WISENMESHNET® Product Specification

Wisen Innovation Ltd

14th June 2018

Revision History and Clarification

Rev.	Issue Date	Version Control	Written by	Revised by
V24	18/09/2016	1. Change from V23 to V24; 2. Small photo deleted from the feature table to save space; 3. Add more photos at the end of each table; 4. Delete the battery life from each production specification table and conclude them battery life session; 5. Add newly released product features, including: B-Type Gateway, Laser Distance Node, 2-Channel 4-20mA/1-5V Interface Node and 6-Channel Foil Gauge Node; 6. Add the battery life estimation charts for the new products; 7. Node data storage changed from "> 300 messages during meshing" to "Min. 450 Messages during Meshing".	Y.W.	Steve Thurgood
V25	18/09/2016	1. Text formatting 2. Adding B-Gateway 110-240VAC to 12VDC adapter, RS232 to USB, TTL to USB connection figures.	Y.W.	B.J.
V26	01/11/2016	Providing individual product specification documents and the combined version.	X.Y.H.; J.T.S.	Y.W.
V27	28/11/2016	Adding the new product Laser Tilt Node Specification. Adding the Mini Smart Gateway Specification.	X.Y.H.; J.T.S.	Y.W.
V28	24/07/2017	Adding Series number to each product Updating new Series-1F06 Leica Laser + the battery life Deleting the old Series-1E00 Laser node + the related battery life Updating new Series-1304 Mini Tilt + the battery life Rewording +/-10 degree and +/-30 degree rewording; Adding notice on B-Gateway internal battery life: "75% of the above values when there are more than 15 nodes taken under one gateway"	Y.W.	
V29	20/10/2017	1) Terminology Section: "ED_Level" and Remote Command Section: "ED_Value" changed to "Signal Threshold", same as software platform documentation; 2) B-Gateway Spec table, wrong description: "(Max. Current <= 2Amp)" changed to "Min. Current >= 2Amp"; 3) WISENMESHNET® Product Overview Section, Page 4, "6x Green/Blue/Red LEDs Onsite Triggering" changed to "Up to 5x Green/Blue/Red LEDs Onsite Triggering"; 4) Adding the latest B-Gateway V8.0 Version layout graph & SIM Card Orientation during inserting; 5) Adding Solar Unit and External Battery Unit.	X.Y.H.	Y.W.
V3.0	05/03/2018	1. Version control and change: 2018 - V3.0 instead of V30; 2. Deleting 1003 A-Gateway, 1303 Tilt & 6-Chanel Foil Gauge; 3. All ER34615M battery is changed to ER34615 except 1F06 laser tilt node; 4. Gateway daughter board interface added (WIFI/Ethernet) and deleted indoor adapter;	X.Y.H.	Y.W.

		5. 8-VW added in the VW Spec; 6. Add Visual Node@page5; 7. Add Visual Gateway@page5		

V3.1	14/06/2018	1. 1F06 Laser:
		    A. Add the instructions to "Laser_Pointing_Mode Switch";
		    B. Add the instructions to "Laser Front Lenses Protection Cover".
		2. Battery description has been improved to its full name, i.e., "3.6V Lithium primary D-Cell ER34615";
		3. The node "Storage" word has changed to "Local Storage";
		4. IP Rating changed to ">= IP66" from "IP66";
		5. Change "Visual Gateway" word into "Camera Node".
			Y.W.	X.Y.H.

Contents

Terminology

Table of Terminology			
	English	中文	Abbreviation
Wireless Sensor Network Related			
1	Wireless Sensor Network	无线传感网络	WSN
2	Mesh Networking	网状网络	-
3	Ultra-Low Power	超低功耗	-
4	Artificial Intelligence	人工智能	AI
5	Hop	中继跳数	-
WSN Monitoring Related			
1	Sampling Time Interval	监测频率	T
2	Radio Frequency	无线频段	F
3	Back_Time	数据回传时间	-
4	Signal Threshold	入网信号强度门限值	-
5	Relay_Factor	中继时间	-
Product Related			
1	Smart Gateway	智能终端	Gateway/GW
2	WSN Dual-Axis Tilt Sensor Node	无线传感网络双倾角传感支点	Tilt Node
3	WSN Laser Distance Sensor Node	无线传感网络激光测距传感支点	Laser Distance Node
4	WSN Vibrating Wire Interface Node	无线传感网络振弦式采集支点	VW Interface Node
5	WSN 4-20mA/1-5V Interface Node	4-20mA/1-5V 无线传感网络采集支点	4-20mA/1-5V Interface Node
6	WSN 120Ω Foil Gauge Interface Node	120Ω 应变无线传感网络采集支点	120Ω FG Interface Node
7	WSN Visual Node	无线传感网络可视化功能支点	Visual Node
Sensor Related			
1	Vibrating Wire Gauge	振弦式应变传感器	VW Gauge
2	Foil Gauge	电阻式应变传感器	FG
Certificate Related			
1	Electromagnetic Compatibility	电磁兼容	EMC
2	London Underground Ltd Product Approval	伦敦地铁装备认证	LUL Approval
Material and Coating			
1	Epoxy Polyester Powder Coating	环氧聚酯树脂粉末涂料	-
2	Aluminium-Alloy Die Castings 12	铝合金压铸件 12	ADC12
3	Ingress Protection Rating	防护等级	IP

WISENMESHNET® Product Overview

WISENMESHNET® Node Series							
Sensor Node (S-Node) Series			Interface Node (I-Node) Series			Function Node (F-Node) Series	
Dual-Axis Tilt (1302)	Mini Dual-Axis Tilt (1304)	Laser Distance (1F06)	1/4/8-Channel Vibrating Wire (1A04/1A05/1A06)	2-Channel 4-20mA (1C02)	2-Channel 1-5V (1C02)	Visual Node	Camera Node
Range [-10,10]° Accuracy 0.01°	[-10,10]° 0.01°	[0.05,33]m 1.0mm	[400,6000]Hz 0.015%@Any Reading	[4,20]mA 0.1%@Any Reading	[1,5]V 0.1%@Any Reading	Up to 3x Green/Blue/Red LEDs Onsite Triggering	3x Green/Blue/Red LEDs Onsite Triggering; 2M Pixel camera

WISENMESHNET® Smart Gateway Series (1004)				
Internal Battery (Non-rechargeable/Rechargeable)	Solar Power/AC Power	Mobile Network (default factory setting) 2G/2.5G/3G/4G Module	Standard RS232 Output 3rd Party Converter: 232 to: 485/Ethernet/Fibre Optics/WIFI/433MHz Module, etc.	SD Storage: 1.5Yr Data

WISENMESHNET® Server	
Linux Server (Recommended) + Data FTP	Local Windows Server

WISENMESHNET® Visualisation Platform									
Login Control	Summary Table	Data Plot	2D Site Planning	Mesh Topology	Data Exporting	Calibration Download	Remote Control	Warning	Project Management

Note: All Wisen products are powered by WISENMESHNET® Wireless Sensor Network Communication Protocol.

WISENMESHNET® Smart Gateway Series

WISENMESHNET® B-Type Smart Gateway (1004 Series) @25°C	
Basics	
Primary Battery Power	Qty. x 4 (3.6V Lithium primary D-Cell ER34615)
Secondary DC Power	7V - 32VDC (Min. Current >= 2Amp) Or with external 100-240VAC adaptor
Mobile Network Stop Voltage	>= 5.5VDC
Mesh Stop Voltage	4.5VDC
Local Storage	8GB (Min. 1.5 Yrs Storage)
L x W x H	180 x 140 x 60mm
Weight	<= 2.0kg
Cable Gland	Qty. 1 x EMC-CMA12 for external RS232 connection Qty. 1 x EMC-CMA14 for external DC input power connection
Wire Connection	DC In - Spring type wiring terminal
External Interface	
Wireless Module	Compatible with 2G/2.5G/3G/4G of Micro SIM card
Wired Port	RS232
WSN Interface	
WSN Protocol	WISENMESHNET® Protocol
Low Power Mode	T>=5min and Server Connection Ratio DTU_T = [1,99]T
Standard System Parameter	
Temperature	Measurement Range: -40 to 80°C, Accuracy: +/-2°C
Voltage	Accuracy: +/-0.1V
Re-Calibration Method	
Inspection Period	Every 3 Years by Manufacturer (or inspected by arranged methods)
Industrial Standard	
Casing and Painting Materials	Aluminium-Alloy Die Castings 12 (Epoxy Polyester Powder Coating)
IP Rating	>= IP66
Operating Temperature	-40 to 80°C
Fire Proof	Approved
Certificates	CE, London Underground Product Approval
Applications	
A gateway is used as a key unit in Wireless Sensor Network system. It is responsible for the command issuing (such as T, F modifications) to and data collection from all the nodes involved in a mesh network; meanwhile, it forwards the data and system information to the remote server via mobile network or the local server via standard RS232 connections.	
Non-Standard Accessory	
A. RS232 to USB connection cable from a gateway to a PC for local parameter configuration; [Software to use: WISENMESHNET® Standard Serial Port Software V3.0.11 or above] B. TTL to USB 1m cable to read the mesh data from a gateway in parallel to the mobile network data transmission; [Software to use: WISENMESHNET® Standard Serial Port Software V3.0.11 or above]	

C. WIFI interface daughter board;

D. Ethernet interface daughter board;

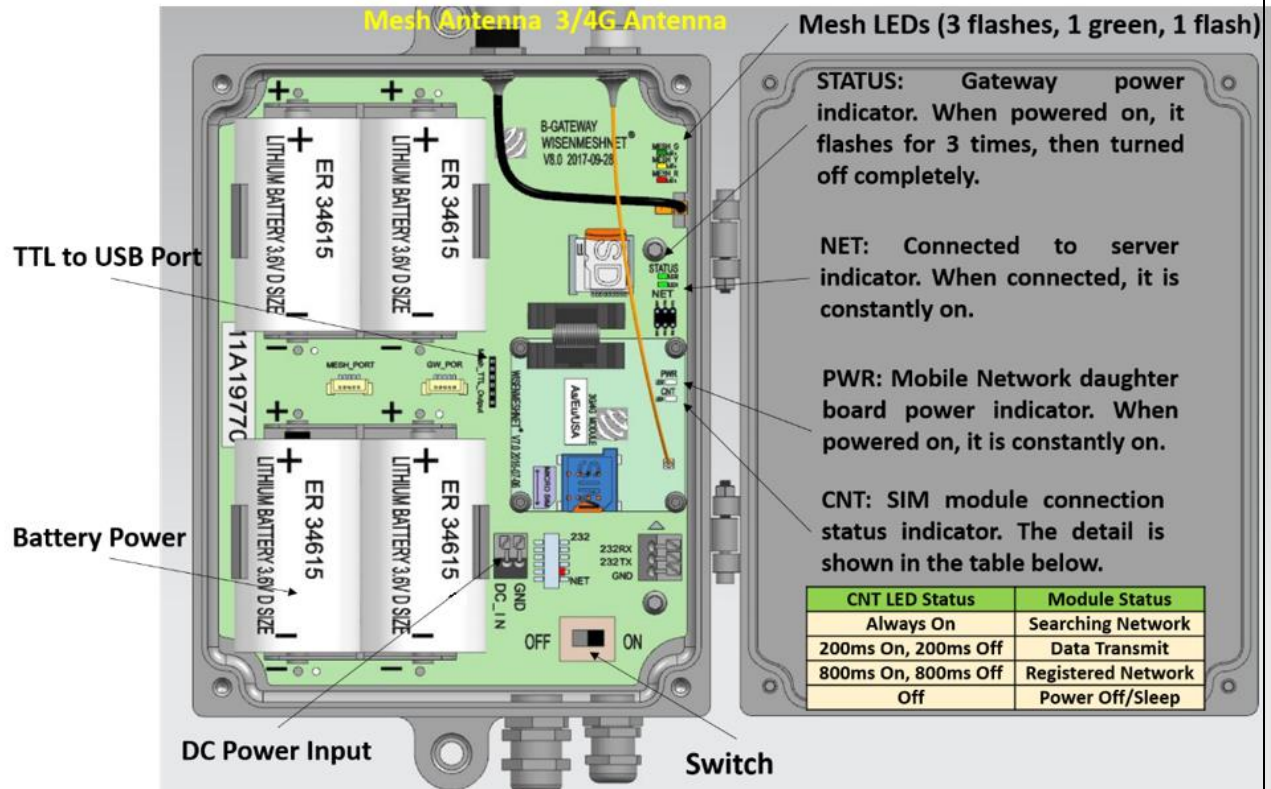E. Outdoor adaptor, IP68: 110-240VAC to 12VDC@5.0A.

Gateway PCB Layout

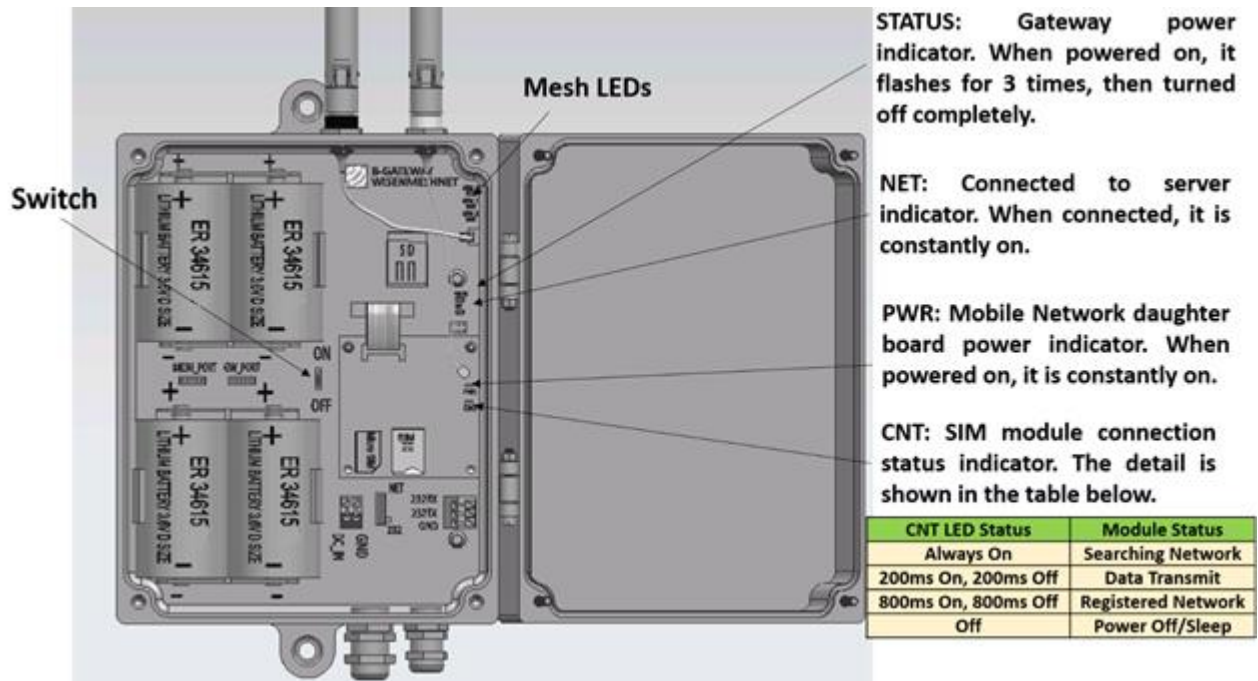Figure. V8.0 B-Gateway Layout (Released after Feb. 2018).

Figure. V7.0 B-Gateway Layout (Released after Oct. 2016).

Highlights

1. When connected to a remote server, "NET" LED will be constantly on;

2. Unlike A-Gateway which takes "IP Address" and "Port Number" as remote server destination, B-Gateway uses "Domain Name" and "Port Number" instead.

Figure. 110-240VAC to 12VDC@5A Adapter Connection.
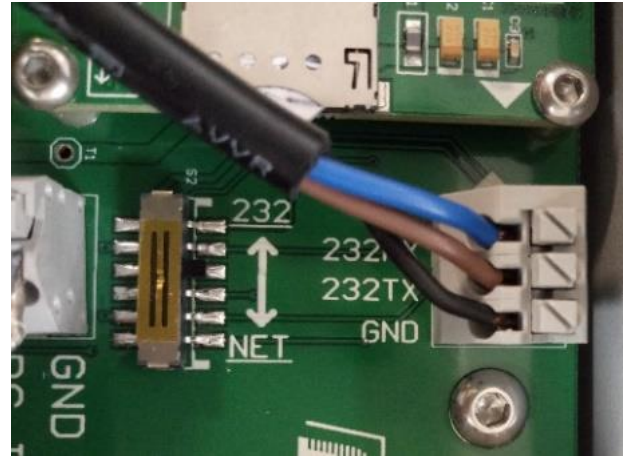
Figure. RS232 to USB Connection.
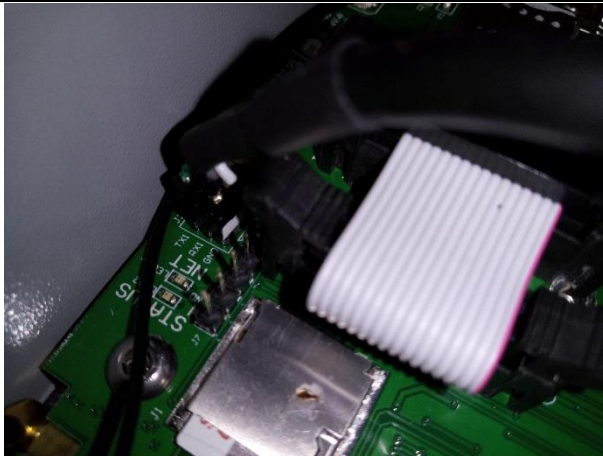
Figure. TTL to USB Connection.

Installation Guidance

Figure. B-Gateway Product Photos.
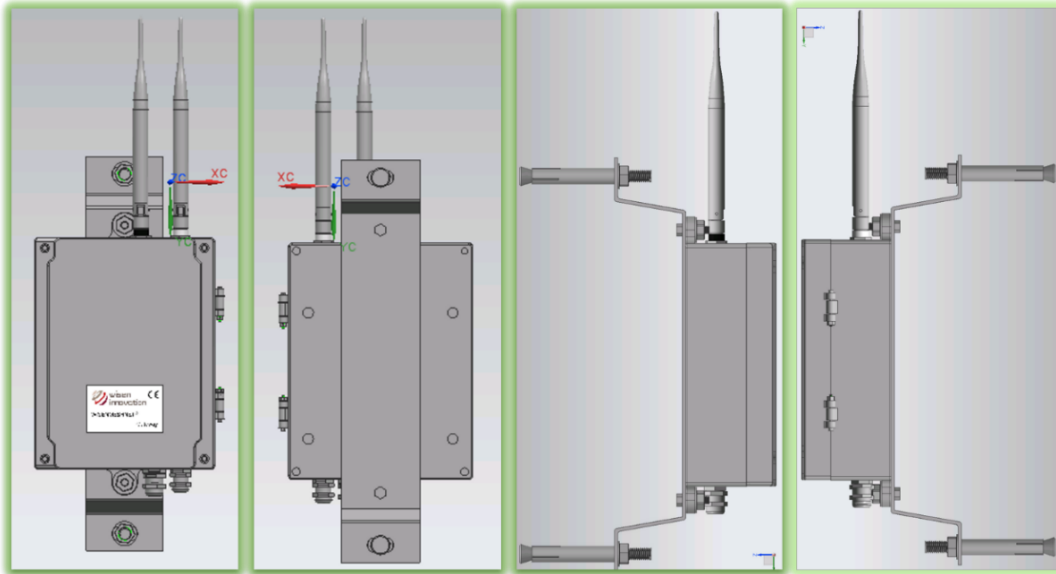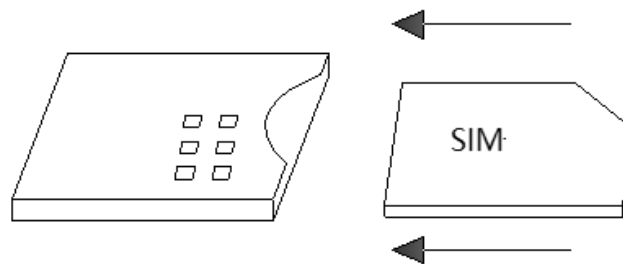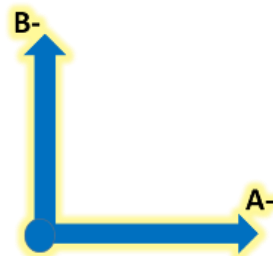
Figure. Gateway Fixing Bracket.

Figure. SIM Card Orientation.

WISENMESHNET® Mini Smart Gateway (1003 Series) @25°C	
Basics	
Primary DC Power	USB 5VDC
L x W x H	52 x 50 x 40mm
Weight	< 80g
Cable Gland	Qty. 1 x USB Connection
External Interface	
Wired Port	USB
WSN Interface	
WSN Protocol	WISENMESHNET® Protocol
Standard System Parameter	
Temperature	Measurement Range: -40 to 80°C, Accuracy: +/-2°C
Voltage	Accuracy: +/-0.1V
Re-Calibration Method	
Inspection Period	Every 3 Years by Manufacturer (or inspected by arranged methods)
Industrial Standard	
Casing and Painting Materials	PC
Operating Temperature	-40 to 80°C
Applications	
A gateway is used as a key unit in Wireless Sensor Network system. It is responsible for the command issuing (such as T, F modifications) to and data collection from all the nodes involved in a mesh network; meanwhile, it forwards the data and system information to the local PC via standard USB connection.	
Non-Standard Accessory	
A. USB connection cable from a gateway to a PC for local parameter configuration. [Software to use: WISENMESHNET® Standard Serial Port Software V3.0.11 or above]	

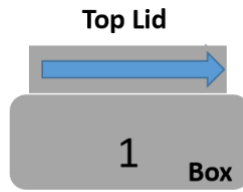Figure. Mini Gateway Product Photo and the relate USB Connection.

WISENMESHNET® Sensor Node Series

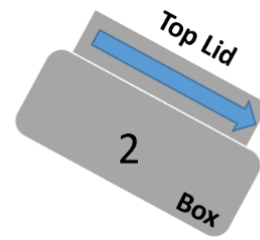| WISENMESHNET® Mini Dual-Axis Tilt Node (1302/1304 Series) @25°C		
Basics	**Standard Dual-Axis Tilt Node (1302)**	**Mini Dual-Axis Tilt Node (1304)**
Battery Power	Qty. x 1 (3.6V Lithium primary D-Cell ER34615)	Qty. x 1 (3.6V Lithium primary 2/3A ER17335)
Accuracy Stop Voltage	2.7VDC	
Mesh Stop Voltage	2.1VDC	
Battery Connection	Standard Metal Battery Holder	
Working Current (DC)	Max. 23mA (Typ. 18mA)	
Local Storage	Min. 450 Messages during Meshing	
L x W x H	80 x 75 x 57mm	52 x 50 x 40mm
Weight	0.43kg	98g
Primary Sensor		
Sensor Type	MEMS Dual-Axis Tilt Sensor, A-axis; B-axis Tilt Values	
Range	-30°- +30°	
Accuracy	0.01° (36" or 0.1745mm/m) for readings within range [-10°, +10°]; 0.04° (144" or 0.700mm/m) for readings within range [-30°, +30°]	
Resolution	0.0025° (9" or 0.0436mm/m)	
Long Term Stability	< 0.014° (50" or 0.2443mm/m)	
Standard System Parameter		
Temperature	Range: -40 to 80°C, Accuracy: +/-2°C	Range: -40 to 80°C, Accuracy: +/-1°C, typical 0.5°C; Resolution: 0.1°C
Voltage	Accuracy: +/- 0.1V	
WSN Interface		
WSN Protocol	WISENMESHNET® Protocol	
Industrial Standard		
Casing and Painting Materials	Aluminium-Alloy Die Castings 12 (Epoxy Polyester Powder Coating)	PC
IP Rating	>= IP66	
Operating Temperature	-40 to 80°C	
Fire Proof	Approved	
Certificates	CE, London Underground Product Approval	
Re-Calibration Method		
Inspection Period	Every 3 Years by Manufacturer (or inspected by arranged methods)	
Tilting Orientation		
Tilting Mark		

As shown below, readings (of the blue axe) get smaller from Status 1 to Status 2; increase from Status 1 to Status 0.

Reading Decreasing Toward +10°   **Reading Close to 0 °**   **Reading Decreasing Toward -10°**

Applications

Infrastructure tilting condition monitoring of accuracy 0.01°, such as retaining wall, supporting column, river embankment etc.

From the 1st level of data conversion, the movement of one end of a beam/crossbar can be monitored (with accuracy of 0.17mm/m), such as land sliding, railway track monitoring.

With our latest developed mathematical model, we can achieve a 0.3mm accuracy for the Horizontal Convergence of a metro tunnel of 6 segments.

Installation Guidance: Ensuring the tilt node is installed parallel to the horizontal ground plane.
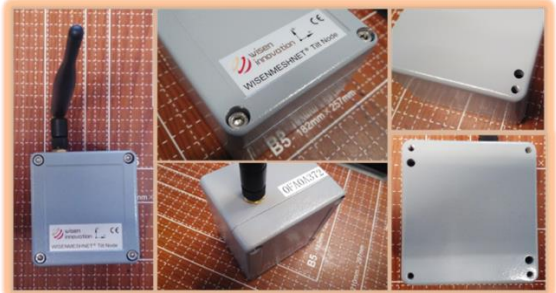

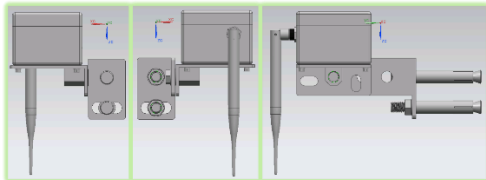Figure. Standard Dual-Axis Tilt Node Product Photos.

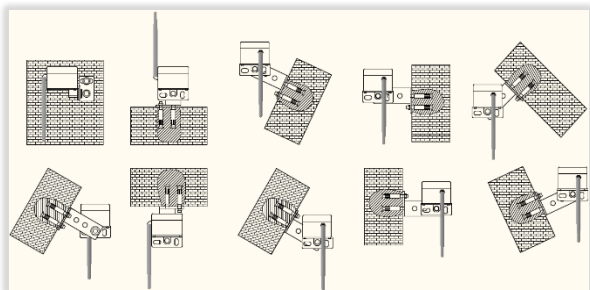Figure. Standard Tilt Node Rotational Bracket.

Figure. Levelling on Different Angular Walls (Ensuring the node is installed parallel to the horizontal ground plane).
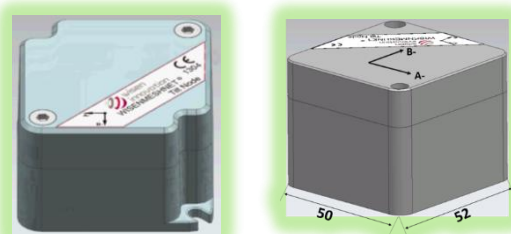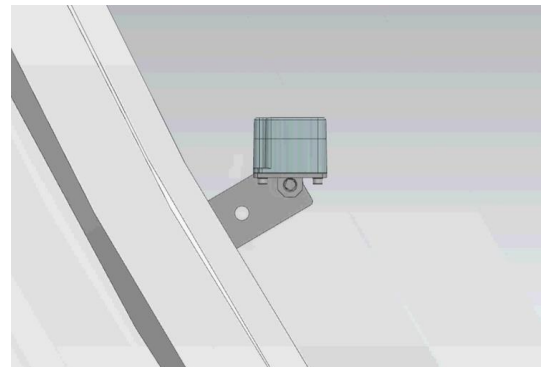

Figure. 1304 Series Mini Tilt Node.

Figure. Levelling on Different Angular Walls (Ensuring the node is installed parallel to the horizontal ground plane).

WISENMESHNET® Laser Distance Sensor Node (1F06 Series) @25°C

Basics	
Battery Power	Qty. x 1 (3.6V Lithium primary D-Cell ER34615**M**)
Accuracy Stop Voltage	2.7VDC
Mesh Stop Voltage	2.1VDC
Battery Connection	Standard Metal Battery Holder
Working Current (DC)	Max. 500mA (Typ. 220mA)
Local Storage	Min. 450 Messages during Meshing
L x W x H	100 x 100 x 60mm
Weight	<= 0.65kg
Primary Sensor	
Sensor Type	Distance
Laser Class	Class 2
Laser Range	0.05m-33m
Laser Accuracy	Better than +/-1.0mm (Typical 0.5mm)
Laser Resolution	0.1mm
Laser Lens Durability	>= 500Hrs@3Hz@50°C or 2500Hrs@3Hz@25°C
Standard System Parameter	
Tilt Sensor	MEMS Dual-Axis Tilt Sensor, A-axis; B-axis Tilt Values
Tilt Range	Range: -30°- +30°; Accuracy: 0.04° (144" or 0.700mm/m); Resolution: 0.0025° (9" or 0.0436mm/m); Long Term Stability: < 0.014° (50" or 0.2443mm/m)
Temperature	Range: -40 to 120°C; Accuracy: +/-1°C; Resolution: 0.1°C
Voltage	Accuracy: +/-0.1V
WSN Interface	
WSN Protocol	WISENMESHNET® Protocol
Re-Calibration Method	
Inspection Period	Every 3 Years by Manufacturer (or inspected by arranged methods)
Industrial Standard	
Casing and Painting Materials	Aluminium-Alloy Die Castings 12 (Epoxy Polyester Powder Coating)
IP Rating	>= IP66
Operating Temperature	-10 to 50°C
Fire Proof	Approved
Certificates	CE
Applications	
Long term distance monitoring between two specific points, such as horizontal convergence of a tunnel.	
Warning!	

A. This is an automated system, the laser beam must be set to point at an appropriate non-reflective surface;

B. The protection window glass on a node must be kept clear all the time;

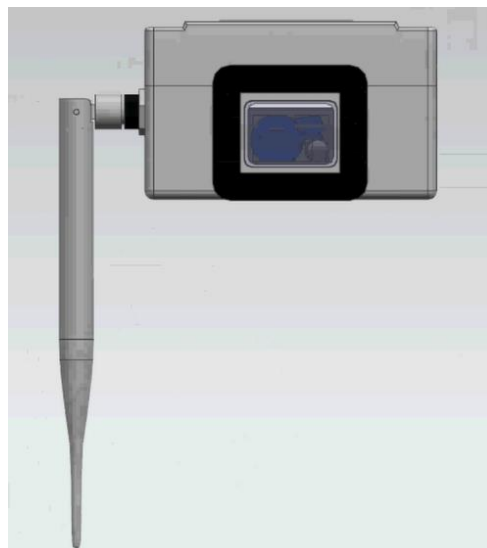C. Distance 0mm starting plane: plane of the protection window glass.

Special Notice

Laser_Pointing_Mode Switch: It sets laser into pointing mode. By default, it is in switched off state (i.e., empty circle sign). Switch location is highlighted in the figure below.
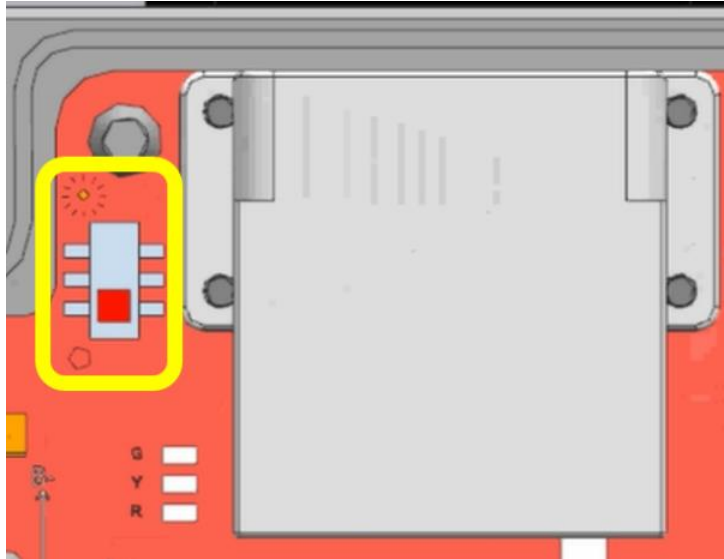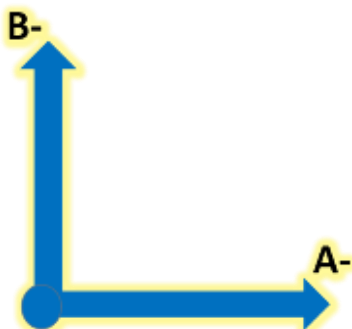

It can be switched on/off before/after a node's power-on. This pointing mode only becomes active after a valid laser reading is achieved.

Note: please do switch it off after an installation is completed, otherwise, the battery life is significantly shortened.

Laser front Lenses Protection Cover: All our laser nodes are shipped with their individual Protection Cover (of a 3M Double Coated Tissue Tape at one side). Once a battery is installed, node is powered on, and lid is screwed on properly. Then glue the cover onto the node as shown in the figure below. It protects the lenses from dust, heat and potential damage.

| Code_Info	Description	Notice
00	Node is working in a good condition	-
01	Target moving too fast or beam interrupt	Repeat measurement, use tripod (@E260)
02	Signal too low or distance out of range	Use special target plate (@E255)
03	Signal too high	Avoid high reflecting surfaces (@E256)
04	Time out on reply	Cable may have gone loose or check if there is any bad physical connection or too far out of range (e.g., point to the sky) (Wisen)
05	Single reading achieved	Single success on the sampling procedure.
06	Max-Min>2xError Tolerance	The difference of sample values is too large, repeat measurement or use tripod. (Wisen)
07	Unknown command or wrong parameter	Use correct syntax (@E203)
08	Error on serial communication	Check communication (@E220)
09	Temperature too high	Cool down module (@E252)
10	Temperature too low	Warm up module (@E253)
11	Voltage supply too low	Improve voltage supply quality (@E254)
12	Too much background light	Protect target against sunlight (@E257)
13	Laser error	Module defect (@E284)
14	APD-voltage can't be adjusted correctly	Module defect (@E288)
15	Flash configuration error	Power down and up again (@E289)
16	Unknown command or wrong parameter from laser module	Change to a new battery (Wisen)
24	Checksum error	Change to a new battery (@E224)
74	No EEPROM detected, code has to be loaded by GSI	Change to a new battery (@E274)
76	Read of code from EEPROM wrong	Change to a new battery (@E276)
78	EEPROM error which appears if something goes wrong during the flashing of the firmware	Change to a new battery (@E278)
90	Calibration signal out of range	Change to a new battery (@E290)
Laser Time	The time period (in the unit of seconds) that a laser module has been switched on at each T. Typically, of value: 2.5-2.7s.	
Sampling Status	The number of samples that has been successfully measured. Typically, of value: 5.	

Tilting Orientation

Tilting Mark	

As shown below, readings (of the blue axe) get smaller from Status 1 to Status 2; increase from Status 1 to Status 0.
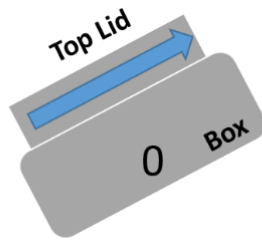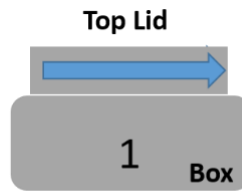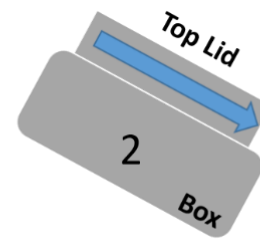
Reading Decreasing Toward +10°   **Reading Close to 0°**   **Reading Decreasing Toward -10°**
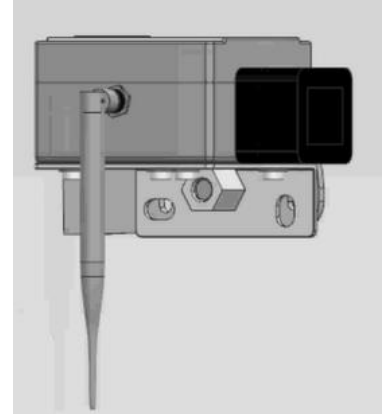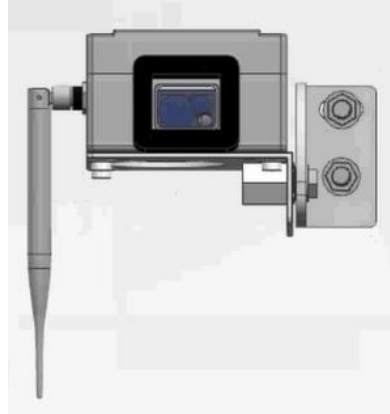
Installation Guidance
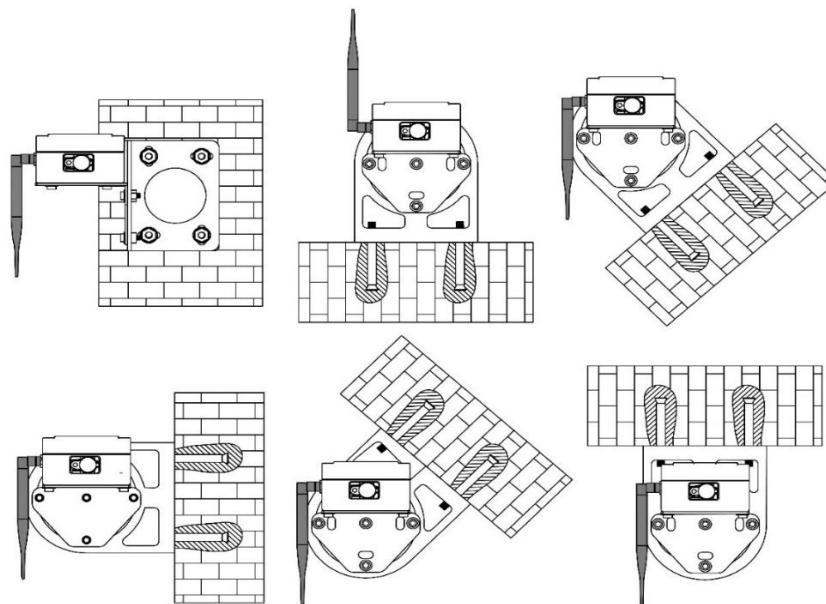

Figure. Laser Tilt Sensor Node Product Photos.

Figure. Laser Tilt Sensor Node Fixing Bracket (Please refer to the actual brackets in the shipment as the final).

WISENMESHNET® Interface Node Series

WISENMESHNET® 1/4/8-Channel Vibrating Wire Interface Node (1A04/1A05/1A06 Series) @25°C		
Basics	**1-Channel VW Interface Node (1A04 Series)**	**4/8-Channel VW Interface Node (1A05/1A06 Series)**
Battery Power	Qty. x 1 (3.6V Lithium primary D-Cell ER34615)	Qty. x 2 (3.6V Lithium primary D-Cell ER34615)
Accuracy Stop Voltage	2.1VDC	
Mesh Stop Voltage	2.1VDC	
Battery Connection	Standard Metal Battery Holder	
Working Current (DC)	Max. 100mA (Typ. 98mA)	
Local Storage	Min. 450 Messages during Meshing	
L x W x H	100 x 100 x 60mm	180 x 140 x 60mm
Weight	0.60kg	1.20kg
Cable Gland	Qty. 1 x EMC-CMA12 for external VW sensor connection	Qty. 4/8 x EMC-CMA12 for external VW sensor connections
Wire Connection	Spring type wiring terminal	
Externally Connected VW Sensor		
Sensor Type	Vibrating Wire Typed	
No. of Inputs	1 Channel	4/8 Channels
Sensor Connection	VW Type of 5 wires: VW+, VW-, T+, T-, GND. Note: Temperature wires (or a 3kΩ resistor) must be connected to the T+ & T- terminals so VW node can work properly; Ground wire between a node and a sensor must be connected.	
Parameter	Resonant Frequency (Hz)	
Range	400 to 6000Hz	
Accuracy	0.015% at Any Reading	
Resolution	0.002Hz@400Hz or 0.05Hz@6000Hz	
Cable Length	<= 1.1km	
Thermistor Sensor		
Parameter	Thermistor Resistor of 3kΩ @25°C	
Range	0.052kΩ to 113.096 kΩ	
Accuracy	0.12kΩ or 2°C	
Standard System Parameter		
Voltage	Accuracy: +/-0.1V	
WSN Interface		
WSN Protocol	WISENMESHNET® Protocol	
Re-Calibration Method		
Inspection Period	Every 3 Years by Manufacturer (or inspected by arranged methods)	
Industrial Standard		
Casing and Painting Materials	Aluminium-Alloy Die Castings 12 (Epoxy Polyester Powder Coating)	

IP Rating	>= IP66
Operating Temperature	-40 to 80°C
Fire Proof	Approved
Certificates	CE, London Underground Product Approval

Applications

WISENMESHNET® VW interface node is Compatible with all different brands & types of high quality Vibrating Wire sensors, therefore it can be applied in all different related monitoring projects.

Examples of VW sensors: Strain Gauge; Displacement Transducers; Piezometers; Settlement Sensors; Pressure Cells; Load Cells. Suggested VW sensor supplier: http://www.soilinstrument.com/

Installation Guidance

Figure. 1-Channel VW Interface Node Product Photos.
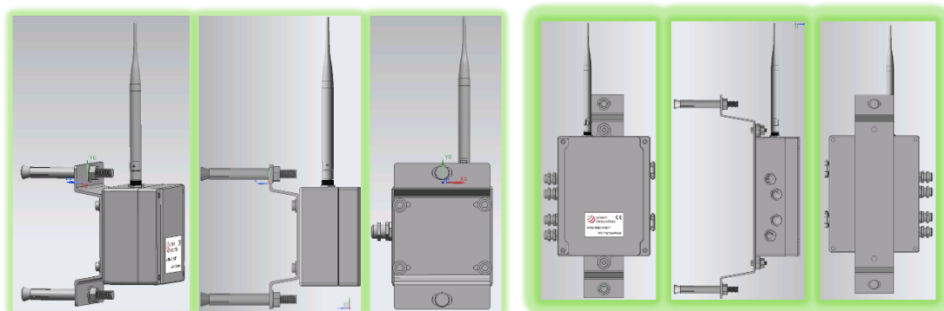
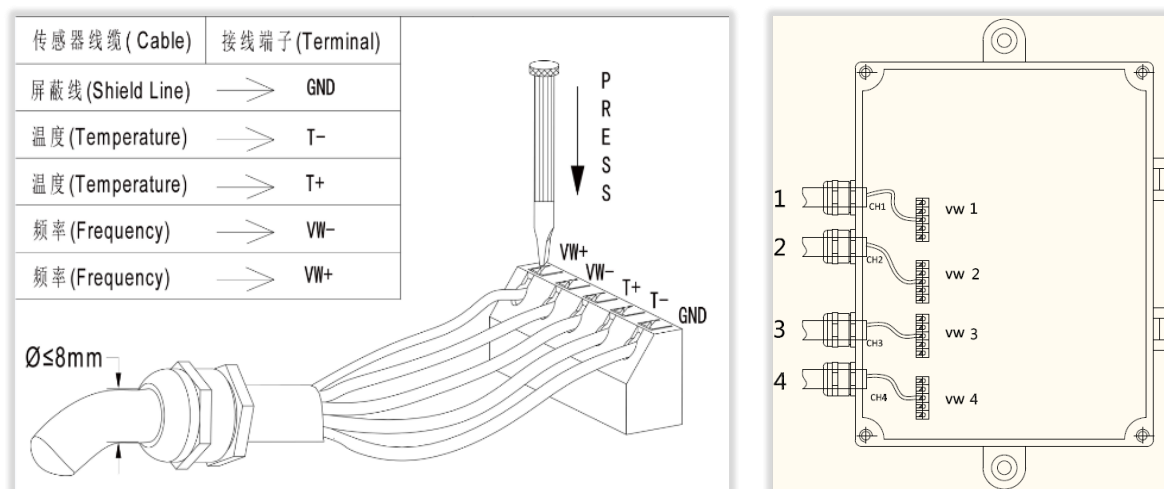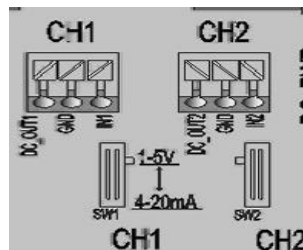Figure. 1-Channel VW Interface Node Brackets.

Figure. Left: VW Sensor Connections (VW+, VW-, T+, T-, GND). Right: Sensor Channel Sequence on a 4-Channel VW Interface Node.

WISENMESHNET® 2-Channel 4-20mA/1-5V Interface Node (1C02 Series) @25℃	
Basics	
Battery Power	Qty. x 4 (3.6V Lithium primary D-Cell ER34615)
Alternative DC Input	12-32VDC@min. 1A
DC Output	12VDC±0.3V @max. 0.3A (Note: confirm against the sensor specification)
Power On Time to External Sensor	2s to reach stable reading (Note: confirm the sensor stable time before use)
Accuracy Stop Voltage	5.9VDC
Mesh Stop Voltage	4.0VDC
Battery Connection	Standard Metal Battery Holder
Local Storage	Min. 450 Messages during Meshing
L x W x H	180 x 140 x 60mm
Weight	1.5kg
Cable Gland	Qty. 2 x EMC-CMA12 for external sensor connections Qty. 1 x EMC-CMA12 for external DC input power connection
Wire Connection	Spring type wiring terminal
Externally Connected Sensor	
Sensor Type	4-20mA / 1-5V Sensor Type
No. of Inputs	2 Channels
Sensor Connection	DC_Out, IN, GND
Parameter	mA / V (Use "4-20mA to 1-5V Switch" for each channel on the PCB to change the sampling parameter.)
Range	4.0000 to 20.0000mA / 1.0000V to 5.0000V
Accuracy	0.1% at Any Reading
Resolution	0.0003mA or 0.0001V
Cable Length	<= 4.5m
Standard System Parameter	
Temperature	Range: 40 to 80℃, Accuracy: +/-2℃
Voltage	Accuracy: +/-0.1V
Re-Calibration Method	
Inspection Period	Every 3 Years by Manufacturer (or inspected by arranged methods)
WSN Interface	
WSN Protocol	WISENMESHNET® Protocol
Industrial Standard	
Casing and Painting Materials	Aluminium-Alloy Die Castings 12 (Epoxy Polyester Powder Coating)
IP Rating	>= IP66
Operating Temperature	-40 to 80℃
Fire Proof	Approved
Certificates	CE, London Underground Product Approval
Applications	
WISENMESHNET® 4-20mA/1-5V Interface Node is compatible with all different types of 4-20mA/1-5V sensors of 12VDC and <=300mA power supply, hence it can be applied to all the corresponding monitoring projects.	

Example of 4-20mA sensors: Manufacturer such as Micro-Epsilon. http://www.micro-epsilon.com/temperature-sensors/index.html?sLang=us

Special Notice on data format corresponding to the 4-20mA/1-5V Switch

Switch Status	CH1 Reading	CH2 Reading
00	1-5V	1-5V
01	4-20mA	1-5V
02	1-5V	4-20mA
03	4-20mA	4-20mA

Installation Guidance

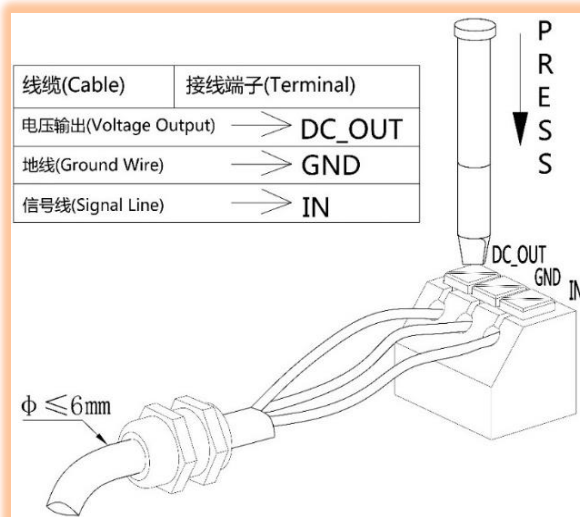Figure. 2-Channel 4-20mA/1-5V Interface Node Product Photos.

Figure. Fixing Brackets.

Figure. Individual 4-20mA/1-5V Sensor Wire Connections

WISENMESHNET® 6-Channel 120Ω Foil Gauge Interface Node (1B02 Series) @25°C

Basics	
Battery Power	Qty.x2 (3.6V Lithium primary D-Cell ER34615)
Accuracy Stop Voltage	2.7VDC
Mesh Stop Voltage	2.1VDC
Working Current (DC)	Max. 78mA (Typ. 46mA)
Battery Connection	Standard Metal Battery Holder
Local Storage	Min. 450 Messages during Meshing
L x W x H	180 x 140 x 60mm
Weight	1.2kg
Cable Gland	Qty. 2 x EMC-CMA12 for external sensor connections
Wire Connection	Spring type wiring terminal

Externally Connected 120Ω Foil Gauge Sensor Parameter	
Sensor Type	120Ω Foil Gauge
No. of Inputs	6 Channels
Sensor Connection	IN+, IN-
Sampling Bridge Arrangement	1/4 Bridge
Parameter	Resistance in Ω
Range	119.0-121.0Ω
Accuracy	0.1% ±0.0005Ω
Resolution	<0.001Ω
Stability	±0.0005Ω
Cable Length	<= 3m

Standard System Parameter	
Temperature	Range: -40 to 80°C, Accuracy: +/-2°C
Voltage	Accuracy: +/-0.1V

Re-Calibration Method	
Inspection Period	Every 3 Years by Manufacturer (or inspected by arranged methods)

WSN Interface	
WSN Protocol	WISENMESHNET® Protocol

Industrial Standard	
Casing and Painting Materials	Aluminium-Alloy Die Castings 12 (Epoxy Polyester Powder Coating)
IP Rating	>= IP66
Operating Temperature	-40 to 80°C
Fire Proof	Approved
Certificates	CE

Applications	

WISENMESHNET® 120Ω Foil Gauge Interface Node is compatible with all 120Ω Foil Gauge sensors, hence it can be applied to all the related monitoring projects.
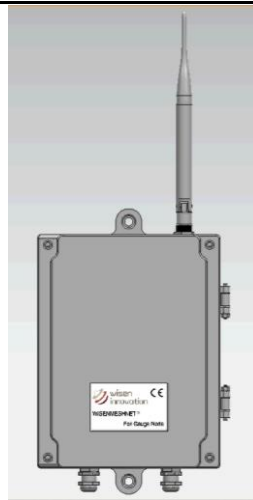
Installation Guidance	

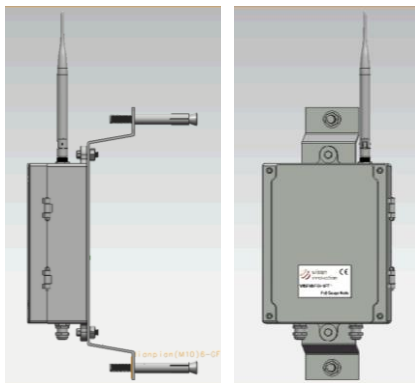Figure. 6-Channel 120Ω Foil Gauge Interface Node Product Photos.
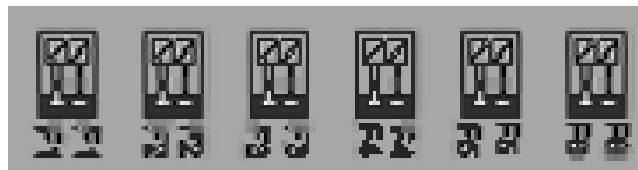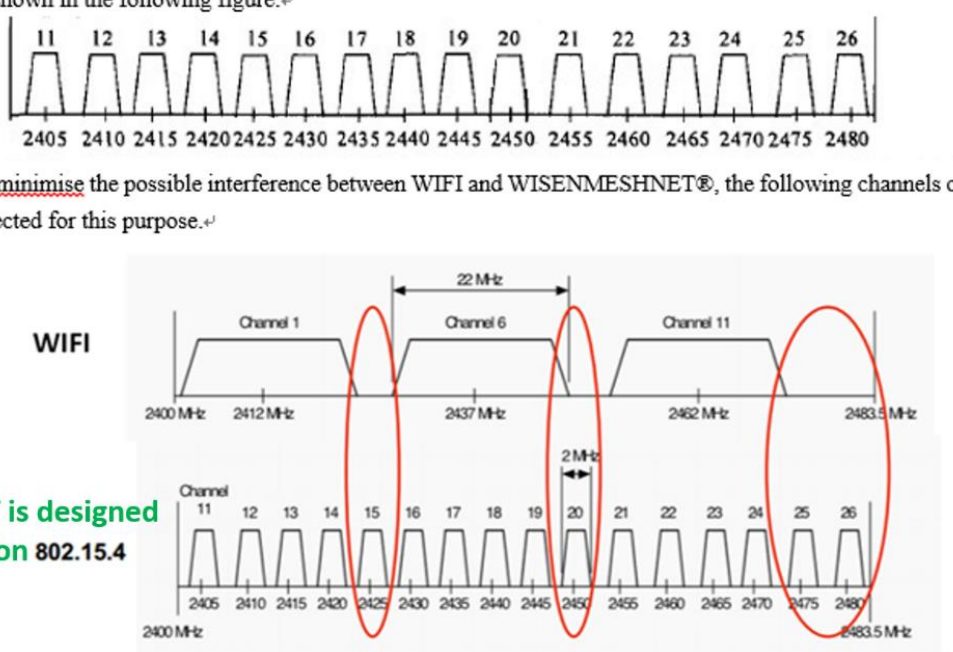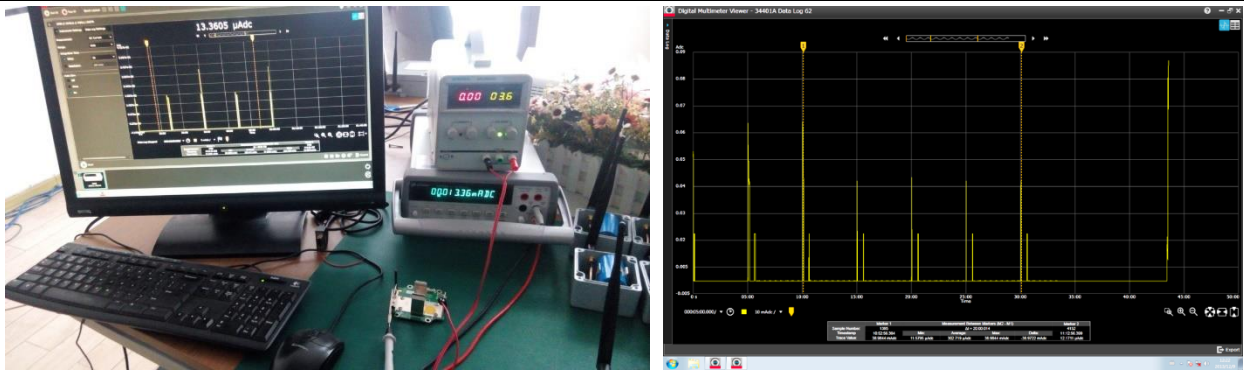

Figure. Fixing Brackets.

Figure. Individual Wire Connections

# Radio, Protocol, Battery Life, Remote Commands, Box Fixing

Point to Point Radio Feature		
Radio Frequency	2.405-2.480GHz (16 Channels of 5MHz Bandwidth)	
Channel Setting	Channel 26 by default	
Transmit Power	Typical <1.4mW (i.e., 1.5dBm); Max. 2mW	
Receive Resolution	-102dBm	
No. of Mesh Hop Supported	10 Hops (e.g., the radio link from a gateway to the 1st layer node is called the 1st hop)	
Antenna Description	2.4GHz-Antenna	Omni-directional 5dBi (20cm in length) or Customised
	2/2.5/3/4G-Antenna	Omni-directional 3.5dBi (20cm in length) or Customised
	Antenna Connector	SMA (M)

WISENMESHNET® Wireless Sensor Network Protocol Standard

Electromagnetic Compatibility

WISENMESHNET® system is designed of ISM2.4GHz, it strictly follows IEEE802.15.4 Standard, which includes 16 channels (Channel 11 to Channel 26 representing 2.405GHz to 2.480GHz) of 5MHz bandwidth at each channel.

Notice: Within any electrically noisy environment, nodes with sensors must be >= 0.3m away from the source of the noise.

Network Life Span

Laboratory Power Consumption Analysis (please apply the data below ONLY as a reference)
Hardware Settings: Keysight 34401A Multimeter; Atten APS3005D Power Supply; Windows PC.

Mini Dual-Axis Tilt Sensor Node/ Standard Dual-Axis Tilt Sensor Node/ 1-Channel VW Interface Node/ 4-Channel VW Interface Node:

Best Case: It is the battery life calculated for a node taking no sub-mesh network of its own, i.e., a leaf node.
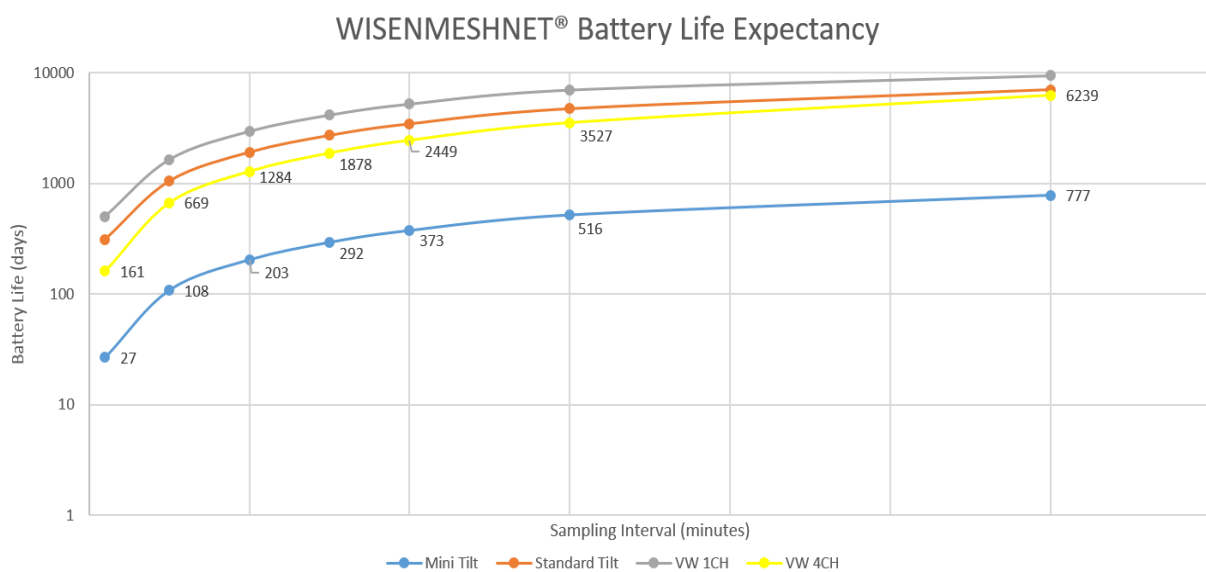
Note: the figure above shows the battery life of 1303 Series Mini Tilt. Under the same circumstances, 1304 Series Mini Tilt node has 30-35% more battery life than 1303 Series Mini Tilt node.

Worst Case: It is the battery life calculated for a node taking 9 hopes of sub-mesh network of its own.
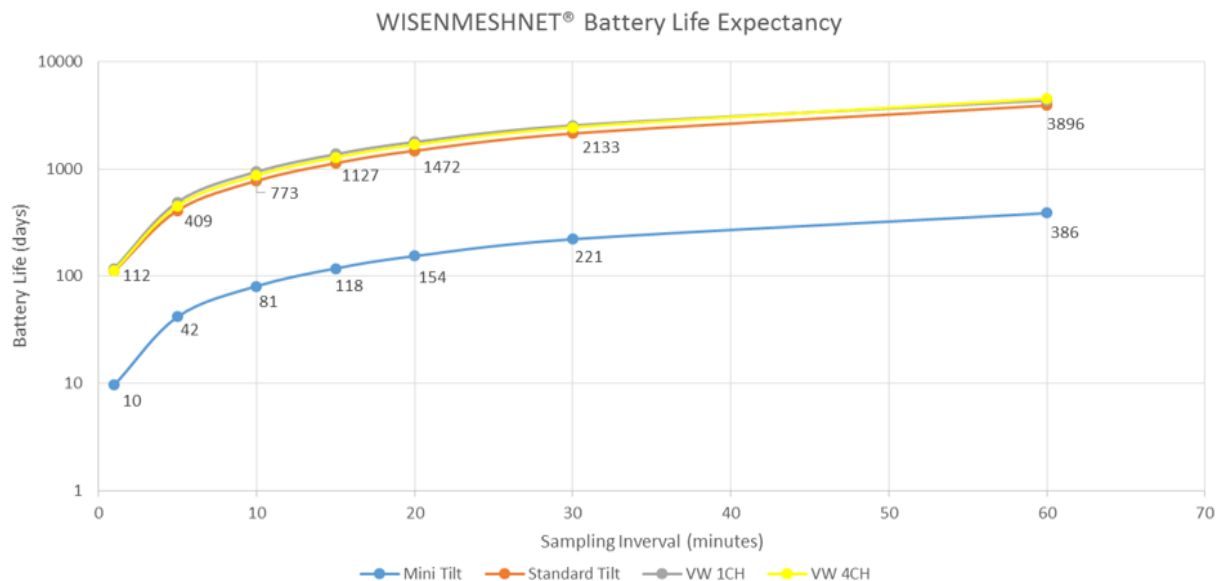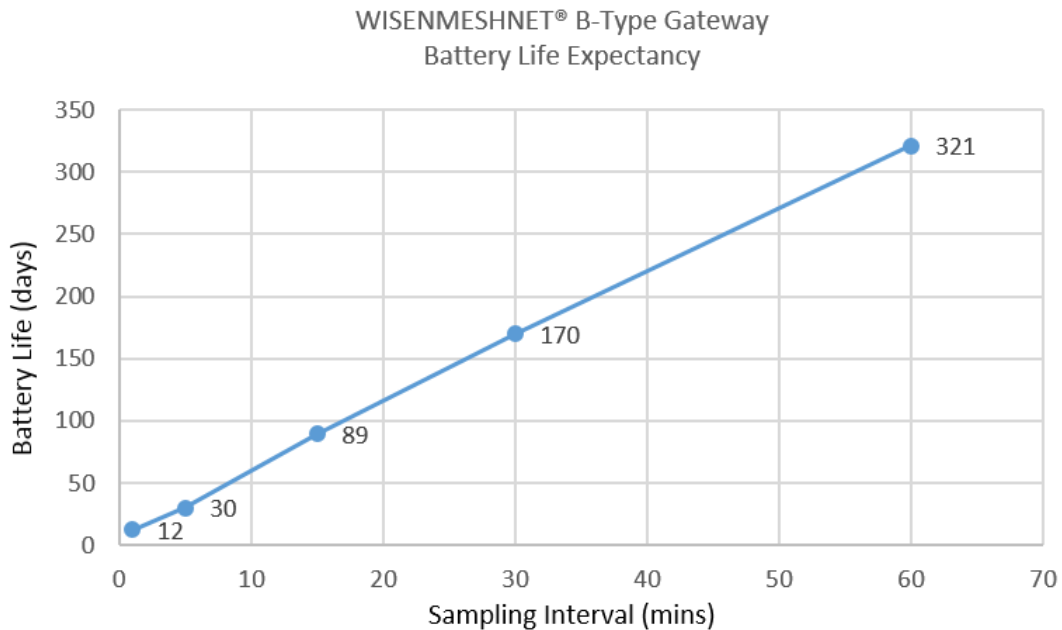
B-Type Smart Gateway

Figure: B-Gateway Battery Life (75% of the above values when there are more than 15 nodes taken under one gateway).

(Note: battery life can be further extended by a factor of 1.5, if a B-Gateway is 1/6 times (i.e., DTU_T=6) often making connections to a server.)
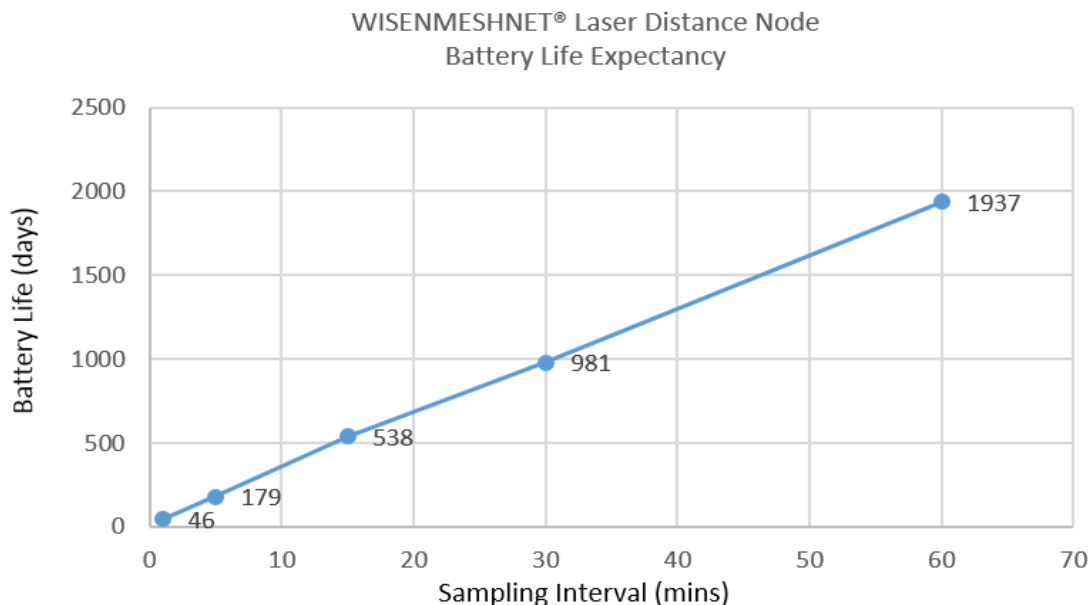
Laser Distance Node

Figure: Best Case (i.e., taking < 3.0s to complete a data reading at each T, as a leaf node).

(Note: The worst case is determined by the combination of two factors: A. 10-hop mesh topology of a factor 1.2 worse than the best case battery expectancy); B. the time that takes to measure the distance for a laser module, typically it is 2.7-2.9s, in general this is affected by target surface and light pollution, this can be a factor of 10-15 worse to normal battery life of a laser distance node.)

2-Channel 4-20mA/1-5V Interface Node

WISENMESHNET® 2-Channel 4-20mA/1-5V Interface Node
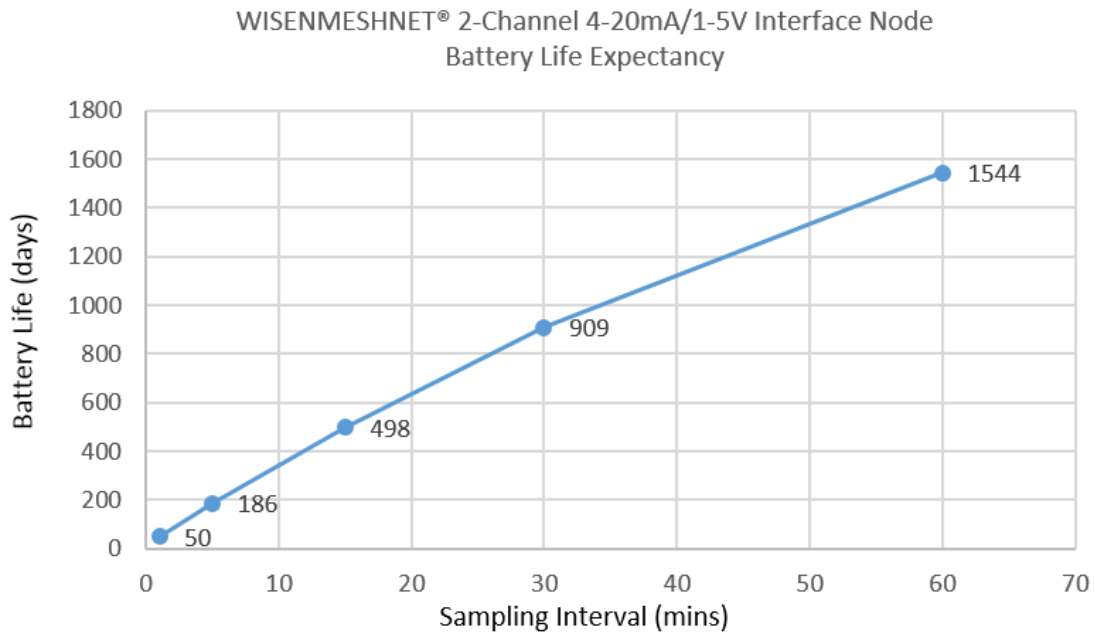Battery Life Expectancy

Figure: Best Case (as a leaf node).

(Note: 1. The test is done when two 4-20mA temperature sensors are both connected to a node at a room temperature of 25°C. The sensors are as the link below: http://www.micro-epsilon.com/temperature-sensors/index.html?sLang=us

2. The worst case is determined by 10-hop mesh topology, it is a factor of 1.2 worse than the best case battery expectancy.)

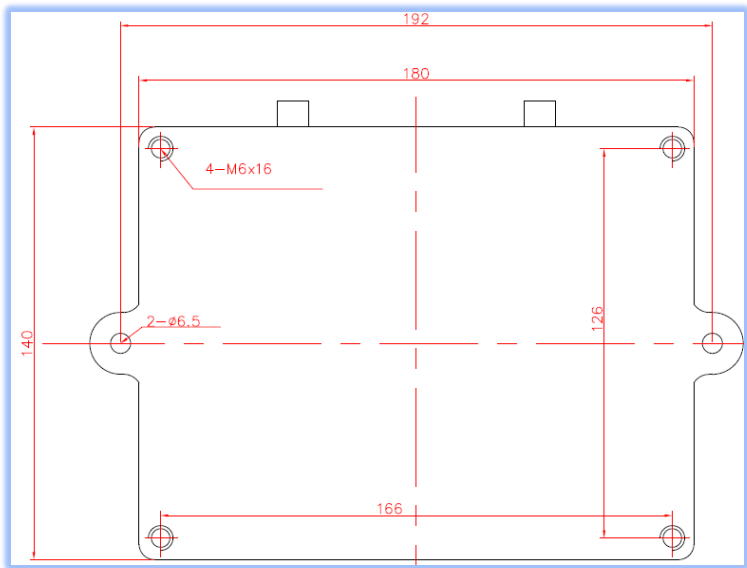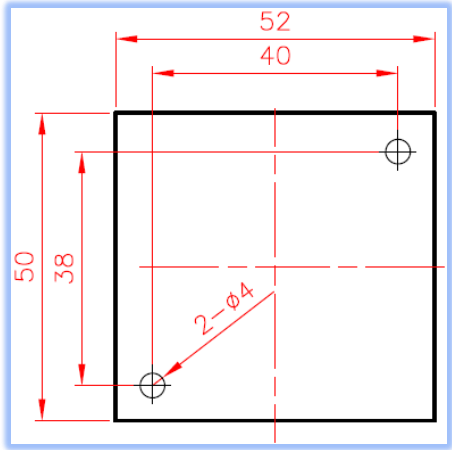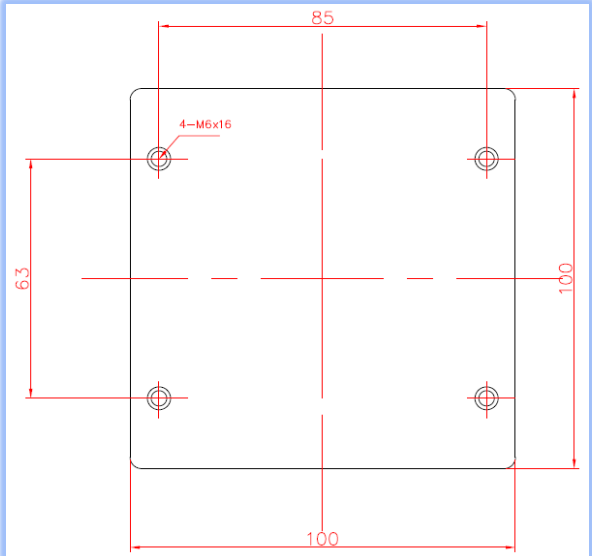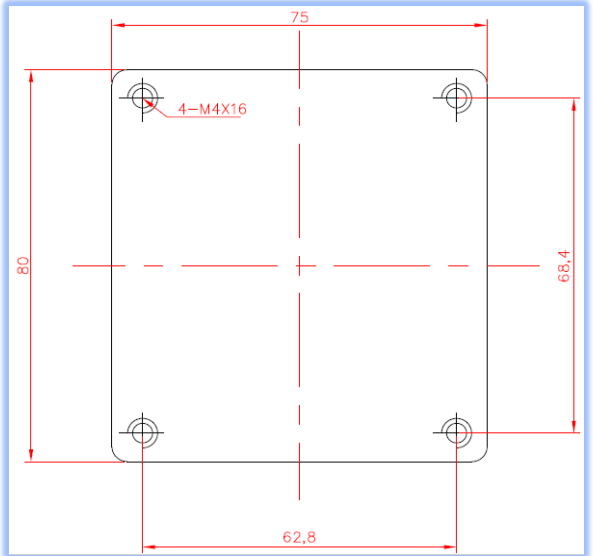| Network Data Arrival Rate |
|---|
| Into WISENMESHNET® greater than 99.5% |

Single Node Environmental Coverage

A. Clear office corridor, line of sight, directly placed on the ground, >= 25m;

B. Clear office corridor, line of sight, 1m above the ground, >= 70m;

C. Inside Metro Tunnels (antenna placed at 10cm away from the wall) >= 100m;

D. Outdoor (Tx and Rx unit placed at 2m above ground) >= 250m.

Data Format

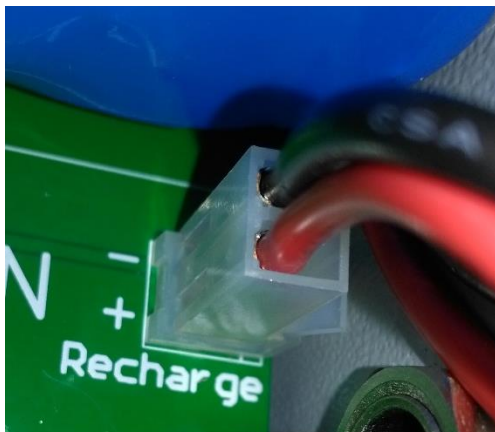| Basic Information	Time Stamp: Universal Time Coordinated (i.e., UTC)
	SN and Short ID
Network Information	Gateway includes: 1. Mesh Network Information, i.e., no. of hops, sequential number of transmission, parent node SN, received power strength, transmit power strength. 2. System Information, Sampling Time Interval (T), radio frequency (F), Back_Time, Signal Threshold (radio power strength threshold), Relay_Factor.
	Node includes: no. of hops, sequential number of transmission, parent node SN, received power strength, transmit power strength and no. of messages unsent in a node.
Sensor Information	Node Type
	Sensor Information： 1. Power information includes: battery voltage, key reference voltage, etc.; 2. Sensor parameters.

Remote Commands

Time Interval	Systematically changing the sampling time interval (T) of the nodes under a gateway.
DTU_T	Server Connection Ratio to Time Interval
Radio Frequency	Systematically changing the radio channel (F) of the nodes under a gateway.
Back_Time	Defining the time taken for all the data from the nodes to reach a gateway.
Signal Threshold	Systematically changing the radio power threshold so it can join into a mesh network so a mesh can be optimised.
Relay_Factor	Systematically changing the relay time for all the node in a gateway so a mesh can be optimised.
APN Settings	Allowing a customer to change the APN/User Name/Password for the 2/3/4G Network setting.

Casing Back Hole Dimension*

180x140x60mm Case Back Hole Dimensions	52x50x40mm Case Back Hole Dimensions

100x100x60mm Case Back Hole Dimensions	80x75x57mm Case Back Hole Dimensions

* The table for back hole fixing dimensions are used for customers to design their own brackets in various applications.

WISENMESHNET® External Power Units

WISENMESHNET® Solar Unit for B-Gateway & 4-20mA Interface Node @25℃	
Basics	
Battery Power	Rechargeable Package (LiFePO4)
DC Output Voltage	11.2V-14.6V
Capacity when fully charged	5AHr
Solar Panel	10W
Single Re-charging Duration	8-12Hr
L x W x H	180 x 140 x 60mm (without bracket)
Weight	2.2kg

B-Gateway Operating Duration		
	Time Interval	Days*
	T=1min	2
	T=5min	5
	T=15min	15
	T=30min	28
	T=60min	52**

* Assumption: we assume that the local mobile 3G/4G networking is covered properly;

** Notice: to further extend the operating duration, please consult with our engineers.

*** Notice: Solar package must have the 4 internal ER34615 batteries installed as a backup UPS to avoid continuous strong sun light day or cloudy days.

Industrial Standard	
Casing and Painting Materials	Aluminium-Alloy Die Castings 12 (Epoxy Polyester Powder Coating)
IP Rating	>= IP66
Operating Temperature	-35 to 65℃

Installation Guidance

Notice: Take special attention when handling the high capacity battery package;

Installation Procedures:

1. Ensure that the output switch on a solar unit is in "OFF" status before any operation of wiring.
2. Ensure the "+" and "-" wires are connected absolutely correct to the "+" and "-" terminals in the unit, including:
   A. PCB Recharge "+" & "-" terminals to Rechargeable Battery Unit "+" & "-" plug;

B. PCB Power_Out "+" & "-" terminals to B-Gateway "+" & "-" terminals;

C. PCB Solar_In "+" & "-" terminals to External solar panel "+" & "-" terminals.

3. When the wirings are checked, ensure the unit is switched "ON", so the power output is activated.
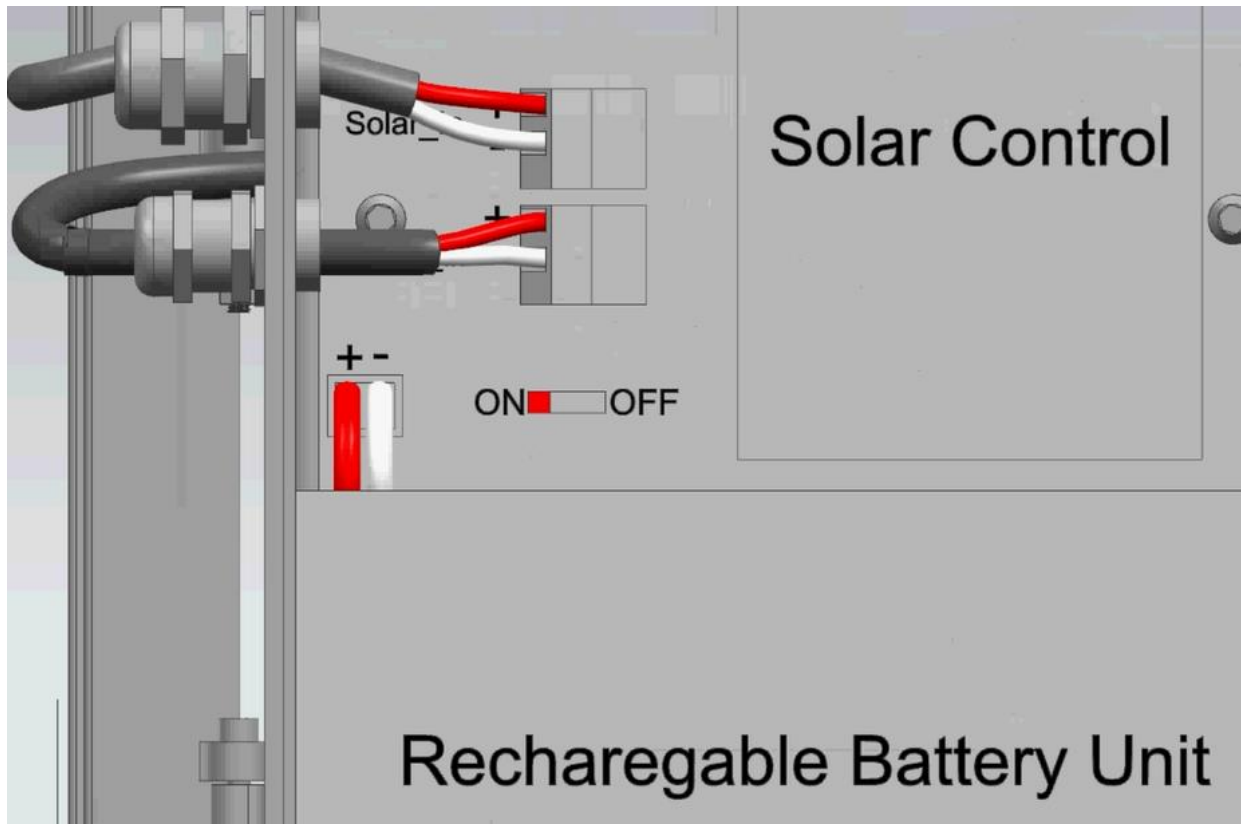

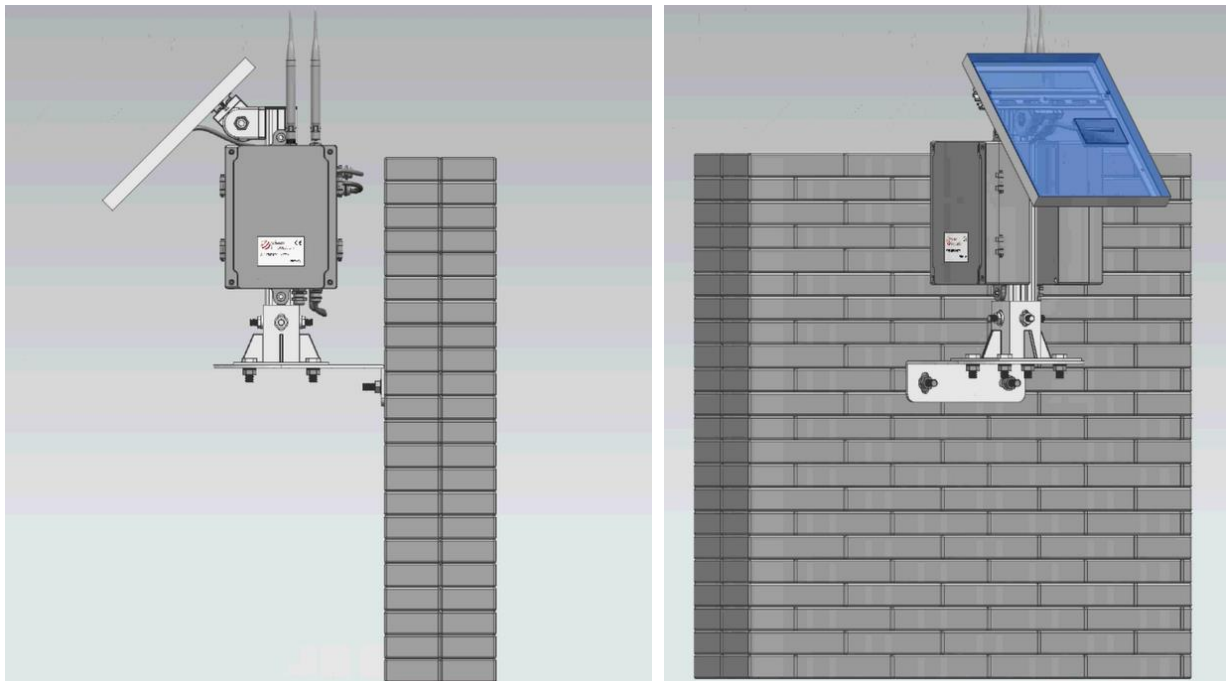Figure. Solar unit – wiring and ON/OFF switch.
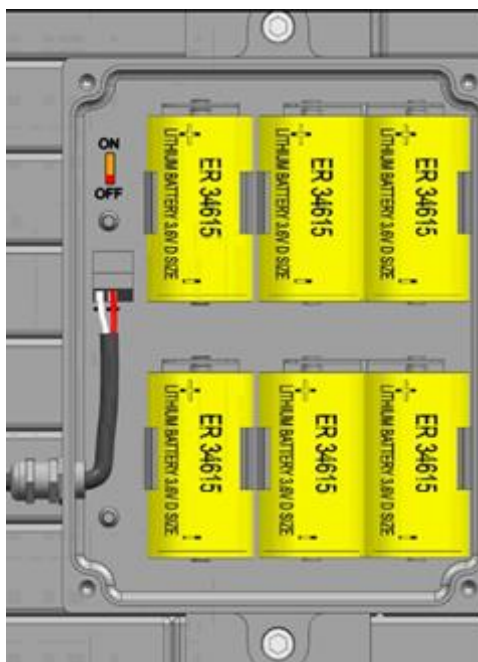

Figure. Solar unit – Overview.

WISENMESHNET® Battery Unit for B-Gateway @25°C

Basics

Battery Power	Qty. x 6 (3.6V Lithium primary D-Cell ER3461)
Battery Connection	Standard Metal Battery Holder
DC Output Voltage	8V-10.8V
Capacity when fully charged	29AHr
L x W x H	180 x 140 x 60mm
Weight	2.2kg

B-Gateway Operating Duration

	Time Interval	Days*
	T=1min	15
	T=5min	38
	T=15min	112
	T=30min	212
	T=60min	401**

* Assumption: we assume that the local mobile 3G/4G networking is covered properly;

** Notice: to further extend the operating duration, please consult with our engineers.

Industrial Standard

Casing and Painting Materials	Aluminium-Alloy Die Castings 12 (Epoxy Polyester Powder Coating)
IP Rating	>= IP66
Operating Temperature	-40 to 85°C

Installation Guidance

Notice: Take special attention when handling the high capacity battery package;

Installation Procedure:

1. Ensure that the output switch on a solar unit is in "OFF" status before any operation of wiring.
2. Ensure the "+" and "-" wires are connected absolutely correct to the "+" and "-" terminals in the unit;
3. When the wirings are checked, ensure the unit is switched "ON", so the power output is activated.
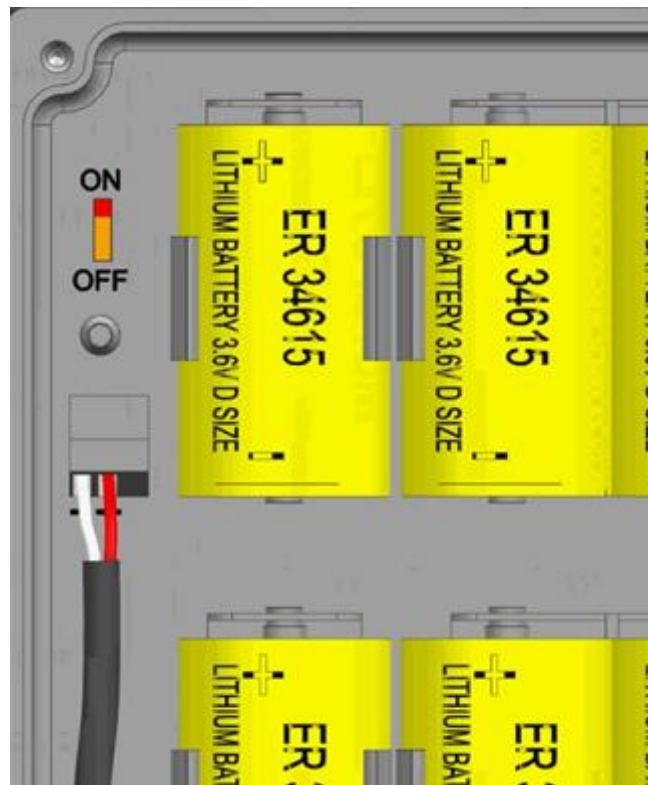
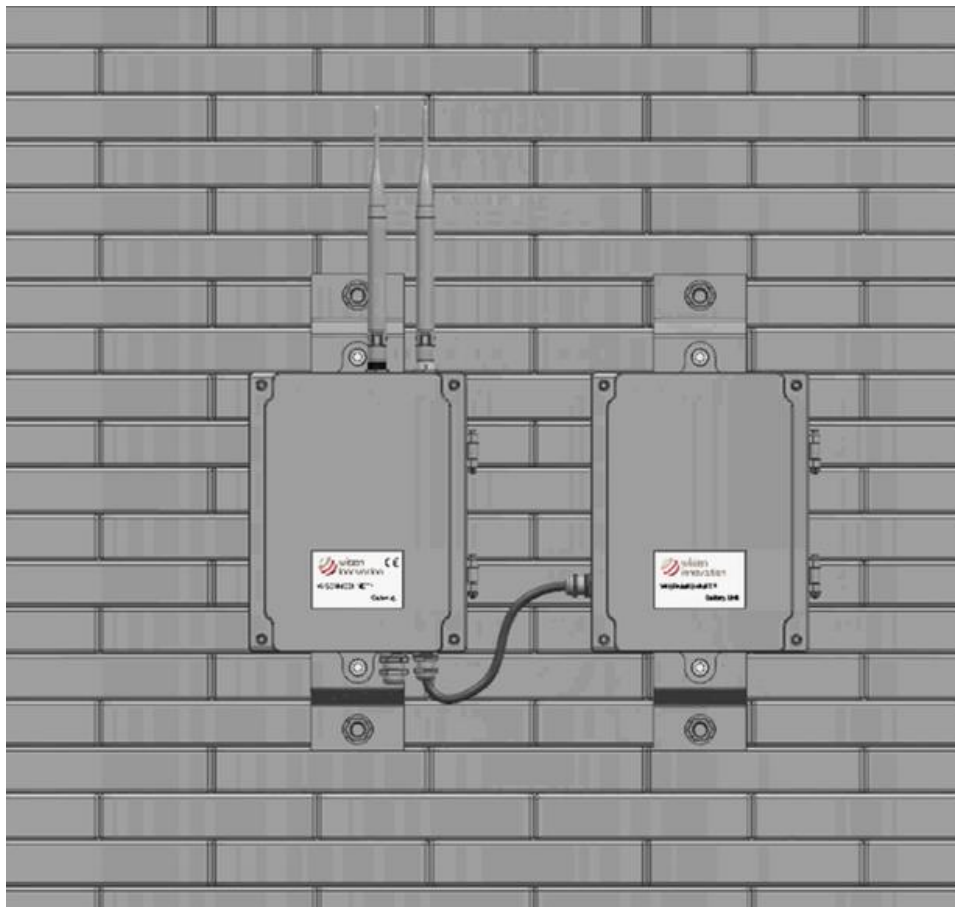Figure. Battery unit - internal layout.

Figure. Battery unit – wiring and ON/OFF switch.

Figure. Battery unit – Overview.