OpenOrienteering Mapper User Manual

Generated by Doxygen 1.14.0

1 User Manual 1

1.1 Contents . . . 1
1.2 Online resources . . . 1
1.3 Installation . . . 2
1.3.1 Windows . . . 2
1.3.2 Android . . . 2
1.3.3 macOS . . . 2
1.3.4 Linux . . . 2
1.4 Introduction to the User Interface . . . 3
1.4.1 The Desktop User Interface . . . 3
1.4.1.1 The Home Screen . . . 3
1.4.1.2 The Map Editor . . . 3
1.4.2 The Touch Mode User Interface . . . 4
1.4.2.1 Using the Mapper app in "Touch Mode" . . . 4
1.5 The Mapper App for Android . . . 7
1.5.1 Preliminary remarks . . . 7
1.5.2 Device Requirements and Recommendations . . . 7
1.5.2.1 Android version . . . 7
1.5.2.2 Water-proofing . . . 7
1.5.2.3 Stylus . . . 7
1.5.2.4 Screen size . . . 7
1.5.2.5 Battery . . . 7
1.5.2.6 Sensors . . . 7
1.5.3 Preparing a Map on the PC . . . 7
1.5.3.1 Georeferencing when you create a new map . . . 8
1.5.3.2 Georeferencing when you use an existing map . . . 8
1.5.4 Storing Maps and Templates on Android Devices . . . 8
1.5.4.1 Storage locations . . . 8
1.5.4.2 File transfer . . . 8
1.5.4.3 Data loss prevention and recovery . . . 9
1.5.5 The Touch Mode User Interface . . . 9
1.5.5.1 Using the Mapper app in "Touch Mode" . . . 9
1.6 Starting a New Map . . . 12
1.7 Georeferencing . . . 13
1.8 Map Grid . . . 16
1.8.0.1 Grid settings . . . 16
1.9 Objects . . . 17
1.9.1 Map Parts . . . 17
1.9.2 Object tags . . . 17
1.9.2.1 About object tags . . . 17
1.9.2.2 The tag editor . . . 17
1.9.3 Find objects . . . 18

1.9.3.1 Querying objects . . . 18
1.9.3.2 Advanced query language . . . 18
1.9.3.3 Buttons . . . 19
1.10 Templates and Data . . . 20
1.10.1 Introduction to Templates . . . 20
1.10.2 Adjusting template positions . . . 22
1.10.3 CoVe, the Contour Vectorizer . . . 23
1.10.3.1 Starting CoVe . . . 23
1.10.3.2 The "Image" tab . . . 24
1.10.3.3 The "Colors" tab . . . 24
1.10.3.4 The "Thinning" tab . . . 25
1.10.4 Geospatial data support with GDAL . . . 27
1.10.4.1 GDAL drivers offered by OpenOrienteering Mapper . . . 27
1.11 Colors and Symbols . . . 32
1.11.1 Color Window . . . 33
1.11.2 Symbol Pane . . . 35
1.11.3 Symbol Replacement Dialog . . . 38
1.12 Using the Course Design Symbol Set . . . 39
1.12.1 Loading a base map . . . 40
1.12.2 Drawing the course . . . 40
1.12.3 Creating the control description sheet . . . 40
1.12.4 About the control description sheet . . . 40
1.12.5 Specifications for Trail Orienteering . . . 41
1.13 Reference . . . 41
1.13.1 Menus . . . 41
1.13.1.1 File Menu . . . 41
1.13.1.2 Edit Menu . . . 42
1.13.1.3 View Menu . . . 44
1.13.1.4 Tools Menu . . . 45
1.13.1.5 Map Menu . . . 45
1.13.1.6 Symbols Menu . . . 46
1.13.1.7 Templates Menu . . . 47
1.13.2 Toolbars . . . 47
1.13.2.1 Toolbar positions and visibility . . . 47
1.13.2.2 General toolbar . . . 47
1.13.2.3 View toolbar . . . 48
1.13.2.4 Map parts toolbar . . . 48
1.13.2.5 Drawing toolbar . . . 48
1.13.2.6 Editing toolbar . . . 51
1.13.2.7 Advanced drawing toolbar . . . 53
1.13.3 Settings . . . 55
1.13.4 CRT Files . . . 56

1.13.4.1 Introduction . . . 56
1.13.4.2 CRT file syntax . . . 57
1.13.4.3 CRT file editing . . . 57
1.14 Frequently Asked Questions (FAQ) . . . 57
1.14.1 Navigation . . . 57
1.14.1.1 How do I move the map? . . . 57
1.14.1.2 How to zoom in and out? . . . 57
1.14.2 Drawing . . . 57
1.14.2.1 I want to start drawing a map, but have no idea how to. . . . 57
1.14.2.2 How do I add points to an existing path or delete points from it? . . . 57
1.14.2.3 How do I change line segments from curved to straight and vice versa? . . . 58
1.14.3 Advanced editing . . . 58
1.14.3.1 How can I cut out a part of a map to take it for a new map? . . . 58
1.14.4 File formats . . . 58
1.14.4.1 What are the advantages of the .omap format? . . . 58
1.14.4.2 What is the difference between .xmap and .omap format? . . . 58
1.14.4.3 Can Mapper read and write .ocd files? . . . 58
1.14.5 Mobile devices . . . 58
1.14.5.1 Will Mapper be available for Android? . . . 58
1.14.5.2 Will Mapper be available for iPhone / iPad? . . . 58
1.14.5.3 How do I hide/protect a symbol in the mobile UI? . . . 58
1.14.6 Experienced mappers' corner . . . 58
1.14.6.1 What are the most notable differences to OCAD? . . . 58

2 Introduction to mapping for orienteering **61**
2.1 Topics to be covered . . . 61
2.2 Surveying (classic method) . . . 61
2.2.1 Prerequisites . . . 61
2.2.2 Fieldwork . . . 61
2.3 Symbols . . . 62
2.3.1 Symbols Window . . . 62
2.4 Colors . . . 62
2.4.1 Color Window . . . 62
2.4.2 Color adjustment . . . 62
2.5 Map scales . . . 63

Index **65**

Chapter 1

User Manual

Note: The online version of this documentation may contain additions and corrections.

1.1 Contents

Installation Instructions to download and install OpenOrienteering.

Introduction to the User Interface Explanation of the home screen and main drawing window.

The Touch Mode User Interface Using the Mapper app in "Touch Mode".

The Mapper app for Android Working with the Android version of Mapper.

Starting a new map First steps.

Georeferencing Defining the relationship between map paper coordinates and real world coordinates.

Map grid Showing a helper grid in the map view.

Objects Organizing, tagging and finding map objects.

Templates and Data Using and processing images and geospatial data.

Colors and symbols Modifying map colors and symbols.

Course design Using the course design symbol set.

Reference Drawing tools, toolbars, menu items, settings, CRT files.

FAQ Frequently asked questions.

1.2 Online resources

Blog The latest news from OpenOrienteering.

Issues list Submit feedback, bug reports, feature requests, and contributions.

Releases Releases, with links to change information and known issues.

1.3 Installation

OpenOrienteering Mapper runs on Android, Windows, macOS and Linux. Visit https://www.openorienteering.org/apps/mapper/ to find downloads. Apart from stable releases, the web site offers packages from other branches of development.

When the website is able to recognize the visitor's operating system, the download button will point right to the recommended package, and another link will bring you to the main page of this release.

The main page of a particular release is also the target of the download button when the operating system cannot be identified. Apart from important notes, it has an "Assets" section with the full list of alternative downloads for Windows, macOS and Android.

1.3.1 Windows

The default download for Windows is the installation program for 64-bit systems ("...-Windows-x64.exe"). Most modern Windows computers will be able to run this version.

For older or otherwise constrained Windows computers, you may choose the 32-bit version which has "Windows-x32" in it file name.

Apart from the installation program packages ("∗.exe"), there are also plain compressed archives ("∗.zip") which can be run without installation, e.g. from a USB stick.

1.3.2 Android

The default download for Android is an APK package for ARM CPUs ("...-armeabi-v7a.apk") Most Android devices will be able to run this version.

More modern ARM based devices will benefit from choosing the 64-bit variant instead, named "...-arm64-v8a.apk". There are also devices based on x86-type CPUs, so there are even more 32-bit ("...-x86.apk") and 64-bit ("...-x86_64.apk") variants.

If you are unsure of your CPU type follow these instructions:

https://android.gadgethacks.com/how-to/android-basics-see-what-kind-processor-you-have-a

1.3.3 macOS

For macOS, there is just a single download ("...-macOS.dmg").

1.3.4 Linux

For Linux, the download links will guide you to Open Build Service where we provide Linux packages for major distribution:

https://software.opensuse.org/download.html?project=home%3Adg0yt&package=openorienteerin

1.4 Introduction to the User Interface

1.4.1 The Desktop User Interface

On computers running Windows, macOS or Linux, the default appearance of OpenOrienteering Mapper is the "Desktop User Interface".

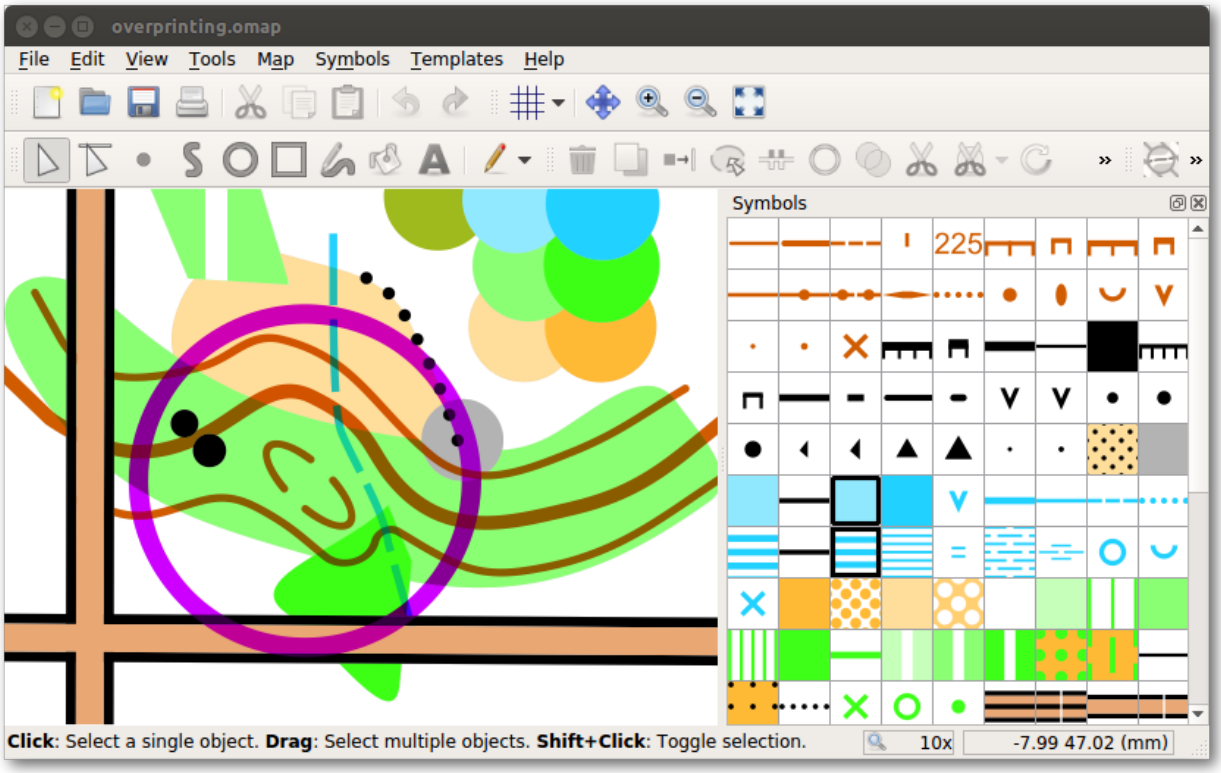
1.4.1.1 The Home Screen

When Mapper is running with no opened map file, the program shows the "Home" screen. It features buttons for key actions (left side) and a list of recently used files (right side).

One special button is labeled "Touch mode". Using this button, you can toggle the Touch Mode User Interface. This user interface is designed for mobile work with a touch screen, and it is the only user interface offered on Android devices. Note that the GNSS tracking feature is available only in touch mode at the moment.

1.4.1.2 The Map Editor

In the desktop user interface, the map editor window looks like this:



The **toolbars** at the top provide access to the drawing tools, among others. See the list of all toolbar elements.

In the middle, the currently opened **map** is displayed.

On the right, a list of all **symbols** in the currently opened map file is shown. See symbols.

On the bottom, there is the **status bar** which shows useful information about the usage of the currently active tool. Just by reading these tips, you can learn a lot about the drawing tools without reading this manual.

You can rearrange the position of the toolbars and the symbol pane as you wish by dragging them to the desired location.

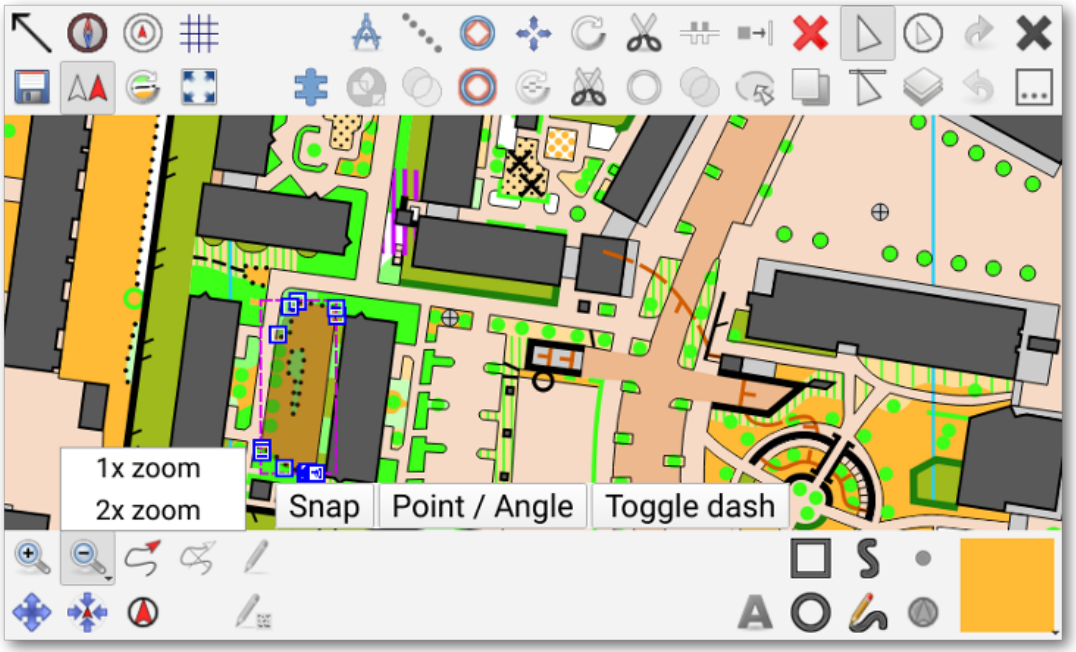
1.4.2 The Touch Mode User Interface

1.4.2.1 Using the Mapper app in "Touch Mode"

The "Touch Mode" is an alternative user interface which is always active on Android devices. It can be activated on PCs, too.

In Touch Mode, the map editor is different from the desktop version. It offers a fixed set of buttons add the top and at the bottom of the screen. Not all Mapper features are offered in Touch Mode, but on the other hands some features such as live GNSS tracking are available only in this mode.

This page focuses on specific features of the touch mode user interface. To find out about the other symbols, see the Toolbars documentation.



↖ Hide the top bar

Using this button, you may hide the top bar, leaving more screen for the map. A similar button will remain visible for restoring the top bar again.

Compass display toggle

When this item is activated, a compass is shown in the top-left corner of the screen. The red line indicates the north direction, while the black-white lines show the up direction of your device. If both are aligned, the device is aligned with magnetic north. When the needle is close to the north direction, a green circle appears which quickly shows how well the device is aligned: the larger it is, the better the alignment is. The compass works three-dimensionally, so you do not need to hold the device in a flat pose for it to work.

Note: the usefulness of the compass depends on the presence of a gyroscope, as mentioned in the device recommendations section.

Attention: the compass is very sensitive to magnetic materials. Android tries the eliminate the influence of local magnetic fields, but this requires calibration. To do this, move the device around in the shape of an 8 while rotating it and while the compass is active. If the local influence changes, re-calibration is required.

Location display toggle

If the currently active map work has valid georeferencing, this control will be enabled and will show a dot at your current position as obtained from Global Navigation Satellite Systems (GNSS, e.g. GPS) or other positioning services. In addition, in case an accuracy estimate (HDOP) is available, this shows a circle around the dot which indicates the positioning accuracy. The chance of your real position being in the circle is approximately 70%.

While this is active, your track is automatically recorded into a GPX file in the directory of your map, named "<map> - GPS-<YYYY-MM-DD>.gpx". This file is included as a template in the map. You can simply show it using the template visibility control button to view your track.

Note that track recording might be interrupted while the screen is off or the app is in the background to save battery. Keep the app active if you want to ensure continuous track recording.

Distance rings toggle

This button is active if location display is active. When activated, this will display rings in 10 meter and 20 meter distance from the current location which can be used to do rough distance estimates.

Automatic north alignment toggle

When this toggle is active, the map is automatically rotated to north using the device's internal compass. The update frequency is 1 update per second. This is quite low on purpose to save battery, but you probably still need some replacement batteries when using this mode. While interacting with the map and for another 1.5 seconds after that, the map is not rotated to allow editing without unwanted rotations. If GNSS position display is activated at the same time, a line starting from the GNSS position and going in the direction of the up direction of your device is displayed which shows your viewing direction (assuming you are holding the device upright).

Map parts selector

This button opens a popup for changing the active map part.

Touch cursor toggle

This symbol activates a helper cursor which allows slow, but precise editing with fingers only. The cursor consists of a circular area and a pointer above the circle.

Touching the map anywhere outside the circle moves the pointer to this position. Touching the circle simulates a real touch at the pointer position above the circle.

Template control

This shows a list of all opened templates. Touching a template toggles its visibility.

Close button

This closes the active map and returns to the map selection screen.

Overflow button

Depending on the screen size of your device, some of the symbols available not fit onto the screen. They are instead placed in a list which is shown on touching the overflow button. If all symbols fit on the screen, this button is unused.

Zoom out / Zoom to fixed

A short press will zoom out by one step.
A long press will open a menu where you can jump to a fixed zoom (cf. screenshot).

Move to location

When positioning services are enabled, this will move the map so that your current location is in the middle of the screen.
A long press will open a menu where you can enable a mode which will automatically move the map so that the current location stay in the central region of the screen.

Mark temporary position

This records a single point at your current location to act as a drawing help. Note that this marker is not saved in the map.

Record temporary trace

This symbol is enabled when the location display is active. It records a temporary trace of the location, which is intended to act as a guideline for drawings. Using the trace directly is rarely useful because of the inaccurateness of location services. Note that the temporary trace is not saved in the map.

Clear temporary markers

This removes the temporary traces and position markers. (They will also be discarded when closing the map file.)

Paint on template

By this tool, mapper supports free-hand drawing onto raster image templates. There is a small selection of colors for drawing as well as an eraser tool. By additional buttons, you can choose to created filled areas instead of lines, to use a dot pattern instead of a solid fill, or to draw only in the background (transparent regions). There is also a dedicated undo/redo feature.
This tool is an convenient alternative when you want to do only (or mostly) drafting in the field, but draw the final version of the map at home on a PC. It does not create new map objects but only alters the template you draw on. This may help to deal with low processing power or battery runtime on mobile devices.
A short press may activate painting on the template which was used before if it is still on the screen. Otherwise, or on long press, there is a menu which indicates available templates, or offers to create a new template.
Please note that direct drawing onto regular base map images is *not* recommended: Color and eraser tool would easily destroy important details. Templates in JPEG format also should not be used: This is a lossy file format which will introduce visible artifacts when saving the file and loading it repeatedly.

Free-hand draw tool

Allows to draw paths free-handedly.

Draw at location tool

Sets a point object at your current location. Selecting this button first enters an averaging mode. While it is active, the input from the location service is averaged to get a more accurate estimate. Touch the map display anywhere to finish the averaging.

1.4.2.1.0.1 Symbol selector

Displays the active symbol, and opens the symbol selection screen on short press.
A long press of the symbol selector opens a popup menu which allows to read the symbol name and description, and to toggle the visibility and the protection state of the symbol.

1.5 The Mapper App for Android

1.5.1 Preliminary remarks

The Android version of OpenOrienteering Mapper is not as self-descriptive as the desktop version, so please read this first for important instructions.
Device requirements and recommendations
Preparing a map on the PC
Storing Maps and Templates on Android Devices
Using the Mapper app in "Touch Mode"
Note: The `online version` of this documentation may contain additions and corrections.

1.5.2 Device Requirements and Recommendations

1.5.2.1 Android version

The minimum version for running the app is 4.1. Write access to SD cards may require Android 4.4 (cf. Storage locations)

1.5.2.2 Water-proofing

For obvious reasons, water-proof devices may be advantageous.

1.5.2.3 Stylus

For doing any serious work, a stylus is a must-have (because of precision & speed, and because of temperature during winter). You should preferably look for devices which come with an adapted stylus such as the Samsung Galaxy Note series, as general styluses for capacitive touch screens have rather wide tips.

1.5.2.4 Screen size

There is a compromise between ease of handling (better on smaller devices) and overview (better on larger devices).

1.5.2.5 Battery

It is very desirable to use a device with replaceable battery. It may be possible to use an external battery pack for devices with integrated battery.

1.5.2.6 Sensors

OpenOrienteering Mapper can use integrated GNSS receivers. However, their accuracy may be low, so it may be advantageous to connect to an external GNSS receiver. There is no direct support for external devices in Mapper, but some third party apps bridge the gap. For example the `Bluetooth GNSS app` provides a "mock" location provider which can be used when Android is put in developer mode.
The app can use a magnetometer and accelerometer as a compass. Almost all modern devices should contain these sensors. If a gyroscope is also available, it will be used to improve the compass stability. However, these sensors are typically not accurate enough to be used for measurements. They can be used for convenience when not relying on a compass, but for accurate measurements, an external compass is recommended.

1.5.3 Preparing a Map on the PC

The Android app cannot be used to create new maps because it would be cumbersome to setup the base maps there. Instead, maps should be prepared with templates and possibly georeferencing using the PC version of Mapper first and then transferred to the mobile device for surveying.

If you want to use live GPS display, the map must be georeferenced. There are several options how to do this:

1.5.3.1 Georeferencing when you create a new map

The first thing to do after creating a new map should be to load a georeferenced template. If you do not have one, you may use for example an OpenStreetMap export in case there is sufficient data at the map's location. To do so, go to https://www.openstreetmap.org, locate the map region, and click 'Export'. Then select an area which covers all of your templates and save the export as .osm file. This file can then be loaded into Mapper as a georeferenced template.
On loading the first georeferenced template, Mapper will show the georeferencing dialog. This may look a bit intimidating at first, but when loading a template, usually little needs to be changed there. First, the projection type should be checked. If you do not know which projection to use, just select UTM. Second, the magnetic declination should be entered to align the map with magnetic north. You may simply use the lookup button to look it up on the internet for the place of the template you loaded. However, be aware that the lookup only uses a model which may deviate from the real declination. It may be advantageous to check this in the terrain. All remaining values in the georeferencing dialog are already initialized using the newly loaded template, so you can then finish the dialog.
Then load all remaining templates and finish preparing the map. Non-georeferenced templates will need to be moved to match the location of the georeferenced templates.

1.5.3.2 Georeferencing when you use an existing map

In this case, the easiest way is to first create a new map with the same symbol set as the existing map. The old map can be selected as the symbol set source in the new map dialog to do this. Then load a georeferenced template as detailed in the paragraph above (use e.g. OpenStreetMap if you do not have a georeferenced template).
After that, load the existing map as template in the new map. Then use the alignment tools for templates to move the existing map to match with the new georeferenced template. When you are finished, import the existing map template into the new map file using the corresponding action in the template dock widget, and you should be done.
Attention: especially for old maps, the whole existing map may be locally distorted. In this case it will not be possible to match the old map and the georeferenced template, and the only way to georeference the map is to do a tedious manual correction for distortion. Mapper does not provide a tool for this.

1.5.4 Storing Maps and Templates on Android Devices

1.5.4.1 Storage locations

Android organizes storage and permissions different than PCs. Especially on SD cards, write access for apps is restricted.
You can choose the following locations for storing data which you want to edit and to display in OpenOrienteering Mapper:

- Folder "OOMapper" at the top level of the primary storage volume. On most devices, the primary storage volume is a part of the built-in storage. Files in this area are stored permanently, until you decide to remove them. Unfortunately, there is usually only limited capacity available - this memory is expensive when buying the device.
- Path "Android/data/org.openorienteering.mapper/files" on arbitrary storage volumes such as built-in memory or SD cards (since Mapper 0.6.5). This is the only convenient way to store map data on cheap extra memory cards. However, you need to be aware of the fact that these folders are removed by Android when you uninstall the Mapper app. So please carefully save your changes to a PC.

OpenOrienteering Mapper for Android will create these folders when they are missing, and scan them for map files. It will display warnings when you open maps from the non-permanent app-specific folders or from read-only locations. (Top-level "OOMapper" folders on secondary storage volumes are scanned, but cannot be written to.)

1.5.4.2 File transfer

You can transfer files from and to a PC via a USB cable. Android supports multiple file transfer protocols.

- MTP is the preferred method now. There is hardly any interference for apps while the device is connected to the PC. Via MTP, Android will only show files which are known to its Media Scanner.

On macOS, the Android File Transfer software must be installed and used for MTP. This software can be downloaded from https://www.android.com/filetransfer/.

- Mass Storage makes the storage unavailable for apps for the duration of the connection with the PC. (Android also needs to terminate apps which are stored on the volume which is provided as mass storage.) Unlike MTP, mass storage does not depend on the media scanner, so all files are always visible.

Note that after mapping, you might want to transfer back not only the modified map but also GPX tracks and templates you painted on.

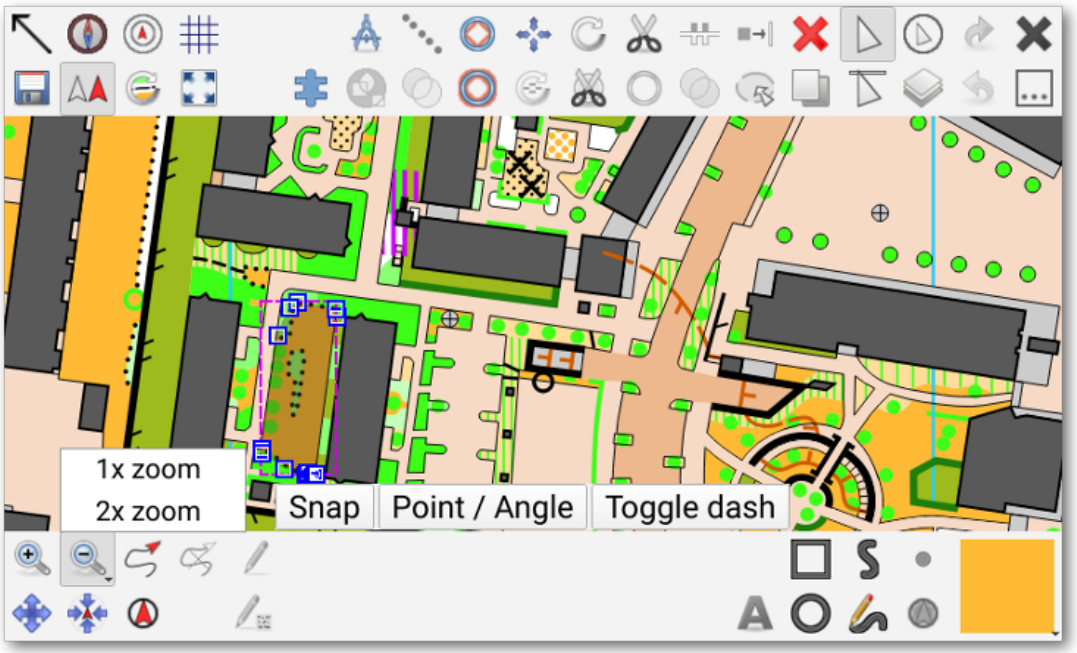
1.5.4.3 Data loss prevention and recovery

Remember to keep backups and to verify transferred files.
If a file appears to be corrupted after transfer back to PC, or you cannot find a new file such as a recorded GPX track, a reboot of the Android device could solve the issue. After the reboot, Android's media scanner will take notice of new files and changed file sizes. However, Mapper v0.8.3 is expected to bring a solution to this issue.
In some situations, the Mapper app might not be able to properly save data and shutdown as quickly as requested by the Android operating system, for example when you start other apps or when the device runs out of power.

1.5.5 The Touch Mode User Interface

1.5.5.1 Using the Mapper app in "Touch Mode"

The "Touch Mode" is an alternative user interface which is always active on Android devices. It can be activated on PCs, too.
In Touch Mode, the map editor is different from the desktop version. It offers a fixed set of buttons add the top and at the bottom of the screen. Not all Mapper features are offered in Touch Mode, but on the other hands some features such as live GNSS tracking are available only in this mode.
This page focuses on specific features of the touch mode user interface. To find out about the other symbols, see the Toolbars documentation.



↖ Hide the top bar

Using this button, you may hide the top bar, leaving more screen for the map. A similar button will remain visible for restoring the top bar again.

Compass display toggle

When this item is activated, a compass is shown in the top-left corner of the screen. The red line indicates the north direction, while the black-white lines show the up direction of your device. If both are aligned, the device is aligned with magnetic north. When the needle is close to the north direction, a green circle appears which quickly shows how well the device is aligned: the larger it is, the better the alignment is. The compass works three-dimensionally, so you do not need to hold the device in a flat pose for it to work.
Note: the usefulness of the compass depends on the presence of a gyroscope, as mentioned in the device recommendations section.
Attention: the compass is very sensitive to magnetic materials. Android tries the eliminate the influence of local magnetic fields, but this requires calibration. To do this, move the device around in the shape of an 8 while rotating it and while the compass is active. If the local influence changes, re-calibration is required.

Location display toggle

If the currently active map work has valid georeferencing, this control will be enabled and will show a dot at your current position as obtained from Global Navigation Satellite Systems (GNSS, e.g. GPS) or other positioning services. In addition, in case an accuracy estimate (HDOP) is available, this shows a circle around the dot which indicates the positioning accuracy. The chance of your real position being in the circle is approximately 70%.
While this is active, your track is automatically recorded into a GPX file in the directory of your map, named "<map> - GPS-<YYYY-MM-DD>.gpx". This file is included as a template in the map. You can simply show it using the template visibility control button to view your track.
Note that track recording might be interrupted while the screen is off or the app is in the background to save battery. Keep the app active if you want to ensure continuous track recording.

Distance rings toggle

This button is active if location display is active. When activated, this will display rings in 10 meter and 20 meter distance from the current location which can be used to do rough distance estimates.

Automatic north alignment toggle

When this toggle is active, the map is automatically rotated to north using the device's internal compass. The update frequency is 1 update per second. This is quite low on purpose to save battery, but you probably still need some replacement batteries when using this mode. While interacting with the map and for another 1.5 seconds after that, the map is not rotated to allow editing without unwanted rotations. If GNSS position display is activated at the same time, a line starting from the GNSS position and going in the direction of the up direction of your device is displayed which shows your viewing direction (assuming you are holding the device upright).

Map parts selector

This button opens a popup for changing the active map part.

Touch cursor toggle

This symbol activates a helper cursor which allows slow, but precise editing with fingers only. The cursor consists of a circular area and a pointer above the circle.

Touching the map anywhere outside the circle moves the pointer to this position. Touching the circle simulates a real touch at the pointer position above the circle.

Template control

This shows a list of all opened templates. Touching a template toggles its visibility.

Close button

This closes the active map and returns to the map selection screen.

Overflow button

Depending on the screen size of your device, some of the symbols available not fit onto the screen. They are instead placed in a list which is shown on touching the overflow button. If all symbols fit on the screen, this button is unused.

Zoom out / Zoom to fixed

A short press will zoom out by one step.
A long press will open a menu where you can jump to a fixed zoom (cf. screenshot).

Move to location

When positioning services are enabled, this will move the map so that your current location is in the middle of the screen.
A long press will open a menu where you can enable a mode which will automatically move the map so that the current location stay in the central region of the screen.

Mark temporary position

This records a single point at your current location to act as a drawing help. Note that this marker is not saved in the map.

Record temporary trace

This symbol is enabled when the location display is active. It records a temporary trace of the location, which is intended to act as a guideline for drawings. Using the trace directly is rarely useful because of the inaccurateness of location services. Note that the temporary trace is not saved in the map.

Clear temporary markers

This removes the temporary traces and position markers. (They will also be discarded when closing the map file.)

Paint on template

By this tool, mapper supports free-hand drawing onto raster image templates. There is a small selection of colors for drawing as well as an eraser tool. By additional buttons, you can choose to created filled areas instead of lines, to use a dot pattern instead of a solid fill, or to draw only in the background (transparent regions). There is also a dedicated undo/redo feature.
This tool is an convenient alternative when you want to do only (or mostly) drafting in the field, but draw the final version of the map at home on a PC. It does not create new map objects but only alters the template you draw on. This may help to deal with low processing power or battery runtime on mobile devices.
A short press may activate painting on the template which was used before if it is still on the screen. Otherwise, or on long press, there is a menu which indicates available templates, or offers to create a new template.
Please note that direct drawing onto regular base map images is *not* recommended: Color and eraser tool would easily destroy important details. Templates in JPEG format also should not be used: This is a lossy file format which will introduce visible artifacts when saving the file and loading it repeatedly.

Free-hand draw tool

Allows to draw paths free-handedly.

Draw at location tool

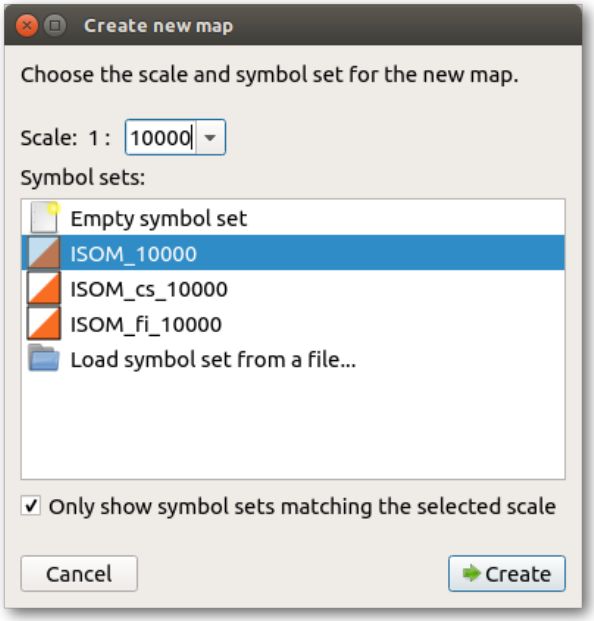
Sets a point object at your current location. Selecting this button first enters an averaging mode. While it is active, the input from the location service is averaged to get a more accurate estimate. Touch the map display anywhere to finish the averaging.

1.5.5.1.0.1 Symbol selector

Displays the active symbol, and opens the symbol selection screen on short press.
A long press of the symbol selector opens a popup menu which allows to read the symbol name and description, and to toggle the visibility and the protection state of the symbol.

1.6 Starting a New Map

Choose the menu item File -> New... to show the new map dialog.



There are two important choices to be made before starting a new map. These are the scale of the map and the symbol set to be employed. While either of these can be altered at a later time, that is sometimes difficult and it is better to decide on the scale and the map standard before beginning. OpenOrienteering Mapper presents a dialog box to set these important parameters before you start.

1.6.0.0.1 Scale

Map scales are set in accordance with the International Specification for Orienteering Maps (ISOM) or International Specification for Sprint Orienteering Maps (ISSprOM). The traditional competition format is 1:15000. For forest orienteering maps, 1:10000 is often used for shorter courses or for older/younger age groups as the readability of these is much better. Maps at 1:10000 are just scaled up versions of those at 1:15000. The ISOM emphasizes that a larger scale 1:10000 shall not be used in order to fit more detail onto the map but simply permits the map to be more easily read by older or younger competitors. Sprint maps according to the ISSprOM specification may be at either 1:4000 or 1:3000 and use a different symbol set appropriate to that scale.
Printing of a map prepared at 1:15000 may be at either scale (and conversely a map prepared at 1:10000 can be printed at 1:15000) with no loss of accuracy or information. Most course planning software provides for this re-scaling at the point of printing.

1.6.0.0.2 Symbol set

In conjunction with the scale it is necessary to make an early decision on the symbol set to be used. Again this is determined by the mapping standard adopted. Maps prepared in conformity with the ISOM will use only the

standard symbols of the ISOM symbol set. It is important to resist the invention of other symbols for local features as these local uses erode the international uniformity which enables competitors from any country or language to use the map in fair competition. Non-conforming local map standards also create confusion for local competitors entering an event on maps conforming to the ISOM.

1.6.0.0.3 Next steps

After clicking Create, the map screen will be shown. Now you probably want to load some templates and establish the map's georeferencing. Note that loading a georeferenced template will show the georeferencing dialog with some values already pre-filled and adapted to your template file, so you probably do not need to do this step separately.
After loading your templates you can start drawing your map objects with the map symbols.

1.7 Georeferencing

- Introduction
- Map coordinate reference system
- Reference point
- Map north
- Related functions
- Further reading

1.7.0.0.1 Introduction

Georeferencing of a map is the best way for aligning templates (such as base maps or aerial imagery) and GPS tracks. In short, to georeference a map means to establish a known relationship between the paper coordinates of the map and the coordinates of a geographic coordinate reference system. This way, data which is known in a geographic coordinate reference system (such as GPS coordinates) can be transformed to map coordinates and thus displayed on the map, and vice versa the map can be transformed to geographic coordinates and e.g. be displayed on a world map. More information is available on Wikipedia.
Georeferencing properties are set in a dialog which is available from the menu **Map** > **Georeferencing...**. The dialog is divided in four sections: Map coordinate reference system, Reference point, Map north, and Scale compensation.

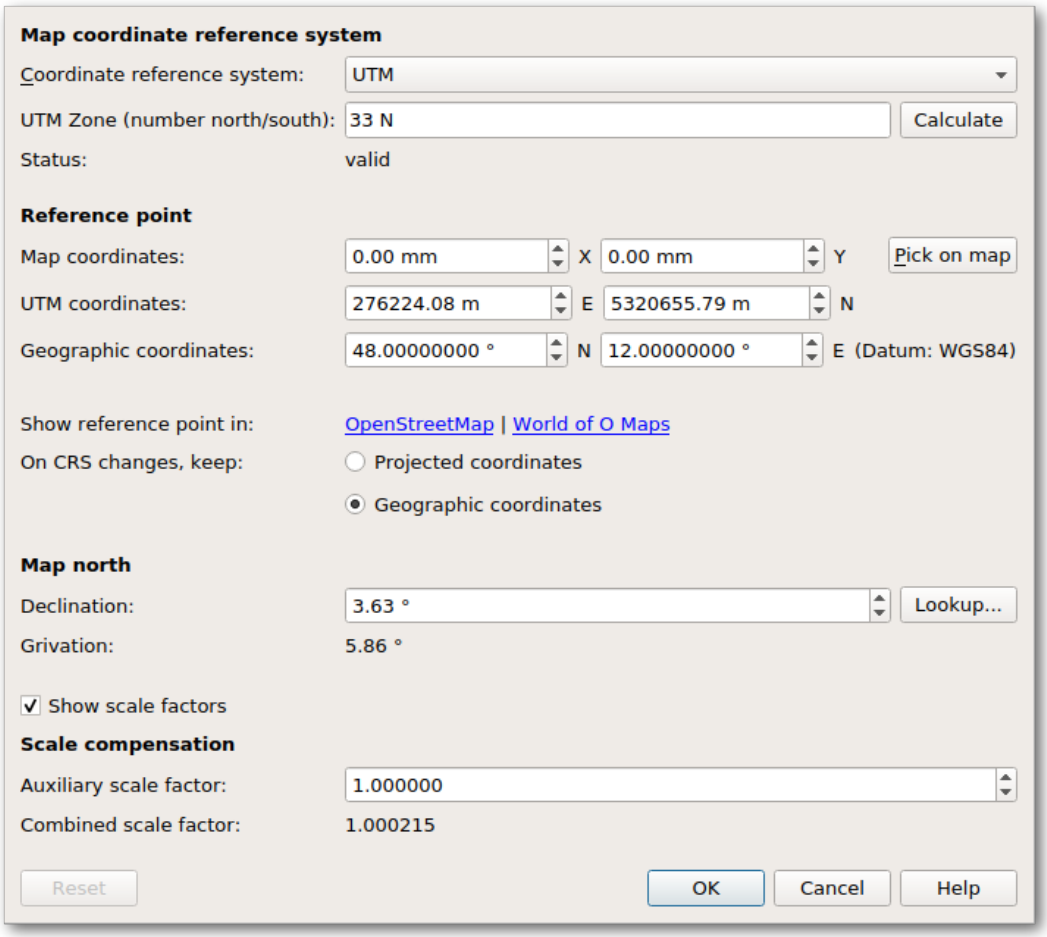


Figure 1.1 Georeferencing dialog

1.7.0.0.2 Map coordinate reference system

This section specifies the projection which relates latitude/longitude (in degrees) to flat coordinates (in real-world meters). The coordinate reference system is one important step in relating coordinates on the round Earth to coordinates on the flat paper map (in actual map millimeters). The additional steps are scaling, rotation, and adding an offset.
In case you just want to load some GPS tracks, you can safely use UTM, which is widely used world-wide. Other choices are:

- **Gauss-Krüger**: this is similar to UTM and widely used in Germany, but is being superseded by UTM.
- **From Proj.4 specification**: projections are internally handled by the `PROJ.4 Cartographic Projections library`, so coordinate reference systems can also be given in its internal specification format. Examples may be found at `http://www.remotesensing.org/geotiff/proj_list/` (Internet Archive) and `https://spatialreference.org/`. When selecting this option, the specification field will be pre-filled with the specification of the previously selected coordinate reference system.
- **EPSG**: for any coordinate reference system in this extensive worldwide registry.
- **Local**: this enables you to use local projected coordinates without a mapping to global geographic coordinates.

Depending on the selected coordinate reference system more settings may show up. For example, for UTM the zone number must be given in addition.

1.7.0.0.3 Reference point

Settings in this section define the reference point, which is a point for which coordinates in all of the involved coordinate systems are known. It acts as the anchor between the different coordinate reference systems.
In case the georeferencing dialog is triggered by loading a georeferenced template in a map which is not georeferenced yet, these settings are probably already pre-filled with sensible values (assuming that no other map objects exist yet), so they do not need to be changed in this case.
The **Map coordinates** field shows the map paper coordinates of this point. To change them, use the **Pick on map** button. The georeferencing dialog will then be hidden until you select a point on the map (left mouse click) or cancel the selection process (another mouse button). Changing the reference point on the map will not affect the other sections.
The next set of coordinates gives the reference point east-west and north-south position in **projected coordinates**, for example in UTM or Gauss-Krüger coordinates. Unless working with local coordinates, changing easting or northing will update the geographic coordinates. Easting and northing are given in meters.
The third set of coordinates gives the reference point position in **geographic coordinates**. Note that after the selection of a coordinate reference system other than local, projected and geographic coordinates are linked together, so changing one will also change the other. Geographic coordinates specify a location on the planet's surface by latitude and longitude. Latitude and longitude are measured in decimal degrees. Also note that according to convention, the first coordinate here is the latitude and the second the longitude.

- The **latitude** specifies the north-south position of the reference point as an angle relative to the equatorial plane. Negative values indicate the southern hemisphere.
- The **longitude** specifies the east-west position as angle relative to a prime meridian. Negative values indicate a position west of the prime meridian.

The **Datum** field shows the datum the geographic coordinates refer to. This is especially relevant for the longitude.
The second last line in the Reference point section contains a hyperlink for opening the reference point in Open↩ StreetMap.
The last option in this section determines which coordinates will be recalculated and which stay equal when changing the coordinate reference system.

1.7.0.0.4 Map north

In the **Declination** field the angle between true north and magnetic north at the position of the map has to be entered to make magnetic north be at the top. This can be looked up from an online accessible model as soon as the reference point geographic coordinates are entered, however it should be checked with a precise compass if accuracy is required.
Grivation determines the rotation which turns the projected grid so that magnetic north is at the top of the map. Grivation is composed of magnetic declination (the angle between true north and magnetic north) and grid convergence (the angle between true north and grid north).

1.7.0.0.5 Scale compensation

Auxiliary scale factor may be set to compensate when distances on the ground differ from distances on the Earth model, such as occurs when the terrain is at high altitude. It is the ratio of model distance to ground distance. The default factor of 1.0 has no effect. Besides that, Mapper automatically calculates the grid scale factor, which accounts for the difference between projected distance and model distance. Mapper puts this together with the auxiliary scale factor to form the **combined scale factor**.

1.7.0.0.6 Related functions

The default, basic Georeferencing dialog is lacking a few of the above-described options that are not generally needed. The settings (menu File > Settings > Georeferencing) can enable these advanced features.
The (mouse) cursor position of the map editor can be displayed in map coordinates, projected coordinates or geographic coordinates (decimal or as degrees/minutes/seconds, DMS). The coordinates of the cursor on the map sheet are discussed here.

1.7.0.0.7 Further reading

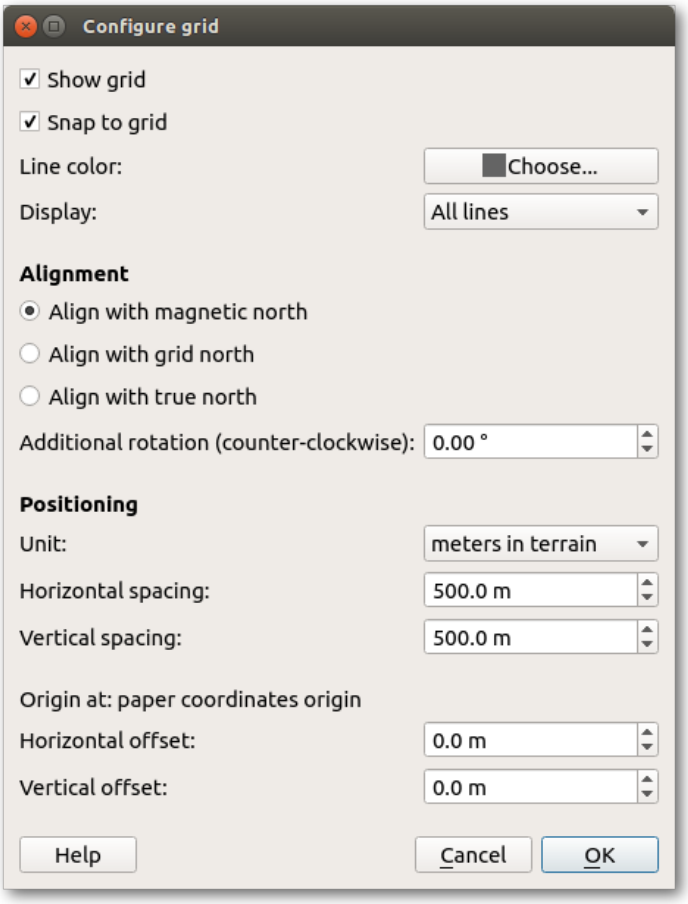
- Wikipedia: Geographic coordinate systems

- Richard Knippers (2009): Geometric Aspects of Mapping
- Larry Simons (2005): Magnetic Declination & Grid Convergence

1.8 Map Grid

The map grid can be activated by clicking the corresponding button in the view toolbar. Settings for the grid can be changed by clicking the arrow to the right of this button.

1.8.0.1 Grid settings



1.8.0.1.1 Show grid

Toggles the grid's visibility.

1.8.0.1.2 Snap to grid

If activated, holding the Shift key while drawing or editing objects will snap not only to existing objects, but also to intersections of grid lines if the grid is visible.

1.8.0.1.3 Line color

The line color can be adjusted here.

1.8.0.1.4 Display

Here the display can be constrained to horizontal or vertical lines only.

1.8.0.1.5 Alignment

Here you can choose whether the vertical grid lines should align with magnetic north (which is assumed to be identical with the up direction of the paper), the grid north or true north directions. The latter work only if the map is georeferenced. If grid north is selected, in addition the origin of the grid will be shifted to the grid coordinates origin. Furthermore, it is possible to define an offset angle which is added to the north angle to calculate the grid orientation.

1.8.0.1.6 Positioning

The spacing of the grid lines can be specified here. Normally, at the coordinate system origin there will always be a grid line intersection. Using the offset values, it can be shifted away from the coordinate system origin.

1.9 Objects

Map parts Organizing objects in maps.
Object tags Attaching arbitrary key-value pairs to objects.
Find objects Finding objects based on textual properties.

1.9.1 Map Parts

Map parts partition the map in different collections of objects which can be worked on independently. This can be used to organize the work of different people in a map making team. Map parts are also used to separate imported objects from existing map content.
Every map object belongs to a particular map part. Selected objects may be moved to a different map part. You may also move all objects of the current part to another one, or merge all other parts into the current one in a single step. See the Map menu for actions which create and change map parts.
Only a single map part can be the "current" one. It is the context where all selection, editing and drawing operations take place. The current map part is displayed and selected in the map part toolbar. This toolbar is not displayed as long as the map has only one part.
Other than templates, map parts are not drawn sequentially one after the other, but simultaneously according to the symbols and colors. All map parts share the map's colors and symbol sets.

1.9.2 Object tags

1.9.2.1 About object tags

In general, map objects are characterized by location and symbol. Object tags store additional information in the form of key-value pairs. In orienteering, this is useful to record feature details for control descriptions (e.g. dimensions) or for converting between map variants (e.g. MTB ridability). Data formats such as OSM and DXF carry object details which will be imported in tags.
The "Find objects" dialog allows to find objects based on their tag keys and values. With CRT files, object tags can guide symbol assignment and replacement.

1.9.2.2 The tag editor

The tag editor is a window with two columns, 'key' and 'value'. When an object is selected, the tag editor displays the key-value pairs for this object.

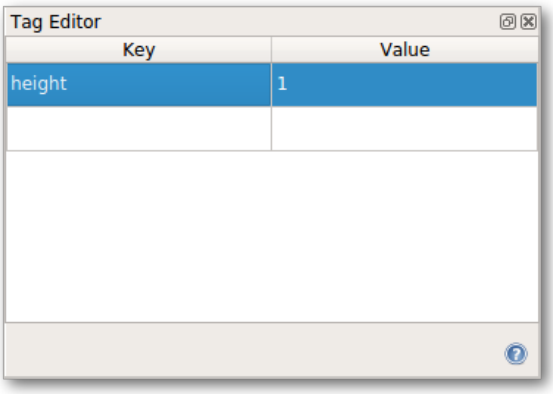


Figure 1.2 Tag editor window

The last row is empty and can be used to add new keys and values.
To erase an existing row, clear the row's key field.

1.9.3 Find objects

The "Find objects" dialog allows to find and select objects in the current map part based on their tags, text, or symbol name. It is opened from the View menu.

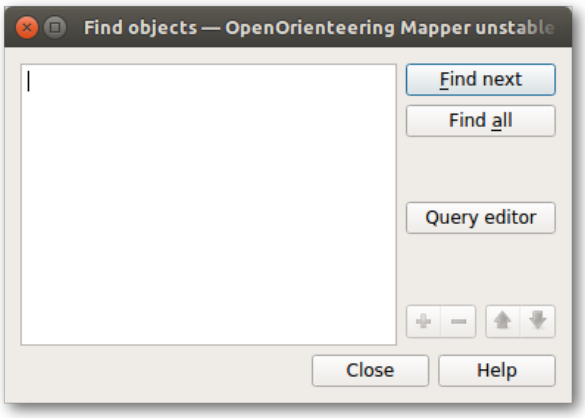


Figure 1.3 Find objects dialog

1.9.3.1 Querying objects

The main element of the "Find objects" dialog is an input field for the text you want to find. The text is looked for in the following *textual properties*:

- in the displayed text of text objects,
- in the name of symbols assigned to objects,
- in the values and keys of object tags.

1.9.3.2 Advanced query language

With just a few keywords, you may enter complex queries which connect subqueries for general textual properties and for particular key-value combinations. The following expressions are supported:

Expression	Matching objects
word	having "word" in any textual property

Expression	Matching objects
"some words"	having the phrase "some words" in any textual property
NOT expr	not matching expr
expr1 AND expr2	matching both expression expr1 and expr2
expr1 OR expr2	matching expression expr1 or expr2 (or both)
key = value	having a tag with the given key and value
key ~= word	having a tag with the given key and a value containing "word"
key != word	having a tag with the given key and a value different from "word", or not having a tag with this key
SYMBOL 123	having the symbol with code number 123

NOT has precedence over AND and OR. AND has precedence over OR. You may use parentheses to nest operators in another way.
You may use double quotes to deal with keys and values containing white space or the special words and signs. Inside double quotes, the backslash character is used to escape the special meaning of double quotes and backslash.
This query language may be used in the second column of CRT files.

1.9.3.3 Buttons

The button "Find next" will select the next object matching the query. The button "Find all will select all matching objects. The main window's status line will temporarily display the number of selected objects. (It may also indicate that the query is invalid.) The "Query editor" button will replace the input field with a table for entering object tag queries. Pressing the button again will restore the input field and make it show the query from editor view. @latexonly \hypertarget{find_objects_query-editor}{} \label{find_objects_query-editor} \endlatexonly @section autotoc_↩ md48 Query editor @latexonly \begin{DoxyImage} \includegraphics[scale=0.55]{query_editor.png} \caption{Query editor} \end{DoxyImage} \hypertarget{find_objects_editor-layout}{} \label{find_objects_editor-layout} \endlatexonly @subsubsection autotoc_md49 Editor Layout Each row in the editor represents a single condition in the query and its relation to the other conditions. @latexonly \hypertarget{find_objects_relation}{} \label{find_objects_relation} \endlatexonly @subsubsection autotoc_md50 Relation The relation column specifies a logical operator describing how this row is related to the row above. Therefore the first row has no relation. There are two possible relations: and or or. and relations take precedence over or relations. Within the editor the and relation is indented slightly to show this precedence. Taking the precedence into account, the query in the screenshot above would map to the following textual query: (highway = "residential" AND source ~= "bing") OR ("highway" = "primary" AND "source" ~= "bing") @latexonly \hypertarget{find_objects_key}{} \label{find_objects_key} \endlatexonly @subsubsection autotoc_md51 Key The key is the name of the tag which this condition applies to. This field cannot be left empty. (Otherwise the query is invalid.) @latexonly \hypertarget{find_objects_value}{} \label{find_objects↩ _value} \endlatexonly @subsubsection autotoc_md52 Value This field specifies a value that the actual tag's value is compared to. It can be left empty. @latexonly \hypertarget{find_objects_comparison}{} \label{find_objects_↩ comparison} \endlatexonly @subsubsection autotoc_md53 Comparison The comparison defines how the actual value of the tag is compared to the value that was specified in the editor. <table class="markdownTable"> <tr class="markdownTableHead"> <th class="markdownTableHeadNone"> Comparison
Description
is
The tag specified must exist for the object, and that tag's value must exactly match the specified value.
is not
If the tag specified exists for the object, then its value must not much the specified value. If the tag doesn't exist, the condition is true.
contains
The tag specified must exist for the object, and its value must contain the specified value. If an empty value is specified, any value of the tag will match. This can be used to test for the existence of a particular tag.

1.9.3.3.0.1 Extra buttons for the query editor

The + and − buttons are used to add or delete a row. Added rows appear below the currently selected row.
The ↑ and ↓ buttons move the selected row up or down.

1.10 Templates and Data

Introduction to Templates Types of templates, loading and positioning
Adjusting template positions For non-georeferenced templates
CoVe, the Contour Vectorizer Vectorizing line features in raster graphics templates.
Geospatial data Geospatial raster data and vector data support based on GDAL.

1.10.1 Introduction to Templates

Images, tracks recorded with GNSS receivers and other layers which are used to provide base information for the mapper are called templates. They can be loaded into the map file using the template setup window which is available via the menu item Templates -> Template Setup Window. Templates can also be "abused" to display information on the final map, for example sponsor logos which are only available as raster images.
Attention: as templates are not covered by the undo/redo system, be sure to save your map before making changes to them!

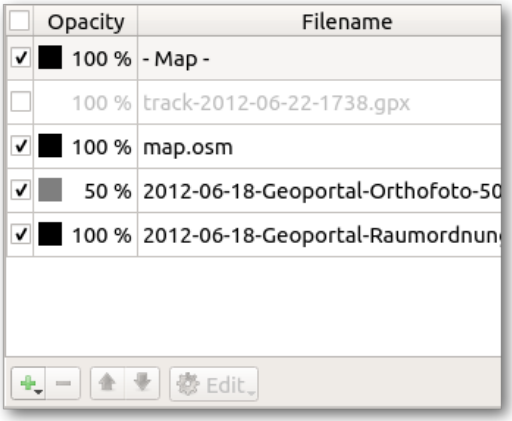
1.10.1.0.0.1 Types of templates

OpenOrienteering Mapper supports the following file formats to be loaded as templates:

- Raster images (bmp, jpg, png, gif and formats supported by GDAL)
- Geospatial vector data (cf. geospatial data support with GDAL)
- GPX tracks (gpx)
- Map files (omap, xmap, ocd)

Additionally, templates can be classified into **georeferenced** and **non-georeferenced** templates. For georeferenced templates, information about the exact positioning of the template in a known world coordinate system is available - see georeferencing. This way, they can be positioned on the map automatically provided that the map is georeferenced too. For non-georeferenced templates, this information is not available, so they have to be positioned manually.

1.10.1.0.1 Template setup window



This window is opened by clicking the menu item Templates -> Template Setup Window. In its center is a list of all opened templates. In addition, the map layer is also included there. The order of items in this list defines the order in which the templates will be displayed: the first will be on the top, the last on the bottom.
Each item can be hidden or shown using the check box on the left. Furthermore, layers can be set to transparent by entering an opacity percentage.

1.10.1.0.1.1 Opening templates

Click the button "Open..." in the template setup window and select the file to be loaded as a template. See types of templates for the list of supported file formats.

1.10.1.0.1.2 Changing the template draw order

When a template is selected, it can be moved up and down in the list using the Move Up and Mode Down buttons to change its position in the display order.

1.10.1.0.1.3 Deleting or closing templates

Using the Delete or Close button, templates can be removed. The label text depends on the corresponding setting "Keep settings of closed templates": if it is activated, it will be "Close" and it will be possible to reopen the template later with the menu item Templates -> Reopen template..., otherwise it will be "Delete" and it will not be possible to reopen the template later.

1.10.1.0.1.4 Positioning

At the bottom of the window, there are the template positioning capabilities:
The upper left button shows whether the template is **georeferenced**. Later it may become possible to switch the georeferencing setting using this button, but this is not yet implemented.
At the lower left is the **Move by hand** button. It allows to move non-georeferenced templates by clicking in the map display and dragging the mouse.
At the lower right is the toggle for the **template positioning window**. It enables to enter numerical values for the positioning of non-georeferenced templates, e.g. to rotate a template by 90 degrees, or to adapt the template rotation to the magnetic declination.

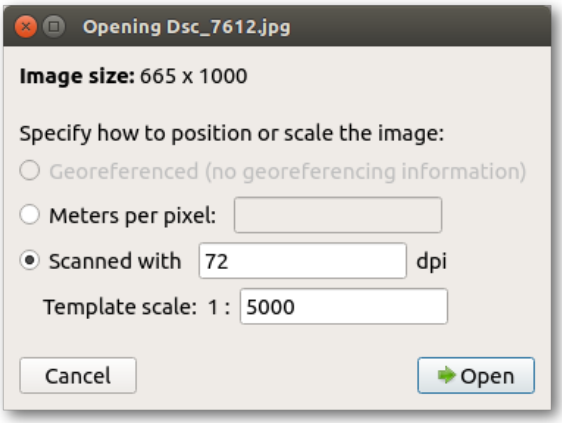
1.10.1.0.1.5 Adjust

At the upper right is the **Adjust** button which enables to adjust the position of a non-georeferenced template to that of an existing template, or the map, which is in the correct position already. Detailed instructions here.

1.10.1.0.2 Template types

1.10.1.0.2.1 Image templates

Raster images are loaded as this template type. When opening such a template, the image positioning dialog is shown:



1.10.1.0.2.2 Georeferenced positioning

This option is only available if the image has georeferencing information associated. Depending on the format, the information may be embedded (e.g. for GeoTIFF), or come in auxiliary files such as so-called world files.
World files are text files containing 6 entries of a transformation matrix mapping pixel coordinates to grid coordinates of some geodetic coordinate reference system (more information on Wikipedia). Unfortunately, a world file does not specify the actual coordinate reference system. So if you choose this option for positioning, you usually have to specify the coordinate reference system in the next step. You should get this information from the place where you got the georeferenced image from.

A world file for an image must have the same file name as the image file and be located in the same directory. The world file extension is determined by the image extension: it starts with the first character of the image file extension, followed by the last character of this extension, and then the letter 'w'. For example, a world file for a png file would have the extension "pgw". Alternatively, the world file extension can also be "wld".
In order for georeferenced positioning to work, the map must be georeferenced, too. If the georeferencing is not yet configured when loading a georeferenced template, the map georeferencing dialog is shown as the next step, with reference point coordinates already pre-filled as the center of the loaded image.

1.10.1.0.2.3 Manual positioning

This method of positioning should only be chosen if you have no georeferencing information available for the image. First, there are two possible options to specify the image scale:

- **Meters per pixel**: this is primarily useful for base maps from a digital source, where you may know this value directly. Alternatively you can also calculate it yourself: if your fieldwork image covers 500m width on the ground and the image is 1200 pixels wide then the scale will be 500 / 1200 = 0.625 meters per pixel. (Take care that the number of meters corresponds exactly to the width of the image file.)
- **Scanned**: if your fieldwork is at a known scale (it should be - say 1:5000), and the scan is at a chosen resolution (say 200dpi) then these parameters may be entered to scale the fieldwork image. This assumes that printer and scanner work accurately.

Note that if you do not know the image scale and / or if you are going to adjust the template position to the existing map anyway using the adjust feature, you can just enter any value here as the scaling will be changed again later.

1.10.1.0.3 Track templates

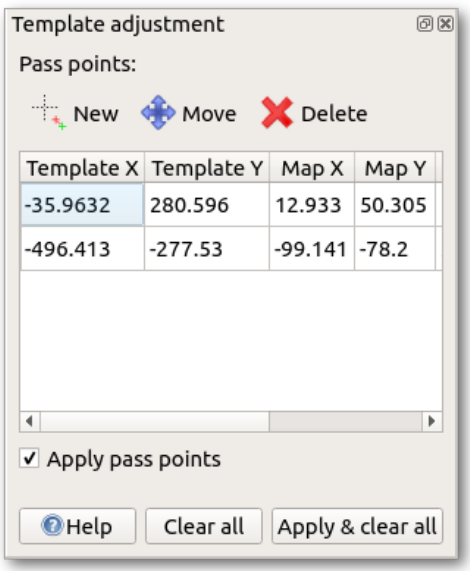
These templates represent tracks from a GNSS receiver or similar. By default, mapper uses a special template type to display this type of files. However, it is possible to disable this special template type on the GDAL settings page, so that GPX tracks will be handled as regular geospatial vector data via GDAL.

1.10.1.0.4 Map templates

This template type enables to load other map files as a template. This has two main purposes:

- Loading an old orienteering map as a base map for a new one.
- Loading a map as a base layer to set a course on top of it.

1.10.2 Adjusting template positions



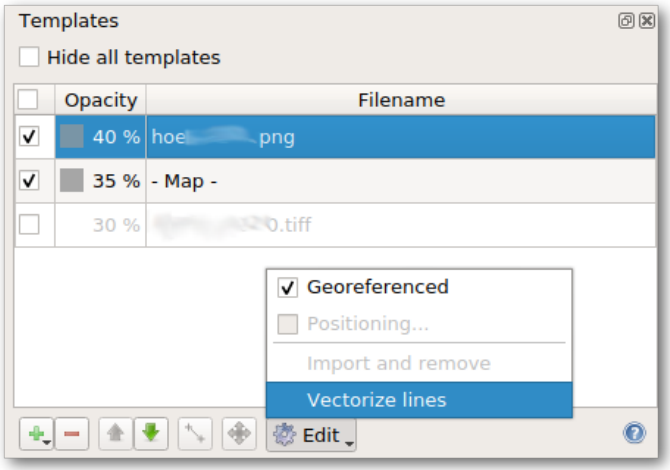
This window can be opened from the template setup window and is used to adjust the positioning of the currently selected template to the position of another existing template, or the map, which is already in the correct location.
The principle is to define two or more so-called pass points. Every pass point defines a source position, this is an arbitrary point on the new template, and a target position, this is the position where the source point should move to. So every pass point is a pair of identical positions on source (template) and target (existing template or map).
To create a new pass point, first select "New", then click at the source position on the template to position. The point should ideally be easily recognizable in both the template and the existing template or map. Zoom in close to place the point accurately. It is marked with a red plus. Then click the corresponding point in the existing template or map, which will be marked with a green plus. The pass point information will also be shown as a line of data in the pass point window. Repeat this for each of the remaining pass points.
In general, the more pass points you define, the more likely it is to get a good result. **One point** does not give enough information for positioning, so in this case the template is simply moved to this point. **Two points** are the minimum to define a similarity transformation, so the template will be moved, rotated and scaled isotropically so the pass points match exactly. For **more points**, the transformation is still constrained to a similarity transformation, so the transformation with the least error between desired and real pass point target positions is calculated. This way, not all pass points will end up at their target positions in general, but the result will usually be better because the information of more pass points is averaged.
When all pass points have been defined tick the box "Apply pass points" and your template will move to the position giving the minimum error. The actual error for each pass point will be shown on the dialog box. If this result is unsatisfactory either edit the pass points (use the "Move" tool above the table to adjust the position of either end of any tie), either while the transformation is still active or after clicking the "Apply pass points" check box again, or clear the pass points completely and try again.

1.10.3 CoVe, the Contour Vectorizer

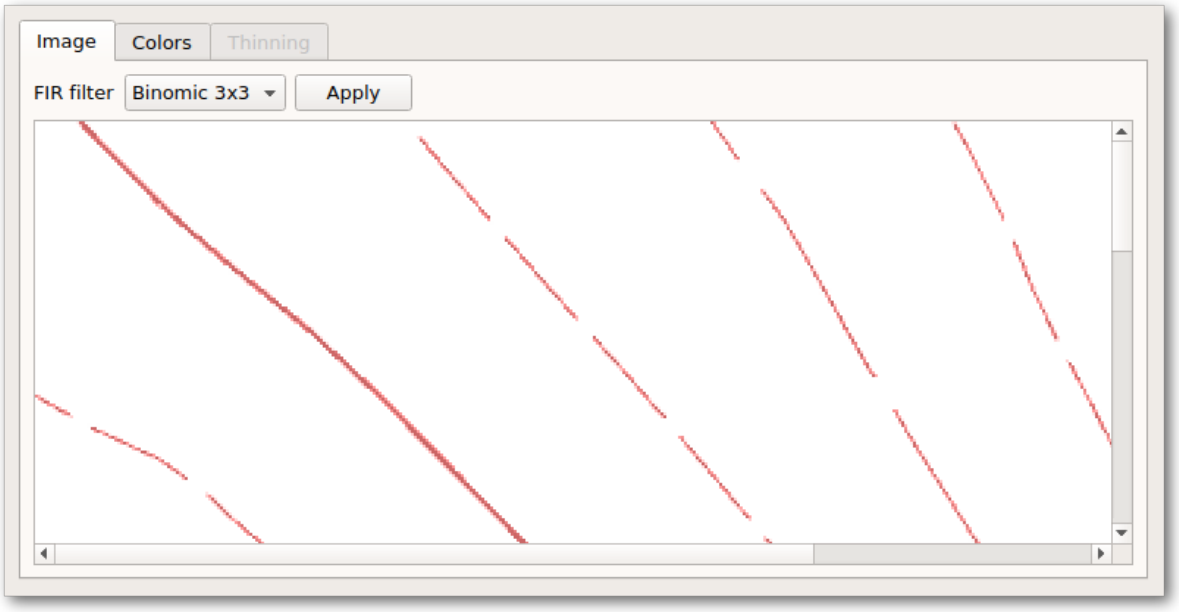
CoVe (for Contour Vectorizer) is the name of a tool which lets users generate vector line objects from visual lines in raster graphics templates. Despite of its original name, it is not limited to contour lines.
The basic line vectorization in a bitmap image always follows the below steps: 1) Choose bitmap image to work on. 2) Classify colors in the image into groups and produce color-reduced image. Choose which colors correspond to the lines of interest. 3) Perform **line thinning** and run vectorization. Store the resulting lines into the map.
The tool offers a number of tuning options. They are, however, not required on good quality images.

1.10.3.1 Starting CoVe

The vectorizer tool is started from the actions offered by the "Edit" button in the template list widget. Note that this tool is available only for raster graphics templates (e.g. JPG, PNG, TIFF), not for vector graphics (e.g. DXF, OSM, SHP).

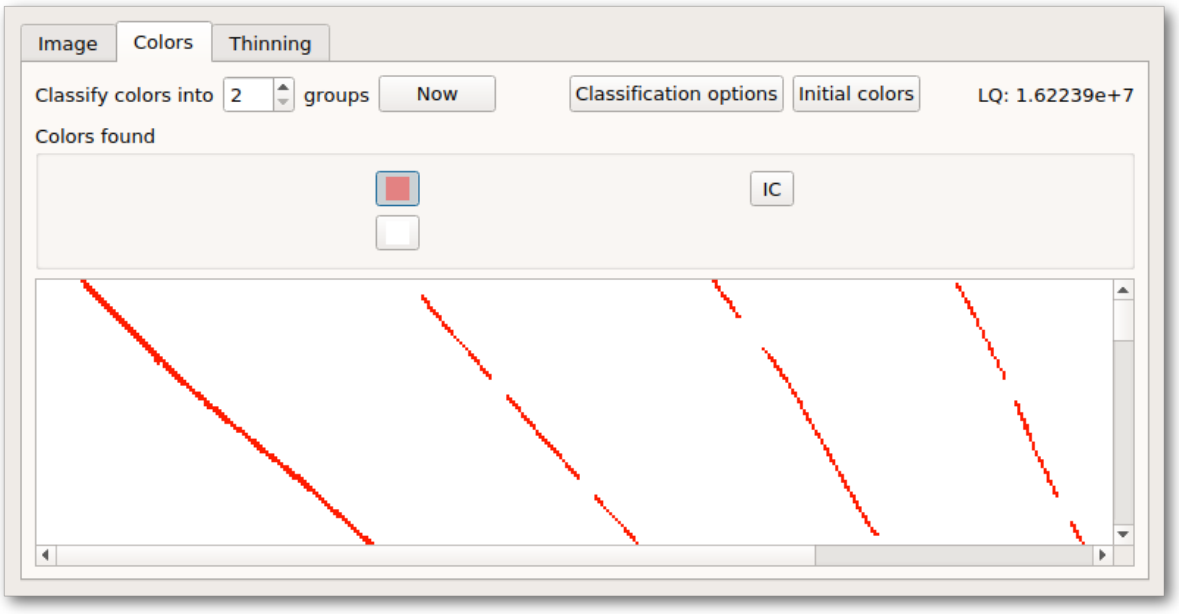


1.10.3.2 The "Image" tab



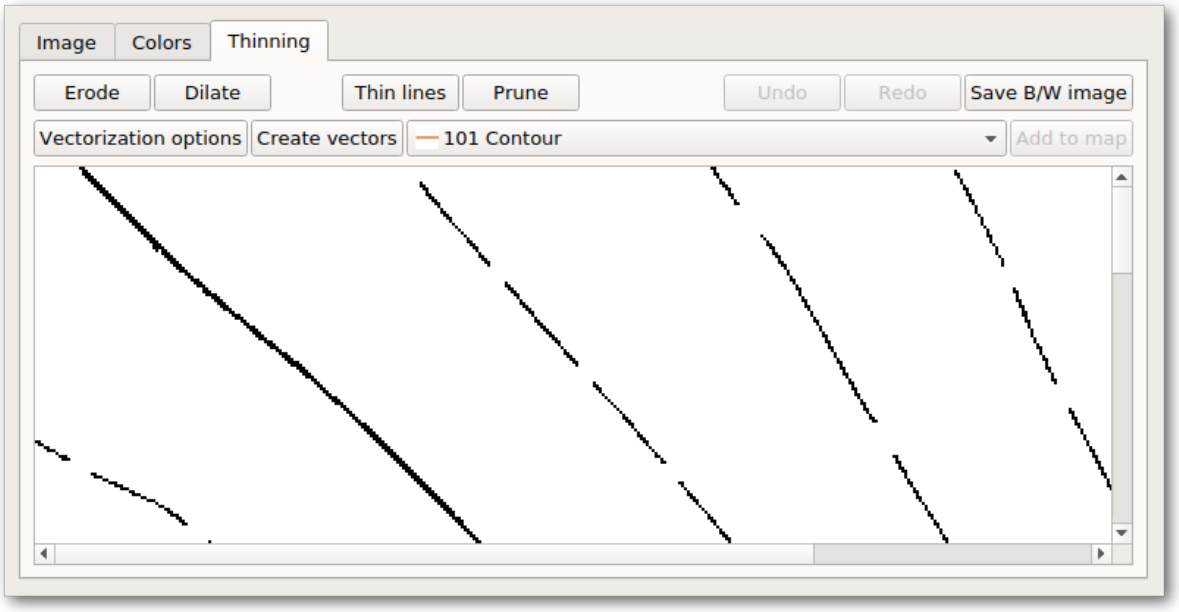
The "Image" tab is the first one displayed after starting the vectorizer tool. It shows the original image and offers tools which allow to reduce certain types of noise, e.g. from scanning of old maps. These tools operate only in memory, i.e. they do not alter the original template image.

1.10.3.3 The "Colors" tab



This tab offers color classification and selection. Color classification analyzes the image for a small set of key colors. After classification, the user must select the color (or maybe multiple colors) which shall be subject to vectorization. The most important control on this tab is the number of colors to be identified in the image. For simple two-color images where there only the objects of interest, the default setting of "2" is sufficient. However, for real scanned maps the number will typically be in the range of 15-20. The reason is that overprinting and color bleeding will create new color combinations which must be identified by the tool.

1.10.3.4 The "Thinning" tab



This tab provides the final steps of vectorization. It shows a black/white image based on the color(s) selected by the user on the previous tab. Apart from the actual vectorization steps, it offers morphological manipulation steps which are essential for a successful vectorization of the image. For these morphological operations, there are also undo and redo actions.

1.10.3.4.0.1 Erode

This tool removes a small margin from every shape in the image. Individual pixels and thin lines will disappear after this operation.

1.10.3.4.0.2 Dilate

This tool adds a small margin to every shape in the image. In particular, this tool is useful when the pixels of an expected vector line are direct neighbors diagonally but not horizontally or vertically.

1.10.3.4.0.3 Thin lines

This tool is used to reduce thick shapes to minimal skeletons suitable for the vectorizer. You will always use this tool just before creating the vectors.
Note that this tool may take some time to complete its task, and it is not possible to report progress accurately.
The algorithm may create line endings which do not accurately match what a human would expect, e.g. small forks or arcs. This is normal, but in some cases it may negatively affect the result of the "Create vectors" step.

1.10.3.4.0.4 Prune

This tool removes pixels from line ends. In that way, it is possible to mitigate the artifacts created by the previous step if needed.

1.10.3.4.0.5 Example

Original black/white image. Note that some pixels are neighboring only diagonally:

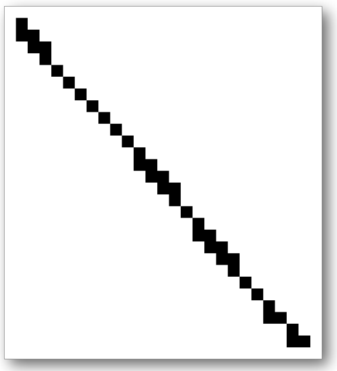


Image after "Dilate" step:

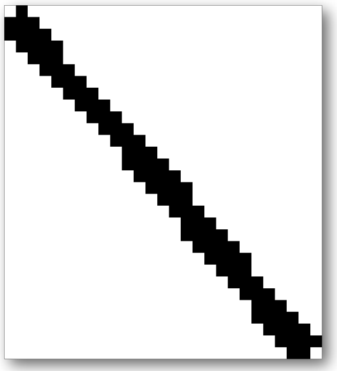


Image after "Thin lines" step. Note the small fork at the top-left end:

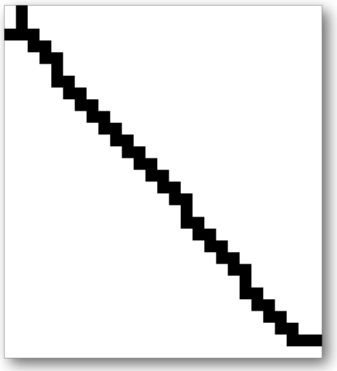
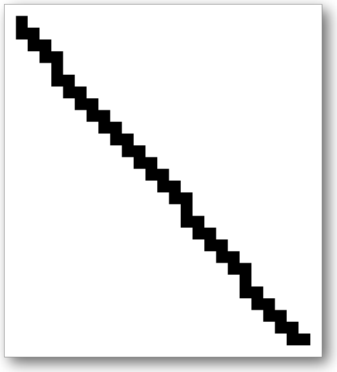


Image after "Prune" step:



1.10.3.4.0.6 Combinations of tools

Dilate-erode

This combination fills small gaps and missing pixels in lines and smooths the lines by removing small turns. However, it will also meld closely spaced lines.

Erode-dilate

This combination makes all single-pixel objects disappear. This is useful for removing noise from the picture when the main objects in the are thick enough to survive the erosion.

1.10.3.4.0.7 Vectorization and adding to the map

The "Create vectors" button starts the actual vectorization process, creating a temporary preview. The user may adjust vectorization options. For example, it is possible to automatically close small gaps, e.g. from dashed lines in the image.
"Add to map" finally adds the preview objects to the map, with the symbol selected in front of this button. Note that this button does not close the window. You may continue with another color, by selecting the "Color" tab again.
All objects added by this tool carry a tag "generator" with value "cove".

1.10.4 Geospatial data support with GDAL

OpenOrienteering Mapper uses the GDAL library for supporting a broad range of geospatial raster data, such as GeoTIFF or JPEG2000 files, vector data, such as Shape, OSM, or DXF files, and hybrid formats such as PDF. GDAL's vector data support used to be known as OGR, so you will sometimes find this name, too.
Geospatial raster data and vector data can be used as templates. However, currently only graphical templates can be displayed; Mapper does not yet process raw raster data, such as altitudes, which first need to be rendered in other software. It also possible to open vector data files as maps and to import vector data into map files.
In addition, the File menu offers the option to export a map in selected geospatial vector data formats. The actual GDAL driver is selected by the extension (e.g. ".dxf") given to the filename.
When using GDAL formats as templates, some filename extensions may be supported by multiple providers (plain image, GDAL raster data, GDAL vector data).
Please note that some of the raster formats listed below are not used for images but for actual geospatial metrics meant for algorithmic processing.

1.10.4.1 GDAL drivers offered by OpenOrienteering Mapper

The following list is valid for the official Android, macOS and Windows releases as of v0.9.4. Linux packages are likely to support a slightly different set of formats, depending on the configuration of the distribution's GDAL package.

1.10.4.1.1 Raster import drivers

Driver	Long name	Extensions
AAIGrid	Arc/Info ASCII Grid	asc
ACE2	ACE2	ACE2
ADRG	ARC Digitized Raster Graphics	gen
AIG	Arc/Info Binary Grid	
ARG	Azavea Raster Grid format	
AirSAR	AirSAR Polarimetric Image	
BIGGIF	Graphics Interchange Format (.gif)	raster.gif
BLX	Magellan topo (.blx)	blx
BMP	MS Windows Device Independent Bitmap	raster.bmp
BSB	Maptech BSB Nautical Charts	
BT	VTP .bt (Binary Terrain) 1.3 Format	bt
BYN	Natural Resources Canada's Geoid	byn err
CAD	AutoCAD Driver	dwg

Driver	Long name	Extensions
CALS	CALS (Type 1)	cal ct1
CEOS	CEOS Image	
COASP	DRDC COASP SAR Processor Raster	hdr
COSAR	COSAR Annotated Binary Matrix (Terra↩ SAR-X)	
CPG	Convair PolGASP	
CTG	USGS LULC Composite Theme Grid	
CTable2	CTable2 Datum Grid Shift	
DAAS	Airbus DS Intelligence Data As A Service driver	
DERIVED	Derived datasets using VRT pixel functions	
DIMAP	SPOT DIMAP	
DIPEx	DIPEx	
DOQ1	USGS DOQ (Old Style)	
DOQ2	USGS DOQ (New Style)	
DTED	DTED Elevation Raster	dt0 dt1 dt2
E00GRID	Arc/Info Export E00 GRID	e00
ECRGTOC	ECRG TOC format	xml
EEDAI	Earth Engine Data API Image	
EHdr	ESRI .hdr Labelled	bil
EIR	Erdas Imagine Raw	
ELAS	ELAS	
ENVI	ENVI .hdr Labelled	
ERS	ERMapper .ers Labelled	ers
ESAT	Envisat Image Format	n1
FAST	EOSAT FAST Format	
FIT	FIT Image	
FujiBAS	Fuji BAS Scanner Image	
GFF	Ground-based SAR Applications Testbed File Format (.gff)	gff
GIF	Graphics Interchange Format (.gif)	raster.gif
GPKG	GeoPackage	gpkg
GRASSASCIIGrid	GRASS ASCII Grid	
GRIB	GRIdded Binary (.grb, .grb2)	grb grb2 grib2
GS7BG	Golden Software 7 Binary Grid (.grd)	grd
GSAG	Golden Software ASCII Grid (.grd)	grd
GSBG	Golden Software Binary Grid (.grd)	grd
GSC	GSC Geogrid	
GTX	NOAA Vertical Datum .GTX	gtx
GTiff	GeoTIFF	tif tiff
GXF	GeoSoft Grid Exchange Format	gxf
GenBin	Generic Binary (.hdr Labelled)	
HF2	HF2/HFZ heightfield raster	hf2
HFA	Erdas Imagine Images (.img)	img
IDA	Image Data and Analysis	
IGNFHeightASCIIGrid	IGN France height correction ASCII Grid	mnt txt gra
ILWIS	ILWIS Raster Map	mpr mpl
INGR	Intergraph Raster	
IRIS	IRIS data (.PPI, .CAPPi etc)	ppi
ISCE	ISCE raster	

Driver	Long name	Extensions
ISG	International Service for the Geoid	isg
ISIS2	USGS Astrogeology ISIS cube (Version 2)	
ISIS3	USGS Astrogeology ISIS cube (Version 3)	lbl cub
JAXAPALSAR	JAXA PALSAR Product Reader (Level 1.↩ 1/1.5)	
JDEM	Japanese DEM (.mem)	mem
JP2OpenJPEG	JPEG-2000 driver based on OpenJPEG library	jp2 j2k
JPEG	JPEG JFIF	raster.jpg raster.jpeg
KMLSUPEROVERLAY	Kml Super Overlay	kml kmz
KRO	KOLOR Raw	kro
L1B	NOAA Polar Orbiter Level 1b Data Set	
LAN	Erdas .LAN/.GIS	
LCP	FARSITE v.4 Landscape File (.lcp)	lcp
LOSLAS	NADCON .los/.las Datum Grid Shift	
Leveller	Leveller heightfield	ter
MAP	OziExplorer .MAP	
MBTiles	MBTiles	mbtiles
MFF	Vexcel MFF Raster	hdr
MFF2	Vexcel MFF2 (HKV) Raster	
MRF	Meta Raster Format	mrf
MSGN	EUMETSAT Archive native (.nat)	nat
NDF	NLAPS Data Format	
NGSGEOID	NOAA NGS Geoid Height Grids	bin
NGW	NextGIS Web	
NITF	National Imagery Transmission Format	ntf
NTv1	NTv1 Datum Grid Shift	dat
NTv2	NTv2 Datum Grid Shift	gsb gvb
NWT_GRC	Northwood Classified Grid Format .grc/.tab	grc
NWT_GRD	Northwood Numeric Grid Format .grd/.tab	grd
OZI	OziExplorer Image File	
PAux	PCI .aux Labelled	
PCIDSK	PCIDSK Database File	pix
PDF	Geospatial PDF	pdf
PDS	NASA Planetary Data System	
PDS4	NASA Planetary Data System 4	xml
PLMOSAIC	Planet Labs Mosaics API	
PLSCENES	Planet Labs Scenes API	
PNG	Portable Network Graphics	raster.png
PNM	Portable Pixmap Format (netpbm)	pgm ppm pnm
PRF	Racurs PHOTOMOD PRF	prf
R	R Object Data Store	rda
RDA	DigitalGlobe Raster Data Access driver	dgrda
RIK	Swedish Grid RIK (.rik)	rik
RMF	Raster Matrix Format	rsw
ROI_PAC	ROI_PAC raster	
RPFTOC	Raster Product Format TOC format	toc
RRASTER	R Raster	grd
RS2	RadarSat 2 XML Product	
RST	Idrisi Raster A.1	rst

Driver	Long name	Extensions
Rasterlite	Rasterlite	sqlite
SAFE	Sentinel-1 SAR SAFE Product	
SAGA	SAGA GIS Binary Grid (.sdat, .sg-grd-z)	sdat sg-grd-z
SAR_CEOS	CEOS SAR Image	
SDTS	SDTS Raster	ddf
SENTINEL2	Sentinel 2	
SGI	SGI Image File Format 1.0	rgb
SIGDEM	Scaled Integer Gridded DEM .sigdem	sigdem
SNODAS	Snow Data Assimilation System	hdr
SRP	Standard Raster Product (ASRP/USRP)	img
SRTMHGT	SRTMHGT File Format	hgt
TIL	EarthWatch .TIL	
TSX	TerraSAR-X Product	
Terragen	Terragen heightfield	ter
USGSDEM	USGS Optional ASCII DEM (and CDED)	dem
VICAR	MIPL VICAR file	
VRT	Virtual Raster	vrt
WCS	OGC Web Coverage Service	
WEBP	WEBP	webp
WMS	OGC Web Map Service	
WMTS	OGC Web Map Tile Service	
XPM	X11 PixMap Format	xpm
XYZ	ASCII Gridded XYZ	xyz
ZMap	ZMap Plus Grid	dat

1.10.4.1.2 Vector import drivers

Driver	Long name	Extensions
ARCGEN	Arc/Info Generate	
AVCBin	Arc/Info Binary Coverage	
AVCE00	Arc/Info E00 (ASCII) Coverage	e00
AeronavFAA	Aeronav FAA	
AmigoCloud	AmigoCloud	
BNA	Atlas BNA	bna
CAD	AutoCAD Driver	dwg
CSV	Comma Separated Value (.csv)	csv
CSW	OGC CSW (Catalog Service for the Web)	
Carto	Carto	
Cloudant	Cloudant / CouchDB	
CouchDB	CouchDB / GeoCouch	
DGN	Microstation DGN	dgn
DXF	AutoCAD DXF	dxf
EDIGEO	French EDIGEO exchange format	thf
EEDA	Earth Engine Data API	
ESRI Shapefile	ESRI Shapefile	shp dbf shz shp.zip
ESRIJSON	ESRIJSON	json
Elasticsearch	Elastic Search	
FlatGeobuf	FlatGeobuf	fgb
GML	Geography Markup Language (GML)	gml xml
GPKG	GeoPackage	gpkg

Driver	Long name	Extensions
GPSBabel	GPSBabel	
GPSTrackMaker	GPSTrackMaker	gtm gtz
GPX	GPX	gpx
GeoJSON	GeoJSON	json geojson
GeoJSONSeq	GeoJSON Sequence	geojsonl geojsons
GeoRSS	GeoRSS	
Geoconcept	Geoconcept	gxt txt
HTF	Hydrographic Transfer Vector	
Idrisi	Idrisi Vector (.vct)	vct
JML	OpenJUMP JML	jml
JP2OpenJPEG	JPEG-2000 driver based on OpenJPEG library	jp2 j2k
KML	Keyhole Markup Language (KML)	kml
MBTiles	MBTiles	mbtiles
MVT	Mapbox Vector Tiles	mvt mvt.gz pbf
MapInfo File	MapInfo File	tab mif mid
MapML	MapML	
NGW	NextGIS Web	
OAPIF	OGC API - Features	
ODS	Open Document/ LibreOffice / OpenOffice Spreadsheet	ods
OGR_GMT	GMT ASCII Vectors (.gmt)	gmt
OGR_PDS	Planetary Data Systems TABLE	
OGR_SDTS	SDTS	
OGR_VRT	VRT - Virtual Datasource	vrt
OSM	OpenStreetMap XML and PBF	osm pbf
OpenAir	OpenAir	
OpenFileGDB	ESRI FileGDB	gdb
PCIDSK	PCIDSK Database File	pix
PDF	Geospatial PDF	pdf
PDS4	NASA Planetary Data System 4	xml
PLSCENES	Planet Labs Scenes API	
REC	EPIInfo .REC	rec
S57	IHO S-57 (ENC)	000
SEGUKOOA	SEG-P1 / UKOOA P1/90	
SEGY	SEG-Y	
SQLite	SQLite / Spatialite	sqlite db
SUA	Tim Newport-Peace's Special Use Airspace Format	
SVG	Scalable Vector Graphics	svg
SXF	Storage and eXchange Format	sxf
Selafin	Selafin	
TIGER	U.S. Census TIGER/Line	
TopoJSON	TopoJSON	json topojson
UK .NTF	UK .NTF	
VDV	VDV-451/VDV-452/INTREST Data Format	txt x10
VFK	Czech Cadastral Exchange Data Format	vfk
VICAR	MIPL VICAR file	
WAsP	WAsP .map format	map
WFS	OGC WFS (Web Feature Service)	
XLSX	MS Office Open XML spreadsheet	xlsx xlsm

Driver	Long name	Extensions
XPlane	X-Plane/Flightgear aeronautical data	dat

1.10.4.1.3 Vector export drivers

Driver	Long name	Extensions
AmigoCloud	AmigoCloud	
BNA	Atlas BNA	bna
CSV	Comma Separated Value (.csv)	csv
Carto	Carto	
Cloudant	Cloudant / CouchDB	
CouchDB	CouchDB / GeoCouch	
DGN	Microstation DGN	dgn
DXF	AutoCAD DXF	dxf
ESRI Shapefile	ESRI Shapefile	shp dbf shz shp.zip
Elasticsearch	Elastic Search	
FlatGeobuf	FlatGeobuf	fgb
GML	Geography Markup Language (GML)	gml xml
GPKG	GeoPackage	gpkg
GPSBabel	GPSBabel	
GPSTrackMaker	GPSTrackMaker	gtm gtz
GPX	GPX	gpx
GeoJSON	GeoJSON	json geojson
GeoJSONSeq	GeoJSON Sequence	geojsonl geojsons
GeoRSS	GeoRSS	
Geoconcept	Geoconcept	gxt txt
JML	OpenJUMP JML	jml
KML	Keyhole Markup Language (KML)	kml
MBTiles	MBTiles	mbtiles
MapInfo File	MapInfo File	tab mif mid
MapML	MapML	
NGW	NextGIS Web	
ODS	Open Document/ LibreOffice / OpenOffice Spreadsheet	ods
OGR_GMT	GMT ASCII Vectors (.gmt)	gmt
PCIDSK	PCIDSK Database File	pix
PDF	Geospatial PDF	pdf
PDS4	NASA Planetary Data System 4	xml
PGDUMP	PostgreSQL SQL dump	sql
S57	IHO S-57 (ENC)	000
SQLite	SQLite / Spatialite	sqlite db
Selafin	Selafin	
TIGER	U.S. Census TIGER/Line	
VDV	VDV-451/VDV-452/INTREST Data Format	txt x10
VICAR	MIPL VICAR file	
WAsP	WAsP .map format	map
XLSX	MS Office Open XML spreadsheet	xlsx xlsm

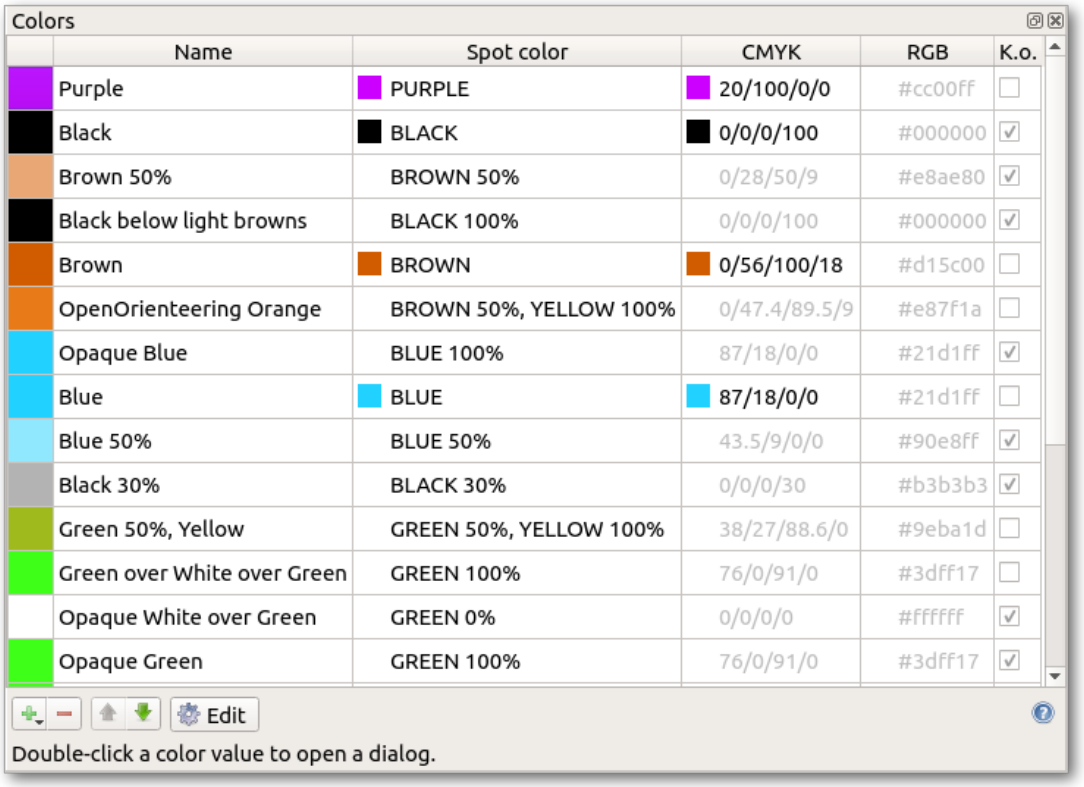
1.11 Colors and Symbols

Modifying map colors and symbols

Color Window Color system explanation and working with colors
Symbol Pane Types of symbols and how to create a new symbol
Symbol Replacement Dialog Replacing the current symbol set by another, useful for updating the symbol set version

1.11.1 Color Window

This window can be shown by clicking the menu item Symbols -> Color window.



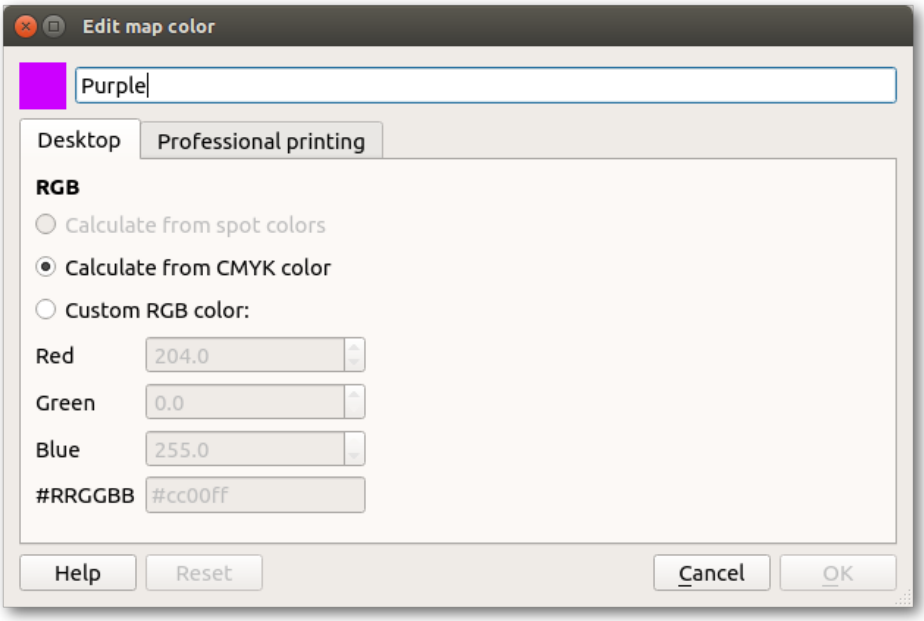
1.11.1.0.0.1 Introduction

Colors on orienteering maps are defined in the orienteering map standards, ISOM and ISSprOM, as colors from the Pantone Matching System (PMS). The recommended way to print maps is to use these spot colors to print each color layer separately onto the map sheet. This way colors printed later will overlap colors which are printed earlier. The color system in OpenOrienteering Mapper follows this analogy: each map file contains a prioritized list of available colors, where colors higher in the list overlap lower colors.
Colors can be managed with the buttons at the bottom of the list. To edit a color, double click its entry in the color list.

1.11.1.0.1 Color editor

Today there are different methods for printing maps and the color editor in OpenOrienteering Mapper is adjusted to that, so there are different settings for "desktop" and "professional" printing.

1.11.1.0.1.1 Desktop printing

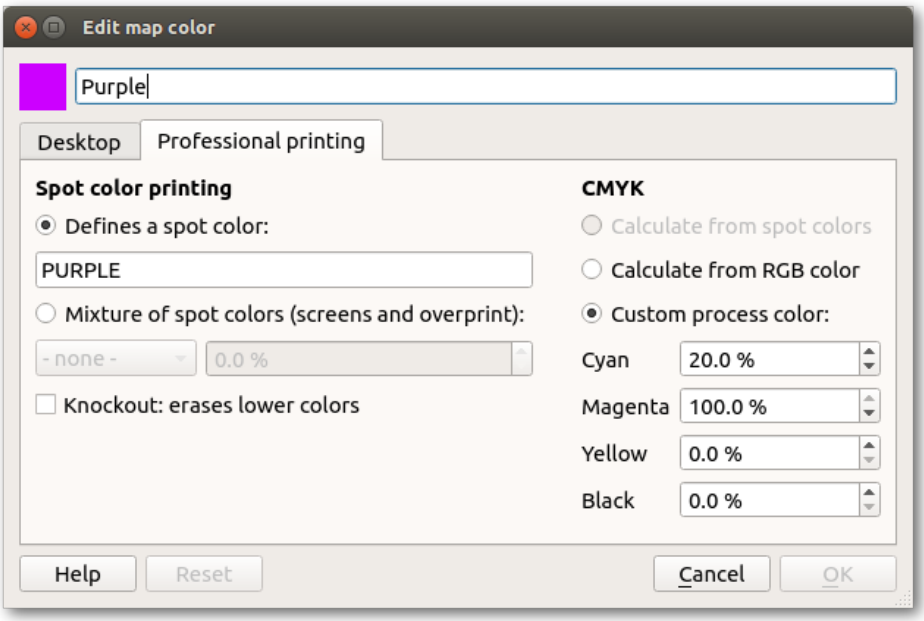


The first page addresses "desktop" printing, i.e. printing maps with cheap home laser printers. These devices use the **RGB color space** to define colors, where each color consists of a given amount of red, green and blue (this is not to be confused with how the colors are actually printed; it is just how the PC tells the printer which color to print). So on the desktop page, you can define how the RGB value for a color should be calculated by OpenOrienteering Mapper:

- **Evaluate spot colors**: the spot colors referenced by this color will define its RGB color. This is only possible if this color references at least one spot color (see later)
- **Evaluate CMYK color**: the CMYK value of this color will be converted to a RGB value (see later)
- **Custom RGB color**: you can enter the RGB value directly

Note that while defining RGB colors is enough for normal desktop printing, using the overprinting simulation effect requires to define spot color printing options also.

1.11.1.0.1.2 Professional printing



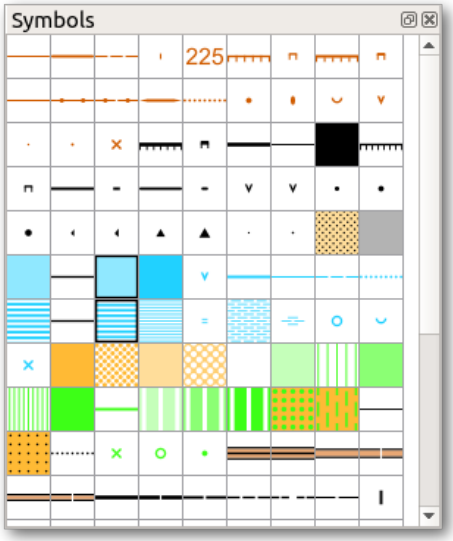
This page is divided into two parts. On the left are the settings for **spot color printing**:

- If the first option is activated, this color entry represents a spot color and will thus define a color layer. Enter the spot color name in the text field below the option.
- If the second option is activated, this color entry represents a color which is printed as a percentage of a spot color (screen) or a mixture of multiple spot colors (overprint). Choose the referenced spot colors and their amounts below.

When multiple colors overlap each other on the map and overprinting simulation is activated, the program simulates the effect of overprinting real spot colors where the colors are darkened when printed on top of each other. This can be very useful to increase map legibility, however it is not desired in all situations. Sometimes a color on top of another should erase the lower color completely. This can be set by activating the "∗∗Knockout∗∗" option.
On the right side of the professional page, there are the options for **CMYK color printing**. These are similar to the RGB color options:

- **Evaluate spot colors**: the spot colors referenced by this color will define its CMYK color. This is only possible if this color references at least one spot color
- **Evaluate RGB color**: the RGB value of this color will be converted to a CMYK value
- **Custom process color**: you can enter the CMYK value directly

1.11.2 Symbol Pane



1.11.2.0.0.1 Introduction

The symbol pane shows all symbols in the opened map file arranged in a grid. Hovering the cursor above a symbol shows its name and its number, which comes from the respective orienteering symbol set standard. Pressing F1 while hovering over a symbol shows the detailed description from the standard document for this symbol, if available. Symbols in this view can be selected like in a file manager:

- **Clicking** a symbol selects it exclusively.
- Clicking a symbol while holding **Shift** toggles the selection of all symbols between this one and the previously selected symbol.
- Clicking a symbol while holding **Ctrl** toggles the selection of this symbol only

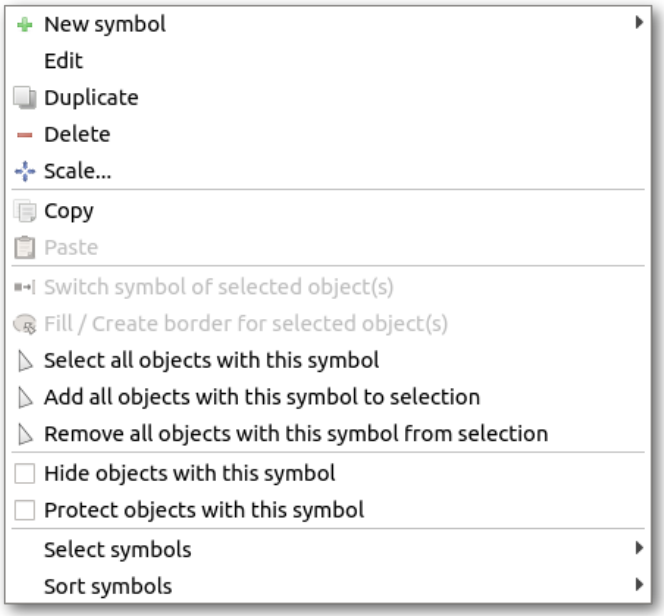
Right clicking shows the symbol menu.

1.11.2.0.0.2 Symbol types

Point symbols are features with small extent, so point objects are represented by a single coordinate. Examples are single trees or small knolls.
Line symbols depict linear objects such as paths or small watercourses. Line symbols can contain point symbols: the fence symbol for example represents its dashes by a point symbol.
Area symbols depict objects with a larger extent which is shown on the map in plan shape, for example buildings or thickets. They can be filled with a solid color, or with different kinds of line and dot patterns.
Text symbols contain font settings such as size, color or thickness. They are used to standardize the appearance of texts on the map, like control numbers or spot heights, but are also used for titles, legends and other notes. Text size may be approximated as 0.24 times the point size for a typical easy to read font (but some fonts may depart significantly from this rule of thumb). Thus 6pt font has a letter height of $6*0.24=1.44$ mm. Choosing an uncommon font may create problems for others opening the map on computer systems where this font is not installed, as font files are not embedded in map files.
Combined symbols are made up of two or more other line or area symbols. This is for example used to combine the gray fill and black outline for houses in sprint maps into a single symbol.

1.11.2.0.0.3 Symbol menu

To show the symbol menu, right click the symbol pane:



- The actions in the first section enable to create new symbols or edit the selected symbol.
- The actions in the second section enable to copy/paste symbols.
- In the third section, in addition to the possibility to select all symbols with the selected object, there are shortcuts to the two drawing functions switch symbol and fill / create border.
- The fourth section enables to hide all objects with a given symbol, for example to remove all paths from a map, and to protect all objects with a given symbol from editing. This is useful to make large area symbols static while editing other objects on top of them.
- The last section offers actions for symbol selection and sorting.

1.11.2.0.1 Symbol editor

1.11.2.0.2 Introduction

The symbol editor enables to create new symbols or to modify any of the existing symbols. Its main use in normal operations is to create symbols for map labeling, because no symbols for this purpose are provided by default as

they depend on the desired styling of the map sheet. Regarding symbols for use in the map itself, it should be understood that the default symbol sets include all the symbols permitted by the ISOM or ISSprOM and that any new symbols created, or modifications of existing symbols, will be a departure from the international standard.
There is a temptation to employ a symbol which is used in other local cartography to represent some feature on the basis that everybody who competes in this area is familiar with the notation. However, any such departure is confusing for a competitor who may be familiar with the international standard but not with your local notation. Similarly a local competitor may find the conforming notation strange when entering international competition. Thus a non-standard notation can be to the disadvantage of both local and visiting competitors.
The symbol editor is opened from the symbol menu which is triggered with a right-click on any symbol. The menu offers options to create a new symbol or to edit the selected symbol.
In each case the dialog opens with a General page which offers common options for all symbol types, which is followed by pages specific to each type of symbol. On the right is a preview of the symbol as it is currently configured, in a variety of lengths and orientations. This preview can be moved and zoomed with the middle mouse button and mouse wheel.

1.11.2.0.2.1 General page

At the top, the symbol number and name can be entered. Both are specified in the ISOM and ISSprOM for orienteering symbol sets. It is recommended that helper symbols are given numbers in the third subset (which is not used by ISOM). Thus a helper for symbol number x.y might be numbered x.y.1.
The description text appears when pressing F1 while hovering over the symbol with the cursor. For orienteering symbol sets, it is directly taken from the ISOM and ISSprOM documents.
At the foot of the dialog is a box which when checked hides the symbol when the map is printed out. It is intended for helper symbols which mark certain terrain features which are useful for mapping but will not be represented in the final map. **Use this with care!** When accidentally ticked, symbols will disappear in printouts without further notice!

1.11.2.0.2.2 Line settings

Line width and **color** define the basic line characteristics. Minimum line length function is not yet implemented. **Line cap** permits the shape of the end of the line to be specified. **Line join** refers to the rendering of vertices where line sections of different orientations join each other.
Dashed lines are created by a tick in the dash box, which shows the dash dialog settings. Typical length of dash and gap may be specified; these will be rendered with gaps of the specified size and dashes as close as practicable to the specified length (so that there is no fractional dash at the end). The appearance of lines with regular symbols or breaks may be improved by making the end dash a half length; a check box provides for this. Dashes may be grouped together with a specified gap within the groups which is different from the between-group gap length.
Many symbols (e.g. 513 Wall) have a **repeated feature** along the line. This line feature is invoked by setting a non-zero integer number in the mid-symbol count. The mid-symbol distance sets the spacing between symbol centers. The distance between spots refers to the distance between symbol groups; if the mid-symbol distance is too large then the groups may overlap. The distance from the end is an approximate length of line projecting beyond the last group. A check box to require at least one mid-symbol ensures that the line has at least one symbol but may give confusing results if the line is too short for meaningful rendering. Setting a minimum mid-symbol count is not yet implemented. A different mid-symbol minimum may be specified for the boundary line of a closed symbol.
Some line symbols require an **outline** which is enabled by selecting the border check box. Border width is the width (thickness) of the border lines. Shift moves the border lines further apart; shift equal to half the border width will place the line just outside the edge of the main line. A dash feature with characteristics which do not have to match the main line is enabled by the corresponding check box.

1.11.2.0.2.3 Start symbol

The start symbol will appear only at the first-fixed end of the line. This can be changed for a particular line with the switch dashes / reversing tool. The start is the left end of the horizontal sample lines in the illustrative graphic to the right of the symbol editor. The start symbol may be made of several elements. To add an element click the + button at the bottom of the elements list. To delete one click the - button. An element may be a point (a circular element), a line or an area element.
The default feature is a point element (line or area elements must be added). **Point elements** have inner diameter and outer width which may be different colors, and will be centered on the beginning of the main line.

A **line element** has width, color, end-shape and join characteristics specified in the current element dialog. The line may have any shape defined by successive pairs of coordinates, add more coordinate pairs with the + button at the bottom of the coordinates window and delete them with the - button. Another way to add a coordinate is to left click the desired position in the preview at the right. A right click repositions the currently selected coordinate. The coordinate system origin is the beginning point of the symbol line, the X axis is positive in the direction of the main symbol line, and the Y axis is up the screen. Curved lines are created by constructing a shape with straights first and then clicking the "Curve start" check boxes to make some parts curves. Better results may be obtained with curves which do not bend more than 90 degrees.
An **area element** has a color and a shape specified in the current element dialog. The shape of the area is defined just as for lines, see above.

1.11.2.0.2.4 Mid symbol

These symbols appear along the line at the spacing set for mid-symbols in the 'line settings' dialog. Mid symbols are edited like start symbols (see above).

1.11.2.0.2.5 End symbol

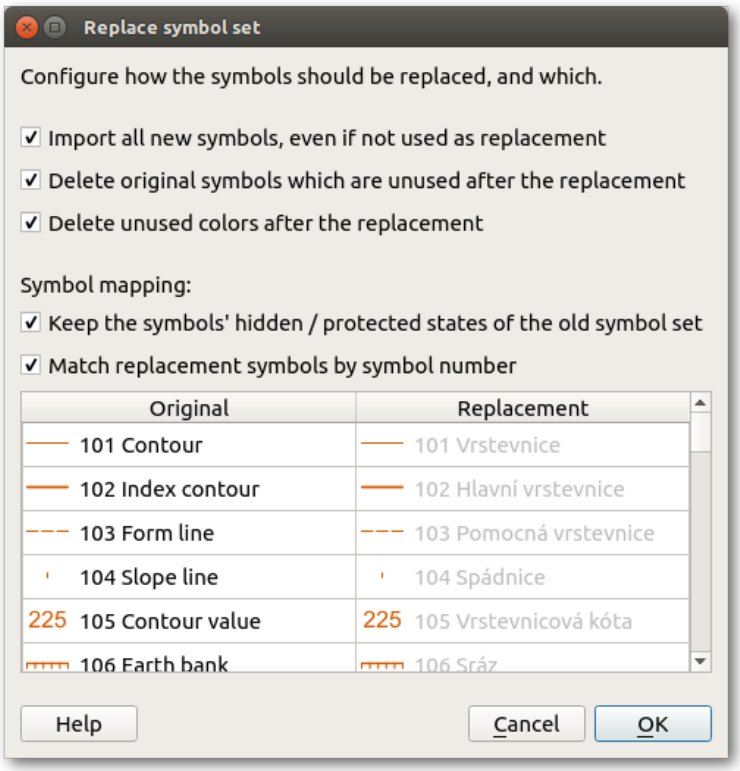
This symbol appears only at the last-fixed end of the symbol line. This can be changed for a particular line with the switch dashes / reversing tool. The end symbol will appear at the right end of the of the horizontal sample lines in the illustrative graphic to the right of the symbol editor. End symbols are edited like start symbols (see above).

1.11.2.0.2.6 Dash symbol

This symbol will appear at dash points along a line; drawing these can be toggled by pressing the space-bar while the drawing tool is active. The symbol will appear at each node drawn while the helpful tip at the bottom edge shows "∗∗Dash points on.∗∗" This switch may vary from point to point along the line. Dash symbols are edited like start symbols (see above).

1.11.3 Symbol Replacement Dialog

This dialog enables to replace the symbol set in the current map file by the set of another file. It is possible to accurately select a replacement symbol for each old symbol. Show it by clicking the menu item Symbols -> Replace symbol set..., then select the map file from which to take the new symbol set. Note that this is not a way to e.g. rescale a map from 1:10000 to 1:15000, use Map -> Scale map... instead.



1.11.3.0.0.1 Import all new symbols, even if not used as replacement

If there are symbols in the new symbol set which are not matched to any existing symbol, they will be imported as additional symbols if this option is checked, otherwise they will be omitted. This is useful to import symbols of the new set which had no counterpart in the old one.

1.11.3.0.0.2 Delete original symbols which are unused after the replacement

If this toggle is activated, all symbols of the old set which are not in use after replacing all chosen symbols will be deleted. This is useful to clean up symbols which are not needed anymore by the new set.

1.11.3.0.0.3 Delete unused colors after the replacement

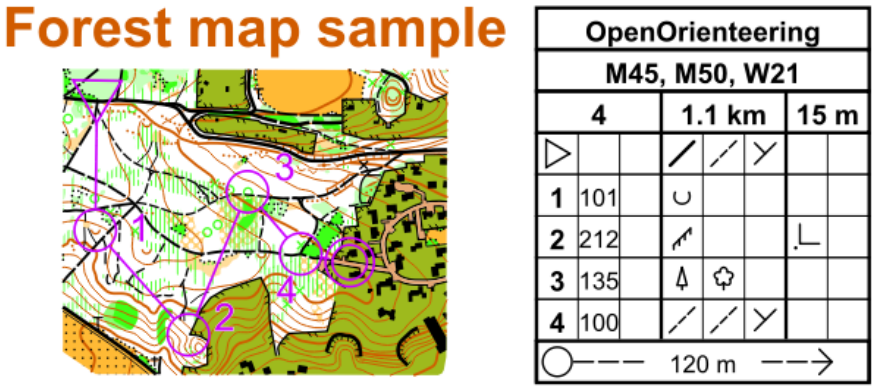
Deletes all colors which are not used by any symbol after the replacement. This is useful to clean up the color list.

1.11.3.0.0.4 Match replacement symbols by symbol number

As long as this check is activated, replacement symbols will be matched to existing symbols based on their numbers only. You can check the replacements in the symbol list below. After deactivating this, you can choose any replacement symbol (or also to not replace a certain symbol) for any old symbol by clicking the replacement symbol in the list and choosing the desired option.

1.12 Using the Course Design Symbol Set

OpenOrienteering Mapper doesn't have a sophisticated course planning feature. The Course Design symbol set provides basic support for designing maps with courses and control descriptions. It contains the overprinting symbols from the ISOM 2000 and the control descriptions from IOF's "International Specification for Control Descriptions - 2004". See the IOF Homepage for details.



1.12.1 Loading a base map

Open the base map as a template in the background. See Templates for details.

1.12.2 Drawing the course

For simple courses which consist only of start, controls, finish and free navigation you may use symbol 799 Simple Orienteering Course. For more complex courses use the individual overprinting symbols. The labels for the controls have to be created explicitly.

1.12.3 Creating the control description sheet

The Course Design symbol set contains the individual pictograms as well as symbols for the different sections which together form the control description sheet. The pictograms' names indicate the column of the control description sheet where they are to be used.
The control description symbols are meant to be used with a grid of horizontal and vertical lines spaced 3.↩
0 millimeters. By pressing the Shift key while creating a new element, you may easily align all the parts of the description.

1.12.4 About the control description sheet

The control description sheet starts with a heading which consists of blocks for the event title, classes (optional), and (in a single row) course code, course length and and height climb. The course length is given in kilometers rounded to the nearest 0.1 km. The height climb is given in meters rounded to the nearest 5 m.
The heading is followed by lines describing the start location, the individual controls, and special routes. The description of start and individual controls uses eight columns which are referred to as A...H.

Column	Description
A	Control number. Numbering of controls is in the sequence they are to be visited, unless the description is for a Score competition.
B	Control code. The control code should be a number greater than 30.
C	Which of any similar feature. This column is used when there is more than one similar feature within the control circle; e.g. south eastern.
D	Control feature. The feature, as shown on the map, at the center of the circle defining the control site; e.g. clearing; boulder. The description of each control is based on the International Specification for Orienteering Maps (ISOM 2000).
E	Appearance. Further information on the nature of the feature if it is required; e.g. overgrown; ruined. In certain circumstances also used for a second control feature where the description requires this.
F	Dimensions / Combinations. Dimensions of the feature should be given where the size of the control feature on the map is symbolic rather than to scale. Also used for the two combination symbols (crossing; junction).
G	Location of the control flag. Position of the control flag with respect to the feature; e.g. west corner (outside); south foot.

Column	Description
H	Other information. Other information that may be of importance to the competitor; e.g. radio control; refreshments.

1.12.5 Specifications for Trail Orienteering

There are two variations in the use of the columns when using IOF Control Descriptions for Trail Orienteering.

Column	Description
B	Number of control flags. This column is used to denote the number of control flags visible at this control; e.g. A-C equals three control flags to choose from; A-D equals four control flags to choose from.
H	Direction of observation. This column is used to denote the direction in which to view a feature. For example an arrow pointing north indicates that the competitor should be on a path/track to the south of the control circle.

1.13 Reference

Menus
Toolbars

- Advanced drawing tools

Settings Adjusting the program to your preferences.
CRT files Providing rules for assigning symbols.

1.13.1 Menus

- File Menu
- Edit Menu
- View Menu
- Tools Menu
- Map Menu
- Symbols Menu
- Templates Menu

1.13.1.1 File Menu

These controls provide standard file management tools.

New

Ctrl+N
This shows the dialog to create a new map.

Open...

Ctrl+O
Shows the dialog to open an existing map file. Currently supported formats are .omap, .xmap or .ocd (versions 8 .. 12, 2018).

Open recent

This shows a list of recently opened files, recognizing that a file to be opened will often have been previously opened in the recent past.

Save

Ctrl+S
Saves the currently opened map. OCD files will be saved in version 8 .. 12 format.

Save as...

Ctrl+Shift+S
Shows the file dialog for choosing a file name and file format to save the currently opened map.

Import...

Permits the import of maps or data in other formats. The following formats are supported: OpenOrienteering Mapper (.omap, .xmap), OCD version 8 .. 12, 2018 (.ocd), geospatial vector data (formats supported by GDAL).

Export as...

Permits the export of the currently opened map or a part of it to another format. The following formats are supported: Image (raster graphics), PDF, KMZ, simple course (XML or KML format), geospatial vector data (formats supported by GDAL).
For raster images, Mapper may additionally create world files. A world file is a small text file which defines the image's georeferencing relative to the map's projected coordinate reference system. Note that these files contain only six numerical parameters. They do not contain an identification of the projection, coordinate system or datum they refer to. The filename is derived from the image's filename, but with a modified filename extension usually ending with letter 'w'.
For geospatial vector data, the actual GDAL driver is selected by the extension (e.g. ".dxf") given to the filename.

Print...

Ctrl+P
Shows the print dialog to print the currently opened map.

Settings...

Opens the settings dialog. (On OS X, the settings are in the usual place instead.)

Close

Ctrl+W, Ctrl+F4
Closes the current program window.

Exit

Ctrl+Q
Exits the program, which will close all open map windows.

1.13.1.2 Edit Menu

Undo

Ctrl+Z
This most important function reverses the last change made to the map. Repeating 'Undo' will undo earlier changes, one step at a time. **Attention:** While changes to map objects can be undone this way, not all map changes are covered by the undo system. This includes changes to colors, symbols or templates.

Redo

Ctrl+Y, Ctrl+Shift+Z
When you have taken Undo too far this will reverse the process — again one step at a time.

Cut

Ctrl+X
This removes the selected object(s) and moves them to the clipboard.

Copy

Ctrl+C
This copies the selected object(s) to the clipboard.

Paste

Ctrl+V
This inserts the map object(s) on the clipboard into the map. They will be centered at the view midpoint. **Note:** When copying objects between different maps, their symbols and colors may be copied too in order to be able to display the objects in the new map in the same way as in the source map.

Delete

Del
This action deletes the selected object(s).

Find...

Opens the "Find objects" dialog which can be used to find objects by contained text, symbol name or tag keys and values.

Find next

Finds the next object matching the last query from the "Find objects" dialog.

Select all

Ctrl+A
This selects all objects in the current map part.

Select nothing

Ctrl+Shift+A
After this action, no object is selected.

Invert selection

Ctrl+I
This action inverts the selection in the current map part.

Select all objects with selected symbols

After this action, the selection consists of all objects in the current map part which have the selected symbol(s).

Clear undo / redo history

Clears the history of undo and redo steps, i.e. all undo and redo steps will be deleted. This reduces the file size for map file formats where the last undo and redo steps are stored, e.g. the omap format.

1.13.1.3 View Menu

Pan

(F6)
Activates the pan tool which can be used to move the map. Note that key F6 starts panning immediately.

Zoom in

F7
Zoom in (enlarge) to view the map closer.

Zoom out

F8
Zoom out (shrink) the map to see more of it.

Zoom to box

Use this tool to zoom to a selectable rectangular area. Left-click and drag to define the box where to zoom to after releasing the mouse button.

Show whole map

Use this tool to display the whole map on your screen.

Set custom zoom factor...

Shows a dialog to enter a specific zoom factor. Note that the zoom factor on the screen is not necessarily equal to the printed scale of the map.

Show grid

G
Shows or hides the map grid.

Hatch areas

F2
When this toggle is activated, all area objects in the map will be drawn in a hatched, semi-transparent style. This is useful to be able to see any templates below the map.

Baseline view

F3
When this toggle is activated, instead of the normal appearance of map objects only their midpoints respectively baselines are displayed. This can be combined with Hatch areas to see anything below the map even better.

1.13.1.3.0.1 Overprinting simulation

F4
When this toggle is activated, the effect of printing the map with layers of spot colors on top of each other will be simulated. This leads to improved map readability. This function requires a color set with spot color definitions.

Hide all templates

F10
When this toggle is activated, no templates will be displayed. This is useful to check the appearance of the map alone.

1.13.1.3.0.2 Display coordinates as ...

The coordinates of the cursor on the map are shown in the position box at the bottom right corner of the program window. Paper coordinates refer to positions on a paper print, from an arbitrary origin. If your map has been georeferenced, additional coordinate systems will be available. Projected coordinates are meters of easting and northing. Latitude & longitude may be expressed in decimal degrees or in degrees, minutes and seconds.
The coordinate system may also be selected by a right-click on the position box at the bottom right corner of your screen which will provide the same choices.

1.13.1.3.0.3 Toggle fullscreen mode

F11
This toggle switches the display to full screen mode and back.

Tag editor

Ctrl+Shift+6
This toggle shows or hides the tag editor.

Color window

Ctrl+Shift+7
This toggle shows or hides the color window.

Symbol window

Ctrl+Shift+8
This toggle shows or hides the symbol pane.

Template setup window

Ctrl+Shift+9
This toggle shows or hides the template setup window.

1.13.1.4 Tools Menu

All tools accessed through this menu are also available on the toolbar. So for documentation, see the drawing toolbars reference.

1.13.1.5 Map Menu

Georeferencing...

Opens the georeferencing dialog.

Configure grid...

Shows the grid configuration dialog.

Change map scale...

Shows a dialog to change the map scale.

Rotate map...

Shows a dialog to rotate the whole map.

Map notes...

Shows a text field for entering additional text which will be saved in the map file, without appearing on the map itself. This can for example be used to store information about map revisions.

Map information...

Shows a window with information about the current map, e.g.:

- number of objects (overall and for each map part)
- list of symbols and their quantitative use by objects
- list of colors and their usage within symbols
- list of fonts and their quantitative use by text symbols The map information report can be saved as a text file.

Add new part...

Opens a dialog for entering the name of a new map part to be created.

Rename current part...

Opens a dialog for changing the name of the current map part.

Remove current part

Removes the current map part and all objects it contains.

Move select objects to

Moves the selected objects to another map part.

Merge this part with

Moves the current part's objects to another map part, and then removes the current map part.

Merge all parts

Moves all other parts' objects to the current part, and then removes all other map parts.

1.13.1.6 Symbols Menu

Symbol window

Ctrl+Shift+8
This toggle switches the display of the symbol pane on the map screen.

Color window

Ctrl+Shift+7
This toggle switches the display of the color window on the map screen.

Symbol set ID...

Opens a dialog for changing the map's symbol set ID. The symbol set ID controls suggested symbol replacements during import and during explicit map symbol set replacement.

Scale all symbols...

This dialog can be used to re-scale all symbol dimensions. It is important to note that use of this feature will create a departure from the standard symbols and the resulting map will thus not conform to the standard.

Replace symbol set...

Shows the symbol set replacement dialog.

Load CRT file...

This action lets you select a CRT file and replace symbols within the current map and symbol set.

Create symbol set report...

This action lets you export a detailed HTML report for the current map showing all colors and symbols.

1.13.1.7 Templates Menu

Template setup window

Ctrl+Shift+9
Switches the display of the template setup window on the map screen. This provides access to the functions required to open, scale, and position a template, and to close it.

Open template...

Opens a template file directly without going through the setup window.

Reopen template...

Shows the template reopen dialog where templates which have been opened and then closed before can be restored.

1.13.2 Toolbars

- Toolbar positions and visibility
- General toolbar
- View toolbar
- Map parts toolbar
- Drawing toolbar
- Editing toolbar
- Advanced drawing

1.13.2.1 Toolbar positions and visibility

Toolbars may be moved to a more convenient position. To detach and move, pick the handle at the left end and drag the toolbar to your preferred position. The resulting order of your toolbars may thus be different from this page.
You may hide toolbars you do not use. To close or open a toolbar, right click on any open toolbar or docked window. This will open a small window where you can disable or enable toolbars and docked windows.

1.13.2.2 General toolbar

New map

Ctrl+N
Click to create a new map.

Open / Save map

Ctrl+O / Ctrl+S
Click to open/save an existing map.

Print map

Ctrl+P
Click to open the print dialog.

Cut / Copy / Paste objects

Ctrl+X / Ctrl+C / Ctrl+V
Click to cut / copy the currently selected objects to the clipboard, or to paste the clipboard contents into the map (at the center of the view).

Undo / Redo

Ctrl+Z / Ctrl+Y
Click to undo or redo the last map editing step.
Note: Not every action can be undone, e.g., changes to colors, symbols or templates can't be reverted.

1.13.2.3 View toolbar

Grid

G
Click the button to toggle showing the map grid. Click the arrow to the right of this button to show the grid configuration.

Pan map

F6
Use this tool to move the map by clicking the map and dragging the mouse.
Note: You may always move the map by dragging with middle mouse button, or by using the arrow keys.

Zoom in / Zoom out

F7, + / F8, -
Use these actions to zoom in (enlarge) or zoom out (shrink). The center of the view stays at the same position in the map.

Zoom to box

Use this tool to zoom to a selectable rectangular area. Left-click and drag to define the box where to zoom to after releasing the mouse button.

Show whole map

Use this tool to display the whole map, including the currently visible templates, at maximum possible zoom.
This can be particularly useful when items (objects, templates) are accidentally moved far from your working area and out of sight. This tool brings them onscreen. If the map is just a dot in one corner then the rogue feature is near the other edge of the screen.

1.13.2.4 Map parts toolbar

This toolbar will not be shown unless the map has multiple parts.
At the moment, the map parts toolbar has only a single drop down box for indicating and selecting the active map part.

1.13.2.5 Drawing toolbar

Edit objects

E

Using this tool, click on the map to select a single object. If the object you wish is not selected with the first click, click more times to go through all objects below the cursor. To select multiple objects, hold the Shift key when you click subsequent objects. If you Shift-click on an object which has already been selected, the click will deselect that object. A group of objects may also be selected by drawing a selection box with a left-click and drag.
If only a few objects are selected, the nodes defining these objects become visible. There are different types of nodes:

- A square stands for a normal node.
- A diamond depicts a dash point (see below).
- A circle depicts a Bézier curve handle, defining the tangent of a curve point. Individual nodes can be dragged with the mouse to change their position. To change the tangent direction of a node on a Bézier curve, click the end of the handle and drag it. Longer handles have greater influence, while shorter handles have only local effect.

To **add** an extra node to an existing line or curve, Ctrl-click on an empty spot of a path. By moving the mouse, the new node can be positioned in the same action. If a **dash point** is required, hold the space bar down while Ctrl-clicking. To **remove** a node, Ctrl-click an existing node.
To move the selected objects as a whole, click and drag the dashed box which encloses all selected objects. While dragging nodes or objects, there are means for more accurate positioning:

- Holding **Ctrl** constrains the movement angle. For nodes and regularly shaped objects, these will be the parallel and perpendicular directions to the object.
- Holding **Shift** makes the cursor snap to other existing objects.

Edit lines

L
Using this tool, objects can be selected like with the edit objects tool.
If only a few objects are selected, line segments of these objects can be edited by clicking them and dragging the mouse. For straight lines, the angle constraint will be active automatically. This makes it easy to edit e.g. rectangular houses while ensuring that they stay rectangular. To toggle the angle constraint, hold Ctrl.
To switch a line segment between curved and straight, hold Ctrl while clicking the segment.

Set point objects

S
This tool enables you to insert a point symbol from the map symbol window. This includes boulders, rocky ground, knolls, waterholes or any other symbol representing a point feature too small to be drawn to scale. Select the symbol for the feature to be inserted by clicking it on the symbol window, click the point tool (if it is not activated automatically) and then click on the map to insert that feature on the map.
Some point symbols may be rotated, like the cave or the elongated small knoll. To set the desired orientation, click and move the mouse into the desired direction while holding the left mouse button down. To change the orientation after the point object has been placed, use the rotate pattern tool.

Draw paths

P
The path tool draws line objects such as contour lines, watercourses and roads and area objects such as open land or different vegetation densities. To draw, first choose the symbol for the feature to be inserted by clicking it on the symbol window, then click the line tool if it has not been activated automatically.
To draw a path consisting of **straight segments**, like the shape of a house, proceed by clicking at the position of each corner on the map. At the last corner, right click or double click to finish the path. Area symbols will be closed automatically, so you do not need to click the first position again. In case you do not want right clicking to set the last path point in addition to finishing the path, you can change this behavior in the program settings.
To create a **smooth path** (a cubic Bézier spline), click and drag the mouse away in the continuing direction. This creates a node with control handles which may be subsequently used to refine the shape of the curve.
Note: While this way of drawing curves may seem to be difficult at first, it is important to get used to it. Drawing "smooth" curves with many small straight segments instead is **not an alternative**, as these will look ugly when

viewed closely. Just practice Bézier curve drawing until you get used to it. Less nodes are often better than too many.
It is also possible to **mix straight and curved segments**: click once to create a corner point, click and drag to create a curve points. Segments between two curve points will be created as smooth curves, while all other segments will be straight.
To **snap** to existing objects when starting to draw or while drawing a path, hold Shift. To **follow** the shape of existing objects while drawing, click at the existing object while holding Shift and drag the mouse along it. Depending on the direction in which you drag the mouse, the object will be followed along this direction.
To constrain the **drawing angle**, hold Ctrl while drawing a path. The available angles will be intelligently chosen such that you can continue paths straight forward, or insert 90 or 45 degree corners.
To **pick a direction** of an existing object, Ctrl+click the desired object before starting to draw the path. Drawing angles will then be automatically constrained to the picked direction (and its perpendicular directions) until you press the Ctrl key. This is very useful for e.g. drawing parallel houses or hedges/fences in front of houses which are parallel to them.
To remove a misplaced point while drawing a line, use the Backspace key to **undo** one step at a time, or leave it and correct the position using the edit objects tool. If the partly drawn line is discovered to be a mistake, use the Esc key to abort and remove it entirely.

Closed paths

To draw a **closed path** (closed contour line, lake, etc.), press the Return key to close the last segment of the path to the starting point. When drawing with area symbols, paths are closed automatically. However, there may be an unwanted corner at the start/end point if you just finish the path roughly at the position where you started it, instead of pressing Return.

Dash points

Dash points serve different purposes, depending on the symbol on which they are used:

1. For dashed line symbols like small paths it is sometimes useful to be able to steer the positioning of the dashes, e.g. path crossings should preferably be at the center of line dashes. When a dash point is inserted in a line, dashes will be exactly centered on this point.
2. For lines with patterns such as fences, it is sometimes useful to be able to steer the positioning of the patterns. When a dash point is inserted in a line with such a pattern, patterns are shifted away from it. This is e.g. useful for corners of a fence to ensure a minimum distance of the dash patterns to the corners.
3. Some symbols (e.g. 511 Major power line) require bars at some nodes (pylons) but for example not at the point where the line ends at the edge of the map (no pylon). The bar is defined as a dash symbol inside the line symbol for 511 Major power line. It will appear only at dash points along a line.

In general, it is enough to remember that dash points steer the positioning of line dashes, patterns, and dash symbols. When drawing, just try out how it behaves. Dash point nodes have a diamond shape when the line is selected (ordinary nodes are square). Drawing of a node as a dash point is toggled with the Space bar: dash points will be drawn while the helpful tip in the status bar at the bottom edge shows "∗∗Dash points on∗∗". This switch may be varied from node to node along the line.

Draw circles and ellipses

O
The circle tool can be used to draw round lines and areas. To start drawing, first select a symbol of type line or area and the circle tool.
To draw a circle, either click on one point on the circle and then on the opposite point, or click and hold at the starting point and release the mouse button at the end point.
To draw an ellipse, click at one of the boundary points on the major or minor axis of the ellipse, then click and hold at the opposite point on the ellipse and define the extent by dragging the mouse away.
Circles and ellipses are represented by four Bézier curves and can be edited like any other path.

Draw rectangles

Ctrl+R
The rectangle tool is used to draw shapes with any number of 90 or 45 degree corners such as a building. To draw, first select the line or area symbol you want to draw with and select the rectangle tool. Then click once at each corner and double click or right click at the last corner of the rectangle. You can speed up drawing by clicking and dragging the mouse to draw two corners in one step: one at the click position and one at the release position.
While drawing, hold Ctrl to constrain the position of the next corner to positions which align with already drawn segments. For example, when drawing a small indentation, Ctrl can be held at its last corner to set it exactly at the position to which the line before the indentation would extend.
Rectangle objects can be edited like any path. However, consider using the line edit tool to preserve the angles.

Draw free-handedly

This tool draws both line and area objects by approximating the path taken by the cursor using straight line segments. To use this tool, click at the starting point, drag the cursor where you want the path to go then release the mouse to finish drawing. The object you have created can be edited in the same way as other line or area objects.

Fill bounded areas

F
This tool fills areas of unbroken white space with an area symbol. To use this tool, select the area symbol, then click on white space i.e. any place not already covered by another area object. Internally, this tool first finds all paths, which can belong to many different objects, that form a boundary around the unbroken white space. A new closed shape is created that has the same paths as the white space boundary and is filled with your chosen symbol. Also, if you use this tool with a line symbol selected, then a border around the white space will be created.
Attention: This tool will not work if your chosen white space is not completely contained by other path objects.

Write text

T
This tool places text on the map. In order to be language-independent, orienteering maps generally do not have names or text information on features, but text is useful for map titles and version numbers for example. It is necessary to select a text symbol (which determines the font settings) before the text tool will become available.
Two different types of text objects can be placed with this tool:

- Clicking once creates a text object with a single anchor point.
- Clicking and dragging the mouse creates a text box (with automatic text wrap).

When text is edited, a small window with horizontal and vertical alignment options is shown. To edit text after it is created, choose the edit objects tool, select the text object, and click again inside the object.

Paint on template

This tool enables the freehand drawing of lines, annotation and erasure on images loaded as templates, in a choice of 7 colors. It is intended for surveying with a mobile computer.
Click and hold the left mouse button to draw while the mouse is moved. Hold the right mouse button as the mouse is moved to erase. The markup is saved in the template image file **permanently**, so it is good practice to keep a copy of the template file in another place or use a blank transparent image for drawing.

1.13.2.6 Editing toolbar

Delete

Del
This tool deletes the currently selected map object(s).

Duplicate

D
This tool creates a duplicate of each selected map object. Select the object(s), then click the tool to create identical cloned objects at the same place. As the duplicates are created at the same place, the appearance of the map does not immediately change. However, the duplicates can be selected and dragged to another location, leaving the original objects behind. To drag an object, select the edit objects tool, then click and hold on the enclosing box and drag as required. The duplicate tool is particularly useful when applied to create and move identical groups of items.

Switch symbol

Ctrl+G
This tool changes the symbols of the selected map objects to another. To use it, select the object(s) to change on the map, then select the target symbol in the symbol window. (*Attention:* With default settings, it is not possible to do this the other way round as selecting an object will select its symbol, so the initial symbol selection is discarded.) Then click the tool and the map symbols will change to the target symbol - provided that the target symbol can be applied to the selected map objects (i.e. either both must be points, or both texts, or both one of line, area or combined symbols.)

Fill / Create border

Ctrl+F
Having drawn a closed boundary which requires a fill (such as a fence containing a thicket), select the boundary on the map (using the edit objects tool tool), then choose the required fill symbol in the symbols window. (*Attention:* with default settings, it is not possible to do this the other way round as selecting a map object will select its symbol, so the initial symbol selection is discarded.) A left click on the fill tool will put the chosen fill into the selected boundary. Internally, this tool creates a duplicate of the selected object and assigns it the selected symbol. So, in addition to filling closed boundaries, it is also possible to create a boundary around an area, or create duplicates of lines with another symbol using this tool.

Switch dash direction

Ctrl+D
This tool changes the direction of the selected (line) objects, so e.g. dashes of fences or cliffs will be flipped to the other side. Internally, the tool just reverses the coordinates of the path objects.

Connect paths

C
This tool enables two (or more) selected lines to be joined together to create a single line.
It is necessary that the selected lines have the same symbol and that the ends to be joined are very close together, otherwise nothing will happen. It may be necessary to adjust the position and direction of the node at the join after connecting the lines.

Unify areas

U
This tool merges two or more areas (having the same symbol) into one, deleting the overlapping parts. Simply select two or more areas using the edit objects tool and then click on the Unify areas tool to apply it.

Cut object

K
This tool cuts a selected existing line or area object into two parts.
To cut **lines**, click at the point where it is desired to break the line. The object will be split into two at this point and both will be selected, so it is possible to insert more cuts after the first. It is also possible to click on a line and drag the mouse along it to remove the marked part completely.
To cut an **area object**, select it and draw a cut line from one side of its boundary to another. Drawing works exactly as with the draw path tool. It is necessary to start and end the cut line on the boundary of the area to be cut. It is

not sufficient to cross the boundary; both ends of the line must be on the boundary within a tolerance of 5 pixels (this may be altered in the program settings). The cut line may contain any number of internal vertices and can be polygonal or curved. The cut occurs immediately when the line is finished on the boundary (with a right click or double click).

Cut free form hole

H
This tool cuts a hole into an area object. To do so, first select the object with the edit objects tool, then click the cut free form hole tool. Then simply draw the shape of the hole on the area as you would draw with the draw path tool. After finishing, the boundary of the hole may then be edited in the same way as any path.
Apart from free form holes, the menu shown by clicking the arrow to the right of this tool offers variants to cut circular or rectangular holes.
If the line describing the hole crosses the boundary of the object, the area outside the former boundary and inside the "hole" will be filled with the area symbol; however, this **must be avoided**! Features such as the unify areas tool or the area measurement will fail for such objects.

Rotate objects

R
This tool rotates any selected object(s), which can include the whole map, about a selected pivot point and by any angle. Select the item(s) to be rotated using the edit objects tool, then click the tool.
The rotation center will be marked with a small circle. Initially it is located at the bounding box midpoint of the selected objects, but it can be set to any position by clicking on the map. Then click somewhere at a convenient radius from the rotation center and move the selected objects about the rotation center to the desired position by dragging the mouse. By holding Ctrl, the rotation angle can be constrained to angles in a fixed stepping.

Rotate pattern

This tool has two purposes:

- Setting the orientation of **area symbol patterns**, e.g. vineyard, forest runnable in one direction.
- Adjusting the orientation of **rotatable point symbols**, e.g. caves, after they have been placed.

To use it, first select the object to be changed with the edit objects tool, then click the rotate pattern tool. Then click any position on the map and drag the mouse into the desired direction to change the object's pattern to.

Scale object(s)

Z
This tool scales the selected object(s), which can include the whole map. It works completely analogous to the rotate objects tool.

Measure lengths and areas

M
This tool can be used to measure line lengths and area sizes. It will show both real world length or area in meters and the resulting length or area on the printed map. It will show a warning if a line length or area size violates the symbol specific minimum dimensions (if defined for the symbol).
When this tool is activated, a window appears containing the measurements for the selected object. To measure different objects, the selection can be changed using the edit objects tool while the window is active. It is also possible to draw new paths and have their length or area shown as they are drawn.

1.13.2.7 Advanced drawing toolbar

Clip area

This cuts away all objects except inside a given region, making a map excerpt. It can also be used to cut away only a selected subset of objects outside the region. To use it:

- Draw the cutout shape (with any line or area symbol). The shape must be closed, ensure this by finishing the drawing by pressing the Return key.
- Then select the cutout tool. The shape will be marked in red.
- For making a cutout of the map, now press the Return key.
- For cutting only some objects, select those objects before pressing Return.

Erase area

This is the opposite to the above clip area tool. It cuts away all or a subset of objects inside a selected cutout region. Usage is identical to that of the clip area tool.
This tool is useful for making training maps where certain symbols are missing in some places.

Convert to curves

N
This tool changes the shape of selected polygonal objects to smooth. It can be used to smooth objects which have been drawn or imported as polygonal objects but are curved in reality. It is also useful for simplifying complex computer-generated objects, such as raw lidar contours.
Note that this tool might take some time to complete for a large number of objects, and the results may not match expectations in some cases. So drawing curved objects manually can be a fair alternative with reasonable effort.

Simplify path

Ctrl-M
This tool simplifies the shape of the selected paths by removing points which can be removed without changing the object's shape significantly. Note that this tool is still experimental and might take some time to compute for a large number of objects.

Distribute points along path

This tool lets you create a number of point objects evenly distributed along a path.
To use this tool, you need to select a path object first, then select the point symbol. Now the action will open a dialog which lets you choose the number of objects and various other parameters.

Intersect areas

This tool deletes all of the selected area objects that do not intersect with first-selected area. The only part which will remain is that part of the first area selected which was previously overlapped by one or more of the other selected areas. Select two or more overlapping objects of the same area type and then click on this tool to use it.

Cut away from area

X
This tool deletes all parts of the first selected area object that overlap with one of the other selected areas. Select two or more overlapping objects of the same area type and then click on this tool to use it.

Area XOr

This tool will XOr all selected areas. This means that all parts of the selected areas that overlap with another selected area will be deleted. Select two or more objects of the same area type and then click on this tool to use it.

Merge area holes

This tool unifies the areas of two or more overlapping holes in an area object into a single hole. These holes must be created using the cut hole tools. This tool is useful as when two area holes overlap, the overlapping portion(s) have the same fill as the parent area object instead of being empty, which may not be desired. This tool may also be useful after boolean operations on objects.

1.13.3 Settings

In the settings dialog, the program can be adjusted to suit your application.

1.13.3.0.1 General page

1.13.3.0.1.1 Language

The program language may be selected here.

1.13.3.0.1.2 Open most recently used file

If this option is set, on program startup the last recently used file will be opened, otherwise the home screen will be shown.

1.13.3.0.1.3 Show tip of the day

This option controls whether the tip of the day should be included on the home screen.

1.13.3.0.2 Editor page

1.13.3.0.2.1 High quality map display (antialiasing)

Map elements are drawn more smoothly (and less pixelated) if this option is set, however the drawing speed is lower.

1.13.3.0.2.2 High quality text display in map (antialiasing), slow

This controls the same option as the above for map texts. It is separate because text display is particularly slow.

1.13.3.0.2.3 Click tolerance

This controls how close you need to click on map objects or object handles for selecting them, but also for cut lines with the cut tool for example. Set a larger value if you have difficulties (or if you use a tablet), however this may lead to some unintentional selections.

1.13.3.0.2.4 Snap distance (Shift)

This controls how close you need to be for snapping to an existing object when holding Shift while editing an object or drawing.

1.13.3.0.2.5 When editing an object, automatically select its symbol, too

When this box is checked selection of any object on the map will cause the the same symbol to be selected in the symbol pane. This is often convenient as symbols may be selected by simply clicking an object with this symbol on the map.

1.13.3.0.2.6 Zoom away from cursor when zooming out

When ticked the zoom function will zoom away from the cursor rather than from the middle of the window when using the scroll wheel to zoom out. Using the menu or toolbar zoom tools (or the function keys F7 & F8) will still zoom to/from the middle of the screen.

1.13.3.0.2.7 Drawing tools: set last point on finishing with right click

When this is activated, right clicking while drawing an object will set the last point **and** finish drawing the object. When disabled, right clicking will **only** finish the object without setting the last point.

1.13.3.0.2.8 Templates: keep settings of closed templates

When active, the settings of templates (like their positions) will be kept in the map file when they are closed, so they can be reopened later while restoring their settings. In essence, "closing" templates does not really close them this way. When the setting is off, closed templates cannot be restored later.

1.13.3.0.2.9 Edit tool: actions on deleting Bézier spline points

These settings control what happens when a node between two curves in a path is deleted. The first is used when a node is deleted normally by Ctrl+clicking it, the second is used when a node is deleted by Ctrl+Shift+clicking it.

- **Retain old shape**: The program tries to move the remaining curve handles so the shape of the old curve is retained as much as possible in the remaining curve.
- **Reset outer curve handles**: The outer handles (those of the remaining curve) are reset to the positions where they would be placed if the outer curve would have been drawn with the draw path tool. Note that this way the resulting shape is independent of the position of the deleted node.
- **Keep outer curve handles**: Nothing happens apart from the deleted node and its two associated handles being deleted. The outer handles (those of the remaining curve) are simply kept at their current positions. Note that this way the resulting shape is independent of the position of the deleted node.

1.13.3.0.2.10 Rectangle tool: radius of helper cross

This controls the radius of the helper cross which is shown when using the rectangle tool, in pixels.

1.13.3.0.2.11 Rectangle tool: preview the width of lines with the helper cross

When this is checked, the helper cross adapts to the selected symbol: for each direction, two lines are drawn which show the radius of the used (line) symbol. This allows for better judgment of the result while drawing, but leads to more cluttering on the screen.

1.13.4 CRT Files

1.13.4.1 Introduction

Cross Reference Table (CRT) files provide rules for assigning and replacing symbols. They are used in the following situations:

- replacing a map's symbol set (menu Symbols $>$ Replace symbol set...),
- replacing symbols within the current map (menu Symbols $>$ Load CRT file...),
- importing geospatial vector data (menu File $>$ Import...).

To facilitate the automatic lookup of a suitable CRT file, CRT files may be placed in the symbol set folder and named following this pattern:
SOURCE_ID-TARGET_ID.crt
where SOURCE_ID is a symbol set ID (menu Symbols $>$ Symbol set ID...) or an import driver name (e.g. OCD, OSM, DXF), and TARGET_ID is another symbol set ID (either of this map or of the replacement symbol set). Examples:

- OSM-ISOM2017.crt will be used when importing data through the OSM driver into an ISOM2017 map.
- ISOM2000-ISOM2017.crt will be used when replacing the symbols of an ISOM2000 map with an ISOM2017 symbol set.

1.13.4.2 CRT file syntax

Empty lines are ignored. Lines starting with a # character are considered comments, i.e. they are ignored, too. Every other line is a replacement rule and consists of two parts.
The first part of the rule is the target symbol number. It determines which symbol will be assigned to matching objects.
The second part of the rule, separated from the first part by white space, determines the objects this rule applies to. This can be given either as a symbol number or as a object query. When using object queries, more specific rules need to follow more general rules.
Example from OSM-ISOM2017.crt:

- 406 natural = wood
- 408 natural = wood AND (wood:age = young OR wood:age = very_young)
- 404 natural = wood AND wood:density = sparse
- 408 natural = wood AND wood:density = dense

Example from ISOM2000-ISOM2017.crt:

- 102 102
- 103 103
- 101.1 104
- 102.1 105

1.13.4.3 CRT file editing

CRT files may be edited with any text editor, e.g. notepad in Windows. However the .crt filename extension is commonly associated with certificate files. You will probably have to select an "All files" filter in the editor's Open-file dialog, or temporarily change the extension to .txt.
When Mapper displays the symbol replacement dialog, modified symbol assignments can be saved to a CRT file via the "Symbol mapping" button. Note that this dialog shows the assigned symbol in the second column, while in the CRT file, assigned symbols are recorded at the beginning of the line.

1.14 Frequently Asked Questions (FAQ)

1.14.1 Navigation

1.14.1.1 How do I move the map?

The easiest way is to hold the middle mouse button while moving the mouse. But you can also press F6 and move the mouse, or use the corresponding toolbar button, or use the cursor keys.

1.14.1.2 How to zoom in and out?

You can use the mouse wheel, press F7/F8 or +/- keys, or click the zoom buttons in the toolbar.

1.14.2 Drawing

1.14.2.1 I want to start drawing a map, but have no idea how to.

Start by reading the short introduction to o-mapping.

1.14.2.2 How do I add points to an existing path or delete points from it?

With the path object selected using the edit tool, hold Ctrl and click a free spot on the path to create a new point there. You can even move the mouse in the same action to set the position of the new point. To delete a point, hold Ctrl and click an existing point.

1.14.2.3 How do I change line segments from curved to straight and vice versa?

With the line edit tool, select the object you want to edit and hold Ctrl while clicking the line segment. This switches the segment between curved and straight.

1.14.3 Advanced editing

1.14.3.1 How can I cut out a part of a map to take it for a new map?

First you save the map to the new file. Then draw some closed line or area (symbol doesn't matter) around the border of the part which you want to keep. Now when this border object is finished and selected, click on the "↩ Cutout" icon or menu item, then press the enter key. Keep in mind that the map area that was cut away has been added to the undo history, so anyone can restore the original map unless the undo/redo history is explicitly cleared.

1.14.4 File formats

1.14.4.1 What are the advantages of the .omap format?

The .omap format is OpenOrienteering Mapper's native format. It is XML-based, which means for example that it is relatively easy for other developers to access the information in map files. Additionally, it is platform independent, error-resistant and makes it possible to keep a high compatibility between different versions of the format.

1.14.4.2 What is the difference between .xmap and .omap format?

The .xmap format is nearly identical but more verbose, even suitable for direct manual editing. The .omap format is tuned towards minimum size and fast processing. If you want to keep your data in a line-based version control system such as git, you must use the .xmap format.

1.14.4.3 Can Mapper read and write .ocd files?

Yes, Mapper reads .ocd files from different versions (8 .. 12, 2018). Currently only version 8 .. 12 .ocd files can be written. Beware that some details are neither loaded from nor saved to .ocd files, and some additional inaccuracies might occur.

1.14.5 Mobile devices

1.14.5.1 Will Mapper be available for Android?

An Android version is available. It already has a special user interface, but it needs a lot of work. See the instructions for the Android app.

1.14.5.2 Will Mapper be available for iPhone / iPad?

Probably not, due to distribution issues. Technically, a build should be feasible.

1.14.5.3 How do I hide/protect a symbol in the mobile UI?

Tap-and-hold on the Symbol selector button. Context menu with hide and protect options will appear. Hidden and protected symbols are marked with usual signs in the symbol list.

1.14.6 Experienced mappers' corner

1.14.6.1 What are the most notable differences to OCAD?

- Whole objects can be moved by dragging the dashed magenta bounding box when ∗∗Edit objects∗∗ tool is selected.
- There is a single tool for drawing straight lines and Bézier curves.
- Another tool combines circle and ellipse drawing.

- Addition and removal of path points (vertices) can be achieved via ∗∗Edit objects∗∗ tool using various combinations of keyboard modifiers. See the status line at the bottom edge of the window for dynamically updated help. See also Drawing.
- Dash points can be added and removed using the ∗∗Edit objects∗∗ tool after pressing **Ctrl-Space** on keyboard.
- There are no explicit corner points. Move the Bézier curve handles independently while holding keyboard **Shift** key.
- Edge lines of double line symbols (roads et al) are inactive and cannot be snapped on. Mapper does not support cutting out parts of the side lines.
- Partial map export is done via a tool. See Advanced editing.

Chapter 2

Introduction to mapping for orienteering

Disclaimer: This is is mostly an empty place holder, not a complete introduction to orienteering mapping. Contributions welcome.

2.1 Topics to be covered

- **Suitability of orienteering terrains, permissions, scale:** Things to consider before starting a new map.
- **Acquiring map templates (aka base maps):** Good templates save you lots of time, so it is often worth looking for the best templates available.
- **Loading and matching templates:** After getting the templates, the map file is created where they need to be put into a common coordinate system.
- **Orienteering symbol sets:** Before starting to map, you should become (more) familiar with the orienteering symbol sets.
- **Surveying (classic method):** Surveying the terrain by printing out templates, drawing in map details, scanning your drawings and doing the final drawing at home.
- **Surveying (digital method):** Surveying the terrain with help of mobile computers.
- **Drawing:** Doing the final drawing with OpenOrienteering Mapper.
- **Generalization:** The importance of generalization.

2.2 Surveying (classic method)

2.2.1 Prerequisites

It is very beneficial to get experience running orienteering before starting with orienteering mapping. This way, most symbols on orienteering maps and what to use them for will be known to you already and you have a feeling for the level of generalization which is expected in orienteering maps.
Depending on the method you want to use for surveying terrain, you will need material such as a compass, printer, scanner, a clipboard, suited pens, or a mobile computer such as a tablet running Windows or Linux.

2.2.2 Fieldwork

Accurate mapping depends on high quality fieldwork. Ordinarily, fieldwork will usually produce a paper sketch with all the detail required to produce the map but often marked up with shorthand codes which are meaningful to the mapper but which will not appear on the finished map. Instead of paper the mapper may use Mylar or other robust drafting film. Working on transparent film also permits the use of an underlay which may have a coordinate grid or an old map visible underneath (at an appropriate scale).
The fieldwork will usually be done at a larger scale than the final map. With convenient rescaling of computer graphic images it is now possible for fieldwork to be undertaken at any convenient scale such as 1:5000 or even larger. This demands less skill in field penmanship than the traditional fieldwork scale of 1:7500.

The fieldwork is scanned - about 200dpi is usually quite sufficient resolution - now save the image as a .png file in your map file directory (.jpg image files also work). This file is then loaded as a template underneath the new map screen and the features are inserted on the map on top of the fieldwork image. The fieldwork must be scaled and positioned appropriately for this purpose.

2.3 Symbols

Symbols for orienteering maps are prescribed in the IOF documents ISOM (International Specification for Orienteering Maps), ISSprOM (Sprint maps), ISMTBOM (MTBO maps), and ISSkiOM (Ski orienteering maps).
It is very desirable that all orienteering maps should conform to the appropriate standard, and that includes conforming to the standard symbols for the discipline.
A full set of symbols for each standard will be made available with OpenOrienteering Mapper, and ideally all maps will be prepared using only the unmodified symbols described in the standards and provided in these symbol sets. This enables international competitors to receive a locally produced map and find it portrays the terrain in exactly the same way as in their home country. It also enables local orienteers to become familiar with the mapping conventions that are used for major events elsewhere. The use of local symbol variations defeats the purpose of mapping standards and confuses visiting competitors.

2.3.1 Symbols Window

This area on the right hand side of the OpenOrienteering Mapper screen shows all the available symbols in the loaded standard set. Use the scroll-bar to move the array up and down to reveal symbols not showing.
Each symbol has a text (a part of the standard) describing where and how it may be used. That text can be made visible in the symbol window by pressing F1 while hovering over the symbol of interest.

2.4 Colors

The standard colors of orienteering maps are defined in the terms of the Pantone Matching System (PMS) and are intended to describe the exact color of inks to be used in offset printing processes for the production of orienteering maps.
With the advent of inexpensive ink-jet printers and high quality printing papers it has become possible to print water resistant orienteering maps at very modest cost and with excellent control of the process and the colors used. In this context there has also been considerable discussion about appropriate colors to better enable color blind competitors to discriminate map features and it is possible that some changes may be adopted as a result.

2.4.1 Color Window

This tool defines colors in terms of the CMYK system or the RGB system. Default colors for orienteering maps are entered but the colors that are actually printed by a particular printer on a particular paper type can produce a result which is quite different from the PMS color intended.
The IOF Map Commission has prepared an offset printed paper test sheet (IOF Print Test Sheet - available from your national mapping officer) and as a map file *PrintTestSheet_2025_v1.omap* (available as download from the IOF). The offset printed paper sheet has the currently prescribed colors for the production of maps (Store in a heavy envelope, do not use copies which have been kept loose and may be faded). The colors for a particular printer and paper may be adjusted using the Color Window so that a better match with the offset printed test sheet is achieved. The colors yellow (open space on the terrain) and brown (contour lines) are commonly quite divergent from the standard.

2.4.2 Color adjustment

1. Scan the offset printed IOF Print Test Sheet in any scanner and use a color picker to get the CMYK values on screen for each color. By way of example this scan may yield CMYK values of 000, .800, .991, .569 respectively for 100% brown.

2. Load the file *PrintTestSheet_2025_v1.omap* into OpenOrienteering Mapper and print the page on your printer. Take this freshly printed page and scan that print on the same scanner and use the same color picker to get

the color values you have in the scan. An example of this scan for 100% brown may yield CMYK values of 000, .689, .942, .255 respectively.

3. The difference between those two sets of values will indicate the adjustments required. Using the example values the Color Window line for 100% brown should have no adjustment to the cyan field, +.111 to magenta, +.049 to yellow, and +.314 to black. Those adjustments must be made in the OpenOrienteering Mapper Color Window. Having made similar adjustments for all colors, then run the step 2 print trial again.

4. In a perfect world the differences will all reduce to zero. In practice they may not because of non-linearities in the hardware and colors like brown are poorly defined on the color palette. Several iterations may be required to get a good match.

The same general approach may be employed but using the RGB color space instead.
When a contour is printed in an area of green on the map the brown of the contour loses contrast and the contour line becomes harder to see. If the map is offset printed the green is laid down without a gap and the brown is printed over it while the green ink is still wet, with the result that the green and brown blend together where they are coincident. This creates a segment of line which is somewhat darker than the 100% brown line outside the green and the darker color is noted to be easier to see. This very desirable result is called an over-printing effect.
The Print Test Sheet is designed to demonstrate beneficial over-printing effects where these are achieved. Consider the visibility of the wavy contour lines (and blue creek lines) printed against a variety of backgrounds on the lower left of the sheet.

2.5 Map scales

Map scales are set in accordance with the International Specification for Orienteering Maps (ISOM). The traditional competition format is at 1:15000. More recently maps may be printed at 1:10000 for shorter courses. Maps at 1:10000 are visually identical to those at 1:15000. The ISOM emphatically requires that a larger scale 1:10000 shall not be used in order to fit more detail onto the map but simply permits the map to be more easily read by older or younger competitors who will generally have shorter courses and do not require large maps. Sprint maps according to the ISSprOM specification may be at either 1:4000 or 1:3000 and use a different symbol set appropriate to that scale.
Printing of a map prepared at 1:15000 may be at either scale (and conversely a map prepared at 1:10000 can be printed at 1:15000) with no loss of accuracy or information. Most course planning software provides for this re-scaling at the point of printing.
The ISOM details the size, shape and use of all the permitted symbols and codes on the map, and these are the only acceptable symbols and sizes on a map to be printed at a scale of 1:15000. If it is desired to prepare the original map at a scale of 1:10000 (or some other scale) a new symbol set appropriate to that scale would need to be created with proportionately larger symbols. There seems little point in this. Do not confuse this with the scale of fieldwork which is sensibly at a larger scale than the finished map. Fieldwork is rescaled to the scale of the map when it is loaded as a template.
Using a larger scale with symbol sizes appropriate to a smaller scale provides more white space and enables more detail to be included but this is at the expense of readability, and the additional detail is almost always unnecessary and thus unhelpful.

Index

Adjusting template positions, 22

Color Window, 33
Colors and Symbols, 32
CoVe, the Contour Vectorizer, 23
CRT Files, 56

Device Requirements and Recommendations, 7

Edit Menu, 42

File Menu, 41
Find objects, 18
Frequently Asked Questions (FAQ), 57

Georeferencing, 13
Geospatial data support with GDAL, 27

Installation, 2
Introduction to mapping for orienteering, 61
Introduction to Templates, 20
Introduction to the User Interface, 3

Map Grid, 16
Map Menu, 45
Map Parts, 17
Menus, 41

Object tags, 17
Objects, 17

Preparing a Map on the PC, 7

Reference, 41

Settings, 55
Starting a New Map, 12
Storing Maps and Templates on Android Devices, 8
Symbol Pane, 35
Symbol Replacement Dialog, 38
Symbols Menu, 46

Templates and Data, 20
Templates Menu, 47
The Mapper App for Android, 7
The Touch Mode User Interface, 4, 9
Toolbars, 47
Tools Menu, 45

User Manual, 1
Using the Course Design Symbol Set, 39

View Menu, 44