



TRIMBLE PENMAP FOR ANDROID SOFTWARE

USER GUIDE

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Penmap for Android

Penmap is a premium data collection software, designed specifically for surveyors and GIS professionals. Penmap for Android provides easy to use field client software specifically designed to run on your Google Android™ device.

Use the large map display to collect features as graphical objects and add GIS records to the feature.

Penmap provides a range of survey methods to create nodes for features, including GNSS positioning, cogo calculations such as bilateration and chain and offset. You can also create a range of construction nodes, from which to create other nodes. Alternatively, key in coordinates or add them by tapping the map. Use as many different methods as required to add all of the nodes you need to any feature.

Use the Trimble Connect cloud-based collaboration platform to download projects sent from the office and to upload data collected in the field.

Supported operating systems

Android 4.4 and later

Supported receivers

Manufacturer	Model	Minimum receiver firmware version
Trimble	Catalyst DA1	–
	R1	4.96
	R2	5.11-0.54
	R4	5.00
	R6	5.00
	R8, R8s	5.00
	R10	5.00
	LA-ProXRT	4.71
Android	Internal GNSS	N/A

To install Penmap

1. On your device go to the Google Play store and search for Trimble Penmap.
2. Install the software from within Google Play.

Alternatively, download the Penmap APK file to a folder on the device. Using the **My Files** App, tap **Device storage** and then navigate to the folder where you saved the APK file. Tap the APK file to run it and then tap **Install**.

3. In the **Apps** screen of the device, tap the Penmap icon  to run Penmap.
4. Do one of the following:
 - Sign in using your Trimble ID.
 - Tap **Create account** and then create a Trimble ID.
 - Tap **Try Penmap**.

Once you are signed in with your Trimble ID, you will have access to the Trimble Penmap Mobile software, Trimble Penmap Project Manager software, and Trimble Connect cloud-based collaboration platform.

TIP – To create a Trimble ID without running Penmap, in your web browser go to <http://connect.trimble.com> and click **Sign in** and then click **Create new Trimble ID**.

Get started

- ▶ To start Penmap
- ▶ Getting to know Penmap
- ▶ Project list menu
- ▶ To synchronize projects with the cloud
- ▶ To open a project

To start Penmap

To start Penmap, tap the Penmap icon  in the **Apps** screen on the device. The first time you start the software, the **Walkthrough** appears, to guide you through the main features of Penmap.

The **Project list** appears each time you start Penmap. The first time you run Penmap, the Project list is empty.

From the Project list you can:

- Synchronize Penmap projects with the file sharing service
- Open a project
- Create a project
- Configure settings that are applied across the application

To collect data you must have a project. Usually you will load projects onto the device by connecting to the appropriate file sharing service. If required, you can create a project on the device.

Getting to know Penmap

If you're new to using an Android App, here are some tips to get you started.

Opening and closing Penmap

To start Penmap, view the **Apps** screen on the device and then tap the Penmap icon .

To close Penmap, tap the **Recent Apps** button on the device and then tap the X in the top right corner of the Penmap application.

To view a walkthrough of the main features of Penmap, tap  and then tap **Walkthrough**.

Touch gestures

Touch gestures work in Penmap as they do in other Android apps. Useful touch gestures are:

- To dismiss a notification or dialog, you can generally swipe it to the left or right, which will move it off your screen or you can touch the screen outside the notification or dialog to close it.
- To view more items in a list, swipe up or down.
- To view more items in the **Survey method** bar, drag right to left across the **Survey method** bar below the map.
- To undo edits you have made to an iFeature, drag left across the **iFeature** action bar above the map.
- To redo edits you have just undone, drag right across the **iFeature** action bar above the map.

Touch-hold buttons

A small arrow on the top left of a button indicates it has additional functions. Touch-hold the button to view the button's pullout menu or, to toggle between the two states of the button. A short tap on the button performs the action shown on the button.

Navigating between screens

To view and configure settings that apply to the current screen, tap .

To end the current measurement mode and return to the previous screen, tap .

To close a project and return to the **Project list**, tap the **Back** key  on the device.

Project list menu

In the **Project list**, tap  to view the **Project list** menu. In the menu:

Tap...	To...
Project list	View the project list.
Download templates	Download iFeature templates from Trimble Connect.
 General	Configure general settings for the Penmap application.
 System	Configure system settings .
 Help	View the Penmap help.
 Walkthrough	View a walkthrough of the main Penmap features.
 About	View information about the installed version of Penmap.

To synchronize projects with the cloud

Projects created in the office using Penmap Project Manager are sent to the device running Penmap Mobile using the Trimble Connect cloud-based collaboration platform. Updates made on the device are also sent to the office using Trimble Connect.

To receive project updates from or to send them to the office, you must connect to Trimble Connect.

When you sign in with your Trimble ID, Penmap connects to Trimble Connect and checks for new Penmap projects available to the device, and for changes to projects already on the device.

To check project status

To check the status of projects on the device at any time, tap  in the **Project list**.

Project status is indicated using the following icons:

Icon	Indicates
	The project in Trimble Connect contains changes which should be downloaded to the device.
	The project is the same in Trimble Connect and on the device.
	The device contains changes to the project, which should be uploaded to Trimble Connect.
	The project on the device has been synchronized with the project in Trimble Connect.
No symbol	The project is on the device only. There is no version of the project in Trimble Connect.

To download a project

1. In the **Project list**, touch-hold the project and then tap **Download**.

After downloading, a thumbnail view of the project map appears next to the project name and the project sync status changes to .

2. To open the project, tap the project name in the **Project list**.

To upload project changes to the cloud

1. When you exit the map, you are prompted to save any changes you have made to the project.
2. In the **Project list**, tap  to check for differences between the project on the device and in Trimble Connect.

If a project has been changed on the device, the project sync icon changes to  to indicate changes need uploading.

3. To upload the changes, touch-hold the project and then tap **Upload**.

After uploading, the project sync status changes to .

To open a project

To open a project, tap it in the project list.

When you create or open a project, the project map appears.

To start surveying, select the **measurement mode**.

To view and configure **project settings**, tap .

To close a project and return to the **Project list**, tap the **Back** key  on the device.

Measurement modes

- ▶ To measure control points
- ▶ To collect numbered points with codes
- ▶ iFeatures
- ▶ To stake out nodes
- ▶ To edit nodes

To start the survey, select the measurement mode from the **Measurement mode** bar.

Select...	To...
 Control points	Measure a point with an extended occupation time for better precision. Control points always use the GNSS method .
 Numbered points	Collect numbered points with codes. You cannot enter attributes for numbered points.
 iFeatures	Collect point, line, and polygon features that have GIS attributes.
 Stake out	Stake out points or navigate to points.

NOTE – A toggle button is used for the *Collect numbered points* and *Collect iFeatures* modes. Touch-hold the button to switch the function of the button and then tap it to start the measurement mode shown on the button.

Once you have selected a measurement mode:

- the appropriate action bar appears above the map
- the survey method bar or navigation bar appears below the map

To end the current measurement mode and return to the previous screen, tap ←.

To measure control points

1. If you are using an external GNSS receiver, connect the receiver to the device using a cable or Bluetooth wireless connection. Control points always use the [GNSS method](#).
2. Tap **Control point** .

3. Touch-hold the **GNSS** button  and then from the **GNSS Method menu**:
 - a. Make sure the **Occupation Type** button shows **Averaging** . Touch-toggle the button to change it to **Averaging** .
 - b. Tap **GNSS Settings**  and then tap **Collection mode**. Set an appropriate number of epochs. The value you select here is used only when measuring control points.
 - c. Make sure all other **GNSS settings** are correct before continuing.
4. Physically move to the location of the control point and then tap the **GNSS** button  to measure the control point. When the configured precision and number of epochs is reached the control point is stored. Alternatively, if you have set the number of epochs to endless, tap  when you are ready to store the control point.

To collect numbered points with codes

1. Tap . If the **Measurement mode** bar does not show this button, touch-hold  to change it to .
2. In the action bar above the map, tap in the Code field and enter the code to use for the numbered point. The point number increments automatically from the last collected point in the project.
3. Select the survey method from the **Survey methods** bar and then perform the appropriate steps to add a node to the map for the point.
4. If required, edit the code for the next point or select a different survey method.
5. Continue adding numbered points as required.

To stop collecting numbered points and return to the map, tap .

iFeatures

iFeatures are point, line, and polygon features that have GIS attributes. To collect iFeatures, from the map tap . If this button is not shown, touch-hold  to change it to .

After selecting the iFeature class from the iFeature action bar, create the geometry of the iFeature by adding nodes using one or more **survey methods**, as required.

If the project template does not contain the iFeature class you need, you can [add the iFeature class definition to the template](#).

The iFeature action bar

The **iFeature** action bar is positioned above the map in the **Topo** screen.

Tap...	To...
Select iFeature	Select the class of iFeature to collect.
•	Add a point iFeature.

Tap...	To...
	Select the line or polygon type to use for the active iFeature. NOTE – The icon shown on the button depends on the selected line or polygon type.
	End the active line iFeature.
	Close the active polygon iFeature.
	Extend the active line or polygon iFeature.
	Add a GIS record to the active iFeature.
001	Edit the point number.
	Stop collecting iFeatures and return to the map.

To add iFeature classes to the Favorites list

To add an iFeature class to the **Favorites** list in the **Add iFeature** screen:

1. In the **Topo** screen, tap  to return to the map.
2. In the **Map** screen, tap  and then tap **iFeature**.
3. Touch-hold the iFeature class you want to add and then select **Toggle favorite**.
An asterisk (*) appears next to the page name of the selected iFeature class.
4. Tap **Close** and when prompted, tap **Update system now**.

To collect a point iFeature

1. Tap . If the **Measurement mode** bar does not show this button, touch-hold  to change it to .
2. In the **Topo** screen, tap **Select iFeature**.
3. In the **Add** dialog, select the iFeature category and then the iFeature type to add to the **iFeature** action bar.
The name of the selected iFeature type and the **Point** button  appears on the **iFeature** action bar.
4. Select the survey method from the **Survey methods** bar and then perform the appropriate steps to add a node to the map for the point.
5. If more information is required, such as a radius or height value, a dialog appears on-screen. Enter the required value and tap **OK**.
6. To add a GIS record, tap . Fill out the GIS record form for the iFeature and then tap **OK**.

TIP – To **Undo** the previous action, drag left across the **iFeature** action bar. To **Redo** the edit, drag right across the iFeature action bar.

To collect another point iFeature of the same type, repeat steps 4 through 6.

To stop collecting iFeatures of the selected iFeature type, tap the iFeature type name in the **iFeature** action bar and then tap **Remove**.

To collect a line or polygon iFeature

1. Tap . If the **Measurement mode** bar does not show this button, touch-hold  to change it to .
2. In the **Topo** screen, tap **Select iFeature**.
3. In the **Add** dialog, select the iFeature category and then the iFeature type to add to the **iFeature** action bar.

The name of the selected iFeature type and the **Line type** button  appears on the **iFeature** action bar.

4. To change the line type, tap the **Line type** button  and then select one of the following:

Icon	Name	Requires you to collect...
	Polyline	At least two nodes.
	Curve	At least three nodes.
	Arc	At least three nodes.
	Circle 1 point	One node in the center of the circle and a radius value.
	Circle 2 point	Two nodes: one node in the center of the circle and one node on the edge.
	Circle 3 point	Three nodes on the edge of the circle.
	Rectangle 2 point	Two nodes along one side of the rectangle and a height value.
	Rectangle 3 point	Three nodes: two nodes along one side of the rectangle and one node on the opposite side.

5. Select the survey method from the **Survey methods** bar and then perform the appropriate steps to add the required number of nodes to the map for the iFeature.
6. If more information is required, such as a radius or height value, a dialog appears on-screen. Enter the required value and tap **OK**.
7. To add a GIS record, tap . Fill out the GIS record form for the iFeature and then tap **OK**.
8. To end the iFeature, tap the **End line**  or **Close polygon**  button.

TIP – To **Undo** the previous action, drag left across the **iFeature** action bar. To **Redo** the edit, drag right across the **iFeature** action bar.

To collect another iFeature of the same type, repeat steps 4 through 8.

To stop collecting iFeatures of the selected type, tap the iFeature type name in the **iFeature** action bar and then tap **Remove**.

To switch between iFeatures in progress

To make your data collection more efficient, you can switch between iFeatures in progress. This is useful, for example, if you are collecting:

- a line iFeature and want to collect some point iFeatures as you travel alongside the line iFeature.
- parallel line iFeatures such as the elements of a road by zigzagging your way across the road.

To switch between iFeatures in progress:

1. Tap . If the **Measurement mode** bar does not show this button, touch-hold  to change it to .
2. In the **Topo** screen, tap **Select iFeature**.
3. In the **Add** dialog, select the iFeature category and then the iFeature type. The button for the selected iFeature type is added to the **iFeature** action bar.
4. To add more iFeature types, touch-hold the iFeature type button in the action bar and add another iFeature type. Repeat until you are done adding iFeature types. You can have up to 6 iFeature types selected at one time.

Additional iFeature type buttons are stacked at the right of the **iFeature** action bar. The active iFeature is highlighted.

5. To change the active iFeature, tap a different iFeature type button.
6. Add nodes for the active iFeature as usual, selecting the required line type and survey method as needed.
7. To switch to a different iFeature:
 - If the active iFeature is a point iFeature, tap the iFeature code button for the new iFeature and then add a node.
 - If the active iFeature is a line or polygon, tap the **End line**  or **Close polygon**  button. Tap the iFeature code button for the new iFeature and then add nodes.
8. To return to the previous iFeature, tap the iFeature type button for the previous iFeature. If the iFeature is a line or polygon, tap  and then tap the node from which to extend the iFeature.

TIP – To disable the current iFeature and measure or compute a point without any associated feature, tap **Select iFeature**. In the **Alter** dialog, tap **Disable**. You can now collect points that are not part of iFeatures. To return to collecting iFeatures, tap **Select iFeature** again, and the current feature is re-enabled.

To stake out nodes

NOTE – To use the eCompass for stakeout, the eCompass must be calibrated. To calibrate the eCompass using Google Maps, go to <https://support.google.com/maps/answer/6145351?hl=en>.

CAUTION – You must complete a calibration before you compute offset or intersection points, or stake out points. If you change the calibration after computing or staking out these points, they will not be consistent with the new coordinate system and any points computed or staked out after the change. For more information, see [Site calibration](#).

1. Tap .
2. Tap  to start the **GNSS method**.
The software connects to the GNSS receiver and a green badge on the **GNSS method** icon  confirms that enough satellites are being used for Penmap to calculate a position.
3. Tap **Stake point**  and then tap the node to stake out.
The eCompass starts, showing the bearing and distance to the selected node.
4. Start walking toward the node. As you move, the map moves to keep the selected node in the center of the map.
When you are within the distance to the target specified in the **Stakeout coarse/fine field**, the eCompass changes to closeup mode.
5. When you reach the target, check the stakeout deltas. When GNSS observations are within the configured stakeout tolerances, the horizontal precision icon and the vertical precision bar in the map turn green.
6. Mark the point on the ground that corresponds to the node in the map.
7. If required, measure the node using the appropriate [survey method](#).

To edit nodes

To edit nodes, **touch-hold** the node in the map. The **Map options** dialog appears.

Tap...	To...
Edit node record	Edit the recorded information for the selected node, including the point number, code, and elevation. Other non-editable fields show the node coordinates and the survey method used to create the node.
Inverse	Calculate the bearing and distance between two nodes. Tap  and then select the second node. The bearing and distance between the two nodes is shown above the map. Tap  or  to select different nodes.
Delete node	Delete the node, including any associated GIS record (if the node is used for an iFeature).

Tap...	To...
Edit GIS record	Edit the GIS record for the iFeature.
Add GIS record	Add a GIS record to the iFeature.
Delete graphic	Remove the graphic used for the node, if a graphic is defined for that iFeature type in the iFeature template.
Cancel	Return to the map.

TIP – When editing iFeatures, to **Undo** the previous action, drag left across the **iFeature** bar above the map. To **Redo** the edit, drag right across the **iFeature** bar.

Survey methods

- ▶ GNSS method
- ▶ Snap node method
- ▶ Free node method
- ▶ Chain & offset method
- ▶ Extend horizontal method
- ▶ Bilateration method
- ▶ Construction method
- ▶ Enter data method

Once you select a **measurement mode**, the **Survey method** bar appears below the map.

CAUTION – You must complete a calibration before you compute offset or intersection points, or stake out points. If you change the calibration after computing or staking out these points, they will not be consistent with the new coordinate system and any points computed or staked out after the change. For more information, see [Site calibration](#).

To add nodes to a survey, select the appropriate survey method from the **Survey method** bar. Drag left or drag right across the **Survey method** bar to view more **Survey method** items.

Select the method...	To...
 GNSS	<p>Add nodes to the survey using coordinate data from a GNSS receiver.</p> <p>When measuring control points or point features, a node is created after a single GNSS observation (epoch) or by averaging multiple epochs. When measuring line or polygon features, add multiple nodes to the feature using single or averaged GNSS epochs.</p>
 Snap to Node	<p>Snaps graphical elements onto existing nodes. You can also use it to snap together nodes to form new features after other nodes have been undone or deleted.</p>

Select the method...	To...
 Free Node	Add a node by tapping on the map.
 Chain & Offset	Add a node offset from two existing nodes. This method is useful if, for example, you cannot measure a GNSS position for the target node but you have two nodes nearby you can use as reference nodes. You would draw a construction line between them and then measure the chain distance along the construction line until you are in line with the target, then measure the offset distance to the target node.
 Extend Horizontal	Add a node in line with two existing nodes.
 Bilateration	Add a node using intersecting arcs from two existing nodes. Use this method in the following scenarios: <ul style="list-style-type: none"> for a single feature, start from one reference node and measure the distance to the target, then move to the second reference node and measure this distance to the target. to quickly collect multiple features or a line feature with a laser rangefinder to two known positions on the map (for example, collected with the GNSS method) stay at the target (such as a manhole or a tree) and take measurements to the two reference nodes, for example the corner of a building. Then move to the next target and take new distance measurements to the same reference nodes.
 Construction	Create construction lines or a construction circle from existing nodes and graphic elements.
 Enter Data	Add a node by entering the coordinates of the node. The generated node is a free node.

GNSS method

You will have set up some GNSS settings when you created the project. Once you connect to the GNSS receiver you can configure additional GNSS settings for the current **measurement mode**. This enables you to select different settings depending on your requirements for that measurement mode.

To start the GNSS method

To start the **GNSS method**, tap  in the **Survey method** bar.

The software attempts to connect to the GNSS receiver you have configured for the current **measurement mode**. If you have not yet configured GNSS settings for the current **measurement mode**, the software uses the

GNSS settings you configured when you created the project.

If the software is unable to detect the connected GNSS receiver, touch-hold the GNSS method button  and then tap **Settings**  / **GNSS receiver** and select the receiver type and connection method. To dismiss the **GNSS settings** dialog, tap anywhere outside the dialog.

When the software successfully connects to the GNSS receiver, the **GNSS Skyplot** dialog appears, showing the number of GNSS satellites being tracked by the receiver.

The badge on the **GNSS method** button displays the number of satellites being used and the GNSS position cursor on the map changes color to indicate the current [GNSS status, page 20](#). The software automatically connects to the configured real-time correction source.

To stop using the GNSS method, touch-hold the GNSS method button  and then tap **Stop GNSS** . You may be prompted to confirm if the software should power off the receiver.

To configure GNSS settings for the current measurement mode

1. Touch-hold the GNSS method icon  to view the [GNSS Method menu](#).
2. Tap  and then select **Collection mode**. Select:
 - the number of epochs to use in an averaged position.
 - the time interval between GNSS positions when logging GNSS positions by time.
 - the distance interval between GNSS positions when logging GNSS positions by distance.
3. Tap  and make sure the configured **Antenna Height** is correct. Measure the height to the bottom of the antenna mount, where it attaches to the pole, tripod, or extension.

NOTE – The software automatically adds the correct offset amount so that the antenna height used is the same as if you measured to the center of the antenna. The antenna offset is predefined for each antenna type. To view the **Antenna offset** details, in the **GNSS Method** menu tap **Settings** / **GNSS receiver** and then tap **Info**.

4. To connect to the configured real-time correction source, tap **Connect** .

To change the GNSS method during a survey

1. Touch-hold the GNSS method icon  to view the [GNSS Method menu](#).
2. Touch-toggle the **Occupation Type** button to select the appropriate occupation type. If it shows:
 - **Averaging** , then GNSS positions are averaged to obtain the measurement position.
 - **Single** , then a single GNSS position is used as the measurement position.
 - **Time** , then single GNSS positions are logged continuously at the time interval specified in the **Collection mode** screen.
 - **Distance** , then single GNSS positions are logged continuously at the distance interval specified in the **Collection mode** screen.

GNSS status

The **GNSS Method** button  shows the most important GNSS status information at a glance:

- The selected observation type. If it shows:
 - **Averaging** , then GNSS positions are averaged to obtain the measurement position.
 - **Single** , then a single GNSS position is used as the measurement position.
- The number of satellites being used.
 - A red badge warns not enough satellites are being used to calculate a position.
 - A green badge confirms that enough satellites are being used for Penmap to calculate a position.
- The current estimated accuracy of the calculated GNSS position.
- The current configured antenna height.

On the map, the GNSS position cursor is color-coded to indicate the quality of the current GNSS position:

Cursor	Indicates the current GNSS position is...
	Outside the quality limits . Measurement is not possible.
	Within the warning limit. A warning message appears if you attempt to log the position. To log the position, tap OK in the message.
	Within the defined quality limits . When you tap the GNSS Method button, measurement starts immediately.

For more detailed GNSS status information, touch-hold the **GNSS Method** button  and then tap **Position**  or **Skyplot** .

GNSS Method menu

To access more detailed GNSS status information and controls, touch-hold the GNSS method button . The **GNSS Method** menu appears.

Tap...	To...
 Position	View detailed coordinate and precision information for the current GNSS position.
 Skyplot	View the GNSS skyplot showing the type and position of the GNSS satellites being tracked by the GNSS receiver.
 Single	Touch-toggle the Occupation Type button to select the appropriate occupation type. If it shows: <ul style="list-style-type: none"> • Averaging , then GNSS positions are averaged to obtain the measurement position. • Single , then a single GNSS position is used as the measurement position.

Tap...	To...
 Averaging	<ul style="list-style-type: none"> • Time , then single GNSS positions are logged continuously at the time interval specified in the Collection mode screen.
 Time	<ul style="list-style-type: none"> • Distance , then single GNSS positions are logged continuously at the distance interval specified in the Collection mode screen.
 Distance	
 Connect	Manually connect to/disconnect from the configured real-time correction source.
 Disconnect	
 Calibration	Load or start a site calibration .
 Antenna Height	<p>Configure the current antenna height for the GNSS receiver.</p> <p>Measure the height to the bottom of the antenna mount, where it attaches to the pole, tripod, or extension. The software automatically adds the correct offset amount so that the antenna height used is the same as if you measured to the center of the antenna. The antenna offset is predefined for each antenna type. To view the Antenna offset details, in the GNSS Method menu tap Settings / GNSS receiver and then tap Info.</p>
 Stop GNSS	Manually disconnect from the GNSS receiver.
 Settings	Configure GNSS settings .

Site calibration

Perform a site calibration to transform WGS-84 coordinates from the connected GNSS receiver into local grid coordinates (NEE).

 **CAUTION** – You must complete a calibration before you compute offset or intersection points, or stake out points. If you change the calibration after computing or staking out these points, they will not be consistent with the new coordinate system and any points computed or staked out after the change.

To perform a site calibration:

1. Before beginning a site calibration, configure the calibration tolerance settings. From the map, tap  / **Tolerances** and then enter values for the calibration **Horizontal** and **Vertical** tolerance.
2. Tap **Control point** and then touch-hold the **GNSS** button  to open the **GNSS Method** dialog and then tap **Calibration** .
3. Depending on your project, you may be prompted to select one of the following options:
 - Tap **New** to start a new calibration.
 - Tap **Edit** to edit the currently loaded calibration.

- Tap **Load** and then select a saved calibration file from the list.
 - Tap **Disable** to discard the currently loaded calibration.
4. To add a calibration point:
 - a. Tap **Calib. Pt.**  and select a reference node from the map. The calibration point coordinates appear.
 - b. Select whether to use a three-dimensional/two-dimensional/one-dimensional coordinate.
 - c. When the GNSS antenna is positioned directly over the point on the ground and you have made sure the antenna is vertical and not moving, tap the **GNSS Measure**  button.

Once the observation is stored, the icon on the **Results** button updates to show if the calibration results are within the configured calibration tolerance values  or outside the configured calibration tolerance values .
 5. Tap the **Results** button to view the **Calibration results** dialog. Tap **Report** to view the results as a report, or tap **Save as preset** to save the calibration for use in future surveys.
 6. If required, tap **Settings**  to change the scale factor or to use a fixed scale. To view how your changes affected the solution, tap the **Results** button to return to the **Calibration results** dialog.
 7. If required, you can remove observations that are outside the tolerance settings. To do this:
 - a. Tap the GNSS node on the map (you can only do this when the calibration bar is open). The **Observation details** dialog appears.
 - b. Exclude different elements of the observation by reducing the number of dimensions used for the measurement i.e. reduce from **3D/2D/1D** to **Off**. Tap **OK**.
 - c. To view how your changes affected the solution, tap the **Results** button to return to the **Calibration results** dialog.
 8. To apply the calibration, tap . To discard the calibration, tap .

Snap node method

The **Snap node** method snaps graphical elements onto existing nodes. You can also use it to snap together nodes to form new features after other nodes have been undone or deleted.

To use this method, tap  and then tap the node on the map.

The **Snap node** method is also a convenient way to add text adjacent to a number of nodes or graphical items. If the position of a node is recalculated, the text moves with the node.

Free node method

Because the **Free node** method enables you to add nodes to the map by tapping the map at the required position, it is useful to have selected a background **map provider** before using this method. You do not need any existing nodes in the survey to use the **Free node** method.

1. Tap .
2. Tap the map at the required position.
Penmap calculates the coordinates of the node from the location on the map and a small circle denoting a free node appears on the map.
3. To exit the **Free node** method, tap  again or select a different survey method.

TIP –

- If you tap the map but a free node does not appear, you may have slightly moved the map instead. Tap the map again to add a free node.
- To add graphical elements to free nodes, for example to represent them as points or to link them as lines, use the **Snap node method**.
- The **Free node** method is also a convenient way to add text adjacent to a node or graphical item. If the position of other nodes is recalculated, the text attached to free nodes remains in the same position, as free nodes are generated independently of other nodes.

Chain & offset method

NOTE – To use this method you must have two reference nodes positioned in the survey and know the chain distance and the offset distance, measured using a tape measure or a laser rangefinder.

1. Tap .
2. Select the two reference nodes that define the construction line: tap ₁ and then tap the first node, then tap ₂ and tap the second node.
The construction line appears on the map.
3. Measure the horizontal chain distance from node 1. Tap  and enter the distance.
4. Measure the horizontal offset distance. Tap  and enter the distance.
The target node appears on the map.
5. Tap the map to toggle between the two possible calculated positions for the target node.
6. Tap  to create the node in the position shown.

Extend horizontal method

1. Tap .

If you do not see this button in the **Survey method** bar, drag left across the **Survey method** bar to view more buttons.

2. Select the two nodes from which a third node in the same horizontal line will be created: tap \oplus_1 and then tap the first node, then tap \oplus_2 and tap the second node.
3. Enter the distance beyond the second node where the new node will be created.
4. Tap  to create the node in the position shown.

Bilateration method

To use the **Bilateration** method you must have two reference nodes positioned in the survey and know their distance from the target node. Use a tape measure or laser rangefinder to measure the distance to the target node.

1. Tap .

If you do not see this button in the **Survey method** bar, drag left across the **Survey method** bar to view more buttons.

2. Select the two reference nodes that define the construction line: tap \oplus_1 and then tap the first node, then tap \oplus_2 and tap the second node.

The construction line appears on the map.

3. Measure the horizontal distance from node 1 to the target. Tap \mathcal{L}_1 and enter the distance.
4. Measure the horizontal distance from node 2 to the target. Tap \mathcal{L}_2 and enter the distance.

The target node appears on the map.

5. Tap the map to toggle between the two possible calculated positions for the target node.
6. Tap  to create the node in the position shown.

Construction method

Use the **Construction** method to create construction objects from existing nodes and graphic elements.

1. Tap .

If you do not see this button in the **Survey method** bar, drag left across the **Survey method** bar to view more buttons.

2. Create the first required construction object, from the buttons on the **Construction** toolbar:

Tap...	To create a construction...
	Line parallel to another line
	Line perpendicular to another line
	Line intercepting another line at an oblique angle
	Line defined by bearing
	Circle

When you create the first construction object, for example a parallel line, it appears in green on the map.

3. Create the second required construction object.

When you accept the second construction object, for example, a perpendicular line, it appears in green on the map and Penmap creates construction nodes at all intersection points. For example, one construction node at the intersection of the parallel line and the perpendicular line is created.

4. Continue creating construction objects as required.

Each time you accept a new construction object, construction nodes are created at the intersection points.

5. When you have created all the required nodes, tap  to exit the **Construction** method.

The construction lines disappear from the map, leaving only the new construction nodes.

6. Use the **Snap node** method to assign the construction nodes to features.

NOTE -

- When creating construction lines, sometimes there is a choice of position for the object. Tap the map to toggle between the alternative positions. The construction line is created in the position shown when you tap .
- To exit the selected construction type at any time, tap .

To create a construction line parallel to another line

1. Tap .
2. Select the two reference nodes that define the construction line: tap  and then tap the first node, then tap  and tap the second node.

The construction line appears on the map.

3. Do one of the following:

- To enter the offset distance, tap . The construction line moves by the distance you entered. To move the construction line in the opposite direction, tap the map. Tap the map again to toggle

between the alternative positions for the construction line.

- Tap  and then tap the node that the construction line should pass through.
4. Tap  to create the construction line.

To create a construction line perpendicular to another line

1. Tap .
2. Select the two reference nodes that define the construction line: tap  and then tap the first node, then tap  and tap the second node.
The construction line appears on the map.
3. Do one of the following:
 - To enter the offset distance, tap . The construction line moves by the distance you entered. To move the construction line in the opposite direction, tap the map. Tap the map again to toggle between the alternative positions for the construction line.
 - To use the middle point between node 1 and node 2, touch hold . The button changes to . Tap . The construction line moves to the middle point between the two nodes.
4. Tap  and then tap the node that the construction line should pass through.
5. Tap  to create the construction line.

To create a construction line intercepting another line at an oblique angle

1. Tap .
2. Select the two reference nodes that define the construction line: tap  and then tap the first node, then tap  and tap the second node.
The construction line appears on the map.
3. Do one of the following:
 - To enter the offset distance, tap . The construction line moves by the distance you entered. To move the construction line in the opposite direction, tap the map. Tap the map again to toggle between the alternative positions for the construction line.
 - To use the middle point between node 1 and node 2, touch hold  to change the button to . Tap . The construction line moves to the middle point between the two nodes.
4. Tap  to enter the angle of the construction line.
5. Tap  to create the construction line.

To create a construction line defined by bearing

This method is useful for determining a feature position using two compass readings to two reference nodes (known as a resection).

1. Tap .
2. Tap  and then tap the node on the map to use as the reference node.
3. Tap  and then enter the azimuth value to the reference node.
4. Tap  to create the construction line.

To create a construction circle

1. Tap .
2. To define the circle by:

Center point plus radius

- a. Tap .
- b. Tap  and then tap the node to use as the reference node.
- c. Tap  and enter the radius.

Two nodes on the circle plus radius

- a. Tap .
- b. Tap  and then tap the first node to use as the reference node.
- c. Tap  and select the second node.
- d. Tap  and enter the radius.

Three nodes on the circle

- a. Tap .
 - b. Tap  and then tap the first node to use as the reference node.
 - c. Tap  and select the second node.
 - d. Tap  and select the third node.
3. Tap  to create the construction circle.

Enter data method

To use this method you must know the plane or WGS84 coordinates of the target position.

NOTE – To enter WGS84 coordinates as Latitude, Longitude and Altitude values you must define the transformation and projection parameters in the [GNSS settings](#).

1. Tap .

If you do not see this button in the **Survey method** bar, drag left across the **Survey method** bar to view more buttons.

4 Survey methods

2. To enter coordinates as:

- Northing, Easting, Elevation, tap .
- WGS84 coordinates (Latitude, Longitude, Height) in Degrees, Minutes, Seconds, tap .
- WGS84 coordinates (Latitude, Longitude, Height) in decimal degrees, tap .

3. To toggle between N/S, tap **N** or **S**.

4. Tap .

Settings

- ▶ Account settings
- ▶ General settings
- ▶ System settings
- ▶ Project settings
- ▶ Coordinate system settings
- ▶ GNSS settings

Project-specific settings are available from the ☰ menu in the map. Other settings can be configured from the ☰ menu in the **Project list**.

Account settings

User ID

Enter your User ID for the selected service.

Password

Enter your password for the selected service.

General settings

To configure general Penmap settings, in the **Project list** tap ☰ and then tap **General**.

Language

Select the language for the application.

Distance units

Select the units to use for distance measurements.

Angle units

Select the units to use for angle measurements.

Library

Select the library to use.

Project wizard

Clear the **Project wizard enabled** check box to disable the project wizard and streamline the steps for creating a project. This is useful if you always use the same [project settings](#).

System settings

To configure general Penmap settings, in the **Project list** tap  and then tap **System**.

Disable standby

Select the check box to disable standby on the device. This prevents the device from powering off automatically.

Project settings

To configure settings for the project, from the map tap  and then select the appropriate menu item.

Application settings

Point numbers active

Select the **Point numbers active** check box to add numbers to nodes when they are added to the map.

Stakeout coarse/fine

Select the distance from the target at which the stakeout navigation display changes from 'coarse' to 'fine'.

Projection reduction

Select the check box to work with local coordinates. This means that nodes that use a different coordinate system to that defined for the project are transformed to grid coordinates and appear on the map. Nodes in a different coordinate system that are not transformed to grid coordinates do not appear on the map.

Display settings

Show points and numbers

Select the **Show points and numbers** check box to display points and point numbers on the map at the current zoom level or above.

GNSS cursor

Select the **GNSS autoscroll** check box to automatically center the map on the current position from the GNSS receiver, if it is available.

Sensitivity

Select the method you use for interacting with the application.

Map provider

Select the provider of the background map. Depending on the provider you select, additional fields may appear for selecting the appropriate map.

GNSS settings

Edit the GNSS settings for the project. These can also be accessed from the GNSS Method menu. See [GNSS settings](#), page 32.

iFeature settings

Edit the iFeature settings in the project template, as required. Changes you make effect all projects that use the same template. For more information, see [iFeature templates](#), page 36.

Tolerances

Enter the horizontal and vertical accuracy limits when performing different tasks.

Coordinate system settings

 **CAUTION** – To avoid issues with your data, do not change the coordinate system once nodes have been added to the project.

You can change coordinate system settings when:

- Creating a project
- Starting Penmap, if the **Show at startup** check box is selected in the **Coordinate system** dialog.

To change the coordinate system settings for a project that does not yet have nodes added, exit the **GNSS method** then touch-hold the GNSS button , tap  and then select **Coordinate system**:

1. Select the **System**. To view more detailed information about the selected coordinate system, tap **Info**.
2. Select the **Zone**, **Datum**, and **Geoid**. By default the software shows a selection of systems, zones and datums appropriate for your location. To view more options, select the **Show all CRS** check box.
3. Tap **Next**.
4. If prompted to download files for the coordinate system you selected, tap **Download**.

GNSS settings

To configure GNSS settings at any time the GNSS method is not active, touch-hold the GNSS button  and then tap .

Alternatively, from the map, tap  and then select **GNSS**.

To close the **GNSS settings** dialog, tap the screen outside the dialog.

NOTE – You cannot change GNSS settings when the **GNSS method** is active. To exit the **GNSS method**, touch-hold  and then tap .

GNSS quality

2D RMS

Drag the slider right to increase quality and reject observations that do not meet the quality criteria.

Drag the slider left to increase productivity and use more observations.

The values and colored boxes above the slider indicate the 2D RMS values when the Penmap behavior changes. The 2D RMS value represents the radius of the two-dimensional circle within which approximately 70% of positions occur.

Color	Meaning	Penmap behavior
Green	Within the defined quality limit	Measurement starts immediately after you tap the GNSS method button.
Orange	Warning limit	You are prompted to confirm you want to log the position.
Red	Outside the quality limit	Measurement is not possible.

When collecting data, the color of the GPS position cursor on the map indicates the quality level of the current position.

Elevation mask

Enter the elevation (degrees above the horizon) below which a satellite will not be used.

Satellites that are too close to the horizon are subject to interference from objects on the ground.

Collection mode

Select the number of epochs to use when averaging GNSS positions.

Real-time corrections

For improved accuracy, connect to a real-time correction service to apply corrections to GNSS data in real time.

Depending on the model of GNSS receiver you are using, you may be able to connect to any of the following types of real-time correction service:

- [NTRIP broadcast server](#)
- [Trimble CenterPoint RTX service](#)
- [Trimble Corrections Hub](#)

The **RTK service** wizard appears.

To configure the connection to an NTRIP server

1. Enter the **Service Name**.
2. In the **Service Type** field, select **NTRIP**.
3. Tap **Next**.
4. Select the **Caster Name** from the drop-down list. The **IP Address** and **Port** fields are automatically filled out. If the service you want to connect to is not listed, tap **+** and then enter the **Caster Name** and the **IP Address** and **Port** number to connect to.
5. If more than one correction stream is available, select the correction stream to receive.
6. If required, enter your user name and password.
7. Tap **OK**.

To configure the connection to the Trimble CenterPoint RTX service:

1. Enter the **Service Name**.
2. In the **Service Type** field, select **Trimble CenterPoint RTX**.
3. Tap **Next**.
4. Select the RTX mode.
5. Tap **OK**.

To configure the connection to the Trimble Corrections Hub:

NOTE – To use the Trimble Corrections Hub you must be using a Trimble Catalyst DA1 antenna.

1. Enter the **Service Name**.

The software automatically connects to the service.

2. Tap **OK**.

Coordinate system

Select the appropriate coordinate system for your location.

Select the **Show at startup** check box to show the **Coordinate system** dialog each time you start the software.

GNSS receiver

Select the **Manufacturer** of the receiver.

If required, select the **Model** and **Connection** method for the GNSS receiver.

Tap **Info** to view information about the connected GNSS receiver.

Projects and templates

Normally, however, projects and iFeature templates will be set up using Penmap Project Manager and then sent to the device. For more information, refer to the Penmap Project Manager documentation.

Occasionally you may need to create a project on the device, or create or modify iFeature templates used by the project.

- ▶ To create a project
- ▶ iFeature templates
- ▶ To create a template
- ▶ To modify an iFeature template
- ▶ To define an iFeature class in the template

To create a project

NOTE – Before creating a project, you must connect to the GNSS receiver you will use to obtain GNSS positions for the project.

1. In the **Project list**, tap **+**. The **Create project** screen appears.
2. Enter the project name.
3. Select the project template to use or create a new template. See [iFeature templates, page 36](#).
4. If required, enter any tags for the project.
If you have a large number of projects on the device you can filter the **Project list** using tags.
5. If required, enter a comment for the project.
6. Tap **Next**.
7. Define the [coordinate system settings](#) for the project:
 - a. Select the **System**. To view more detailed information about the selected coordinate system, tap **Info**.
 - b. Select the **Zone**, **Datum**, and **Geoid**. By default the software shows a selection of systems, zones and datums appropriate for your location. To view more options, select the **Show all CRS** check box.
 - c. By default the **Show at startup** check box is selected, so that the coordinate system settings are

shown each time you start the software. To prevent this from happening, clear the **Show at startup** check box.

 **CAUTION** – To avoid issues with your data, do not change the coordinate system once nodes have been added to the project.

- d. Tap **Next**.
- e. If prompted to download files for the coordinate system you selected, tap **Download**.
8. Define the **GNSS settings**:
 - a. Select the manufacturer of the GNSS receiver.
 - b. If required, select the model of the connected GNSS receiver model.
 - c. If the selected receiver requires a Bluetooth wireless connection, tap **Bluetooth**. The software scans for nearby devices. From the list of available devices, select the receiver to connect to.
 - d. If required, select the real-time correction service to use for receiving **real-time corrections** or set up a new one.
 - e. Tap **Next**.
 - f. Set the **GNSS quality settings** to exclude GNSS positions that do not meet your quality criteria.
9. Tap **Done**.

The project map appears.

iFeature templates

The iFeature template defines the data model used for the project, including the iFeature classes, map layers, symbols, and GIS data lists used. You can use different templates for different applications, for example, you could set up a utility template and a local government template.

NOTE – *The template does not define any **GNSS quality settings**. GNSS quality settings are set at the project level, not the feature level.*

Generally templates are created in the office and then sent to the field device with the project. Any templates used by projects sent from the office are also available for you to use with new projects. In addition, the following default templates are provided with Penmap:

- Example
- QuickStart

Usually you would not need to modify the template in the field. However, you can **create templates** or **modify existing templates** on the device, if required.

To create a template

You can create a template on the device when you [create a project](#).

You can also create a template by [modifying an existing template](#) on the device and then saving it as a new template.

To create a template when you create a project:

1. In the **Project list**, tap **+**. The **Create project** screen appears.
2. Enter the project name.
3. In the **Template** field, select **[New template]**. The **Template** screen appears.
4. In the **Template** screen:
 - a. Enter the template name.
 - b. For each template item, select the source file to use for the template.
 - c. When you have finished making your selection, tap **Create template**.

In the **Create project** screen, the name of the template you created appears in the **Template** field.

If required you can [modify the template](#) or [add an iFeature class to the template](#) as required after creating the project.

5. Continue [creating the project](#) as usual.

To modify an iFeature template

1. From the map, tap **≡** and then tap **iFeature**. The **iFeature** screen appears, listing all the iFeature classes defined in the current project template.
2. To add an iFeature class to the template, tap **Add** and then [define the new iFeature class](#).
3. To manage existing iFeature definitions, tap the name of an iFeature definition in the list and then tap:
 - **Toggle favorite** to add/remove the feature from the **iFeature** list in the **Topo** screen.
 - **Copy** to create a copy of the feature, which you can then edit.
 - **Edit** to redefine the iFeature class.
 - **Delete** to delete the feature from the template.
 - **Close** to return to the feature list.
4. When you have finished making changes to the template, tap **Close**. You are prompted to:
 - **Update the system now**. Select this option to update the existing template, wherever it is used.
 - **Save into a new template**. Select this option to create a template to use for new projects.
 - **Cancel. Don't save**. Select this option to leave the iFeature Editor without saving your changes.

To define an iFeature class in the template

1. From the map, tap  and then tap **iFeature**.
2. Tap **Add**.
3. In the **Feature name** field, enter the name to use for this iFeature class.
4. In the **Code** field, enter the code to assign to iFeatures of this class.
5. Tap the **Page** button and then select the template page in which this iFeature class will appear. To create a new page, tap **[New]**, enter the page name and then tap **OK**.
6. Tap the **Feature type** button and then select the feature type (point, polyline, or area).
7. Tap the **GIS** button to select the GIS form that can be added to iFeatures of this class.
8. Tap the **Layer** button and then select the map layer in which iFeatures of this class will appear.
9. Tap the **Graphic element** button and select the graphic element used to represent iFeatures of this class. Options available depend on the Feature type you selected.
 - For **Point** feature types:

Select from...	And then...
Point	Select the symbol to use for features of this class in the Point style field.
Symbol 1 pt.	Select the symbol to use for the feature in the Symbol name field. Enter the width, height, and degrees of rotation for the symbol in the fields below the Graphic element field.
Symbol 2 pt.	Select the symbol to use for the feature in the Symbol name field.
Text	Enter the height and degrees of rotation to use for the text in the fields below the Graphic element field.

- For **Polyline** or **Area** feature types:

Select from...	When collecting the feature you will need to add...
Arc	At least three nodes.
Circle 1 point	One node in the center of the circle and a radius value.
Circle 2 point	Two nodes: one node in the center of the circle and one node on the edge.
Circle 3 point	Three nodes on the edge of the circle.
Curve	At least three nodes.
Polyline	At least two nodes.
Rectangle 2 point	Two nodes along one side of the rectangle and a height value.
Rectangle 3 point	Three nodes: two nodes along one side of the rectangle and one node on the opposite side.

10. Tap **Save** to return to the iFeature template screen.

Buttons – quick reference

Tap...	To...
	Accept the changes and close the method or message.
	Cancel the changes and close the method or message.
	Delete one character at a time from an edit field.
	Delete the entire contents of an edit field.
	View the project list .
	Compare projects on the device with projects on the file sharing service.
	Create a new project on the device.
	View the menu.
	View the map.
	Configure settings .
	View the <i>Penmap Help</i> .
	View information about the version of Penmap you are running.
	Start collecting control points
	Start collecting numbered points with codes
	Start collecting iFeatures .
	Start staking out nodes .
	Create a point feature.
	Create a point feature that uses custom symbol 1
	Create a point feature that uses custom symbol 2.
	Tap the map once to add the center node for the feature then move to the perimeter of the feature and tap the map again.
	Create a polyline.
	Create a curve.
	Create an arc.
	Create a circle using one node.

Tap...	To...
	Create a circle using two nodes.
	Create a circle using three nodes.
	Create a rectangle using two nodes.
	Create a rectangle using three nodes.
	End the current line feature.
	Close the current polygon feature.
	Add more nodes to extend the active feature.
	Fill out the GIS record for the active feature. If there is no GIS record for the feature, this button shows  .
001	Edit the point number.
	Close the action bar and return to the Home screen.
	Start the GNSS method .
	Add nodes by averaging GNSS positions.
	Add nodes by recording a single GNSS position.
	Add nodes by logging GNSS positions at a regular time interval.
	Add nodes by logging GNSS positions at a regular distance interval.
	Add nodes using the Snap node method .
	Add nodes using the Free node method .
	Add nodes using the Chain/Offset method .
	Add nodes using the Extend horizontal method .
	Add nodes using the Bilateration method .
	Add nodes using the Construction method .
	Add nodes using the Enter data method .
	View the GNSS Position dialog.
	View the GNSS Skyplot .
	Tap to start the GNSS method . Touch-hold to view the GNSS Method menu .
 or	Tap-toggle GNSS Connect/GNSS Disconnect to connect/disconnect from the configured real-time correction source.
	Perform a site calibration .

Tap...	To...
	Configure the GNSS Antenna Height .
	Stop the GNSS method.
	Configure GNSS settings .
	Enter the first, second, or third reference node.
	Enter the horizontal chain distance from the reference node.
	Enter the horizontal offset distance.
	Enter the first horizontal distance.
	Enter the second horizontal distance.
	Create a construction line parallel to another line.
	Create a construction line perpendicular to another line.
	Create a construction line intercepting another line at an oblique angle .
	Create a construction line defined by bearing .
	Create a construction circle.

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