Map reading

Understanding and using national maps

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Understanding and using maps

The Swiss national maps are among the world's best and most precise. But how are they created – and how do you read them correctly? Map reading is a valuable skill that supports outdoor enthusiasts and nature explorers in planning and navigation.

This guide provides you with everything you need to know about the national maps: Learn about the methods and tools needed to create the maps. Learn how to use maps effectively, determine your exact location, and navigate confidently. With some practice, map reading becomes an easy and indispensable skill for every expedition.

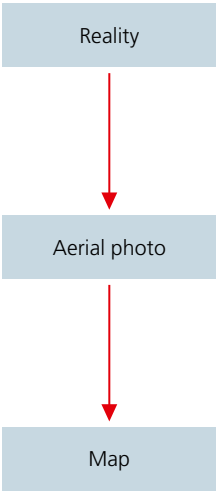
Contents

Understanding maps

Using maps

Mapping the reality

Based on aerial photographs, reality can be transfered into a map. This creates a simplified and precise representation of the earth's surface.



Reality
The environment we live in is characterised by complex structures. Humans have always needed to simplify and represent reality. Humans are used to seeing the terrain from a more or less horizontal viewpoint. The challenge lies in imagining what is seen from an aerial perspective.

Aerial photos
Aerial photos are vertical aerial photographs of the Earth's surface and serve as an essential source for updating national maps. There are no additional contentssuch as boundary lines or annotations. They must still be collected.

Maps
Maps are scaled down and simplified representations of a section of the Earth's surface. In a simple and legible form, they provide as much information as possible on settlements, paths, bodies of water, terrain, vegetation as well as individual objects. The degree of detail mainly depends on the scale – the reduction ratio. The sensible reduction of the map content is called cartographic generalisation.

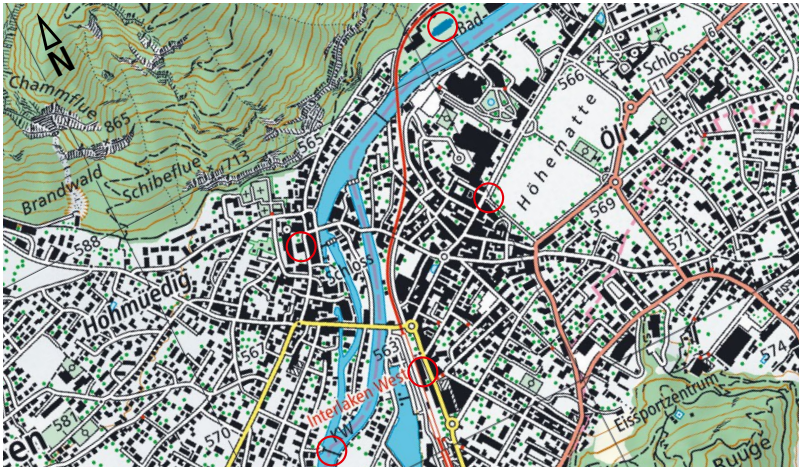
Landscape memory of Switzerland
Maps must be updated frequently as reality continually changes in terms of construction or landscape. By preserving earlier maps, a landscape memory of Switzerland is created.

www.swisstopo.ch/timetravel

Reality

Aerial photo

Map

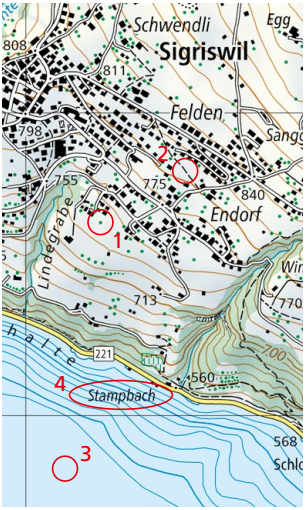


Map symbols

Symbols are graphic characters used in maps to provide information.

Symbols can be compared to the letters of a language. They have to be quickly recognisable to allow us to deduce the landscape's appearance from the map or to orient ourselves swiftly in the field.

Map symbols can be divided into the following groups:



Point symbols [1]
Representation of local objects.
e.g. trees, towers, spot heights, fountains

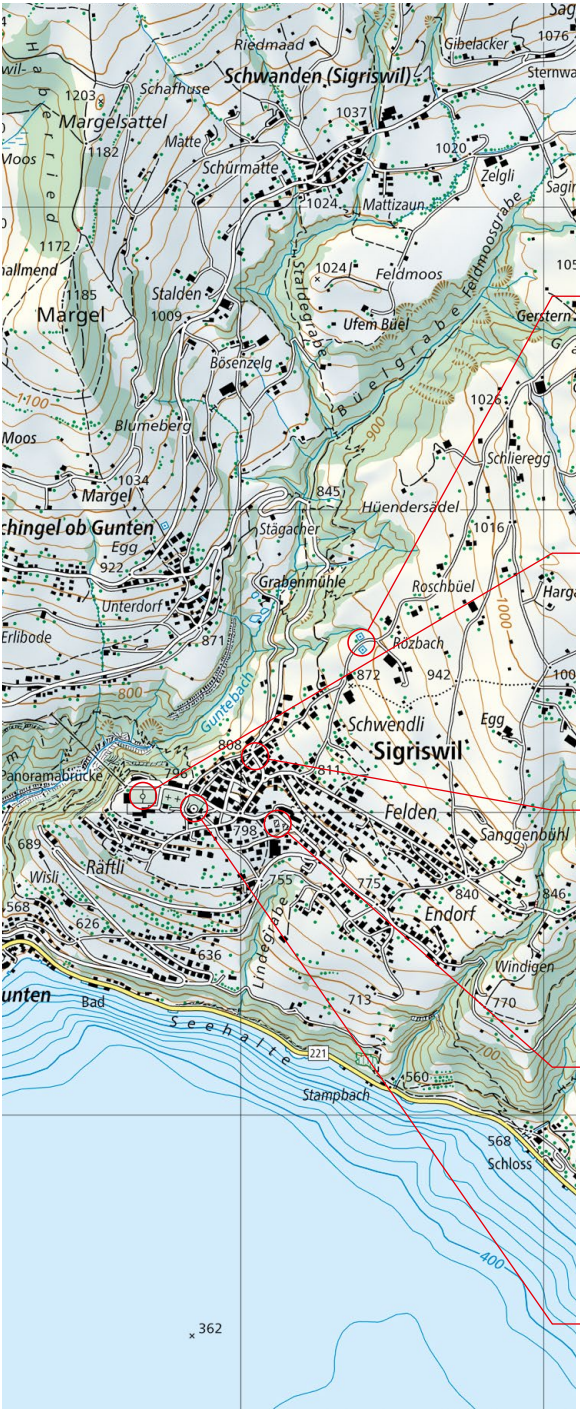
Line symbols [2]
Representation of objects shown by a linear route.
e.g. rivers, streams, roads, tracks, boundaries

Area symbols [3]
Representation of surface areas.
e.g. forests, lakes, orchards, waste disposal sites

Annotations [4]
Additional elements that indicate and explain map contents more precisely.
e.g. place names, field names, mountain names

Conventional signs
Follow this link for an overview of Swiss national map symbols.

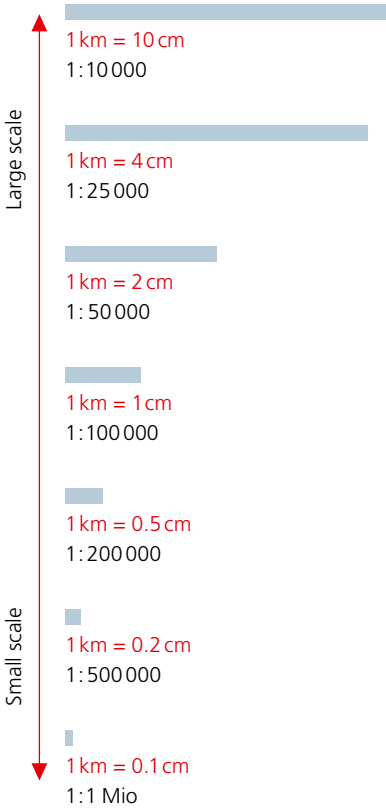
www.swisstopo.ch/mapreading



Cartography aims to represent symbols as realistically as possible, both graphically and in terms of colour.

Map scale

Map scales show the relationship between distances on a map and corresponding distances in reality.



The map's scale is expressed as 1: scale figure, e.g. 1:25,000. This meansthat 1 cm on the map corresponds to 25,000 cm (250 m) in reality.

Conversion:

1:25,000 4 cm = 1 km
Map distance in cm divided by 4 = actual distance in km

1:50,000 2 cm = 1 km
Map distance in cm divided by 2 = actual distance in km

1:100,000 1 cm = 1 km
Map distance in cm = actual distance in km

Large scale vs. small scale

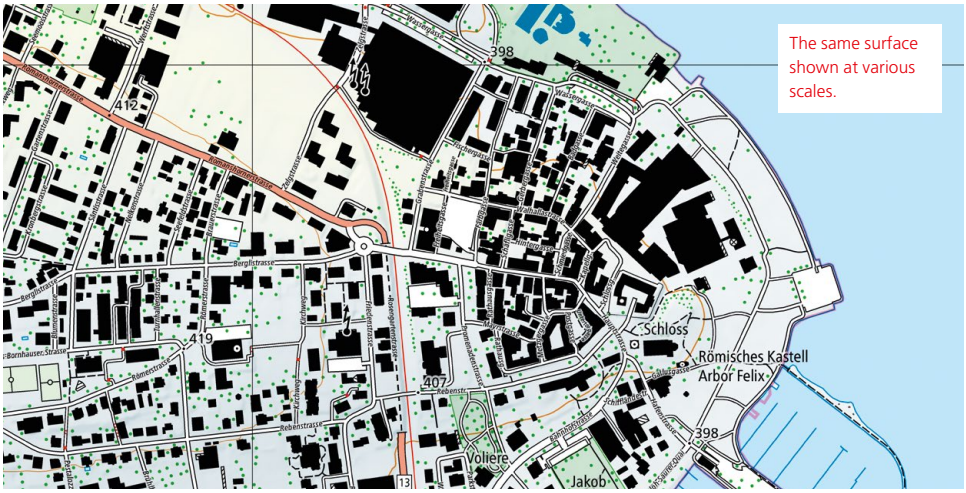
The level of detail on a map depends on its scale. Large-scale maps depict a small area with great detail, whereas small-scale maps cover larger areas with less detail. The smaller the scale, the less space is available on the map, and consequently, the fewer details can be shown.

What scale for which use:

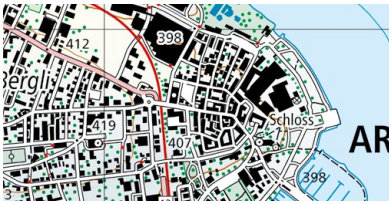
1:10,000	Local orientation
1:25,000	Hiking, mountain climbing, mountain biking
1:50,000	Hiking, cycling
1:100,000	Overview for cycling, motorised traffic
1:200,000 to 1:1 m	Motorised traffic, overview

Generalisation

Cartographic generalisation simplifies maps both graphically and in terms of content.



1:10 000



1:25 000

1:50 000

1:100 000

The smaller the scale, the less space is available on the map to depict relevant content. When producing maps, content is selected, simplified, summarised or emphasised according to its importance. The aim is to optimise the map's legibility and usability, a process known as cartographic generalisation.

Example

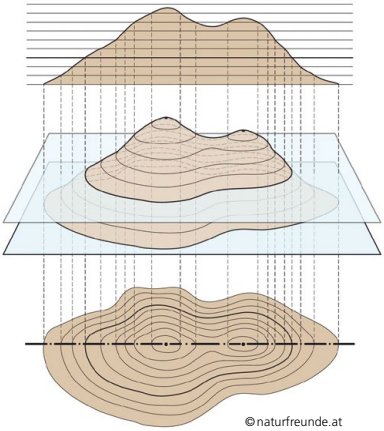
For the same surface area, there is one hundred times more space available at a scale of 1:100,000 than at 1:10,000.

Tip:

On the maps with scales of 1:10,000, 1:25,000 and 1:50,000, the distances between the coordinate grid always correspond to 1 km in reality.

Contour lines

Contour lines connect points of equal altitude. They enable the representation of terrain features such as hills and valleys.



Contour lines are lines on map that connect points at the same altitude. The vertical distance between two neighbouring contour lines is called equidistance.

The following equidistances apply to national maps:

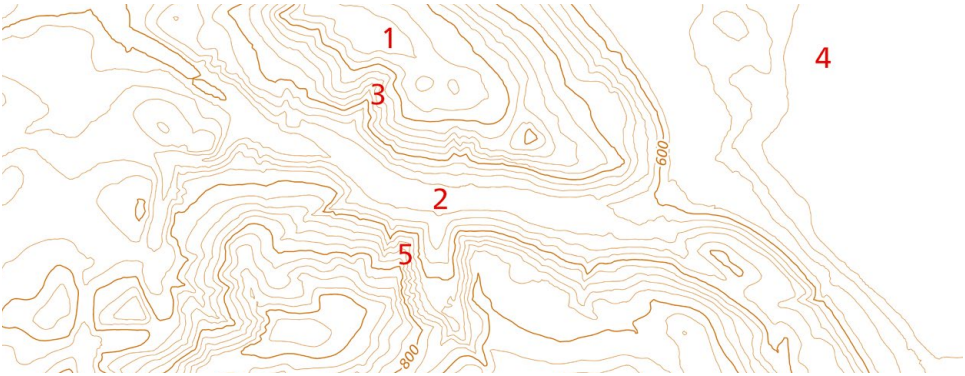
- 1:10,000 = 10 m
- 1:25,000 = Swiss Mittelland/Jura: 10 m/Alps: 20 m
- 1:50,000 = 20 m
- 1:100,000 = 50 m
- 1:200,000 = 100 m

Contour lines provide valuable information about the terrain. Their pattern and spacing can reveal various topographical features such as ridges [1], valleys [2] or troughs [3].

The following principles apply when interpreting the spacing of contour lines:

Widely spaced contour lines indicate gentler slopes or flatter terrain. [4]

Closely spaced contour lines represent steeper terrain or more abrupt changes in elevation. [5]



Relief and rocks

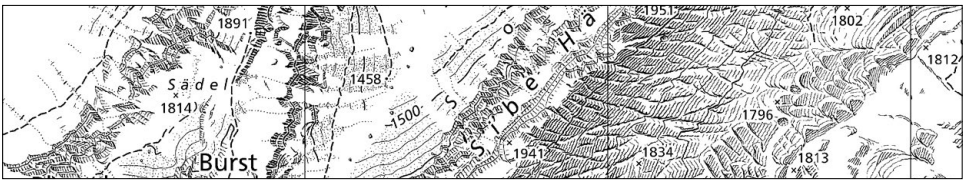
Shaded relief and rock representation, combined with contour lines, aid in depicting and interpreting terrain effectively.

A three-dimensional effect is created by emphasising shade tones. Shaded relief, a three-dimensional shadow effect, enhances both the realism and legibility of terrain on maps.
Rock depiction, essential when combined with contour lines, aids users in interpreting mountainous areas.

Relief

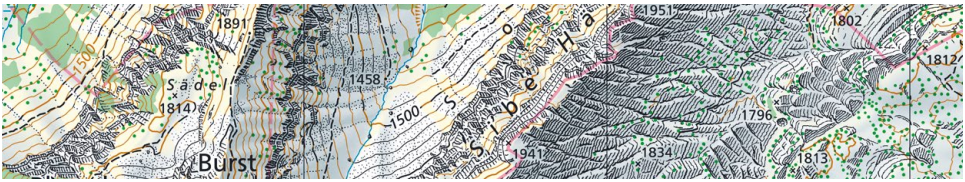
The relief lighting is assumed to originate from the upper left (northwest). Although this does not correspond to natural sunlight, it aligns with the brain's familiar perception habit, as the brain is used to light coming from above. The shading effect is enhanced by using a light yellow.

Rock representation



National maps depict rock zones with clarity and remarkable detail.

National map with relief and rock representation



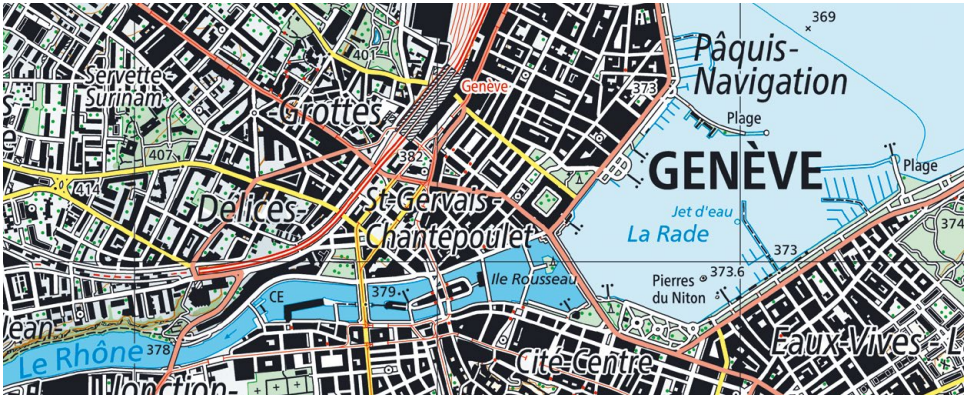
The map looks three-dimensional thanks to the relief and rock representation.

Annotation system

The lettering on maps enables quick and easy identification of places and objects.

Certain typefaces and font sizes are chosen according to the type and importance of the labelled object. For instance, places places sharing the name of the political municipality are written in upright font, while allother place names, city districts, and neighbourhoods are written in italics. The size of the place names corresponds to the number of inhabitants.

Swiss national maps use the concise, sans-serif Frutiger typeface to enhance the legibility of lettering, which is sometimes very small due to limited space.

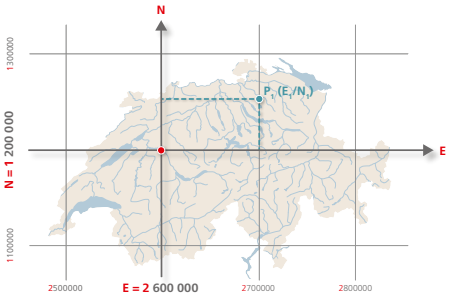


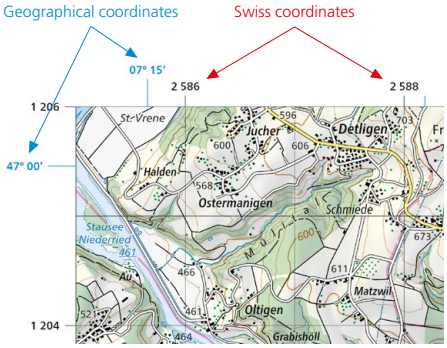
Examples of lettering

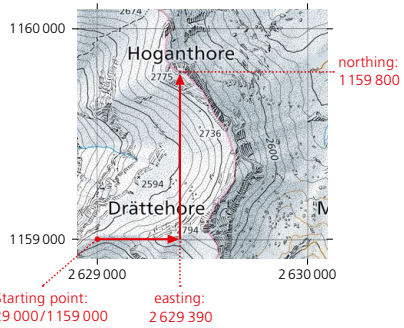
Municipalities Places Districts	**BASEL** **LUGANO** ***Oerlikon*** *Bethlehem*
Mountains	Piz Bernina Wildhorn Mont Tendre Belchenflue Cima Pescia
Passes	*Passo del San Gottardo* *Col de la Croix* *Hohtürli* *Oberlugge*
Area and topo-graphical names	*Kiental* *Pfywald* *Allmend* *Grundwald* *Chlistalde*
Lakes and rivers	*Thunersee* *Lac de Joux* *Greifensee* *Lago Ritóm* *Lej dals Chöds*

Coordinates in Switzerland

Coordinates enable the precise location of any point in Switzerland.







The Hoganthore has the coordinates: 2 629 390/1 159 800

Swiss national coordinates

Berne serves as the origin point for the Swiss coordinate system, with coordinates 2,600,000/1,200,000.
The first number indicates the location in a west-east direction, while the second indicates the location in a south-north direction. The 2 and 1 million digits were added with the new Swiss national survey (national survey of 1995).
The numbers represent metres and can thus be used for measurement purposes.

Coordinate indications on the Swiss national map

Swiss national coordinates are displayed on national maps as an orthogonal coordinate grid. For 1:25,000 and 1:50,000 scales, this appears as a 1 km grid represented as 4 cm and 2 cm grid lines, respectively.
Geographical coordinates are shownin blue along the maps edges. Longitudes and latitudes are indicated in degrees and minutes.

Determining a coordinate

Begin at the bottom-left intersection of two coordinate lines. From this point, measure or estimate the distance in metres eastward and northward.

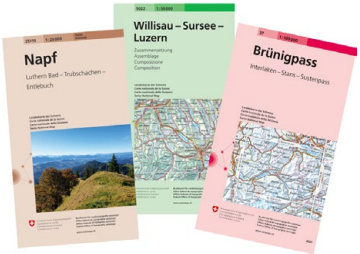
Tip: To prevent misunderstandings or mistakes, especially in emergencies, coordinates should always be supplemented with additional location details. These may include the name of the canton or municipality, altitude, valley, or nearby summit.

Printed maps

Regardless of battery life and internet availability, printed maps provide a quick overview of large areas. They are usefull for planning, allow easy note-taking or markings, and serve as an important backup whilst travelling.

mySwissMap
The famous maps of Switzerland can be customised! Using mySwissMap, you can design your personalised paper map featuring your desired section of Switzerland in just a few clicks.

www.swisstopo.ch/myswissmap



National Maps
The world-famous topographic maps by swisstopo are the basis for a wide range of activities and requirements. The national maps on paper reveal even the remotest corners of Switzerland in various scales.

www.swisstopo.ch/nationalmaps

Leisure and thematic Maps
Switzerland is the ultimate leisure destination. swisstopo publishes paper maps for hiking and winter sports for your outdoor activities and most memorable experiences.

www.swisstopo.ch/shop

Digital maps

With digital maps, you enjoy the most up-to-date maps and receive additional real-time information on selected POIs.

Map viewer and app
Maps and geodata can be easily explored on map.geo.admin.ch. The map viewer allows users to view and print geodata.

The swisstopo app brings the national maps and numerous topics for leisure and work to your smartphone or tablet.

www.swisstopo.ch/app

Web maps
Web maps are dynamic maps optimised for mobile use based on vector tiles technology. The Base Map additionally displays points of interest (POIs) on various topics as integrated elements.

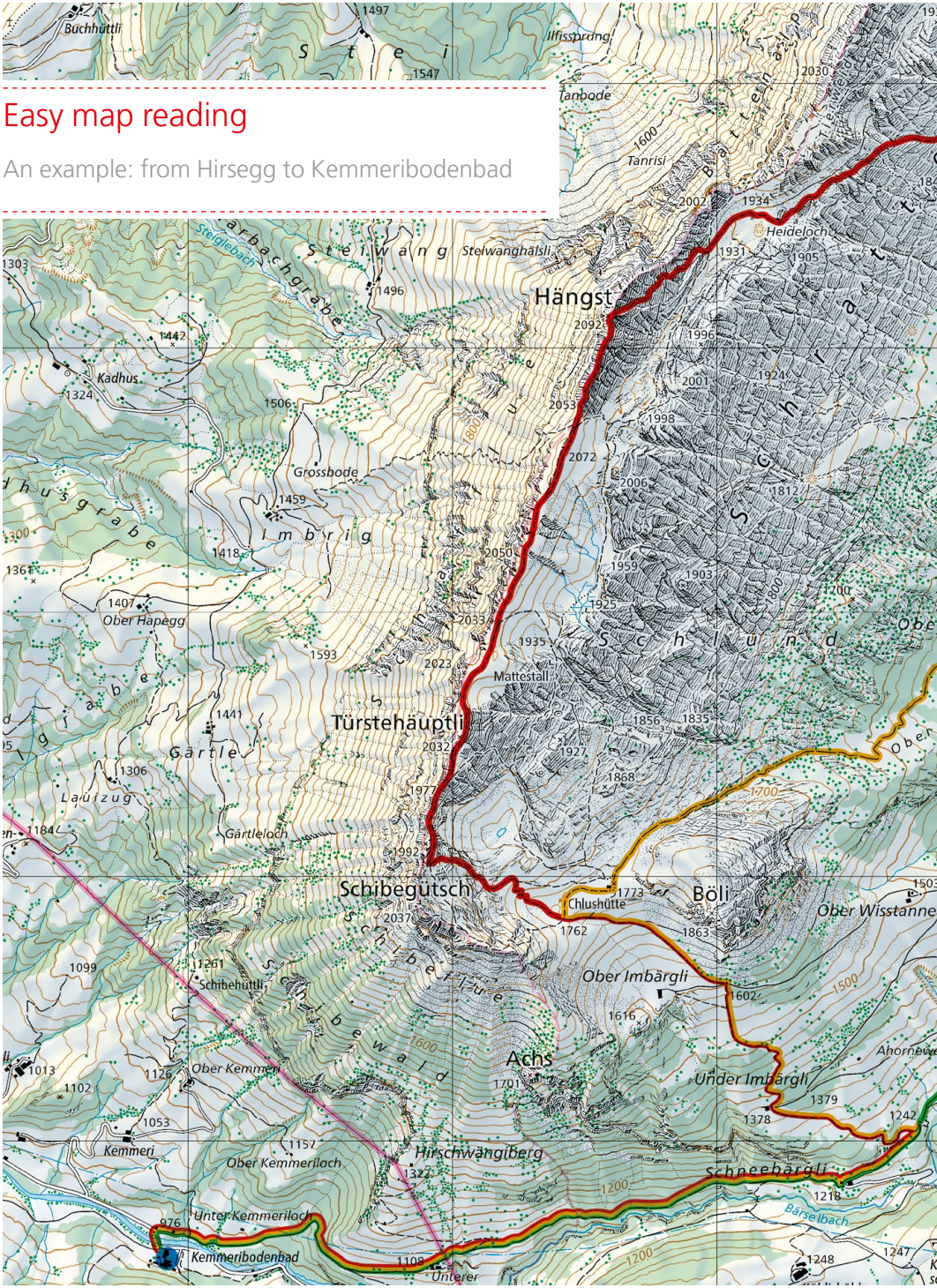
www.swisstopo.ch/smw

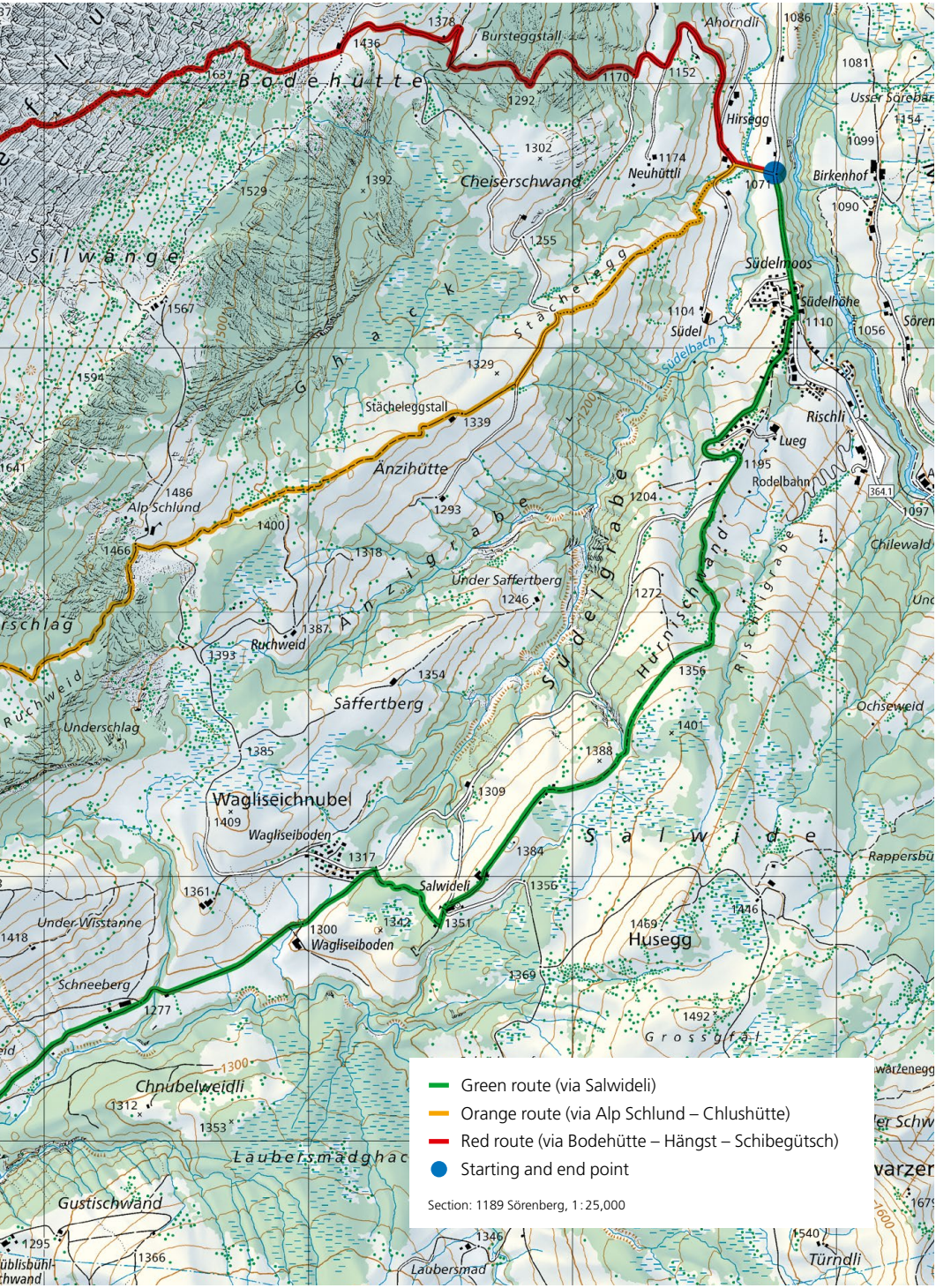
Digital maps
Maps, aerial photographs, landscape and elevation models, amongst other ressources, are available in digital format. Standard digital products are free of charge and can be used without restriction.

www.swisstopo.ch/geodata

Easy map reading

An example: from Hirsegg to Kemmeribodenbad




Bodehütte
Ahorndli
Bursteggstall
Hirsegg
Usser Sörebar
Birkenhof
Neuhüttli
Cheiserschwand
Silwänge
Südelmoos
Südelhöhe
Südel
Südelbach
Stächeleggbach
Stächeleggstall
Rischli
Lueg
Rodelbahn
Änzihütte
Alp Schlund
Änzigrabe
Under Saffertberg
Südelgrabe
Hürnischwand
Rischgrabe
Chilewald
Ochseweid
Ruchweid
Underschlag
Säffertberg
Wagliseichnubel
Wagliseiboden
Salwide
Salwideli
Under Wisstanne
Schneeberg
Husegg
Grossbüel
Chnubelweidli
Laubersmadghac
Gustischwand
Laubersmad
Türndli
Green route (via Salwideli)
Orange route (via Alp Schlund – Chlushütte)
Red route (via Bodehütte – Hängst – Schibegütsch)
Starting and end point
Section: 1189 Sörenberg, 1:25,000

Preparation using maps

Maps enable the interpration of various route selection factors.

The right map
Selecting the appropriate map with the correct section and scale is crucial for your intended route. Planning withup-to-date maps avoidsunexpected surprises along the way.
When using digital maps for hiking, it's advisable to download the required section onto your smartphone in advance. This ensures the map is accessible even when you're offline.

Physical requirements
Maps provide essential information such as distances, differences in altitudes, ascents and descents as well as path types. This data helps determine the approximate hiking time and difficulty of a route, allowing you to create a realistic timetable. Understanding these details is crucial for assessing whether you're up to the challenge and physically prepared for the hike.

Itinerary
Use the map to identify the type and surface of the paths. Be aware that pathless sections may present increasedorientation challenges. Allow extra time in your calculations for crossing obstacles or navigating exposed paths.

Finding significant waypoints
It is recommended to determine significant waypoints during your planning. This will improve your orientation and divide the route into manageable stages.

Other important factors to consider when planning:

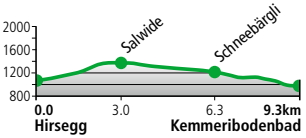
Season and weather:
Check the weather forecast for potential rain, thunderstorms, fog, or snow. Consider the ground condition: is it dry, wet, or covered in leaves? Are there snow conditions at higher altitudes?

Bags and equipment:
Check your load: is it manageable? Ensure you have enough food and water.
Wear suitable clothing and sturdy footwear for the terrain.

Route analysis and selection

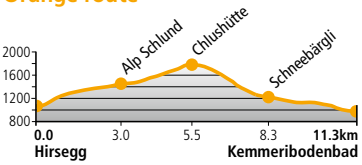
Careful and thoughtful planning is a safety factor.

Green route



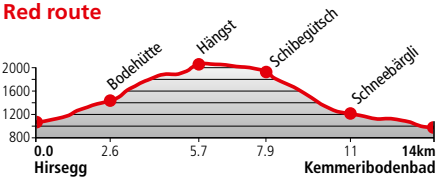
Open route in the swisstopo app

Orange route



Open route in the swisstopo app

Red route



Open route in the swisstopo app

Tip: Mark the planned route on the map and decide on possible alternatives for difficult sections.

Distance

The distance can be determined using a map app on a PC, tablet or smartphone, or with a distance calculator, or estimating from a physical map.

Green route:	9.5 km
Orange route:	11.4 km
Red route:	14.6 km

Elevation

Ascents and descents are calculated by counting the contour lines on a map or using an online tool to create an elevation profile.

Green route:	347 m	458 m
Orange route:	761 m	856 m
Red route:	1,138 m	1,233 m

Route analysis

Green route: good paths and roads, no steep ascents or descents, no exposed sections, simple orientation requirements.

Orange route: sections on trails, paths and roads, medium-steep climbs, possibly exposed area near in Chlushütte, simple to medium orientation requirements.

Red route: sections on trails, paths, roads and some pathless areas. Very steep ascents and descents, gullies require sure-footedness, exposed sections on the Hängst ridge to Schibegütsch, high orientation requirements including pathless sections.

Route selection

Following the route analysis, select the appropriate route considering all influencing factors.

Calculating walking times for hikes

Accurate walking time estimation is crucial planning hiking trips.

The calculation of walking time is applied in situations where no time indications are available.

Many route-planning apps offer automatic calculations.

This rule of thumb helps estimate walking times for small groups:

	Approximate value:
One kilometre on level path	15 min
Per 100 m ascent	+ 15 min
Per 200 m medium-steep descent	+ 15 min
Gentle descent	10 % deducted from time

Example

The red route from Hirsegg to Kemmeribodenbad provides the following basic timings:

Distance: 14 km	14 x 15 min	= 210 min
Ascent: 1000 m	10 x 15 min	= 150 min
Descent: 300 m (steep)	1.5 x 15 min	= 22.5 min
Gentle descent: 5 km	–0.1 x (5 x 15 min)	= –7.5 min

Estimated walking time (incl. short breaks): = 375 min
= 6 hours 15 min

Other factors affecting pace

Quicker than usual:
Alone, unencumbered, cool weather, good paths, gentle descent, morning start, well-rested

Slower than usual:
In groups, heavy load, hot weather, difficult terrain, afternoon start, as the day progresses, snowy conditions

Important: Calculate breaks separately and plan stopping places in advance using the map.

Navigation in the field

Using a map and compass, align the map and determine your precise location in the landscape – keep your bearings.

Orienting the map using a compass or automatically on a smartphone.

In order to orientate a map towards the north and to determine where you are in the field, navigation devices or smartphones with map apps now provide good service. The devices are located by satellite, allowing your position to be determined. It is also important for hikers to be able to determine where they are without any technical devices.

All topographical maps are orientated north, i.e. the upper edge of the map is north. In order to orientate yourself with a map in the field, you first need to determine which way is north.

Orienting the map

The simplest way is to orient the map towards the north with a compass. However, the map can also be oriented by means of easily recognisable lines in the field such as roads, water-courses or forest edges.

Determining your location

Orient the map northwards, identify distinctive nearby landmarks (such as a church tower, bridge, or road intersection) and correlate them with the map. This will help you pinpoint your current position.

Tip: Paper maps can also be aligned using a smartphone. Use the compass function and position the smartphone along the coordinate grid on the paper map. Turn them until they point north.

The compass as your directional guide

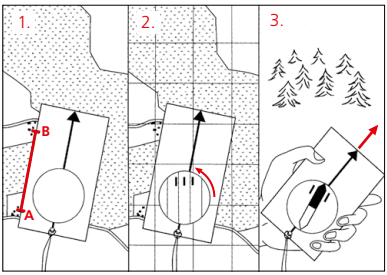
North up and precise navigation – use the compass to determine the direction.

Northing with a compass

1. Compass needle pointing north.

2. Compass needle and map pointing north.

Transferring the direction



Three steps to transferring a direction from a map to the field.

Compasses

The natural orientation of a compass' magnetic needle towards the north aids in orientation in the field. This advantage is especially useful in fog or difficult terrain (e.g. forest).

A compass' main task is to show the north and to transfer a direction from the map into the field.

Northing

The north can be surely and simply determined using a compass.

1. Lay the compass along the coordinate grid.
2. Turn both until the magnetic needle points to the north marking.

Transferring the direction

Transferring a direction from the map into the field is done using the 3-point rule:

1. Lay the longitudinal edge of the compass on the map on the line linking location A with goal B.
2. Turn the bezel until the bezel's south-north line is parallel to the one on the map (north mark uppermost).
3. Turn the compass until the northern half of the magnetic needle is on the north marking of the bezel. The compass' longitudinal edge now shows the desired walking direction.

Please note:

- The magnetic needle can be severely disturbed in the vicinity of metallic objects, vehicles and high-tension power lines.
- Do not expect great precision from transferring directions and thus divide the route into short stretches.

Orientation on the go

Maintaining overview while on the move – the thumb grip helps with orientation.

With a thumb grip, you always know where you are on the map.

An up-to-date map is useful for orientation purposes. En route, the terrain should be regularly compared with the map to ensure that you are on the right route.

Thumb grip

The best thing to do is to fold the map into handy sections. The map should always be oriented towards the north so that the map image is comparable to the landscape. Keeping your thumbs on your location greatly helps in map reading.

Orientation errors

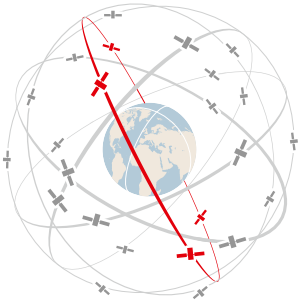
An orientation error is often the reason why the map information no longer corresponds to the terrain. It is easy to make a mistake when map reading, but you should first check if the map is up-to-date or if information is missing (new building, new path). Keep calm and proceed systematically if a map reading error has actually occurred.

Checklist in case of error

- Look for any distinctive locations on the map
- Think back on the route covered since the last certain position; can you find any features on the map? If not:
- Go back to the last certain position. If this is not possible:
- Look for a spot with a good view of the surroundings and get an overview (hills, crossroads, forest edges)

GNSS – Global Navigation Satellite System

Navigating without orientation features thanks to satellite technology



Satellite orbits around the Earth

Note: The availability and accuracy of satellite systems can be limited due to signal masking (e.g. in narrow valleys, forests, densely built-up areas) or multipath propagation (e.g. reflections from buildings).

The systems

Global Navigation Satellite System or GNSS is the general term for all existing and emerging satellite navigation systems.

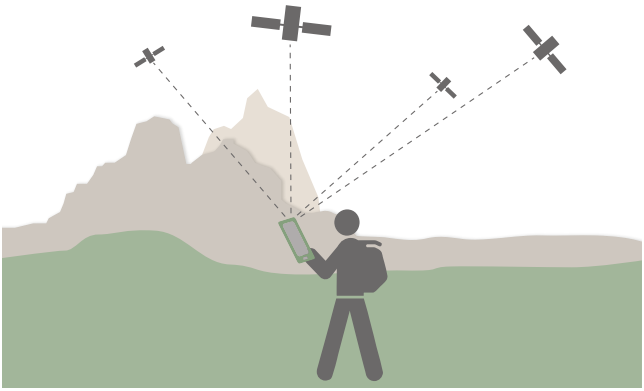
Some examples are:

- GPS (Global Positioning System) from the USA
- GLONASS (Global Navigation Satellite System) from Russia
- Galileo from the European Union
- Beidou from the People's Republic of China

All these systems are based on a constellation of 24–30 satellites that orbit the Earth twice a day at an altitude of approximatively 20,000 km.

To determine a position you need at least four satellites

Global navigation satellite systems permit worldwide, 24/7, three-dimensional positioning as long as signals are received from at least 4 satellites. For this, you need a satellite receiver, such as those integrated in all smartphones today, or available on the market as various types of standalone devices. The precision of the position coordinates is about 5 to 10 metres. Altitudes are generally estimated to be two to three times less precise.



Satellite-aided navigation

Thanks to satellite technology, navigation devices and smartphones provide valuable services in field orientation.

Smartphones offer good orientation capabilities thanks to integrated satellite receivers and map apps.

Position
The devices primarily deliver coordinates and altitudes at the current position and can represent them on a digital map.

Navigation
A route can be followed by means of waypoints entered beforehand. The device constantly shows the distance and the direction to the next point.

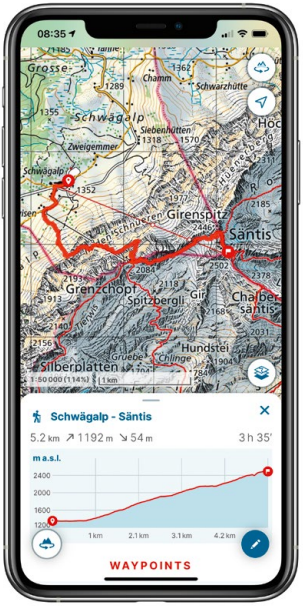
Tracking
En route, positions are continuously determined and stored. After the hiking trip, the route can be evaluated on the device or a computer.

Tips
- Coordinate settings
  Set the device to the Swiss coordinate grid (Swiss Grid/CH-1903+).
- Precision
  To increase precision, change your location, stretch out your arm or measure again later.
- Batteries
  Only turn on the device briefly, take extra batteries or a power bank with you.

Warning: Navigation devices do not recognise hazards such as crevasses or slopes exposed to avalanches. Satellite-assisted navigation offers many possibilities and tools, but does not replace map-reading or mountain skills. Having a map in your rucksack as a fallback solution is never a mistake.

Maps on smartphones

Smartphones offer many functions – for navigation purposes, too.



Smartphones with map apps are a cheap and versatile alternative to navigation devices for orientation purposes. Smartphones combine many practical functions.
The planned route is simply entered and directs the hiker to their goal.
The integrated satellite receiver allows positions to be determined at almost any time, even without a mobile network.

Important facts:

- Most smartphones are not intended for outdoor use and are neither weatherproof nor sturdy.
- Satellite-aided navigation, displaying maps and a frequently activated backlight use a lot of energy.
- In remote areas, there is no mobile reception to download maps.
- Many smartphone displays are hard to read in sunlight.

→ Download map sections and routes in advance and navigate with offline maps.
→ Take along extra batteries or a power bank and deactivate unnecessary functions.
→ Take along paper maps as a fallback solution.

The swisstopo app

The app brings the National Maps of Switzerland, together with many other topics such as hiking, cycling, snow sports and aviation, to your smartphone.

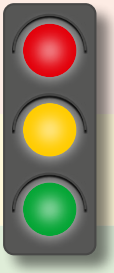
www.swisstopo.ch/app
Download now for free

Safety and emergencies

Minimising risks and reacting appropriately

People travelling with maps are often in mountainous or challenging terrains. This can be hazardous. Appropriate preparations and caution behaviour are important in avoiding accidents. In emergencies, keep calm, get an overview, think and act.

The traffic light diagram helps in reacting to an emergency.



Red = observe	Look at the situation • What has happened? • Who is involved? • Who is injured? • How many people are injured?
Yellow = assess	Recognise dangers • Danger for victims of an accident? • Danger for helpers? • Danger for other people?
Green = respond	Pay attention to safety Give first aid

Alert emergency services	112	International emergency number	• Who is calling? • What has happened? • When did it happen? • Where (precise indication of position with coordinates and place names)? • How many accident victims? • Other dangers?
	144	Ambulance	
	1414	Rega helicopter assistance	
If alerting the helicopter also report:			• Power lines • Ropes • Weather at the scene of the accident

Tip: In rough and inaccessible terrain it is advisable to raise the alarm directly to the Rega.

Rega's free mobile app also transmits the caller's current position when raising the alarm.

Signals for the emergency helicopter:

YES, help is needed
(do not wave arms)
Y as in yes

NO help is needed
(do not wave arms)
N as in no

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