selection prompts after the candidate is chosen. The moment you select the valid fix and confirm, Vincenta immediately writes the record to the log.

5. Press **[Calculate]** or key **[C]**.

9.3 Resolving the Four Candidate Solutions

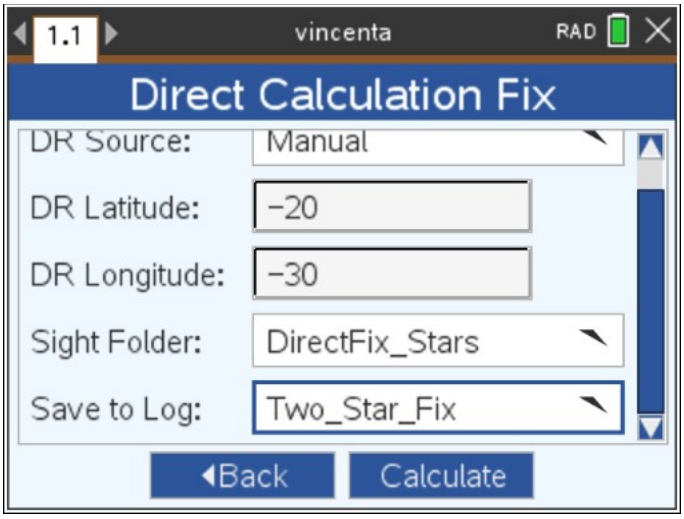
When you press **[Calculate]**, Vincenta solves the intersecting celestial vectors. Because two circles of equal altitude on a sphere intersect at two points, and each body can lie either East or West of the observer, the underlying geometry produces **four valid mathematical coordinate solutions**.

Vincenta opens the **Select Fix Solution**, presenting the candidate positions in a clear, selectable list.

The software uses two operational pathways to help you identify the single true position fix:

Method A: Resolving Solutions with an Approximate DR

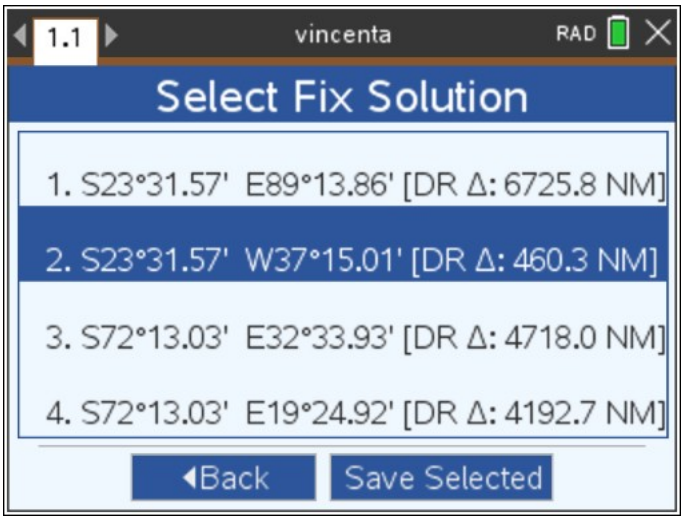
If you entered even a very rough estimate of your location in the setup screen, Vincenta calculates the distance (DR Δ) from your guess to each of the four mathematical candidates.



***Direct Calculation Fix**. In this instance, the user has specified a gross estimate of latitude and longitude.*

The list displays the candidates formatted with their offset distance, as shown in the screen below.

- **Automatic Highlighting**: Vincenta automatically places the selection bar on **Solution 1**—the candidate closest to your approximate position. In almost all cases, the false mathematical solutions lie thousands of miles away in different oceans or hemispheres.



***Direct Calculation Fix solution for Approximate DR**. The screen lists the four mathematical solution to the direct fix problem. Vincenta automatically selects the solution closest to the approximate position.*

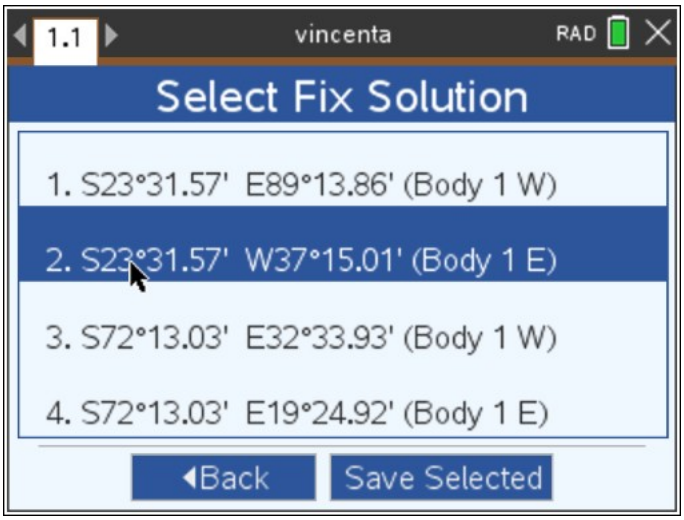
Method B: Resolving Solutions with Zero DR

If you left the DR fields completely blank, as in the first screen of this chapter, Vincenta presents four mathematical solutions as shown in the screen below. They are labelled by the cardinal direction of the first sight body (**Body 1**) of the last two sights in the folder selected in the input screen.

When navigating without a DR, you can easily identify the true fix using basic real-world observation knowledge:

1. **Compass Quadrant Verification**: Recall which direction you were facing when you observed the first body. In the example screen above, the navigator took a sight of body 1 due East. Solutions 1 and 3 (labelled `Body 1 W`) can be immediately eliminated.
2. **Gross Geographic Filtering**: The remaining two solutions (Solutions 2 and 4) will be separated by vast global distances—often placing one solution in your actual hemisphere or climate zone (e.g., the North Pacific) and the false twin in a completely different world region (e.g., the South Indian Ocean or Antarctica). In the example screen above, the correct solution is obviously 2.

Even a navigator lost at sea knows whether they are in temperate northern latitudes or the Antarctic, making it effortless to pick the correct true fix.



***Direct Calculation Fix solution for no-DR**. The screen lists the four mathematical solution to the direct fix problem. In this example, Body 1 was observed to the East, and the navigator knows the vessel is operating in the South Tropics rather than high southern latitudes. Solutions in the Antarctic or with Body 1 to the West are ruled out, making Solution 2 the correct choice.*

9.4 Saving and Logging the Verified Fix

Once you identify the correct true solution:

1. Use **[▲] / [▼] (Up / Down Arrows)** or the touchpad to highlight the correct coordinate solution in the list.
2. Press **[Save Selected]** (or press key **[S]** or **[Enter]**).
3. Vincenta writes a new **FIX** entry directly into your selected **Navigation Log** folder, recording the true Latitude, Longitude, Date, Time, and notes detailing the two bodies used for the direct fix.
4. A confirmation dialogue appears. Press **[Enter]** or **[Esc]** to return to the Direct Calculation Fix input screen.

Chapter 10: System Utility: Full System Backup & Restore via Clipboard

Updating software on an air-gapped handheld calculator traditionally posed a challenge: how to install a new software release (`vincenta_x_x_x.tns`) without losing your accumulated voyage records, custom sight folders, and vessel settings.

Vincenta solves this elegantly through its built-in **Clipboard Backup & Restore Engine**. Because the TI-Nspire™ operating system maintains a unified system clipboard across all open documents in memory, Vincenta can package your entire navigation database—including all sight folders, electronic logbooks, and user settings—into a single, high-density encrypted text string.

This enables seamless, 100% offline migration between software versions directly on your handheld in seconds, without requiring USB cables, desktop software, or internet connectivity.

10.1 Operational Setup

Accessing the Backup / Restore Utility

To open the Backup / Restore screen, navigate from the main menu: **Main Menu ➔ 6: Utilities ➔ 2: Backup / Restore**

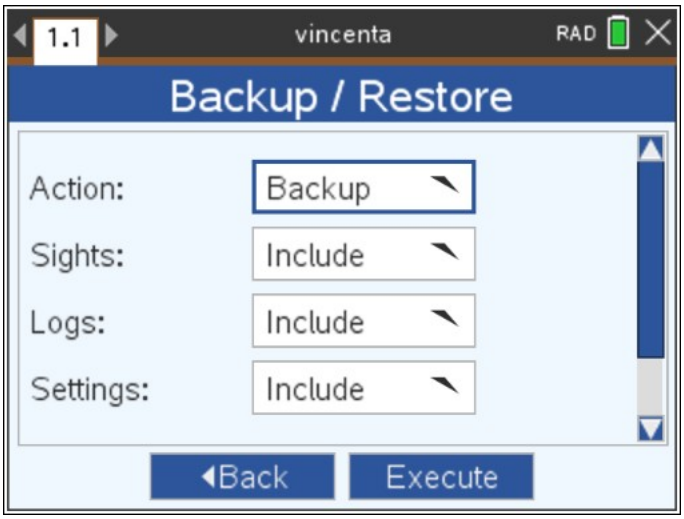
Configuring Backup & Restore Parameters

The Backup / Restore form contains four interactive selection controls:

1. **Action (Drop-down: Backup or Restore):**
    - **Backup:** Packages your active navigational data into a structured text string and copies it directly to the TI-Nspire™ system clipboard.
    - **Restore:** Reads the system clipboard, verifies the Vincenta backup header, and restores the packaged data into the active document.
2. **Sights (Drop-down: Include or Exclude):**
    - **Include:** Includes all custom Sight Folders and their contained sight reduction records in the backup/restore operation.
    - **Exclude:** Skips sight folders.
3. **Logs (Drop-down: Include or Exclude):**
    - **Include:** Includes all electronic Navigation Logbook folders and their contained DR, EP, and FIX entries.
    - **Exclude:** Skips log folders.
4. **Settings (Drop-down: Include or Exclude):**

- **Include:** Includes all custom vessel defaults (Height of Eye, Index Error, default coordinates, display preferences, and unit selections).
- **Exclude:** Retains existing settings.

Licence Safety: The device-specific activation key is permanently protected. Restoring data never alters or overwrites your calculator's licence activation status.



***Backup / Restore utility screen**. Allows navigators to package sight folders, electronic logbooks, and custom vessel settings into the system clipboard for seamless, 100% offline data migration between software releases.*

10.2 Step-by-Step Guide: Backing Up Your System Data

Use this procedure before installing a new Vincenta release:

1. Press **[Home]** on your handheld and open your `vincenta_x_x_x.tns` old release file.
2. Navigate to **Main Menu ➔ 6: Utilities ➔ 2: Backup / Restore**.
3. Set **Action** to **Backup**.
4. Ensure **Sights**, **Logs**, and **Settings** are set to **Include** (or select **Exclude** for any category you do not wish to back up).
5. Press **[Execute]** or key **[E]** (or **[C]**).
6. Vincenta packages your database and copies it to the system clipboard. A confirmation dialogue appears detailing the number of sight folders, log folders, and settings packaged.
7. Press **[Enter]** or **[Esc]** to dismiss the confirmation.



***Backup Complete confirmation modal**. Confirms that all selected sight folders, logbooks, and user settings have been packaged and copied to the system clipboard, with step-by-step instructions for restoring the data in a new software release.*

10.3 Step-by-Step Guide: Restoring Your System Data

Use this procedure after opening a fresh Vincenta release:

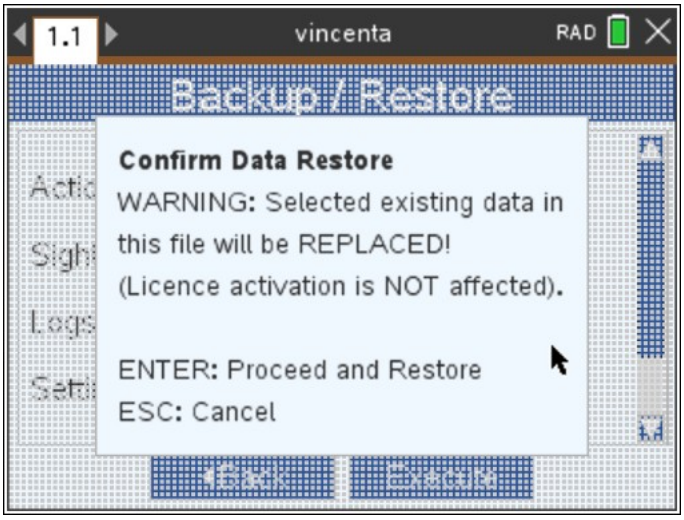
1. Press **[Home]** on your handheld and open your `vincenta_y_y_y.tns` new release file.
2. Navigate to **Main Menu ➔ 6: Utilities ➔ 2: Backup / Restore**.
3. Set **Action** to **Restore**. *(Note: If valid backup data is present in the clipboard, Vincenta automatically enables the relevant Include/Exclude drop downs based on what sections exist in the backup).*
4. Press **[Execute]** or key **[E]** (or **[C]**).
5. A confirmation dialogue appears warning that selected existing data in the active file will be replaced.
6. Press **[Enter]** to confirm. Vincenta unpacks the clipboard data, recreates all folders, and restores your settings.
7. A final confirmation dialogue confirms successful restoration.

Important Notes on Data Persistence (RAM vs. Flash ROM)

> **Operational Rule 1 (Flash ROM Commit):** Performing a Restore writes data directly to volatile working memory (RAM). To permanently save your restored sight folders,

logbooks, and settings to the calculator's non-volatile Flash ROM memory, press **[Ctrl] + [S]** on the TI-Nspire™ keypad before turning off the handheld.

Operational Rule 2 (Exiting & Quitting): When exiting the application, press **[Ctrl] + [W]** and select **Yes** when prompted to save changes to the document file.



***Confirm Data Restore modal dialogue**. Warns the navigator that selected active data in the file will be replaced by the clipboard backup before proceeding. Note that device licence activation is strictly preserved and unaffected.*

Form Controls & Keypad Shortcuts

- **[E] / [C] (Execute):** Triggers the backup or restore process immediately.
- **[T] (Top Field):** Jumps focus back to the top field (**Action**).
- **[H] (Help):** Displays an on-screen summary of keyboard shortcuts.
- **[Esc] (Back):** Returns to the Utilities submenu.

Chapter 11: Advanced Utilities: Sight Analysis

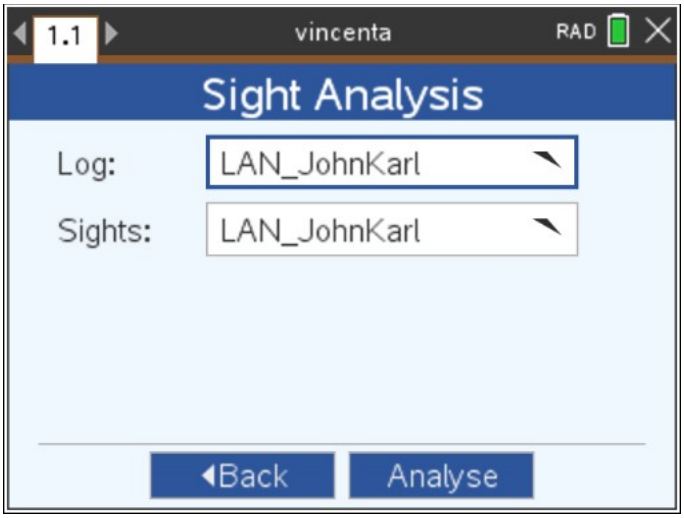
The **Sight Analysis Tool** is one of the signature flagship features of Vincenta. At sea, taking a single celestial sight can be challenging—a rolling deck, sea spray, or a mistimed stopwatch can introduce random errors into an observation.

To achieve maximum accuracy, experienced navigators observe a "round" of sights—taking 5 to 10 consecutive observations of the same body over a period of 15 to 60 minutes. Vincenta's Sight Analysis engine processes these rounds simultaneously, plotting the apparent altitudes against the curve that follows the shape formed by the calculated altitudes, allowing you to visually filter out bad observations, and mathematically or graphically determining your exact time of **Local Apparent Noon (LAN)** if the round of sights is relative to a LAN. Vincenta will also provide a FIX from a LAN estimate that you can save to a log folder.

11.1 Overview & Operational Setup

To launch the Sight Analysis tool from the main menu, navigate as follows:

Main Menu ➔ 6: Utilities ➔ 3: Sight Analysis



Sight Analysis screen. *Configured with the log and sight folders corresponding to the LAN example illustrated in John Karl's 'Celestial Navigation in the GPS Age'.*

Step-by-Step Analysis Setup

1. **Log**: Select the **Navigation Log** folder containing your vessel's active track record during the observation period. Vincenta uses the last entry of the selected log folder to transpose all sights in the round to a single, motion-compensated reference position.
2. **Sights**: Select the **Sight Folder** containing a series of 3 or more sights of the *same celestial body* (e.g., a folder containing 10 Sun sights taken around midday). Vincenta will use all the

sights in the folder. Vincenta will offer as selectable folders only those folders that contain sights from a single body.

3. Press **[Analyse]** or key **[A]**.

Vincenta transposes all observations to a common baseline, recalculates the related sight reductions, and opens the interactive **Sight Analysis Plot**.

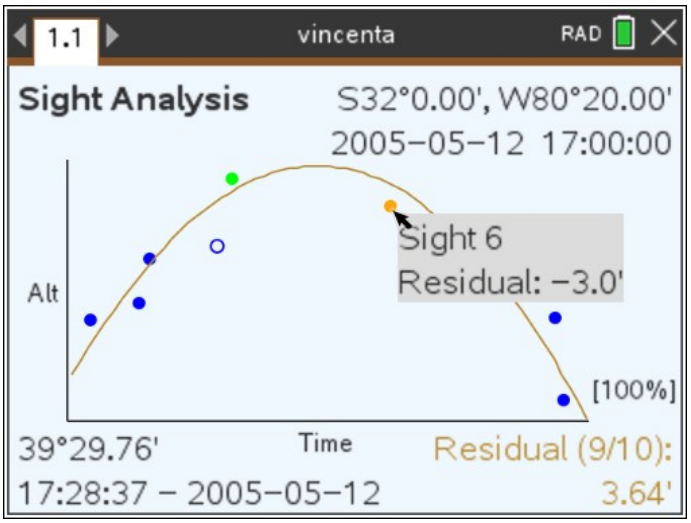
The following sections demonstrate the plot features using the Local Apparent Noon (LAN) example from John Karl's *Celestial Navigation in the GPS Age*.

11.2 Anatomy of the Interactive Sight Analysis Chart

The Sight Analysis Chart renders an interactive graphic plot displaying body apparent altitude along the vertical axis against time along the horizontal axis.

Visual Plot Elements

- **Data Point Dots (Observations)**:
  - **Solid Blue Circle**: Active, valid sight included in the regression fit.
  - **Hollow Blue Circle**: Excluded sight (an outlier filtered out of calculations by the user).
  - **Solid Orange Circle**: Currently hovered sight under the touchpad pointer.
  - **Hollow Orange Circle**: Currently hovered excluded sight under the touchpad pointer.
  - **Solid Green Circle**: Sight flagged/selected for saving to a new folder.
  - **Solid Red Circle**: Currently hovered sight that is also flagged for saving.
- **Gold Calculated Curve:** The smooth curve drawn through the data points represents the **True Astronomical Altitude Curve Hc(t)** of the celestial body over time. It is calculated directly from high-precision ephemerides and transposed sight reduction geometry relative to your vessel's reference Dead Reckoning baseline.
- **Gold LAN Peak Marker**: A bright gold triangle rendered at the apex of the parabolic curve indicating the exact moment of Local Apparent Noon.
- **Upper Right Summary**: Displays your vessel's Reference DR position and timestamp.
- **Lower Right Residual Summary:** Displays the number of active (included) sights versus total sights, and the root-mean-square (RMS) residual error in arcminutes: (e.g., `Residual P (6/7): 0.28'`).
- **Lower Left Pointer Status**: Displays real-time continuous altitude and time coordinates as you move the touchpad pointer across the chart. Nothing is displayed if the pointer is off the chart.



Sight Analysis plot of John Karl's LAN example. *The fourth sight has been excluded (hollow blue circle), the fifth sight is selected for saving (green dot), and the sixth sight is hovered under the pointer (amber dot), displaying its individual residual in a pop-up box. The RMS residual summary reflects the nine active sights (two are hidden under the pop up box), excluding the single filtered observation.*

11.3 The True Astronomical Curve & 2D Least-Squares Offset Solver

When analysing a round of sights, older navigation programs attempt to fit arbitrary mathematical polynomials (such as standard parabolas or straight regression lines) directly to noisy sextant readings. Because observations at sea inevitably contain random wave-motion and timing scatter, unconstrained polynomials distort the true curvature of the sky, leading to erroneous transit times and inaccurate position fixes.

Vincenta eliminates this vulnerability by employing a **Physical Curve-Shifting Engine** that separates known celestial mechanics from shipboard observational errors.

The Physical Curve-Shifting Method

Rather than guessing an arbitrary curve shape, Vincenta calculates the **True Astronomical Trajectory Hc(t)** of the observed body across the entire observation window. This trajectory is generated directly from high-precision ephemerides using your vessel's reference DR position and motion vectors:

1. **Exact Celestial Mechanics:** The curvature of the body's altitude path is physically determined by the Earth's diurnal rotation rate and the body's celestial declination. This shape is immutable and mathematically exact.
2. **The Two Navigational Errors:** In a series of sights, observations deviate from the theoretical curve due to two physical unknowns:

- **Vertical Offset (V_off — Altitude/Latitude Error):** An error in your vessel's assumed latitude (or an uncorrected sextant index error) shifts the entire altitude curve uniformly up or down.
- **Horizontal Offset (H_off — Time/Longitude Error):** An error in your vessel's assumed longitude or chronometer time shifts the altitude curve uniformly earlier or later in time.

Curvature-Aware Optimisation Modes

When you launch the analysis, Vincenta automatically evaluates the observation geometry and solves for the optimal offset vector:

1. **Meridian Passage (LAN Mode):**
    - If your sight series contains a transit peak (observations taken before and after Local Apparent Noon), Vincenta identifies the summit of the solar arc.
    - The solver executes a **2-dimensional least-squares optimisation**, simultaneously determining the optimal horizontal time shift (H_off, within ±15 minutes) and vertical altitude shift (V_off) that minimises root-mean-square (RMS) residuals across all active sights.
    - This solves directly for both true Latitude and true Longitude at transit.
2. **Single-Slope (Off-Meridian Mode):**
    - If your sight round represents morning or afternoon sights taken on a continuous upward or downward slope, attempting to solve for horizontal time shift along a near-linear curve introduces mathematical rank deficiency (collinear indeterminacy).
    - Vincenta automatically locks the horizontal shift to zero (H_off=0) and solves strictly for **vertical altitude offset (V_off)**.
    - This provides an exceptionally stable, noise-resistant alignment that accurately filters bad sights without introducing artificial time distortion.

11.4 Exhaustive Operational Control Scheme

The Sight Analysis Plot provides a complete suite of interactive tools operated entirely through the TI-Nspire™ keypad and touchpad:

1. Inspecting & Reviewing Individual Sights

- **Hovering**: Move the touchpad pointer near any data point dot. A high-contrast pop-up box appears displaying:
    - Sight Index Number (e.g., `Sight 6`).
    - Residual Error in arcminutes (e.g., `Residual: -3.5'`).

    - Status flags (e.g., `(excluded)` or `(selected for saving)`).
- **View Full Original Reduction**: Highlight any sight dot and press key **[V]**. Vincenta opens a dedicated text window displaying the full, unabridged sight reduction details for that specific observation.
- **View Reference DR Record**: Press key **[D]** to open a text window showing full details of the reference Navigation Log record used for the analysis.

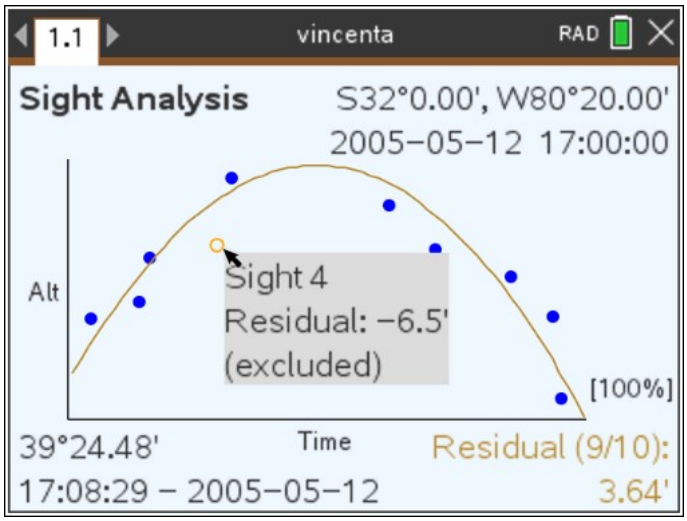
2. Zooming & Panning the Chart

- **Zooming**: Press **[+]** to zoom in on a cluster of points; press **[-]** to zoom out. Zooming is centred on the pointer position.
- **Panning**: Press **[P]** or click and drag the touchpad to move the chart viewport in any direction.
- **Resetting View**: Press key **[R]** to reset zoom, panning, curve shifts, and sight exclusions back to initial state.

3. Filtering Outlier Sights (Point Exclusion)

If an observation was affected by a bad wave or a mistimed stopwatch, it will appear visibly offset from the main calculated line:

1. Move the touchpad pointer over the anomalous sight dot.
2. Press key **[E]** (or click the touchpad centre key).
3. The dot instantly transforms into a **hollow circle**, indicating it has been excluded from the mathematical regression.
4. Vincenta **dynamically re-calculates the fit curve and residual error in real time**, redrawing the fit line through the remaining valid sights!
5. Pressing **[E]** (or clicking the touchpad centre key) again on a hollow dot re-includes it in the analysis.



***Excluded Sight hovered**. The excluded site, a hollow circle, turns orange from blue, and its exclusion flag is displayed in the pop-up box.*

4. Manual Curve Shift & Re-Fit

- **Vertical Curve Adjustment:** Press **[▲] / [▼]** (Up / Down Arrows) to shift the theoretical curve vertically up or down in precise 0.1' altitude steps.
- **Horizontal Time Adjustment:** Press **[◄] / [►]** (Left / Right Arrows) to shift the theoretical curve horizontally left or right in 6-second (0.1-minute) time steps.
- **Recompute Optimal Fit:** If you have manually shifted the curve and wish to return to the mathematically perfect least-squares alignment across all active sights, press key **[C]**.

5. Generating Synthetic Sights ([X] Key)

The Sight Analysis engine allows you to synthesise an ideal, noise-filtered observation from your sight round to use in subsequent multi-body running fixes:

1. Glide the touchpad pointer over the chart until the pointer time and altitude coordinates align with any desired point along the fitted theoretical curve.
2. Press key **[X]**.
3. Vincenta opens the **Synthetic Sight** confirmation dialogue, showing:
    - Body name and limb contact (Centre): Body name with Centre limb contact.
    - Exact timestamp (UT) at the cursor: Time corresponding to the cursor position on the plot.
    - Target Observed Altitude (Ho): Filtered altitude derived from the curve and transposed for vessel motion.

- Computed raw Sextant Altitude (Hs): Back-calculated with zero index error (IE = 0') and zero height of eye (HoE = 0 m), allowing direct comparison.
- Advanced Dead Reckoning position: Projected along your vessel's log track (Course and Speed Over Ground) to the exact cursor timestamp.
- Resulting Intercept: Distance and direction toward (T) or away from (A) the geographic position (e.g., 6.00nM (A)), formatted to the decimal precision set in User Settings.

4. Press **[Enter]** to select a destination sight folder. Once saved, Vincenta confirms the entry with a summary dialogue displaying the destination folder, timestamp, computed Hs, and the matching intercept.

This synthesised sight inherits all environmental parameters and provides a verified, outlier-free observation for your navigational fix calculations.

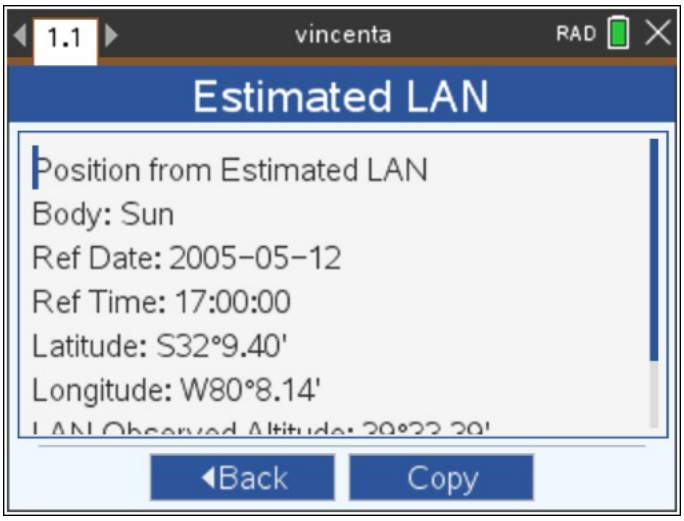
6. Target Saving: Building Clean Sight Folders

After filtering out anomalous observations, save the highest-quality sights to a clean folder:

1. Hover the touchpad pointer over an active sight dot and press key **[S]**. The dot turns solid green, indicating it is flagged for saving.
2. Repeat for all sights you wish to archive.
3. Press key **[O]**.
4. Select a destination Sight Folder from the drop-down list and press **[Enter]**. Vincenta writes all flagged sights into that folder.

7. Determining & Saving Local Apparent Noon (LAN) Fixes

- **View Calculated LAN Details:** Press key **[L]**. If your sight round contains a transit peak, Vincenta calculates the exact vertex of the curve and displays the calculated LAN Universal Time, maximum observed altitude (Ho), and true Latitude/Longitude coordinates. Press **[Back]** to automatically select a Navigation Log folder and save the resulting FIX.
- **Hovered Pointer LAN Fix:** Place the touchpad pointer on any point along the curve where you judge transit occurred and press key **[A]**. Vincenta solves for Latitude and Longitude based on that specific pointer coordinate and opens the log selection dialogue to save the record.



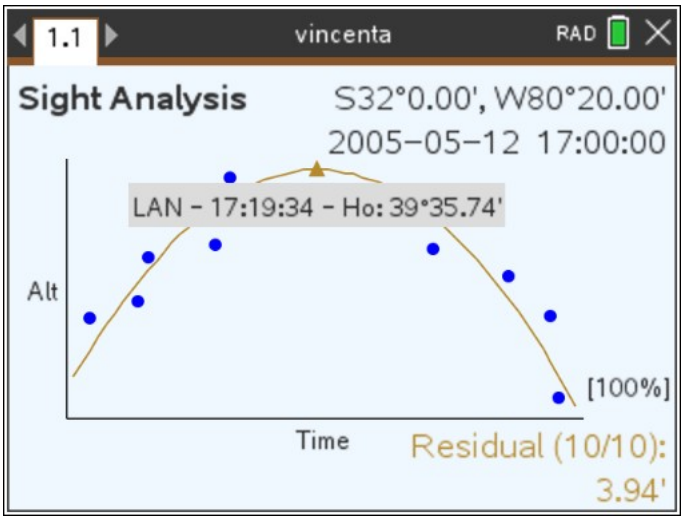
Estimated LAN Fix result screen. *Pressing key* ***[L]*** *calculates and displays the LAN parameters derived from the parabolic curve fit. Upon pressing the* ***[Back]*** *button, the user is automatically prompted to select a Navigation Log folder to save the resulting FIX.*



Touchpad Hovered LAN result screen. *Pressing key* ***[A]*** *calculates and displays the fix parameters corresponding to the pointer's position on the plot. Upon pressing the* ***[Back]*** *button, the user is automatically prompted to select a Navigation Log folder to save the resulting FIX.*

8. Display Toggles & Quick Help

- **Toggle Curve Visibility:** Press key **[Q]** to hide or show the theoretical Hc(t) curve.
- **Toggle LAN Peak Marker:** Press key **[F]** to display or hide the gold peak triangle indicating the vertex of Local Apparent Noon (active during LAN rounds).



***Local Apparent Noon (LAN) marker**. Pressing key **[F]** toggles the display of the Vincenta calculated LAN marker, indicating time and observed altitude at LAN relative to the reference DR.*

- **Toggle Hover Info Box:** Press key **[I]** to show or hide the on-screen hover data box.
- **Short Help Dialogue:** Press key **[H]** for a concise on-screen summary of keypad shortcuts.
- **Detailed Mathematical Guide:** Press key **[M]** to open a comprehensive full-screen reference document detailing the analytical and mathematical principles of the Sight Analysis engine.
- **Exit:** Press **[Esc]** to return to the Sight Analysis setup screen.

Chapter 12: Advanced Utilities: Lunar Distances Using the Wendel Brunner Method

For over two centuries, determining longitude at sea without a reliable clock was the greatest challenge in marine navigation. Before the invention of rugged sea-going chronometers, navigators relied on **Lunar Distances**—using the Moon as a celestial clock face and the surrounding celestial bodies as hour marks.

Vincenta includes a dedicated **Lunar Distance Reduction** tool based on the modern algorithm described by Wendel Brunner (Longitude by the Method of Lunar Distance, 2005) and further analysed by Eric Romelczyk (GMT and Longitude by Lunar Distance: Two Methods Compared From a Practitioner's Point of View, 2019). This feature enables navigators to measure the angular distance between the Moon and another celestial body to determine exact Universal Time (UT), allowing them to correct both their vessel's chronometer and longitude.

12.1 Real-World Context & The Wendel Brunner Method

Historical Context: The Celestial Clock

The Moon orbits Earth at an average speed of approximately 0.55” of arc per second of time (13.2º per day). Because the Moon moves relative to the background stars faster than any other celestial object, the angular distance between the Moon and a nearby star or planet changes continuously.

By measuring this **Lunar Distance** with a sextant, a navigator can deduce the exact Universal Time (UT) at Greenwich, regardless of how badly their shipboard watch has drifted.

The Brunner Method vs. Classical Manual Clearing

Historically, reducing a lunar distance required complex manual "clearing" formulas (such as the Dunthorne, Young, or Bowditch methods) to correct the observed distance for atmospheric refraction and parallax. Classical methods required three navigators taking simultaneous sextant observations: one measuring the lunar distance, a second measuring the Moon's altitude, and a third measuring the star's altitude.

Instead of requiring simultaneous altitude sights or manual table clearing, Brunner's method uses high-precision ephemeris algorithms to compute the topocentric positions of both bodies at an estimated watch time. The software then **iteratively adjusts the time step-by-step** until the calculated lunar distance matches the observed distance, solving for the exact time error.

Operational Note: Recording the Time Correction

The primary output of the Lunar Distance tool is a **Time Correction** (showing whether your watch or chronometer is **FAST** or **SLOW**) and a **Corrected Longitude**.

Important Operating Rule: **Vincenta does not save the time correction into system memory.** Navigators are expected to manually note the time correction on paper or on their watch bezel, and

adjust their chronometer log accordingly. However, it is important to also note that lunars time correction estimates are highly dependent on observation accuracy.

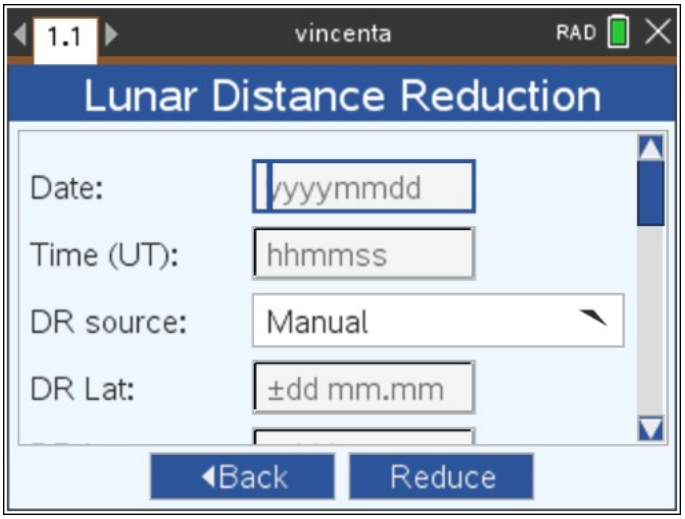
12.2 Step-by-Step Guide: Entering a Lunar Distance Observation

To open the Lunar Distance tool from the main menu, navigate as follows:

Main Menu ➔ 6: Utilities ➔ 4: Lunars by Distance

Step 1: Enter Time & Assumed DR Position

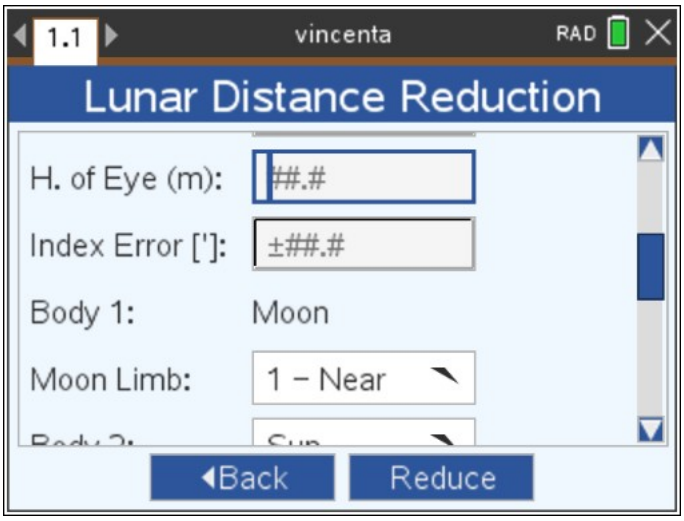
1. **Date**: Enter the observation date (`YYYYMMDD`).
2. **Time (UT)**: Enter the estimated Universal Time read off your watch (`HHMMSS`).
3. **DR Source**: Select `Manual` or choose a saved **Navigation Log** folder.
4. **DR Lat & DR Lon**: If in manual mode, enter your estimated Dead Reckoning position.



***Lunar Distance Reduction screen**. Date, Time, and DR part of the input screen.*

Step 2: Enter Instrument Corrections & Moon Limb

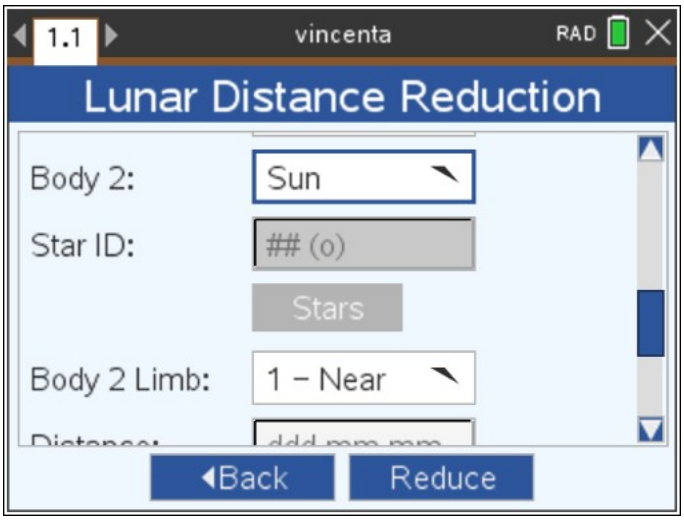
1. **H. of Eye**: Enter your bridge height above sea level (m or ft).
2. **Index Error [']**: Enter your sextant's index error in arcminutes (').
3. **Moon Limb**: Select which edge of the Moon was observed:
    - `1 – Near`: The limb of the Moon closest to the second body.
    - `2 – Centre`: The centre of the Moon's disc.
    - `3 – Far`: The limb of the Moon furthest from the second body.



***Lunar Distance Reduction screen**. Height of Eye, Index Error, and Moon Limb section of the input screen.*

Step 3: Select Body 2 & Limb

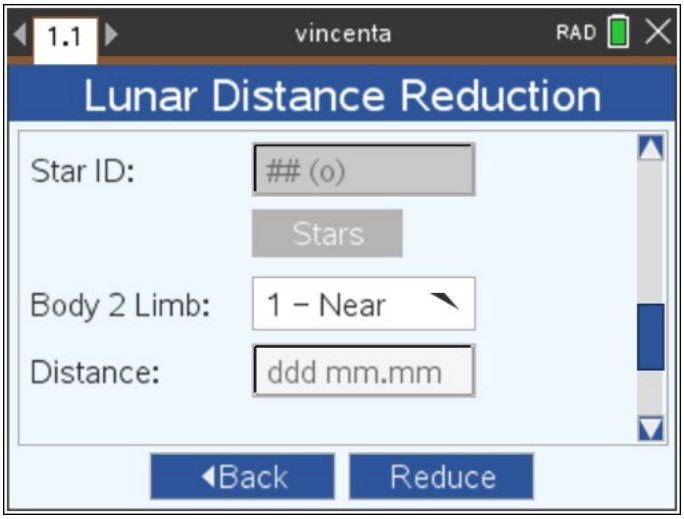
1. **Body 2**: Select the second observed body: `Sun`, `Venus`, `Mars`, `Jupiter`, `Saturn`, or `Star`.
2. **Selecting a Star**: If `Star` is selected, press **[Enter]** on the **[Stars]** button to pick a star from the catalogue, or type its index number into **Star ID**.
3. **Body 2 Limb** (Sun only): If observing the Sun, select `1 – Near`, `2 – Centre`, or `3 – Far`. For stars and planets, this setting is not made available.



Lunar Distance Reduction screen. *Body 2 selection and Limb section of the input screen.*

Step 4: Enter Observed Lunar Distance

- **Distance**: Type the measured sextant angle between the Moon's limb and Body 2 in degrees and decimal minutes (`DD MM.M`, e.g., `48 22.4` for 48º 22.4').



Lunar Distance Reduction screen. *Lunar Distance section of the input screen.*

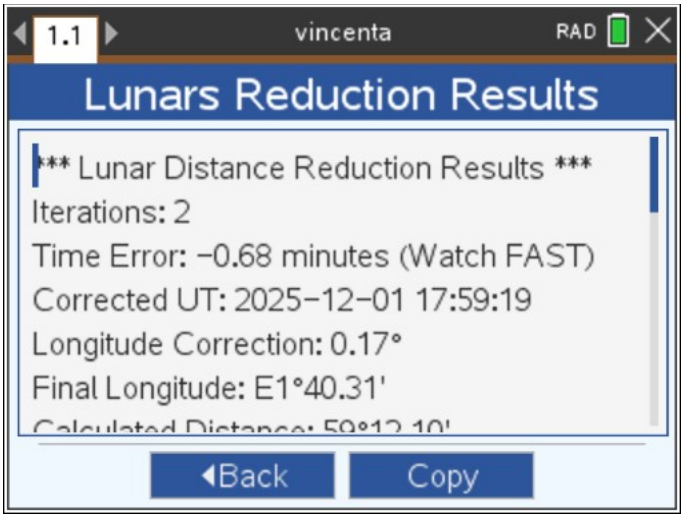
Form Command Shortcuts

- **[Reduce]** (Shortcut **[R]**): Triggers the Brunner iterative reduction engine.
- **[B] (Blank Field)** / **[W] (Wipe All)**: Clears the focused field or all fields.
- **[D] (Default)** / **[U] (User All)**: Pre-fills saved user defaults.
- **[T]**: Jumps focus back to the top field.

- **[H]**: Displays a help pop-up.

12.3 Interpreting Lunar Reduction Results

When you press **[Reduce]** or key **[R]**, Vincenta runs the Brunner iterative clearing loop and opens a text results window.



***Lunars Reduction Results**. Watch Time Error and Longitude Correction. Full results are below.*

```
*** Lunar Distance Reduction Results ***
Iterations: 2
Time Error: 0m 41s (Watch FAST)
Corrected UT: 2025-12-01 17:59:19
Longitude Correction: 0.17°
Final Longitude: E1°40.31'
Calculated Distance: 59°12.10'
Observed Distance: 59° 12.1'

*** Input Data ***
Date: 2025-12-01
UT: 18:00:00
DR Position: N51°52.80', E1°30.10'
Observed Distance: 59° 12.1'
Index Error: 0.0'
Height of Eye: 3.0m
Moon Limb: Near
Body 2: Capella

*** Notes ***
Typical lunar rate: 106-136 sec time per
1' arc.
±0.5' distance ≈ ±60 sec time ≈ ±15'
longitude.
Accuracy depends on precise measurement
and proper corrections.
```

Reading the Outputs

1. Watch Time Error & Corrected UT

- **Time Error**: Displays the calculated error of your watch in minutes and seconds, clearly labelled as `(Watch SLOW)` or `(Watch FAST)` (e.g., `Time Error: 0m 41s (Watch FAST)`). Note that the sign is omitted from the correction, as `SLOW` or `FAST`

alone determines if the error needs to be added or subtracted from the current watch time, avoiding errors.

- **Corrected UT**: The true, precise Universal Time at Greenwich corresponding to the exact moment of your observation.

2. Longitude Correction & Final Longitude

- **Longitude Correction**: The change in longitude resulting from the time correction (e.g., `Longitude Correction: 0.17°`).
- **Final Longitude**: Your corrected longitude based on the cleared lunar distance.

3. Convergence Audit

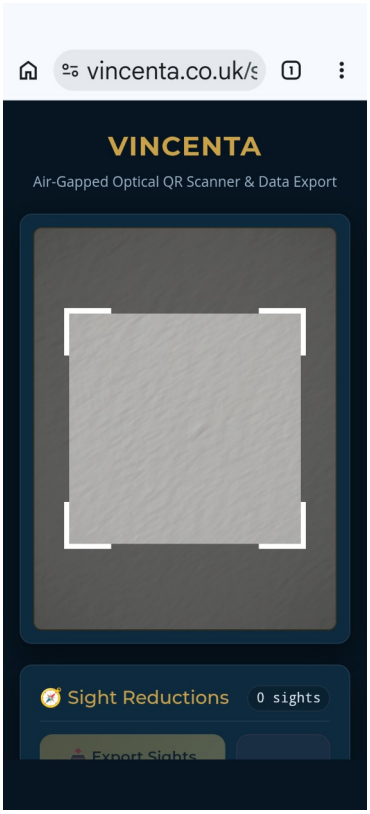
- **Iterations**: The number of iterative steps required to achieve mathematical convergence (typically 2 to 4 iterations).
- **Calculated/Observed Distance**: Displays both the cleared observed distance and the theoretical distance at the corrected UT, confirming convergence of the iterative algorithm.

Chapter 13: Optical QR Scanner App

13.1 Overview & Air-Gapped Data Transfer

Vincenta is designed to operate in strict air-gapped environments without relying on USB cables, Wi-Fi, Bluetooth, or active internet connections. To facilitate data transfer from the TI-Nspire™ CX calculator to external logbooks, mobile devices, or computer spreadsheets, Vincenta generates high-density optical QR codes on the calculator screen.

The **Vincenta Web Scanner** (`https://www.vincenta.co.uk/scanner.html`) is a Progressive Web App (PWA) that uses your mobile device or tablet camera to scan these optical QR codes directly off the calculator screen.



***Vincenta QR code scanner app**. Here it is accessed via Google Chrome.*

Key Features

- **100% Air-Gapped & Offline:** Operates entirely locally inside your browser without sending data to remote servers.
- **Instant Data Parsing:** Automatically decodes compact astronomical sight reductions and navigation log entries.

- **Full CSV Export:** Compiles scanned sights and log entries into standard CSV files compatible with Excel, Apple Numbers, and LibreOffice Calc.
- **Built-in Inspection & Printing:** Allows viewing detailed sight/log breakdowns and generating printable PDFs.

13.2 Installing the Scanner App (PWA Setup)

Although hosted on the web, the Scanner App can be permanently installed onto your smartphone or tablet as a stand-alone Progressive Web App (PWA). Once installed, it operates fully offline at sea.

Installation Instructions

Google Chrome (Android & Desktop)

1. Open Chrome and navigate to the Scanner page (`https://www.vincenta.co.uk/scanner.html`).
2. Tap the browser menu (⋮ or **share** icon).
3. Select **Add to Home screen** or **Install app**.
4. Confirm installation. The Vincenta Scanner icon will appear on your device's home screen.

Safari (iOS / iPadOS)

1. Open Safari and navigate to `https://www.vincenta.co.uk/scanner.html`.
2. Tap the **Share** button (the square with an arrow pointing up).
3. Scroll down and select **Add to Home Screen**.
4. Tap **Add** in the top-right corner.

> **Important Note for Offline Operation:**
> The Scanner App must be opened **once while connected to the internet** after installation so the browser can cache the application files and register the Service Worker. After this initial load, the app and camera scanner will function completely offline.

13.3 Generating QR Codes on the TI-Nspire™ CX

Vincenta provides built-in QR generation tools for both Sight Reductions and Navigation Logbook entries. While the full procedures for creating, managing, and displaying these QR codes are covered in detail in the **Sight Folders** and **Log Folders** chapters, they are summarised below for completeness.

Exporting a Sight Reduction

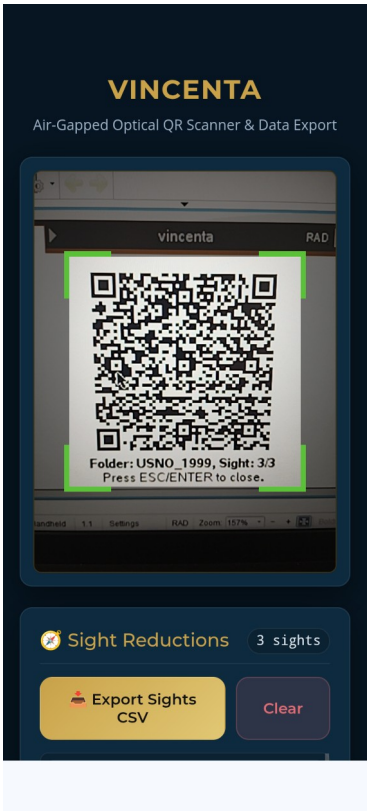
1. Navigate to the **Sight Reduction** or **Sight Folder** menu.
2. Select the desired sight entry.
3. Choose **Export QR Code** (or press the dedicated shortcut key).
4. A high-density QR code representing the complete sight reduction dataset will display on the calculator screen.

Exporting a Logbook Entry

1. Navigate to the **Log Folders** or **Dead Reckoning / Fix** menu.
2. Select the log entry you wish to transfer.
3. Choose **Export QR Code**.
4. A QR code representing the logbook entry will display on screen.

13.4 Scanning Operations

1. Launch the **Vincenta Scanner** app from your device's home screen.
2. If prompted, grant **Camera Access** to the application.
3. Point your device camera at the TI-Nspire™ CX screen:
    - Position the calculator screen within the target viewport box on your mobile screen.
    - Ensure adequate screen brightness on the calculator. Avoid direct glare or reflections on the screen glass.
4. Upon detection, the app will emit an audible/visual confirmation and automatically categorise the record into **Sight Reductions** or **Navigation Logbook**.
5. If continuous or batch scanning mode is active, the scanner will continuously process multiple QR codes in succession as the calculator cycles through records on the screen, adding each new entry to the list automatically without requiring you to restart the camera.



***Vincenta QR code scanner app**. Here it is accessed via the stand-alone Progressive Web App, installed on an Android mobile phone. Three sights have been scanned, and they are ready for export to a `.csv` file*

13.5 Data Review & Inspection

Scanned records are temporarily held in local browser memory and organised into two interactive lists:

Sights List

- Displays the celestial body name (e.g., *Sun*, *Moon*, *Jupiter*, *Arcturus*), observation date/time (UT), and sight folder tag.
- Tapping 👁 **View** opens a detailed report containing:
  - **General Data:** Folder, Body ID, UT Date/Time, Delta T.
  - **Position & Environment:** Assumed/DR Position, Index Error, Height of Eye, Temperature, and Pressure.
  - **Reduction Results:** Sextant Altitude (Hs), Observed Altitude (Ho), Calculated Altitude (Hc), Intercept, Azimuth, GHA, and Declination (Dec).

Logbook List

- Displays record type (e.g., *DR*, *EP*, *Fix*), UT Date/Time, and position.
- Tapping 👁️ **View** opens a detailed breakdown including:
  - **General Data:** Record Type, Date/Time (UT), Latitude, and Longitude.
  - **Vector Data:** Course, Distance, Speed, Leeway, Current/Tide Direction & Drift, Course Over Ground (COG), Distance Over Ground (DOG), and Speed Over Ground (SOG).

Printing and PDF Export

From the detailed view pop-up, tap 🖨️ **Print / Save as PDF** to generate a formatted navigational record for paper archives or PDF storage.

13.6 Exporting CSV Files

Once all observations or log entries for a passage or watch have been scanned, they can be exported as standard `.csv` files for archival or further processing.

1. Tap 📩 **Export Sights CSV** or 📩 **Export Logs CSV**.
2. A `.csv` file will be generated and saved to your device's downloads folder:
   - `vincenta_sights_export.csv`
   - `vincenta_logs_export.csv`
3. These files can be imported directly into spreadsheet applications (Microsoft Excel, Apple Numbers, LibreOffice Calc) or secondary navigation software.

Clearing Local Data

Tap **Clear** under either section to empty the current batch of scanned entries after exporting.

13.7 Troubleshooting & Camera Permissions

Camera Not Launching / Black Screen

- **Permissions Reset After Clearing Browser Data:**
  Clearing Chrome site settings or browser history revokes camera permissions. Because mobile browsers block permission prompts while offline, connect to the internet **once** and tap **Enable Camera**, or manually enable camera access via:
  `Chrome Settings` ➔ `Site Settings` ➔ `Camera` ➔ `Allow`.

- **Reflection & Glare:**
  If the QR code does not scan immediately, adjust the angle of the calculator screen to eliminate overhead cabin light reflections.
- **Screen Brightness:**
  Increase the TI-Nspire™ CX backlight brightness by pressing `[Ctrl]` + `[+]`.

Chapter 14: Customer Support, Bug Reporting & Continuous Development

Welcome to the Vincenta Community. At Vincenta, we are dedicated to providing sailors with the most reliable, accurate, and practical electronic celestial navigation suite available for handheld platforms. Celestial navigation is both a timeless art and an exacting science, and your real-world experience at sea is invaluable to the ongoing refinement of our software.

14.1 Getting Help & Technical Support

If you have questions regarding installation, licence activation, feature operation, or celestial navigation workflows, our dedicated support team is ready to assist you.

- Official Support Email: support@vincenta.co.uk
- Official Website: https://www.vincenta.co.uk

When contacting support regarding a specific calculation or sight reduction query, please include details of the body observed, date, time (UT), dead reckoning position, and sextant altitude so we can assist you with benchmark verification.

14.2 Reporting Bugs & Unexpected Behaviour

Although every release of Vincenta undergoes rigorous mathematical benchmarking and operational testing, software operating across diverse maritime observation scenarios may occasionally exhibit unexpected behaviour.

If you encounter a calculation anomaly, screen display issue, or unexpected system message:

1. Note the specific screen, data inputs, and error message (if any).
2. Email the details to support@vincenta.co.uk with the subject line "Bug Report".
3. Every reported issue is investigated promptly, and verified corrections are incorporated into free maintenance updates.

14.3 Requesting New Features & Future Improvements

Vincenta is an actively evolving platform. We warmly encourage you to share your ideas, feature requests, and suggestions for future releases. Whether you would like to see an additional astronomical calculation, an enhanced graphical display, or a workflow refinement, your feedback directly shapes our development roadmap.

Every effort is made to correct reported issues promptly and incorporate user-requested enhancements into future updates, ensuring Vincenta remains the premier independent handheld celestial navigation aid for sailors worldwide.

Appendix A: Quick-Reference Master Matrix

This master matrix provides a complete, unified reference of every operational screen in Vincenta, its primary function, and its full set of physical keypad controls, hotkeys, and touchpad interactions.

Screen / Tool Name	**Visual Pathway / Access**	**Primary Navigational Function**	**Physical Keypad Controls, Hotkeys & Touchpad Actions**
Main Menu	**Home ➔ My Documents ➔ Vincenta_x_x_x.tns**	Central directory linking to all 7 submenus.	• **[1]-[7]**: Direct jump to numbered submenus. • **[▲]/[▼]**: Highlight menu option. • **[Enter]** / **Touchpad Click**: Select highlighted option.
User Settings	**Main Menu ➔ 6: Utilities ➔ 1: Settings**	Configures global units (m/ft, ºC/ºF), HE, IE, DR defaults, tolerances, and themes.	• **[Tab]** / **[▼]**: Move focus to next setting. • **[Shift]+[Tab]** / **[▲]**: Move focus backward. • **[►]** / **Touchpad Click**: Expand drop-down menu. • **[T]**: Jump focus to top field (**H. of Eye Unit**). • **[S]**: Save all settings to memory. • **[R]**: Reset all settings to factory defaults. • **[Esc]**: Exit screen (triggers unsaved warning if modified).
Sight Reduction Entry	**Main Menu ➔ 1: Sight Reduction**	Primary data entry form for single-body celestial observations (Hs, time, DR, HE, IE, limb).	• **[Tab]** / **[Shift]+[Tab]** / **[▲]/[▼]**: Field navigation. • **[S]**, **[L]**, **[V]**, **[M]**, **[J]**, **[R]**, **[E]**: Direct body selection hotkeys (Sun, Moon, Venus, Mars, Jupiter, Saturn, Star). • **[Stars]** / **[E]**: Open Star Catalogue in selection mode. • **[Notes]**: Open multiline sight notes editor. • **[C]** / **[Calculate]**: Reduce sight. • **[X]**: Load sample dummy sight data. • **[N]**: New sight (reset form). • **[B]**: Blank focused field. • **[W]**: Wipe all fields on screen. • **[D]**: Fill focused field from user defaults. • **[U]**: Fill all fields from user defaults.

Screen / Tool Name	Visual Pathway / Access	Primary Navigational Function	Physical Keypad Controls, Hotkeys & Touchpad Actions
			• **[T]**: Jump focus to top field. • **[H]**: Display help dialogue. • **[Esc]**: Return to Main Menu.
Reduction Results	**Sight Reduction ➔ [Calculate]**	Displays calculated Hc, Ho, Intercept (Toward/Away), Azimuth (Zn), GHA, Dec, and inputs.	• **[S]** / **[Save]**: Save sight record to folder. • **[E]** / **[Save EP]**: Calculate EP and save entry to log. • **[T]** / **[Tri]**: Open 3D Navigation Triangle. • **[P]** / **[EP]**: Open 2D Intercept & LOP Plot. • **[C]**: Copy full text results to clipboard. • **[H]**: Display help dialogue. • **[Esc]** / **[◀Back]**: Return to input form.
3D Navigation Triangle	**Reduction Results ➔ [Tri]**	Renders interactive 3D celestial sphere showing Pole (P), Zenith (Z), and Body GP (X).	• **[▲] / [▼]**: Tilt globe elevation. • **[◄] / [►]**: Rotate globe around vertical axis. • **[R]**: Reset 3D view orientation. • **[H]**: Display help dialogue. • **[Esc]**: Return to Reduction Results.
2D Intercept & LOP Plot	**Reduction Results ➔ [EP]**	Mercator chart showing DR circle, Intercept vector, EP square, and blue perpendicular LOP line.	• **[+] / [-]**: Zoom chart in/out at pointer. • **[P]** / **Touchpad Drag**: Toggle Pan mode / drag chart. • **[R]**: Reset zoom and pan view. • **[1]**: Toggle LOP line selection highlight. • **[L]**: View LOP Info dialogue. • **[I]**: View Sight Info dialogue. (Body, Date, Time). • **[H]**: Display help dialogue. • **[Esc]**: Return to Reduction Results. • **Touchpad Hover**: Highlight nearby features.
Celestial Phenomena	**Main Menu ➔ 2: Celestial Bodies ➔ 1: Phenomena**	Calculates Rise, Set, Transit, Twilights, and LHA Aries for Sun, Moon, Planets, and Stars.	• **[Tab]** / **[Shift]+[Tab]** / **[▲]/[▼]**: Field navigation. • **[S]**, **[L]**, **[V]**, **[M]**, **[J]**, **[R]**, **[P]**, **[E]**: Body selection hotkeys. • **[Stars]**: Open Star Catalogue in

Screen / Tool Name	Visual Pathway / Access	Primary Navigational Function	Physical Keypad Controls, Hotkeys & Touchpad Actions
			selection mode. • **[C]** / **[Calculate]**: Generate phenomena report. • **[B]**, **[W]**, **[D]**, **[U]**, **[T]**, **[H]**: Form entry shortcuts. • **[Esc]** / **[◀Back]**: Return to Celestial Bodies menu.
Sky Plot Setup	**Main Menu ➔ 2: Celestial Bodies ➔ 2: Sky Plot**	Configures date, time, time zone, DR position, height of eye, index error, and magnitude/altitude filters.	• **[Tab] / [Shift]+[Tab] / [▲]/[▼]: Field navigation.** • **[C]** / **[Calculate & Plot]**: Render sky chart. • **[B]**, **[W]**, **[D]**, **[U]**, **[T]**, **[H]**: Form entry shortcuts. • **[Esc]** / **[◀Back]**: Return to Celestial Bodies menu.
Interactive Sky Chart	**Sky Plot Setup ➔ [Calculate & Plot]**	2D conformal Stereographic (default) or Polar projection of visible sky with real-time Triad Sight Finder, angular measurement, and hover pop-ups.	• **[M]:** Toggle between Stereographic and Polar projection. • **[V]:** Open View & Projection Settings Modal. • **[◄] / [►]:** Rotate central azimuth (Stereo mode, 5° steps). • **[▲] / [▼]:** Tilt central altitude (Stereo mode, 5° steps). • **[N], [E], [S], [W], [Z]:** Snap view North, East, South, West, or Zenith. • **[Space] / [Enter]:** Center view on hovered body. • **[+] / [-]**: Zoom in/out at pointer. • **[P]** / **Touchpad Drag**: Toggle Pan mode / drag chart. • **[R]**: Reset zoom, pan, and view centre. • **[F]**: Toggle Full-Screen view. • **[I]**: Toggle body info pop-ups ON/OFF. • **[C]**: Toggle constellation lines ON/OFF. • **[L]**: View visible bodies text list. • **[1] / [3]**: Step time backward/forward 30 minutes. • **[4] / [6]**: Step time

Screen / Tool Name	Visual Pathway / Access	Primary Navigational Function	Physical Keypad Controls, Hotkeys & Touchpad Actions
			backward/forward 1 hour. • **Touchpad Click on 2 Bodies**: Measure angular distance. • **[T]**: Toggle Triad Sight Finder ON/OFF. • **[O]**: Toggle Triad Info Panel ON/OFF. • **[X]**: Open the Top 10 Triads List. • **[7] / [9]**: Cycle candidate triads backward/forward. • **[5]**: Center chart view on active triad. • **[G]**: Open Triad Settings Modal. • **[Esc]**: Return to Sky Plot Setup.
Triad Settings Modal	**Sky Chart ➔ [G] Key**	Configures altitude limits, magnitude cut-off, grid step, slop, and weights for Triad Finder.	• **[▲] / [▼]**: Highlight setting. • **[+] / [-]** or **[◄] / [►]**: Adjust parameter value. • **[T]**: Toggle Triad Finder enabled/disabled. • **[R]**: Reset parameters to factory defaults. • **[Enter]**: Apply settings and re-run search. • **[Esc]**: Cancel and close modal.
Body Identification	**Main Menu ➔ 2: Celestial Bodies ➔ 3: Body Identification**	Reverses PZX reduction to identify unknown bodies from observed altitude (Hs) and bearing.	• **[Tab]** / **[Shift]+[Tab]** / **[▲]/[▼]**: Field navigation. • **[I]** / **[Identify]**: Run identification search. • **[B]**, **[W]**, **[D]**, **[U]**, **[T]**, **[H]**: Form entry shortcuts. • **[Esc]** / **[◀Back]**: Return to Celestial Bodies menu.
Star List Catalogue	**Main Menu ➔ 2: Celestial Bodies ➔ 4: Star List**	Interactive 59-star database browser and sight selection tool.	• **[▲] / [▼]**: Scroll line-by-line through stars. • **[9] / [3]**: Scroll page-up / page-down. • **[I]**: Sort catalogue by Star ID (1–59). • **[N]**: Sort catalogue alphabetically by Name. • **[M]**: Sort catalogue by Visual Magnitude. • **[R]**: Sort catalogue by Right

Screen / Tool Name	Visual Pathway / Access	Primary Navigational Function	Physical Keypad Controls, Hotkeys & Touchpad Actions
			Ascension. • **[D]**: Sort catalogue by Declination. • **[+] / [-]**: Toggle Ascending / Descending sort order. • **[L]** / **[Enter]** / **[Load]**: Load selected star into Sight Reduction form (or return Star ID in selection mode). • **[H]** / **[Help]**: Display help dialogue. • **[Esc]** / **[◀Back]**: Return to parent menu.
Sight Folders Directory	**Main Menu ➔ 3: Sight Folders**	Directory listing all stored sight folders and record counts.	• **[N]** / **[New]**: Create new sight folder. • **[R]** / **[Rename]**: Rename highlighted folder. • **[C]** / **[Copy]**: Duplicate highlighted folder. • **[D]** / **[Delete]**: Delete folder (with confirmation). • **[O]**: Toggle alphabetical sort order. • **[+] / [-]**: Move selected folder up/down in list. • **[Enter]**: Open highlighted sight folder. • **[Esc]** / **[◀Back]**: Return to Main Menu.
Sight Folder Content	**Sight Folders ➔ [Enter] on Folder**	Displays stored sight records within a selected folder.	• **[Enter]** / **[View]**: View full reduction results (view-only mode). • **[L]** / **[Load]**: Load sight into Sight Reduction form. • **[C]** / **[Copy]**: Copy sight to another folder. • **[D]** / **[Delete]**: Delete sight record (with confirmation). • **[▲]/[▼]** or **[+]/[-]**: Re-order sight in list. • **[Q]**: Export single optical QR code on screen. • **[S]**: Export sequential batch QR

Screen / Tool Name	Visual Pathway / Access	Primary Navigational Function	Physical Keypad Controls, Hotkeys & Touchpad Actions
			codes for all sights. • **[T]**: Jump to top of list. • **[H]**: Display help dialogue. • **[Esc]** / **[◀Back]**: Return to Sight Folders directory.
Log Folders Directory	**Main Menu ➔ 4: Log Folders**	Directory listing all stored navigation logbook folders.	• **[N]** / **[New]**, **[R]** / **[Rename]**, **[C]** / **[Copy]**, **[D]** / **[Delete]**: Log folder operations. • **[O]**: Toggle alphabetical sort order. • **[+] / [-]**: Move log folder up/down in list. • **[Enter]**: Open highlighted log folder. • **[Esc]** / **[◀Back]**: Return to Main Menu.
Log Folder Content	**Log Folders ➔ [Enter] on Log**	Displays stored DR, EP, and FIX log records within a selected log folder.	• **[Enter]**: View log entry details (view-only mode). • **[A]** / **[Add]**: Create new log entry. • **[E]** / **[Edit]**: Edit existing log entry. • **[L]**: Load entry as template for new record. • **[C]** / **[Copy]**: Copy log record to another log folder. • **[D]** / **[Delete]**: Delete log record (with confirmation). • **[▲]/[▼]** or **[+]/[-]**: Re-order log record in list. • **[Q]:** Export single optical QR code on screen. • **[S]:** Export sequential batch QR codes for all log entries in folder. • **[T]**: Jump to top of list. • **[H]**: Display help dialogue. • **[Esc]** / **[◀Back]**: Return to Log Folders directory.
Log Record Input Form	**Log Content ➔ [Add] / [Edit] / [Load]**	Form for entering DR, EP, and FIX log records with track advance options.	• **[Tab]** / **[Shift]+[Tab]** / **[▲]/[▼]**: Field navigation. • **[Notes]**: Open multiline log notes editor. • **[C]** / **[Calculate]**: Solve track

Screen / Tool Name	Visual Pathway / Access	Primary Navigational Function	Physical Keypad Controls, Hotkeys & Touchpad Actions
			advance (COG, DOG, SOG) and view details. • **[B]**, **[W]**, **[D]**, **[U]**, **[T]**, **[H]**: Form entry shortcuts. • **[Esc]** / **[◀Back]**: Return to Log Folder content.
Log Record Details	**Log Input ➔ [Calculate]**	Displays calculated track advance (COG, DOG, SOG, new position) with comparison to previous entry.	• **[S]** / **[Save & Exit]**: Save record to log folder. • **[D]** / **[Discard]** / **[Esc]**: Discard record (triggers unsaved check). • **[C]**: Copy text details to clipboard.
Celestial Running Fix Setup	**Main Menu ➔ 5: Navigation ➔ 1: Running Fix**	Configures Log folder (DR reference) and Sight folder for multi-body running fix.	• **[Tab]** / **[Shift]+[Tab]** / **[▲]/[▼]**: Field navigation. • **[C]** / **[Calculate]**: Execute USNO least-squares fix. • **[Esc]** / **[◀Back]**: Return to Navigation Submenu.
Celestial Running Fix Results	**Running Fix Setup ➔ [Calculate]**	Displays iteration history, final fix coordinates, and DR reference baseline.	• **[S]** / **[Save]**: Save calculated FIX entry to log folder. • **[P]** / **[Plot]**: Open multi-LOP and uncertainty ellipse plot. • **[C]**: Copy text report to clipboard. • **[H]**: Display help dialogue. • **[Esc]** / **[◀Back]**: Return to setup screen.
Celestial Fix Plot	**Fix Results ➔ [Plot]**	Multi-LOP chart showing Fix point, DR point, intersecting LOPs, and 95% confidence uncertainty ellipse.	• **[+] / [-]**: Zoom in/out at pointer. • **[P]** / **Touchpad Drag**: Toggle Pan mode / drag chart. • **[R]**: Reset plot view. • **[F]**: Toggle FIX point display ON/OFF. • **[D]**: Toggle DR point display ON/OFF. • **[E]**: View Uncertainty Ellipse Data Dialogue (Semi-major A, Semi-minor B, Orientation). • **[1]-[9]**: Toggle individual LOP selection highlight. • **[0]**: Deselect all LOPs. • **[A]**: Select all LOPs. • **[L]**: View LOP Summary List

Screen / Tool Name	Visual Pathway / Access	Primary Navigational Function	Physical Keypad Controls, Hotkeys & Touchpad Actions
			Dialogue. • **[I]**: View Sight Summary List Dialogue. • **[S]**: Save manual pointer FIX position to log. • **[H]**: Display help dialogue. • **[Esc]**: Return to Fix Results screen.
Direct Calculation Fix Setup	**Main Menu ➔ 5: Navigation ➔ 2: Direct Fix**	Configures 2-body Stanley W. Gery direct fix without an assumed position.	• **[Tab]** / **[Shift]+[Tab]** / **[▲]/[▼]**: Field navigation. • **[C]** / **[Calculate]**: Solve 2-body direct fix. • **[Esc]** / **[◀Back]**: Return to Navigation Submenu.
Direct Fix Solution Selection	**Direct Fix Setup ➔ [Calculate]**	Displays 4 mathematical coordinate solutions (labelled with DR delta or Body 1 East/West).	• **[▲] / [▼]**: Highlight solution candidate. • **[S]** / **[Save Selected]** / **[Enter]**: Save selected FIX solution to log. • **[Esc]** / **[◀Back]**: Return to setup screen.
Backup / Restore	**Main Menu ➔ 6: Utilities ➔ 2: Backup / Restore**	System-wide backup and restore of sight folders, logbooks, and user settings via system clipboard.	• **[Tab] / [Shift]+[Tab] / [▲]/[▼]:** Field navigation. • **[►] / Touchpad Click:** Expand drop-down menus. • **[E] / [C] / [Execute]:** Execute backup or restore. • **[T]:** Jump focus to top field (Action). • **[H]:** Display help dialogue. • **[Esc] / [◀Back]:** Return to Utilities Submenu.
Sight Analysis Setup	**Main Menu ➔ 6: Utilities ➔ 3: Sight Analysis**	Selects Log folder and Sights folder (same body, 3+ sights) for round analysis.	• **[Tab]** / **[Shift]+[Tab]** / **[▲]/[▼]**: Field navigation. • **[A]** / **[Analyse]**: Execute transposition & launch plot. • **[Esc]** / **[◀Back]**: Return to Utilities Submenu.
Interactive Sight Analysis Plot	**Sight Analysis Setup ➔ [Analyse]**	Altitude vs. Time plot comparing observed sights against true	• **[+] / [-]**: Zoom in/out at pointer. • **[P]** / **Touchpad Drag**: Toggle Pan mode / drag chart. • **[▲] / [▼]**: Shift fit curve

Screen / Tool Name	Visual Pathway / Access	Primary Navigational Function	Physical Keypad Controls, Hotkeys & Touchpad Actions
		astronomical Hc(t) curve with 2D least-squares offset fitting, outlier filtering, and synthetic sight generation.	vertically up/down. • **[◄] / [►]**: Shift fit curve time horizontally in 6-sec steps. • **[C]**: Recompute optimal mathematical least-squares fit. • **[X]:** Generate and save Synthetic Sight at cursor position. • **[Q]**: Toggle fit curve visibility ON/OFF. • **[I]**: Toggle hover info box ON/OFF. • **[F]**: Toggle LAN peak vertex marker ON/OFF. • **[E]** / **Touchpad Click**: Exclude/include hovered sight. • **[S]**: Select/deselect sight for batch saving. • **[O]**: Save selected sights to new folder. • **[L]**: View estimated LAN details & save LAN Fix to log. • **[A]**: Calculate LAN fix from pointer position & save to log. • **[V]**: View full original sight reduction details. • **[D]**: View Reference DR log record. • **[R]**: Reset plot, view, manual shifts, and exclusions. • **[H]**: Display short help dialogue. • **[M]**: Display detailed mathematical help guide. • **[Esc]**: Return to Sight Analysis setup screen.
Lunar Distance Reduction	**Main Menu ➔ 6: Utilities ➔ 4: Lunars**	Reduces lunar distance sights using the Wendel Brunner method to compute watch error and longitude.	• **[Tab]** / **[Shift]+[Tab]** / **[▲]/[▼]**: Field navigation. • **[Stars]**: Open Star Catalogue in selection mode. • **[R]** / **[Reduce]**: Execute Brunner iterative reduction. • **[B]**, **[W]**, **[D]**, **[U]**, **[T]**, **[H]**: Form entry shortcuts. • **[Esc]** / **[◀Back]**: Return to Utilities Submenu.

Screen / Tool Name	Visual Pathway / Access	Primary Navigational Function	Physical Keypad Controls, Hotkeys & Touchpad Actions
Optical QR Code Display	**Sight Folder Content ➔ [Q] or [S]**	Renders high-contrast 2D QR matrix for wireless camera scanning to mobile devices.	• **[Enter]** / **Touchpad Click**: Close single code / advance to next code in batch mode. • **[Esc]**: Close single code / abort batch export mode.
Text Results & Details Window	*Triggered across multiple screens*	Multi-purpose text window displaying reduction reports, phenomena, star list, help, and log entries.	• **[▲] / [▼]**: Scroll text line-by-line. • **[9] / [3]**: Scroll page-up / page-down. • **[C]**: Copy full text content to clipboard. • **[Esc]** / **[◀Back]**: Return to calling screen.

VINCENTA

Electronic Celestial Navigation for the Sailor

Document Control

- **Document Title:** Vincenta User Manual & Operational Guide
- **Software Version:** Version 1.1.0 (Build 2026)
- **Hardware Platform:** Texas Instruments TI-Nspire™ CX / CX II
- **Publication Date:** September 2026
- **Document Reference:** `DOC-VINC-UM-2026-V1.1.0`

Technical Support & Resources

For technical support, software updates, or licensing inquiries:

- **Official Website:** https://www.vincenta.co.uk
- **Technical Support:** support@vincenta.co.uk
- **Web Optical QR Scanner:** https://www.vincenta.co.uk/scanner.html

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> *"When systems fail, the stars remain."*