



Product Data Sheet: Tilt Beam

The Tilt Beam is a lightweight, rigid aluminium beam that is used in conjunction with a Triaxial Tilt Node or a NanoPlus. The beam can be mounted in any orientation and rapidly deployed in single and daisy chained configurations.

Installation of the Tilt Beam can be performed with minimal tools in minutes. Complex bolting and washer arrangements are not required due to the beam's inbuilt bearing and joint system. This allows for thermal expansion and misalignment of the support brackets while still accurately monitoring the structure. The attached tilt node does not require any levelling, further reducing onsite installation time.

Key Features

- Lightweight and durable aluminium and stainless-steel construction.
- Fully wireless; no wiring or electrical connections required.
- Can be installed in any orientation without requiring levelling.
- Low friction, weather resistant bearings that do not require maintenance or lubrication.
- Automatically compensates for thermal expansion and misalignment of support brackets.
- Can be daisy chained to provide movement profiles.

Applications

- Movement monitoring of any structure
- Longitudinal settlement
- Tunnel convergence/divergence
- Lateral displacements

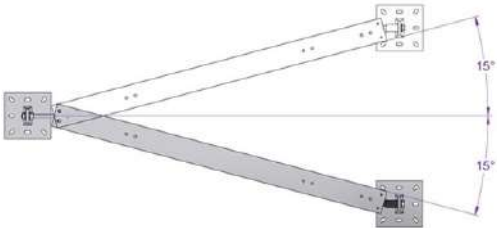
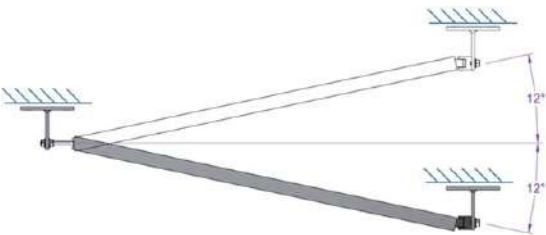
Tilt Beam



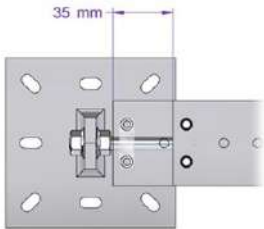
Physical Specifications

Parameter	Value
Beam Dimensions	500 mm, 1000 mm, 2000 mm, 3000 mm (custom lengths available on request)
Support Bracket Dimensions	Base: 100 x 100 mm Height: 75 mm
Total Mass (without node)	2 kg (approx. for 2 m beam)
Material	Aluminium with A2 stainless steel fasteners

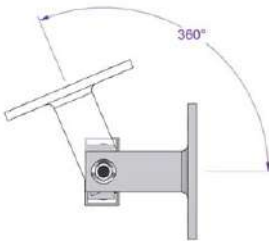
Vertical Range



Expansion Range



Rotational Range



Tilt Beam



Ordering Step 1 - Tilt Beam

Beam length is specified using the part numbers below. The length refers to the distance between the support bracket centres.

Part No.	Description
FF-BK-500	Tilt Beam 500 mm
FF-BK-1000	Tilt Beam 1000 mm
FF-BK-2000	Tilt Beam 2000 mm
FF-BK-3000	Tilt Beam 3000 mm
FF-BK-Cxxxx	Custom Length (xxxx mm) Tilt Beam

Ordering Step 2 - Tilt Beam Chain End Kit

A single end kit is required per beam chain. A single beam counts as a single chain and would require a single end kit. Daisy chained configurations require a single end kit per chain, e.g. a chain of 10 beams would only require one end kit.

Part No.	Description
FF-BE	Tilt Beam Chain End Kit

Ordering Step 3 - Tilt Node

Select the desired tilt node and accompanying mounting bracket. A tilt node is required for each beam.

Node Part No.	Bracket Part No.	Description	Battery Life
FM3N-IX	FF-MP-S360	FlatMesh Triaxial Tilt Node	12-15 years
LR3N-IX	FF-MP-S360	GeoWAN Triaxial Tilt Node	10-12 years
FM3NT-30	FF-BB30	FlatMesh NanoPlus Node	4-5 years



Product Data Sheet: FlatMesh Triaxial Tilt Node

The FlatMesh Triaxial Tilt Sensor Node is an extremely high precision and exceptionally stable three axis tilt sensor which reports its measurements through Senceive's FlatMesh wireless communications network to a FlatMesh Gateway.

Successfully used in many applications, including those measuring:

- Tunnel distortion
- Tunnel heave/settlement
- Embankment slippage
- Structural movement
- Rail track heave/settlement
- Rail trackbed cant and twist

Key features

- Integrated triaxial tilt sensor
- Extremely low noise performance
- Resolution of 0.0001° (0.0018 mm/m) and repeatability of $\pm 0.0005^\circ$ ($\pm 0.009 \text{ mm/m}$)
- Integrated long life battery
- 12-15 year battery life, including when acting as a relay node within the mesh communications network
- Integrated temperature sensor
- Versatile mounting options
- Waterproof to IP66 / IP67 / IP68
- Firmware is remotely upgradeable over the air via the gateway reducing costly site visits



FlatMesh Triaxial Tilt Node

Physical Specifications

Parameter	Value
Dimensions	90 x 90 x 60 mm
Dimensions including vent	90 x 96 x 60 mm
Total Mass	0.6 kg (approx.)
Housing Material	Die cast aluminium body
Internal Protection Marking	IP66 / IP67 IP68 (1 m for 24 hours)
Mounting Options	1/4" UNF holes in bottom, M4 blind holes in side Plates and brackets available for magnetic fixing, trackbed, stake and pole mounting, and many other applications
Operating Temperature Range	-40°C to +85°C

Internal Battery

Parameter	Value
Battery Type	Lithium Thionyl Chloride, non-rechargeable
Nominal Voltage	3.6 V
Nominal Capacity	19000 mAh
Typical Battery Life	12-15 years at 30 minute reporting intervals, including when acting as a relay node. Consult with Senceive for your application.

FlatMesh Triaxial Tilt Node



FlatMesh Radio Specifications

Parameter	Value
Communication Type	Proprietary FlatMesh v3 Mesh Networking Protocols IEEE 802.15.4 compliant
Frequency Band	2400 – 2485 MHz ISM Band
Maximum Transmit Power	6.5 dBm (EN 300 328 v1.8.1)
Maximum Permitted Antenna Gain	2.2 dBi
Range	Up to 300 m depending on the environment and fitted antenna Consult with Senceive for your application
RF Module	Senceive FM3Node

Tilt Sensor Specification

Parameter	Value
Resolution	0.0001° (0.00175 mm/m)
Repeatability (-IX variant)	±0.0005° (±0.0087 mm/m)
Repeatability (-IXH variant)	±0.0025° (±0.0436 mm/m)
Range	±90°

Certifications

- Tested to conformity with all the essential requirements of the Radio Equipment Directive 2014/53/EU and RoHS Directive 2011/65/EU
- FCC Grant of Equipment Authorization
- RCM (Australia and New Zealand)

FlatMesh Triaxial Tilt Node



Ordering Information and Accessories

Model	Description
FM3N-IX	FlatMesh 3 Triaxial Inclinator
FM3N-IXH	FlatMesh 3 Triaxial Inclinator (High-g)
FF-MP-S360	Swivel mounting kit with 360-degree adjustment range Screw directly to vertical walls
FF-MP-V	Vertical mounting plate Use U-bolts to fix to poles or stakes Use glue to fix to walls where drilling is not permitted (Order with FF-MP-S360)
FF-MP-RA	Right angle mounting bracket Screw to concrete tunnel linings and inclined walls (Order with FF-MP-S360)
FF-MP-T2	Trackbed mounting plate kit
FF-BK-xxxx FF-BE	Tilt beam kit See separate datasheet for more information
FA-FM-WPS	Waterproof straight antenna Overall node height 168 mm (approx) when fitted Maximum gain +1.1 dBi
FA-FM-LPS	Waterproof low profile straight antenna Minimum overall node height, perfect for trackbed and tight spots Overall node height 92 mm (approx) when fitted Maximum gain 0 dBi
FA-FM-ADJ	Adjustable angle antenna Flexible installation, perfect for use in tunnels and indoor environments Overall node height 202 mm (approx) when fitted and upright Overall node height 102 mm (approx) when fitted and at 90-degree angle Maximum gain +2 dBi
FC-NC	Antenna cover kit Use with FA-FM-LPS antenna Overall node height 96 mm (approx) when fitted



Product Data Sheet:

Nano Triaxial Tilt Sensor Node

The FlatMesh Nano is an extremely high precision and exceptionally stable three axis tilt sensor which reports its measurements through Senceive's FlatMesh wireless communications network to a FlatMesh Gateway.

Successfully applied in many applications, including those measuring:

- Tunnel distortion
- Tunnel heave/settlement
- Embankment slippage
- Structural movement
- Rail track heave/settlement
- Rail trackbed cant and twist

Key features

- Integrated triaxial tilt sensor
- Extremely low noise performance
- Extremely low profile
- Resolution of 0.0001° (0.0018 mm/m) and repeatability of $\pm 0.0005^\circ$ ($\pm 0.009 \text{ mm/m}$)
- Operational in any orientation
- Integrated battery
- 1 year battery life, including when acting as a relay node within the mesh communications network
- Integrated temperature sensor
- Versatile mounting options
- Waterproof to IP67 / IP68

Nano Triaxial Tilt Sensor Node



Physical Specifications

Parameter	Value
Diameter	40 mm
Height	30 mm
Total Mass	40 g
Housing Material	PVC and Aluminium
Protection (BS EN 60529: 1992 + A2: 2013)	IP67 IP68 at 2 m for 24 hours
Mounting Options	Magnetic, screws, gluing
Operating Temperature Range	-40°C to +85°C

FlatMesh Radio Specifications

Parameter	Value
Communication Type	Proprietary FlatMesh v3 Mesh Networking Protocols IEEE 802.15.4 compliant
Frequency Band	2400 – 2485 MHz ISM Band
Maximum Transmit Power (EN 300 328 v1.8.1)	6.5 dBm
Range	Up to 300 m depending on the environment and fitted antenna Consult with Senceive for your application
RF Module	FM3Nano

Nano Triaxial Tilt Sensor Node



Tilt Sensor Specifications

Parameter	Value
Resolution	0.0001° (0.00175 mm/m)
Repeatability	±0.0005° (±0.0087 mm/m)
Range	±90°

Internal Battery

Parameter	Value
Battery Type	Lithium Manganese Dioxide
Nominal Voltage	3.0 V
Nominal Capacity	1000 mAh
Typical Battery Life	9 – 12 months at 20-30 minute reporting intervals, including when acting as a relay node Consult with Senceive for your application

Certifications

- Tested to conformity with all the essential requirements of the Radio Equipment Directive 2014/53/EU and RoHS Directive 2011/65/EU
- FCC Grant of Equipment Authorization

Nano Triaxial Tilt Sensor Node



Ordering Information and Accessories

Model	Description
FM3NT-10	FlatMesh Nano
FF-GS10	Direct gluing plate Single use direct gluing to structures.
FF-MK10	Magnetic mounting kit Perfect for steel or cast iron structures



Product Data Sheet:

NanoPlus Triaxial Tilt Sensor Node

The FlatMesh NanoPlus is an extremely high precision and exceptionally stable three axis tilt sensor which reports its measurements through Senceive's FlatMesh wireless communications network to a FlatMesh Gateway.

Successfully applied in many applications, including those measuring:

- Tunnel distortion
- Tunnel heave/settlement
- Embankment slippage
- Structural movement
- Rail track heave/settlement
- Rail trackbed cant and twist

Key features

- Integrated triaxial tilt sensor
- Extremely low noise performance
- Extremely low profile
- Resolution of 0.0001° (0.0018 mm/m) and repeatability of $\pm 0.0005^\circ$ ($\pm 0.009 \text{ mm/m}$)
- Operational in any orientation
- Integrated battery
- 5 year battery life, including when acting as a relay node within the mesh communications network
- Integrated temperature sensor
- Versatile mounting options
- Waterproof to IP67 / IP68

NanoPlus Triaxial Tilt Sensor Node



Physical Specifications

Parameter	Value
Diameter	58 mm
Height	45 mm
Total Mass	110 g
Housing Material	Polycarbonate and Aluminium
Protection (BS EN 60529: 1992 + A2: 2013)	IP67 IP68 at 2 m for 24 hours
Mounting Options	Magnetic, screws, gluing, or clamping
Operating Temperature Range	-40°C to +85°C

FlatMesh Radio Specifications

Parameter	Value
Communication Type	Proprietary FlatMesh v3 Mesh Networking Protocols IEEE 802.15.4 compliant
Frequency Band	2400 – 2485 MHz ISM Band
Maximum Transmit Power (EN 300 328 v1.8.1)	6.5 dBm
Range	Up to 300 m depending on the environment and fitted antenna Consult with Senceive for your application
RF Module	FM3Nano

NanoPlus Triaxial Tilt Sensor Node



Tilt Sensor Specifications

Parameter	Value
Resolution	0.0001° (0.00175 mm/m)
Repeatability	±0.0005° (±0.0087 mm/m)
Range	±90°

Internal Battery

Parameter	Value
Battery Type	Lithium Thionyl Chloride
Nominal Voltage	3.6 V
Nominal Capacity	4400 mAh
Typical Battery Life	4-5 years at 20-30 minute reporting intervals, including when acting as a relay node Consult with Senceive for your application

Certifications

- Tested to conformity with all the essential requirements of the Radio Equipment Directive 2014/53/EU and RoHS Directive 2011/65/EU
- FCC Grant of Equipment Authorization

NanoPlus Triaxial Tilt Sensor Node



Ordering Information and Accessories

Model	Description
FM3NT-30	FlatMesh NanoPlus
FF-GS30	Direct gluing plate Single use direct gluing to structures.
FF-MK30	Magnetic mounting kit Perfect for steel or cast iron structures
FF-T2P30	Two Part Mount Trackbed, screwing, gluing
FF-M8S30	M8 Stud Mount Threaded prism mounts
FF-C30	Clamp Mount Stakes, Scaffolding, handrails
FF-BB30	Flange Mount Screwing or bolting directly to a structure Fits Tilt Beam Kit FF-BK-xxxx



Product Data Sheet:

NanoMacro Triaxial Tilt Sensor Node

The FlatMesh NanoMacro is an extremely high precision and exceptionally stable three axis tilt sensor which reports its measurements through Senceive's FlatMesh wireless communications network to a FlatMesh Gateway.

The FlatMesh NanoMacro is highly robust, has a long battery life, and comes with Near Field Communication (NFC)™ capability, enabling on the spot interactions with the node.

Successfully applied in many applications, including those measuring:

- Tunnel deformation
- Tunnel heave/settlement
- Embankment slippage
- Structural movement
- Rail track heave/settlement
- Rail trackbed cant and twist

Key features

- Integrated triaxial tilt sensor
- Extremely low noise performance
- Extremely low profile
- Resolution of 0.0001° (0.0018 mm/m) and repeatability of $\pm 0.0005^\circ$ (± 0.009 mm/m) (Standard version)
- Operational in any orientation
- Integrated battery
- 12-15 year battery life, including when acting as a relay node within the mesh communications network
- Integrated temperature sensor
- Versatile mounting options
- Waterproof to IP68 / IP69K
- NFC capability, enabling on the spot adjustments to the node
- "Sleep mode" functionality

NanoMacro Triaxial Tilt Sensor Node



Physical Specifications

Parameter	Value
Diameter	86.7 mm
Height	64.2 mm
Total Mass	305 g
Housing Material	Polycarbonate and Aluminium
Protection	IP68 at 1 m for 24 hours IP69K
Mounting Options	Magnetic, screws, gluing, swivel mount or clamping
Operating Temperature Range	-40°C to +85°C

FlatMesh Radio Specifications

Parameter	Value
Communication Type	Proprietary FlatMesh v3 Mesh Networking Protocols IEEE 802.15.4 compliant
Frequency Band	2400 – 2485 MHz ISM Band
Maximum Transmit Power (EN 300 328 v2.2.2)	6.5 dBm
Range	Up to 300 m depending on the environment and fitted antenna Consult with Senceive for your application
RF Module	FM3Nano

NanoMacro Triaxial Tilt Sensor Node



Tilt Sensor Specifications

Parameter	Value
Resolution	0.0001° (0.00175 mm/m)
Repeatability	±0.0005° (±0.0087 mm/m)
Repeatability (High G variant)	±0.0025° (±0.0436 mm/m)
Range	±90°

Internal Battery

Parameter	Value
Battery Type	Lithium Thionyl Chloride
Nominal Voltage	3.6 V
Nominal Capacity	19000 mAh
Typical Battery Life	12-15 years at 30 minute reporting intervals, including when acting as a relay node Consult with Senceive for your application

Certifications

- Tested to conformity with all the essential requirements of the Radio Equipment Directive 2014/53/EU and RoHS Directive 2011/65/EU
- FCC Grant of Equipment Authorization
- Transit Drop Tested to MIL-STD-810G CN1 method 516.7
- Vibration and Shock tested to EN 50125-3 on sleeper levels

Patents pending in the UK and other jurisdictions. Registered design.

NanoMacro Triaxial Tilt Sensor Node



Ordering Information and Accessories

Model	Description
FM3NT-50	FlatMesh NanoMacro
FM3NT-50H	FlatMesh NanoMacro (High-G)
FS-FM3NT-NFC	Contactless NFC Reader
FF-MK50	Magnetic Mounting Kit Perfect for steel or cast iron structures
FF-T2P50	Two Part Mount Trackbed, screwing, gluing
FF-S50	Swivel Mount Screw directly to vertical walls
FF-SK-NT50	NanoMacro Stake Mount NanoMacro Stake Mount Kit for self-supplied stake/pole with diameter 23-53 mm
FF-SK-NT50-1250	NanoMacro Stake Mount Kit with 1250 mm long stake
FF-SK-NT50-1500	NanoMacro Stake Mount Kit with 1500 mm long stake
FF-SK-NT50-1750	NanoMacro Stake Mount Kit with 1750 mm long stake



Product Data Sheet

GeoWAN Triaxial Tilt Node

The GeoWAN Triaxial Tilt Sensor Node is an extremely high precision and exceptionally stable three axis tilt sensor which reports its measurements using Senceive's GeoWAN wireless communications network to a GeoWAN Gateway.

Successfully applied in many applications, including those measuring:

- Tunnel distortion
- Tunnel heave/settlement
- Embankment slippage
- Structural movement
- Rail track heave/settlement
- Rail trackbed cant and twist

Key features

- Integrated triaxial tilt sensor
- Extremely low noise performance
- Resolution of 0.0001° (0.0018 mm/m) and repeatability of $\pm 0.0005^\circ$ ($\pm 0.009 \text{ mm/m}$)
- Integrated long life battery
- Up to 12 year battery life
- Integrated temperature sensor
- Versatile mounting options
- Waterproof to IP66 / IP67 / IP68

GeoWAN Triaxial Tilt Node



Physical Specifications

Parameter	Value
Dimensions (excluding antenna and vent)	90 x 90 x 60 mm
Dimensions (excluding antenna)	90 x 96 x 60 mm
Total Mass	0.6 kg (approx.)
Housing Material	Die cast aluminium body
Internal Protection Marking	IP66 / IP67 IP68 (1 m for 24 hours)
Mounting Options	1/4" UNF holes in bottom, M4 blind holes in side Plates and brackets available for magnetic fixing, trackbed, stake and pole mounting, and many other applications
Operating Temperature Range	-40°C to +85°C

Internal Battery

Parameter	Value
Battery Type	Lithium Thionyl Chloride, non-rechargeable
Nominal Voltage	3.6 V
Nominal Capacity	19000 mAh
Typical Battery Life	12 years at 30 minute reporting intervals Consult with Senceive for your application

GeoWAN Triaxial Tilt Node



GeoWAN Radio Specifications

Parameter	Value
Communication Type	Star Topology
Frequency Band (868 variant)	863 MHz - 870 MHz ISM Band
Frequency Band (902 variant)	902 MHz - 928 MHz ISM Band
Frequency Band (915 variant)	915 MHz - 928 MHz ISM Band
Maximum Transmit Power (868 variant)	14 dBm conducted
Maximum Transmit Power (902 variant)	18 dBm conducted
Maximum Transmit Power (915 variant)	18 dBm conducted
Maximum Antenna Gain	1.8 dBi
Range	Up to 15 km depending on the environment and fitted antenna Consult with Senceive for your application

Tilt Sensor Specification

Parameter	Value
Resolution	0.0001° (0.00175 mm/m)
Repeatability (-IX variant)	±0.0005° (±0.0087 mm/m)
Repeatability (-IXH variant)	±0.0025° (±0.0436 mm/m)
Range	±90°

Sampling and Reporting

Parameter	Value
Maximum Reporting Frequency	30 seconds
Sample Storage	Stores the last 29 days of samples at a reporting interval of 30 minutes when using radio preset 1

GeoWAN Triaxial Tilt Node



Certifications

- Tested to conformity with all the essential requirements of the Radio Equipment Directive 2014/53/EU and RoHS Directive 2011/65/EU
- FCC Grant of Equipment Authorization
- ACB ISSED Canada Certificate: 24373-LR3N
- RCM (Australia and New Zealand)

Ordering Information and Accessories

Model	Description
LR3N-IX(868)	GeoWAN Triaxial Inclinator Europe
LR3N-IXH(868)	GeoWAN Triaxial Inclinator (High-g) Europe
LR3N-IX(902)	GeoWAN Triaxial Inclinator North America, South America
LR3N-IXH(902)	GeoWAN Triaxial Inclinator (High-g) North America, South America
LR3N-IX(915)	GeoWAN Triaxial Inclinator Australia, New Zealand, Chile, Brazil
LR3N-IXH(915)	GeoWAN Triaxial Inclinator (High-g) Australia, New Zealand, Chile, Brazil
FF-MP-S360	Swivel mounting kit with 360-degree adjustment range Screw directly to vertical walls
FF-MP-V	Vertical mounting plate Use U-bolts to fix to poles or stakes Use glue to fix to walls where drilling is not permitted (Order with FF-MP-S360)
FF-MP-RA	Right angle mounting bracket Screw to concrete tunnel linings and inclined walls (Order with FF-MP-S360)
FF-MP-T2	Trackbed mounting plate kit
FF-BK-xxxx FF-BE	Tilt beam kit See separate datasheet for more information
FA-LR-WPS	Waterproof straight antenna Overall node height 168 mm (approx) when antenna fitted Maximum gain +1.8 dBi