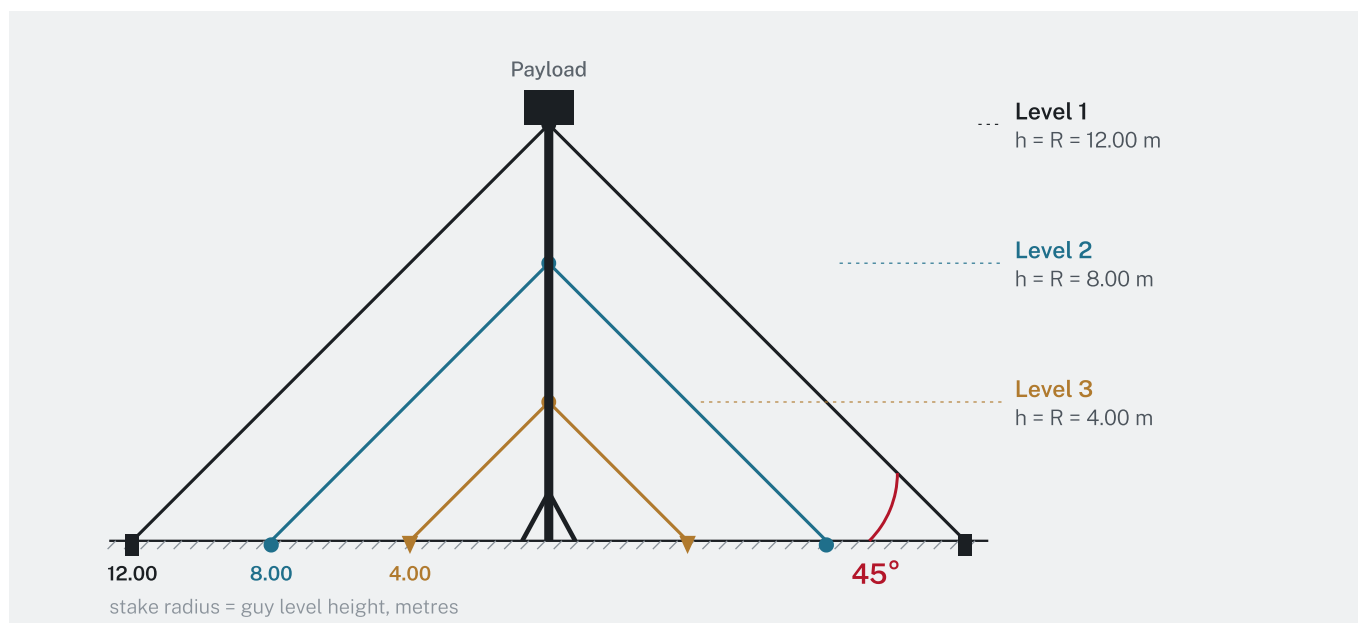


FIELD INSTALLATION GUIDE

Guy Wire Installation

MMT10 · MMT20 Manual Tripod/Mast Systems

This guide describes how the guy wires of the mast systems are installed in the field. Whatever the mast height and the number of guy levels, the three rules below do not change.



GUY GEOMETRY — EXAMPLE: 12.00 M MAST, THREE LEVELS (12 · 8 · 4 M)

RULE 1

One line

Every guy level uses **the same azimuth lines**. Levels are never rotated relative to one another.

RULE 2

$R = h$

The stake radius **equals the height** of that level's guy collar, so every rope runs at 45°. Permitted deviation on a constrained site: p. 02.

RULE 3

Separate stake

Each level ties to **its own stake**. Three levels on one line means three stakes.

BEFORE YOU START — EQUIPMENT

- Tape measure, at least 25 m
- Spirit level or plumb bob
- Come-along or lever puller
- Guy rope and tensioner — 4 per level
- Line marking material
- Sledgehammer and stake puller
- Crane scale or load cell
- Stakes — one per level, plus spares
- Thimbles and stainless rope clips
- Installation record

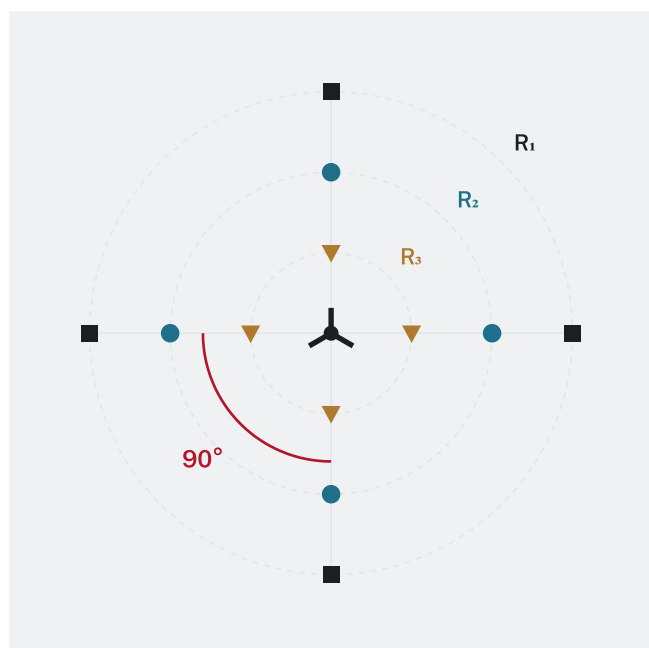
SAFETY — BEFORE YOU START

Power lines. The site must be no closer to an overhead power line than the full height of the mast.

Wind. Do not raise the mast in wind that makes the ropes hard to control by hand; raise it in calm air.

Exclusion zone. While the mast is being raised, nobody stands under it or in its fall direction.

01 Level and Stake Layout



■ Level 1 ● Level 2 ▼ Level 3

PLAN VIEW — FOUR LINES, A SEPARATE STAKE FOR EACH LEVEL

MARKING THE LINES

- 1 If the prevailing wind direction is known, set the first line into it.
- 2 Extend the opposite line along the same straight line; the mast centre stays exactly midway.
- 3 Set the two perpendicular lines with a **3-4-5 triangle**: the span between the 3 m and 4 m marks must be exactly **5 m**.

FINDING THE LEVEL HEIGHTS

Divide the mast height by the number of levels.

Level 1 is at the top; the rest step down at equal intervals, measured **from the ground**: three levels on a 12 m mast → **12 · 8 · 4 m**.

Radius = height. Start the tape at the mast axis and walk out along the line to the same figure.

Rope cut length = 1.5 × height — end terminations and tensioning allowance included.

HOW MANY LEVELS

The user chooses the number of levels; the table gives the **minimum**. Three levels may be fitted on a five-metre system as well.

MAST TOP HEIGHT H _t	MINIMUM NUMBER OF LEVELS
Up to 5 m	1 level
5–10 m	2 levels
10–15 m	3 levels

EXAMPLES

12 m mast · 3 levels

L1	12.00 m	rope 18.0 m
L2	8.00 m	rope 12.0 m
L3	4.00 m	rope 6.0 m

8 m mast · 2 levels

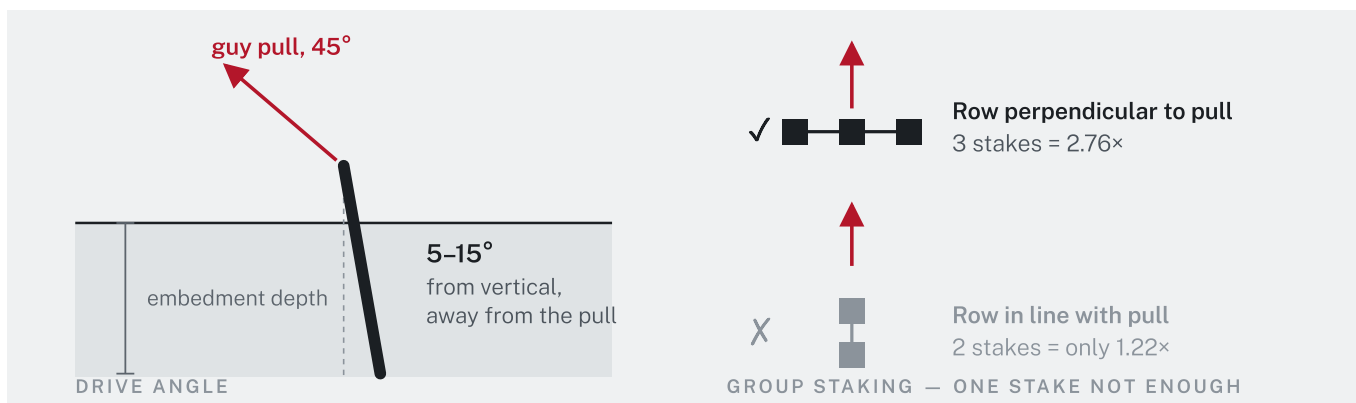
L1	8.00 m	rope 12.0 m
L2	4.00 m	rope 6.0 m

5 m mast · 3 levels

L1	5.00 m	rope 7.5 m
L2	3.33 m	rope 5.0 m
L3	1.67 m	rope 2.5 m

The span between levels must not exceed **5 m** — this is where the minimum number of levels comes from. The lowest level must not fall below the tripod top (MMT10 1.10 m, MMT20 1.40 m); if it does, reduce the number of levels. Where the site allows it, enlarging the radius by 20% lowers rope tension by 8% and stake load by 16%. The radius may never be less than two thirds of the level height; at that limit, stake capacity is increased by 50%.

02 Stakes and Anchors



A drive angle within 5–15° causes no loss of capacity; **at 30° the capacity drops by 23%**. In group staking, the spacing between stakes may not be less than one third of the embedment depth.

STAKE PULL-OUT CAPACITY — Ø25 MM STAKE, VERTICAL, 45° PULL, ROPE ≤50 MM OFF GROUND

SOIL	PENETRATION PER BLOW, MM	610 MM EMBEDMENT, kN	915 MM EMBEDMENT, kN
Very hard / very dense	< 5	6.0	11.1
Hard / dense	5 – 13	3.8	7.1
Stiff / medium dense	13 – 38	1.9	3.6
Medium	38 – 76	0.96	1.8
Soft / loose	76 – 152	0.48	0.89
Very soft / very loose	> 152	0.24	0.44

Identify the soil class with the sledgehammer: how far the stake sinks per blow selects the row. **In saturated (wet) ground these values are halved.** Factor of safety: 2.0 where the soil is known and confirmed by a pull test, 3.0 where it is not. **The working load must not exceed 50% of the measured ultimate capacity.** Correction factors for intermediate depths: 0.84 for 810 mm, 0.69 for 710 mm. The flat stakes in the kit do not match this table exactly; Inventra issues their capacities separately.

PULL TEST — ONE STAKE ON EVERY LINE

1. Drive the stake at 5–15° from vertical.
2. Pull in the rope direction with the come-along, through a crane scale or load cell, in steps up to the **test load**.
3. If there is visible movement, drive the stake deeper, switch to group staking or move the point.
4. Write the measured value on the installation record.

Test load = twice the rope force given on the installation record. With no record, apply at least **1.5 kN (≈150 kgf)** and write the measured value on the record.

GROUND THAT WILL NOT TAKE A STAKE

CONDITION	SOLUTION
Asphalt, concrete	Anchor bolt, or a ballast block — attach the rope at the block's bottom edge
Rock	Expanding wedge rock anchor
Frozen ground	Drill , do not drive. A driven stake will not enter frozen gravel
Soft, saturated ground	Duckbill or helical screw anchor

03 Rope, Pre-Tension and Installation Sequence

Rope. Use **non-conductive** rope so the antenna radiation pattern is not disturbed; polyester is the best-balanced choice in the field. Fit a thimble at every loop and a stainless rope clip at every termination.

Pre-tension. The value is given on the installation record. Tension opposing ropes equally; **with four guys, a plumb mast does not prove that the tensions are equal** — measure the opposing pairs separately. Over-tensioning reduces the load capacity of the mast.

The sequence is written for a single operator. **All guys are connected with the mast retracted; the mast is then extended with the guys attached.**

- 1 Set up the tripod, spread the legs equally and bring the top plate level with a spirit level.
- 2 Mark the azimuth lines — four lines, 90° apart. If the prevailing wind direction is known, set one line into it. Check that the lines clear the tripod legs and the operator walkway.
- 3 Calculate the level heights: divide the mast height by the number of levels. The stake radius equals the height; start the tape at the mast axis and mark points R₃, R₂ and R₁ on every line.
- 4 Drive the stakes — 5–15° from vertical, leaning away from the pull. Pull-test one stake on every line.
- 5 Fit the guy collars. The Level 1 collar goes immediately below the payload adapter.
- 6 Lay out the ropes and tie each rope to its own stake. Leave the tensioners fully open; check that no rope is fouled on another rope or on a tripod leg.
- 7 Extend the mast **from the bottom section upwards**; confirm by ear that the lock engages on every section. Take up the rope slack by hand, do not tension.
- 8 Tension from the bottom up: Level 3 first, then Level 2, Level 1 last. Tension opposing ropes in turn, in equal steps.
- 9 Re-tension. Tensioning an upper level slackens the ones below it; repeat step 8 once more.
- 10 Plumb the mast. Check it in two perpendicular planes with a plumb bob or spirit level.
- 11 Lock and record. Secure the tensioners and fill in the installation record.

04 Acceptance Checklist

Once the mast is plumb and before the system is handed over, verify each of the nine items below in turn. If any single item fails, the installation is not complete.

- ☐ Level height: calculated value ± 100 mm
- ☐ Stake radius: within $\pm 3\%$ of the chosen design value
- ☐ Guy angle 39° – 50° (56° maximum on a constrained site)
- ☐ Azimuth separation $90^\circ \pm 5^\circ$
- ☐ Azimuth difference between levels: 0°
- ☐ Mast plumb $1/400$ — 25 mm over 10 m
- ☐ Pull test: no movement at the test load
- ☐ Rope pre-tension: within $\pm 5\%$ of target
- ☐ Thimble and stainless rope clip at every loop

NEVER DO THIS

- Levels are **never rotated** relative to one another. All levels use the same azimuth lines.
- The levels on one line are **never gathered on a single stake** — the load on that stake multiplies by the number of levels and pulls it out of the ground.
- Ropes are **never over-tensioned**. Over-tensioning reduces the load capacity of the mast.
- Group stakes are **never driven one behind the other**; they are set in a row perpendicular to the pull.

AFTER INSTALLATION

Check the stake heads by hand **every day**; drive any that has loosened, or move it. **After rainfall** stake capacity is halved — repeat the pull test. Synthetic rope beds in over the first few days; check the tension **every 3–7 days**. Pre-tension is defined at the temperature of assembly — readjust it whenever the temperature changes by more than $\pm 20^\circ\text{C}$. After high wind, hail or snow loading, fully inspect the stakes, the rope terminations and the plumb of the mast.

05 Installation Record

Fill this in at every installation; one copy stays with the system. The pre-tension and test-load values are read from this record.

SITE / PROJECT

DATE

INSTALLED BY

MAST MODEL

MAST TOP HEIGHT H_t, M

NUMBER OF LEVELS

LEVEL HEIGHTS AND RADII — AS MEASURED

LEVEL	COLLAR HEIGHT H, M	STAKE RADIUS R, M	GUY ANGLE, °
Level 1			
Level 2			
Level 3			

STAKES AND PULL TEST — PER LINE

LINE	AZIMUTH, °	SOIL CLASS	EMBEDMENT DEPTH, MM	TEST LOAD, KN	RESULT
Line A					
Line B					
Line C					
Line D					

MAST PLUMB, MM / 10 M

AIR TEMPERATURE, °C

WIND, KM/H

PRE-TENSION — LEVEL 1, N

PRE-TENSION — LEVEL 2, N

PRE-TENSION — LEVEL 3, N

INSTALLED BY — SIGNATURE

ACCEPTED BY — SIGNATURE