How to set out a survey grid

Why?
Covering a site with a regular grid of squares allows you to quickly establish rough or precise positions within the site. It is the standard form of position control used in fieldwalking and in geophysical surveys.

Method A: Using a Survey Tape

When?
Use this method to quickly set out a small number of grid squares (up to 20 or so) or to set out a grid in a remote location when you don’t want to carry much equipment.

What you need

- Pegs, stakes or canes for each grid corner.
- A survey tape that is as long as possible (at least 3 times your grid size)

Step 1: Establish a baseline
Place a peg near one end of your site, then stretch a tape out across you site and place a second peg near the opposite end. Make sure the length of your baseline is a multiple of your intended grid size. So if you will be setting out 30m grids your baseline could be 30m, 60m, 90m long, etc..

If your tape isn’t long enough to stretch across your site then just stretch it across the middle of your site. If your site is much larger than your tape then you’re better off using Method B below.
Step 2: Place pegs along your baseline
With your tape running between your two baseline pegs, place further pegs at each grid-size interval (so for 30m grids, place a peg every 30m).

Step 3: Place further pegs using right-angled triangles
For this step you will need to know the diagonal length for your grid size. Fortunately the most commonly used grid sizes have easily memorable diagonals as shown in the table below. For other grid sizes use Pythagoras’ Theorem as shown in the last row below:

<table>
<thead>
<tr>
<th>Grid Size</th>
<th>Diagonal</th>
</tr>
</thead>
<tbody>
<tr>
<td>10m</td>
<td>14.14m</td>
</tr>
<tr>
<td>20m</td>
<td>28.28m</td>
</tr>
<tr>
<td>30m</td>
<td>42.42m</td>
</tr>
<tr>
<td>$x$</td>
<td>$\sqrt{2 \times x^2}$</td>
</tr>
</tbody>
</table>

These numbers will allow you to place further pegs at their correct positions as shown below (using the example of 10m grids)

In practice, the easiest way to use this method is to fix the end of your tape (the 0m position) onto one of the pegs on your baseline, then fix onto the next peg along the position that is your grid size plus your diagonal (so for 10m grids: $10 + 14.14 = 24.14m$).
Now stretch out the 10m position of your tape (or whatever grid size you are using) so that the tape is taut to both pegs. This is your peg location:

Next, stretch the position on your tape that equates to your diagonal length (14.14m in the case of 10m grids) - again making sure the tape is taut to both pegs - to place a peg at the final corner of the square:

Repeat this process along both sides of your baseline:
If you need to add further pegs, then simply repeat this process using the rows of pegs you have already placed. However, be aware that errors will accumulate as you work further from your baseline.

You can also extend lines by eye. To do this, attach the end of your tape to a peg and extend it the required distance in the approximate direction you think the peg should be placed. Then kneel to bring your eye close to the ground and sight along the row of existing pegs to ensure your new peg is placed on the same alignment:
Method B: Using a Level or Total Station

When?
Use this method when you want to quickly set out a large number of pegs and maintain accuracy over a large area.

What you need
- Pegs, stakes or canes for each grid corner
- A survey tape that is as long as possible (at least the length of your grid size)
- A quickset (dumpy) level or a total station, with its tripod
- A 2 metre ranging pole (non-essential if using a total station on flat terrain)
- A fellow human that can be persuaded or coerced into assisting your work

Step 1: Establish a baseline
Place a peg near one end of your site and set up your level or total station directly above it using a plumb bob or laser plumb if your instrument has one.

Face your level or total station so that it is pointing across the middle of your survey area (if your survey area is oblong in shape your baseline should extend across the longer axis) then zero the horizontal angle of the instrument:

- On the level, this is achieved by rotating the plate at the base of the instrument so that 0 coincides with the marker on the angle window.

- On the Leica Builder total stations it is achieved by pressing the ‘Hz = 0’ button when on the THEO screen.

Once set, this orientation defines your baseline. Be careful not to knock it out of alignment.
Step 2: Place pegs along your baseline

Attach the end of your survey tape to the peg beneath your level or total station, then run it out in the direction of your baseline. When you get to the first grid size interval, turn to face the instrument and hold a peg or ranging pole against the correct distance marker on your tape (i.e., the 30m mark if setting out 30m grids).

Your assistant, who has remained next to your level or total station, should sight through the instrument (being careful not to turn it horizontally from its zero position) and indicate whether you need to move left or right to bring the peg onto the baseline. (Over large distances, and particularly in noisy or windy conditions, verbal communication becomes impossible and a system of hand signals is necessary to signal left or right.) Once your peg is the correct distance in the correct direction, place it in the ground.

Continue this process along your tape until you reach the end. Then detach the tape from its peg, re-attach it to the furthest peg and continue onwards, repeating as necessary until you have a perfectly straight line of pegs running across the length of your survey area.

Step 3: Place pegs along perpendicular lines

Turn your level or total station so that its horizontal angle reads 90° and lay out another line of pegs up to the edge of your survey area in that direction. Then turn the instrument to 270° and set out a line of pegs in that direction too.
Pick up your level or total station with its tripod and walk to the next peg along your baseline. Set up and level the instrument directly over the peg using the plumb bob or laser plumb.

Sight along your baseline to the most distant peg and zero the horizontal angle of the instrument, then turn the instrument to 90° and 270° to set out the next perpendicular line as above.

Repeat this process along each peg on your baseline.

**Step 4: Fill in any missing pegs**

Fill in any missing pegs either by moving the level or total station to pegs on your perpendicular lines, or simply measure them in by eye (as described in the final step of Method A).