THE RUNLINE GENERATOR

RUNLINES · KP LINES · OFFSETS

User Manual

Runlines, KP lines and offsets on any datum and projection,
with .rlx runline files, DXF and PDF reports

Version 1.0

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Contents

1 Introduction . . . 3
1.1 Words used in this manual . . . 4
2 Getting started . . . 4
2.1 What you need . . . 4
2.2 Installing and starting . . . 4
2.3 Quick start . . . 4
3 Geodesy . . . 5
3.1 Datum . . . 5
3.2 Projection . . . 6
3.3 Latitude and longitude . . . 6
3.4 Checking a point . . . 6
3.5 Changing the geodesy of a project . . . 6
4 Runlines . . . 7
5 Waypoints . . . 8
5.1 Adding waypoints on the plan . . . 8
5.2 Typing waypoints . . . 8
5.3 Curves at the bends . . . 8
5.4 Pasting from Excel . . . 9
6 KP lines and offset lines . . . 9
6.1 KP lines . . . 9
6.2 Offset lines . . . 9
6.3 Parallel runlines . . . 10
7 The plan . . . 11
8 Background drawings . . . 11
9 The tables . . . 12
10 Runline files (.rlx) . . . 13
10.1 Exporting . . . 13
10.2 Importing . . . 14
11 Other exports . . . 14
12 The PDF report . . . 14
13 Files . . . 16
14 Trial and licence . . . 16
15 Troubleshooting . . . 16

1 Introduction

The Runline Generator makes runlines for survey and construction work. You place the waypoints, in Easting and Northing or in latitude and longitude, and give each bend a curve radius. The program works out the straights and curves, the KP along the line, KP cross lines at a spacing you choose, and parallel offset lines either side. The result can be exported as an .rlx runline file, a DXF drawing or CSV tables, and printed in a PDF runline report.

It works anywhere in the world: you choose the datum and projection of the job (UTM, Gauss-Kruger, Transverse Mercator, Lambert Conformal Conic or Mercator, on WGS 84 or a local datum), or use a local grid with no geodesy at all. The geodesy is calculated by the program itself, so it doesn't need the internet.

The Runline Generator with a route, its KP lines and offset lines, and a field layout drawing behind it.

Part of the screen	What it's for
Title banner	The compass rose, the program name and, top right, the project from the job details.
Toolbar	Files, job details, geodesy, background drawings, import and export, the runline file and the PDF report.
Geodesy line	The coordinate system in use. Click it to change it.
Runlines (left)	The runlines in the project. The selected one is the one you edit.
Runline (left)	A summary of the selected runline: length, KP, curves, bearings, KP lines, offsets, grid convergence and scale factor.
The plan	The runlines drawn on the grid. Add, move and measure here.
Readout (above the plan)	Easting, Northing, latitude, longitude, KP and distance off line under the mouse.
Tables (bottom)	Waypoints, straights and curves, and KP lines of the selected runline.

1.1 Words used in this manual

Word	Meaning
Waypoint	A point you place. The runline goes from waypoint to waypoint. A bend at a waypoint can have a curve radius.
Leg	The straight line between two waypoints.
Curve radius	The radius of the circular curve fitted into a bend. 0 means a sharp corner.
KP	Kilometre point: the distance along the runline in kilometres, starting from the KP you give the start (normally 0).
KP line	A short line across the runline at a KP, used as a cross line or a KP marker.
Starboard / port	Right / left of the runline, looking along it from the start to the end.
DOL	Distance off line: how far a point is to starboard (S) or port (P) of the runline.
Grid bearing	The bearing on the grid, clockwise from grid north. All bearings in the program are grid bearings.

2 Getting started

2.1 What you need

- A Windows PC.
- The program file, **RunlineGenerator.exe**. Nothing else needs to be installed.

2.2 Installing and starting

Copy **RunlineGenerator.exe** into a folder of your choice and double-click it. There is no installer. The project you were working on last opens again when the program starts.

> **Tip**
> For quick access, right-click RunlineGenerator.exe and choose **Send to > Desktop (create shortcut)**, or pin it to the Start menu or taskbar.

> **Note**
> The first time you start the program, Windows may show a **Windows protected your PC** message. Click **More info**, then **Run anyway**.

2.3 Quick start

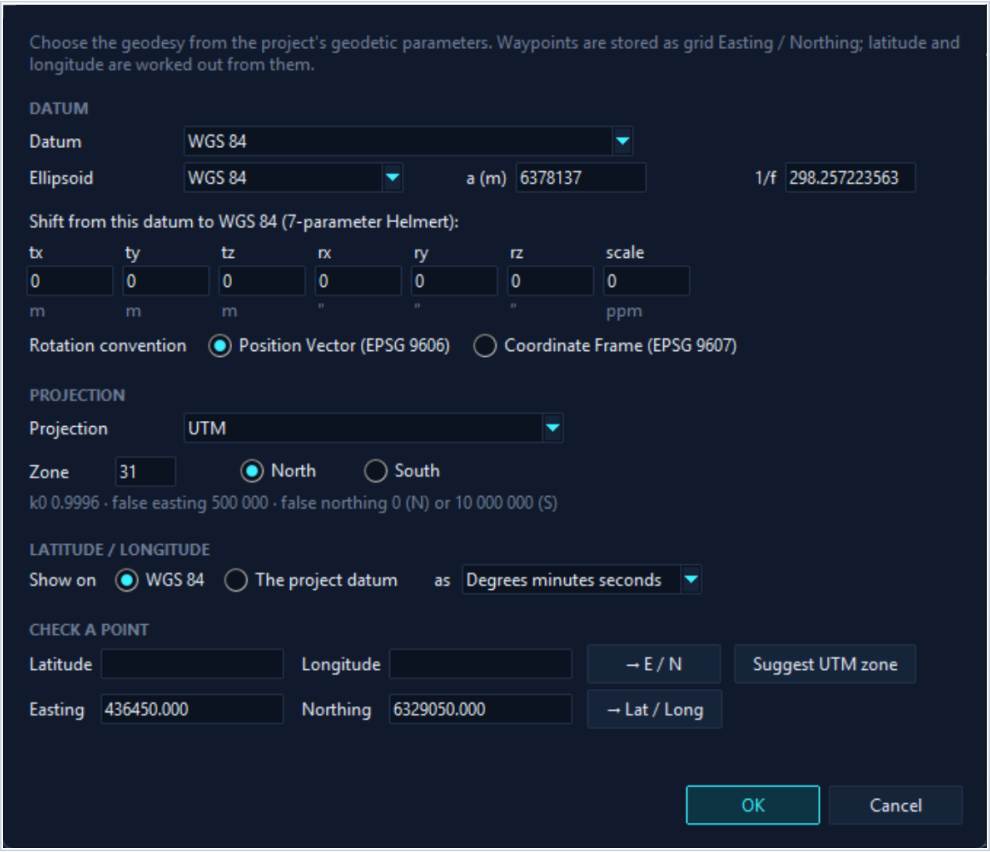
1. Click **Geodesy…** and choose the datum and projection of the job (section 3). For a quick test the default local grid is fine.
2. Click **New…** under Runlines, give the runline a name, and set the KP lines and offsets you want (section 6). Click **OK**.
3. The plan is now in **Add points** mode: click on the plan to place the waypoints, or click **Add…** or **Paste from Excel…** under the waypoints table to type or paste exact coordinates.
4. Double-click a waypoint in the table to type its curve radius, or change its position.
5. Click **Export runline file…** to save the .rlx runline file.
6. Click **Save** to keep the project, and **Create PDF report…** for the report.

> **Tip**

> An example project is included: open **Example.runlines** to see two runlines, KP lines, offset lines and a background drawing. The pictures in this manual are of the example.

3 Geodesy

Click **Geodesy…** (or the geodesy line under the toolbar). Choose the settings from the geodetic parameters of the job. The waypoints are always stored as grid Easting and Northing; latitude and longitude are worked out from them.



The geodesy settings.

3.1 Datum

Choose a datum from the list. It fills in the ellipsoid and the shift to WGS 84. To use the parameters from your project's geodetic parameter sheet, choose **Custom** (or just type over the numbers) and enter the ellipsoid and the 7 shift parameters.

Datum in the list	Ellipsoid	Shift to WGS 84
WGS 84	WGS 84	None
ETRS89	GRS 1980	None (the same as WGS 84 at survey accuracy)
ED50 - North Sea common offshore	International 1924	EPSG transformation 1311 (7 parameters)
ED50 - Western Europe mean	International 1924	EPSG transformation 1133 (3 parameters)
OSGB36 - UK petroleum	Airy 1830	EPSG transformation 1314 (7 parameters)
NAD83, GDA94, GDA2020, CGCS2000	GRS 1980 / CGCS2000	None (about 1 m from WGS 84)
WGS 72	WGS 72	EPSG transformation 1238
Custom	Any	The parameters you type

The shift is a 7-parameter Helmert transformation: three translations (tx, ty, tz in metres), three rotations (rx, ry, rz in arc-seconds) and a scale change (ppm). The rotations can be in either convention; choose the one your parameter sheet uses:

- **Position Vector** (EPSG method 9606), used by most of Europe and the offshore industry.
- **Coordinate Frame** (EPSG method 9607), used in some countries (for example Australia and the US).

The numbers are the same; the signs of the rotations are opposite.

> **Note**
> Always check the geodesy against a known point from the job (section 3.4) before using the runlines. The datum presets are standard published values; your project may use a different transformation.

3.2 Projection

Projection	Settings
Local grid (no geodesy)	Coordinates are used as they are. No latitude / longitude.
UTM	Zone 1 to 60 and North or South. Scale factor 0.9996, false easting 500 000 m, false northing 0 (north) or 10 000 000 m (south).
Gauss-Kruger	Zone and zone width (3° or 6°). Scale factor 1. False easting 500 000 m, with the zone number in front if ticked (for example zone 20: 20 500 000).
Transverse Mercator	Latitude of origin, central meridian, scale factor, false easting and northing. Use this for national grids such as the British National Grid.
Lambert Conformal Conic	With two standard parallels, or one parallel and a scale factor.
Mercator	Central meridian, scale factor, false easting and northing.

Angles can be typed as decimal degrees (negative for south or west) or as degrees, minutes and seconds, for example 2 30 W or 49°N.

3.3 Latitude and longitude

Choose whether latitude and longitude are shown on WGS 84 (as from GNSS and on modern charts) or on the project datum, and whether they are shown in degrees, minutes and seconds, degrees and decimal minutes, or decimal degrees. This also sets the datum used when you type a waypoint as a latitude and longitude.

3.4 Checking a point

Type a latitude and longitude and click → **E / N**, or an Easting and Northing and click → **Lat / Long**. The program shows the position on the project datum and on WGS 84, the grid convergence and the point scale factor, so you can compare them with a known point. **Suggest UTM zone** picks the UTM zone for the latitude and longitude you typed.

3.5 Changing the geodesy of a project

If the project already has waypoints and you change the projection or datum, the program asks what to do:

- **Yes**: convert the waypoints (and the background drawings) to the new grid, so they stay at the same places on the earth.
- **No**: keep the same Easting / Northing numbers, for example if the geodesy was set wrongly and the coordinates are already right.

4 Runlines

A project can have any number of runlines. They are listed on the left in their colours; the selected one is drawn thicker and is the one the tables and editing apply to. Clicking a waypoint of another runline on the plan selects that runline.

Button	What it does
New…	A new runline: name, colour, KP and KP / offset lines. The plan then goes into Add points mode.
Settings…	Change the selected runline's settings (or double-click it in the list).
Duplicate	A copy of the selected runline, for example to make a similar line next to it.
Delete	Delete the selected runline.
Show / hide	Hide a runline from the plan (shown with an open circle in the list). Hidden runlines are still saved and can still be exported.
Reverse	Make the runline run the other way, so the KP starts at the other end. The KP lines and offset lines stay on the same sides of the line.
Parallel lines…	Make new runlines parallel to the selected one (section 6.3).
Import .rlx…	Read the runlines in an .rlx runline file (section 10.2).

The runline settings.

KP at the start is the KP of the first waypoint, normally 0.000. A runline that continues another can start at that line's end KP.

> **Note**
> Runline names can't contain " or ; because they are used in the runline file.

5 Waypoints

5.1 Adding waypoints on the plan

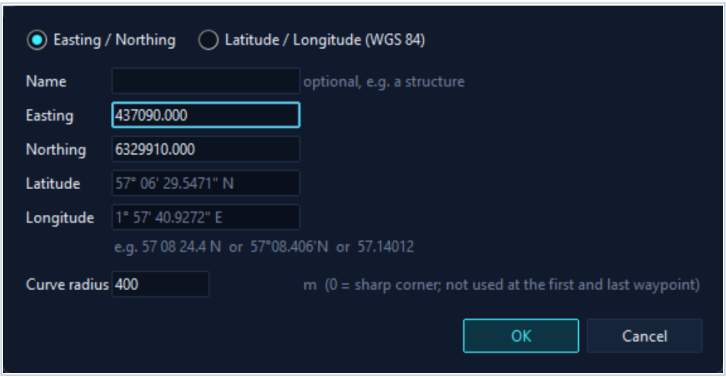
Choose **Add points** above the plan and click where each waypoint goes; each click adds a waypoint to the end of the selected runline. **Ctrl+click** puts a new waypoint into the nearest leg instead. Press **Esc** or choose **Select / move** when you have finished.

In **Select / move** mode, drag a waypoint to move it. The KP, curves, KP lines and tables follow as you drag. Press **Delete** to delete the selected waypoint.

> **Tip**
> Use Ctrl+Z to undo and Ctrl+Y to redo any change to the runlines.

5.2 Typing waypoints

Click **Add…** under the waypoints table, or double-click a waypoint to edit it. A waypoint can be typed as an Easting and Northing, or as a latitude and longitude once the geodesy is set.



Adding or editing a waypoint.

Latitudes and longitudes can be typed in any of the usual forms:

```
57 08 24.4 N        57°08'24.4"N        57 08.406 N
57.14012            -2.5   (minus = south or west)
N 57 08 24.4        2 05 33.2 W
```

Insert before… adds a waypoint in front of the selected one; **Move up** and **Move down** change the order.

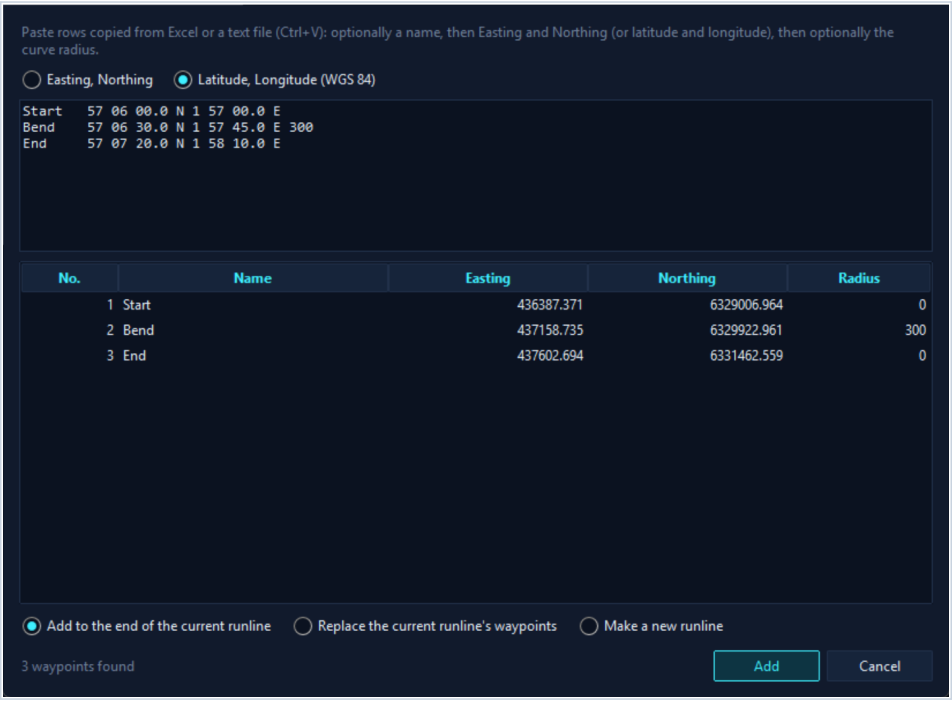
5.3 Curves at the bends

Each waypoint between the first and the last can have a curve radius. The program fits a circular curve of that radius into the bend, touching both legs. The waypoint itself is then the intersection point of the two legs (the point the line would go through with no curve), and the runline passes inside it. The thin dashed lines on the plan show the legs.

- A radius of 0 gives a sharp corner at the waypoint.
- Each curve uses some of the straight on both legs (the tangent length, radius × tan(deflection / 2)). If the curves at both ends of a leg need more than the leg's length, the program says so in the Runline box: use a smaller radius or move the waypoints apart.
- The radius isn't used at the first and last waypoint.

5.4 Pasting from Excel

Copy the rows in Excel (or a text file) and click **Paste from Excel…**. Each row needs an Easting and Northing (or a latitude and longitude), and can have a name in front and a curve radius after. Heading rows that aren't coordinates are skipped. Choose whether to add the waypoints to the end of the runline, replace its waypoints, or make a new runline.



Pasting waypoints given as latitude and longitude.

Import… → Waypoints from a CSV / TXT file… reads a file in the same way.

6 KP lines and offset lines

6.1 KP lines

In the runline settings, tick **Make KP lines across the runline** and set:

Setting	Meaning
Every	The spacing in metres, for example 50 or 100. KP lines are at whole multiples of the spacing (KP 0.000, 0.050, 0.100 …).
Length to starboard / port	How far each KP line goes to each side of the runline. They don't need to be equal, for example 100 m to starboard and 50 m to port.
From KP / To KP	Only make KP lines over part of the runline. Leave blank for the whole line.

Each KP line is square to the runline at its KP, including on the curves. In the runline file each is a short line running from the starboard end to the port end, named like +0,050Kp, the usual style in .rlx files.

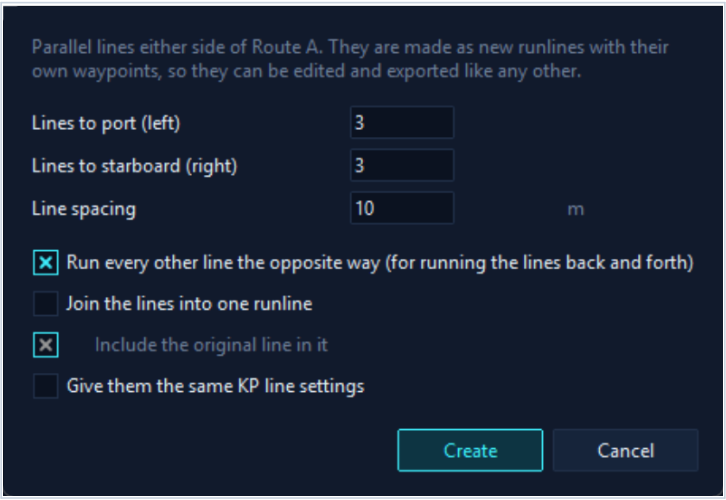
6.2 Offset lines

Type the offsets in metres, separated by commas: + to starboard and – to port, for example +25, -25, +50. Each offset line is parallel to the runline. On the curves the offset line has the same centre, so its radius is smaller on the inside of the bend and larger on the outside. An offset larger than a curve radius on the inside of the bend isn't possible, and the program says so.

Offset lines are drawn dashed and are named after the runline, for example Route A S25 and Route A P25. Their KP is measured along the offset line itself.

6.3 Parallel runlines

Parallel lines… under Runlines makes new runlines parallel to the selected one, for example a set of survey lines either side of a route. Unlike offset lines, they are runlines of their own, with their own waypoints, so they can be moved, edited, given KP lines and exported separately.



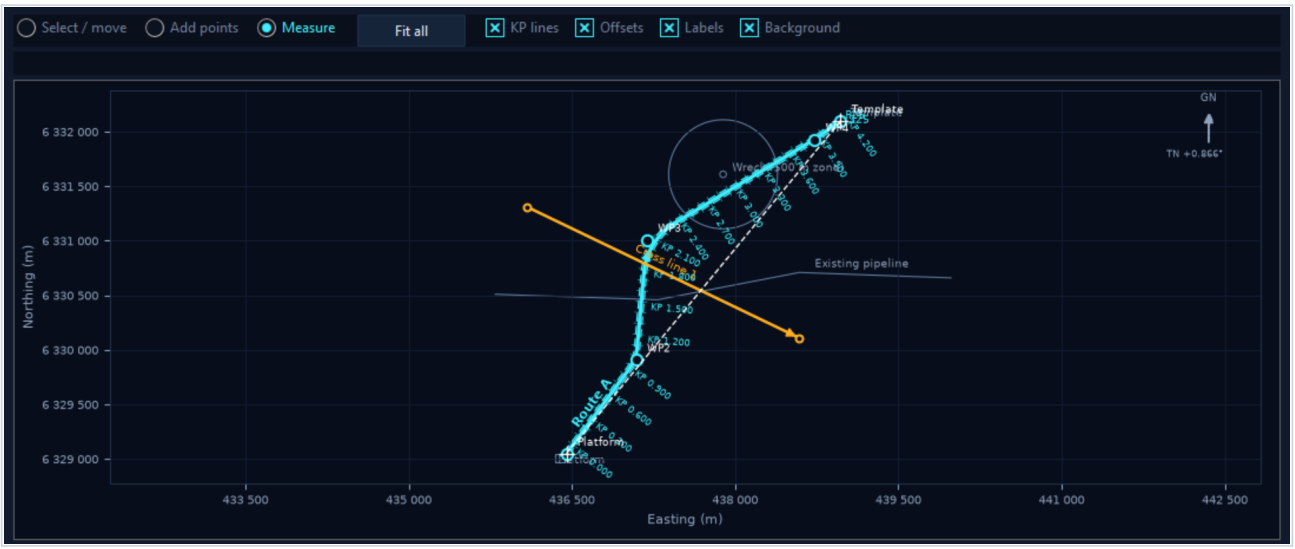
Making parallel runlines.

Setting	What it does
Lines to port / starboard	How many lines on each side.
Line spacing	The distance between the lines, in metres.
Run every other line the opposite way	Reverses every second line, so the lines can be run back and forth without the vessel going back to the same end.
Join the lines into one runline	Makes one long runline that runs each line in turn, from the furthest to port to the furthest to starboard, with a short leg joining the end of each line to the start of the next. Tick **Include the original line** to put the original line in it as well.
Give them the same KP line settings	Copies the KP line settings of the original line.

The new lines are named after the original with their side and offset, for example Route A P20 and Route A S20, or Route A parallels when they are joined. On a curve, a parallel line on the inside of the bend has a smaller radius; if the curve is too tight for the offset, that line gets a sharp corner there and the program says so.

7 The plan

To	Do this
Zoom	Turn the mouse wheel; it zooms around the mouse.
Pan	Drag with the right mouse button, or drag the background with the left button in Select / move mode.
See everything	Click **Fit all**.
Measure	Choose **Measure** and click two points: the range, grid bearing, ΔE and ΔN are shown at the bottom of the window.
Hide things	Untick **KP lines**, **Offsets**, **Labels** or **Background**.
Save a picture	**Export…** → **Picture of the plan (PNG)**: the current view on a white background.



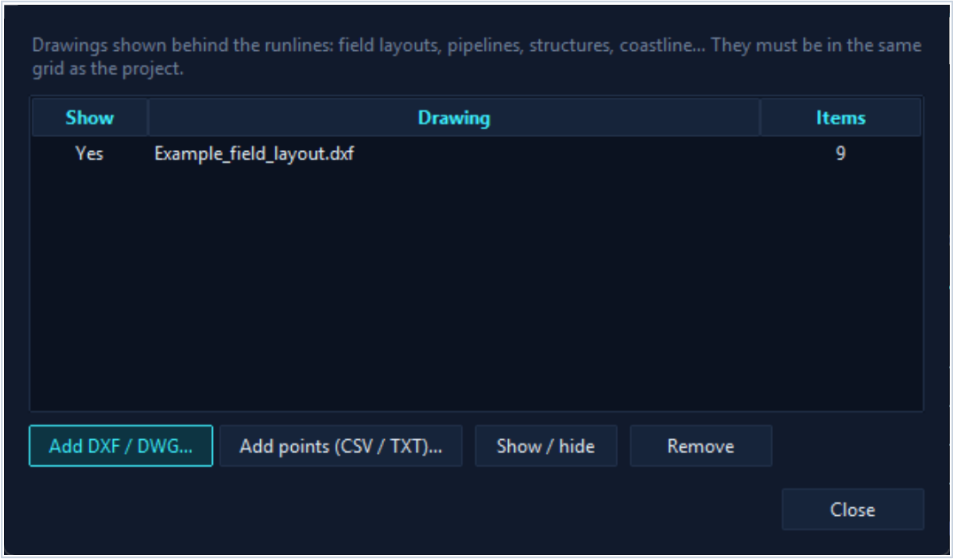
Measuring from the start of a runline to its end (the dashed white line).

The readout above the plan shows the Easting and Northing under the mouse, its latitude and longitude, and its KP and distance off line (DOL) on the selected runline: S for starboard, P for port.

The arrow at the top right shows grid north (GN). When a projection is set, a second, dashed arrow shows true north (TN) with the grid convergence: the angle of true north east (+) or west (–) of grid north at the middle of the view.

8 Background drawings

Click **Background…** and **Add DXF / DWG…** to show drawings behind the runlines: a field layout, existing pipelines and cables, structures, wrecks, the coastline… They must be in the same grid as the project.



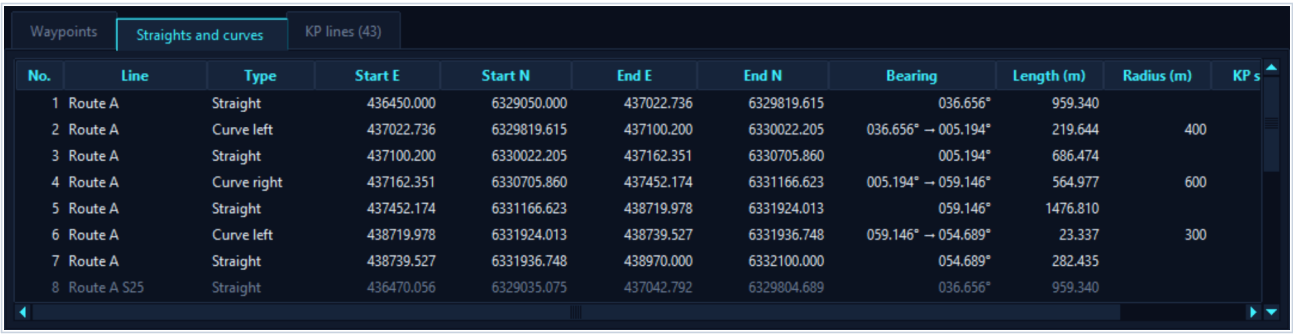
The background drawings.

- **DXF**: lines, polylines (including curved segments), arcs, circles, ellipses, splines, points, text and blocks (with their scale, rotation and arrays) are drawn. The DXF must be a normal text (ASCII) DXF.
- **DWG**: DWG drawings are read by converting them to DXF with the free ODA File Converter (from opendesign.com, under Guest Files). Install it once; the program finds it and uses it automatically. Without it, save the drawing as a DXF in your CAD program and add the DXF.
- **Points (CSV / TXT)**: a name (optional), Easting and Northing on each row. Each point is drawn with its name.

Double-click a drawing in the list, or click **Show / hide**, to hide it. The drawings are saved in the project file, so the original file isn't needed afterwards.

9 The tables

Tab	Columns
Waypoints	Number, name, Easting, Northing, latitude, longitude, curve radius, grid bearing and length of the leg to the next waypoint, and the KP of the point on the runline nearest the waypoint.
Straights and curves	Each element of the runline and its offset lines: type (straight, curve right, curve left), start and end, bearing (in and out for a curve), length, radius and the KP at each end.
KP lines	The KP, the position on the runline, its latitude and longitude, the bearing of the runline there, and the starboard and port ends of the KP line.



Waypoints | Straights and curves | KP lines (43)

No.	Line	Type	Start E	Start N	End E	End N	Bearing	Length (m)	Radius (m)	KP s
1	Route A	Straight	436450.000	6329050.000	437022.736	6329819.615	036.656°	959.340		
2	Route A	Curve left	437022.736	6329819.615	437100.200	6330022.205	036.656° → 005.194°	219.644	400	
3	Route A	Straight	437100.200	6330022.205	437162.351	6330705.860	005.194°	686.474		
4	Route A	Curve right	437162.351	6330705.860	437452.174	6331166.623	005.194° → 059.146°	564.977	600	
5	Route A	Straight	437452.174	6331166.623	438719.978	6331924.013	059.146°	1476.810		
6	Route A	Curve left	438719.978	6331924.013	438739.527	6331936.748	059.146° → 054.689°	23.337	300	
7	Route A	Straight	438739.527	6331936.748	438970.000	6332100.000	054.689°	282.435		
8	Route A S25	Straight	436470.056	6329035.075	437042.792	6329804.689	036.656°	959.340		

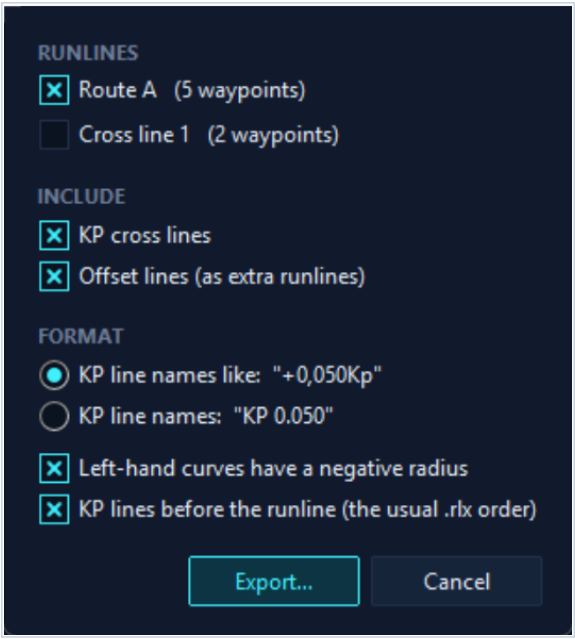
The straights and curves of a runline and its offset lines.

Copy table copies the waypoints so they can be pasted into Excel.

10 Runline files (.rlx)

10.1 Exporting

Click **Export runline file…**. Tick the runlines to put in the file and choose what to include:



Exporting a runline file.

Choice	What it does
KP cross lines	Adds each KP line as a short runline of its own.
Offset lines	Adds each offset line as a runline of its own.
KP line names	+0,050Kp (the usual .rlx style) or KP 0.050. With more than one runline in the file, the runline's name goes in front.
Left-hand curves have a negative radius	How the direction of a curve is written (see the note below).
KP lines before the runline	The order of the lines in the file.

The file is plain text. Each line in it starts with a heading row (name, type and start KP), then one row for each straight or curve:

```
"Route A"; 65; 0.0000
436450.000; 6329050.000; 437022.736; 6329819.615; 0.00000000; 0.95934019; 0.0000; 1; 64
437022.736; 6329819.615; 437100.200; 6330022.205; 0.95934019; 1.17898414; -400.0000; 1; 128
437100.200; 6330022.205; 437162.351; 6330705.860; 1.17898414; 1.86545838; 0.0000; 1; 64
```

Here the second row is a 400 m curve to the left. A row holds the start Easting and Northing, end Easting and Northing, KP at the start and end, the curve radius (0 for a straight), and the type: 64 for a straight, 128 for a curve, 80 for a KP line.

> **Note**
> A curve to the right is written with a positive radius. A curve to the left is written with a negative radius. Before using the program on a job, import a test file into your navigation software and check that the curves bend the right way. If the left-hand curves come out the wrong way, untick **Left-hand curves have a negative radius**.

10.2 Importing

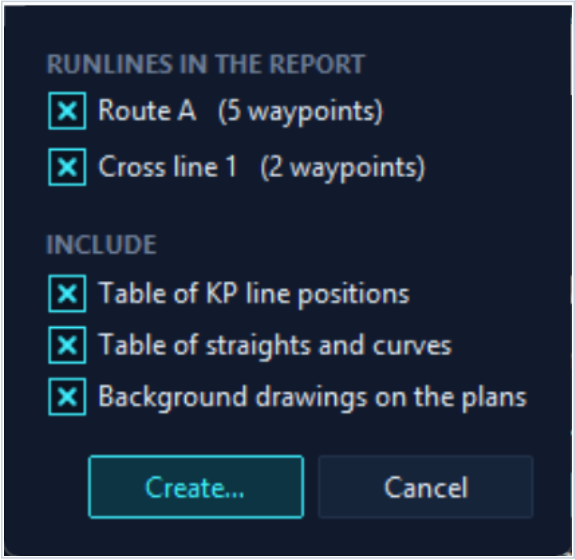
Import… → **Runline file (.rlx)…** (or **Open…** and choose the .rlx) reads a runline file back in. Each runline in the file becomes a runline in the program, with its waypoints and curve radii worked out from the straights and curves. KP lines in the file become the runline's KP line settings: spacing, starboard and port lengths. Offset lines in the file come in as runlines of their own.

11 Other exports

Export	What you get
DXF drawing	The runlines with real arcs for the curves, on a layer for each runline, with layers for its KP lines (with KP labels), offset lines and waypoints (with names).
Waypoints (CSV)	Every runline's waypoints with latitude, longitude, radius, bearing, leg length and KP.
KP positions (CSV)	The position of every KP line with latitude, longitude and bearing, and the ends of the KP line.
Straights and curves (CSV)	Every element of every runline and offset line.
Picture of the plan (PNG)	The current view of the plan on a white background.

12 The PDF report

Fill in **Job details…** first: project, client, vessel, location, who prepared and checked it, the revision and the date. Then click **Create PDF report…**, tick the runlines to include and what to show, and choose where to save it.



The report choices.

The report is A4 landscape:

- **Front page**: the job details, the full geodesy (datum, ellipsoid, shift and projection parameters) and a summary of the runlines.
- **Overview** (when there is more than one runline): all the runlines on one plan.
- **A section for each runline**: its plan, the waypoints table, the straights and curves, and the KP lines.

RUNLINE REPORT Example field development · Rev A

Runline Report

Example field development · Example Energy · Survey vessel · North Sea

Project	Example field development	Client	Example Energy
Vessel	Survey vessel	Location	North Sea
Prepared by	A. Surveyor	Checked by	
Revision	A	Date	19/10/2026

Geodesy

Coordinate system	WGS 84 / UTM zone 31N
Datum	WGS 84
Ellipsoid	WGS 84 a = 6378137.000 m 1/f = 298.257224
Datum shift to WGS 84	None
Projection	Transverse Mercator · latitude of origin 0° 00' 00.000" N · central meridian 3° 00' 00.000" E · scale factor 0.9996 · false easting 500 000.000 m · false northing 0.000 m
Latitude / longitude shown on	WGS 84

Runlines

Runline	Waypoints	Start (E / N)	End (E / N)	Length (m)	KP	Curves	KP lines	Offset lines
Route A	5	436450.000 / 6329050.000	438970.000 / 6332100.000	4213.017	0.000 – 4.213	3	43 @ 100 m	S25, P25
Cross line 1	2	436090.000 / 6331310.000	438590.000 / 6330110.000	2773.085	0.000 – 2.773	0	—	—

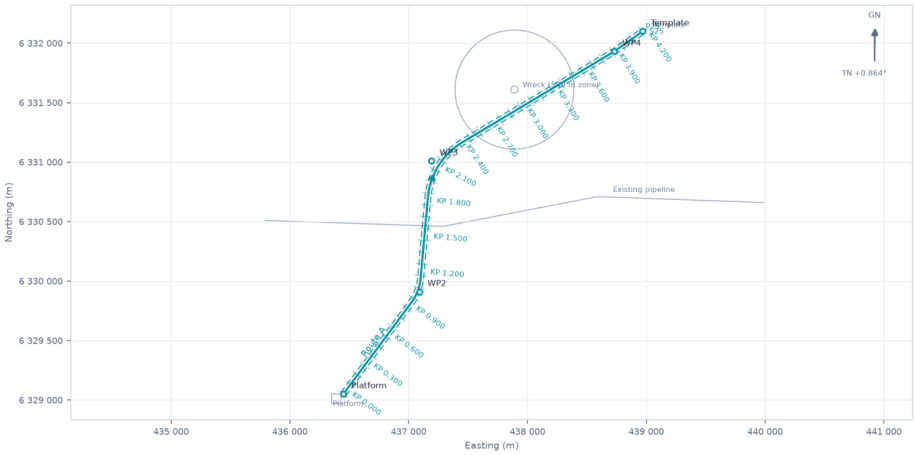
The Runline Generator · Kleboe Tech Solutions Ltd · WGS 84 / UTM zone 31N · bearings are grid bearings Page 1

The front page of the example's report.

RUNLINE REPORT Example field development · Rev A

Route A

5 waypoints · length 4213.017 m · KP 0.000 – 4.213 · KP lines every 100 m, 50 m starboard / 50 m port · offset lines S25 m, P25 m



Notes: Proposed route. Crosses the existing pipeline at about KP 1.62.

Waypoints

WP	Name	Easting	Northing	Latitude (WGS 84)	Longitude (WGS 84)	Radius (m)	Bearing to next	Leg (m)	KP
1	Platform	436450.000	6329050.000	57° 06' 01.423" N	1° 57' 03.682" E		036.656°	1072.007	0.0000
2		437090.000	6329910.000	57° 06' 29.547" N	1° 57' 40.927" E	400	005.194°	1104.536	1.0692
3		437190.000	6331010.000	57° 07' 05.164" N	1° 57' 45.876" E	600	059.146°	1793.878	2.1479
4		438730.000	6331930.000	57° 07' 35.660" N	1° 59' 16.603" E	300	054.689°	294.109	3.9189
5	Template	438970.000	6332100.000	57° 07' 41.272" N	1° 59' 30.722" E				4.2130

The Runline Generator · Kleboe Tech Solutions Ltd · WGS 84 / UTM zone 31N · bearings are grid bearings Page 3

A runline page.

13 Files

File	What it is
.runlines	A Runline Generator project: the job details, geodesy, runlines and background drawings. Double-click it to open it (after the program has been run once).
.rlx	A runline file, exported or imported.
.dxf	A drawing, as a background or exported.
.csv / .txt	Waypoints to import, or tables exported for Excel.

The program remembers the last project and opens it when it starts.

14 Trial and licence

The program runs as a free 48-hour trial with everything working. The bar under the title shows how long is left:

The trial bar.

After that it needs a Survey Software Utilities licence key: click **Enter licence key…**, paste the key from the email and click **Activate**. One key unlocks every Survey Software Utilities program on the PC, on up to 4 PCs. With a licence the bar goes, and the window title shows **Licensed until** and the date. The licence is checked online now and then and works for up to 30 days at a time without internet.

15 Troubleshooting

Problem	What to check
The runline is drawn red and dashed	A curve doesn't fit: see the message in the Runline box. Use a smaller radius or move the waypoints apart.
No latitude / longitude is shown	Choose a projection in Geodesy… A local grid has no latitude and longitude.
Positions are a few hundred metres out	Check the datum and its shift, and whether latitude and longitude are on WGS 84 or the project datum.
A KP line is on the wrong side	Starboard is to the right looking from the start of the line to the end. Use Reverse, or swap the starboard and port lengths.
Curves bend the wrong way in the navigation software	Untick Left-hand curves have a negative radius when exporting (section 10).
Paste finds nothing	Each row needs an Easting and a Northing (or a latitude and longitude) next to each other. Choose the right type at the top of the paste window.
The background is in the wrong place	It must be in the same grid as the project.
A DWG won't open	Install the free ODA File Converter, or save the drawing as a DXF in your CAD program.
The report or file won't save	Close it in the PDF viewer or Excel, or save with another name.