Instruction Guide

All-in-One Map Tool *Pro*™

Introduction

The Map Tool Pro provides scales, slope indexes and Universal Transverse Mercator (UTM) rulers for the maps commonly used for backcountry travel throughout the US, Canada, Alaska, the UK and Europe. The Brooks-Range All-in-One Map Tool Pro™ is the only map tool you will need!

Conceived by a certified Alpine Guide to streamline his equipment needs, the Map Tool Pro provides ten scales and slope indexes; three Universal Transverse Mercator (UTM) rulers; a compass rose with the standard 360º notation on the outer ring and a 64º notation (traditionally used in maritime navigation) on the inner ring and a metric-to-English conversion table. **We hope you enjoy using your All-in-One Map Tool Pro™!**

Accuracy of Maps and the All-in-One Map Tool Pro™

At Brooks-Range, we understand that trip planning and navigation are dependent upon the accuracy of maps and the Map Tool Pro, as well as the skill of the traveler. In developing the Map Tool Pro, we used state-of-the-art computer drafting techniques under the guidance of a cartographer. We worked with the production team to maintain the accuracy designed into the Map Tool Pro. We beta-tested the Map Tool Pro in the field. Our goal is to provide the most accurate tool on the market – and to the best of our knowledge, we have succeeded!

However, even the most accurate tools have limitations. As a backcountry traveler, be informed about the limitations inherent in maps and map reading so you can make informed, sound judgments.

The U.S. Geological Survey (USGS) horizontal accuracy standard for most topographic maps is 1/50th inch – about the size of the period at the end of this sentence. The error, using a 1:24,000 scale, is +/- 40 feet on the ground; and using a 1:100,000 scale, is +/- 167 feet. (This USGS map standard applies only at well defined points such as stream intersections, crossroads or summits. Errors in maps for less well defined features could well be much larger.) In these days of GPS, these errors may seem large. Given average human eyesight, even the most careful Map Tool Pro user is unlikely to be able to distinguish readings closer than 1/50th inch.

For more information, see *http://rockwebcr.usgs.gov/nmpstds/qmapstds.html*

The UTM Coordinate System and the Map Tool™

Nearly all new topographical maps use UTM (Universal Transverse Mercator) grids. These grids are composed of perfect squares measured in meters. The grids repeat and overlap themselves over the surface of the earth and are labeled with a zone identifier which consists of a number/letter combination. On small scale maps (50,000 and less), the sides of a grid square measure 1000 meters, shown by a black grid overlay or blue ticks on the map's edge. 1:63,360 maps have UTM grids with 5000 meter intervals, and 1:100,000 and 1:250,000 maps use grids with 10,000 meter intervals.

UTM gridlines or ticks will be labeled to indicate their distance east or north of standardized reference points. These distances can be further broken down to more precise measurements by using the UTM Grid Overlay and Corner Rulers. UTM coordinates describe a measurement reading west to east (easting) followed by a south to north (northing) measurement and are not expressed with decimals. A general rule to remember is "Read RIGHT then UP." This refers to the standard order of recording the easting (east/west or horizontal) coordinate prior to the northing (north/south or vertical) coordinate.

As an example, a point 10 S 556821 mE 4322635 mN tells you that the grid is in Zone 10 S, the easting measurement (down to a meter) is 0556821 and the northing measurement (down to a meter) is 4322635. When using UTM coordinates in one geographic region the larger scale descriptions (zone and numbers above 10,000 meters) are often dropped leaving two sets of numbers with an equal number of digits. The above coordinate expressed to a one meter square would read 56821 22635. Expressed to a 10 meter square it would read 5682 2263. Merely dropping the last digits will express it to a 100 meter square, 568 226.

The UTM Grid Overlay located inside the compass rose provides a tool for quickly breaking down the grid of a standard 7.5 minute USGS quadrangle (1:24,000) to an 100 meter section.

1. Identify a point on the map and mark it.
2. Overlay the Map Tool Pro grid exactly over the UTM grid square that contains the point with the compass rose North pointing to the top of the map.
3. Read the location of the marked point through the square on the grid overlay, adding the easting number of that square to the easting coordinate on the map. Do the same for the northing coordinate.
4. A reasonable accuracy to 10 meters can be obtained by estimating the position of the marked point within the grid overlay square, reading right then up.

To use the UTM corner rulers to describe a position on a map in UTM coordinates:

1. Identify the scale of your map (1:24,000,1:25,000 etc.). Most maps indicate the scale in the margin. Choose the matching UTM corner reader on the Map Tool Pro and place it over the map so that the arms of the reader point left and up from the tools corner.
2. Identify the UTM gridlines that define a box containing the point you wish to describe. (You may need to draw connecting lines between common UTM ticks on either side of the map if there is no printed grid overlay). Lay the horizontal arm of the reader directly over the UTM grid line that runs east/west to the south of your point.
3. Establish your 'easting' coordinate first. Slide the corner reader along the east/west grid line until the vertical arm of the reader lies over the point you wish to describe. Your easting coordinate is read where the horizontal scale crosses the north/south UTM gridline to the immediate west. Your coordinate consists of the gridline (labeled at the edge of the map) with the addition of the finer detail of the numbers read from the reader's scale. Example: The intersection of the ruler and gridline 691 reads 2.7. Your easting coordinate is 69127 (no decimals).
4. Establish your 'northing' coordinate by reading the ruler at its intersection with the point you wish to describe. The coordinate consists of the gridline over which the horizontal arm lies with the addition of the detail read from the reader's vertical scale. Record the northing coordinate as you did the easting. The coordinate point is always read as an easting/northing coordinate.

Note: The 1:50,000/100,000 UTM Corner Reader has a shortened scale. If the point you wish to describe on the map cannot be read by the short end scale, you have two alternatives.

but off of the gridlines to the east and north of the point, then subtract the scale numbers from the gridlines instead of adding them.

the scale on the UTM Corner Reader. A map point located beyond the reach of the scale can be reached by lining the intersection of the end of the scale with the gridline (easting) or map point (northing) and marking a tic at the reader's corner (one full length of the scale). Then use the scale as you would above, shifting your read intersection point from the gridline or map point to the tic. The length of the scale must then be added to the coordinate number.

To use the UTM corner rulers to locate a UTM coordinate position on a map:

1. Identify the scale of your map (1:24,000,1:25,000 etc.). Most maps indicate the scale in the margin. Choose the matching UTM corner ruler on the Map Tool Pro.
2. Locate the intersection of the gridlines that correspond to the larger numbers of your easting and northing coordinates. (You may need to draw connecting lines between common UTM ticks on either side if the map has no printed grid overlay).
3. Place the UTM corner ruler on the map with the arms of the ruler pointing to the left and up. Lay the horizontal arm directly over the east/west gridline that corresponds to your easting coordinate. Slide the reader along this gridline until the horizontal arm crosses the north/south gridline that corresponds to your northing coordinate.
4. Adjust the placement of the reader until the scale on the horizontal arm crosses the north/south gridline at the point described by the remaining (smaller) numbers of your easting coordinate.
5. Mark the map at the point along the vertical scale that describes the remaining (smaller) numbers of your northing coordinate. This is the position of the UTM coordinates.

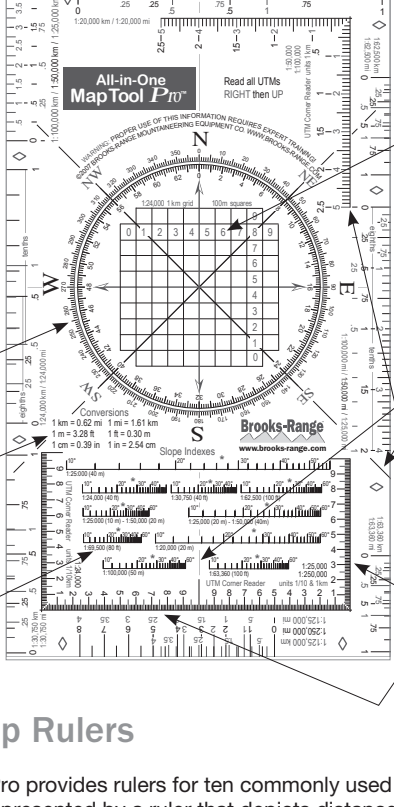
Note: The 1:50,000/100,000 UTM Corner Reader has a shortened scale. If you wish to locate a point on the map from coordinates that are beyond the reach of the short end scale, you have two alternatives:

the number labeling the map's gridlines that are nearest, but larger, than your coordinates (to the east and/or north of your point). Turn the map 180º and read the corner reader as you would above but measuring only to your subtracted easting and/or northing point.

the scale on the UTM Corner Reader. An easting coordinate that lies beyond the reach of the scale can be reached by marking a tic along the east/west gridline at one full scale's length, and completing the rest of the measurement from the tic mark. Similarly to extend your measurement north place a tic at the end of a full length of the vertical scale and slide the entire reader north to complete the measurement, being careful to keep the same easting reading on your horizontal scale. (You may have to draw a north/south reference line one scale length east of the gridline to ensure accuracy). Mark your point as above.

List of Components

Map rulers in mi. and km.:
1:20,000
1:24,000
1:25,000
1:30,750
1:50,000
1:62,500
1:63,360
1:100,000
1:125,000
1:250,000 mi



Using Map Rulers

The Map Tool Pro provides rulers for ten commonly used map scales. Each scale is represented by a ruler that depicts distances in miles and kilometers. Most of the rulers represent miles in black or gray tics along the ruler edge with kilometers described by red tics for easy reading. The exception is the combined 1:100,000/1:50,000/1:25,000 scale ruler which is represented in two rulers, one that describes miles and another that describes kilometers. In these rulers the color separation represents the different scales.

The Map Rulers provide a measurement of line of sight distance without taking into account changes in slope that could add actual distance to your trek. Many maps will round the contours of a trail, which can hide further travel distance on the ground.

To use a map ruler:

1. Identify your map scale (1:24,000 mi, 1:25,000 km, etc.). Most maps indicate the scale in the margin.
2. Locate the matching ruler on the Map Tool Pro.
3. Align the “0” at your starting point.
4. Keeping the “0” on your initial point, rotate the Map Tool Pro so that the selected ruler is aligned with your destination point and read the distance off of the scale.

- If the ruler is too short to measure the complete distance, draw a tick mark on the map at the end of the ruler, move the “0” onto the tick mark and measure again, adding the numbers for total distance. Repeat until the destination point is reached. You may need to draw a line on the map or use a second straight edge to keep the ruler properly aligned during successive measurements.
- To determine the distance along a route you may need to break the route into legs, measuring from point to point along relatively straight sections of the route and adding the distance of each leg to the total distance.

Using Slope Indexes

Slope indexes become critical in ski mountaineering to help ascertain the relative danger of avalanche on sloped terrain. Typically, avalanches occur on slopes that lie at gradients measuring between 27° and 47°. However, avalanches can and do occur on both shallower and steeper slopes. The slope indexes on your Map Tool Pro are marked with a red “*” at the low end of the avalanche caution zone of 27°. Steeper gradients located to the right of the “*” should be considered potential avalanche zones.

Note: Those who trek into the backcountry snow pack should be trained in avalanche assessment and recovery before attempting any trip.

To use the slope indexes:

1. Identify the scale (1:24,000 mi, 1:25,000 km, etc.) and contour interval (10 meters, 20 meters, 40 feet, etc.) of your map. Most maps list both in the margin.
2. Locate the slope index on the Map Tool that matches both parameters.
3. Place the index over the map contours of the slope in question and slide the index perpendicular to the contours until you reach a set of tick marks on the index that are equidistant to two contour lines plotted next to one another on the map.
4. Read the number indicated on the slope index for the approximate slope, in degrees.

Inclinometer

Add a string in the center of the Map Tool Pro and the compass rose can be used as an inclinometer to estimate the slope of a terrain in the backcountry.

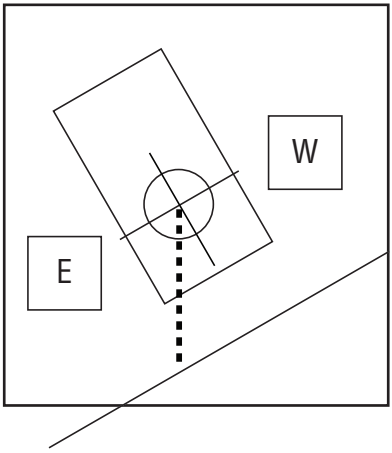
To adapt the Map Tool Pro to serve as an inclinometer:

1. Using a needle, pierce a small hole in the center of the compass rose, at the intersections of the red NS and EW lines.
2. Thread a string approximately eight inches in length through the hole. We recommend a colored string (no white) for ease of use in winter conditions.
3. Knot the string close to the hole on both sides of the Map Tool.

Hint: A weight on the end of the string may prove helpful in windy conditions.

To use the inclinometer:

1. Position the Map Tool Pro so that the north arrow of the compass rose is pointing to the ground perpendicular to the slope. Site along the red east/west arrows (from east to west) keeping this line parallel to the slope of the terrain.
2. Allow the string to dangle freely across the NE quadrant of the compass rose.
3. Read the outer ring of the compass at the point where the string crosses it. The measurement, between 0° and 90°, is the approximate slope of the terrain.



Compass Rose

Use the compass rose to identify the direction of one point from another or to plot a bearing from a point toward a set direction. The external dial is graduated in degrees, a standard for use on land. The internal dial is graduated in points, a standard for nautical navigation.

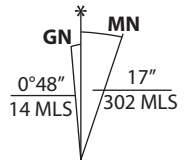
To use the compass rose to identify the direction that a point is situated from a set point of origin:

1. Using the straight edge of the tool, draw a line between the two points.
2. Position the center of the Map Tool Pro compass rose over the point you wish to measure from (i.e. your current position).
3. Rotate the Map Tool Pro to align the north arrow on the compass rose with the north arrow on your map. You may use the long edge of the Map Tool Pro as well as any of the vertical lines on the tool (all which trend north/south) in conjunction with the north/south trending gridlines on the map to aid in this.

Note: You may need to draw a north/south trending line from ticks along the maps margin.

4. Read the direction (in degrees or points) from the point where the drawn line intersects the compass ring.

Note: If you use meridians of longitude as a guide, this technique will give you a direction from true north (the direction toward the north pole). If you use the UTM north/south lines as a guide (which are up to 3 degrees different from true north) you will find the direction from what is known as grid north. You can adjust the direction to match your compass' north (magnetic north) by adding or subtracting the degrees of declination (angular difference between your map north and magnetic north). In North America, a rule of thumb is to add the number of degrees difference if the magnetic north arrow is to the left of true north and subtract if it is to the right. The maps declination is often printed on the map's margin, described by a simple arrow device (labels true north, MN labels magnetic north, GN labels grid north).



UTM grid and 1968 magnetic north declination at center of sheet

To use the compass rose to plot a bearing from a given point:

1. Locate the position on the map from which you will plot your bearing and mark it.
2. Flip the Map Tool Pro over and place the compass rose center point on one of the map's north/south trending gridlines located near this marked position, aligning the north on the compass rose with the north arrow on the map.

Note: You may need to draw a north/south trending line from ticks along the maps margin.

3. Keeping the center of the compass directly over the line, rotate the Map Tool Pro until the line to the map's north of the compass center intersects the compass ring at the given degree.
4. Slide the Map Tool Pro north or south along the maps gridline (keeping both the compass center and the degree tick aligned on the gridline) until the marked point lies along the edge of the Map Tool Pro.
5. Draw a line from the marked point along the Map Tool Pro's edge in the direction of the north arrow (the Map Tool Pro's top).

Note: When referencing a UTM grid, there will be a slight discrepancy between the north/south gridlines and the north/south meridians of longitude on certain portions of the map due to complications arising from the representation of a round globe on a flat map. This discrepancy increases as you move away from the equator and closer to the poles. The meridians of longitude represent true north but they taper inward to the north of the map. The UTM grid is square and easier to use with consistent right angles.

Disclaimer

Mountaineering, climbing, skiing, ski mountaineering, rescue work, backcountry travel and other outdoor activities are inherently and exceptionally dangerous and may result in severe injuries and death. Any individual using equipment from Brooks-Range Mountaineering Equipment Co. is responsible for evaluating its use and for fully understanding its limitations prior to any application. Further, any person using this equipment in any manner assumes all risks and accepts full responsibility for any and all damages or injuries including, but not limited to, death or severe injuries, which may result from the use of equipment purchased from Brooks-Range Mountaineering Equipment Co. Even while we strive to assist you, it remains the responsibility of you, the user, to act safely and to educate yourself in proper use of all gear. Know what you are doing, and know your limitations.