FieldTools

Reference Guide

Plot Types · Cross Sections · Drill Hole Maps
Gridding, Contouring and 3D Visualisation
Reserve Estimation · Coordinates · Drill Logs · File Formats

MinServ
August 2026

Contents

1. About This Guide

FieldTools is a Windows application for plotting and drawing geological data: drill hole maps, sample maps, strike and dip maps, cross sections, drill logs, contour maps and 3D surfaces. Data is entered or imported into a built-in spreadsheet, columns are assigned to roles such as easting, northing and depth, and the plot is generated in its own window where it can be annotated, saved, printed and exported.

This guide describes each plot type, the data it requires, the options that control it, and the file formats involved. It is written for the geologist using the program rather than for the developer maintaining it. Menu paths are written as **Menu > Command**. Where a numeric limit or default is quoted, it is the value the program actually enforces.

The general workflow

1. **Get data into the spreadsheet.** Type it, paste it, open a `.plt` / `.txt` / `.csv` / `.xls` file, or use **File > Import Text File** for delimited and fixed-width text.
2. **Give the columns headings.** The **Options** menu inserts a correct heading row for each plot type. Row 1 is always headings; data starts at row 2.
3. **Tell FieldTools which column is which.** **Options > Define Columns for…** maps spreadsheet column numbers to roles. If you use the inserted headings unchanged, the defaults already match.
4. **Choose the plot.** Everything is on the **Plot** menu. An options dialog appears first for scale, titles and labels.
5. **Refine in the plot window.** Draw, annotate, contour, rotate to 3D, adjust exaggeration.
6. **Save.** Save the drawing to its own file type (`.pln`, `.sec`, `.drl`) and export or print the picture.

> **The single most common mistake** is a mismatch between the heading row in the spreadsheet and the column numbers set in **Define Columns**. If a plot comes out empty, flat, or with everything stacked at zero, check that first. Section 13 lists the expected layout for every plot type.

2. How FieldTools Works

The spreadsheet

Each data file opens in its own spreadsheet window inside the main FieldTools window. The status bar at the bottom shows the plot type currently assigned to that window, along with the current row and column.

- **Row 1 is reserved for column headings.** Anything typed there is treated as a label, not as data. Plotting begins at row 2.
- Up to 100 columns are read. Reading stops at the first empty heading cell, so do not leave a gap in the heading row.
- Reading of data rows stops at the first completely blank row. A blank row in the middle of a data set will truncate the plot.
- Editing, sorting, searching, row insertion and deletion are on the **Edit** menu. **Options > Statistics** gives descriptive statistics for a selected column.

Column definitions

FieldTools does not identify columns by their heading text. It uses column *numbers* held in the Define Columns dialogs. There is a separate dialog for each plot family, reached from the **Options** menu:

Dialog	Roles it sets
Define Columns for Contour Map	ID, Name, Symbol, Colour, X, Y, Z
Define Columns for Cross Section	ID, Name, Symbol, Colour, X, Y, Z, Top, Bottom, Length, Datum, Bearing, Inclination, Data
Define Columns for Log Plot	Depth, Pattern, Colour, Text
Define Columns for Strike and Dip Map	ID, Name, Symbol, Colour, X, Y, Z (strike), Data (dip)

Each dialog has a **Defaults** button that restores the standard layout, and each field accepts a column number from 1 to 100. The Contour Map dialog is also used by the drill hole / sample map, since both read X, Y and Z in the same way.

Symbols and colours

Symbol and colour are given per data row as index numbers in their own columns, not as names. Values are 1–24 for symbols and 1–14 for the standard colour set.

- **Options > Symbols > Symbols…** and **Options > Colors > Colors…** show which index corresponds to which symbol or colour, and let you change the assignment.
- **Options > Symbols > Auto Symbols** and **Options > Colors > Auto Colors** fill the symbol and colour columns automatically, cycling through the available sets and grouping rows. This overwrites whatever is in those columns.
- **Options > Log Pattern** shows the lithology fill patterns used by drill logs, and **Tables > Log Patterns** displays the full pattern chart with its index numbers.
- Structural and drill symbols are supplied as fonts (`DrillSymbol`, `plotsymbmin2`, `dhmspat`) installed with the program, so symbols print at full resolution at any size.

The plot window

Every plot opens in its own window with a consistent set of tools. The details differ by plot type, but the following are common:

- **Drawing:** line, box, filled box, ellipse, filled ellipse, text, geology symbol, pen colour. Draw by clicking and dragging on the plot.
- **Edit:** Undo Draw, Redo, Delete All, Refresh.
- **Titles and fonts:** Set Title, Axes Title Font, Axes Label Font, Fonts, Number of Ticks, Tick Marks/Labels, axes label number format.
- **Legends:** ID legend, Name legend, Standard legend, Chart legend, Patterns/Symbols legend. Legends can be saved and reloaded as `.lgd` files.
- **Zoom:** fixed percentages, zoom rectangle, and scroll axes.
- **Output:** Copy Diagram to clipboard, Export Diagram to an image file, Save As PDF, Print Preview, Print Diagram, Page Setup.

3. Coordinate Systems

FieldTools plots numbers. It has no projection engine, no datum transformation and no zone handling. That makes it fast and predictable, but it puts the responsibility on you to supply coordinates that are already in one consistent system. This section explains what each system means in practice and what FieldTools does with it.

Cartesian coordinates

A Cartesian system is a pair of perpendicular axes with a common origin and a single unit of length. X increases to the right, Y increases upwards, and a point is written (X, Y). Adding a third axis Z perpendicular to both gives (X, Y, Z) in three dimensions.

All FieldTools map plotting is Cartesian. The X column supplies the horizontal position, the Y column the vertical position, and the Z column the value being contoured, labelled or plotted in the third dimension. Distances are computed with ordinary Pythagoras, so the two axes must be in the same units. Mixing metres on one axis with feet on the other silently distorts every distance, contour and volume.

Because the system is Cartesian and unprojected, the map is a plane. Over the area covered by a drill programme — typically a few kilometres — the curvature of the Earth is far below plotting precision, so this is not a practical limitation.

UTM coordinates

The Universal Transverse Mercator system is the Cartesian system most exploration data arrives in. It divides the world into 60 zones, each 6° of longitude wide, and projects each zone separately onto a plane. Within a zone:

- **Easting** is metres east of the zone's false origin. The central meridian is given the value 500,000 m so that all eastings are positive. Eastings are therefore six-figure numbers, roughly 160,000 to 840,000.
- **Northing** is metres north of the equator in the northern hemisphere, giving values up to about 9,300,000. In the southern hemisphere the equator is given a false northing of 10,000,000 m so northings again stay positive, counting downwards from 10,000,000 at the equator.
- **Zone and hemisphere** must be quoted with the coordinates, and **datum** must be quoted as well — the same point has different UTM coordinates on WGS84, GDA94, GDA2020, NAD83 and older local datums, with differences ranging from a few centimetres to several hundred metres.

Enter the easting in the X column and the northing in the Y column. FieldTools uses them as plain numbers, which is exactly right for a single-zone data set.

> **Working across a zone boundary.** Two holes in adjacent UTM zones have eastings that are not comparable — a hole 200 m east of a zone boundary has a small easting, its neighbour 200 m west of it has an easting near 840,000. Plotted together they appear hundreds of kilometres apart. Convert the whole data set into one zone (an extended zone is acceptable for a small overlap) before plotting.

> **Mixed datums.** Historic drill collars surveyed on an old datum and modern GPS collars on WGS84 will not sit on the same grid. The offset is systematic and often looks like a plausible geological shift, which makes it dangerous. Reconcile the datum before contouring or estimating volumes.

Local grid coordinates

A local or mine grid is a Cartesian system with an arbitrary origin, and often an arbitrary rotation, chosen to suit a particular property. Typical reasons for using one are:

- **Alignment with the orebody.** Rotating the grid so that one axis runs along strike makes sections perpendicular to strike fall on round-numbered grid lines.
- **Smaller numbers.** A local origin turns 7-digit northings into 3- or 4-digit ones, which are easier to read on axes and in tables.
- **Historic continuity.** Older workings, survey pegs and plans are already labelled on the mine grid.

FieldTools plots local coordinates exactly as it plots UTM coordinates. Two points are worth keeping in mind:

- **Rotation affects bearings.** If your local grid is rotated relative to true north, drill hole bearings must be quoted relative to the same reference as the grid you are plotting. A bearing measured from true north used with a grid rotated 30° will place inclined holes in the wrong direction on a section.
- **Converting a local grid to UTM** is a shift plus a rotation plus, occasionally, a scale factor. FieldTools does not do this. Convert externally, or keep the whole project on one grid.

Creating a local grid from UTM by subtracting a round origin — for example subtracting 6,540,000 from every northing — is a legitimate and often useful tactic. It preserves all distances and directions, keeps the axis labels short, and avoids any loss of resolution when large coordinates are handled at single precision. Record the origin you subtracted somewhere in the project.

Depth, elevation and datum

The third dimension appears in FieldTools in three different senses. Keeping them apart avoids most cross-section problems.

Quantity	Meaning	Where it is used
Depth	Distance below the collar, measured down the hole. Always positive, increasing downwards.	Top and Bottom columns; drill log depth column
True vertical depth	Vertical distance below the collar. Equals depth only in a vertical hole.	Computed from length and inclination
Elevation (RL)	Height above a datum, usually mean sea level. Increases upwards.	Elevation / Datum column; Plot Elevations option

A cross section can be drawn either against depth below collar or against elevation. Plotting against elevation requires a collar RL for every hole in the Elevation column, and produces a section with a real topographic surface. Plotting against depth hangs every hole from a common zero and is appropriate when collar RLs are unknown or the ground is flat.

Bearing and inclination

Deviated and inclined holes are described by two angles per interval:

- **Bearing** — the azimuth of the hole, 0 to 360 degrees, measured clockwise from north on the grid you are using.
- **Inclination** — the plunge of the hole below horizontal, 0 to 90 degrees. 90 is a vertical hole, 0 is horizontal.

Where a hole changes direction, enter successive intervals as consecutive rows carrying the same hole ID, each with its own length, bearing and inclination. FieldTools accumulates them down the hole in the order given, so the rows must be in downhole sequence.

```
ID#     Thickness   Bearing   Inclination
A23     10          123       56
A23     25          154       67
A23     35          125       76
```

The coordinate calculators

Two calculators are available from **Options** in the main window, and also from the **Tools** menu inside the cross section and drill log windows.

True Vertical Depth Calculator

Converts a measured length down the hole into a vertical depth. Enter the measured length of the drill string, the bearing of inclination and the inclination, and it returns:

```
true vertical depth = measured length × sin(inclination)
```

So 45 m of core in a hole inclined at 60° represents 45 × sin 60° = 38.97 m of vertical depth. Results can be printed or copied to the clipboard.

Dip Calculator

Converts between true dip and apparent dip. The apparent dip of a plane seen in a section that is not perpendicular to strike is always shallower than the true dip. Enter the angle between the section line and the strike of the bed, then convert in either direction:

```
tan(apparent dip) = tan(true dip) × sin(angle between section and strike)
true dip = arctan[ tan(apparent dip) / sin(angle between section and strike) ]
```

The angle is 90° when the section is perpendicular to strike, in which case apparent dip equals true dip. As the angle approaches zero — a section running along strike — the apparent dip approaches zero and the calculation becomes unstable, which is the mathematical statement of the familiar rule that a section along strike tells you nothing about dip.

4. Plot Types at a Glance

All plots are launched from the **Plot** menu of the main window.

Plot	What it shows	Minimum data	Saves as
Drill Hole / Sample Map	Plan view of collars or sample sites as symbols, optionally labelled, optionally contoured and taken to 3D	ID, symbol, colour, X, Y, Z	`.pln`
Strike and Dip Map	Plan view with an oriented strike-and-dip symbol at each station	ID, symbol, colour, X, Y, strike, dip	`.pln`
Cross Section	Vertical slice through a line of holes, with lithology intervals, topography and vertical exaggeration	ID, X, Y, top, bottom (and bearing / inclination for inclined holes)	`.sec`
Log Plot	Single-hole graphic log: patterned lithology column, descriptions, headers, and wireline curves	Depth, pattern, colour, text	`.drl`
3D Contour Map	Gridded surface from scattered X, Y, Z data as contours, colour grid, surface or iso-surface	X, Y, Z (from file or spreadsheet)	`.pln`

The contour map is not really a sixth plot type so much as a second stage available to the map plots: any drill hole or sample map can be gridded and contoured from within its own window, and the 3D Contour Map command on the Plot menu is a shortcut that goes straight there from a file on disk.

5. Drill Hole and Sample Maps

The drill hole / sample map is a plan view: each row of the spreadsheet becomes one symbol at its easting and northing. It is the starting point for contouring, for 3D surfaces, and for picking a line of section.

Open it with **Plot > Drill Hole/Sample Map…**.

Preparing the data

Two heading sets produce a plottable map. Both are on the **Options** menu:

Command	Columns produced	Use for
Insert Sample Headings	`ID #`, `Name`, `Symbol`, `Color`, `X`, `Y`, `Z`	Surface samples, geochemistry, any scattered X Y Z data
Insert Drillhole Headings	`ID #`, `Name`, `Symbol`, `Color`, `Easting`, `Northing`, `Data`	Drill collars with a value attached

Both layouts are read through **Options > Define Columns for Contour Map**, whose defaults are ID 1, Name 2, Symbol 3, Colour 4, X 5, Y 6, Z 7. The Z column is the value that gets contoured, so put the grade, thickness, elevation or depth you care about there.

```
ID #    Name     Symbol  Color   X       Y       Z
A32     Brenn    1       2       20      55      42
C567    Brenn    1       2       36      52      23
F62     Kelly    3       5       56      37      78
B85     Kelly    3       5       21      32      67
```

The Drill Hole / Sample Map options dialog

Setting	Effect
Scale Type	*Auto Scale* fits the axes to the data. *Manual Scale* enables the X and Y minimum and maximum boxes so several maps can be drawn at an identical scale for overlay or comparison.
Labels	*None*, *ID #* (label each point with its identifier) or *Z Value* (label each point with its data value — the usual choice before contouring, so the posted values can be checked against the contours).
Titles	Plot title and X and Y axis titles. The axis titles are pre-filled from the spreadsheet headings of the columns currently assigned to X and Y, which is a useful confirmation that Define Columns is set correctly.
Define Cols	Opens the Define Columns dialog without leaving the options window.
Symbols	Opens the symbol description editor, which supplies the text used in the symbol legend.

Working in the map window

Beyond the common drawing and annotation tools, the map window offers:

- **Options > Contour Map…** — grid and contour the X, Y, Z data. See sections 9 and 10.
- **Options > Quick 3D Contour…** — grid the data and open it directly in the fast 3D viewer.
- **Options > 3D Chart…** — a 3D scatter of the points themselves, without gridding.

- **Options > Plot Section…** — draw a section line on the map and generate the cross section from it. **Edit > Clear Sections** removes section lines already drawn.
- **Options > Data Table…** — view the plotted values alongside the map.
- **Options > Data Information Display** — read values off points as the cursor moves.
- **Edit > Background Image > Change…** — place a scanned plan, air photo or geology map behind the data.
- **Options > Legends** — ID, Name, Standard, Chart and Patterns/Symbols legends.

The toolbar shows the cursor position as Top / Left / Right coordinates and the number of points plotted, which is the quickest check that every row was read.

Save the annotated map with **File > Save Plan As…** to a `.pln` file.

6. Strike and Dip Maps

A strike and dip map posts an oriented structural symbol at each station, rotated to the measured strike and annotated with the dip. It is the same plan view as the drill hole map, but with two extra data columns driving symbol rotation.

Open it with **Plot > Strike and Dip Map…**, after inserting headings with **Options > Insert Strike/Dip Map Headings**.

Column	Heading	Contents
1	`Sample #`	Station identifier
2	`Name`	Description or unit name
3	`Symbol`	Structural symbol index — bedding, foliation, cleavage, joint and so on
4	`Color`	Colour index
5	`X`	Easting
6	`Y`	Northing
7	`Strike`	Strike in degrees, 0–360, used to rotate the symbol
8	`Dip`	Dip in degrees, 0–90, plotted as the annotation beside the symbol

Column roles are set in **Options > Define Columns for Strike and Dip Map**, where strike occupies the Z field and dip the Data field. The defaults match the inserted headings.

> **Strike convention.** FieldTools rotates the symbol by the strike value you supply and does not interpret it. If your data uses the right-hand rule, dip-direction-and-dip, or a quadrant convention, convert it to a single consistent 0–360 strike before plotting. Mixing conventions in one file produces symbols that are individually plausible and collectively meaningless.

Options for scale type, labels, titles and symbols work exactly as they do for the drill hole map, and the map window offers the same drawing, legend, zoom and export tools. Strike and dip maps save to `.pln`.

7. Cross Sections

A cross section is a vertical slice through a line of drill holes. Each hole is drawn as a vertical or inclined trace at its position along the section, divided into intervals that are filled with colour and pattern according to the data.

Open it with **Plot > Cross Section…**, or from within a drill hole map with **Options > Plot Section…**.

Preparing the data

Options > Insert Cross Section Headings lays out the heading row. Each row of data is one *interval* in one hole; a hole with four lithological units occupies four consecutive rows sharing the same ID.

```
ID #  Name    Symbol  Color  Easting  Northing  Top  Bottom  Thickness  Elevation  Bearing  Inclination  Da
A1    Brenn   1       2      112      135       0    45      45         310        0        90           1.
A1    Brenn   1       4      112      135       45   78      33         310        0        90           3.
B2    Kelly   1       2      248      141       0    52      52         305        0        90           0.
```

Column role	Contents
ID #	Hole identifier. Rows are grouped by this value, so all intervals in a hole must be consecutive and in downhole order.
Easting / Northing	Collar position. Both are needed — even for a section drawn along easting, the northing is used to compute true separation between holes.
Top / Bottom	Depth to the top and bottom of the interval, below collar.
Thickness	Interval length. For inclined holes this is the length measured down the hole, which is what drives the geometry when bearing and inclination are used.
Elevation	Collar RL. Required only when plotting against elevation.
Bearing / Inclination	Hole orientation for that interval. Bearing 0–360, inclination 0–90 with 90 vertical.
Data	Assay, grade or other value carried through for labelling.
Symbol / Colour	Index numbers controlling how the interval is drawn.

> **Headings and column definitions are kept in step.** **Options > Insert Cross Section Headings** writes the 13-column row above and sets **Options > Define Columns for Cross Section** to match it: ID 1, Name 2, Symbol 3, Colour 4, X 5, Y 6, Top 7, Bottom 8, Length 9, Datum 10, Bearing 11, Inclination 12, Data 13. If you build a sheet with a different layout, or rearrange the columns afterwards, set the numbers in the dialog to match. The dialog is authoritative; the headings themselves are only labels.

The Cross Section options dialog

Coordinates — which way the section runs

Sections are drawn along one of the two grid axes:

- **Use Easting (W–E)** — holes are ordered by easting and the horizontal axis is easting. Choose this for a section running roughly east–west.
- **Use Northing (S–N)** — holes are ordered by northing and the horizontal axis is northing. Choose this for a section running roughly north–south.

Choose the axis along which the holes are most spread out. A line of holes trending north–south plotted against easting will collapse into a narrow band.

Calc True Distance Between Holes

This is the option that makes sections along oblique lines work. With it off, each hole is placed at its raw easting (or northing), so a line of holes trending northeast is compressed by the cosine of its trend — a section that looks 700 m long when the holes actually span 1,000 m.

With it on, FieldTools sorts the holes along the chosen axis and then replaces the horizontal coordinate of each hole with the *cumulative straight-line distance* from the first hole:

```
distance from hole i-1 to hole i = √[ (E₂ − E₁)² + (N₂ − N₁)² ]

position of first hole  = 0
position of hole i      = position of hole i-1 + distance from hole i-1 to hole i
```

The horizontal axis then measures true distance along the section line rather than easting or northing. This is the correct setting whenever the drill line is not parallel to a grid axis, and it is the setting to use before scaling anything off the section.

> Because the axis becomes cumulative distance, a section drawn with this option turns a dog-legged drill line into a straight one of the correct total length. That is the desired behaviour for a fence diagram, but it does mean the horizontal axis values are no longer grid coordinates and cannot be read as eastings.

Inclined and vertical holes

Option	Effect
Use Bearing/Inclination	Hole traces are drawn using the bearing and inclination columns, deflecting down and across the section. Intervals accumulate down the hole, so multi-segment holes bend correctly.
Vertical	Every hole is drawn as a vertical trace regardless of what the orientation columns contain. Use this for vertical drilling or when orientation data is absent.
Use True Plunge	The inclination values are used as measured.
Use Apparent Plunge	The plunge is projected into the plane of the section. This is the correct choice when holes are inclined obliquely to the section line, since a hole plunging at 60° towards 045 appears shallower in an east–west section than it truly is. Use the Dip Calculator to check the numbers.
Correct Inclined Holes to 90°	Straightens every hole to vertical while preserving true vertical depths, by converting each interval length to its vertical component (length × sin inclination) and stacking the results. The result is a section of vertical traces showing correct depths — convenient for correlating stratigraphy, but it discards the lateral offset of the holes.

Plot Elevations and the surface

Ticking **Plot Elevations** switches the vertical axis from depth-below-collar to elevation, using the collar RL in the Elevation column. A topographic surface line is drawn through the collars. The **Surface** setting controls whether the collars are hung from the topographic surface or referenced to a common datum.

With Plot Elevations off, the vertical axis is depth and every collar sits at zero, which is the right presentation for flat ground or where RLs are unavailable.

Scale and titles

Auto Scale fits the depth axis to the data. *Manual Scale* enables the Top Depth and Bottom Depth boxes so that a series of sections can be drawn on one consistent depth range — essential if the sections are to be compared or printed as a set. The Titles group sets the section title, the easting/northing axis title and the depth axis title.

Working in the section window

Command	Effect
Options > Vertical Exaggeration	x1, x2, x5, x10, x50 to stretch the vertical axis, or /2, /5, /10, /50 to compress it, plus *0*, *Level Surface* which flattens topography. Exaggeration is essential for shallow, flat-lying units and is the single most misleading control on the section, so always annotate the value used.
Options > Drill Hole Width	Sets the drawn width of the hole traces. Narrow traces suit closely spaced holes; wide traces make lithology patterns readable.
Options > Drill Hole ID	Show or hide the hole identifier above each trace.
Options > Drill Hole Icon	Show or hide the collar symbol.
Options > Plot Surface Line	Draw or suppress the topographic surface through the collars.
Options > Plot Depth Scale	Show or hide the depth scale on the hole traces.
Options > Legend…	Build a lithology legend from the colours and patterns in use; save and reload it as a `.lgd` file.
Options > 3D Chart	View the section in three dimensions.
File > Open Template…	Load a saved layout so a series of sections share borders, titles and fonts.

The section drawing, complete with annotations, saves to a `.sec` file via **File > Save Section File As…**.

8. Drill Logs

The log plot is a single-hole graphic log drawn to a depth scale: a patterned lithology column, descriptive text, a printed header block, and optionally wireline curves plotted alongside. It is the one plot type that can be built entirely by hand, without a spreadsheet, by drawing pattern boxes directly onto a blank log.

Open it with **Plot > Log Plot…**.

Core logs from the spreadsheet

Options > Insert Log Headings creates the four-column layout:

Column	Heading	Contents
1	`Depth`	Depth to the *top* of the interval. Rows must be in increasing depth order. The last row marks the bottom of the log and needs only a depth.
2	`Pattern`	Lithology fill pattern index. See **Tables > Log Patterns** for the chart.
3	`Color`	Colour index for the interval fill.
4	`Text`	The lithological description printed beside the interval.

```
Depth   Pattern   Color   Text
0       5         1       Sandstone
35      6         2       Siltstone
45      7         3       V. fine grained sandstone
65
```

Each row runs from its own depth to the depth of the next row, so the example gives sandstone 0–35, siltstone 35–45, fine sandstone 45–65. Column roles are set in **Options > Define Columns for Log Plot**; the defaults are Depth 1, Pattern 2, Colour 3, Text 4.

The Log Plot options dialog

Group	Settings
Page Layout	*Single page* fits the whole log on one page. *Single column* and *Two column* run the log down continuous columns. *Length* sets the drawn length of the log in centimetres, up to a maximum of 800 cm.
Scale	*Units per cm* is the depth scale — how many depth units one centimetre of paper represents. *Top Depth* and *Bottom Depth* set the interval logged. *Calc Scale* works the scale out for you from the length and the depth range.
Units	Millimetres, centimetres, inches, feet, metres, miles or kilometres. This labels the depth axis and is used by the scale calculation.
Header	The printed header block at the top of the log: *none*, *blank* (an empty form to fill in), *core log*, *environmental*, *oil well*, or *logo*. Each is a pre-drawn form appropriate to that style of logging.
Template	A saved page layout (`.dht`) defining columns, borders and fonts.
Source	*Plot from spreadsheet* builds the log from the depth / pattern / colour / text columns. Leave it unticked to start with a blank log and draw intervals by hand.
Title	The log title, usually the hole name.

Building a log by hand

1. Enter the length of the log in centimetres and set the depth scale.
2. Choose a header — one of the pre-defined forms, or *blank* to design your own.
3. Use **Draw > Log Pattern Box** to add lithology intervals: pick a pattern and colour, then click on the log and drag down to the required depth.
4. Add descriptions with **Draw > Add Text…**, and structural or fossil symbols with **Draw > Geology Symbol…**.
5. **Edit > Undo Draw** steps back; **Edit > Delete All** clears the log and starts again; **Edit > Delete Column…** removes a whole track.
6. Save with **File > Save Log File As…** to a `.drl` file.

Depth presentation can be changed after the fact from **Options**: *Depth Scale*, *Depth Title* and *Depth Units*. **Options > Log Header** swaps the header form, and **Options > Legend…** builds a pattern legend.

Wireline logs and LAS import

Geophysical wireline logs are read from LAS files — the Log ASCII Standard used by essentially every logging contractor. Import them with **File > Import LAS…** from inside the drill log window.

Versions 1.2, 2.0 and 3.0 are supported. Choose the correct version in the file dialog: FieldTools reads the `VERS` line in the file's version block and will report an error if it does not match what you selected.

From the file it reads:

- `STRT` — start depth, and the depth unit
- `STOP` — stop depth
- `STEP` — sample interval
- `NULL` — the null / no-data value, typically −999.25
- `~WRAP` — whether data lines wrap
- `~CURVE` — the list of curve mnemonics available in the file

The curve mnemonics are listed for selection. Pick one and set the plot options:

Option	Effect
Select a Curve to Plot	The curve mnemonics read from the `~CURVE` section — GR, CALI, RHOB, DT, RES and so on.
Plot Scale	Minimum and maximum of the curve axis. Set this explicitly for logs that will be compared between holes.
Plot Depth Interval	The depth range to plot, defaulting to the file's own start and stop depths, which are displayed.
Null Value	The value to treat as no-data. Pre-filled from the `NULL` line. Getting this wrong draws a null of −999.25 as a real reading and flattens the whole curve.
Line Plot / Histogram / Points	Curve presentation. Line is conventional for continuous logs; histogram suits blocked or interval data.
Plot in Column / Plot as Overlay	Give the curve its own track beside the lithology column, or overlay it on an existing track so two curves can be compared directly.
Title	Track heading.

Repeat the import to add further curves. A typical composite log ends up with the lithology column from the spreadsheet or drawn by hand, then gamma, resistivity and density tracks imported from the LAS file, all on one depth scale.

Text curve import

Curve data that is not in LAS format can be brought in with **File > Import Text Data…**, which reads tab-delimited `.txt` / `.dat` files and CSV. The dialog shows the file contents so the layout can be checked, and asks for:

- **Depth in Column** — which column holds depth
- **Data in Column** — which column holds the curve value
- **Skip first *n* lines** — to step over file headings

The remaining options — scale, depth interval, null value, presentation and column placement — are the same as for LAS. **File > View Text File…** opens the raw file for inspection if the layout is unclear.

Templates

A template (`.dht`) stores a log page layout — track widths, borders, headers, fonts and titles — so that every log in a programme is drawn identically. Load one with **File > Open Template…** or pick a built-in layout from **Options > Template**: *None*, *Standard*, *Graph1* to *Graph4*, or *3D Chart*.

9. Gridding

Drill hole and sample data is scattered: values exist at the points that were drilled or sampled, and nowhere else. Contouring, surfaces and volumes all require values at regular intervals. *Gridding* is the interpolation step that fills a regular mesh of nodes from the scattered data, and it is where most of the geological judgement in a contour map actually sits.

Gridding runs from the Contour Settings dialog, reached by **Options > Contour Map…** or **Options > Quick 3D Contour…** in the drill hole map window, or by **Plot > 3d Contour Map…** from the main window.

Grid geometry

The grid covers the bounding rectangle of the data — from the minimum to the maximum X, and the minimum to the maximum Y. Grid size is set as **Columns** and **Rows** in the Grid Size group:

```
node spacing in X  =  (X max − X min) / columns
node spacing in Y  =  (Y max − Y min) / rows
number of nodes    =  columns × rows
```

- The default is **100 × 100** nodes.
- Each dimension must be **greater than 75 and less than 50,000**. Values outside that range are rejected with an "Incorrect Grid Size" message.
- Cost grows with the product. A 100 × 100 grid is 10,000 nodes and is near-instant; 1,000 × 1,000 is a million nodes and kriging will take real time. Gridding runs on a background thread with a progress window, so the program stays responsive.

> **Choosing a grid size.** A useful rule is to make the node spacing roughly one quarter to one half of the typical spacing between data points. Finer than that adds no information — it only interpolates the interpolation, producing smooth-looking detail that the data does not support. Coarser than that throws away real structure. If holes are on a 100 m grid over 2 km, node spacing of 25–50 m means about 40–80 columns, so the minimum of 76 is already at the fine end.

Gridding methods

Three methods are offered in the Gridding Method group.

Classic kriging

Kriging estimates each grid node as a weighted average of the surrounding data, with the weights derived from a *variogram* model of how the values are spatially correlated. Unlike a fixed-distance weighting, kriging weights account for the clustering of the data: two samples close together carry less combined weight than two well-separated samples at the same distance from the node, because they largely duplicate each other's information.

Classic (point) kriging estimates the value *at* each node. It honours the data closely and is the general-purpose choice.

Block kriging

Block kriging estimates the *average* value over the block surrounding each node, rather than the value at the node itself. The result is smoother, with less extreme highs and lows, because averaging over a block suppresses short-range variability.

Block estimates are the more appropriate basis for volume and tonnage work, since what is mined is a block rather than a point. For contour presentation, classic kriging is usually preferred because it follows the data more faithfully.

Inverse distance

Inverse distance weights each surrounding data point by the reciprocal of its distance raised to a power, so nearer points count for more:

$$Z(\text{node}) = \Sigma \left(Z_i / d_{i\gamma} \right) / \Sigma \left(1 / d_{i\gamma} \right)$$

where *d* is the distance from the node to data point *i* and *p* is the power. FieldTools uses:

- **Power = 2** — inverse distance squared, the standard exploration default. Higher powers make the surface more local and more bullseyed around individual samples; lower powers make it smoother and flatter.
- **Search radius** = the maximum distance between any two data points, so by default all data can contribute to every node.
- **Nearest points** = all data points by default.
- **Tolerance** = one tenth of a cell length. A data point closer to a node than the tolerance is assigned directly to that node, which avoids a division by zero and makes the grid honour the sample exactly.

Inverse distance makes no assumption about spatial correlation, needs no variogram, and always produces a result. It is the right choice for a first look, for sparse or erratic data, and for anyone who does not want to defend a variogram model. Its weakness is the characteristic bullseye around isolated high values.

Variogram models and parameters

When either kriging method is selected, the Kriging (Variogram) Model group offers three models describing how similarity between two points falls off with the distance between them:

Model	Behaviour	Suits
Linear	Variance increases in direct proportion to distance and never levels off. The simplest model and the default.	Data with no obvious range, regional trends, a first pass at any data set
Spherical	Variance rises steeply then flattens completely at the range. The classic geostatistical model.	Most ore deposits and stratigraphic surfaces, where influence genuinely dies out at a definable distance
Exponential	Variance rises and approaches the sill asymptotically, never quite reaching it. Smoother near the origin than spherical.	More continuous, gradational properties such as thickness, elevation or alteration intensity

Three parameters are set in the Variogram Variables group:

Parameter	Meaning	Default
Nugget	The variance at zero distance — sampling error, analytical error and variability at scales finer than the sample spacing. A high nugget relative to the sill means the data is noisy and the resulting surface will be smoother and less confident.	1
Sill	The total variance the variogram levels off at. Should be of the order of the variance of the data. The dialog takes the total (nugget + structured component); the structured part is the difference.	3
Range	The distance beyond which values are effectively uncorrelated. Ticking **Autocalc** sets it to the diagonal of the data's bounding rectangle, $\sqrt{[(X\ max - X\ min)^2 + (Y\ max - Y\ min)^2]}$, which is generous and gives a smooth surface. Untick it to enter a range derived from your own variogram analysis.	Autocalc

> **Fitting a variogram properly** requires an experimental variogram computed from the data, which FieldTools does not produce. In practice: start with the defaults and Autocalc range, look at the map, then set the range to roughly the distance over which you believe the geology is continuous — often one to two times the drill spacing for a structurally controlled deposit, considerably more for a bedded one. Raise the nugget if the data is known to be noisy and the map looks implausibly spiky.

Choosing a method

Situation	Suggested method
First look at unfamiliar data	Inverse distance
Regular grid drilling, well-understood continuity	Classic kriging, spherical model
Smooth, gradational property (thickness, RL, seam elevation)	Classic kriging, exponential model
Input to a volume or tonnage estimate	Block kriging
Sparse, clustered or erratic data	Inverse distance, or kriging with a high nugget
Strong regional trend across the area	Kriging, linear model

Whatever is chosen, grid the same data by two different methods and compare. Where the two agree, the data is controlling the answer; where they differ, the method is. Contours in the second category should not be relied upon.

10. Contouring

Once the grid exists, contours are threaded through it at a set of levels. The controls are in the same Contour Settings dialog, in the Contour Settings group.

Setting	Effect
Contour Levels	The number of contour intervals to draw, from 2 to 1,000, default 10. Values outside the range are rejected.
Contour Level Minimum / Maximum	The value range the contours span. The data's own minimum and maximum are displayed beside these boxes as Data Limits.
Autocalc	When ticked, the minimum and maximum are taken from the gridded data. Untick it to impose your own range — the way to force several maps onto identical contour levels for comparison. The maximum must exceed the minimum.
Decimal Points	Decimal places on contour labels, 0 to 6.
Label Size	Contour label font size, 4 to 22 points.
Color Palette	Palette 1 Multicolor, Palette 2 Smooth Multicolor, Palette 3 Strong Multicolor, or Palette 4 Greyscale. Greyscale is the one that survives photocopying and monochrome printing.

The contour interval follows from the levels and the range:

```
contour interval = (maximum − minimum) / number of levels
```

So the default of 10 levels across the data range gives ten equal intervals. To get round-numbered contours — every 5 m, every 0.5 g/t — untick Autocalc, set the minimum and maximum to round values, and choose the number of levels that divides them evenly.

Display styles

Once the grid is calculated the contour map window offers several presentations of the same grid, switchable at any time from the **Options** menu:

Style	Description
Contour Map	Contour lines only.
Contour Map w/Labels	Contour lines with values annotated on them.
Color Contour Map	Contour lines with the bands between them filled from the palette.
Color Contour Map w/Labels	Filled bands with labelled contours — the most informative single view.
Color Grid	Each grid cell coloured by value, with no contour lines. Shows the raw grid without the smoothing implied by contours, and is the honest way to display a coarse grid.
3D Surface Map	The grid as a shaded surface in three dimensions.
3D Iso Surface Map	The surface drawn as banded iso-surfaces.

Additional display controls:

- **Options > Isolines** — overlay contour lines on a coloured or 3D view.

- **Options > Display Drill Holes/Samples (2D)** — post the original data points on top of the contours. Always switch this on at least once: contours that wander far from the posted values are a sign that the gridding parameters need work.
- **Options > Show Grid** — display the grid mesh itself.
- **Options > Axes Label Format** — `0`, `0.0`, `#,##0.00` or `#.0E+0` for the axis numbers. The comma format is easiest to read for UTM coordinates.
- **Options > Chart Legend…** — a colour scale for the contour values.

> **Interpolation and extrapolation.** The grid covers the full bounding rectangle of the data, including corners with no nearby holes. Contours in those corners are extrapolated from distant points and carry no real information. Either trim the map to the drilled area or annotate the limit of reliable data, particularly if the map will be used to support a volume estimate.

11. 3D Visualisation

Three-dimensional views are available from several places, each suited to a different purpose.

Routes into 3D

Command	What it does
Plot > 3d Contour Map…	Loads an X, Y, Z file (`.plt` , tab-delimited `.txt` / `.dat` , or `.csv`) straight from disk, opens the Contour Settings dialog, grids the data and displays the result. The fastest path from a data file to a surface, bypassing the spreadsheet.
Options > Quick 3D Contour… (map window)	Grids the current map data and opens it in the lightweight 3D viewer — quick to rotate and inspect, fewer presentation options.
Options > 3D Chart… (map window)	A 3D scatter of the data points themselves. No gridding, so nothing is interpolated — useful for checking the raw distribution of values before committing to a grid.
Options > 3D Surface Map (contour window)	Turns the existing contour grid into a shaded 3D surface, keeping all the contour settings.
Options > 3D Chart (section window)	Views a cross section in three dimensions.

Controlling the 3D view

- **Options > Rotate Chart (3D)** — set to True, then drag on the chart to rotate, change elevation and adjust perspective.
- **Options > Block Diagram View (3D)** — render the surface as a solid block with sides, giving the classic block diagram appearance rather than a floating sheet.
- **Options > Zoom (3D)** — 25%, 40%, 60%, 80%, 100%.
- **Options > Isolines** — drape contour lines over the 3D surface, which greatly improves the readability of a shaded surface.
- **Options > Chart Editor…** — full control over lighting, wall colours, axis appearance and 3D percentage.
- **Options > Chart Size…** — set the drawing size before export or printing.

> **Vertical scale in 3D.** A surface whose Z values span 40 m across an area 3 km wide is, to scale, almost flat. 3D views necessarily exaggerate the vertical axis to show anything at all. Treat the relief in a 3D view as qualitative unless you have deliberately set and recorded the scaling, and never scale a thickness or an elevation off a 3D picture.

12. Reserve Estimation from Gridded Data

Once a grid exists, FieldTools can report its statistics and, from them, a volume. This gives a quick volumetric estimate directly from drill hole data — the basis of an exploration target or a first-pass resource figure.

Open it with **Options > Grid Stats…** in the contour map window, after gridding.

What Grid Statistics reports

Statistic	Meaning
Title	A free-text label you supply, carried through to the printout and clipboard copy.
No. of Data Points	The number of *grid nodes* (columns × rows) — not the number of drill holes.
Minimum / Maximum	Lowest and highest interpolated node values.
Median	Middle value of all nodes.
Mean	Arithmetic mean of all nodes.
Standard Deviation	Spread of node values about the mean.
Sum	Total of all node values.
Map Area	Area of the full gridded rectangle: (X max − X min) × (Y max − Y min).
Gridded Area with Z>0	Area of the nodes whose value is positive — the footprint of the mineralised or thickness-bearing part of the grid.
Volume with Z>0	The volumetric estimate. See below.

Print sends the whole set to a printer; **Copy** puts it on the clipboard for pasting into a report or spreadsheet.

How the volume is calculated

The volume is the sum, over every grid node with a positive value, of the node's cell area multiplied by its value:

```
cell area   = X spacing × Y spacing

Volume      = Σ  ( X spacing × Y spacing × Zᵢ )   for all nodes where Zᵢ > 0

Area (Z>0)  = Σ  ( X spacing × Y spacing )          for all nodes where Zᵢ > 0
```

This is a simple prism, or rectangular-rule, integration of the gridded surface above the plane Z = 0. Each grid cell is treated as a rectangular prism of the cell's footprint and the node's height, and the prisms are added up.

> **The Z column must be a thickness.** This is the point on which the whole calculation turns. For the volume to mean anything, the value gridded must be a vertical thickness or true intercept — seam thickness, mineralised intercept, overburden depth, ore width. If Z is a grade, an elevation or an assay, the "volume" returned is arithmetically correct but geologically meaningless. Grid thickness to get volume; grid grade separately to get an average grade.

From volume to tonnage and metal

FieldTools reports volume. The rest of the calculation is arithmetic you do yourself:

```
Tonnage         = Volume × Bulk density
Contained metal = Tonnage × Average grade
```

Units must be tracked carefully. If eastings, northings and thicknesses are all in metres, the volume is in cubic metres, and bulk density in tonnes per cubic metre gives tonnes directly. If coordinates are in metres and thickness in centimetres, the volume is wrong by a factor of 100.

Worked example

A coal seam is drilled on a nominal 200 m grid over an area roughly 2,000 m by 1,500 m. Seam thickness is logged in each hole and entered in the Z column, in metres. The data is gridded 150 × 150 by classic kriging with a spherical variogram, and Grid Statistics reports:

Statistic	Value
No. of Data Points (grid nodes)	22,500
Minimum / Maximum	0.0 m / 4.8 m
Mean	2.1 m
Map Area	3,000,000 m^2
Gridded Area with Z>0	2,420,000 m^2
Volume with Z>0	5,082,000 m^3

With a coal bulk density of 1.35 t/m^3:

```
Tonnage = 5,082,000 m³ × 1.35 t/m³ = 6,860,700 t  →  approximately 6.9 Mt in situ
```

If the seam averages 22% ash and 78% recoverable product, saleable tonnes would be roughly 5.4 Mt — but that step involves washability and mining recovery assumptions well beyond the grid.

Refining the estimate

- **Apply a cut-off before gridding.** The calculation includes every node with Z greater than zero. To estimate only the part of the deposit above a minimum thickness or grade, set values below the cut-off to zero in the spreadsheet before gridding, so that sub-economic nodes contribute neither area nor volume.
- **Trim to the drilled area.** The grid extends to the corners of the bounding rectangle. If the deposit does not, the volume includes extrapolated ground. Adding zero-value control points around the known limit of mineralisation is the standard way to pull the surface down to zero at the edges.
- **Use block kriging.** Block estimates are the appropriate basis for tonnage, since they estimate the average over a volume rather than the value at a point.
- **Check the grid resolution.** Re-grid at a finer and a coarser spacing and compare the volumes. If the answer moves substantially, the grid is too coarse to integrate the surface properly.
- **Vary the method.** Grid by inverse distance and by kriging and compare. The spread between them is a rough, informal indication of how much of the estimate is method rather than data.

What this estimate is and is not

A grid-based volumetric calculation is a legitimate and widely used first-pass tool. It is not a Mineral Resource or Ore Reserve in the sense of JORC, NI 43-101, SAMREC or any other reporting code. Those require, at minimum, demonstrated geological continuity, quality-controlled sampling and assaying, validated density measurements, a documented estimation methodology with classification, and sign-off by a Competent or Qualified Person. What FieldTools gives you is the volumetric core of such an estimate, computed transparently, which is exactly the right input to that process and the wrong thing to report as its output.

Practical caveats to record alongside any figure produced this way:

- The volume is only as good as the interpolated surface, which depends entirely on the gridding method and parameters chosen. Record them.
- Bulk density is usually the least well-constrained number in the whole calculation, and it multiplies straight through to the answer.
- The estimate takes no account of mining dilution, mining recovery, geotechnical constraints or economic cut-offs.
- The prism rule integrates the surface above zero. Structures below the base of the grid, faulted repetitions and overturned sequences are invisible to it.

13. File Formats

FieldTools distinguishes between *data files*, which hold the numbers in the spreadsheet, and *plot files*, which hold a finished drawing with all its annotations. The two are saved separately, and both are usually needed to reproduce a figure.

Data files

The spreadsheet reads and writes plain, delimited text. The native format is tab-delimited ASCII with a `.plt` extension, which opens directly in Excel and in most other spreadsheets.

Extension	Format	Open	Save
`.plt`	FieldTools file — tab-delimited ASCII	Yes	Yes
`.txt`, `.dat`	Tab, space or semicolon delimited text	Yes	Yes (tab)
`.csv`	Comma delimited text	Yes	Yes
`.xls`	Excel workbook	Yes	Yes
`.xml`	XML spreadsheet	Yes	Yes
`.flx`	FlexCell grid file — preserves cell formatting	Yes	Yes
`.pdf`	PDF of the spreadsheet	—	Yes (export)
`.html`	HTML table	—	Yes (export)

File > Import Text File… runs an import wizard for text that is not in one of the standard layouts, handling tab, comma, space and semicolon delimiters and fixed-width columns, with a setting for how many header lines to skip.

Rules that apply to every data file

- Row 1 holds column headings and is never plotted.
- Data begins at row 2 and must be contiguous — the first fully blank row ends the data.
- Up to 100 columns are read; reading stops at the first blank heading.
- Numeric fields must contain numbers. Text in a numeric column reads as zero, which typically puts the point at the origin.
- Symbol and colour are index numbers, not names.
- Coordinates must be in one consistent unit and one consistent grid across the whole file.

Required columns by plot type

The tables below give the heading row produced by the corresponding **Options > Insert…Headings** command, together with the Define Columns defaults. Where the two differ, the Define Columns setting is what the program actually uses.

Drill hole and sample map, and contour map

Col	Sample headings	Drillhole headings	Role in Define Columns for Contour Map
1	`ID #`	`ID #`	ID / Sample
2	`Name`	`Name`	Name
3	`Symbol`	`Symbol`	Symbol index
4	`Color`	`Color`	Colour index
5	`X`	`Easting`	X
6	`Y`	`Northing`	Y
7	`Z`	`Data`	Z — the value gridded and contoured

```
ID #    Name      Symbol  Color   X       Y       Z
A32     Brenn     1       2       20      55      42
C567    Brenn     1       2       36      52      23
F62     Kelly     3       5       56      37      78
```

Strike and dip map

Col	Heading	Role in Define Columns for Strike and Dip Map
1	`Sample #`	Sample / station ID
2	`Name`	Name
3	`Symbol`	Structural symbol index
4	`Color`	Colour index
5	`X`	X (easting)
6	`Y`	Y (northing)
7	`Strike`	Z field — strike, 0–360°
8	`Dip`	Data field — dip, 0–90°

```
Sample #  Name        Symbol  Color   X      Y      Strike  Dip
S001      Bedding     1       1       4520   6710   045     32
S002      Bedding     1       1       4680   6755   051     28
S003      Cleavage    4       3       4710   6690   118     74
```

Cross section

Col	Inserted heading	Define Columns for Cross Section default
1	`ID #`	Sample / hole ID = 1
2	`Name`	Name = 2
3	`Symbol`	Symbol = 3
4	`Color`	Colour = 4
5	`Easting`	X = 5
6	`Northing`	Y = 6
7	`Top`	Top = 7
8	`Bottom`	Bottom = 8 (also used as Z)
9	`Thickness`	Length / thickness = 9
10	`Elevation`	Datum / elevation = 10
11	`Bearing`	Bearing = 11
12	`Inclination`	Inclination = 12
13	`Data`	Data = 13

> **Northing is not optional.** Even for a section plotted along easting, the northing is read — Calc True Distance Between Holes uses both coordinates to compute the separation between holes, and inclined holes are placed using both. Inserting the headings sets the column definitions to match automatically; this is also the layout of the supplied demo file `data\drillhole1.plt`.

```
ID #  Name   Symbol  Color  Easting  Northing  Top  Bottom  Thickness  Elevation  Bearing  Inclination  Dat
A1    Brenn  1       2      112      135       0    45      45         310        0        90           1.2
A1    Brenn  1       4      112      135       45   78      33         310        0        90           3.6
B2    Kelly  1       2      248      141       0    52      52         305        0        90           0.8
```

For a deviated hole with several orientation segments, repeat the ID on consecutive rows in downhole order, each carrying its own thickness, bearing and inclination:

```
ID #    Thickness    Bearing    Inclination
A23     10           123        56
A23     25           154        67
A23     35           125        76
```

Drill log

Col	Heading	Role in Define Columns for Log Plot
1	`Depth`	Depth to the top of the interval, increasing downwards
2	`Pattern`	Lithology pattern index
3	`Color`	Colour index
4	`Text`	Description printed beside the interval

```
Depth   Pattern   Color   Text
0       5         1       Sandstone
35      6         2       Siltstone
45      7         3       V. fine grained sandstone
65
```

The final row carries only a depth and closes the last interval.

Plot files

Each plot window saves its drawing — geometry, annotations, symbols, fonts, titles, borders and settings — to its own file type. These are plain text files with a signature line, a timestamp, and then bracketed sections each holding a record count followed by the records.

Type	Produced by	Sections stored
`.pln`	Drill hole / sample map, strike and dip map, contour map File > Save Plan As…	`[Lines]`, `[Text]`, `[Symbols]`, `[Axes Font]`, `[Title]`, `[Options]`
`.sec`	Cross section File > Save Section File As…	`[Lines]`, `[Text]`, `[Symbols]`, plus axis, title and option blocks
`.drl`	Drill log File > Save Log File As…	`[Lines]`, `[Pattern Boxes]`, `[Text]`, `[Symbols]`, `[Borders]`, `[Header Text]`, `[Labels]`, `[Legends]`, `[Logo]`, `[Scale]`, `[Template]`, `[Title]`, `[Options]`, `[Undo]`
`.lgd`	Legend editor in any plot window	Legend entries: symbol or pattern index, colour and description
`.dht`	Drill log template File > Open Template…	Page layout: track widths, borders, header form, fonts

The first line identifies the file — for example a plan file begins `Logplotms MS Plan File`, a section file `CrossSection MS Section File`, and a drill log `Logplotms Log File` — followed by the date and time it was written.

> **These files are program-managed.** The records are position-dependent, one value per line, with counts that must match the number of records that follow. They are readable, which is useful for diagnosis, but hand-editing them will usually break the file. Change the drawing in FieldTools and re-save.

> **A plot file is not a data file.** A `.pln`, `.sec` or `.drl` file stores the drawing, not the drill hole data behind it. Archive the `.plt` data file alongside the plot file, or the figure cannot be regenerated if the plotting parameters need to change.

Wireline log files

Extension	Format	Imported by
`.las`	Log ASCII Standard, versions 1.2, 2.0 and 3.0	File > Import LAS… (drill log window)
`.txt`, `.dat`	Tab-delimited depth / value columns	File > Import Text Data…
`.csv`	Comma-delimited depth / value columns	File > Import Text Data…

A LAS file must declare its version in the version block, and FieldTools checks that the declared version matches the one selected in the file dialog. The well block supplies `STRT`, `STOP`, `STEP` and `NULL`; the `~CURVE` block supplies the curve mnemonics offered for plotting; `~WRAP` declares whether data lines wrap. For text imports, specify the depth column, the data column and the number of header lines to skip.

Image and document export

Format	Notes
`.bmp`, `.png`, `.tiff`	Lossless raster. PNG is the best general choice for a figure that will be placed in a report.
`.jpg`	Lossy. Acceptable for photographs, poor for line work — contours and text acquire visible artefacts.
`.gif`	Limited to 256 colours. Fine for line drawings, unsuitable for colour-filled contour maps.
`.wmf`	Windows metafile — a vector format that scales without pixellation and is the best choice for placing a plot into a Word document at unknown final size.
`.pdf`	**File > Save As PDF…** in any plot window, or print to a PDF printer driver.

Edit > Copy Diagram puts the plot on the clipboard for pasting directly into another application.

14. Quick Reference Tables

Plot menu and its options dialogs

Plot menu command	Options dialog	Key settings
Drill Hole/Sample Map…	XY Plot Options	Scale type, labels (None / ID # / Z Value), titles, Define Cols, Symbols
3d Contour Map…	File selection, then Contour Settings	Loads X, Y, Z from file and grids it directly
Cross Section…	Cross Section Options	Coordinates, true distance, plunge, correct to 90°, elevations, scale, titles
Log Plot…	Log Plot Options	Page layout, length, scale, units, header, template, source, title
Strike and Dip Map…	Strike/Dip Map Options	Scale type, labels, titles, Define Cols

Gridding and contouring limits and defaults

Setting	Default	Permitted range
Grid columns	100	> 75 and < 50,000
Grid rows	100	> 75 and < 50,000
Contour levels	10	2 to 1,000
Contour decimal points	1	0 to 6
Contour label size	—	4 to 22 pt
Gridding method	Classic kriging	Classic kriging, block kriging, inverse distance
Variogram model	Linear	Linear, spherical, exponential
Nugget	1	—
Sill	3	Must exceed the nugget
Range	Autocalc (bounding-box diagonal)	—
Inverse distance power	2	—
Inverse distance search radius	Maximum distance between data points	—
Inverse distance tolerance	One tenth of a cell length	—
Contour level min / max	Data limits (Autocalc)	Maximum must exceed minimum
Colour palette	1 Multicolor	1 Multicolor, 2 Smooth, 3 Strong, 4 Greyscale
Log length	—	Up to 800 cm
Define Columns field values	—	1 to 100

Formulas used

Quantity	Formula
True vertical depth	measured length × sin(inclination)
Apparent dip	arctan[tan(true dip) × sin(angle between section and strike)]
True dip	arctan[tan(apparent dip) / sin(angle between section and strike)]
Distance between two holes	$\sqrt{[(E_2 - E_1)^2 + (N_2 - N_1)^2]}$
Grid node spacing	(max − min) / number of columns or rows
Auto variogram range	$\sqrt{[(X\ max - X\ min)^2 + (Y\ max - Y\ min)^2]}$
Contour interval	(maximum − minimum) / number of levels
Inverse distance estimate	$\Sigma(Z_i / d_i^2) / \Sigma(1 / d_i^2)$
Map area	(X max − X min) × (Y max − Y min)
Gridded area with Z>0	(number of nodes with Z > 0) × X spacing × Y spacing
Volume with Z>0	Σ(X spacing × Y spacing × Z_i) for $Z_i > 0$
Tonnage	volume × bulk density
Contained metal	tonnage × average grade

File extensions

Extension	Contents
`.plt`	FieldTools spreadsheet data, tab-delimited
`.txt` / `.dat`	Delimited text data or wireline curve data
`.csv`	Comma-delimited data
`.xls` / `.xml` / `.flx`	Excel, XML and FlexCell spreadsheet files
`.pln`	Saved plan: drill hole map, sample map, strike/dip map, contour map
`.sec`	Saved cross section
`.drl`	Saved drill log
`.dht`	Drill log template
`.lgd`	Legend
`.las`	Wireline log, LAS v1.2 / v2.0 / v3.0
`.bmp` `.png` `.jpg` `.gif` `.tiff` `.wmf`	Exported diagram images
`.pdf` / `.html`	Exported documents

Troubleshooting

Symptom	Likely cause
"No Data to Plot"	Data does not start at row 2, or a blank row sits above the data, or the wrong columns are set in Define Columns.
Only some rows plotted	A completely blank row in the middle of the data ends the read.
Points stacked at the origin	Text or blanks in a numeric coordinate column, read as zero.
Two clusters far apart on a map	Data spans two UTM zones, or mixes local grid and UTM coordinates.
Section much shorter than the drill line	Calc True Distance Between Holes is off and the line is oblique to the grid axis.
Holes bunched up on a section	The wrong axis is selected — try Use Northing instead of Use Easting, or vice versa.
Inclined holes drawn in the wrong direction	Bearings are quoted relative to a different north than the grid being plotted, or the orientation rows are not in downhole order.
Contours spiky, with bullseyes on single points	Inverse distance with a high power, or kriging with too small a nugget. Raise the nugget, or switch method.
Contours implausibly smooth, ignoring known highs	Range set too long, block kriging where classic was wanted, or grid too coarse.
Contours far from posted data values	Switch on Display Drill Holes/Samples and review the gridding parameters.
"Incorrect Grid Size"	Columns or rows outside the 76 to 49,999 range.
Wireline curve flat, pinned to one edge	The null value is wrong — nulls of −999.25 are being plotted as data.
"Expected LAS V2.0 File"	The version chosen in the file dialog does not match the VERS line in the file.
Volume figure looks absurd	The Z column is not a thickness, or coordinates and thickness are in different units.

FieldTools Reference Guide — MinServ. Menu names, defaults, limits and formulas in this guide were taken from the FieldTools source. Where a value differs in your installation, the program is authoritative.