ENCARDIO RITE

ONE STOP MONITORING SOLUTIONS | HYDROLOGY | GEOTECHNICAL | STRUCTURAL | GEODETIC

Over 50 years of excellence through ingenuity

USERS' MANUAL

WIRELESS SYSTEMS (RF)
NODES & GATEWAY

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1 INTRODUCTION

1.1 Wireless networks

Wireless sensor networks are vital in monitoring construction sites, large structures and landslide areas. They are extensively used in applications where geotechnical and other sensors are used for data collection and transfer to a central server for access by multiple users. Encardio-rite offers an innovative network solution that allows real-time monitoring of geotechnical and structural sensors in challenging conditions with reliable data transfer without any delay.

The system operates on ISM sub 1 GHz operating frequency bands adjustable to requirement of each territory. The system can be adjusted to different frequency bands; for example:

India	865 – 867 MHz
Europe	868 MHz
USA/Canada/Singapore/Australia	915 MHz

A detailed reference for frequency bands allowed in different Countries is available at:

https://www.thethingsnetwork.org/docs/lorawan/frequencies-by-country.html

The gateway has provision to set the frequency band, depending upon the Country

Encardio-rite manufactures the following range of wireless products:

EAN-95MW	Wireless tilt meter	It is a complete unit in itself including the sensor and the node
EWN-01V	Vibrating wire node – 1 channel	To be used with vibrating wire sensor
EWN-08V	Vibrating wire node – 8 channel	To be used with vibrating wire sensors
EWN-01D	Digital node	To be used with SDI-12 interface sensors
EWN-01A	Analog node – 1 channel	Suitable for sensors with millivolt, voltage, 4-20 mA, wheatstone bridge outputs
EWN-01A	Analog node – 4 channel	Suitable for sensors with millivolt, voltage, 4-20 mA, wheatstone bridge outputs
EWN-01R	Relay node	To enhance range of any node
EWG-01G	Gateway	To collect sensor data from nodes, upload collected data to Encardio-rite cloud server or a third party server

The wireless system is easy to configure, manage and monitor. The gateway can conveniently support automatic data collection from around 50 sensors. However, considering the time taken to finish a cycle of collecting data from too many sensors in a network, it is advisable not to use more than 25 sensors to a gateway.

1.2 Gateway nodes interface

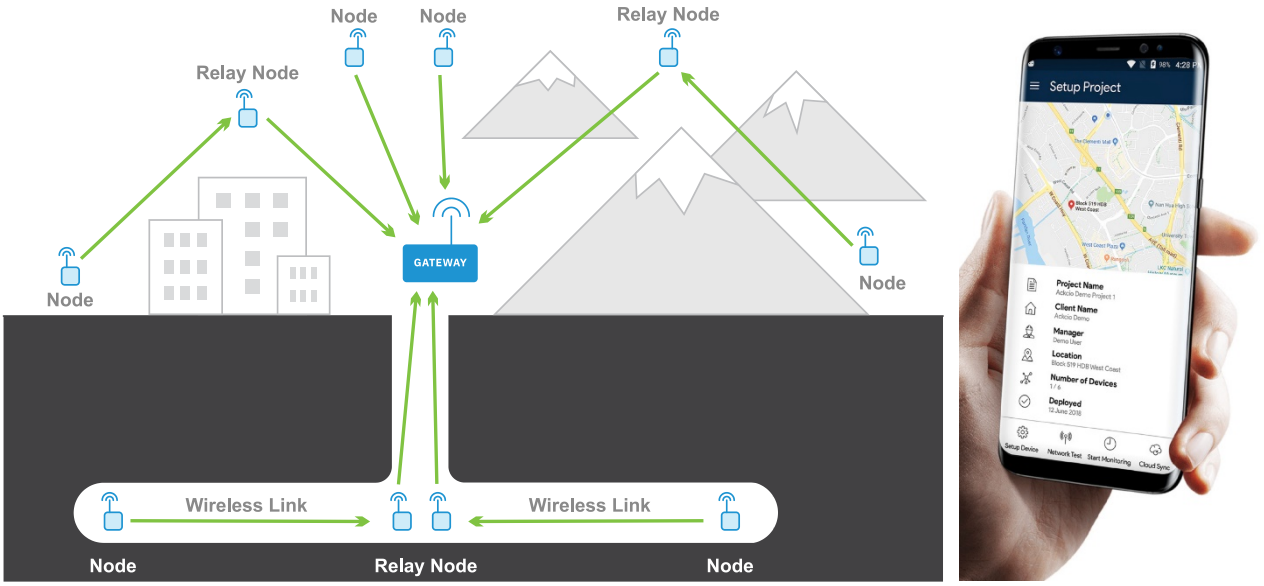
Encardio-rite model EWG-01 gateway is used as a main networking hardware, which uploads data gathered from all the sensors to the Encardio-rite cloud server or a third party server. The gateway enabled wireless network provides reliable data transfer over long distances, without any delay. The wireless system eliminates the need for running lengthy cables. This is especially useful at locations where sensors are distributed over a wide area and running cables to long distances can be tricky and risky.

The data is accessible 24 x 7 to all the stakeholders. With Drishti, a cloud-hosted data management and configuration software, the system can be programmed to generate automatic reports and provide automated alerts over SMS or email for any reading crossing the pre-defined alert levels.

With the real-time data collected from wireless sensors connected to the nodes and gateway, information about the slightest of change taking place in the project is available. This allows timely decisions, increased safety, reduction in project delays and consequently cost effectiveness.

1.3 Setting up the Gateway and Nodes Location

In an end-to-end wireless monitoring system from Encardio-rite, the sensors are interfaced with the long range, low power network through **Nodes** that send recorded data to the **Gateway** with utmost reliability. The gateway then uploads the collected data from sensors to the central/cloud server. A schematic is shown below in figure 1-1 and 1-2.



Typical wireless network scheme

Mobile configuration

Figure 1-1: General layout with sensor nodes and relay nodes

The innovative wireless based data collection network provides seamless connectivity in large sites and tunnels.

To improve connectivity, up to one relay node with a single hop can be used between any sensor node and the gateway. Several examples on how to use a relay node are illustrated in figures 1-1 and 1-2.

Drishti, a cloud-hosted data management and configuration software is available to manage the network. The configuration is done with an easy to use smartphone application that comes free with the system. The database management system allows analysis and visualization of the sensor data collected from project site/installation locations.

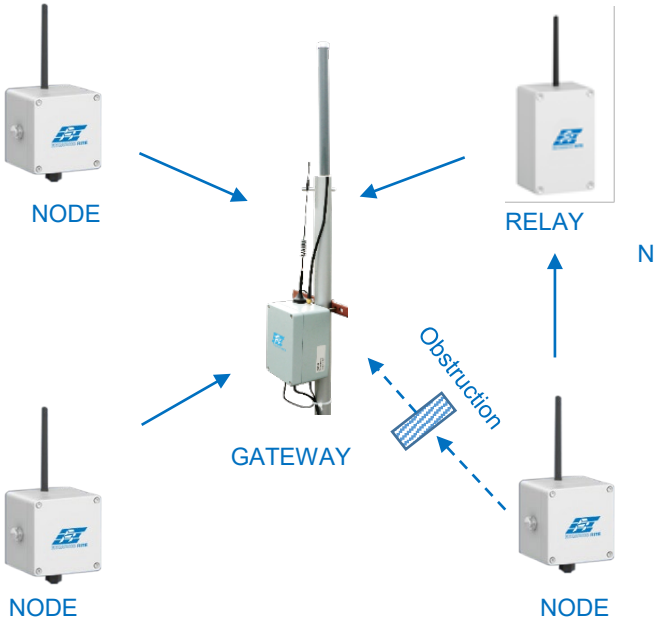


Figure 1-2: Typical layout

1.3.1 Signal strength

The first step is to install the Gateway at a location that is in line of sight with all the sensors or in line of sight with most sensors. The best location will have to be determined at the site itself. Once the gateway is installed, the node to be installed should be taken to the location where the sensor is to be installed. For best results, the link between the gateway and the node should be strong, preferably better than -100 dBm. If it is not strong i.e. less than -100 dBm, use a relay node at an appropriate location to get to a signal strength better than -100 dBm. A two way switch is provided on the node to switch it to a single hop position. For best results, please ensure that the link between the relay node and the node is also stronger than -100 dBm. Please note, the stronger the link (-95 dBm or -90 dBm) the better will be the results.

NOTE: Refer to section 3.7 for details on how to determine signal strength at any location. If signal strength is not good, a relay node should be added between the gateway and the node.

1.4 How to use this manual

This users' manual includes instructions to install and configure the gateway. Screenshots are included in the manual showing configuration step-by-step. There are separate users' manual for Vibrating wire, Analog, Digital and Relay Nodes.

NOTE: It is recommended that the users' manuals of the respective Nodes required to be used with the Gateway are read together with this manual for a complete understanding of operations of the wireless system.

This users' manual is intended to provide sufficient information on installation and operation of Gateway. All efforts have been made to clarify each and every function/feature. The next section describes:

NOTE: Installation personnel must have a background of good installation practices and knowledge of the fundamentals of geotechnics and wireless systems. Novices may find it very difficult to carry on the installation work. The intricacies involved in installation are such that even if a single essential but apparently minor requirement is ignored or overlooked, the most reliable of instruments will be rendered useless.

A lot of effort has gone in preparing this users' manual. However, the best of instruction manuals cannot provide for each and every condition in the field, which may affect performance of the instrument. Also, blindly following the instruction given in the manual will not guarantee success. Sometimes, depending upon field conditions, the installation personnel will have to consciously depart from the written text and use their knowledge and common sense to find the solution to a particular problem.

1.5 Conventions used in this manual

WARNING! Warning messages calls attention to a procedure or practice that if not properly followed could possibly cause personal injury.

CAUTION: Caution messages calls attention to a procedure or practice that if not properly followed may result in loss of data or damage to equipment

NOTE: Note contains important information and is set off from regular text to draw the users' attention.

2 INSTALLATION OF GATEWAY & NODES

2.1 Installation of Gateway

2.1.1 Wall mounting

The gateway can be directly fixed to a flat surface using four screws. A gateway bracket is provided which makes mounting on a flat surface or on a pipe (using C-bolts) easier. Installation may have to be improvised or tailor made depending upon site conditions, like using cable ties.

The gateway is supplied from the factory fixed to the bracket with four sets of screws and nuts as shown in figure 2-1.

Fix the gateway antenna and the cellular antenna to the bracket as shown in figure 2-2.

NOTE: Please note that the gateway has two identical ports at the bottom for GPS and Cellular (GSM) antenna. Please ensure to connect the cellular antenna to the correct port.

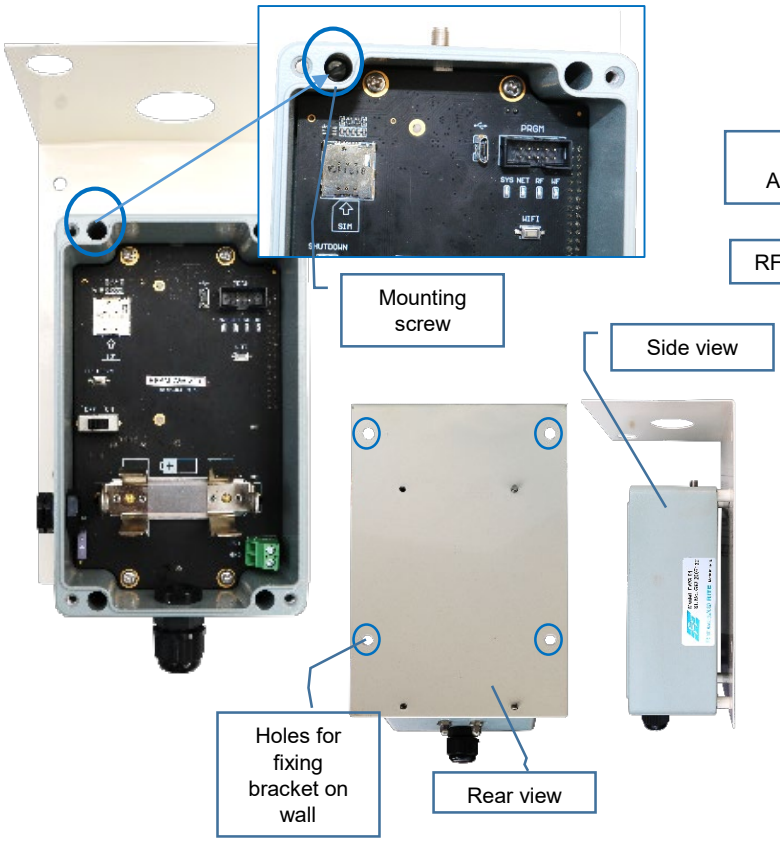


Figure 2-1 Wall mounting bracket for gateway

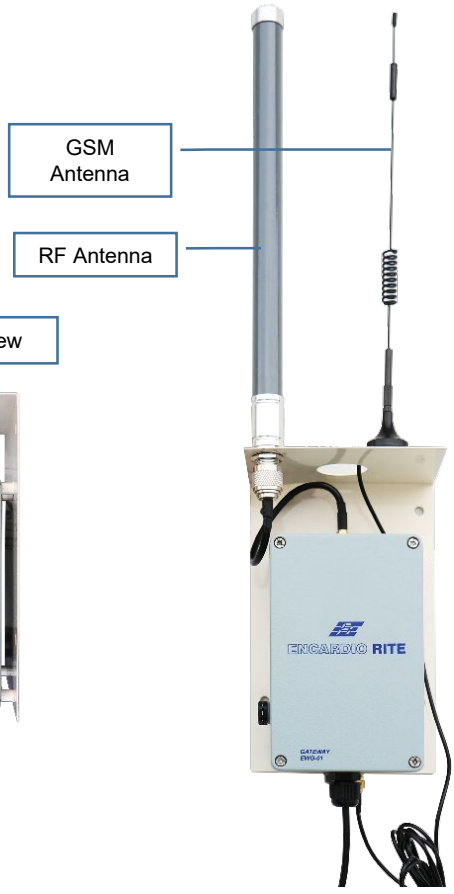


Figure 2-2 Gateway antenna & Cellular (GSM) antenna positioning

2.1.2 Mast mounting

Sites being different from each other must be properly surveyed to determine the best place for mounting the gateway. Generally, the gateway should be in line of sight of all the nodes and if this is not possible in line of sight with most of the nodes. In a hilly region, the best place to mount a gateway may be a portable cabin from where all the nodes are visible.

A good place to mount the gateway maybe on a mast on the tallest building in the neighbourhood. To achieve better coverage/transmission of data, it is recommended that the gateway (antenna) be mounted at the site as high as practicably possible. Mounting the gateway on a tall mast is a good solution. Extra precaution must however be taken for protection of the equipment.

Type of mast to be used for any application depends on the site conditions. Mast maybe a small pole mounted to the roof of any structure or a tall pole in an open field structured on a strong foundation. If required, the mast maybe supported with guy wires.

Once a stable mast is ready the gateway can be fixed on it using suitable clamps and the mounting plate. A typical installation schematic is shown in figure 2-3 for reference. A protection box may be provided, depending on site requirement.

NOTE: Mast, mounting accessories, protection cover and necessary civil work is in the scope of the client.

Figure 2-3 Gateway mounted on mast

2.2 Installation of Nodes

2.2.1 Wall mounting

The Nodes can be directly fixed to a flat surface using four screws. A node bracket is provided which makes mounting on a flat surface or on a pipe (using C-Clamps) easier. Installation may have to be improvised or tailor made depending upon site conditions, like using cable ties.

The node is supplied from the factory fixed to the bracket with four sets of screws and nuts. The node is mounted on the bracket using M4/M6 screws and nuts. A single channel vw node with mounting plate is shown in figure 2-4. Model EWN-01A, EWN-01V, EWN-01R nodes (smaller size units) are fixed to the bracket using M4 screws and nuts. Model EWN-04A, EWN-08V, EWN-01D nodes (larger size units) are fixed to the bracket using M6 screws and nuts.

Connect the SMA antenna to the bulkhead. The bracket can be now fixed to the wall or flat surface with suitable fasteners provided with supply.

Figure 2-4 EWN-01V single channel vw node with mounting plate

2.2.2 Mast mounting

Sites being different from each other must be properly surveyed to determine the best place for mounting the nodes and gateway. Generally, the gateway should be in line of sight of all the nodes. To achieve better coverage/transmission of data, it is recommended to mount the vibrating wire node as high as practicably possible at site. Mounting the node on a tall mast is a good solution. Ample precaution must however be taken for protection of the equipment.

Type of mast to be used for such application depends on the site location. Mast can be a small pole mounted to the roof of any structure or portable cabin available at site (with required permissions).

In case of an open field or hilly region application, mast can be a pole installed in ground with strong foundation. If required, it can be supported with guy wires. Height of Node mounting needs to be carefully planned such that it is in line of sight of Gateway, but not too high to attract lighting.

Once the mast is ready, node can be fixed on it using suitable bracket, clamps and fixing plate. If required, a suitable protection box can be provided. A typical installation schematic is shown in figure 2-6 for reference. A protection box may be provided, depending on site requirement.

NOTE: Mast, mounting accessories, protection cover and necessary civil works is in the scope of the client.

Figure 2-5 EWN-01V VW node mounted on mast with a protection box (antennae inside protective tube)

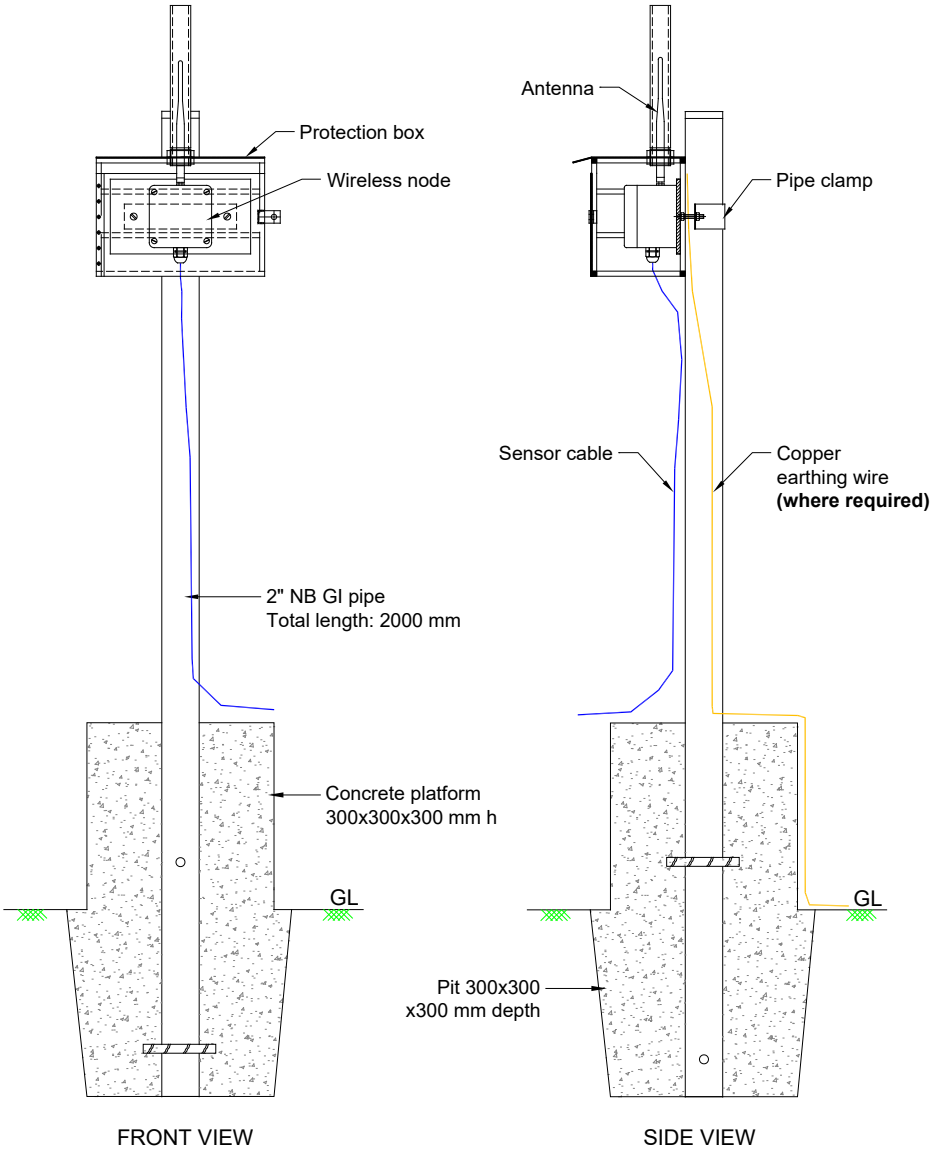


Figure 2-6 Typical installation schematic for mounting node on mast, with protection cover

3 SETTING UP THE GATEWAY

3.1 Initial set-up

1 Connect a 12 VDC, 1 Amp power supply to the gateway. Ensure correct polarity while connecting the power supply. The power supply can be a 12 VDC power adapter. Insert the battery while ensuring the correct polarity.

2 Switch on the gateway by putting the power switch to ON position. On/Off switch shown in figure 3-1.

3 Once the gateway turns ON, RF LED (Radio Signal) will turn green. After around 1~2 minutes, the WF and SYS LED will also turn green (refer to figure 3-1). The RF and SYS LED will start blinking after few seconds, while the WF LED will stay green (RF and SYS LED will be in blinking state for about 4 minutes and then stop glowing).

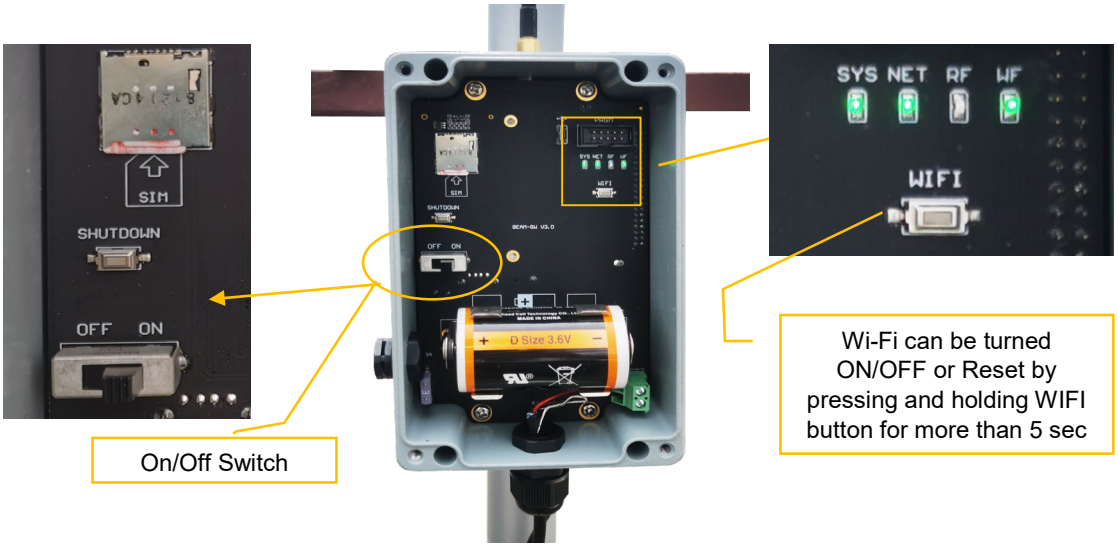


Figure 3-1 Gateway details

4 On PC/laptop, search for Wi-Fi networks and connect to the "EnRite_Beam_DAC0" (Wi-Fi of Gateway). The password is *adminadmin (Refer to figure 3-2)*

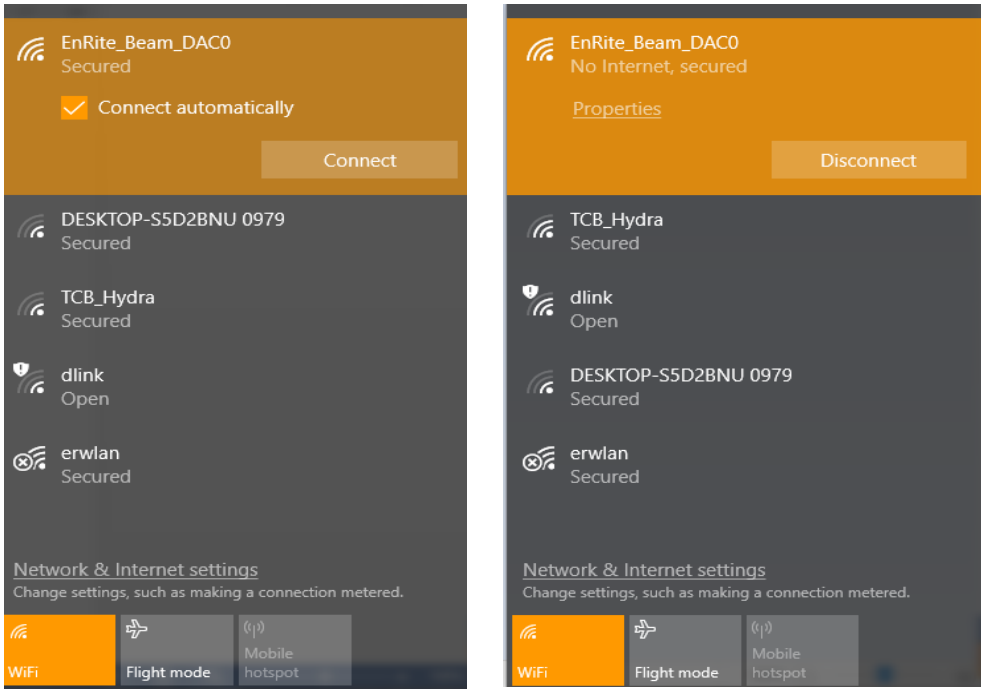


Figure 3-2

5 In any of the available internet browser (like Google Chrome, Internet Explorer etc.), open url link http://192.168.0.10. Enter username and password as given below (as shown in figure 3-3)

Username: *admin*

Password: *adminadmin*

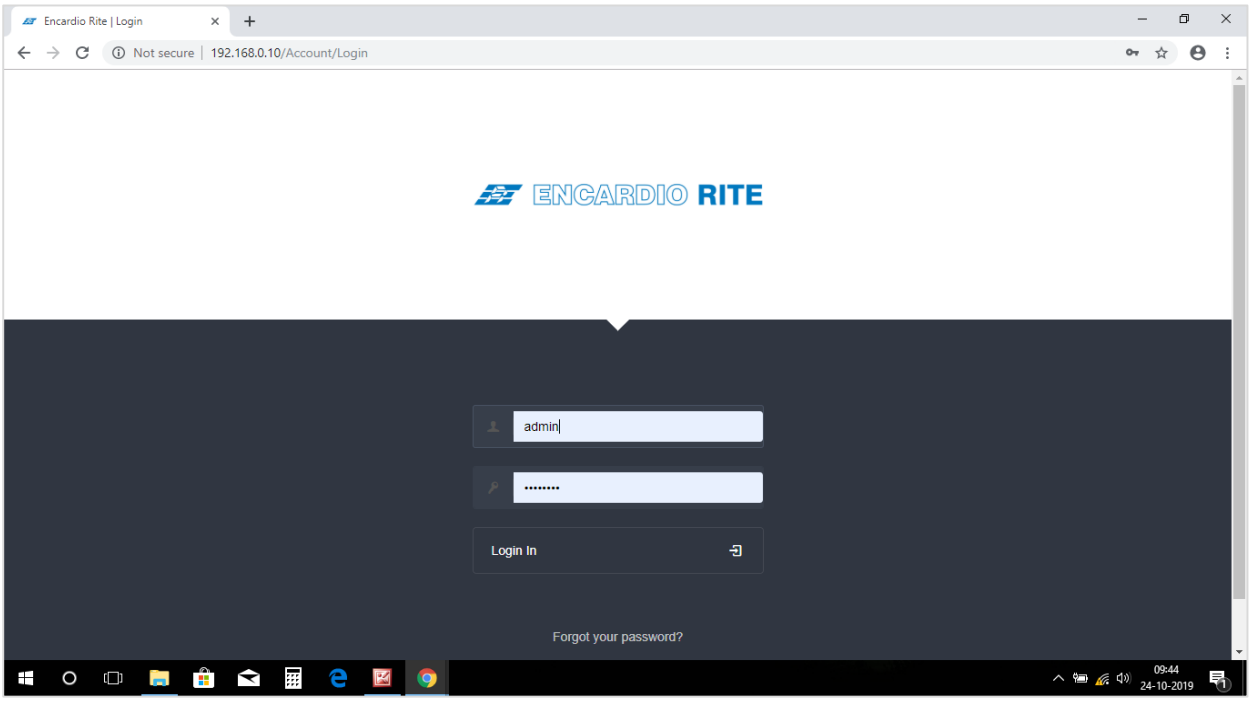


Figure 3-3

6 After logging, screen as shown in figure 3-4 will open. Click on the Gear Icon (encircled in figure).

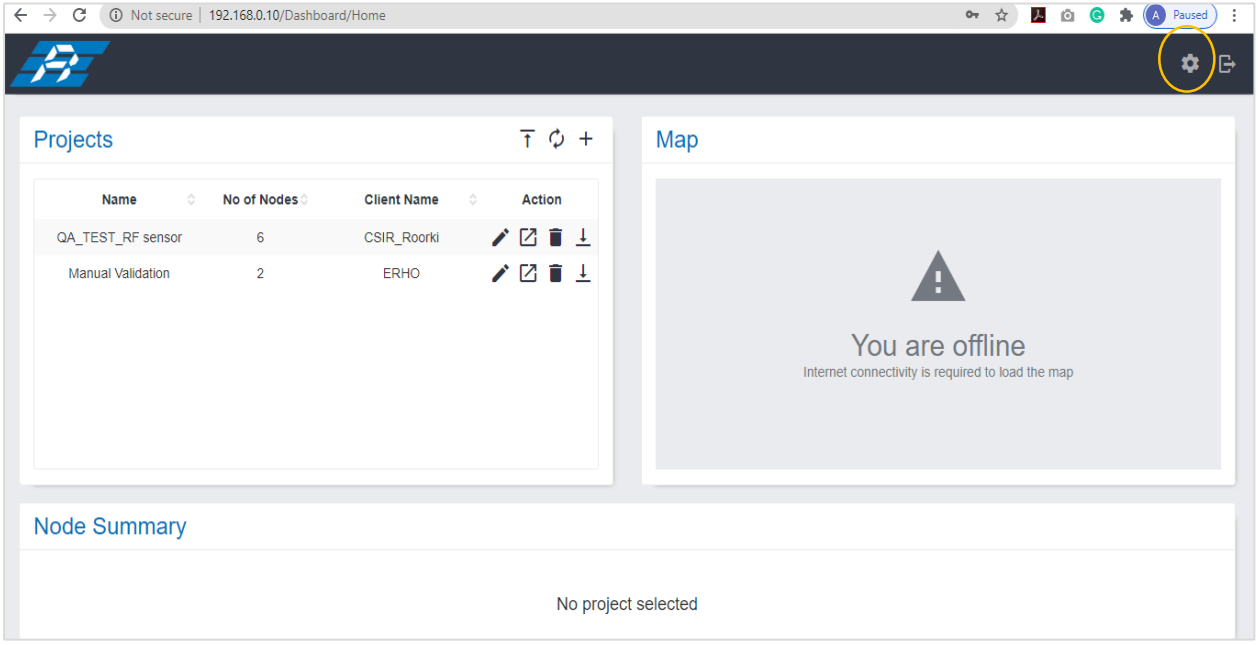


Figure 3-4

3.2 Gateway settings

The following screen will appear on clicking the gear icon. From here, settings can be updated as explained below.

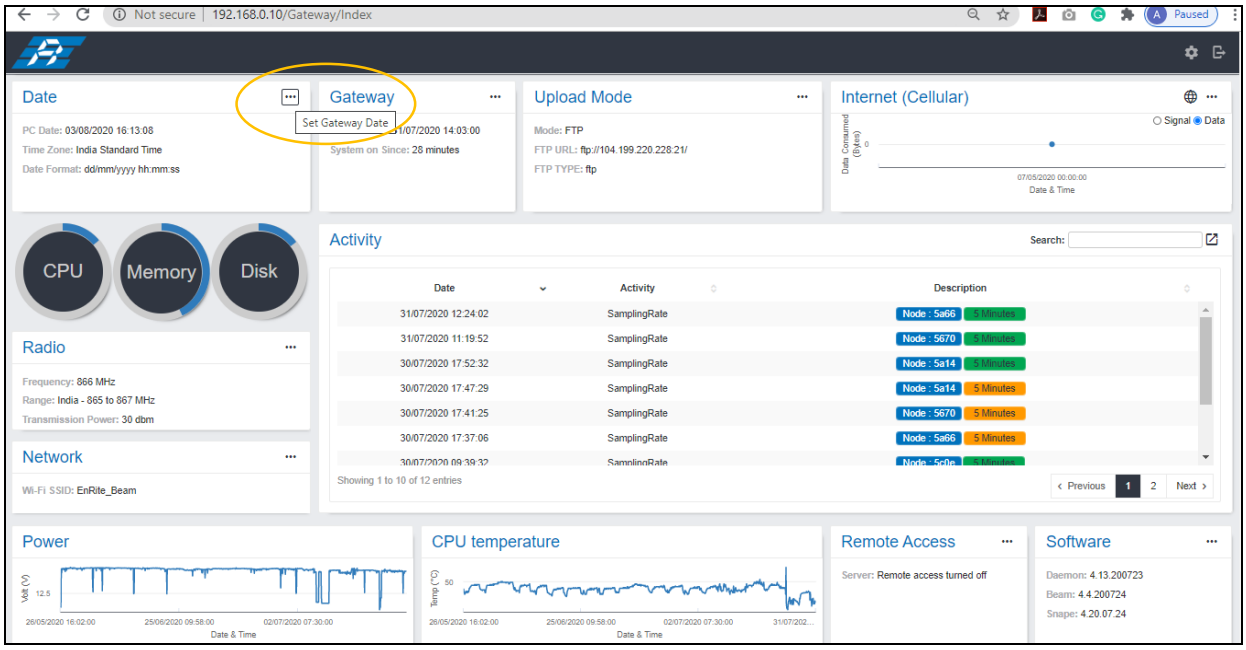


Figure 3-5

3.2.1 Date and Time settings

Click on the three dots on the 'Date' section (refer to figure 3-5). A window of Gateway Date will pop up as shown in figure below. Select the 'Time Zone' (for the specific country) and desired 'Date Format'.

Click on "Sync Date Time with PC" button (encircled in figure 3-6). After synchronizing with system date and time, click on the 'Save' button.

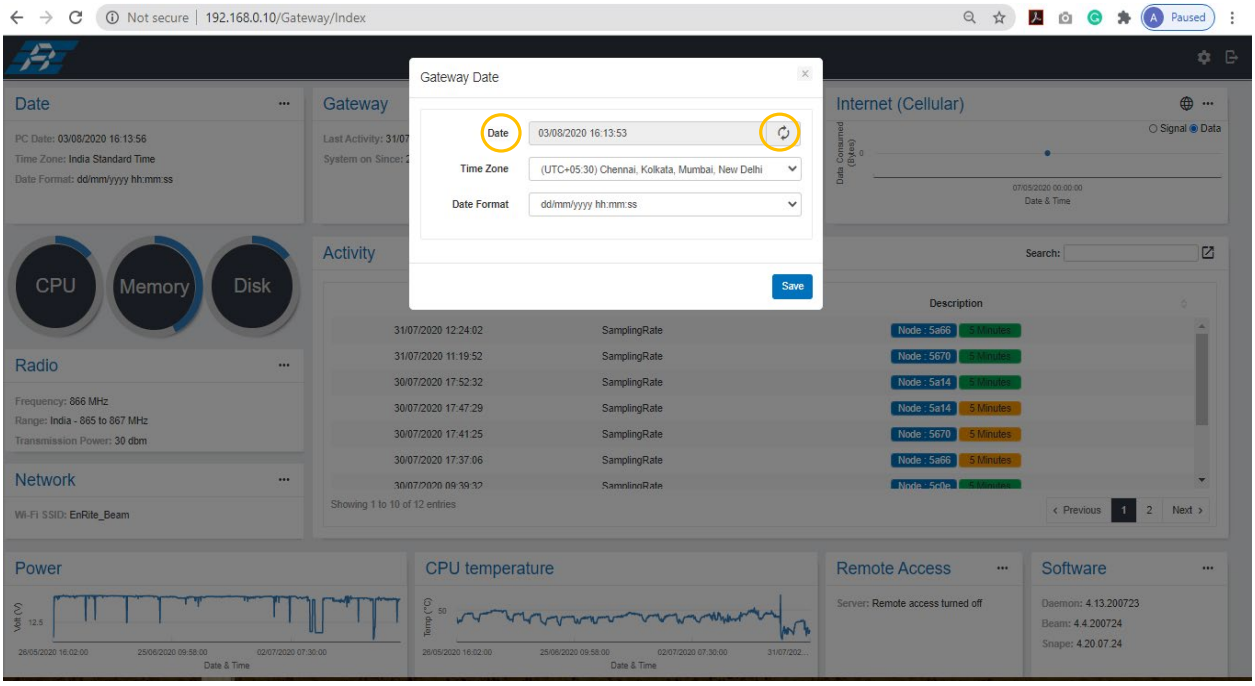


Figure 3-6

3.2.2 Radio settings

Click on the three dots on the 'Radio' section (refer to figure 3-5). Screen as shown in figure 3-7 appears.

Normally, the frequency is factory set to suit country band in which the wireless system will be installed. The settings can however be changed by selecting specific country from 'Country' tab (drop down menu) and entering desired frequency in "Frequency" tab.

NOTE: Please refer to section 1.1 for preferred frequency bands for specific regions, or refer to the following link to check the allowed frequency band in your country.

https://www.thethingsnetwork.org/docs/lorawan/frequencies-by-country.html

'Transmission Power' setting comes with default value of 30 dBm (refer to figure 3-7). This can be changed at user end, if required.

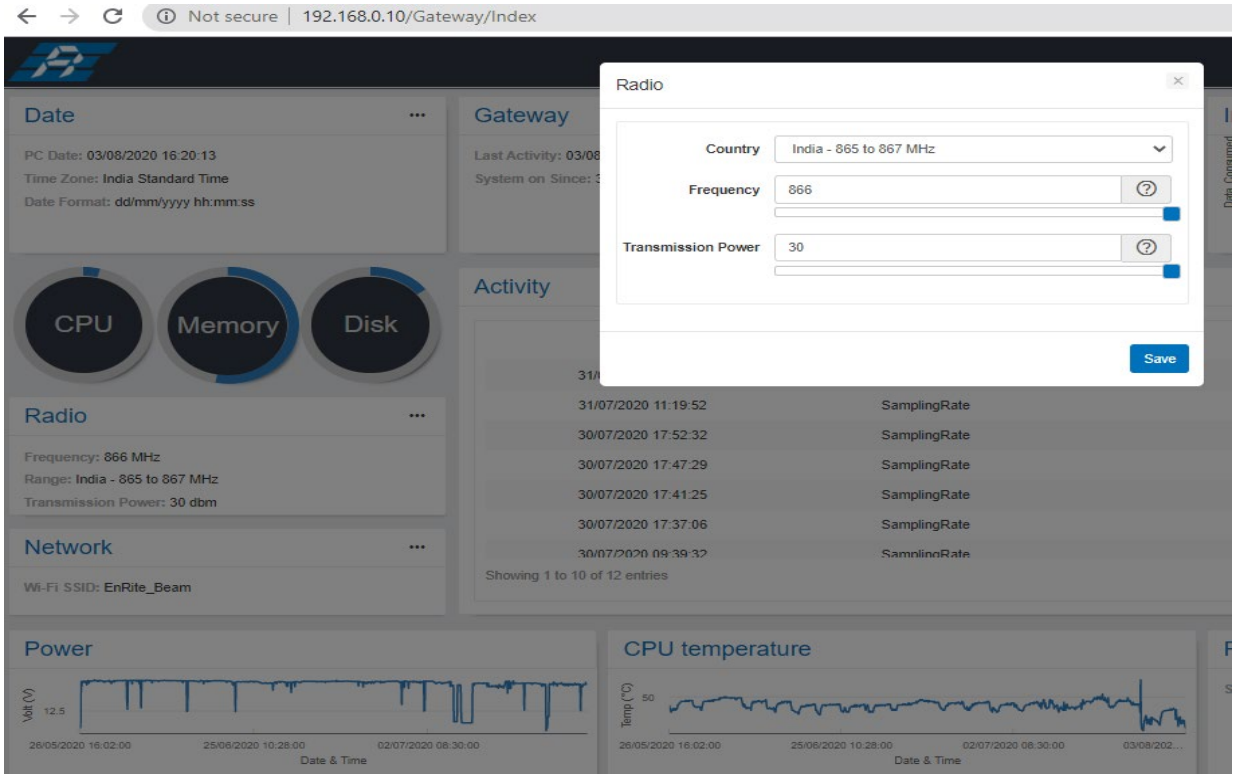


Figure 3-7

3.2.3 Internet settings

Click on the three dots provided "Internet (Cellular)" (top right corner in figure 3-5) for configuring its settings. Window as shown in figure 3-8 will appear.

For "Internet Mode", select either LAN or Cellular.

If **Cellular** is selected, set the APN, Username & Password based on the details provide by the relevant service provider.

Once configuration is done, click on little "world icon" to test signal strength (encircled in blue in figure 3-8 below). The check box on "Enable Internet Always" can be ticked to enable Internet permanently.

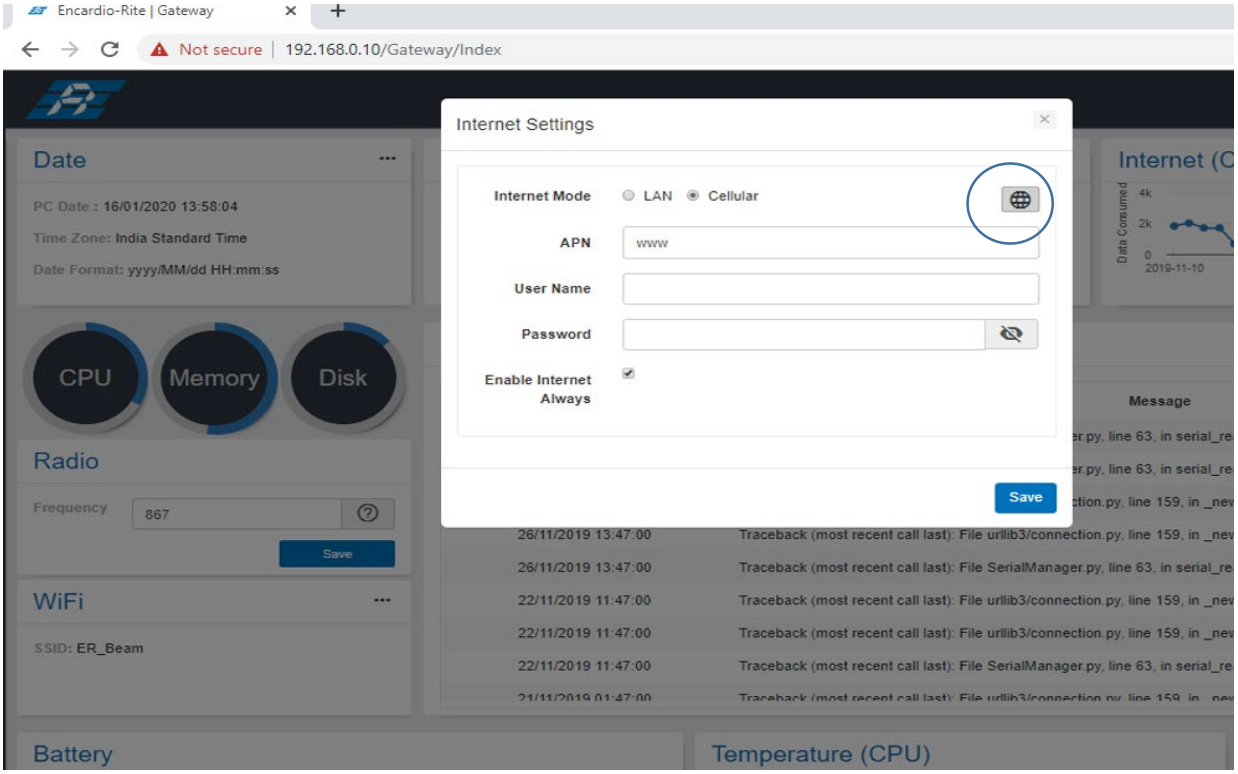


Figure 3-8

3.2.4 Upload Mode settings

Click on the three dots provided at "Upload Mode" for configuring data upload settings (refer to figure 3-5). Window as shown in figure 3-9 will appear. For uploading data, two options are available API and FTP.

Select FTP if data is to be transferred to a FTP server. For uploading to FTP server, enter the respective FTP information like URL, Port, Username, Password and Folder (to which the data needs to be pushed) as shown in figure 3-9. The "Enable new file creation' should be ticked.

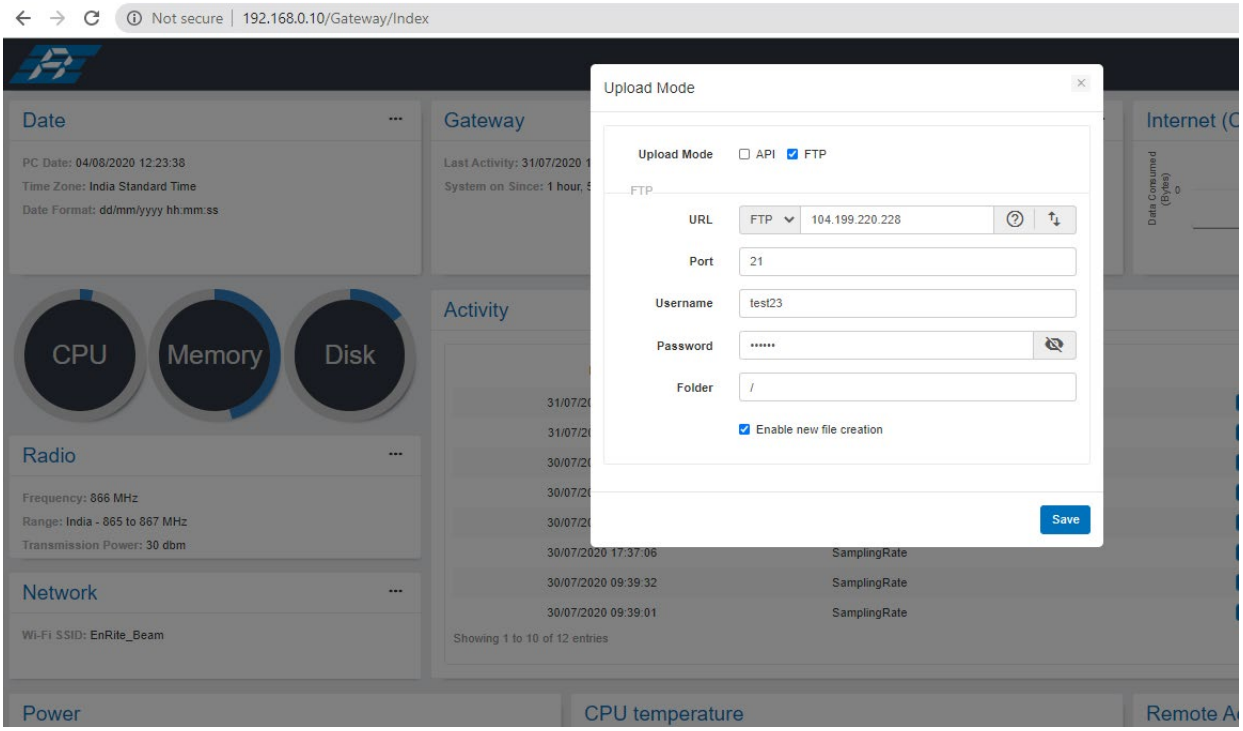


Figure 3-9

3.2.5 Network settings

Click on the three dots at "Network" tab to update network settings. Window as shown in figure 3-10 will appear.

The "Wi-fi SSID" and "Wi-Fi Password" can be changed as desired. The Wifi SSID format is as follows:

"*User Input Text_User Input Text_Device ID No"*. (Device ID cannot be changed).

If the gateway address needs to be changed, it can be done as shown below in figure 3-10.

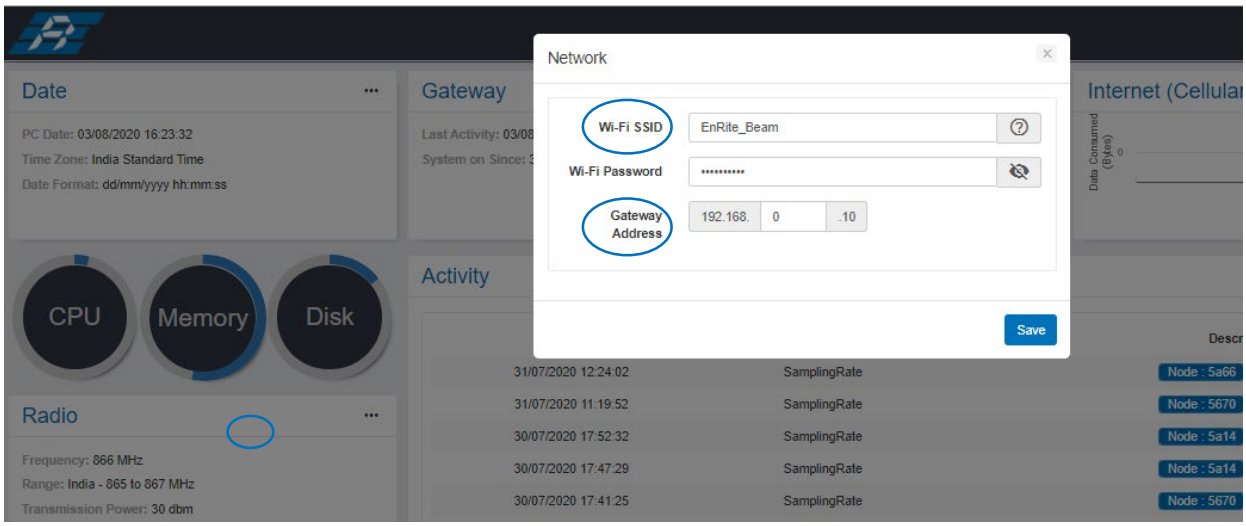


Figure 3-10

3.2.6 Activity settings

The "Activity" section (on the main screen as shown in figure 3-5) displays the key functionalities and changes that are carried out in the gateway. The information with respect to changes made (if any) can be checked out in this section.

Using the export icon (encircled in red in figure 3-11), gateway logs can be exported.

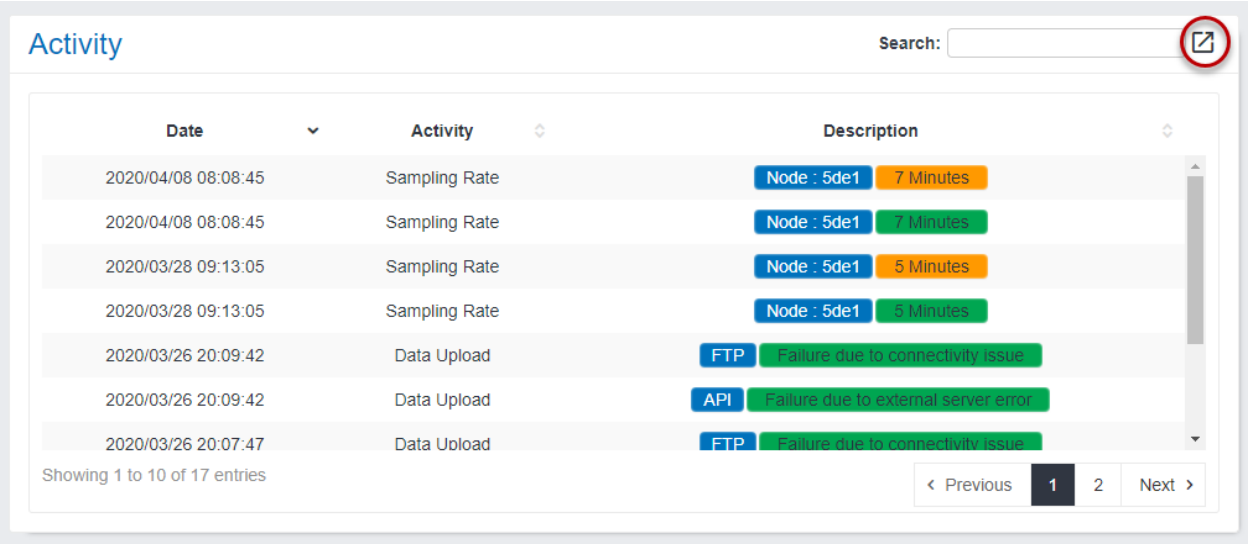


Figure 3-11

3.2.7 Remote Access

'Remote Access' setting is required if the gateway needs to be accessed remotely using a dynamic DNS. It is turned "off" as default factory settings.

For remote access configuration details, please contact factory.

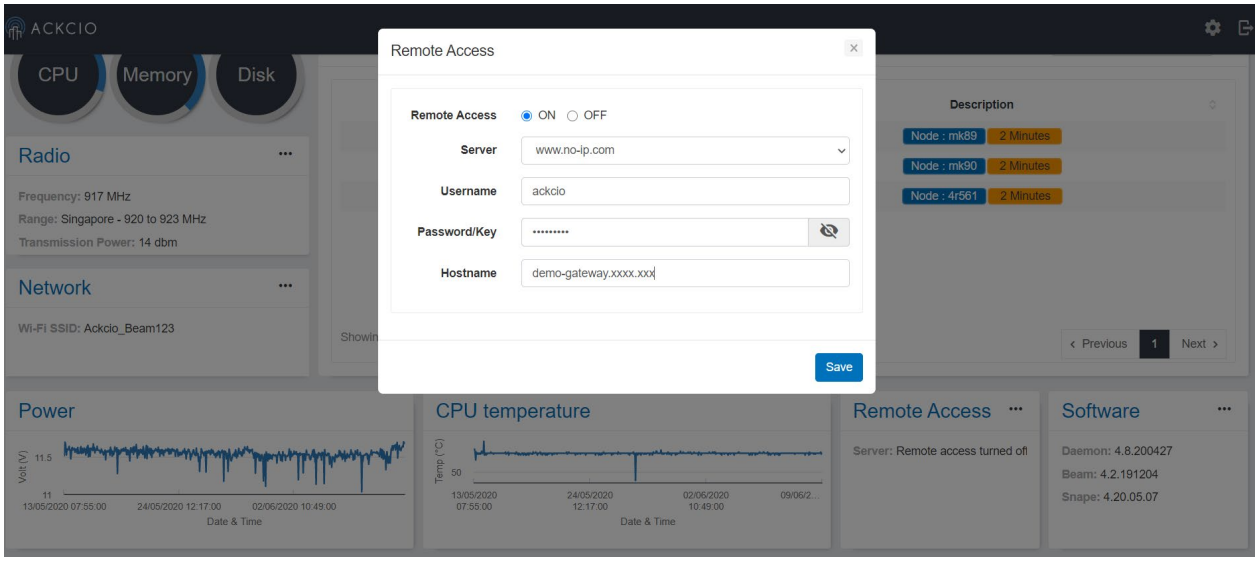


Figure 3-12

3.2.8 Software

'Software' section at the bottom right corner provides the current firmware & software version details.

This brings to the end of **Gateway Settings**. Click on the ER Logo at the top left corner on screen (figure 3-5) to come back to the dashboard.

3.3 Creating project and adding nodes

Create a project by clicking "+" button on the top right corner of "Projects" section. Screen as shown in figure 3-14 will appear.

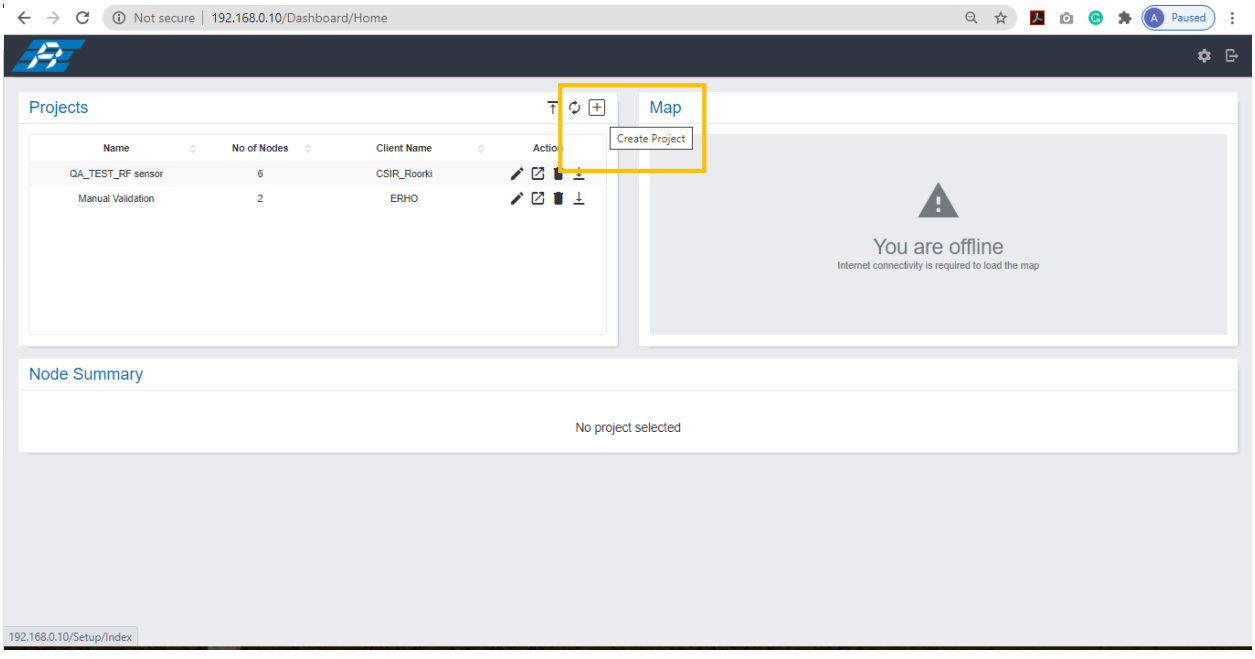


Figure 3-13

3.3.1 Project settings

Enter the **Name, Start date, Client, Location** of the project to complete project profile as shown in figure 3-14.

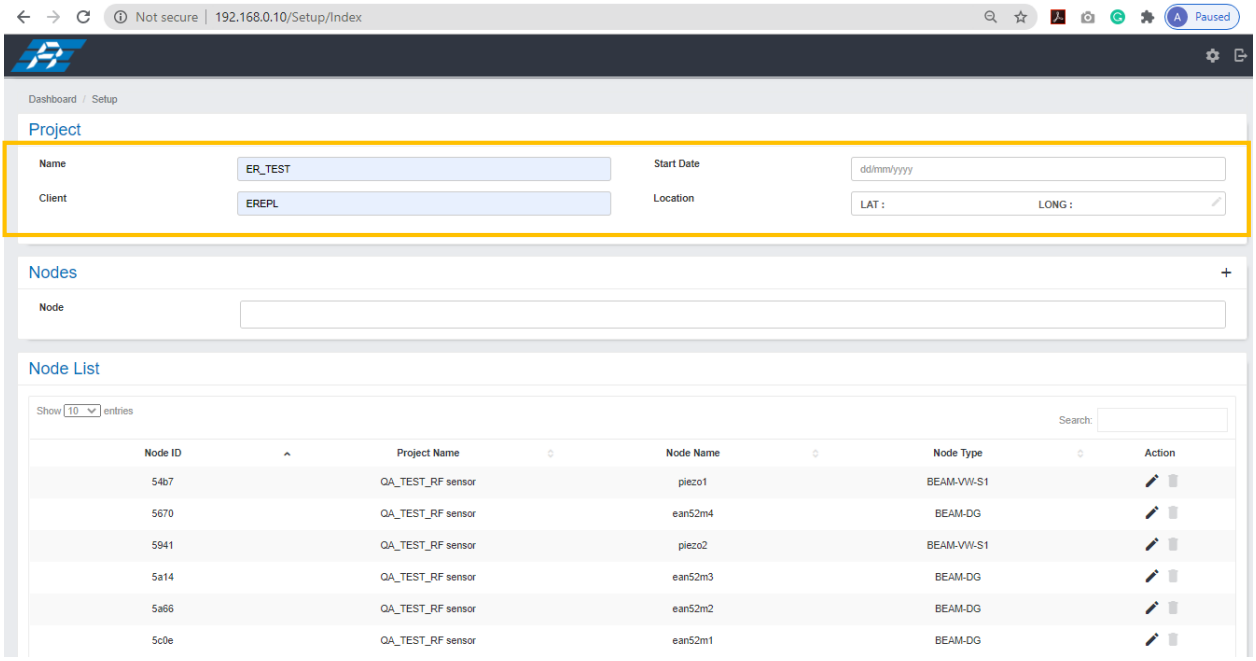


Figure 3-14

3.3.2 Nodes setting

NOTE: As an initial step to configure the Project, it is necessary to add all the devices (Nodes or wireless tilt meter) to the gateway.

1. Under Nodes tab, at the right corner click "+" button to create Node as shown in figure 3-15.

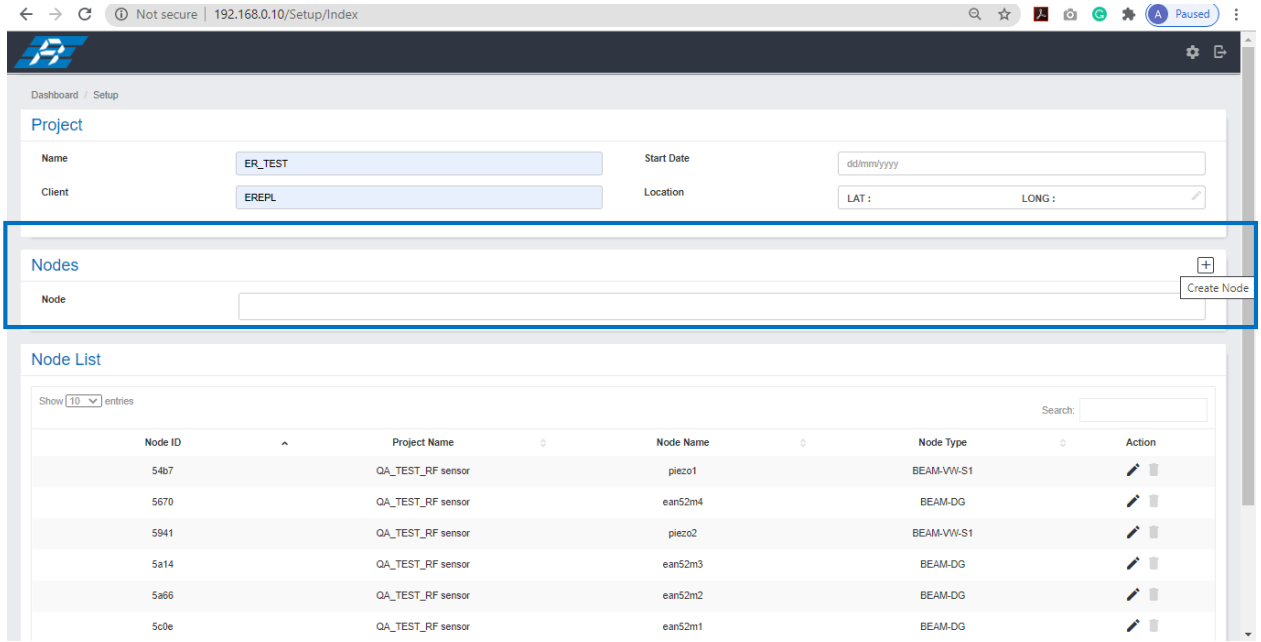


Figure 3-15

2. The window that open will require following information (Refer to figure 3-16):

Node Type: From the drop down menu, select the type of node selected.

Node ID: Give the respective serial number of the node/tiltmeter.

Node Name: Give a name to the node, for easy recall of node type and location.

NOTE: In case you are connecting model EAN-95MW wireless tilt meter, select "Beam-AV-S1" (refer to the drop down menu in figure 3-16)

After filling up the device information, click the "**Save**" button.

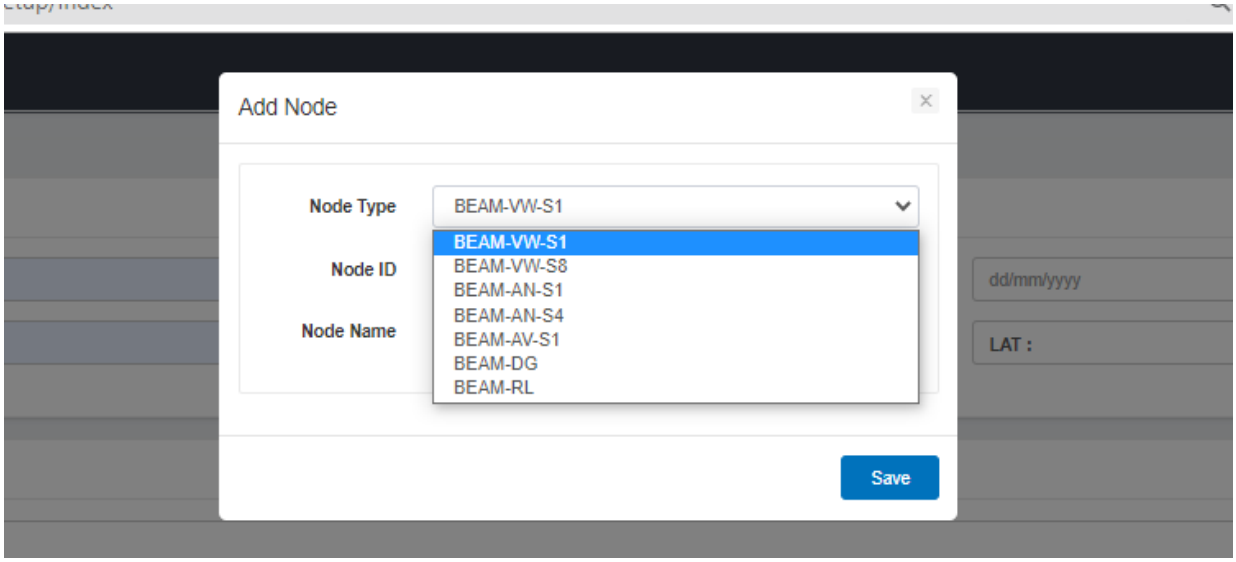


Figure 3-16

3. Repeat the above steps to add additional nodes.

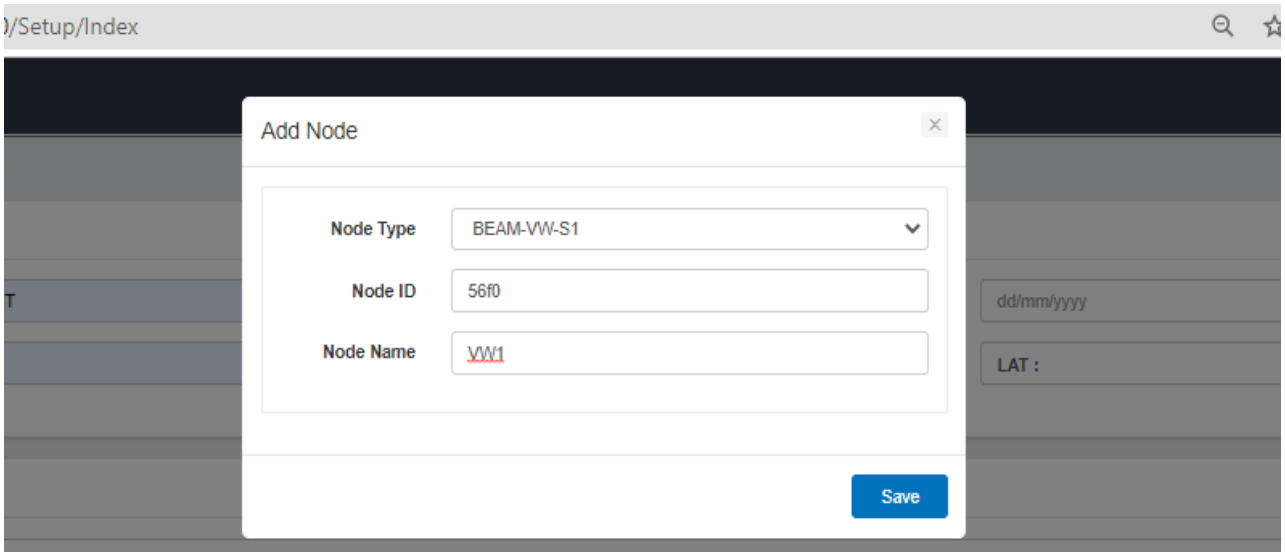


Figure 3-17

4. The information on nodes added can be checked under "Nodes list" section (Refer to figure 3-18).

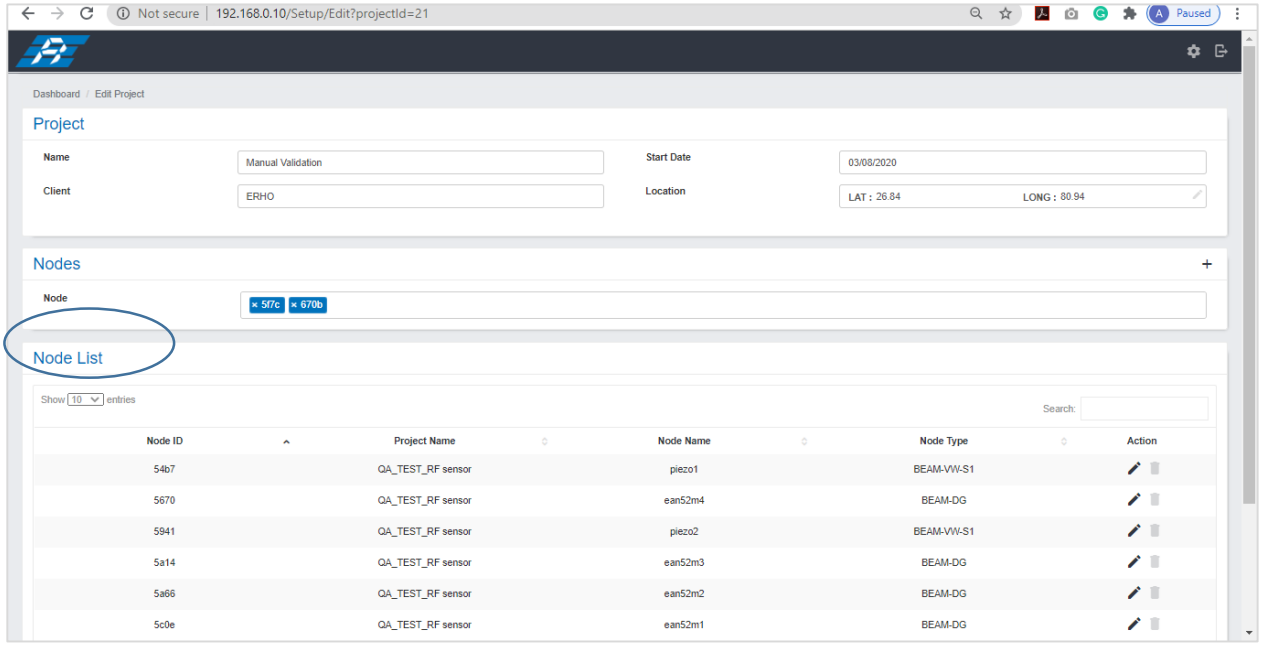


Figure 3-18

5. On Node tab, click with cursor in the text box. IDs of Nodes already added will be seen. Select the nodes. (Multiple nodes can be selected) (refer to figure 3-19)

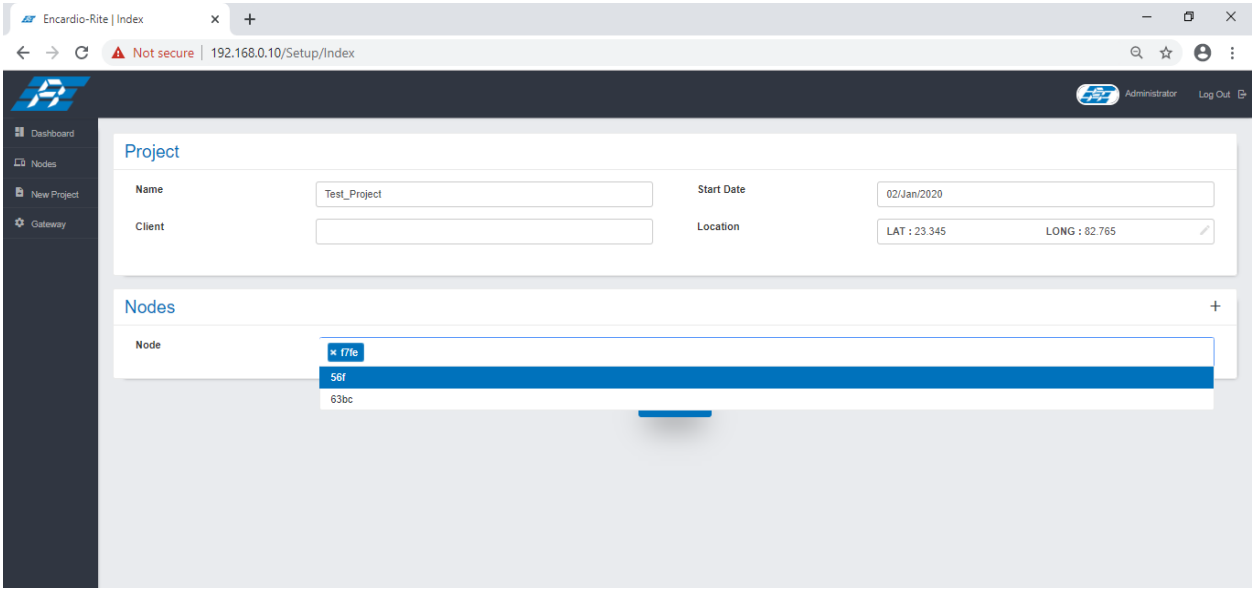


Figure 3-19

6. After selecting all the Nodes, click on 'Next' button as shown in figure 3-20.

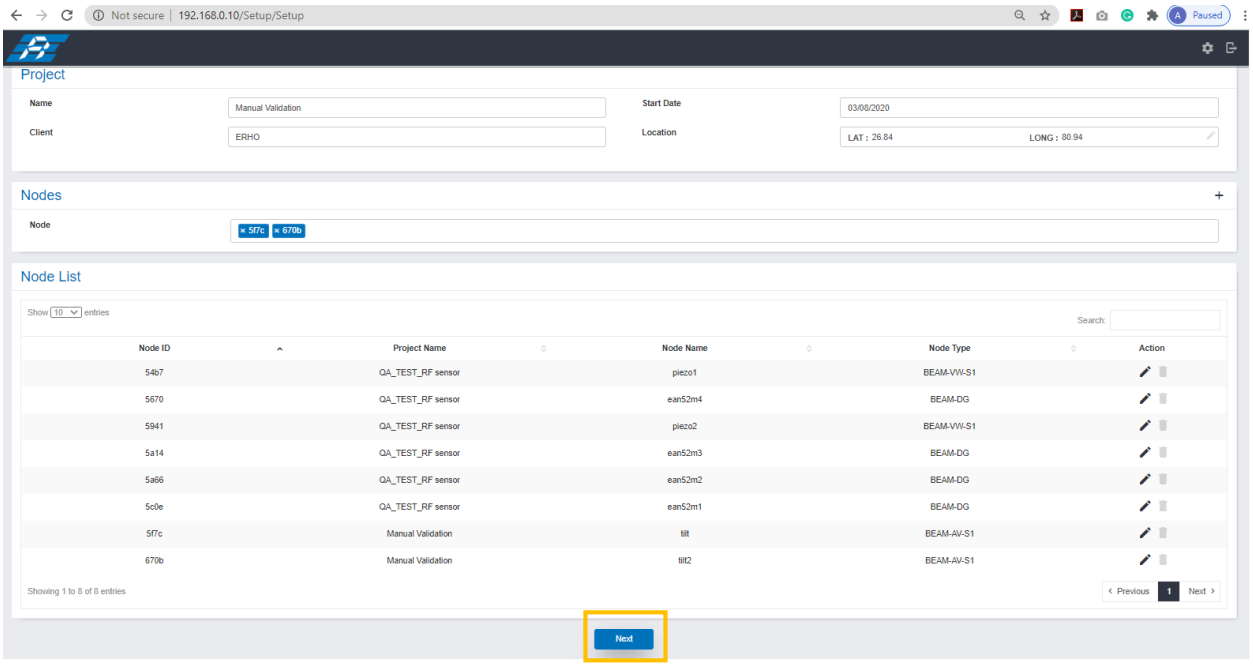


Figure 3-20

7. Once 'Next' button is pressed, Nodes & Sensors window will open up as shown in figure 3-21. Click on 'Setup' button..

NOTE: If one wants to configure sensor setting, it can be done here itself by PC/laptop or refer to individual Nodes manual for complete configuration through mobile.

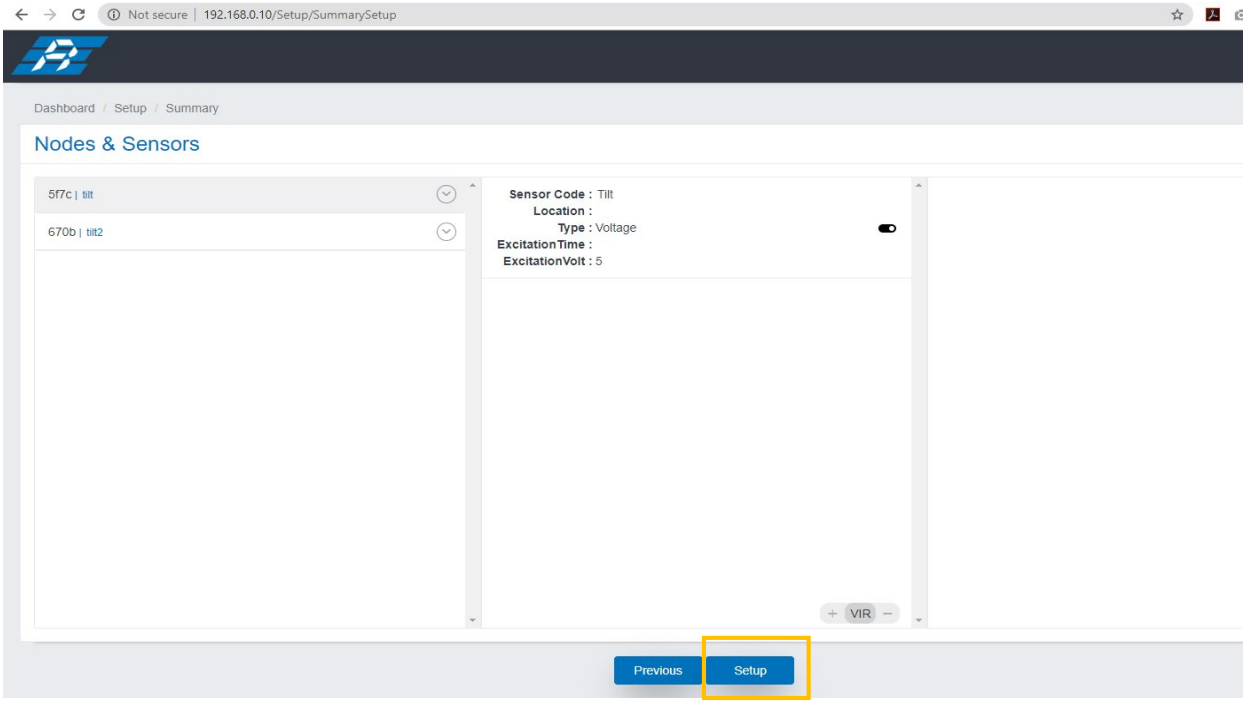


Figure 3-21

8. After pressing 'Setup' button, the software will take back to the Dashboard with the project details list as shown in figure 3-22.

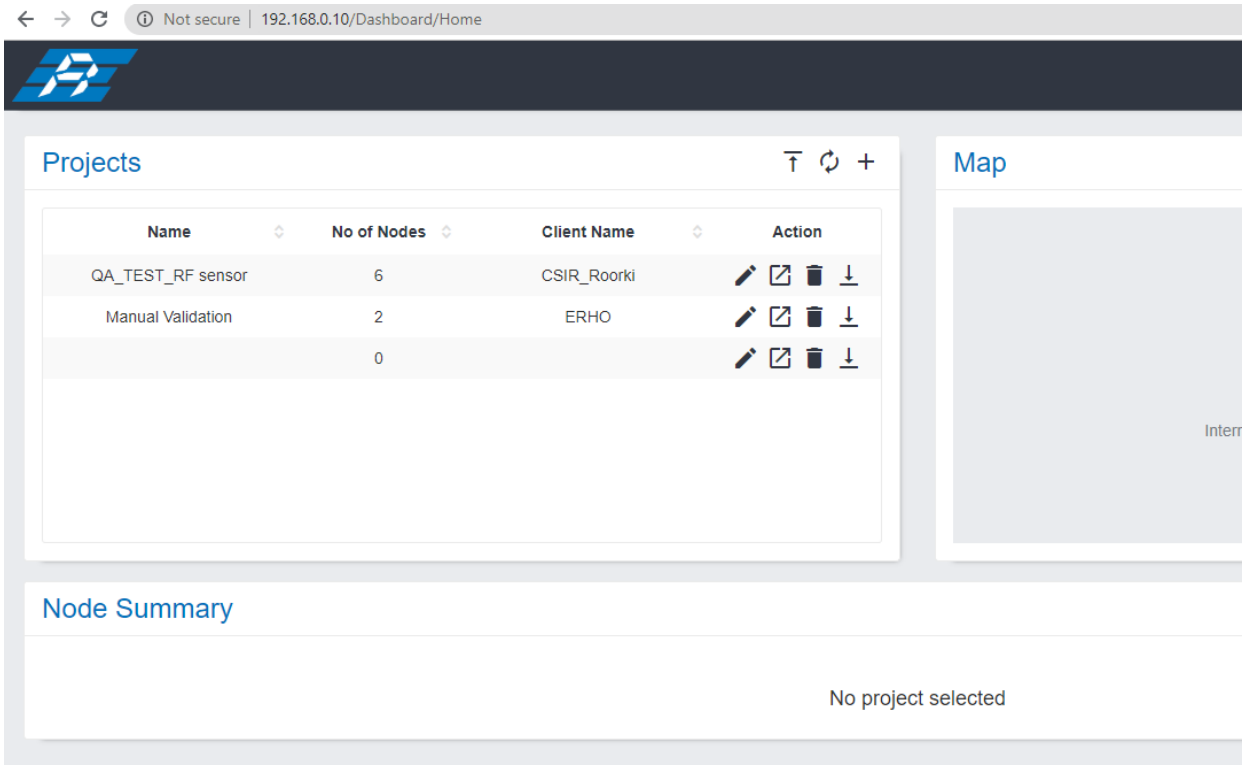


Figure 3-22

9. Double click on the selected 'Project name'. It will show the Node Summary like Node Status, Node name, Sampling Rate, Battery Status, RSSI, Last Updated. (Refer to figure 3-23)

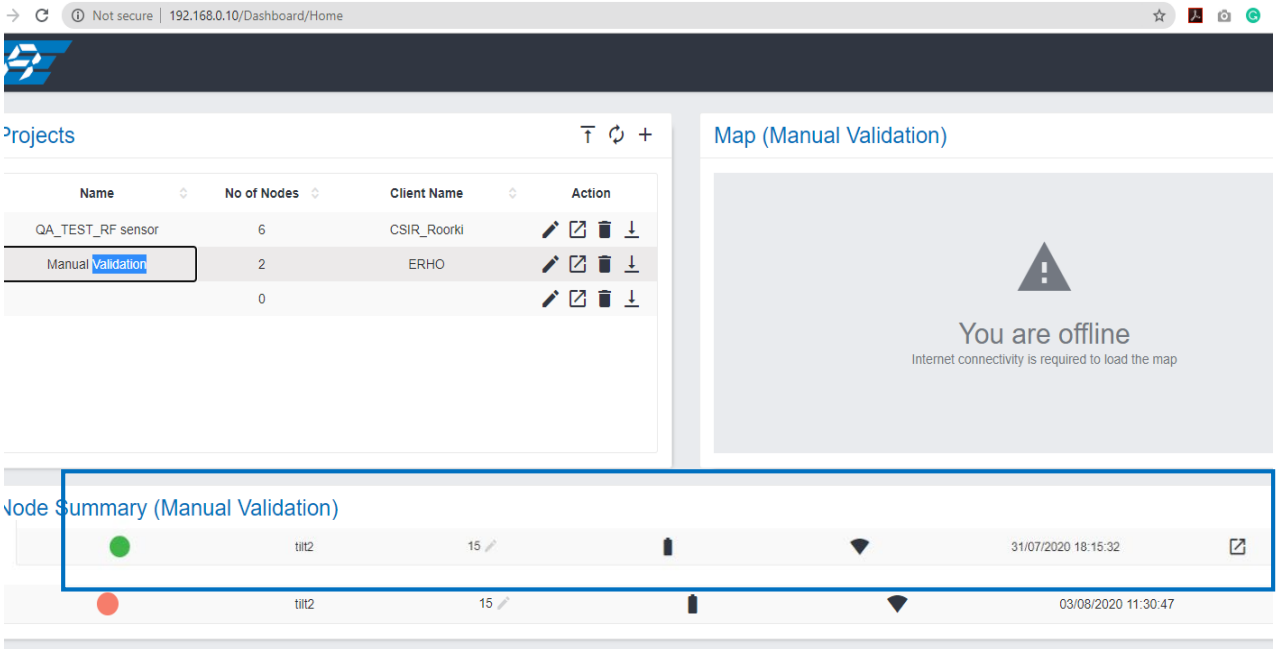


Figure 3-23

10. Set the desired "Sampling Rate" for all the nodes. The rate can be reset by the user by clicking the Up and Down button. Once the desired rate is set, click on the tick button to complete the step. (Refer to figure 3-24)

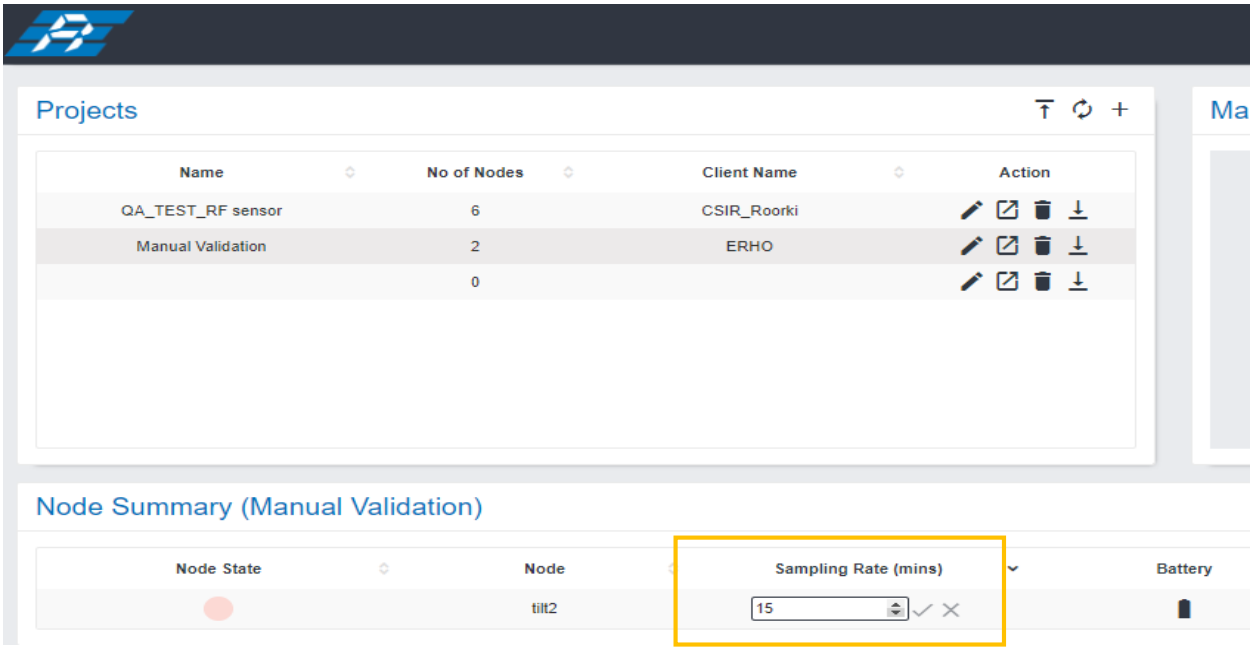


Figure 3-24

3.4 Configuring nodes with sensors

Please refer to the section # 4 and 5 on Nodes set-up and configuration (of this manual) to setup and commission the nodes (for the sensors to be connected to it) with the help of software on mobile phone.

3.5 Sync Gateway with Nodes

After commissioning all the nodes, go to Dashboard, select project, and click on the "sync" button as shown in figure 3-25.

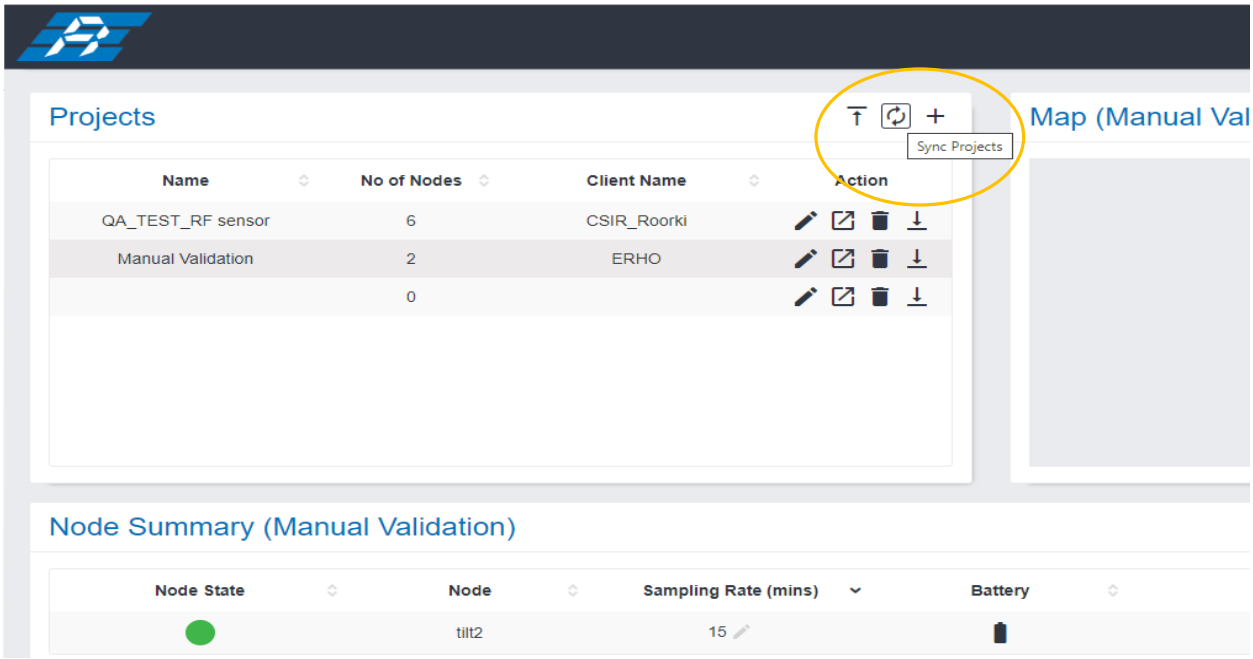


Figure 3-25

3.6 Setting equations (sensor data reduction)

This section describes how to input gage factors of the sensor from the respective calibration certificate for sensor data reduction.

1. On the Dashboard, in the 'Projects' section, click on pencil icon to edit the selected Project (refer to figure 3-26).

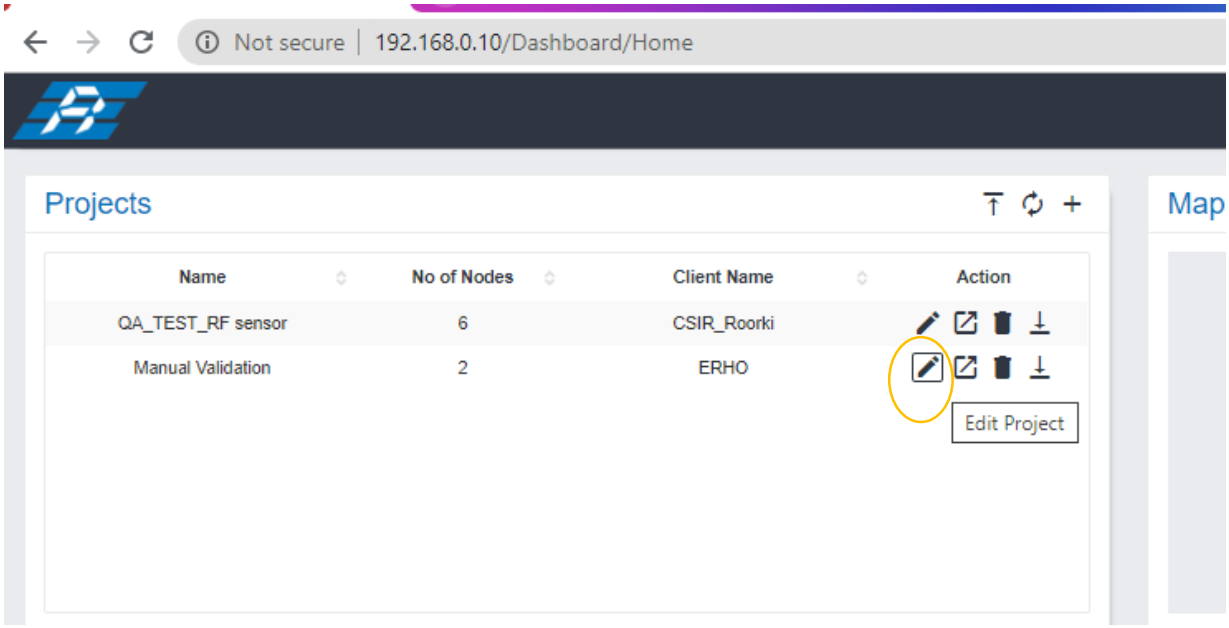


Figure 3-26

2. Once in edit mode, the list of nodes will appear as shown in figure 3-27. Click on the 'Next' button

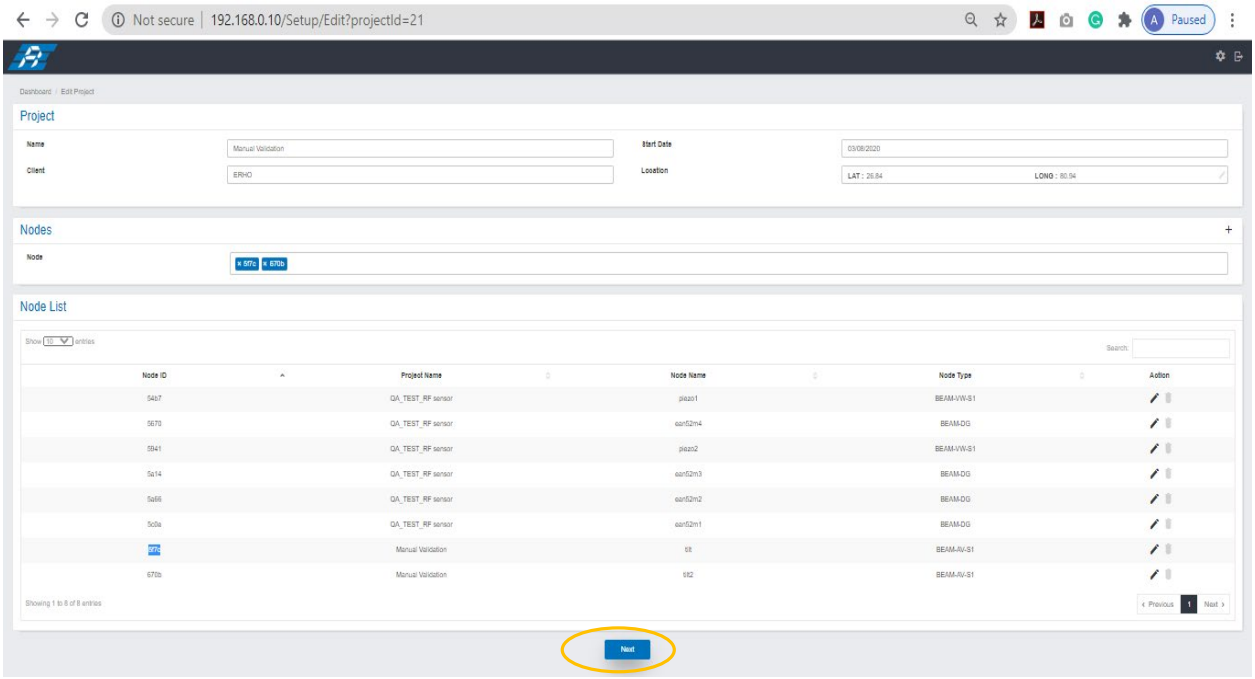


Figure 3-27

3. 'Nodes & Sensors' page will appear with the list of Nodes added in the specific project. Select the Nodes (one by one) and fill-in the Sensor Code and its Location.

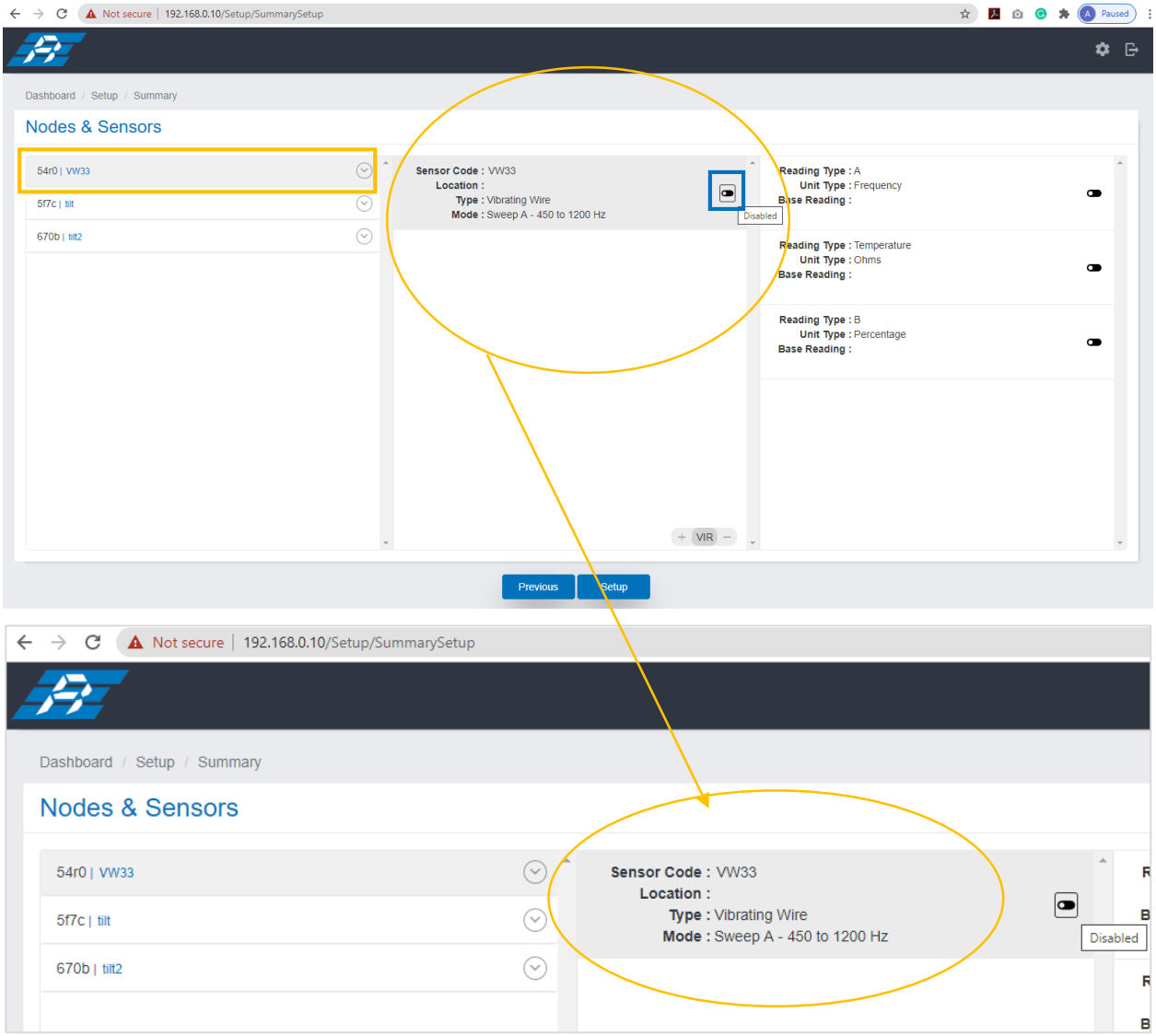


Figure 3-28

4. Enable the 'Disabled' button as shown in figure 3-29. This will enable all the parameters of that sensor (on the right side of figure 3-29). User can disable any parameter, reading of which is not required.

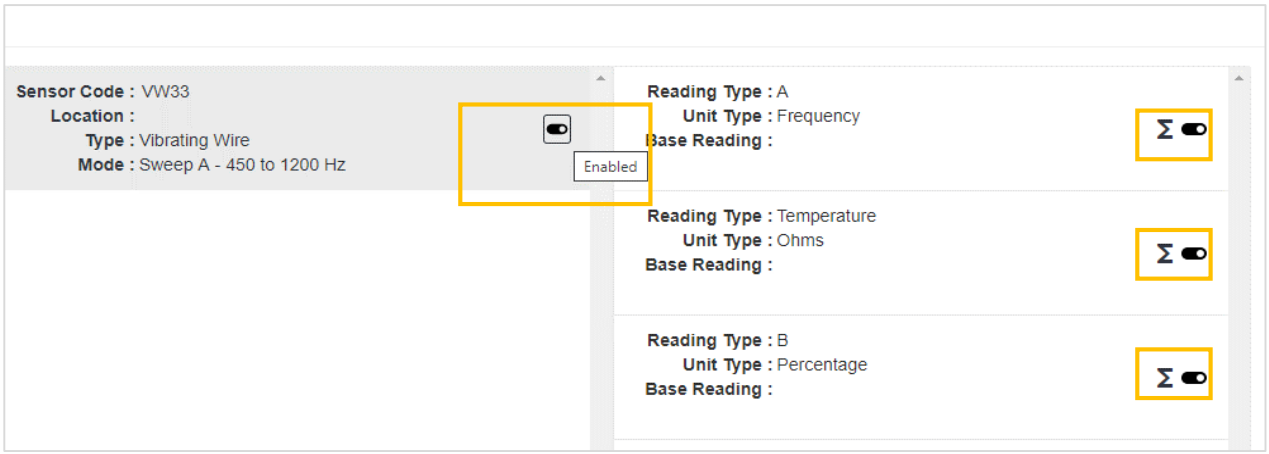


Figure 3-29

5. Click on ∑ symbol to add/edit coefficients and gage factor. In the example given below, ∑ symbol has been selected for a vibrating wire sensor. (Refer to figure 3-30)

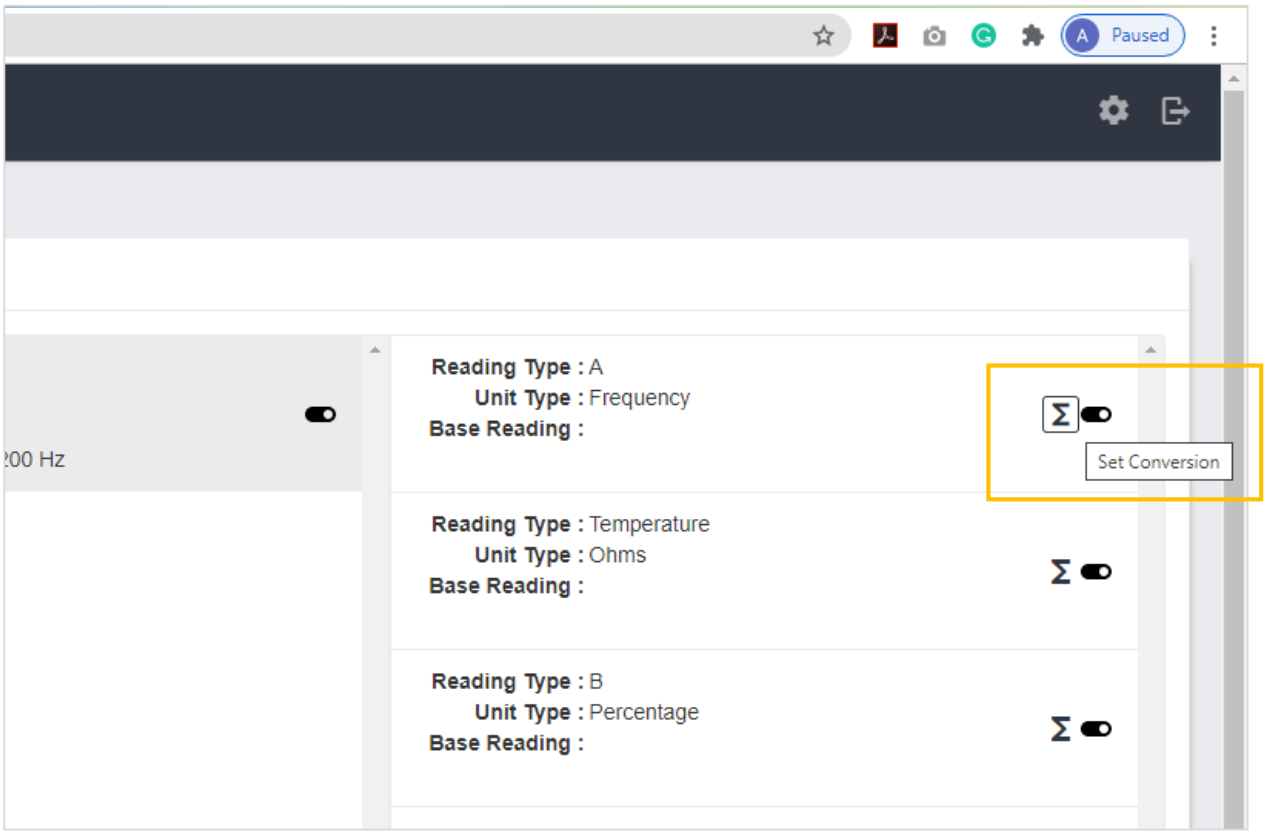


Figure 3-30

6. On selecting ∑ symbol, window as shown in figure 3-31 will appear. Click on the drop down arrow on the 'Formula' tab and select the desired formula type. In the example shown below in figure below, "Polynomial (Absolute)" has been selected for the vibrating wire sensor.

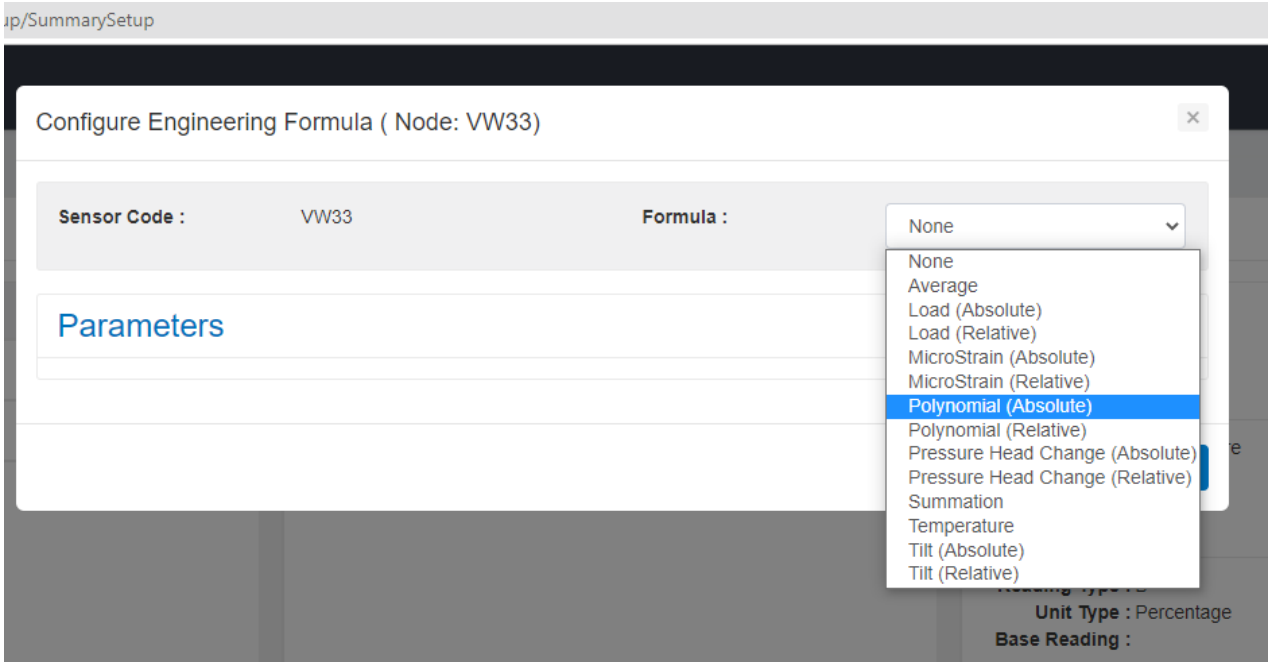


Figure 3-31

7. Under '**Parameters'** section, the related formula will be displayed as shown in figure 3-32. Fill in the **A, B, C, D** coefficients from the respective test/calibration certificate provided for the sensor. Click on '**Save Changes'** button as shown in figure below.

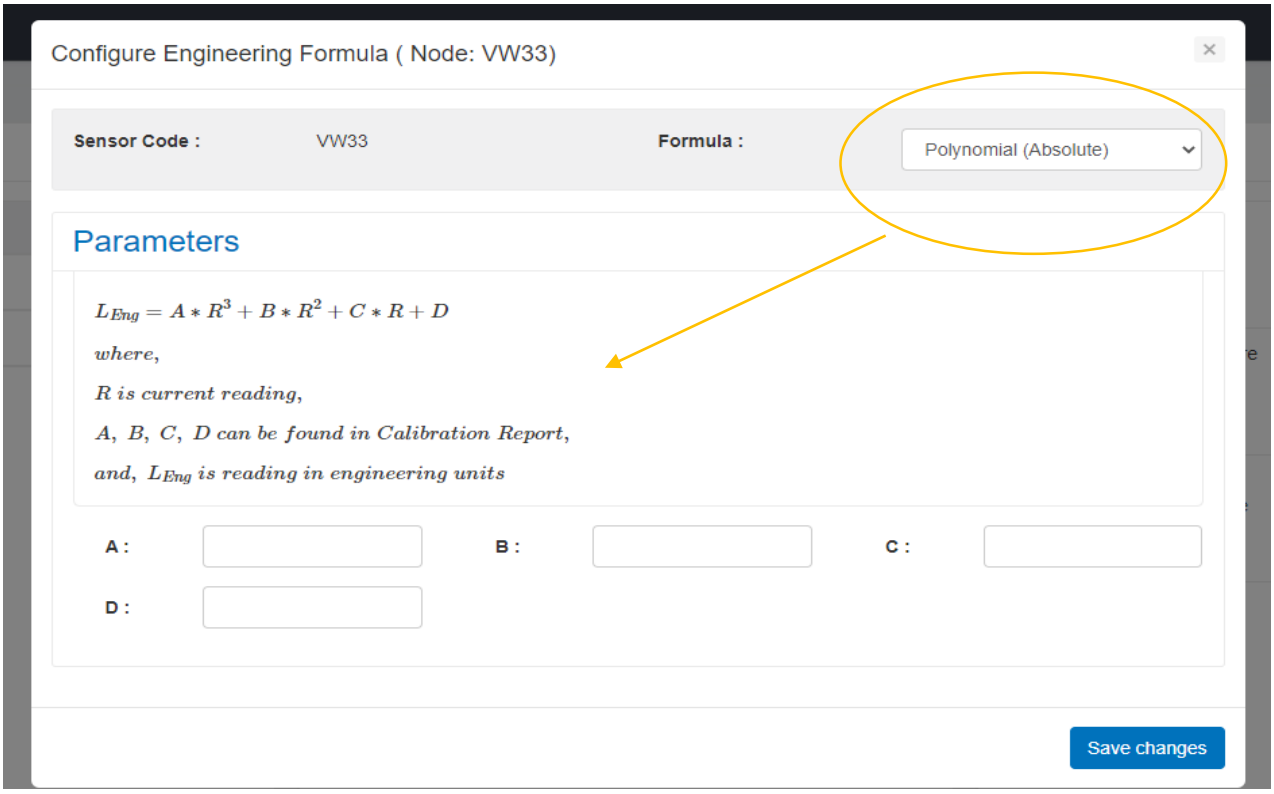


Figure 3-32

8. Similarly, for Temperature reading from vibrating wire sensor, the following formula will be displayed as shown in figure 3-33.

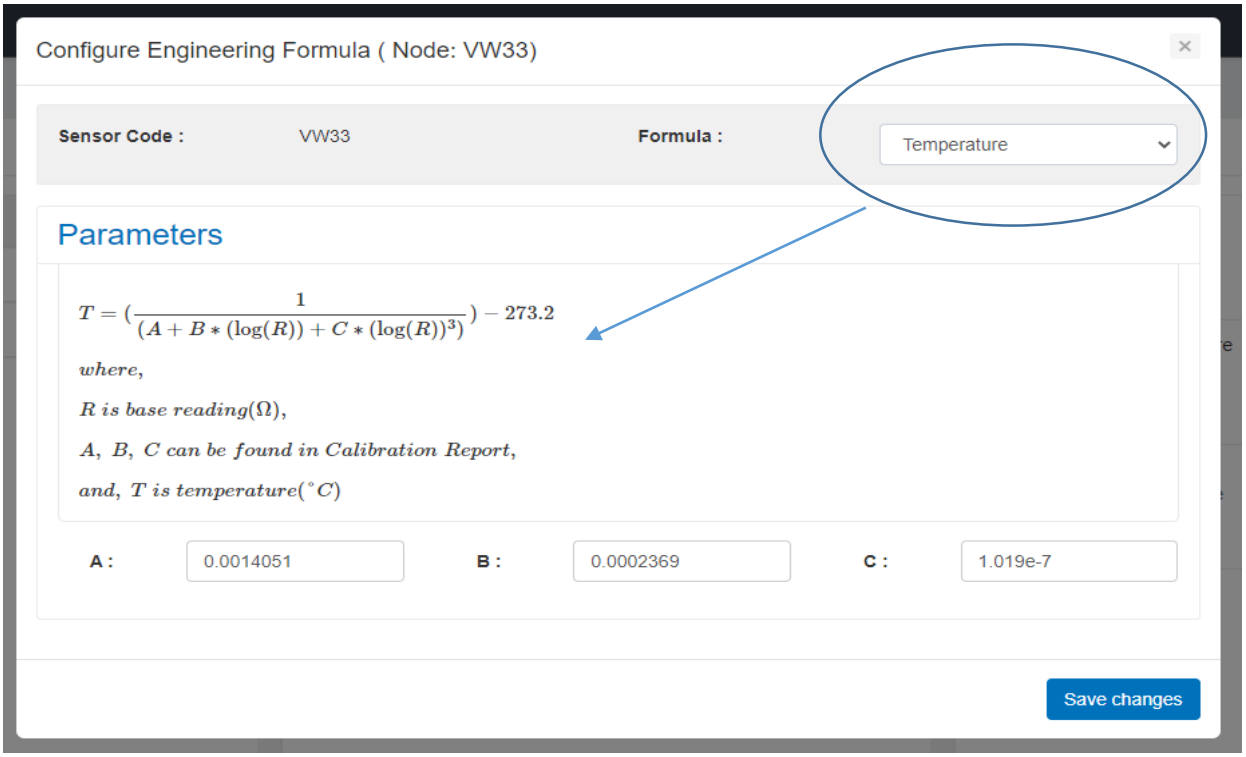


Figure 3-33

9. Select the unit required for the respective parameter. In the figure shown below, Celsius is selected for Temperature reading.

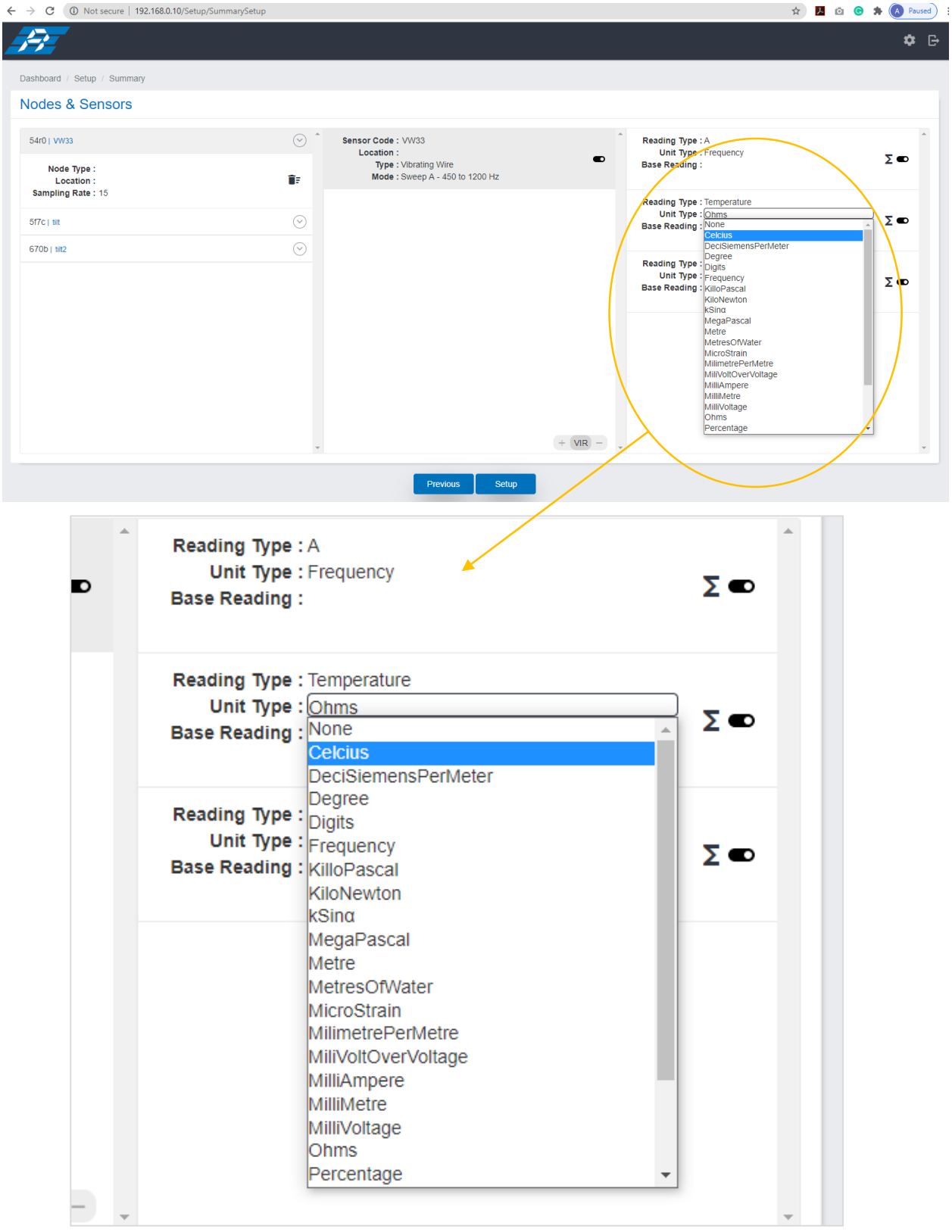


Figure 3-34

10. Click on "**Setup**" button to complete and save the updated project.

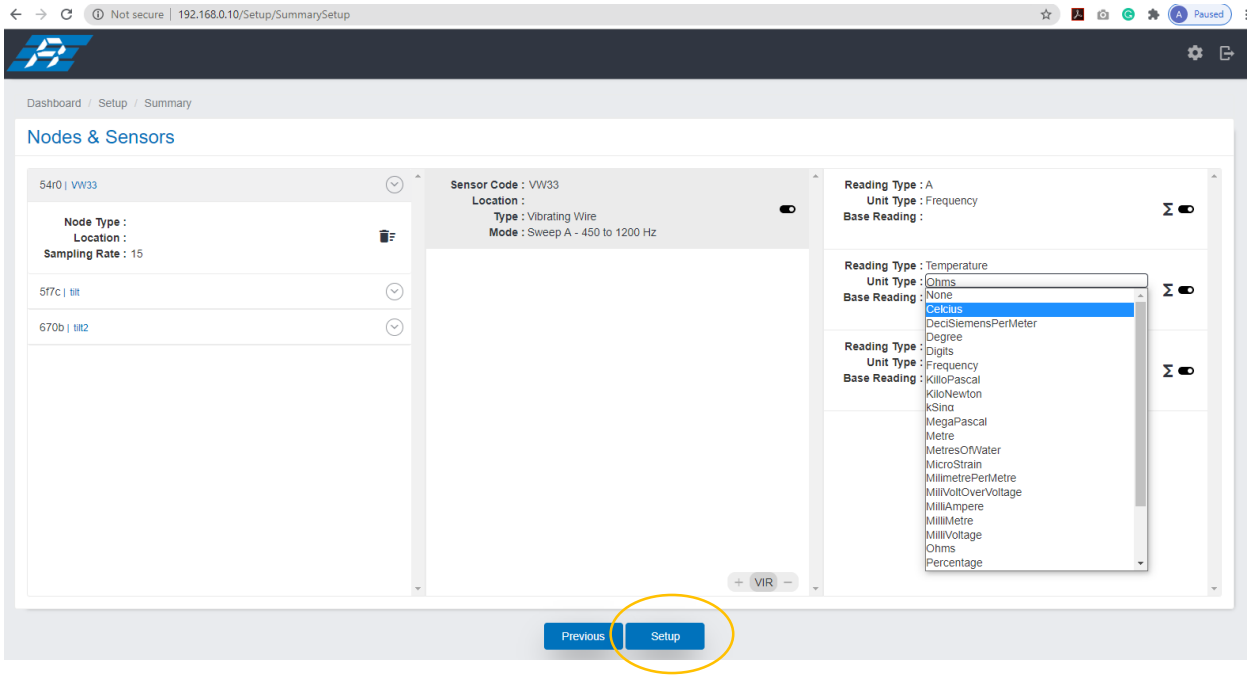


Figure 3-35

11. Project configuration completion message will appear on the right side corner as shown below in figure 3-36.

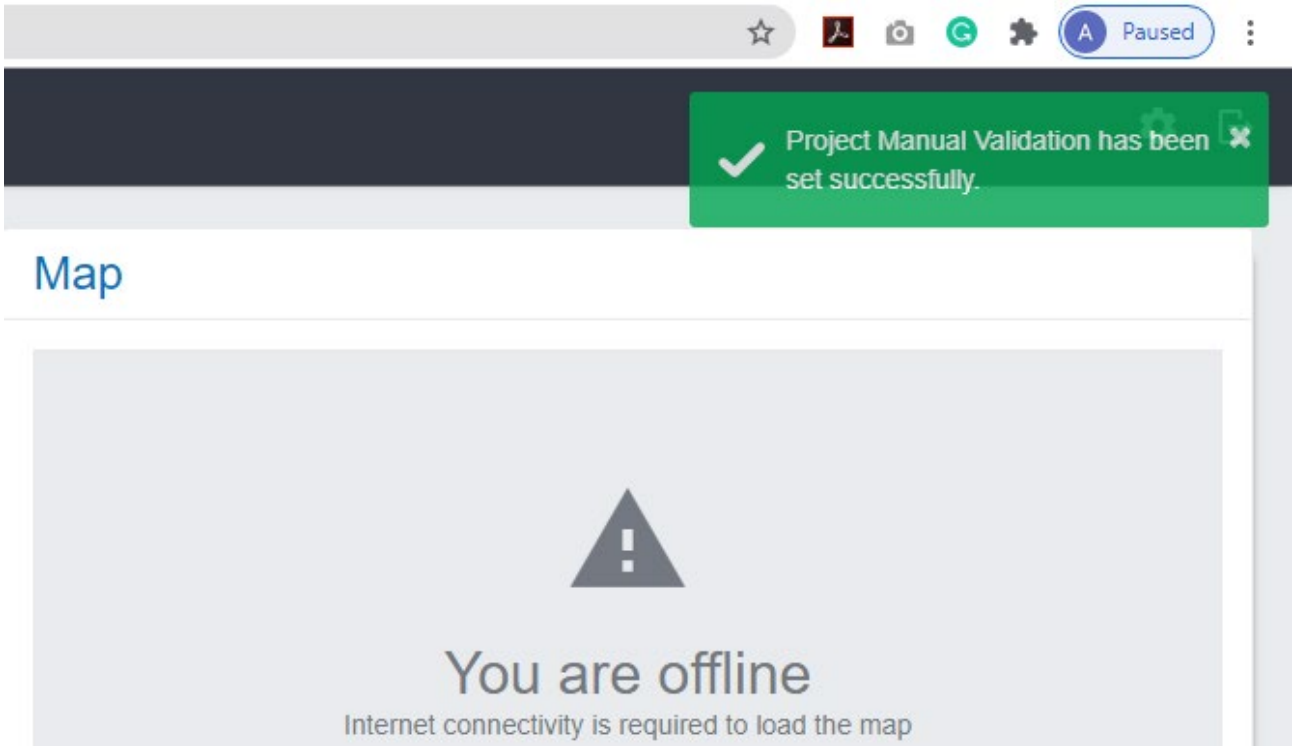


Figure 3-36

3.7 Export data files

1. To export Individual Project, click on "**Export**" icon (as highlighted in figure 4-1) and download the .json file.

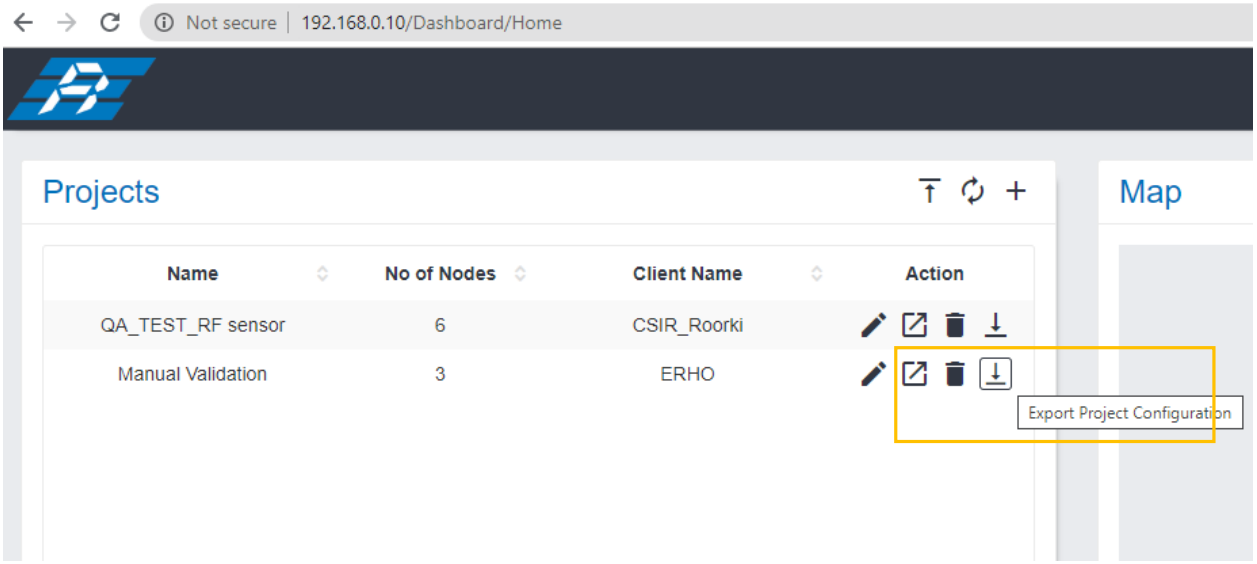


Figure 3-37

2. To export individual node data file, click on "Export" icon next to individual node under "Node Summary" section.

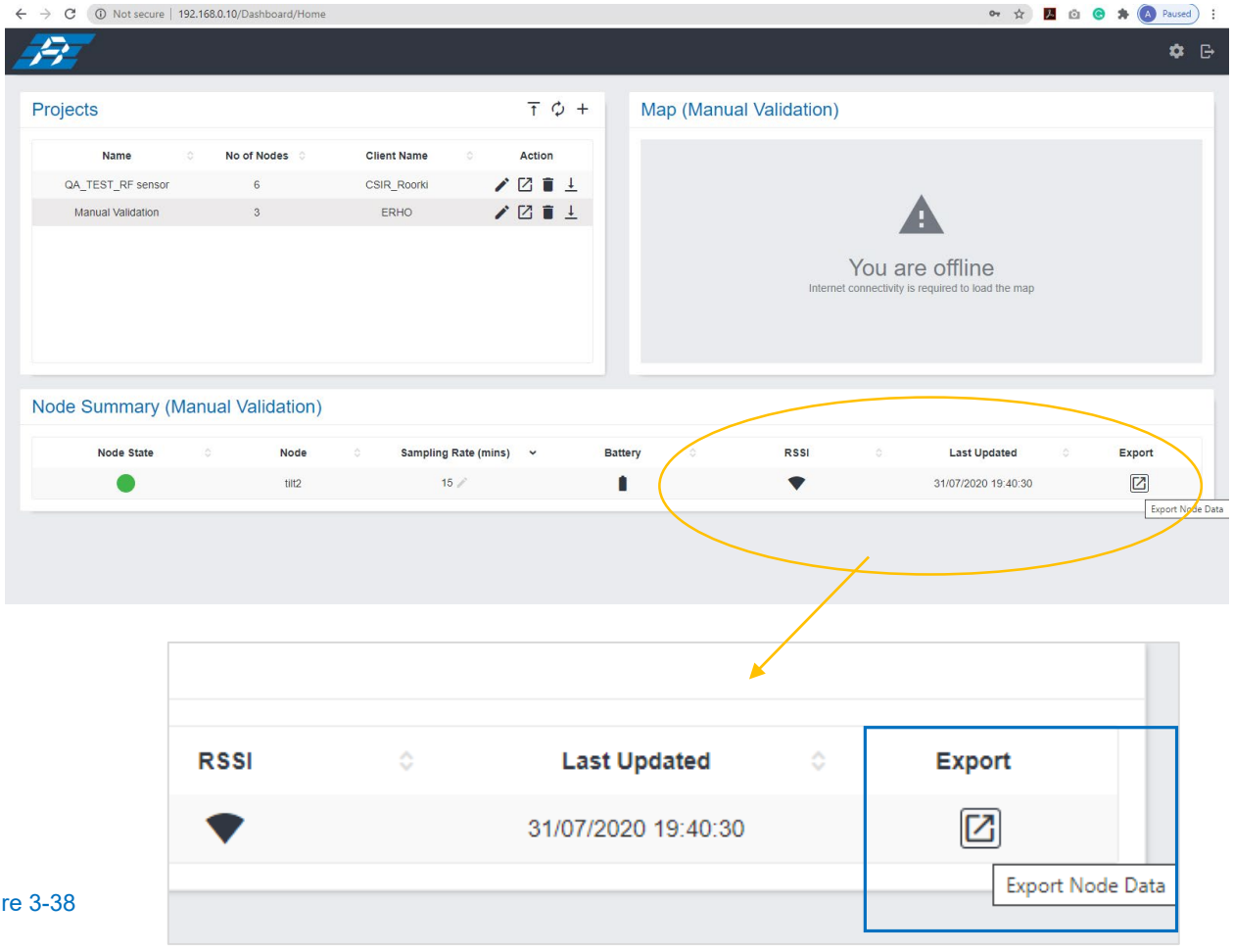


Figure 3-38

3. Click "Save File" to save the .csv file. When you open the downloaded .csv file, all the Nodes exported files will be available.

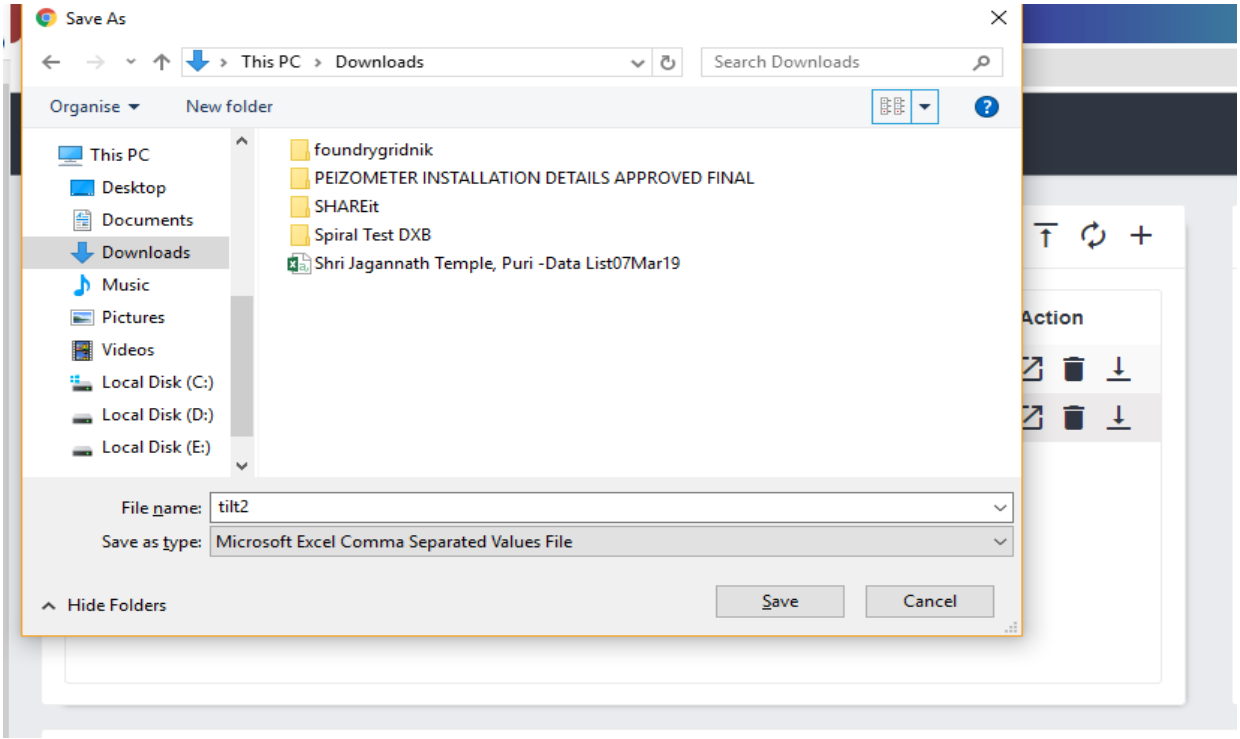


Figure 3-39

3.8 Determining signal strength of nodes

A concise method to configure the Nodes is described below for checking the signal strength. For a detailed configuration of Nodes, please refer to the respective Nodes' (Analog/Digital/Vibrating Wire) Manuals.

1 Connect the sensor wires to the respective node while ensuring that the wires are plugged in correctly.

2 Switch off the Node and insert the battery while ensuring the correct polarity.

3.8.1 Configuring via the ER Offline App

1. Connect the Android phone to the EnRite_Beam_DAC0 Wi-Fi network as shown in figure 3-40.

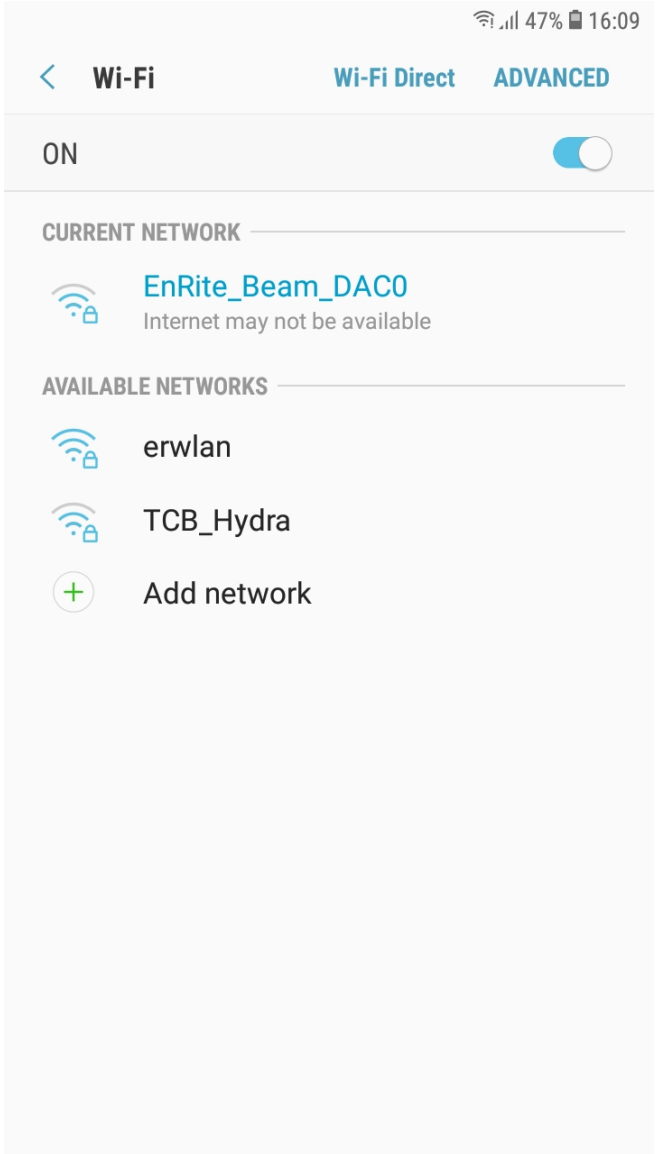


Figure 3-40

2. Connect the Android smartphone to the Node via an OTG adapter (Refer to figure 3-41). A prompt window will appear asking to access the USB device. Then Click OK as shown below in figure 3-41.

Android phone connected to single channel vw node

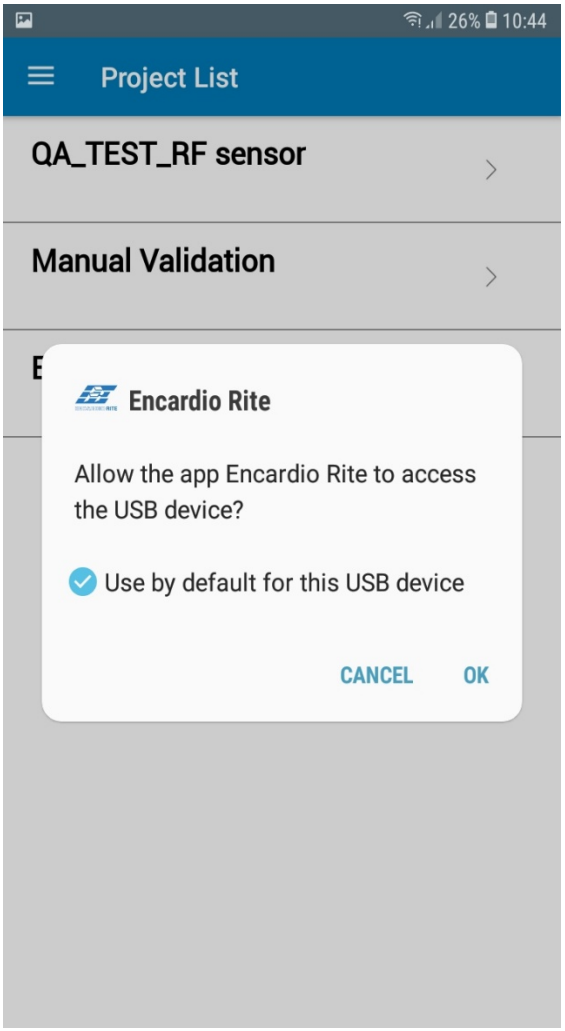


Figure 3-41

NOTE: *Please make sure the Node is switch off before connecting to your Android phone.*

3. Switch on the Node.

4. Open the 'Encardio Rite' (ER) app on the phone.

NOTE: Nodes can be added and then project can be created or a node can be commissioned and add to a created project. Please refer to the section on 'Setup of Gateway'.

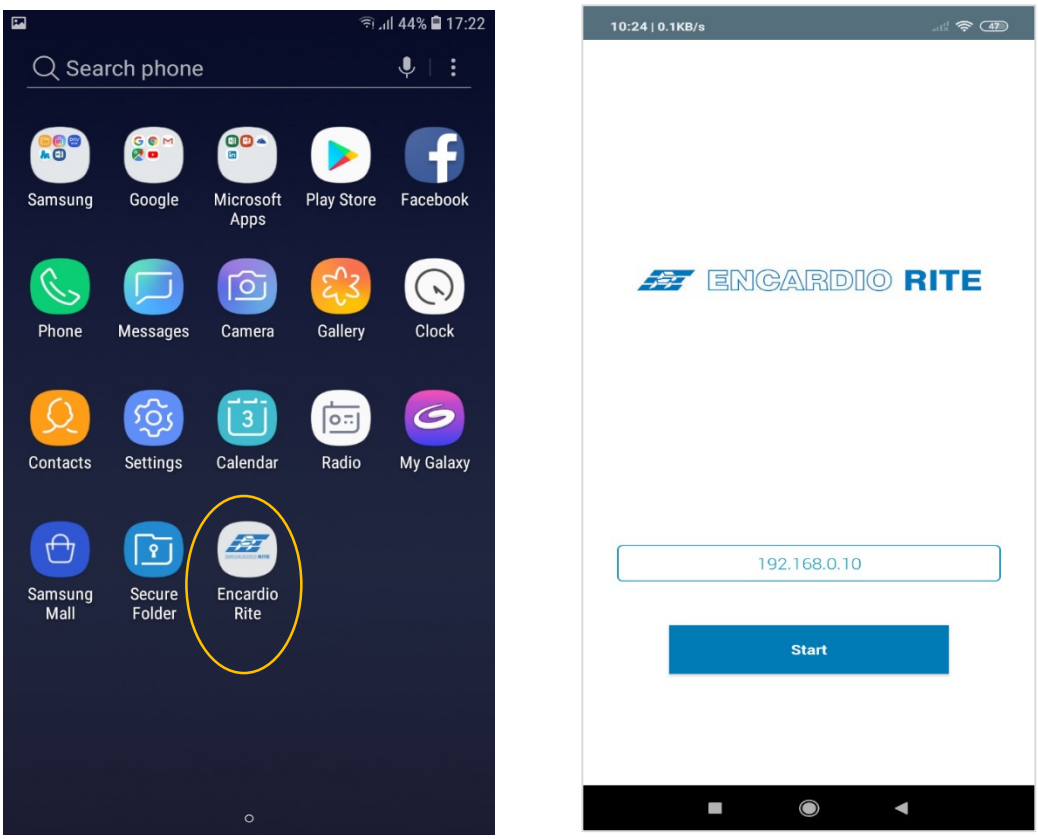


Figure 3-42

5. After opening the ER app, search for the project, which is already created. Select and click the download button (left screenshot in figure below) to download the project and enter in to the project, where the project details would be mentioned.

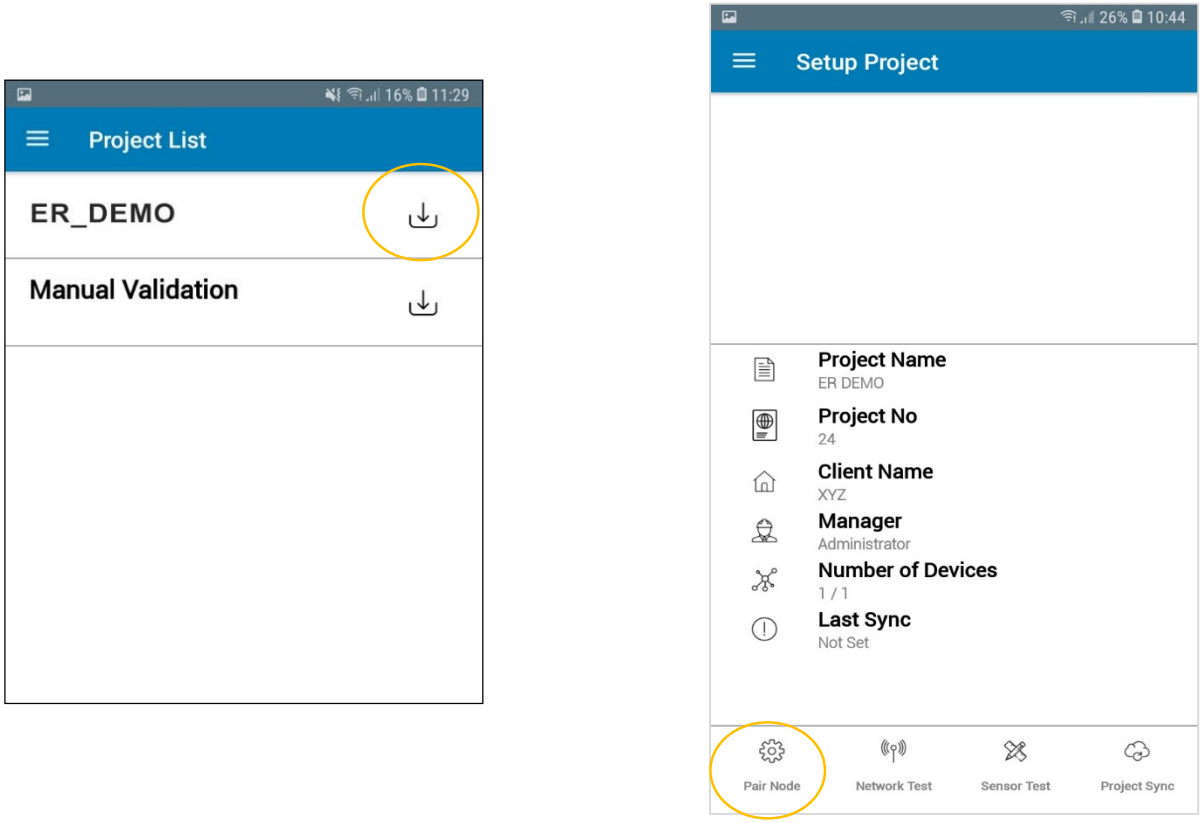


Figure 3-43

6. Click on "Pair Node" on the menu (at the bottom of the screen (right side) in figure 3-43), the app will show connected node information. Click on the 'Setup Sensor' as shown in left side screenshot in figure 3-44.

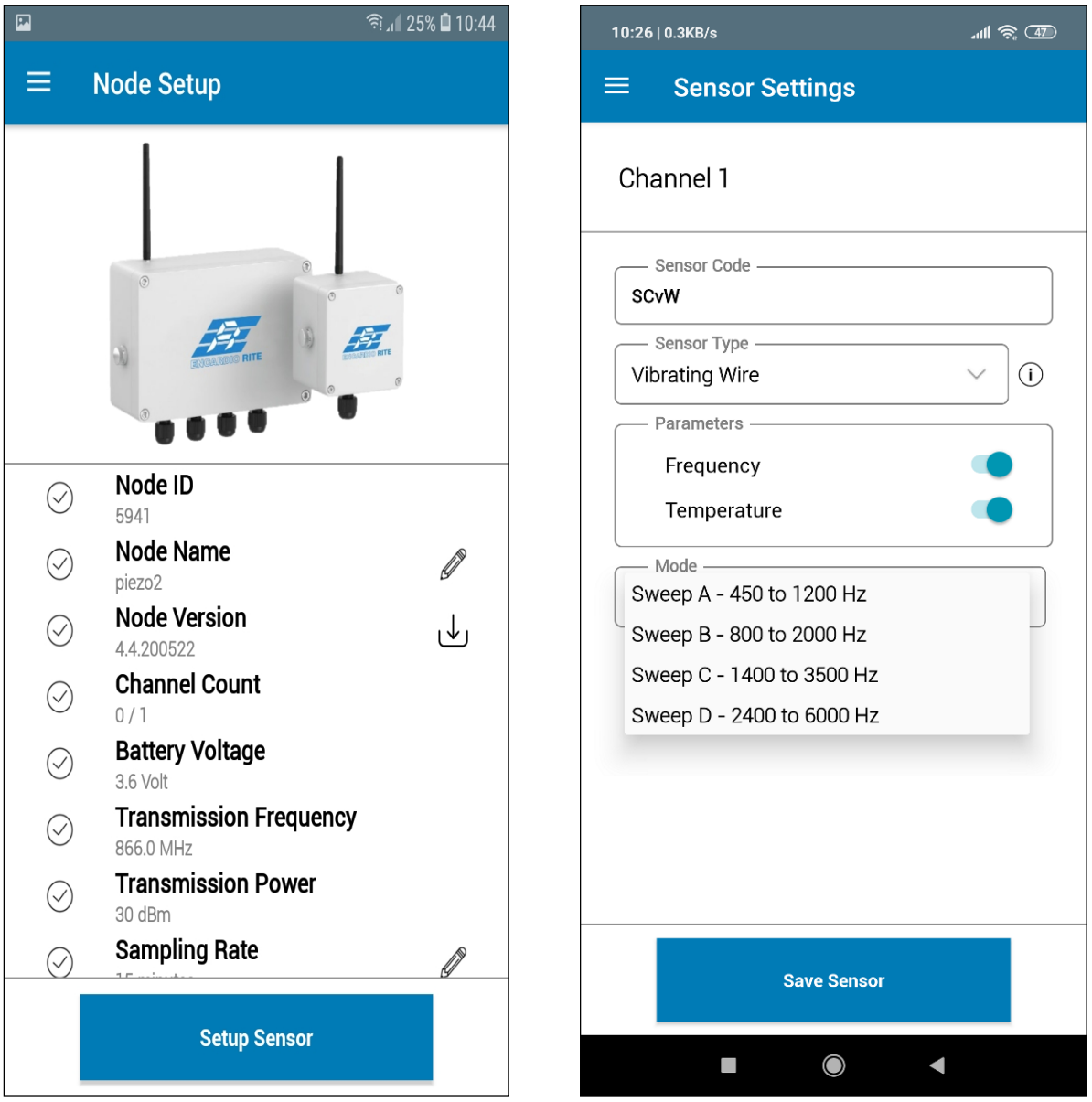


Figure 3-44

7. Sensor details will appear under Sensor setting screen as shown in right side screen in figure 3-44. Click on Save Settings. The Node will now read the configured sensor.

8. Repeat above steps to configure other sensors connected to the Node.

9. Once all sensors are configured, click on "Enable Sensor" button. "Scanning Network" screen will appear, which will scan the wireless signal strength (RSSI) between the Node and Gateway.

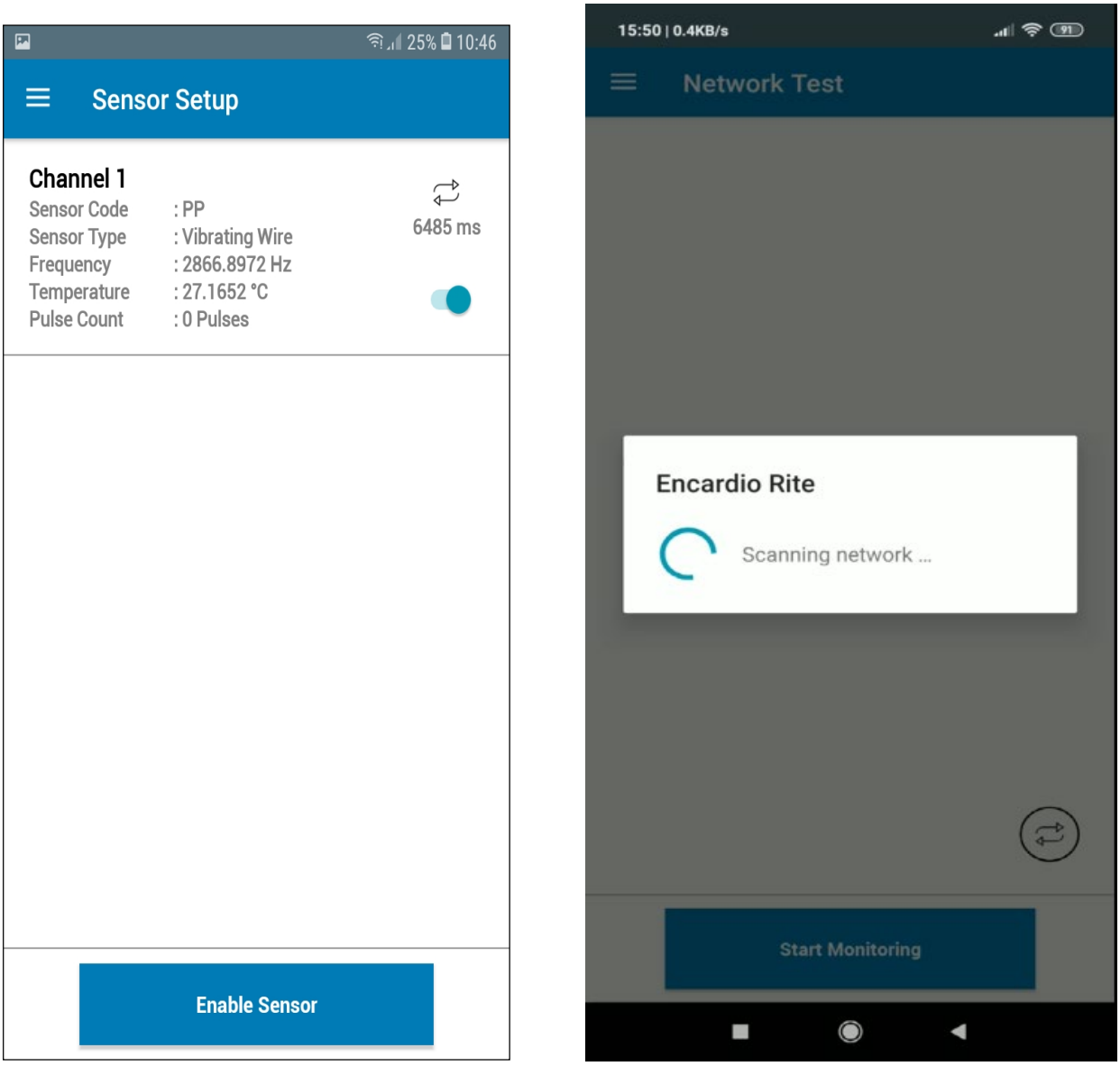


Figure 3-45

10. After receiving the Network Test information, network test can be preformed by pressing the 'Refresh' button located at the lower right corner to check the Signal Strength (for uploading data) as highlighted in the figure 3-46. Once the signal strength received is around -90 to -100 dBm, the Node can be installed at that location.

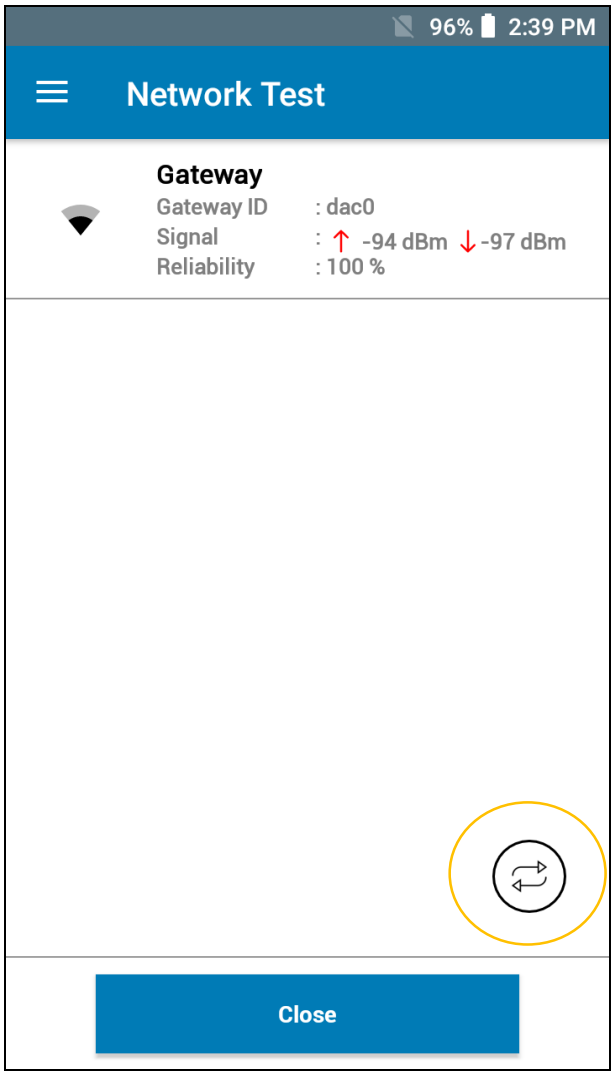


Figure 3-46

11. In case there is any obstruction in the line of sight between Node and Gateway, a Relay Node can be installed in between Node and Gateway to transmit the data. Typical schemes on this is given in section 1 for reference.

12. To configure the Relay Node, follow the same steps as explained above.

NOTE: The refresh button (encircled in blue in figure 3-46) needs to be pressed every few minutes to update the Signal Strength.

NOTE: For complete installation of Nodes, refer to respective users' manual on Vibrating wire, Analog or Digital node

4 SETTING UP OF NODES

4.1 Setting up of vibrating wire (VW) node

1. Connect the sensor wires to the node while ensuring that the wires are plugged in correctly (refer to figure 4-1)

   +S: Vibrating wire input of sensor
   -S: Vibrating wire input of sensor
   +T: Thermistor
   -T: Thermistor
   SHLD: Shield wire of sensor

2. Switch off the Node (from On-Off switch) and insert the battery while ensuring the correct polarity.

Figure 4-1

4.2 Setting up of analog node

1 Connect the node antenna to the antenna bulkhead.

2 Connect the sensor wires to the node while ensuring that the wires are plugged in correctly.

Voltage Output Sensors

PWR: +Voltage input to sensor (e.g. +12 V)
GND: 0 Voltage input to sensor (e.g. 0 V)
12VN: 12 V Voltage input to sensor
1H: 1st channel positive output of sensor
1L: 1st channel negative output of sensor
2H: 2nd channel positive output of sensor
2L: 2nd channel negative output of sensor
+T: Thermistor
-T: Thermistor
SHLD: Shield wire of sensor

Current Loop Sensor

PWR: +Voltage input to sensor (e.g. +12 V)
GND: Not used
12VN: Not used
1H: 1st output channel of sensor (e.g. –Voltage wire)
1L: Not used
2H: 2nd output channel of sensor (e.g. –Voltage wire)
2L: Not used
+T: Thermistor
-T: Thermistor
SHLD: Shield wire of sensor

Resistance Bridge (Wheatstone Bridge) Sensor / Potentiometer Sensor

PBRG: Positive excitation input to sensor (+5 V)
GND: Ground excitation input to sensor
12VN: Not used
1H: Positive output channel of sensor (e.g. –Voltage wire)
1L: Negative output channel of sensor (applicable to Wheatstone Bridges)
2H: Not used
2L: Not used
+T: Thermistor
-T: Thermistor
SHLD: Shield wire of sensor

3 Switch off the Node and insert the battery while ensuring the correct polarity.

4.3 Setting up of digital node

1 Connect the SDI-12 sensor wires to the node at SDI port (as shown in figure 4-1) while ensuring that the wires are plugged in correctly.

PWR: +12 V Supply
GND: Ground
SIG1: Output Signal
SIG2: If reqd
SHLD: Shield wire of sensor

2 Switch off the Node with the On-Off switch as shown in figure 4-1. Insert the battery while ensuring the correct polarity.

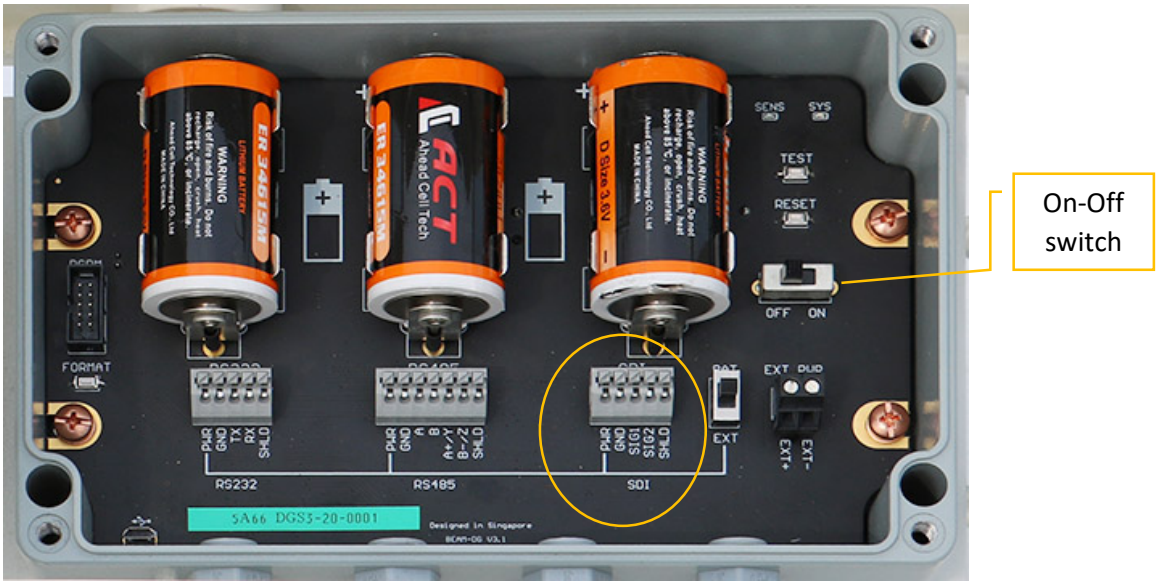


Figure 4-2 Digital Node

4.4 Setting up wireless relay node

1 Connect the node antenna to the antenna bulkhead.

2 Switch off the Node and insert the battery while ensuring the correct polarity.

5 CONFIGURING OF NODES VIA THE ER OFFLINE APP

5.1 Installation of application software and setup

1. Install the apk file (provided with the supply) for "Encardio Rite" app on the phone. App shortcut will be available in the list of application software, as shown in left screenshot in figure 5-1.
2. Connect the Android phone to the '*EnRite_Beam_DAC0'* Gateway Wi-Fi network as shown in right screenshot of figure 5-1. The password is *adminadmin.*

NOTE: Refer to section 3 "Setting up the Gateway" to learn how to switch on the EnRite_Beam_DAC0 Gateway Wi-Fi network.

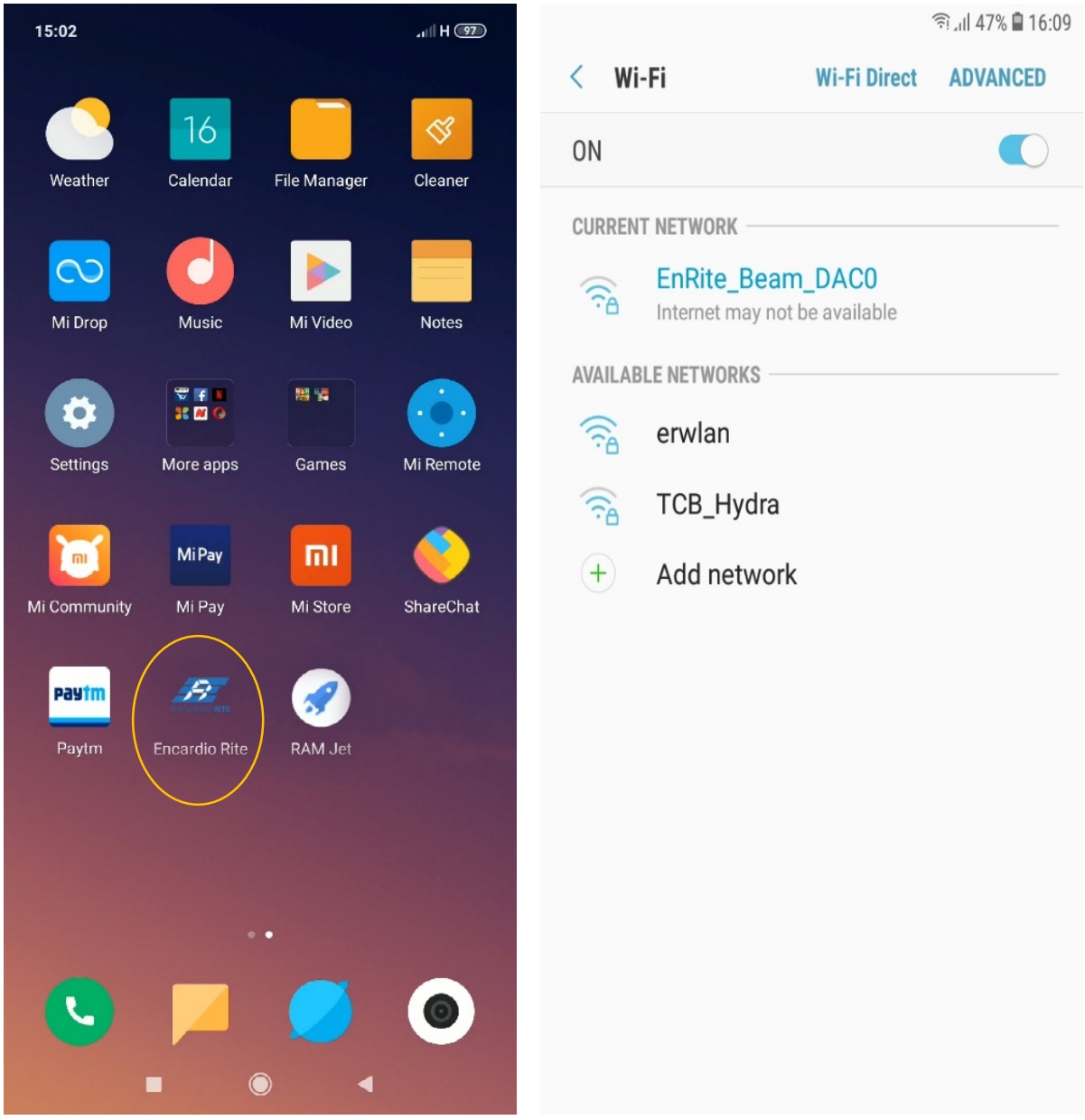


Figure 5-1

3. Connect the Android smartphone to the Node via an OTG adapter.

CAUTION: Please make sure the Node is switched off before connecting to the Android phone.

Figure 5-2 Smartphone connected to single and multi channel nodes with USB cable through OTG Adaptor

4. Switch on the node with On-Off switch as shown in figure 5-2 above.

5. Open the 'Encardio Rite' app by clicking the Software Icon (extreme left screenshot in figure below). Screen as shown in the middle screenshot will appear. Click on start button. A prompt window will appear as shown in the extreme right screenshot in figure below, asking to access the USB device. Tick the circle (for '*Use by default for this USB device*') and click on OK.

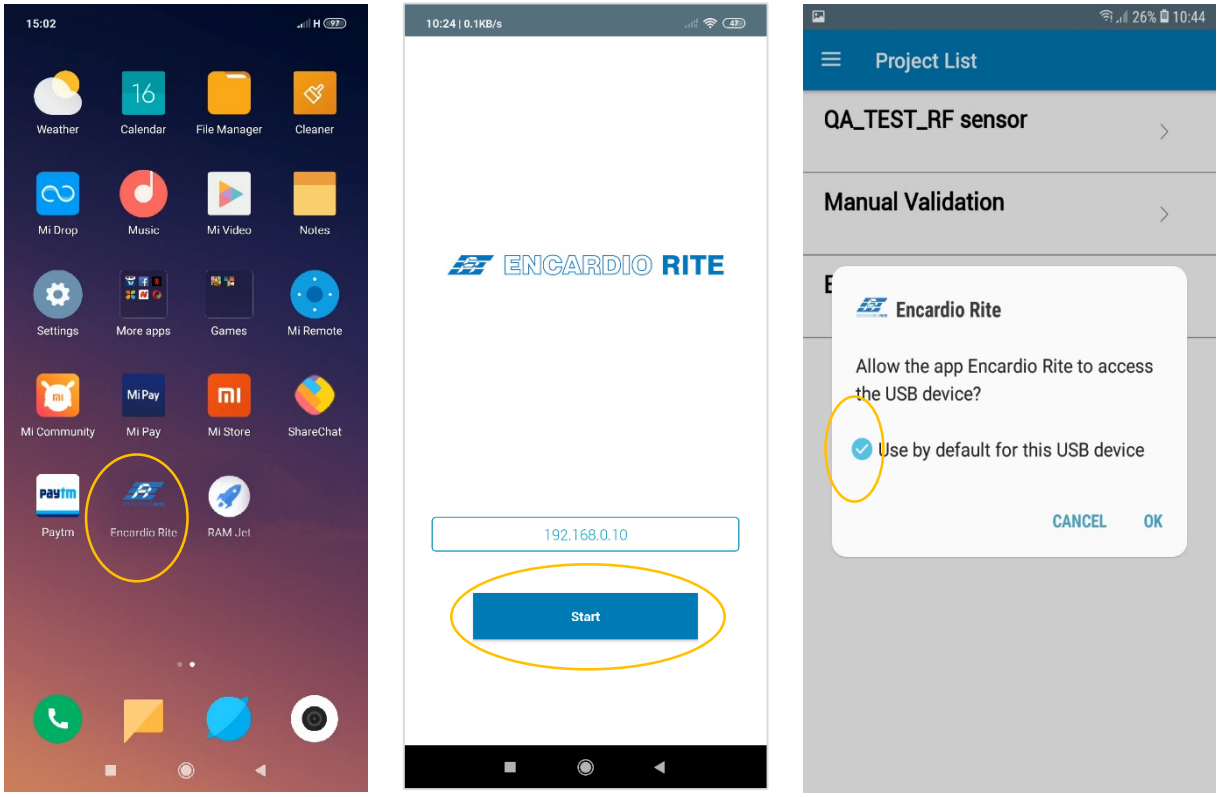


Figure 5-3

NOTE: Please refer to Section 3 on 'Setting up the Gateway' for creating project. Either add the Nodes and create the project or commission the node and get them added to the project.

6. Once the 'Encardio Rite' app opens, the project already created (while configuring Gateway) can be seen. Select the project and click the download button (shown in figure 5-4) to download the project.

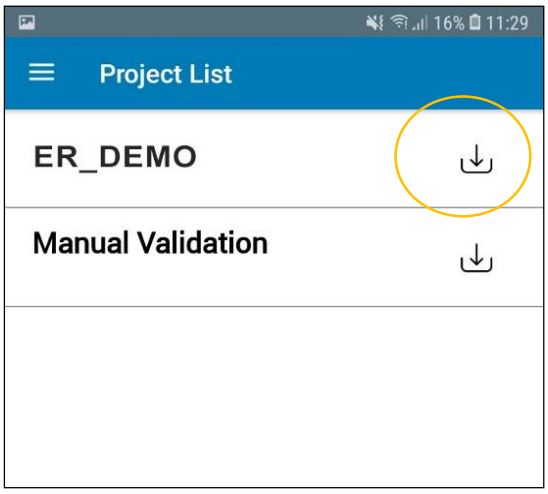
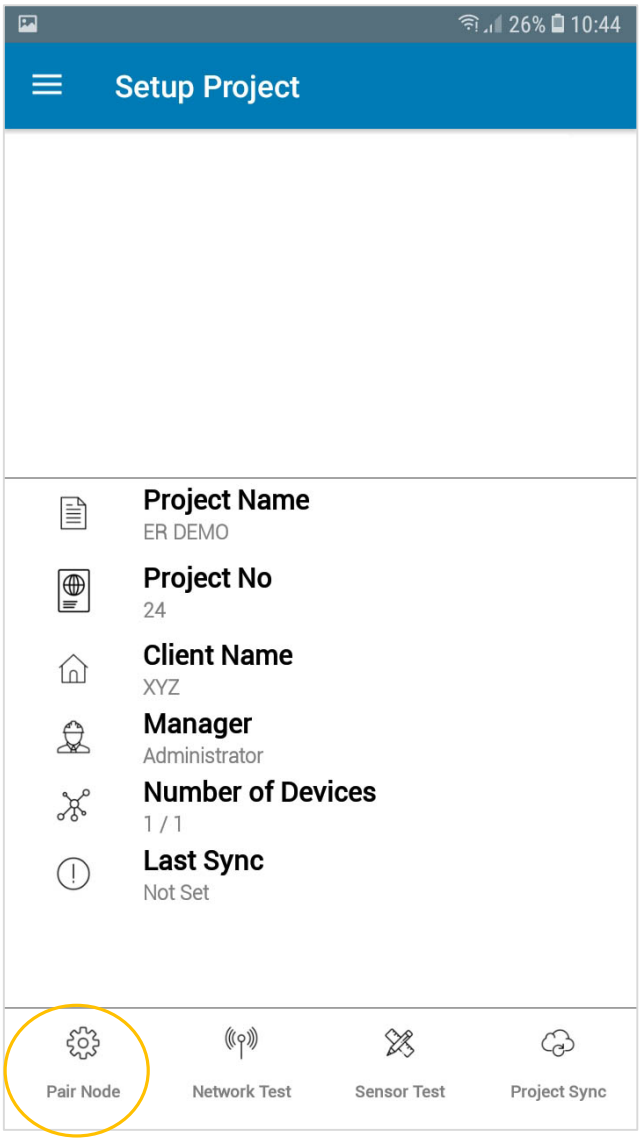


Figure 5-4

7. Once downloaded, enter the project. Screen showing project details can be seen as shown in the left screenshot in figure 5-5. Press "Reset" button on the Node (as shown in right side figure below). Now click on "Pair Node" on the menu (at the bottom of screen, shown in left screenshot in figure 5-5).



EWN-01V vw single channel node

EWN-01D digital node

Figure 5-5

NOTE: If the connection is unsuccessful, press "Reset" button on Node and connect again by clicking on 'Pair Node'.

8. Once connection is done by clicking on 'Pair Node', the app will show connected node information on "Node Setup' screen as shown in figure 5-6.

NOTE: **Optional Step:** If "**Relay**" function is to be deployed, click on "Wireless Mesh" toggle button to enable i.e. in case the Node needs to be used as a relay node (as shown in right side screenshot in figure 5-6).

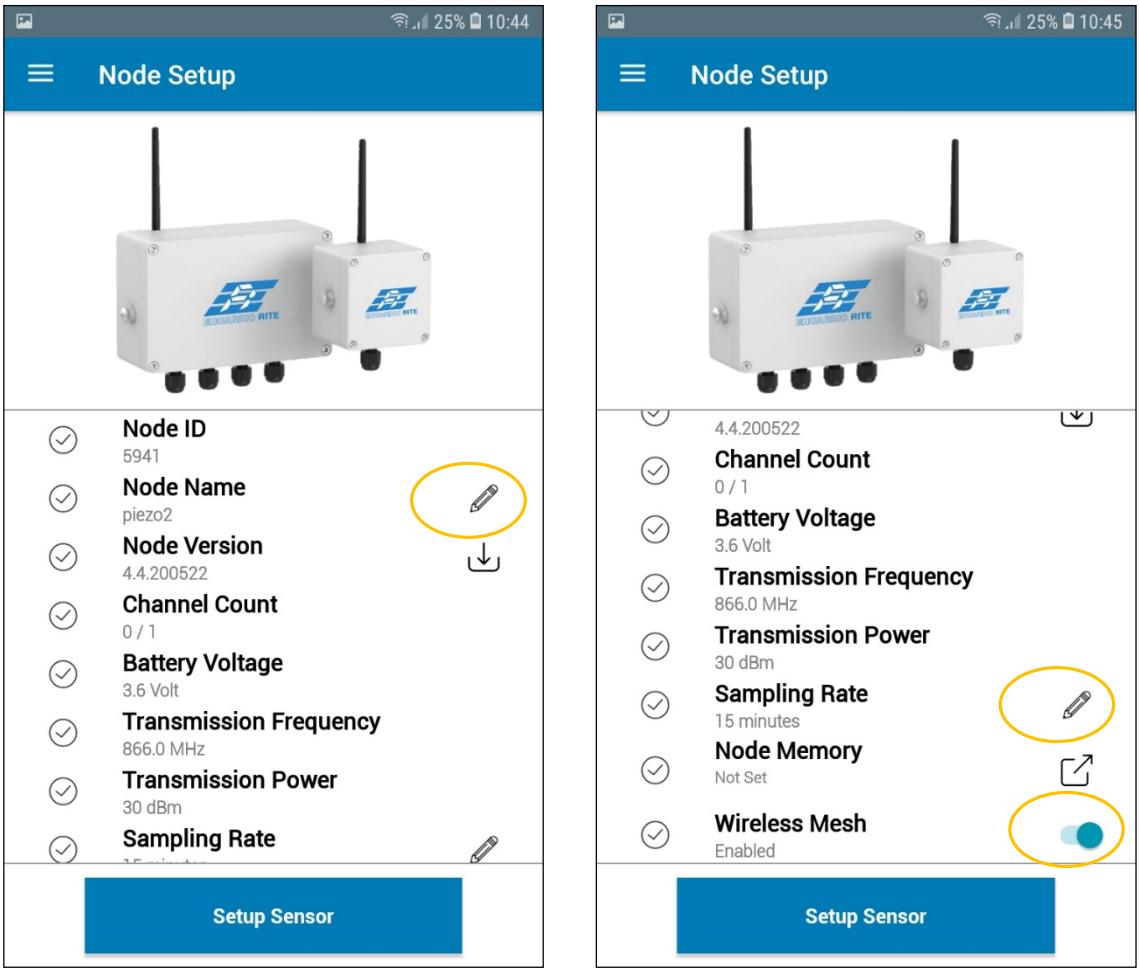


Figure 5-6

9. In case required, the 'Node Name' and 'Sampling Rate' inputs can be edited here by clicking on the pencil icon. Setting Sampling Rate is shown in figure 5-7. Please note that the sampling rate should be set between 1 minute to 2 hours. Factory setting is 2 hours.

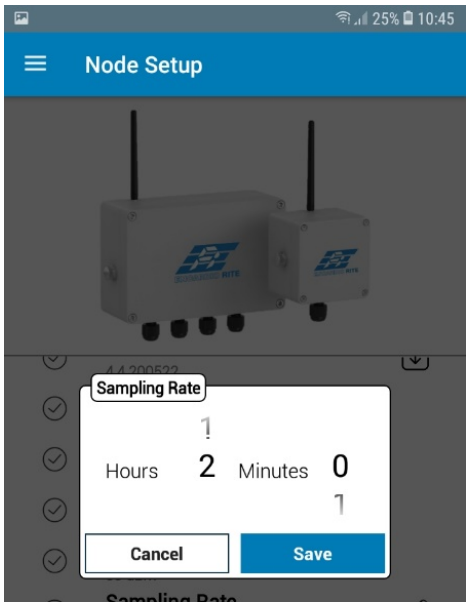


Figure 5-7

10. Once done, click on 'Setup Sensor' button to configure the sensor settings (as shown in Node Setup screen in figure 5-6).

5.2 Sensor setting in nodes

5.2.1 Sensor setting in vibrating wire node

1. Sensor setting can be made as follows (shown in the left side screen in figure 5-8):

   Sensor Code: Desired sensor name.
   Sensor Type: Select respective sensor type.
   Parameters: Turn on the parameters as connected to the Node.
   Mode: Please select the respective Sweep Mode (A or B or C or D), depending on the sensor.

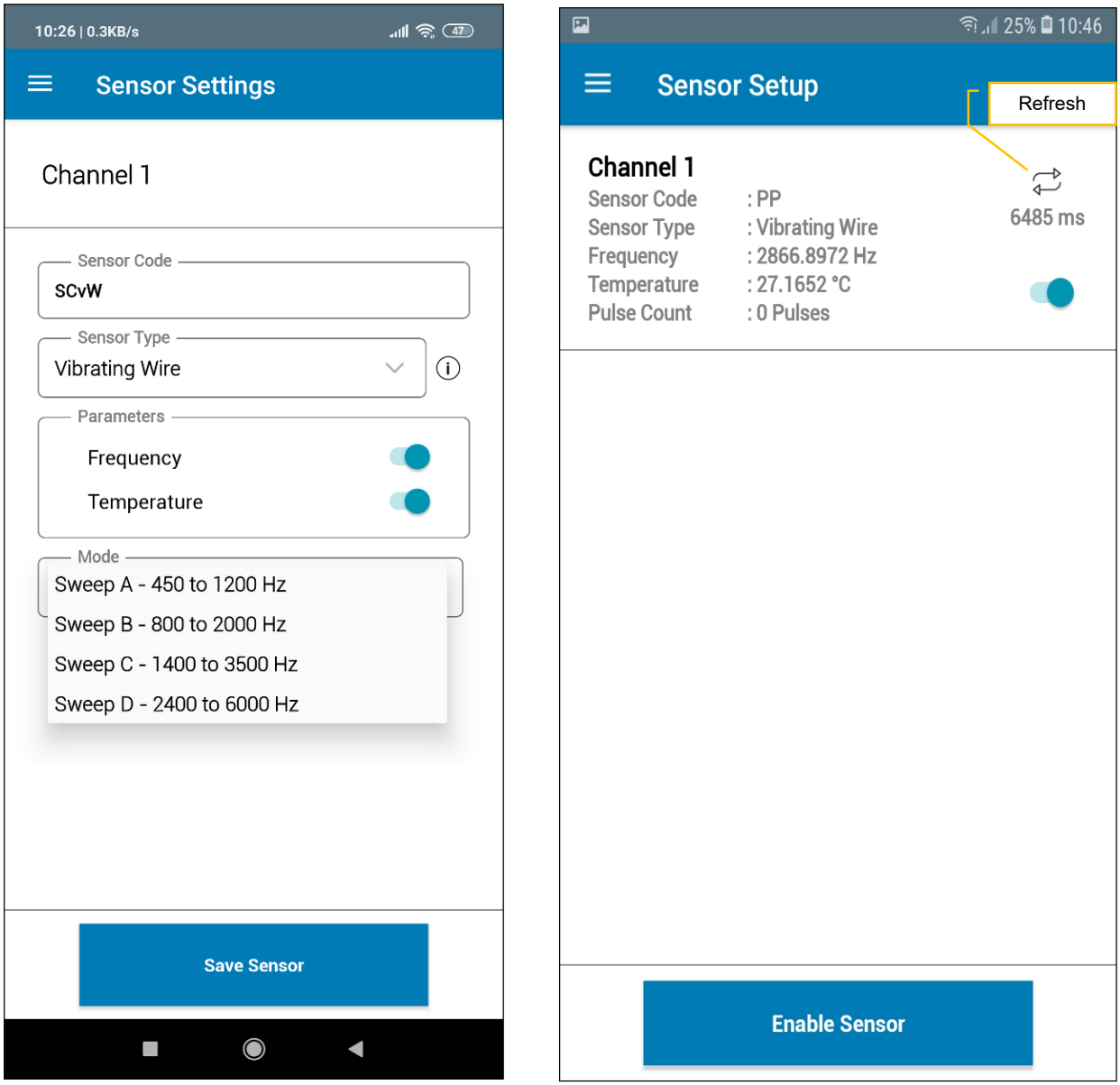


Figure 5-8

2. Click on 'Save Sensor'. The Node will now read the configured sensor, displaying the sensor readings, as shown in right side screenshot in figure 5-8.
3. To get another reading, click on the refresh button (shown in the right side screenshot in figure 5-8).
4. Repeat above steps to configure other sensors connected to the Node, when eight channel node is used.

5.2.2 Sensor setting in analog node

1. Sensor setting can be made as follows:

Sensor Code: Desired sensor name.
Sensor Type: Select respective sensor type.
Parameters: Turn on the parameters as connected to the Node.
Excitation time: Set the warm up time required for the sensor.
Excitation Voltage: Select either 5 or 12 or 24, depending on the sensor.

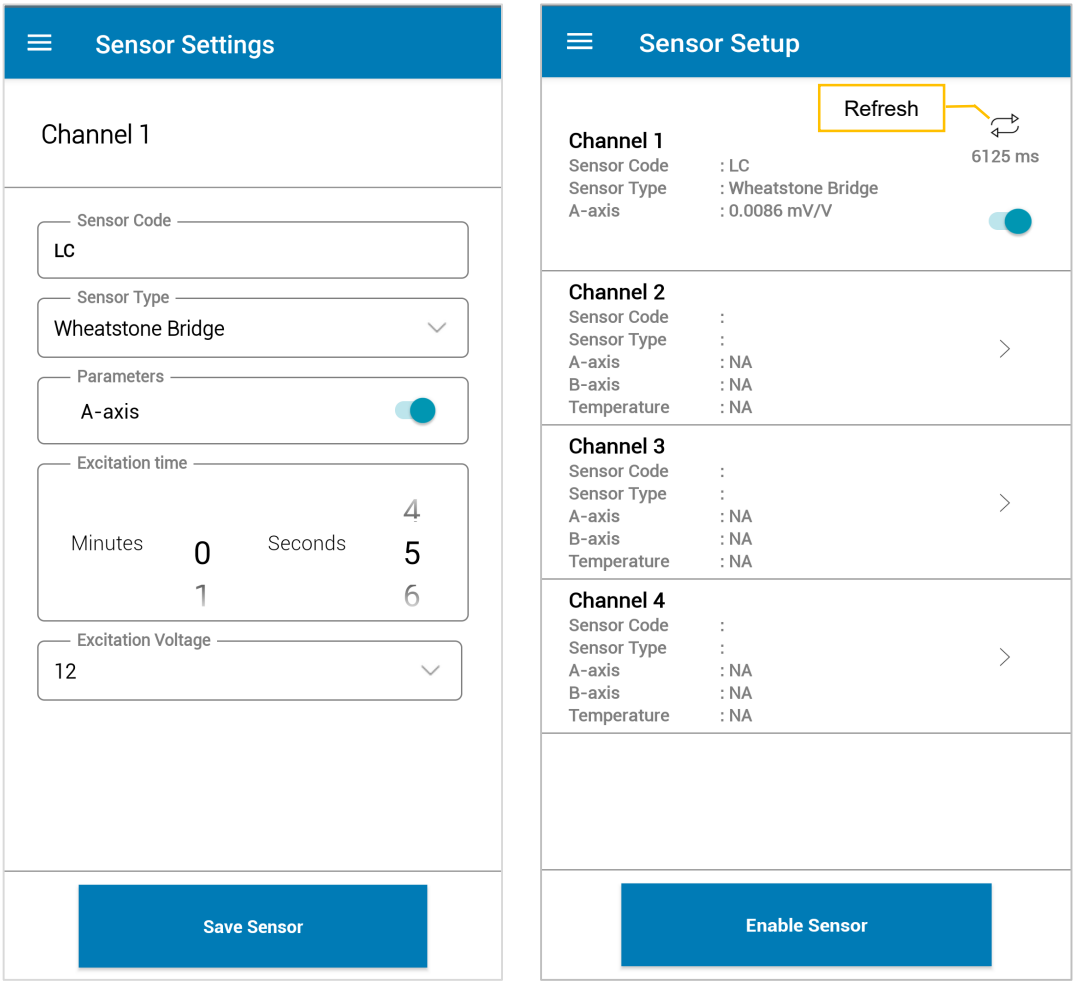


Figure 5-9

13. Click on 'Save Sensor'. The Node will now read the configured sensor, displaying the sensor readings, as shown in figure 5-9 (right screenshot).
14. To get another reading, click on the refresh button (shown in the right side screenshot in figure 5-9).
15. Repeat above steps to configure other sensors connected to the Node, when four channel node is used.

5.2.3 Sensor setting in digital node

1. On clicking 'Setup Sensor' button to configure the sensor settings, in digital node a page with a + sign button will appear as shown in figure 5-10. Click on the + button to configure the sensors.

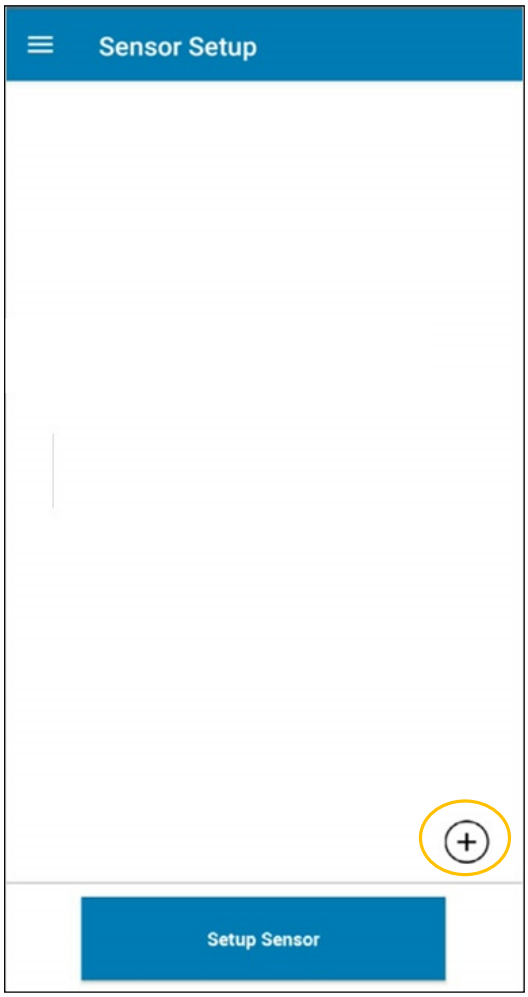


Figure 5-10

2. Sensor setting can be made as follows (shown in the left side screen in figure 5-11):

Sensor Code: Desired sensor name.

Sensor Address: Serial number of the sensor.

Sensor Type: Select respective sensor type.

Parameters: Turn on the parameters as connected to the Node.

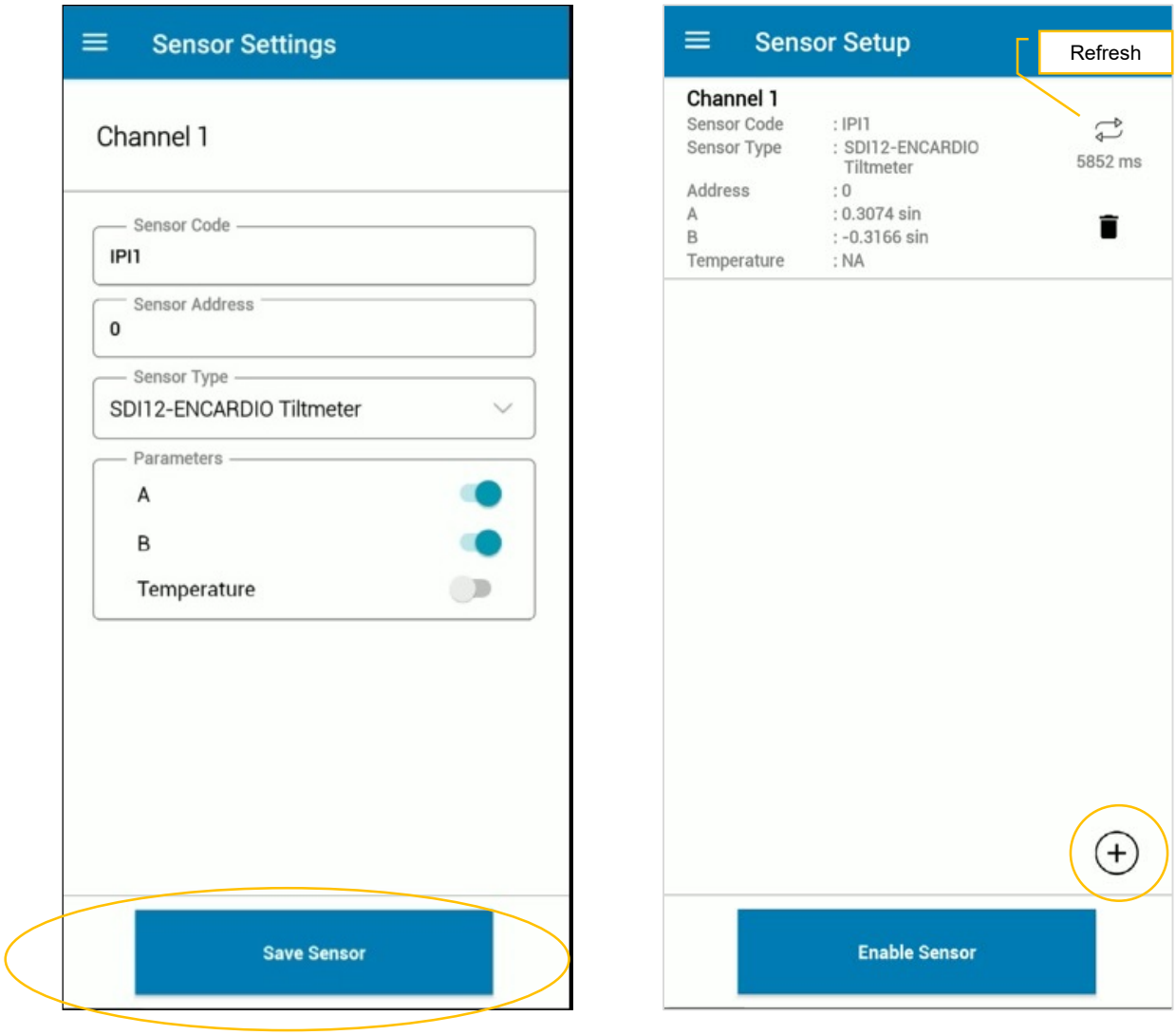


Figure 5-11

3. Click on 'Save Sensor'. The Node will now read the configured sensor, displaying the sensor readings, as shown in right side screenshot in figure 5-11. To get another reading, click on the 'Refresh' button.

4. Repeat above steps to configure other SDI-12 sensors connected in chain, by clicking on add (+) button (as shown in the right side screen in figure 5-11).

5.3 Configuration after sensor conenction

1. Once all sensors are configured to VW, analog and digital nodes, click on "Enable Sensor" button as on the "Sensor Setup" screen.
2. "Scanning Network" function will operate, which will scan the wireless signal strength (RSSI) between the Node and Gateway/Relay Node (as shown in figures 5-12).

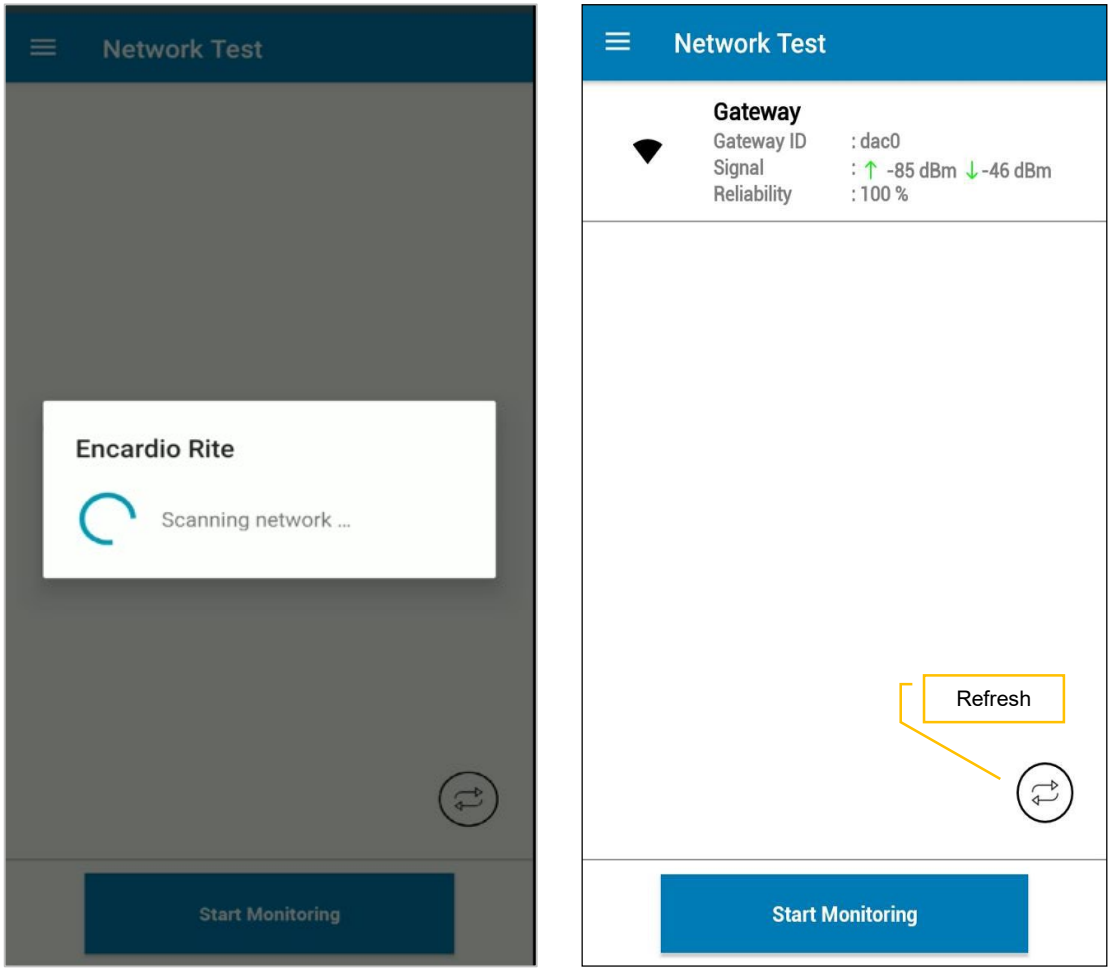


Figure 5-12

3. After receiving the Network Test information, if required, another network test can be performed by pressing the 'Refresh' button located at the lower right corner, as shown in the right side screenshot in figure above.
4. Next, click "Start Monitoring" button on the "Network Test" screen (shown in the right side screenshot in figure above).

NOTE: In case of relay node, click on "Start Relay" button n the "Network Test" screen (shown in the screenshot in figure 5-13).

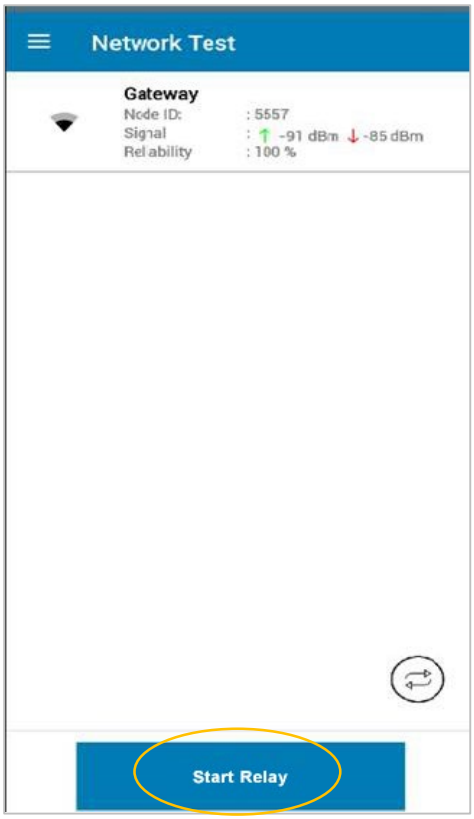


Figure 5-13

5. The app will prompt, "Node commissioned" as shown in left side screenshot in the figure 5-14. Click OK.

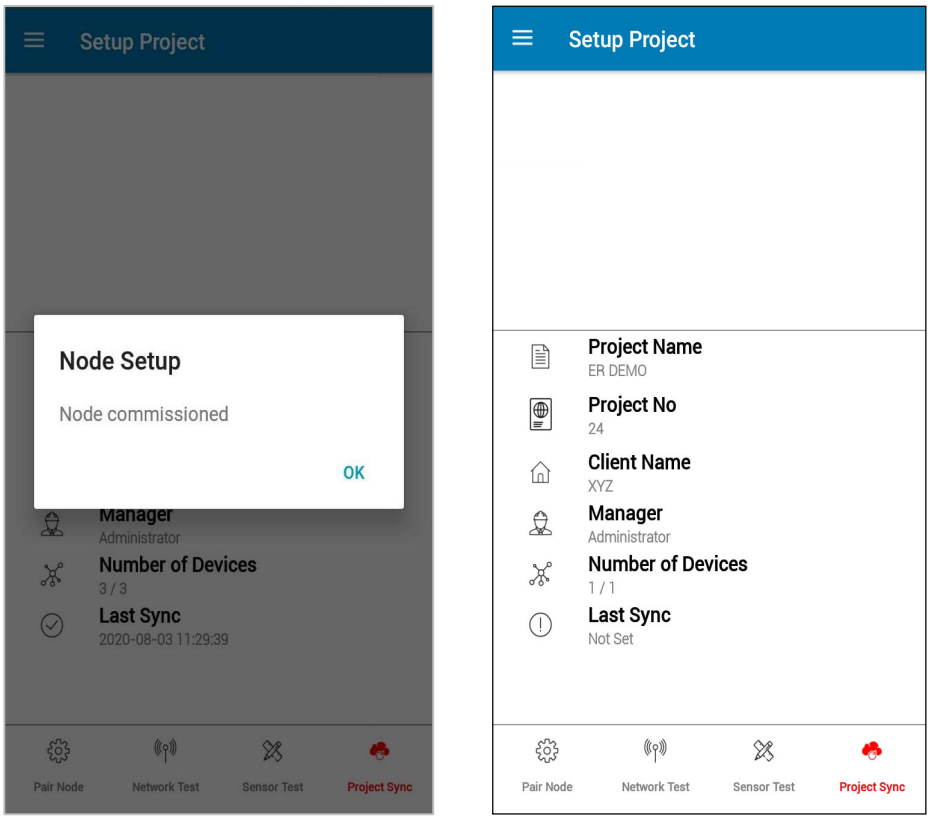


Figure 5-14

6. Press the 'Project Sync' button at lower right of screen (shown in the right side in figure 5-14) to send all the configuration information back to the gateway.

7. To test, press the "TEST" button (as shown in figure 5-15). The node will immediately send a reading to the gateway.

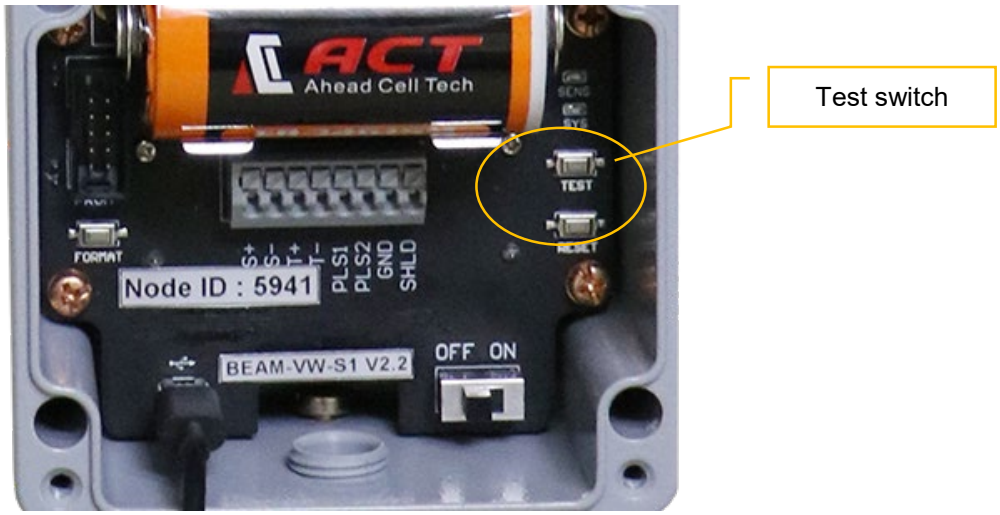


Figure 5-15

8. For commissioning of additional nodes, repeat the above steps.

9. Now proceed to the Gateway software dashboard on the Laptop and click on the project created (ER-Demo in screenshot shown in figure 5-16). The commissioned devices can now be seen under "Device Summary" Section.

NOTE: For further configuration and setting of sensors, equations, engineering units, etc., please refer to Section 3 "Setting up the Gateway".

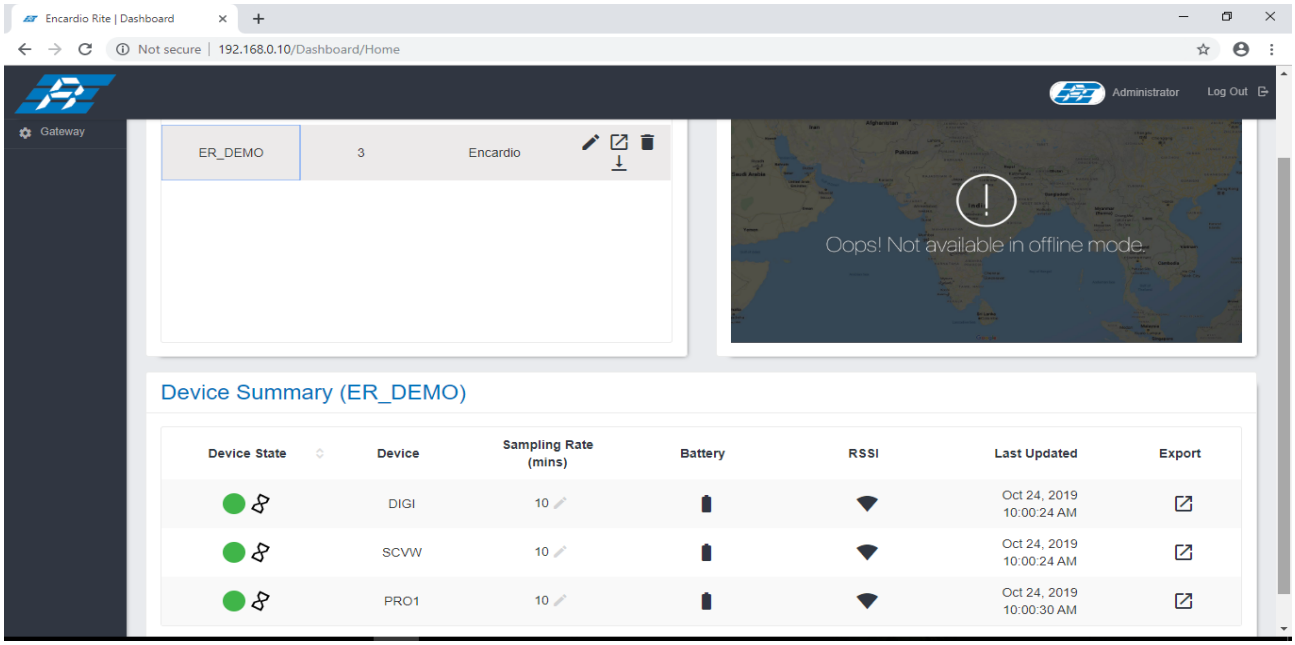


Figure 5-16

6 ANNEXURE A – EARTHING & LIGHTNING PROTECTION

6.1 For Gateway

In case the gateway is enclosed in a metallic box and is installed in open field, it is recommended to ground it. This is done to prevent any interference of the noise, which the metallic box can pick, in the data transmission. Earthing/grounding is however not required if gateway is installed at a shielded structure like building or inside portable cabin.

Heavy currents or lightning during thunderstorms can induce short spikes of sufficiently high electrical energy in the gateway that can damage the internal circuit. Some measure of lightning protection for the gateway is thus recommended, especially if it is installed in the open field or hilly region (over mast or inside portable cabin).

Consult the factory for additional information on these or alternate lightning protection schemes that will depend on specific site location. A typical case of lightning protection methodology for a Landslide Project where gateway is installed in a portable cabin in hilly region is given in figure 6-1.

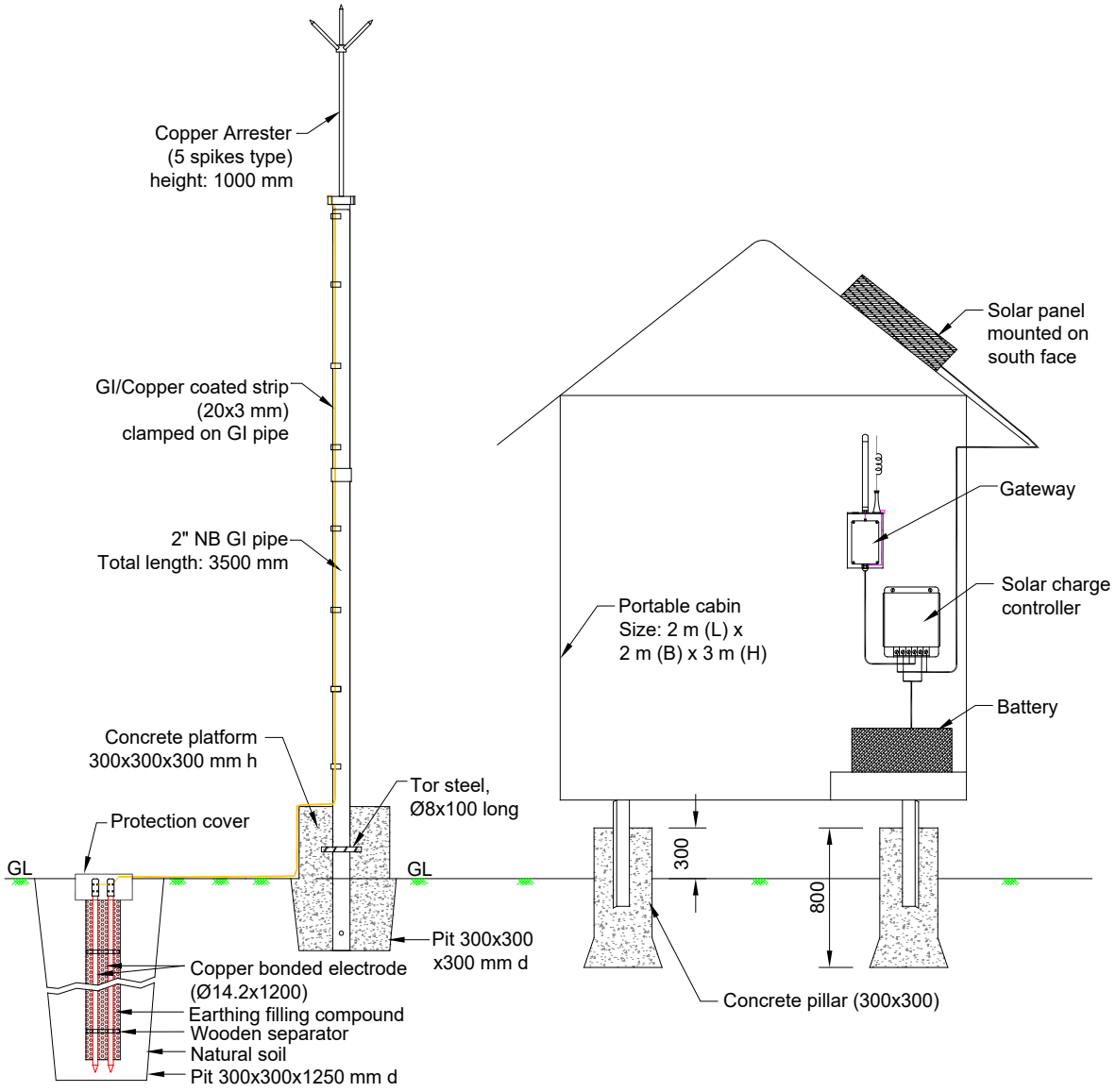


Figure 6-1 Typical scheme for Gateway in hilly region

6.2 For Nodes

In case the node is enclosed in a metallic box, it is recommended to ground it. This is done to prevent any interference of the noise, which the metallic box can pick, in the data transmission. Model EWN-01-08V vibrating wire nodes have an easy-to-use grounding screw next to the cable gland for grounding and protection. The relevant screw is shown in figure 6-2.

Figure 6-2 Grounding screw provided on metallic enclosure of model EWN-01D digital node

A typical case of earthing methodology when node is installed in an open field or hilly region installation is given in figure 6-3 (client scope).

Heavy currents or lightning during thunderstorms can also induce short spikes of sufficiently high electrical energy in the node that can damage the internal circuit. Lightning protection is generally not required if the connecting wire from the sensor to node is very short, say only a few meters in length, or node is installed at a shielded structure, e.g. a building.

Some method of lightning protection for the node is however recommended, especially if it is mounted in the open field or hilly region. As hilly regions are more prone to lightning, a separate lightning protection methodology can be provided (in client scope) as shown in figure 6-4.

A complete layout plan, including all the instrument, nodes and Gateway location, with their earthing and lightening protection scheme is given in the User's Manual for Gateway.

Consult the factory for additional information on these or alternate lightning protection schemes that will depend on specific site location.

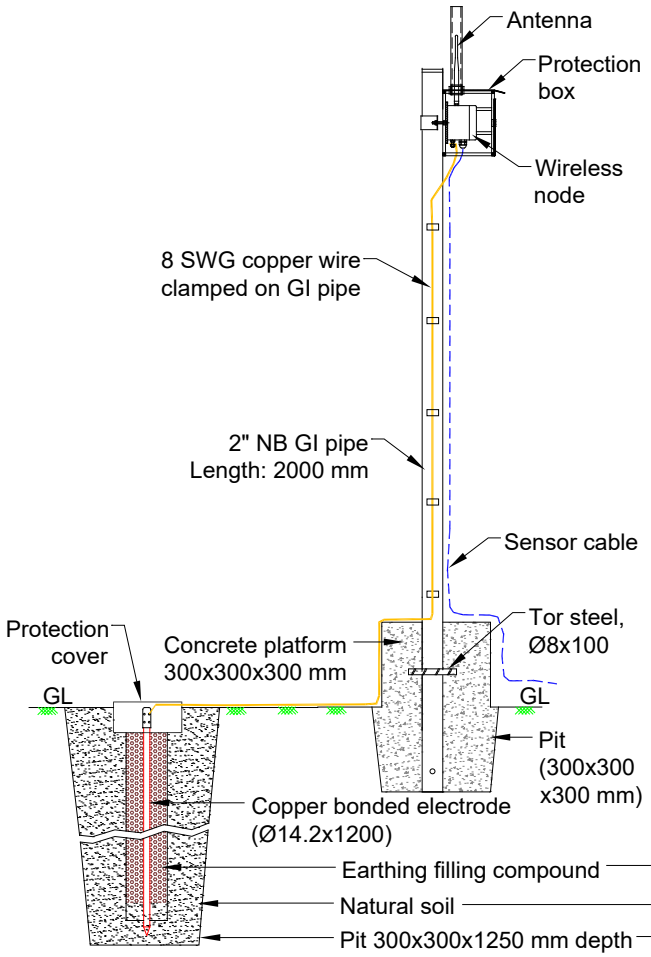


Figure 6-3 Typical grounding of Node installed in hilly region

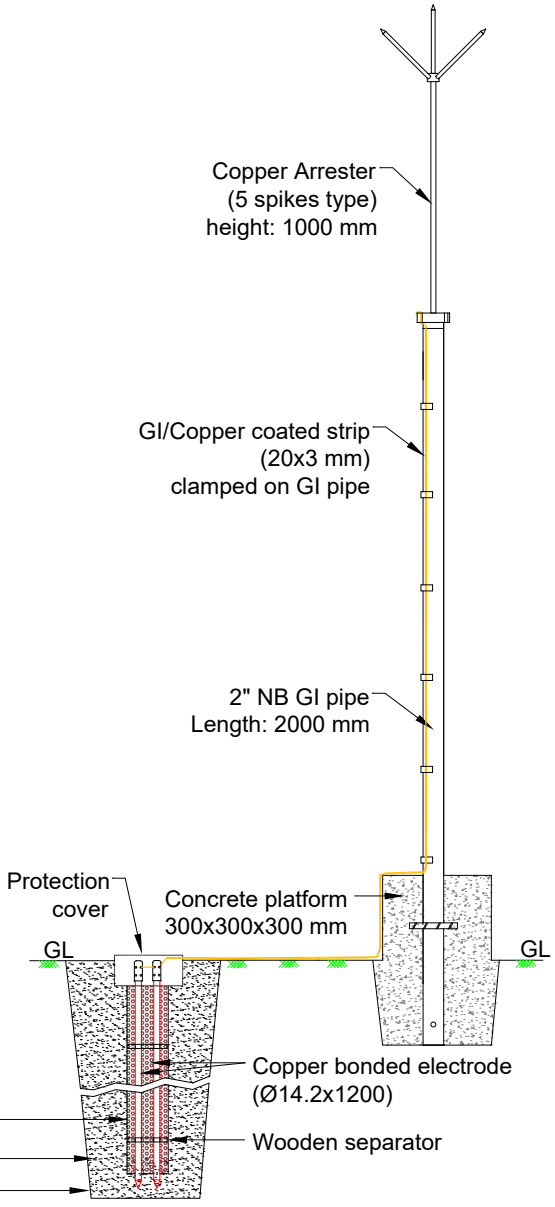


Figure 6-4 Typical lightning protection for node installed in hilly region