

EMIGMA BASIC

November 2025

EMIGMA Basic describes the tools that are available in every EMIGMA license. EMIGMA Basic is also the name we use for our free viewing utility that facilitates shared use of the software. This package allows Basic users to view the work produced by licensed users. In other words, plots, survey designs, models including complex polyhedra, grids can all be easily shared with colleagues and peers for quick viewing at no cost. The functionality is limited to viewing existing databases; therefore, data import is not allowed nor is any modeling or inversion allowed. The package does, however, provide the user with access to a wide array of data processing and display features such as data correction and survey planning tools in addition to many 2D and 3D visualization tools of models and inversion grids.

For evaluation purposes, we recommend downloading our fully-functional demo software, EMIGMA DEMO. With the exception of data import, all other features for data processing and modeling are enabled in the DEMO version—thus allowing the user ample opportunity to assess and appreciate the full potential of the software (using the demo databases either provided with the DEMO installation or by downloading from our website additional databases designed for specific types of data).

Database Structure

- EMIGMA uses a true relational database design. Not simply a spreadsheet which allows for only owning one data set with associated channels. EMIGMA offers the ability for the database to hold many surveys and selective subsets of surveys.
- Three levels of data organization are provided:
 - Projects divided into Surveys containing Data setsThe database may contain many projects and in each project there may be many Surveys and associated with each Survey are different datasets which contain processed data or forward or inversion models.

Project: Designed to hold what the user considers a project. It could contain several different data sets which were collected in the same survey region or full datasets and subsets of the larger dataset or it could consist of a series of model studies using different survey designs or configurations.

Survey: A survey consists of one specific survey organization which may be either measured data or a synthetic (survey) data for model studies. Thus, it consists of only one type of geophysical survey/equipment such as magnetics, IP, TEM, gravity, etc. This would represent the standard data definition used in conventional geophysical software. However, EMIGMA is different in its design of a survey, in that the instrument specifics are also included with the survey data and coordinates. For instance, for an IP dataset, the survey data has attached to it, within the database, not only the survey points or locations and data, but also the type of survey that was completed: Details such as the type of IP survey that was carried out (e.g. Pole-Dipole, Gradient, etc) and the specifics of the receivers (antennas) that were used (i.e. Length of the dipoles and separations between TX and RX).

Not only are these specifics directly stored (in the database) and attached to the survey data, but also the specifics of the type of measurement. For example, the type of data, whether it is time-domain, frequency-domain or static data as well as parameters such as repetition rate and sample times for time-domain data and frequencies for frequency-domain data.

This extensive design enables many common functions performed in the interpretation process to be more direct, easier and faster for the user. For example, when gridding, the interpolation tools know exactly what data has been collected for the survey and thus, it easily creates a multi-dimensional grid of the survey data with not just for a single data element but with ALL data elements (stored in ONE grid). For example, for an IP time domain survey, the resulting grid contains all the TX-RX separations and all the time channels for each separation. For grid viewing, the grid display tools are designed to not only allow the user to display different data elements with simple clicks (e.g. different times or different frequencies, different separations or different field components), but they also provide immediate and relevant data conversion features. For instance, working with Resistivity data, one can select to see the voltages and can also click 'Apparent Resistivity' to have the data immediately converted to resistivity units and then displayed. This type of functionality is also useful when plotting, as the plotter then allows the user to quickly cycle through the data and provides automatic, appropriate processing for the specific types of data being plotted. These intuitive design concepts are consistent throughout the software. Even when inverting data, for example, the user does not have to inform the inversion software about the survey characteristics; this information is loaded from the database automatically into the inversion application because the application is not simply a spreadsheet. Other software term their software as a database but is simply not valid.

In summary:

- Ability to store data for entire project(s) in one database
- Full integration of survey data, maps, grids and models in a single database with actual database functionality. The user does not have to search for their grids or models as these are directly attached to the survey for quick, automatic loading
- Supports multiple surveys with several different designs in one database

Data Processing and filtering options

- A wide range of processing and filtering tools are provided. We will not provide, here, a complete list of all the available tools, but instead a selection to give the reader a glimpse into EMIGMA's capabilities.
- Data correction tool with operations to Shift, Multiply and Divide data for a single survey line/profile or multiple profiles with one click. For single or multiple components.
- Other useful options include Reverse Sign, Reverse Profile Direction, Set No Data, Delete functions for windows, frequencies, separations, stations, etc
- A variety of Spatial filters and Interpolation
- Coordinate system translation, data unit conversion
- Outlier removal, Editing Tx strength, Vector rotations
- IGRF calculation, trend removal and tie line leveling features for magnetic data
- Survey editing tool for planning and editing surveys
- Profile and Data Location Sorting
- Data Reduction option to Add, Subtract or Set No Data values for entire data sets with a single click

Filters

- Digital and Spatial filters of arbitrary length including Mean, Median, Gaussian and Savitzky-Golay (spatial radius)

2D and 3D Visualization

- 3D Visualizer for models and data
- Geophysical model viewing and building tool in 3D space
 - Unlimited prism, polyhedra, thin-sheet plates and sphere targets
 - Viewing complex polyhedron objects using DXF (AutoCAD), ASC (Vulcan), TRI (Surface Mesh) formats as well as Poly (.xyz) and QCTool grid (.egr) formats
 - Integration of topography (into models) using ASCII column (.XYZ) and QCTool grid (.egr) formats
 - Various model editing tools
 - Supports multiple data channel displays
 - Ability to quickly toggle between time channels, frequencies or components for measured and simulated data
 - Supports export of models to AutoCAD, Surpac/Gemcom or Vulcan formats
- Survey Editor
 - 2D viewing tool for editing or planning surveys
 - Map underlay feature with transparencies
 - Surface projection of models and model editing
 - Map/view export to raster and Georeferenced formats as well as vector formats such as DXF (AutoCAD) and KML (Google)
- 3D surfaces (contoured)
- 2D/3D visualization of Euler/ Werner solutions as well as magnetic/gravity/resistivity/TDEM/FDEM/CSEM 3D inversions
- PEX Show/CDI Viewer
 - Ability to view 1D inversion results as 2D depth sections
 - Toggle between Resistivity, Conductivity and Susceptibility displays for applicable data
 - Equal Range and Equal Weight display options in Log and Linear scales
 - Export depth or cross sections as well as 3D volumes

Plotting

- Extensive XY Plotter for plotting data as function of variety of profile parameters as well as decays, frequency spectra and TX-RX separations
- User-defined options for scaling, zoom and formatting
- Multiple plots per page with ability to toggle between channels, profiles, stations and models
- Supports multi-field, multi-component and multi-separation display options
- Real and Imaginary component display for applicable data
- Determination of decay rates as a function of user-selected window range
- Residual plots of measured and simulated data sets
- Ability to save and retrieve plot settings

Grids

- 2D Grid viewer with many extended features
- Multi-component grids with customizable grid size and style options – non-square grid cells allowed
- Equal Area and Equal Weight display options
- Contour, profile, data and map overlays supported with 'transparency' and 'layer order' options
- Analytic Signal and Horizontal Analytic Signal displays for Potential Field data
- Euler overlays for 3D Euler and post-processed solutions
- Superposition feature for raster maps
- Decay rate display for time-domain data
- MultiGrid tool for viewing and comparing up to 4 grids (at a time)
- Map underlay and grid customization options with transparency controls

Contouring

- Enhanced display capabilities. options for switching between types of data (measured, simulated or gridded) and corresponding components, fields and channels
- Contour displays in B&W and with 2 colour palettes
- Flexibility toggles between various parameters. E.g. Apparent Resistivity, Apparent Conductivity, Chargeability, Decay rate and Derivatives for applicable data
- 3D interpolation of inversion grids; section/depth cutting
- Range of pseudo-depths and pseudo-section display options
- Display lighting and other useful features
- Supports 'view export' to 3D .pdf, raster and vector formats

These are just some of the basic features allowed in all EMIGMA licenses. For a full study, please download our viewer (BASIC) or our DEMO licenses.