India Meteorological Department
Ministry of Earth Sciences
Government of India

STANDARD OPERATIONAL PROCEDURE FOR INSTALLATION, MAINTENANCE & OPERATION OF AVIATION INSTRUMENTS 2024

ISSUED BY

SURFACE INSTRUMENT DIVISION
OFFICE OF THE HEAD, CLIMATE RESEARCH & SERVICES
INDIA METEOROLOGICAL DEPARTMENT
PUNE - 411005
&
CENTRAL AVIATION METEOROLOGICAL DIVISION
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MAUSAM BHAWAN, LODI ROAD
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CONTENTS

ANNEXURES

Chapter 1
Overview of Aviation of meteorological Instruments

1.1 Introduction

The present document contains set of step-by-step instructions to help Aviation Meteorological officials to carry out routine installation, maintenance and operation of aviation instruments installed at the runway for observing and reporting of weather elements SOPs aim is to achieve efficiency, quality output and uniformity of performance in compliance with the regulations laid-in.

Weather factors have marked influence on the operation and performance of modern aircrafts. The impact of a relatively small change in parameters likes Wind, Temperature, Visibility, Pressure, and Cloud base height etc. on-air operations are very high. The aviation meteorological instruments are used for continuous monitoring and display of weather parameters namely wind direction, wind speed, air temperature, dew point, humidity, pressure, runways visual range and cloud.

The present setup in IMD consists of mainly following instrument setup at runway sites

1.) DCWIS
2.) DIWE
3.) Transmissometer / RVR
4.) Ceilometer

1.2 Criteria for Installing of Met Equipment at Airports

1. Site should have free exposure conditions away from nearest boundary wall.

2. Site shall be Free from bushes, levelled and shall be same level as that of Runway.

3. Recommended size of the Met park is 50m X 10m in view of multiple AMI installations, often redundant instruments installations are required to ensure continues services, safety during the installation and maintenance, need of multiple earth pits and in view of exposure conditions for the instruments
However, in exceptional cases where in constrains are there for getting 50mX10m space and only one set of basic instrument is required for the operation a meteorological park size of 50mX5m may be considered. However, such cases should be mutually inspected and certified by AAI/Airport operator and IMD local offices.

4. Site shall be within 120mts from Central line of runway

5. Site shall be within 300mts from runway threshold

Height of sensors:
Wind: 6m to 10m
Temperature: 2m
Visibility, MOR & RVR: 2.5m

1.3 Location of Meteorological Instruments at aerodrome

At aerodromes there is a range of requirements and conditions in addition to adequate exposure which instrument location must satisfy and in particular these include the following:

a. Representative measurement for the aerodrome as a whole and for take-off and landing operations in particular.

b. Compliance with obstacle restriction provisions.

c. Suitability of location in respect of terrain conditions, power supply and communication facilities.

Met. elements measured	**Typical equipment**	**Typical dimensions of equipment**	**Operational area for which element is to be representative**	**Siting provision in Annex. 3**
Surface wind speed and direction	Anemometer and Wind vane	Usually mounted on tubular mast 6 to 10m (20-30ft) high. Single tube mast for both instruments appropriate in proximity to runways.	Take-off areas and touchdown zone.	No specific provision so long as observations are representative of relevant operational areas.
Temperature sensor (TTRH)		Usually mounted on tubular mast 2m (6-7ft) within a Stevenson screen	Take-off areas and touchdown zone.	
RVR	Transmisso-meter	Dual baseline (10m to 75m)	Up to three transmissometers per runway	Refer to point no 1.3.1 for recommended location of RVR as per ICAO

Height of cloud	Ceilometer	Usually less than 1.5m high but rather solid structure including foundation plinth.	Generally representative of the approach area, but for precision approach runways representative for the middle marker site.	No specific provision so long as observation representative of relevant operational areas.

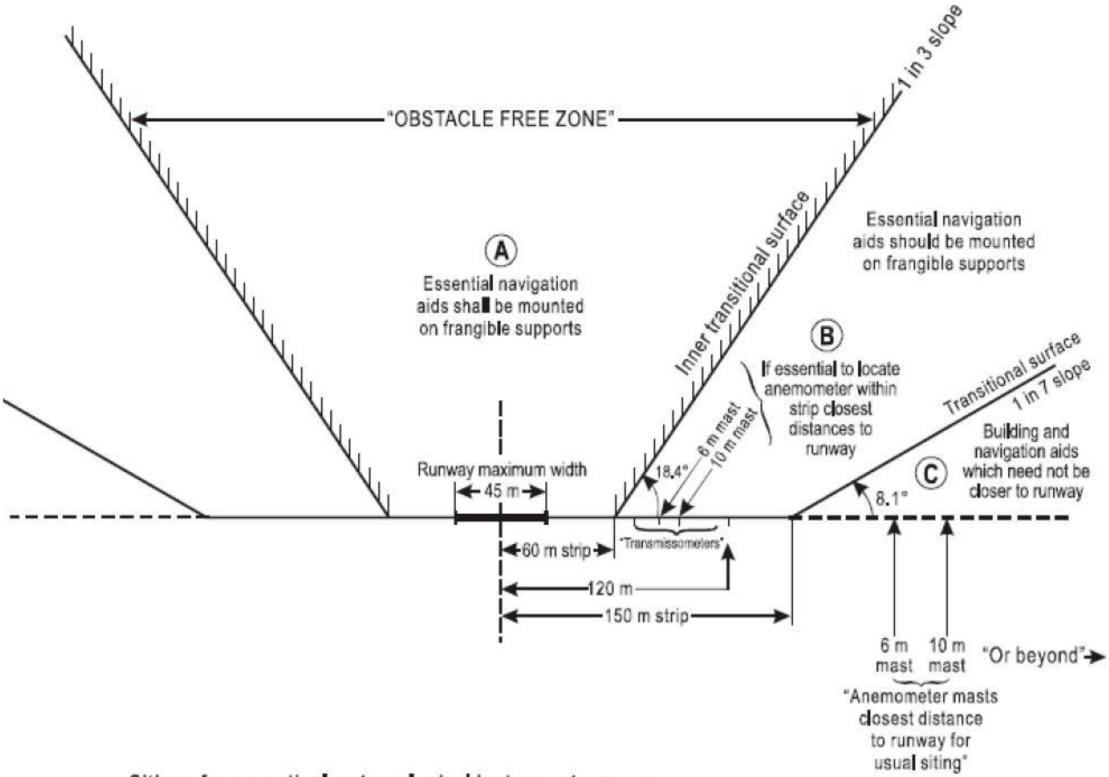
1.3.1 Detailed location of RVR as per the ICAO annex-3 as mentioned below

4.3.1.1 Recommendation. — Runway visual range should be assessed at a height of approximately 2.5 m (7.5 ft) above the runway.

4.3.1.2 Recommendation. — Runway visual range should be assessed at a lateral distance from the runway centre line of not more than 120 m. The site for observations to be representative of the touchdown zone should be located about 300 m along the runway from the threshold. The sites for observations to be representative of the mid-point and stop-end of the runway should be located at a distance of 1 000 to 1 500 m along the runway from the threshold and at a distance of about 300 m from the other end of the runway. The exact position of these sites and, if necessary, additional sites should be decided after considering aeronautical, meteorological and climatological factors such as long runways, swamps and other fog-prone areas.

4.6.3.4 Runway visual range assessments shall be representative of:
a) the touchdown zone of the runway intended for non-precision or Category I instrument approach and landing operations;
b) the touchdown zone and the mid-point of the runway intended for Category II instrument approach and landing operations; and
c) the touchdown zone, the mid-point and stop-end of the runway intended for Category III instrument approach and landing operations.

1.4 Runway complex and touchdown area



Siting of aeronautical meteorological instrument sensors

Chapter 2
Digital Current Weather Instrument System

2.1 Overview

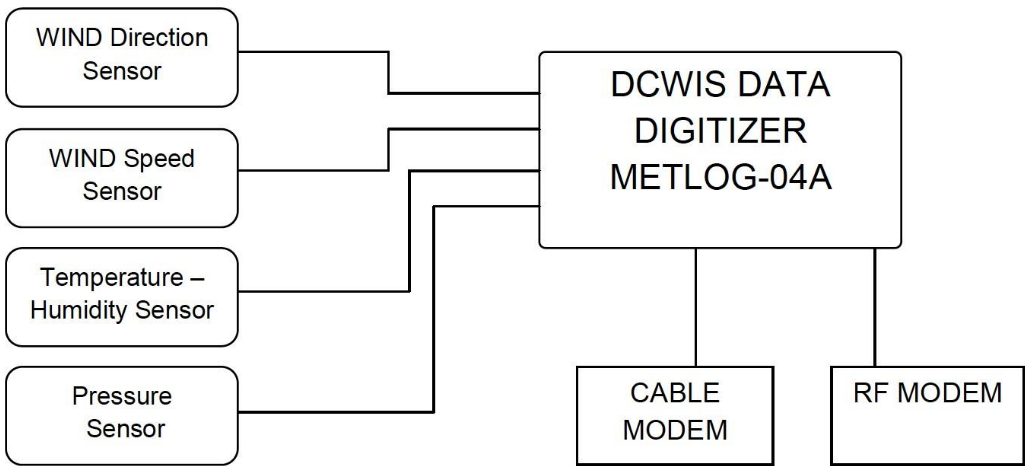
The DCWIS can be divided into two main parts namely
a.) Field instruments
b.) ATC/MBR instrument

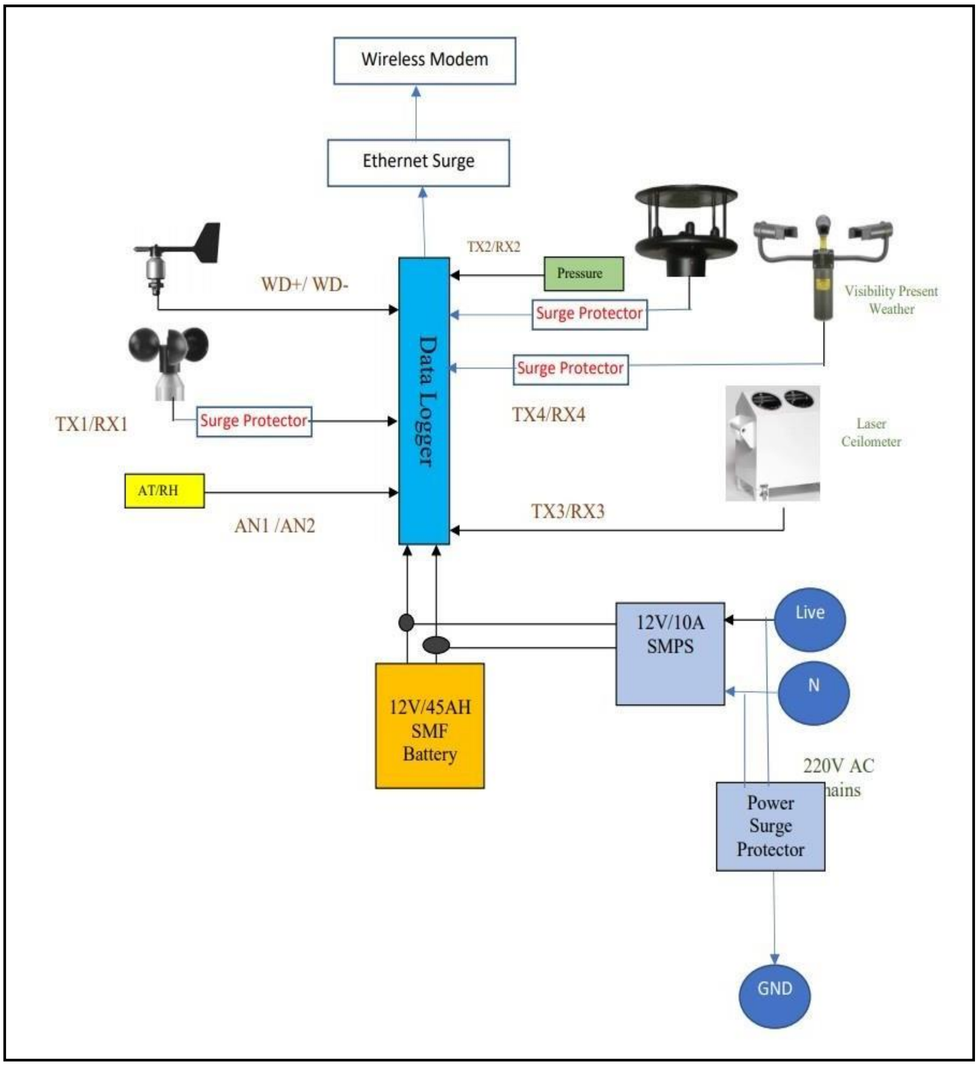
Field Instruments system contains following main parts:
1. Meteorological Sensors
2. Wind Direction Sensor
3. Wind Seed Sensor
4. Temperature – Humidity Sensor
5. Barometric Pressure Sensor
6. Data Digitizer: Metlog-04A
7. RF Modem / Cable modem (Transmitter)

ATC / MBR Instruments consists of following main parts
1. RF Modem / Cable Modem (Receiver)
2. PC Acting as Server
3. PC Acting as Client (Slave Displays)

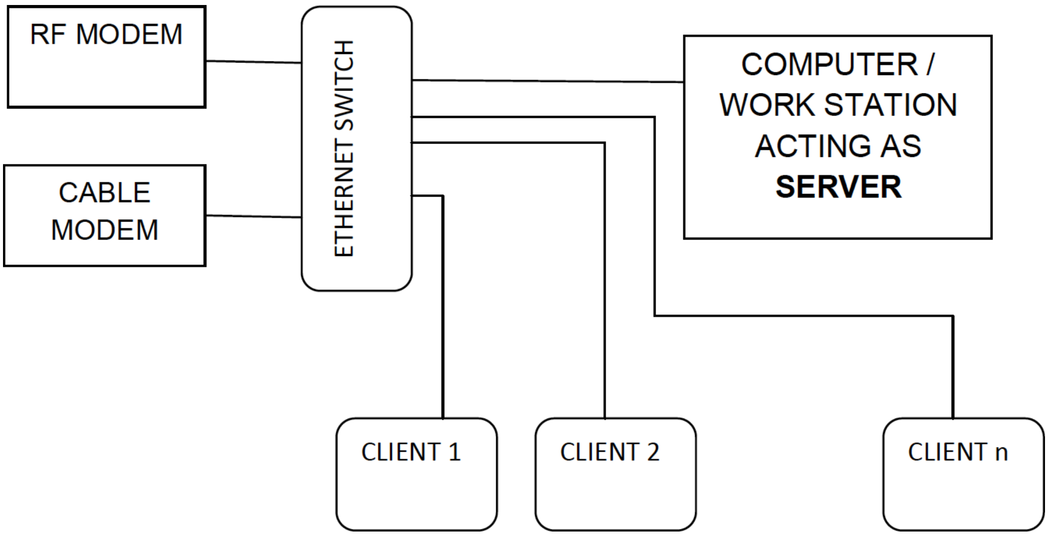
2.2 BLOCK DIAGRAM OF DCWIS SYSTEM

Field Instruments:





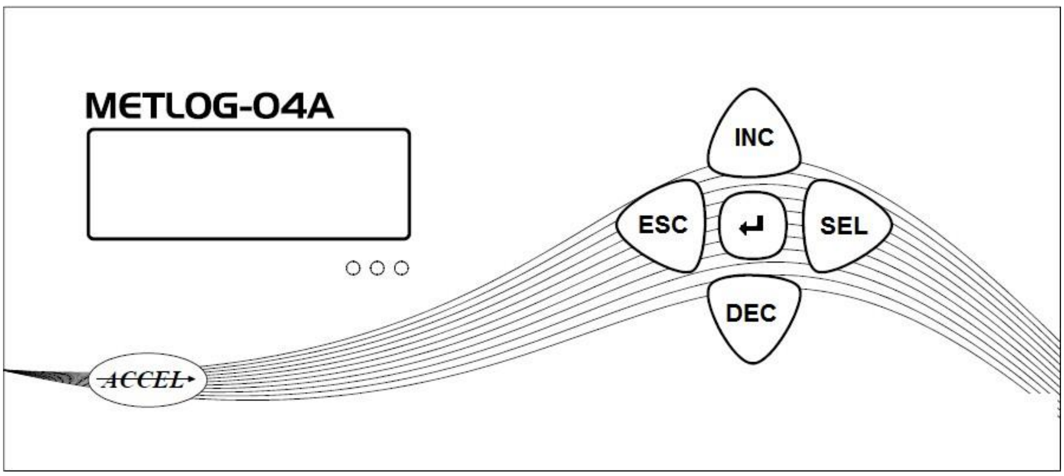
ATC / MBR Instruments:



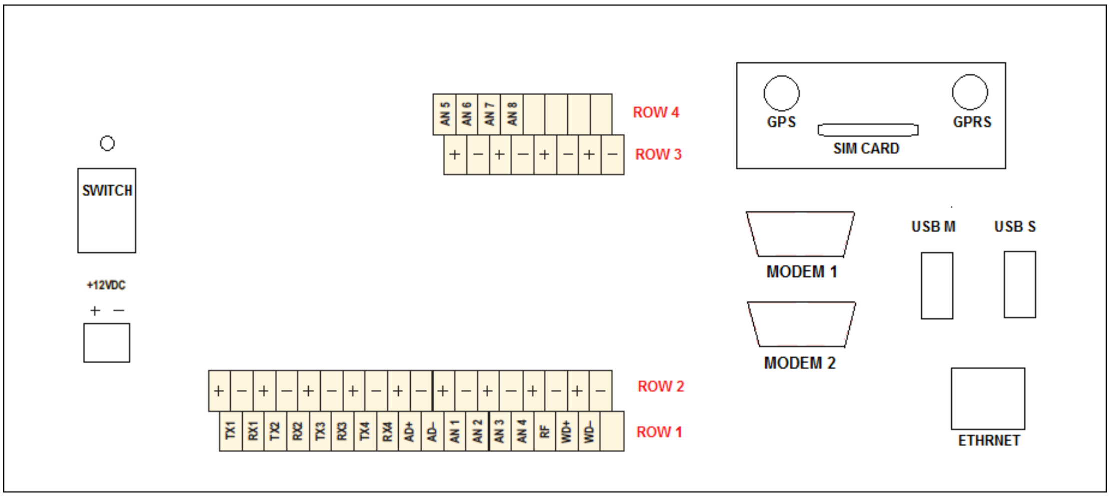
2.3 Type of sensors interfaced to Data Digitizer:

Parameter	Sensor Type	Excitation Voltage	Output	Make & Model
Temperature – Humidity Sensor				
Temperature		12 V DC	0 – 1 VDC ⇔ -40°C to +60°C	Rotronic – HC2 / Vaisala / *Microstep Make RHT 175*
Humidity		12 V DC	0 – 1 VDC ⇔ 0 – 100 %	
Wind Direction Wind Speed Sensor:				
Option 1 - Ultrasonic				
Wind Direction Wind Speed	Ultrasonic	12 VDC	RS232 XXXXX-8–N-1	Gill Sensor
Option 2 : IMD Make				
Wind Speed	Optical Anemometer	12 VDC	RS232 4800–8–N–1	IMD
Wind Direction	10 K Potentiometric	--	0 – 10 K	IMD
	Hall Effect	12 VDC	0 – 20 mAmp	IMD
Pressure Sensor				
Barometric Pressure	Digital	12 VDC	RS232	RM Young
	Digital	12 VDC	RS232	ThiesClima
	Digital	12 VDC	RS232	Microcomm
	Digital	12 VDC	RS232	VAISALA / SGS Weathertech

Front Panel :



Back Panel:



2.4 Pin Details of digitizer

Pin No.	ROW 1		ROW 2	
	Name	Connection	Name	Connection
1	TX1	Wind Speed Sensor Rx Signal	+	Wind Speed Sensor Supply
2	RX1	Wind Speed Sensor TX Signal	-	Wind Speed Sensor Ground
3	TX2	Pressure Sensor Rx Signal	+	Pressure Sensor Supply
4	RX2	Pressure Sensor Tx Signal	-	Pressure Sensor Ground
5	TX3	Laser Ceilometer – Rx Signal	+	12VDC
6	RX3	Laser Ceilometer – Tx Signal	-	GND
7	TX4	Spare	+	12VDC
8	RX4	Spare	-	GND
9	AD+	RS485 (D+)	+	12VDC
10	AD-	RS485 (D-)	-	GND
11	AN1	Temperature Sensor	+	TT-HH Sensor Supply
12	AN2	Humidity Sensor	-	TT-HH Sensor Ground
13	AN3	Spare	+	12VDC
14	AN4	NC(Not to be connected)	-	GND
15	RF	TBRG Signal	+	12VDC
16	WD+	Potentiometric / Hall Wind Vane	-	GND
17	WD-	Potentiometric / Hall Wind Vane		

Pin No.	ROW 3		ROW 4	
	Name	Connection	Name	Connection
1	+	12VDC	AN5	Analog IP 5 (0- 5000 mV Range)
2	-	GND	AN6	Analog IP 5 (0- 5000 mV Range)
3	+	12VDC	AN7	Analog IP 5 (0- 5000 mV Range)
4	-	GND	AN8	Analog IP 5 (0- 5000 mV Range)
5	+	12VDC		
6	-	GND		
7	+	12VDC		
8	-	GND		

2.5 Sensor details of DCWIS

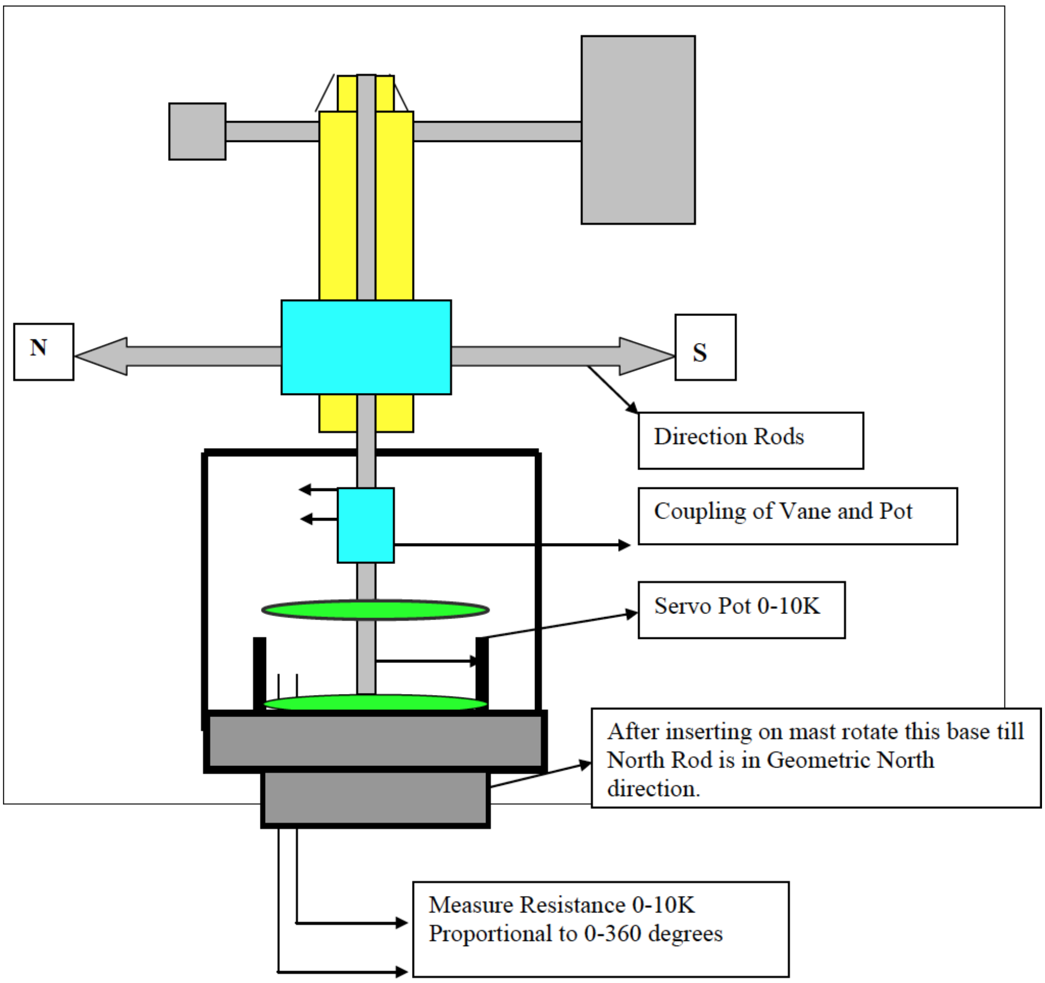
1. Wind Vane

Wind vane is the instrument used measure direction of flow of wind. At present there are two types of wind vane

a) Potentiometric wind vane

The sensor used for measurement of wind direction is an IMD-make potentiometric wind vane. The potentiometer in the wind vane is a servo-micro torque potentiometer and has a maximum resistance of 10 kilo-ohms over an end gap of about 4 degrees. The potentiometer is coupled to the wind vane shaft so as to give a resistance output increasing linearly with the increasing of wind direction. Thus 0 KΩ corresponding to the north, 2.5 KΩ for east, 5 KΩ for south, 7.5 KΩ for west and the variation of 0-360 degree corresponds to 0 to 10 kilo ohms

Cross sectional view of wand vane



Calibration procedure for Potentiometric Wind vane:

1. Mark geometric North using magnetic compass.
2. Measure resistance output of pot using multimeter. Move the vane till the resistance is exactly zero ohms.
3. Now arrest vane movement. Rotate North Direction Rod and align to the wind vane position. Fix the north direction rod. (tighten the screws)
4. Fix wind direction sensor without disturbing the position of direction rods. Now rotate whole wind direction sensor (base of the sensor) over the mast using screw mechanism. Align North rod to exact North direction.

b.) Hall Effect wind vane

Hall Effect wind direction sensor works on principle of hall voltage. It is contact less. Hall voltage is proportional to sin of angle between the hall chip carrying fixed current. There are two hall plates perpendicular to each other if one give hall voltage proportional to sine of wind direction, perpendicular hall plate gives hall voltage proportional to cosine of angle, angle is proportional to ratio of the two hall voltages this eliminating current magnetic field created etc. Hall Effect sensor are contactless hence no friction so responds to very low wind or very less threshold

2.) Anemometer

Anemometer is used to measure wind speed.

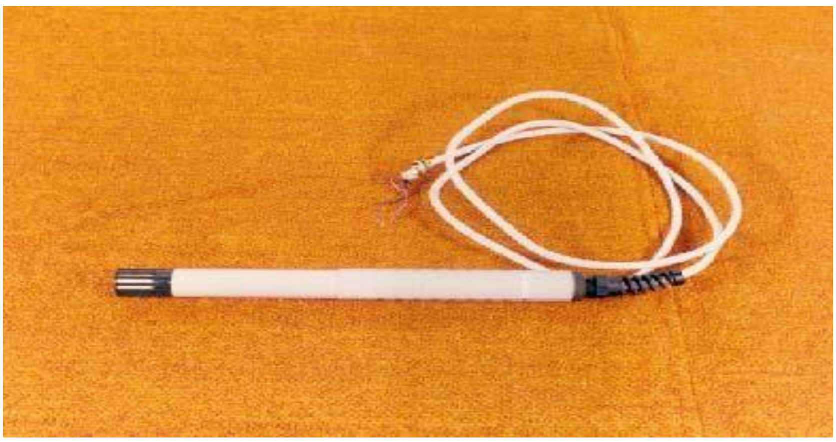
Optical anemometer gives digital as well as analog outputs with respect to the wind speed in knots. Suitable scaling has been provided in the data logger for other units, such as Kilometres per hour, meters per seconds etc. The basic operating element is an opto-coupler, which is having a transmitter and a receiver with a toothed wheel connected to the shaft of the cup anemometer. The receiver, which is a photo detector, receives infrared light from the transmitter through the gaps between the teeth of the wheel generates pulses proportional to the true wind speed. These pulses are counted by an inbuilt counter in the 16–bit microprocessor (Microchip makes model no.12F682).

The following table shows the average number of generated pulses from the optical anemometer at different wind speeds in knots. These values are obtained at the time of calibration of the anemometer in wind tunnel.

No.of Pulses	22	56	76	165	200	290	340	396	525	600	650	790
Wind speed in knots	2.5	6.3	8.5	18	22	33	38.6	45	60	68	72	89

3. Hygroclip

Hygroclip is a combined sensor for both temperature and relative humidity.



a.) Temperature sensor

Pt-100 is used to measure temperature. Pt100 is an RTD sensor. It consists of an element that uses resistance to measure temperature. The abbreviation **RTD** comes from **"Resistance Temperature Detector".** It is a temperature sensor in which the resistance depends on temperature; when temperature changes, the sensor's resistance changes. So, by measuring the sensor's resistance, an RTD sensor can be used to measure temperature. Platinum has a reliable, repeatable and linear temperature-resistance relationship. RTD sensors made of platinum are called **PRT**, **"Platinum Resistance Thermometer".** The most common platinum PRT sensor used in the process industry is the **Pt-100** sensor. The resistance is 100 ohms at 0°C. and the resistance increases linearly with the increase in temperature. It has a measuring range of -40 to 60 C% for temperature. Its output is 0-1 volts dc.

b.)Humidity sensor

The basic sensor for relative humidity is a thin polymer, which is having the property to absorb moisture from the air, and changes its electrical permittivity in proportion to the relative humidity. The polymer is placed between the parallel plate capacitor as a dielectric. It has a measuring range of 0-100% for relative humidity and -40 °C. Its output is 0-1 volts dc.

4. Pressure sensor

Measuring air pressure is important both in weather forecasting. Digital barometers are deployed at the airport for measurement of atmospheric pressure. A micromechanical sensor that uses dimensional changes in its silicon membrane to measure pressure. As the surrounding pressure increases or decreases, the membrane bends, thereby increasing or decreasing the height of the vacuum gap inside the sensor. The opposite sides of the vacuum gap act as electrodes, and as the distance between the two electrodes changes, the sensor capacitance changes. The capacitance is measured and converted into a pressure reading.

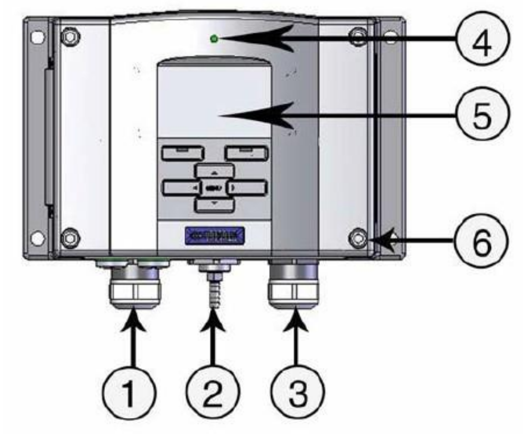


Figure 1 Barometer Body

Numbers refer to Figure 1 above:

1 = Cable for signal/powering Ø 8 ... 11 mm
2 = Pressure port
3 = Cable for optional power supply/relay module Ø 8 ... 11 mm
4 = Cover LED
5 = Display with keypad (optional)
6 = Cover screw (4 pcs)

Outer structure of barometer

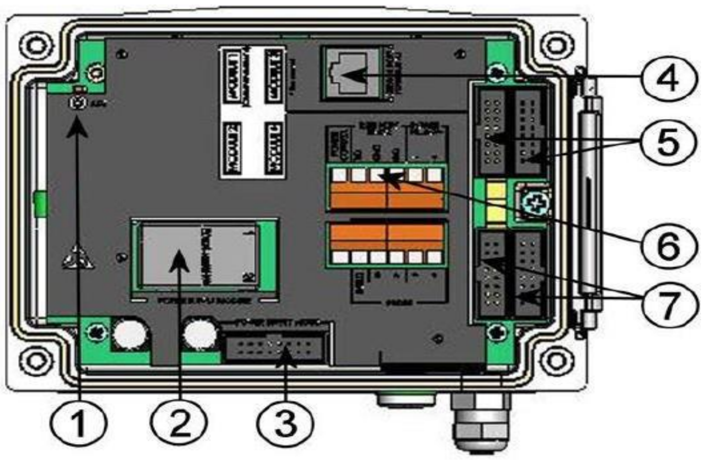


Figure 2 Open Barometer Interior

Numbers refer to Figure 2 above:

1 = Adjustment button with indicator LED
2 = Galvanic isolation module (optional)
3 = Power supply mode selections
(Do not change the factory settings!)
4 = Service port (RS-232)
5 = Module 1/Module 3 connectors
6 = User port
7 = Module 2/Module 4 connectors

Inner structure of barometer

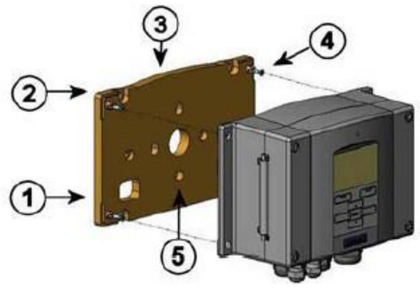


Figure 4 Mounting with Wall Mounting Kit

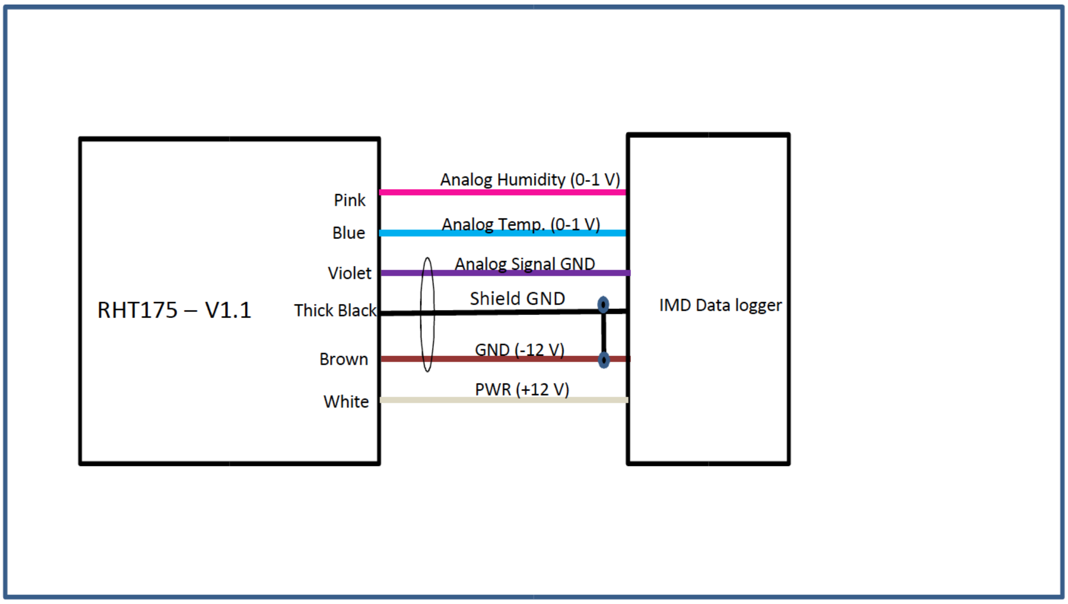
Numbers refer to Figure 4 above:

1 = Plastic mounting plate
2 = Mount the plate to wall with 4 screws M6 (not provided)
3 = The arched side up
4 = Fasten barometer to the mounting plate with 4 fixing screws M3 (provided)
5 = Holes for wall/junction box mounting

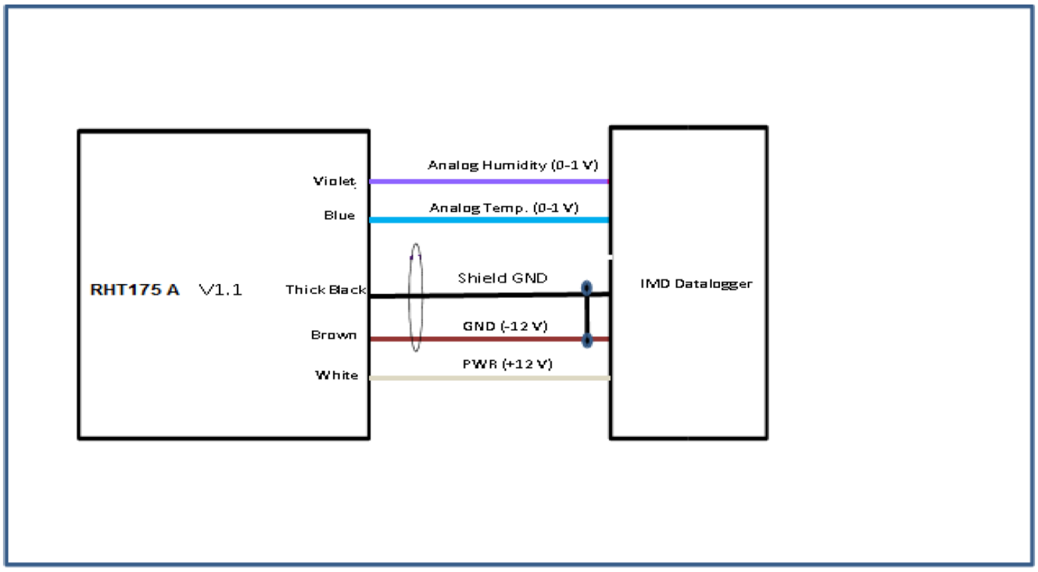
2.6 Interface of various sensors to the digitizer at runway site

a.) Temperature- Humidity sensor

- Microstep Make RHT 175



➢ Microstep Make RHT 175 A



➢ Komoline make KAS-011 Air Temperature and Relative Humidity Sensor

- Red Wire: +12 V DC
- Black wire: Ground
- White wire: Temperature(+)
- Blue Wire: Temperature(-)
- Yellow/Orange: Humidity(+)
- Green wire: Humidity(-)

b.) Wind direction sensor

Two types of wind direction sensor are used at present:

1. Potentiometric wind vane:
This sensor is having two wires having some resistance as per position of potentiometer according to wind direction. These two wires are to be connected at pins described in table having PIN details irrespective of color.

2. Hall effect Wind sensor:
This sensor is having 4 wires, 2 for power and 2 as output. Positive of power is connected with 12 V DC and negative with ground. Signal wires are connected at positive and negative pins as mentioned in PIN description table.

Configuration in Digitizer for Wind Vane:

➢ Press and hold Enter key on data logger.
➢ Go to Configuration setting with help of INC button.
➢ Enter with password: "INC DEC INC DEC" for METLOG4A.
➢ Move down with INC button and go to WD Sensor type.
➢ Press enter and select POT for potentiometric wind vane or Hall effect for
➢ Hall effect-based wind vane

Connection of 10 KΩ Servo POT and North Setting of Wind Vane

1. 10 K Servo pot terminal A and C are shorted, then one wire is taken from one of the shorted terminals (terminal A in picture) and other wire is taken from terminal

2. Fix the servo pot in the base of wind vane assembly with the help of three clamps.
3. Now loose the direction rod ring (E,S,W,N) for the rotation by screw driver.
4. Align NORTH direction rod with maximum resistance of servo pot (max resistance is approx. 10K ohm)
5. Tight the aligned North direction rod with max. Resistance of servo pot.
6. Check the resistance with direction of E=2.5k ohm, S=5.0k ohm, W= 7.5k ohm, N = 10 K ohm / 0 Ohm
7. Tighten the screws of direction rod ring of Wind vane.
8. Connect to DCWIS4A logger pins as described in section 1.2.

c.) Ultrasonic Wind Sensor

Digitizer is having feature to interface Gill make ultrasonic wind sensor.

To interface Gill Make Ultrasonic wind sensor:

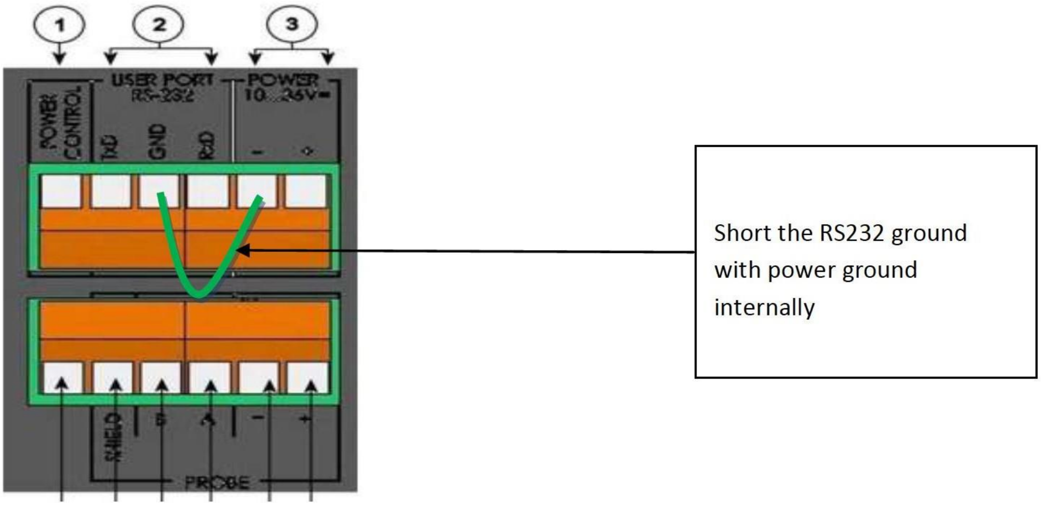
- Connect positive of power cable of sensor at 12 VDC terminals and Negative at GND terminal.
- TXD wire from sensor is connected at WS input pin at Digitizer.

Configuration in Digitizer for Ultrasonic Wind Sensor:

- Press and hold Enter key on digitizer and go to Configuration setting with INC button.
- Enter with password: “INC DEC INC DEC” for METLOG4A and go to WS sensor type.
- Select the sensor type “ULT”. Then go to ULT baud rate and set it to 9600 or at known baud rate of sensor.

d.)Pressure sensor

Vaisala Make Pressure Sensor (Ptb 330)



- Open the Vaisala make PTB 330 sensor with help of Allen key.
- Inside the sensor green connection terminal is available as shown in above figure.
- Tx, Gnd and Rx are for serial data (RS232) output from the sensor(2).
- Power supply is connected at +(10-36 V DC) and –(GND) markings.
- Short the GND terminal in RS 232 with –(GND) in power option so that ground to serial output can be provided.

For connecting the pressure sensor to Data Logger:
TxD: Pin2 of DB9 Connector
RxD: Pin3 of DB9 Connector
GND: Pin5 of DB9 Connector

This DB9 connector is connected at the COM4 port of Digitizer.

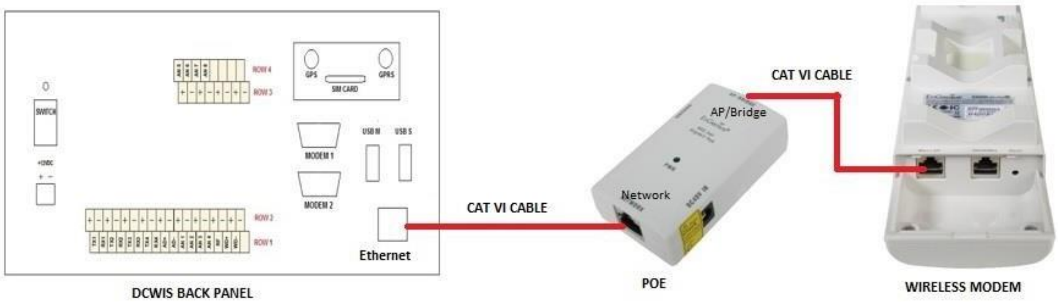
Configuration in Digitizer for pressure sensor:

- Press and hold Enter key or PGM key in data logger. Press password as: “INC DEC INC DEC” for METLOG4A and “INC SHIFT INC SHIFT” for METLOG3.
- With INC button go to PR Sensor Type and select the sensor being used.
- Similarly go to PR Station Height Menu and enter height of station from mean sea level.
- Then go to PR sensor height menu and enter the height of pressure sensor from ground.

e.) Wind Speed

Optical anemometer consists of 3 wires for interfacing to the digitizer. Two wires are for providing 12V DC power supply. The third wire provides ready to use RS232 output in knots.

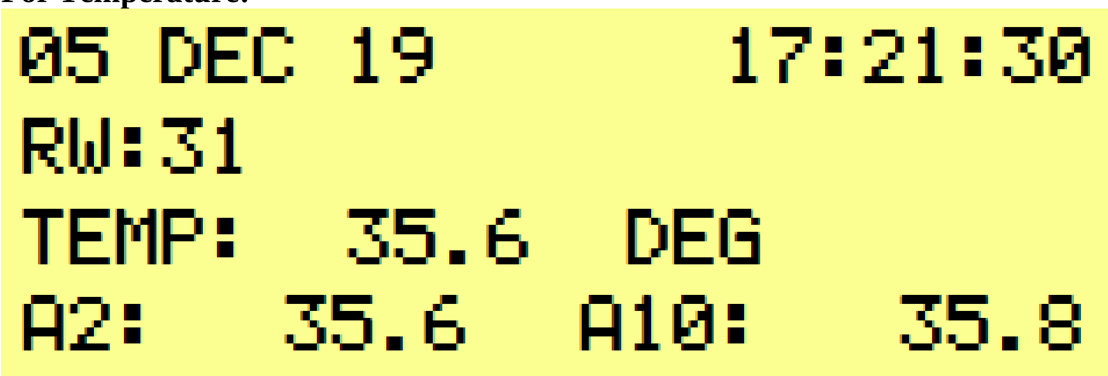
2.7 Communication setup at Runway site



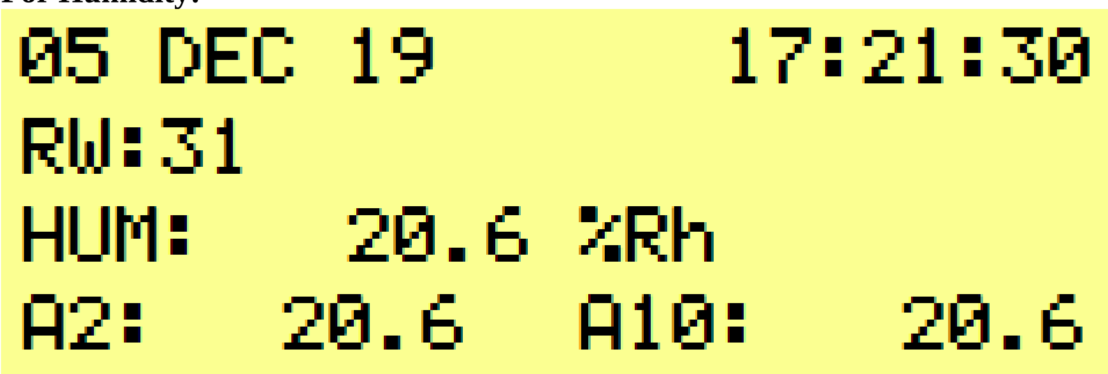
2.8 FUNCTIONAL DESCRIPTION OF METLOG-04A

After power on, the system goes in initialization. After initialization, system starts reading meteorological sensors connected to it and starts processing the data. The system calculates the meteorological parameter values, its average values (1 minute, 2 minute & 10 minute) and displays it on the LCD screen.

For Temperature:



For Humidity:



For Dew point:

```
05 DEC 19          17:21:30
RW:31
DEW PT:   21.3  DEG
A2:    21.3   A10:    21.3
```

For Wind Direction:

```
05 DEC 19          17:21:30
RW:31
W DIR:       36 DEG
A2:     36      A10:     36
```

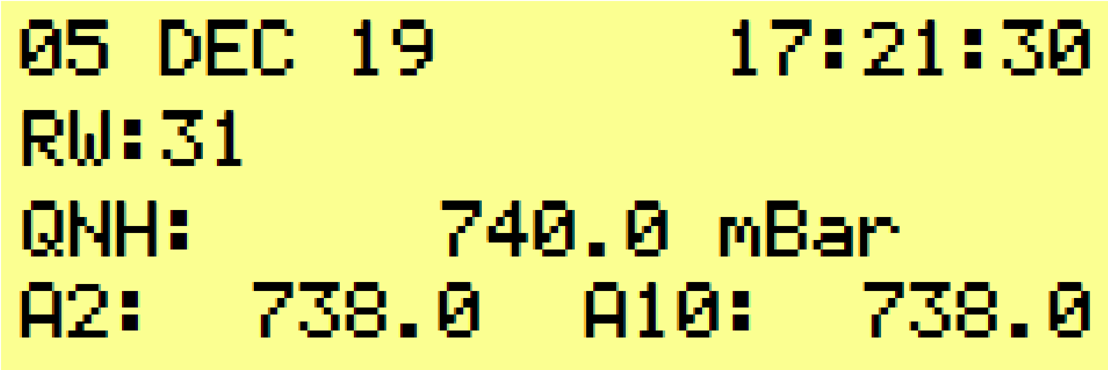
For Wind Speed:

```
05 DEC 19          17:21:30
RW:31
W SPEED:      22.4  Knots
A2:   20.1    A10:    21.4
```

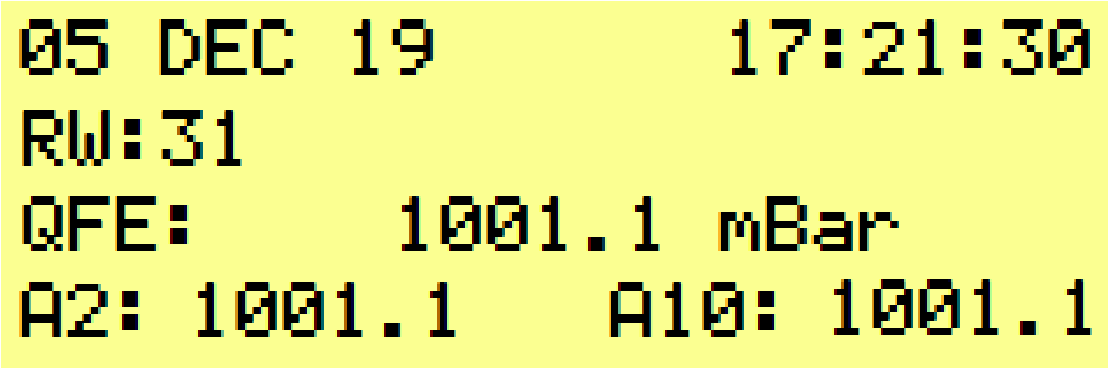
For Pressure:

```
05 DEC 19          17:21:30
RW:31
PRESS:   944.0 mBar
A2:   946.1   A10:   946.1
```

For QNH



For QFE



The display will show each screen one by one. This is the normal Run Mode of the DCWIS system. Apart from Run Mode, various modes are provided to the operator to monitor few parameters or to configure & calibrate the data logger. For security purpose, some of the modes are password protected.

2.9 DCWIS SOFTWARE INSTALLATION

The DCWIS setup works in form of server-client over IP network. The software installation is divided into two parts

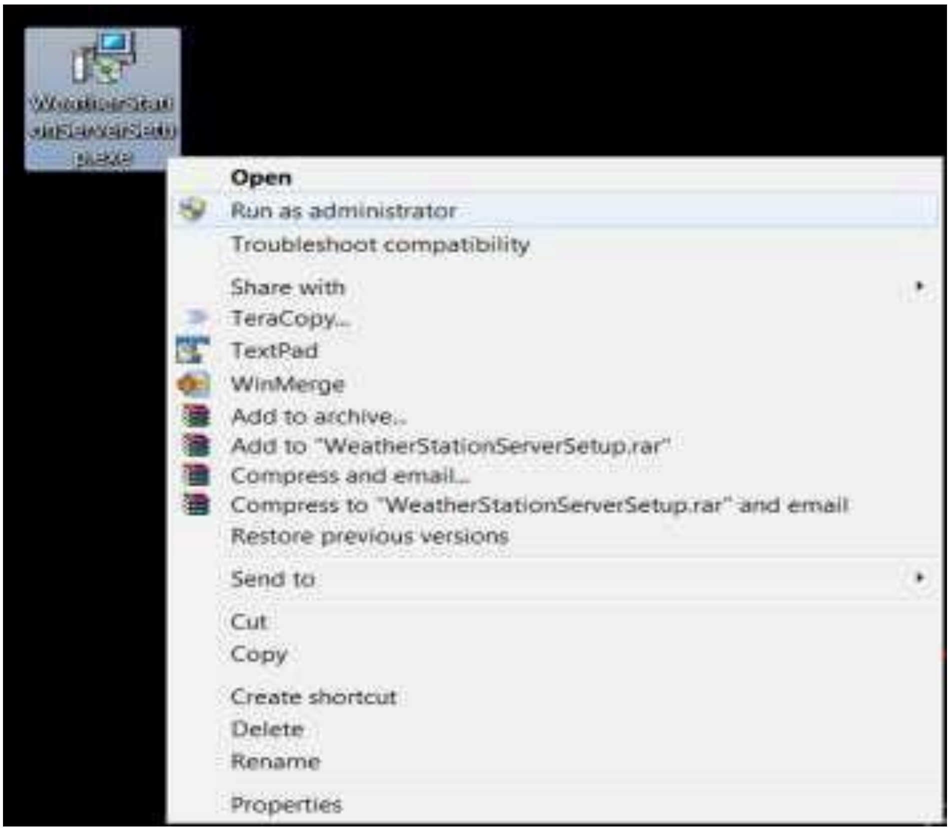
a.) Server setup

b.) Client setup

a.) DCWIS server setup

Before installation of the DCWIS Server software, make sure PC / server has required configuration or better. Administrator should install the software with administrative rights.

1.) Operator can install the software by right clicking on the DCWIS SERVER Application software .exe file. In this menu select "**Run As Administrator**"



2.) Select the destination folder i.e. the path where the software should get installed. Default will install the software in Program Files in C Drive. User can select any drive / path for installation.

3. The DCWIS Server software will start installing. Press Next.

If a shortcut on desktop is required click on „Create a desktop shortcut" and press NexT

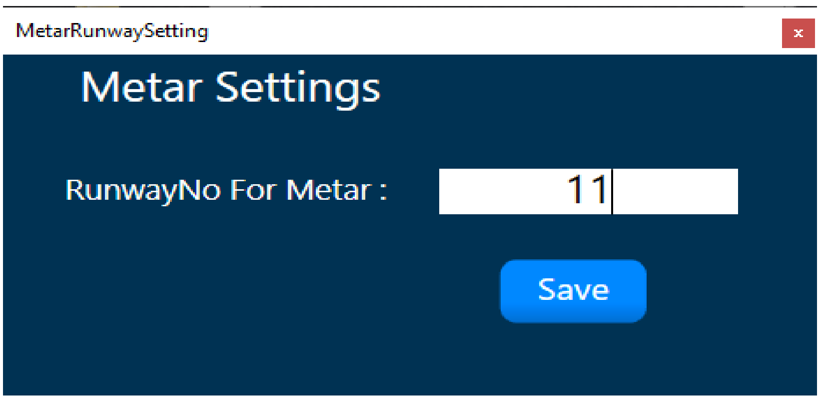
5. The screen will display the options selected by you and will prompt for further

action. Press “Install‟ if all the selection is correct.

The software will start installation, and when installation is complete, press Finish to exit setup. If the software is installed on „C‟ Drive or main drive, then while running the software, you must select the option of Run As Administrator.

b.) DCWIS server software configuration

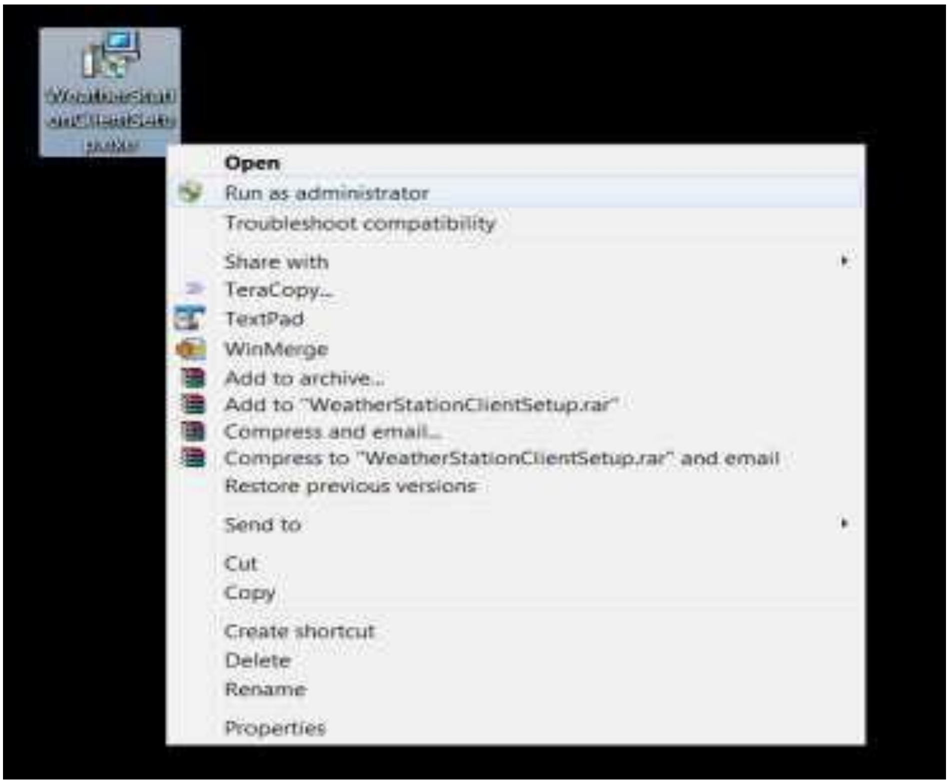
After installation, user can run the “DCWIS Server version number‟ application from programs/ desktop shortcut. After the Server application is run a window will pop up for selecting the Runway number for generating the METAR. Enter the Runway number and press the “Save‟ button to complete the settings.
Press “Save‟ Button once the settings are complete.



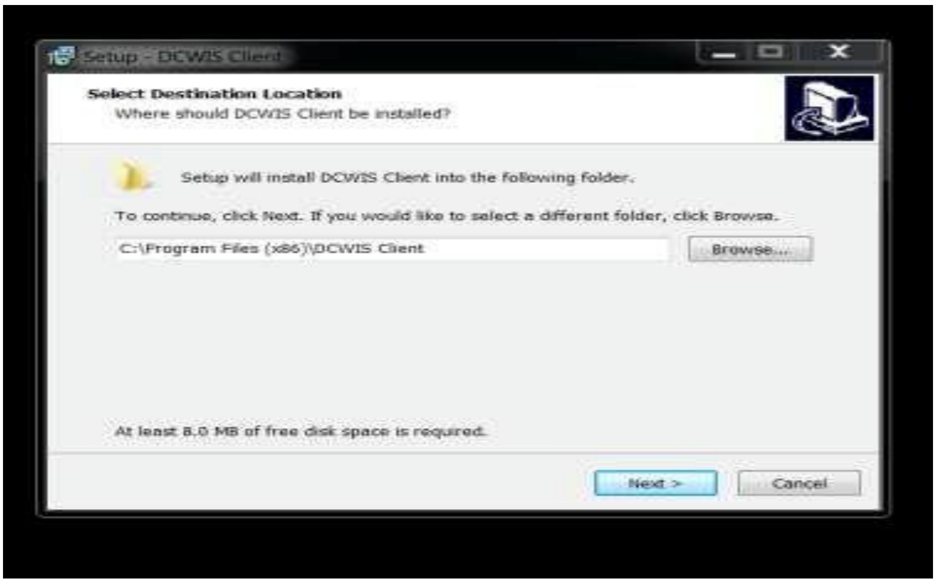
c.)DCWIS client setup

Administrator should install the software with administrative rights.

1.) Operator can install the software by right clicking on the DCWIS CLIENT application software exe file. In this menu select “Run As Administrator”



2) Select the destination folder i.e. the path where the software should get installed. By default the software will get installed in Program Files in C Drive. User can select any drive / path for installation.



3. The DCWIS Server software will start installing. Press Next.

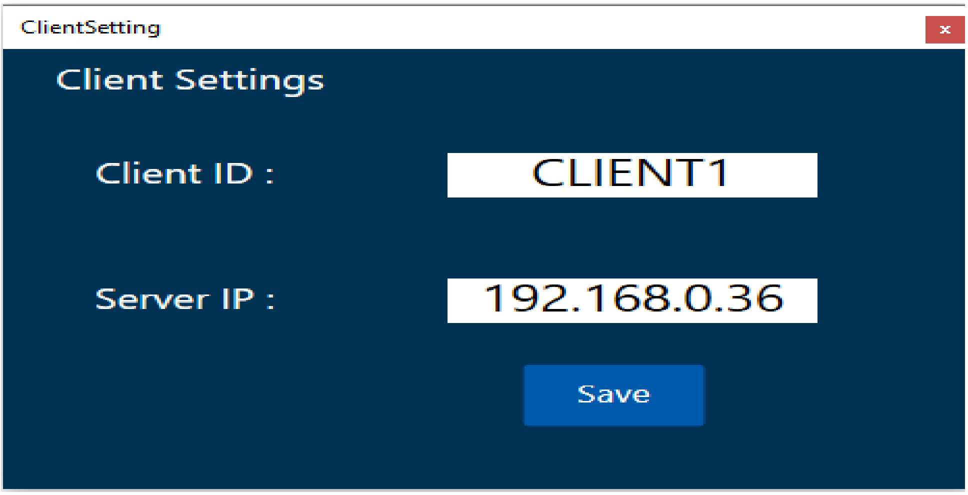
If a shortcut on desktop is required click on „Create a desktop shortcut" and press NEXT

4.)The screen will display the options selected by you and will prompt for further action. Press „Install" if all the selection is correct.

The software will start installation, and when installation is complete, press Finish to exit setup.

d.) DCWIS client software configuration

There are few settings to be carried out for client software to get it connected to the server. The main setting is Server IP. Operator should provide the IP address of the PC / server where DCWIS Server software is running. Client ID should be unique to each client and should not get repeated to any other client working in the same network.



Client Settings can be carried out later by pressing "Ctrl+t" button on the keyboard. Following options are provided for viewing data from different runways on the client screen:

- One Runway

- One Runway with Report
- Two Runway
- Two Runway with Report
- Three Runway
- Four Runway
- Six Runway
- Forecaster

Operator can select any one option depending on the requirement.
Press "Save" Button once the settings are complete.

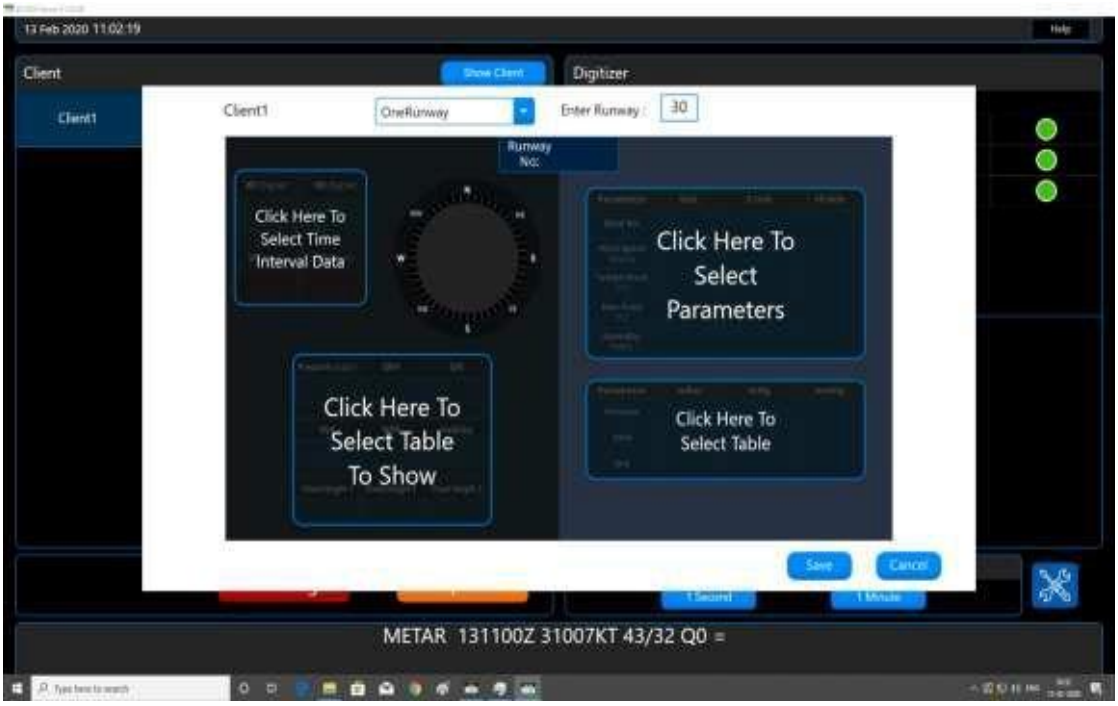
e.)Operation of server software

Once the server & client software are installed, operator can view the status of incoming data from field instruments & different Clients connected to the server.
The screen will be as:

- At the top left of the screen we can see the date and time of the runway selected for generating the METAR. Operating manual including both hardware and software details is provided in "Help" tab.
- The right part of the screen displays the list of digitizers (field instruments) Status of the digitizers either connected through RF Modem or Cable modem is displayed in the tabular format including respective IP address and respective COM Ports.
- Current client configuration (screen type and runways selected) can be seen on left part of the server screen.
- If the client software is installed on the same machine as server, "Show Client "button can be used to open client window.
- Once all the clients connected are visible, operator at the server can modify the settings of each client by pressing the „Modify" button. Server can change the screen types of the client as per their requirement.

One Runway Screen:

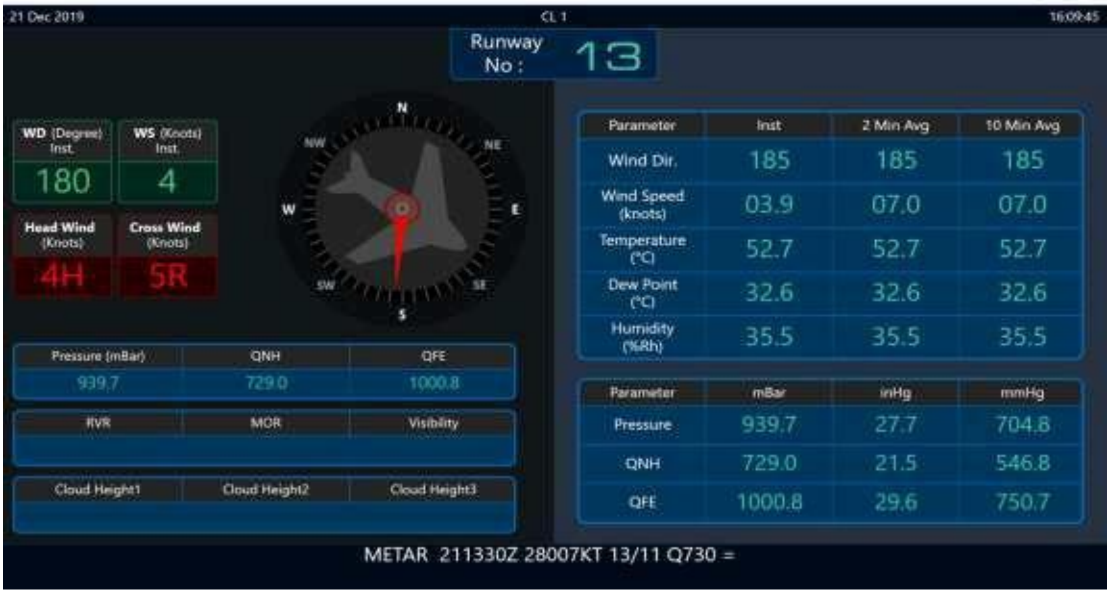
On pressing the "Modify" button the following screen can be seen. Select "One Runway" from the drop-down box and enter the runway no. in the box. The window will appear as shown below



Operator has to make a few selections ahead.

- Select the time Interval of Data from -Instant, 2-Minute Average and 10-Minute Average.
- Select Table (Multiple selections possible)
  Options of three tables are given,
  - Table1: Pressure, QNH, QFE
  - Table2: RVR, MOR, Visibility
  - Table3: Cloud Height 1, Cloud Height 2, Cloud Height 3
- Select Parameters (Any five)
  Options are Wind direction, Wind speed, Temperature, Dew point, Humidity, Pressure, QNH, QFE.
- Select Table
  Pressure table with different units can be shown or hidden using this option.
- Press "Save" button.

"One Runway" Client screen is as shown below,



Similar settings can be done with other screen layouts.

Chapter 3
Distant Indicating Wind Equipment

DIWE-03 specially designed to monitor Wind Direction and Wind Speed Inputs for small /medium airports

This system contains following main parts:

1. Data Logger: DIWE –ver 03
2. Sensors (Wind direction and wind speed)
3. Mini Slave Displays (Wind Direction – Wind Speed)
4. PC Software

3.1 Block diagram of DIWE

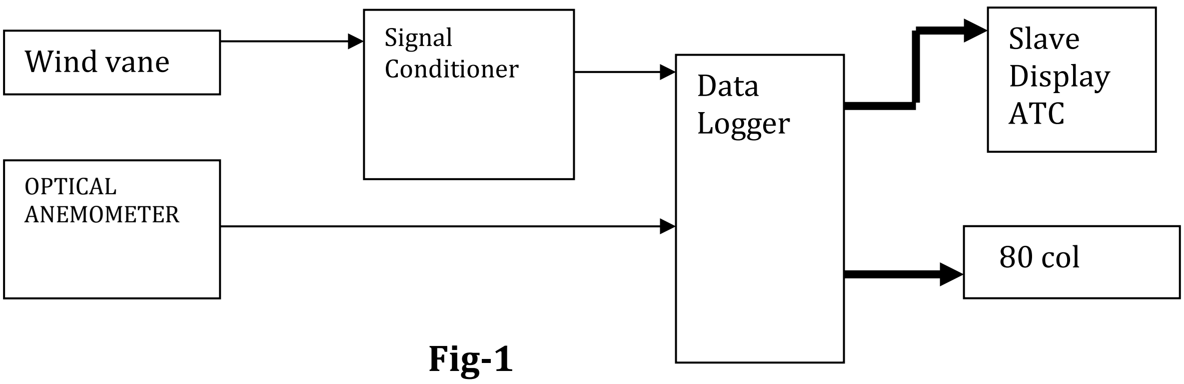
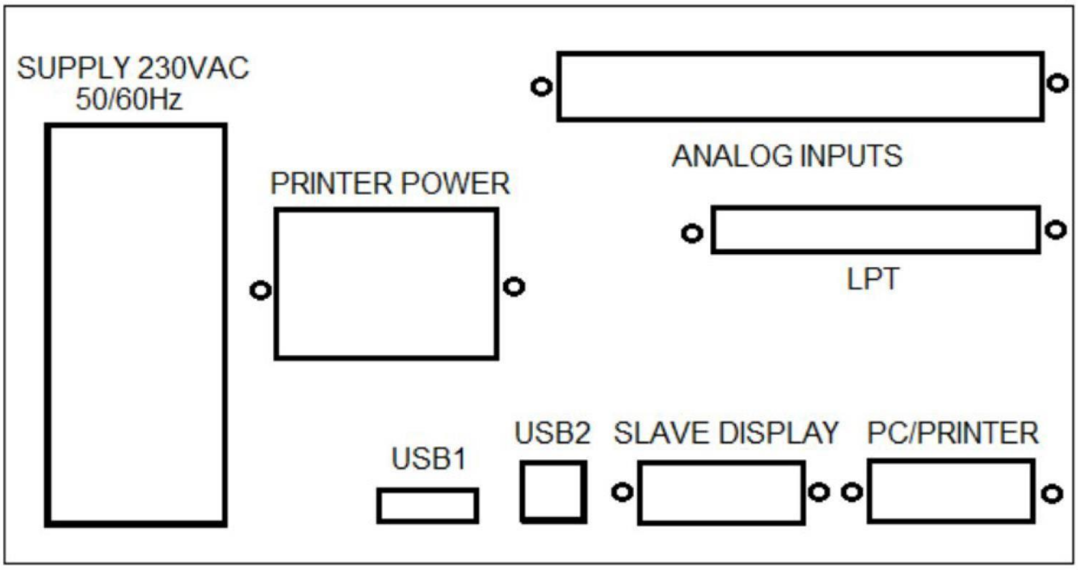


Fig-1

Front panel

Back panel



Connect the sensors as per the Block diagram

a. **Wind Direction:** Measure the wind direction by keeping Vane in N-E-S-W directions. Measure the corresponding resistance using multimeter.
b. **Windspeed:** Measure the wind speed by rotating cups of optical anemometer manually and note different readings. Measure the output voltages with multimeter at Pin No. 2 and 3. Supply voltage should be measure between Pin No 1 and 3 it is always 10-12 V DC.

3.2 Functions of DIWE

- Reads Wind Direction and Wind Speed sensors connected to it.
- Converts the sensor values into digital format.
- Transmits the data over RS422 to Slave Display.
- Stores the data in the internal memory
- Through PC Software user can monitor all the parameters in run time
- Stored data can be downloaded on a PC using Windows based PC software provided with the System.

3.3 Sensors interfaced to DIWE-03

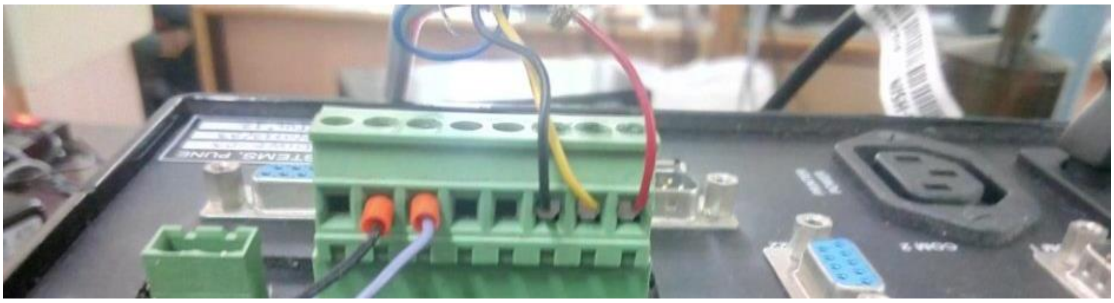
Parameter	Sensor Type	Excitation Voltage	Output	Make & Model
Wind Direction Wind Speed Sensor:				
Option 1 - Ultrasonic				
Wind Direction	Ultrasonic	12 VDC	RS232 9600-8–N-1	Gill Sensor
Wind Speed				
Option 2 : IMD Make				
Wind Speed	Optical Anemometer	12 VDC	RS232 4800–8–N–1	IMD
Wind Direction	10 K Potentiometric	--	0 – 10 K	IMD
	Hall Effect	12 VDC	0 – 20 mAmp	IMD

3.4 Connection Diagram

The Analog pin connection diagram for three type of pin details has been described below

1. For DIWE logger having 18 PIN connector (Accel)
   PIN1: +12VDC(RED) (Supply for Optical Anemometer
   PIN2: (Yellow Wire from Anemometer)
   PIN4: GND signal for optical Anemometer (Black Wire from Anemometer)
   PIN13: Potentiometric Wind Vane +
   PIN14: Potentiometric Wind Vane –

2. For DIWE logger having 8 PIN connector (Accel)
   PIN1: +12VDC(RED)(Supply for Optical Anemometer
   PIN2: (Yellow Wire from Anemometer)
   PIN3: GND signal for optical Anemometer (Black Wire from Anemometer)
   PIN6: Potentiometric Wind Vane +
   PIN7: Potentiometric Wind Vane –



3. DIWE logger having 10 PIN connector (Arks)

PIN1: +12VDC(RED) (Supply for Optical Anemometer
PIN2: (Yellow Wire from Anemometer)
PIN3: GND signal for optical Anemometer (Black Wire from Anemometer)
PIN8: Potentiometric Wind Vane +
PIN9: Potentiometric Wind Vane –

Chapter 4
Runway visual range

4.1 Introduction

RVR is the range over which the pilot of an aircraft on the center line of a runway can see the runway surface markings or the lights delineating the runway or identifying the center line. It is not an observation like surface winds, visibility etc., but it is an assessment based on (a) atmospheric factors such as extinction coefficient of the atmosphere (b) physical/biological factors such as visual threshold of illumination and (c) operational factors like runway light intensity

Presently IMD has installed NAL make Drishti RVR. The base length of drishti RVR is 30m.

The most important factor in assessing RVR is to establish the atmospheric extinction coefficient or the related value for atmospheric transmittance. The extinction coefficient represents the attenuation of light passing through air due to two effects:

- The scattering of light by airborne particle.
- The absorption of light by airborne particles

Two different equation are used to measure RVR

i. Koschmieder's Law

ii. Allard's law

Koschmieder's Law is a method of assessing visibility based upon the relative luminance of a black body against the luminance of the background it is viewed against. It is principally used to assess IRVR in daylight. When calculated from the extinction coefficient using World Meteorological office (WMO) assumptions the result is known as the Meteorological Optical Range (MOR).

Allard's Law is a method of assessing the visibility of sources of light (such as runway lights). It requires values for extinction coefficient, the luminous intensity of the lights being viewed and the background luminance and is principally used to assess IRVR at night.

Instrumental RVR is measured using two methods:

1. Transmissometer
2. Forward scatter meter

4.2 Transmissometer

An instrument that takes a direct measurement of the transmittance between two points in space over a specified path length or base line is known as transmissometers.

The main components of a transmissometer are a light source and a photo detector, where the former forms the transmitter unit and the latter form the receiver unit. The distance between the transmitter and the receiver is called the baseline length of a transmissometer. The base parameter of transmissometer is MOR. MOR is calculated using Koschmieder's equation.

$MOR = (3*b) / \log_e (1/t)$

b = baseline length of transmissometer

t = transmissivity within an optical path of a given length (b) in the atmosphere.

At present IMD is using NAL make Drishti RVR for measurement. The baseline length (b) is 30m

On putting 30m baseline length MOR calculation using Koschmieder's equation reduces to

$MOR= (3*30) / \log_e (1/t)$

$= 90 / \log_e (1/t)$

t is measured using ratio of reference photodiode voltage at light source (Transmitter) and received photodiode voltage at receiver.

T = K* (PD/Ref) where K is calibration constant

RVR is calculated using:

a. Atmospheric transmittance from the Transmissometer

b.The background luminance from the background luminance sensors c. Runway light intensities

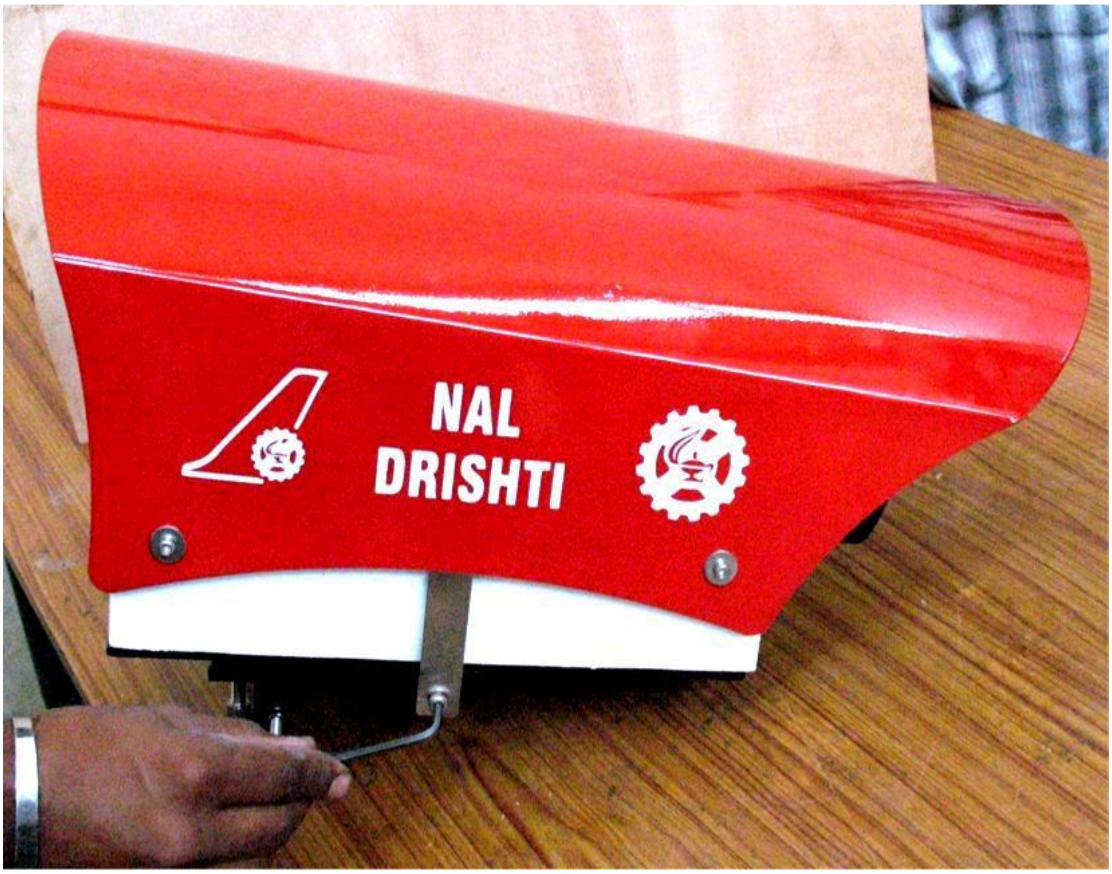
4.3 Drishti RVR Hardware maintenance

a.) Removing optical enclosure

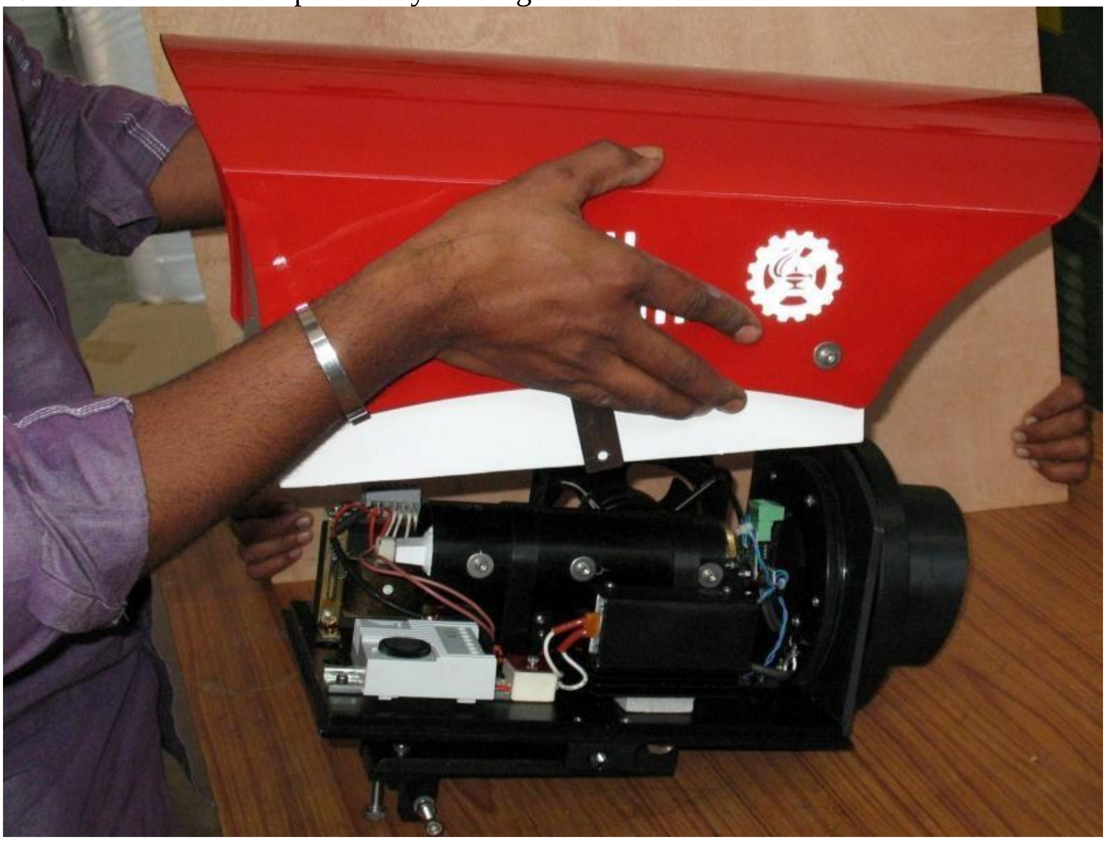
The steps below describe how to open the optical enclosure both at transmitter and receiver

**Switch Off the Mains Power to the Drishti system before performing any of the operations*

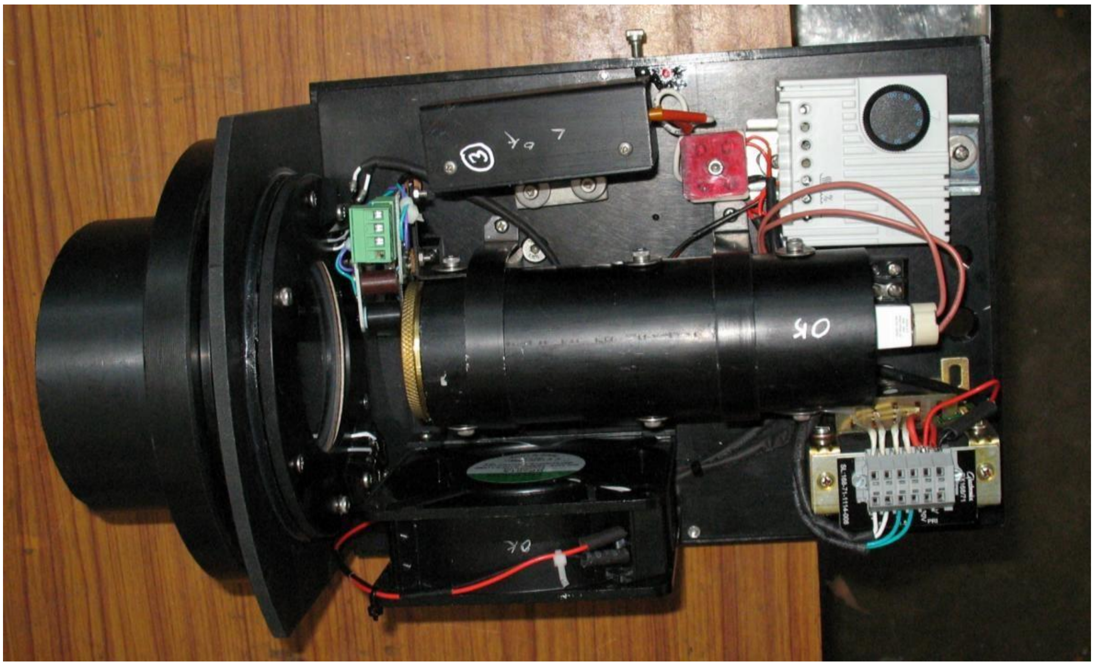
1. Remove/ Fix the Two M5 fastener (Left & Right side of enclosure) using 4mm Allen key



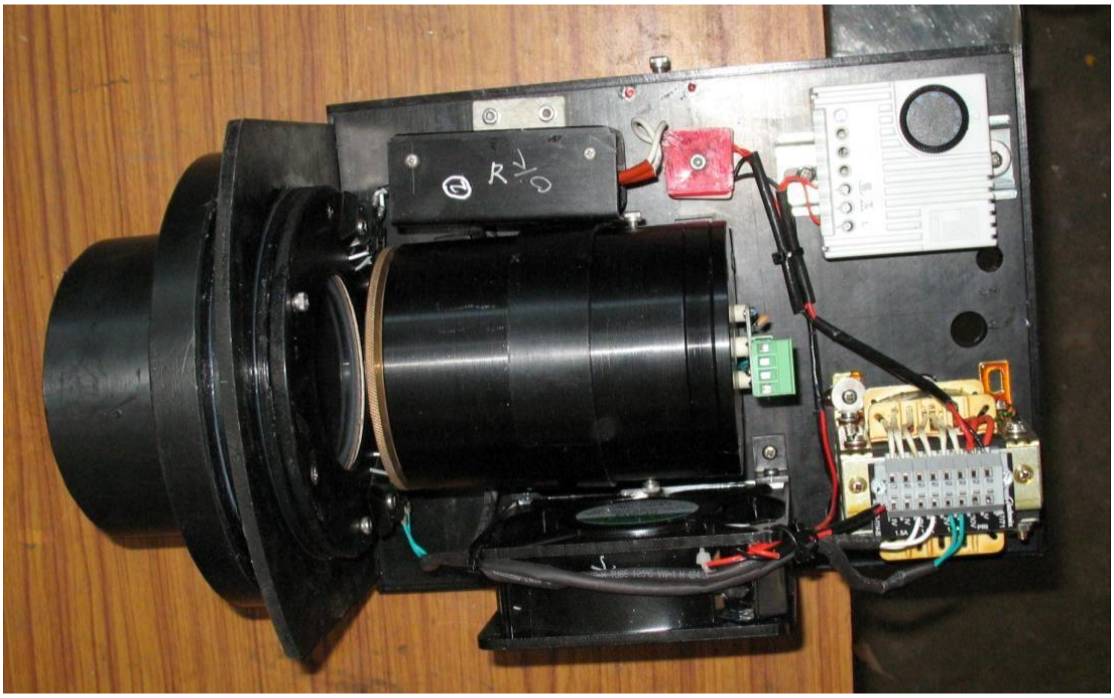
2. Pull the enclosure upwards by holding sides of the enclosure



b.) View of Lamp side optics inside the enclosure

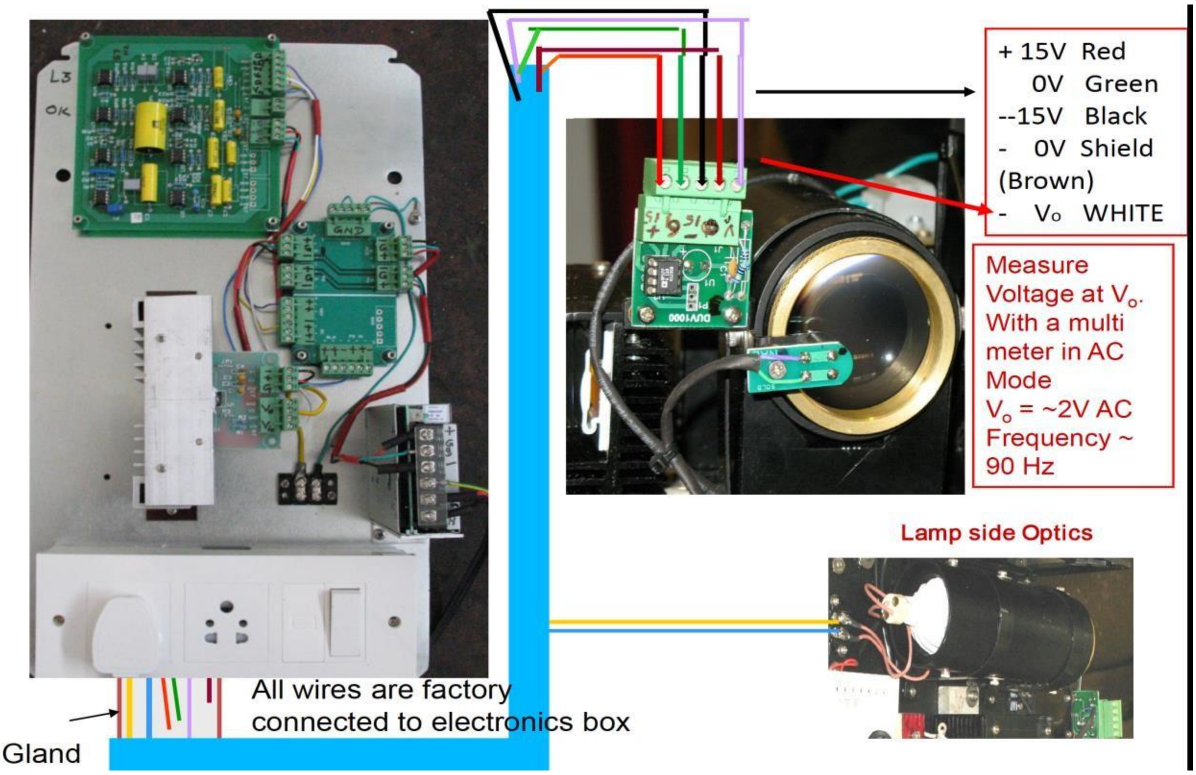


c.) Receiver side optics inside the enclosure

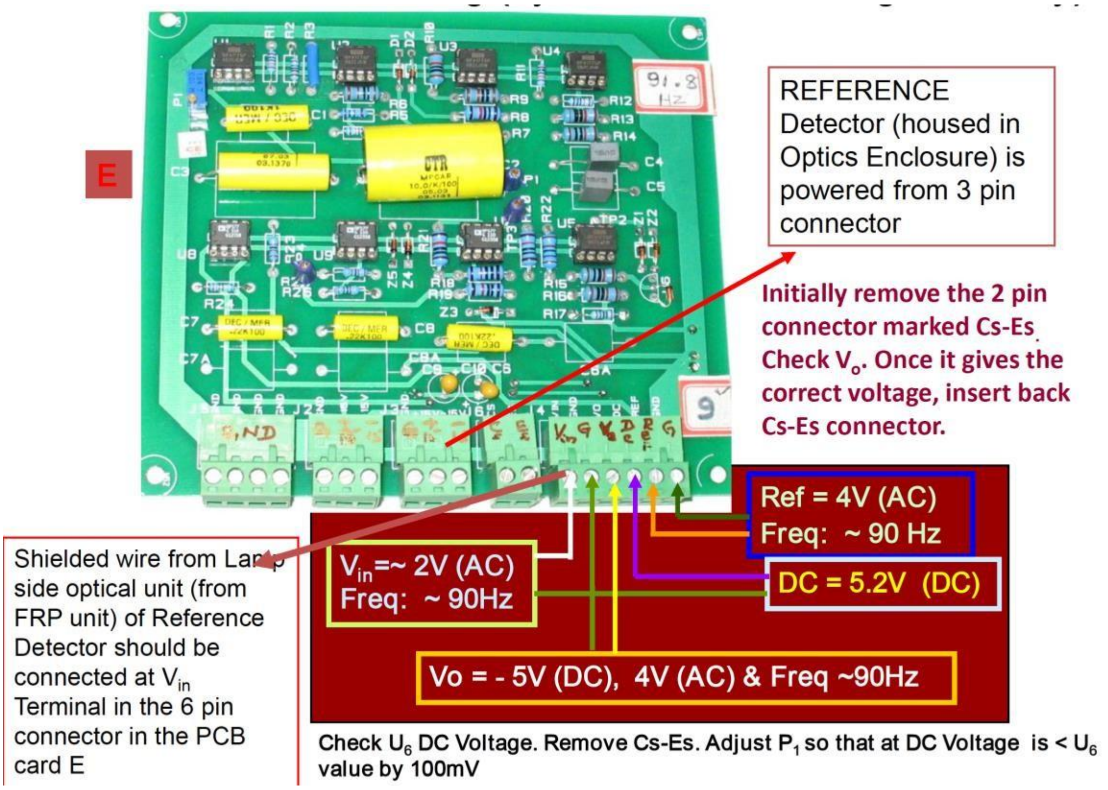


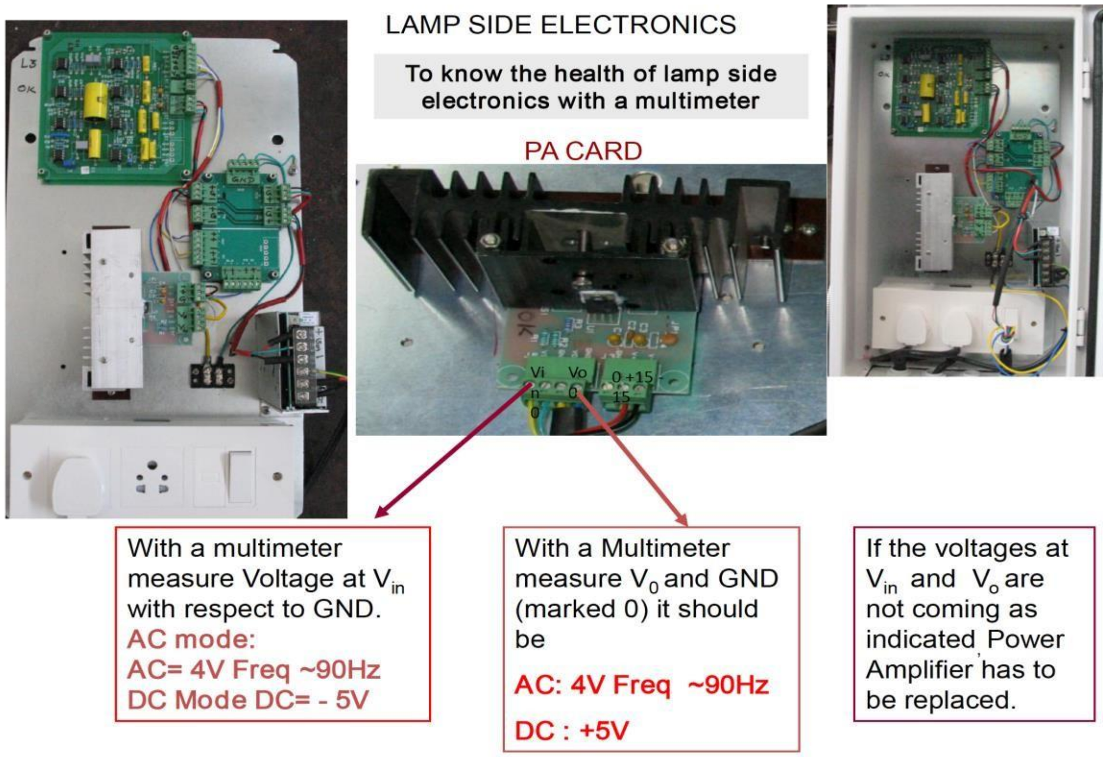
4.4 Transmitter side electronics

a.) Wiring Diagram between Lamp side optics and Electronics box



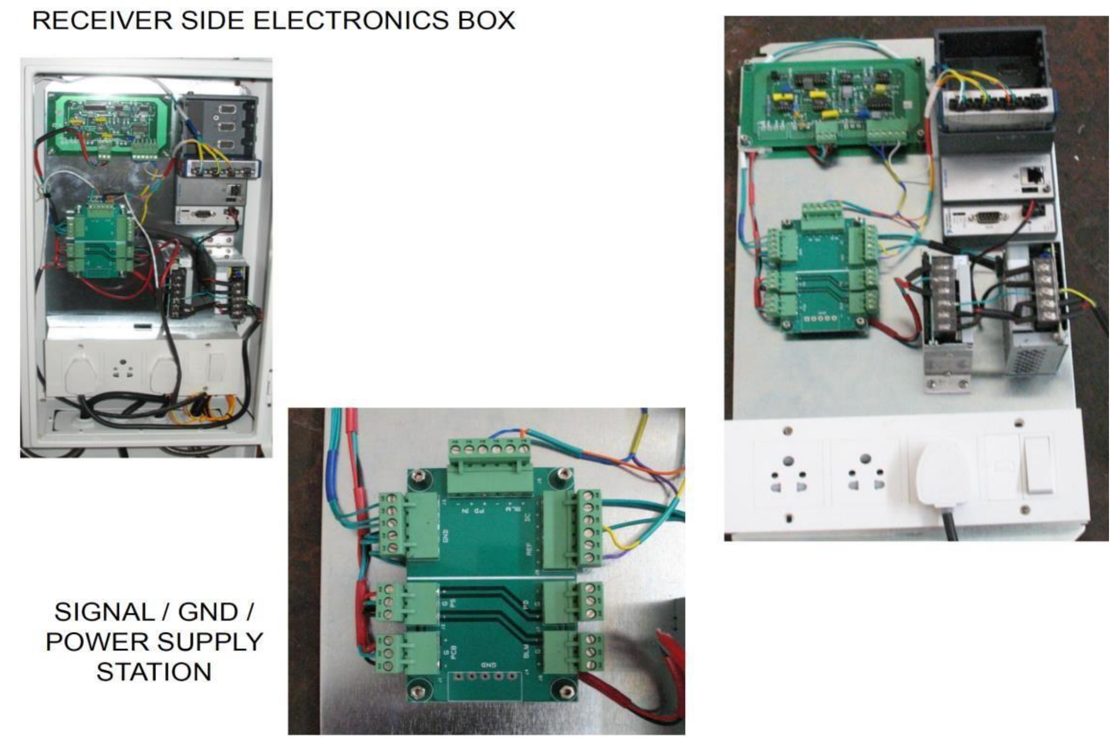
b.) Transmitter site PCB & various voltage levels



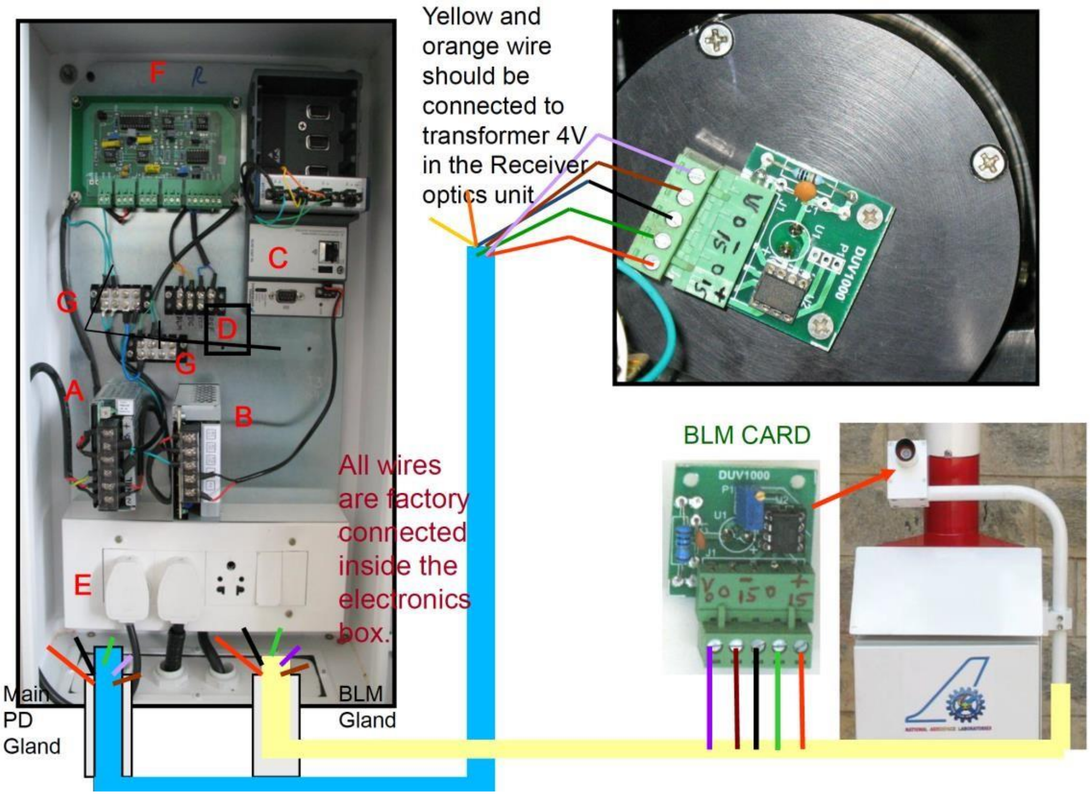


4.4 Receiver Side electronics

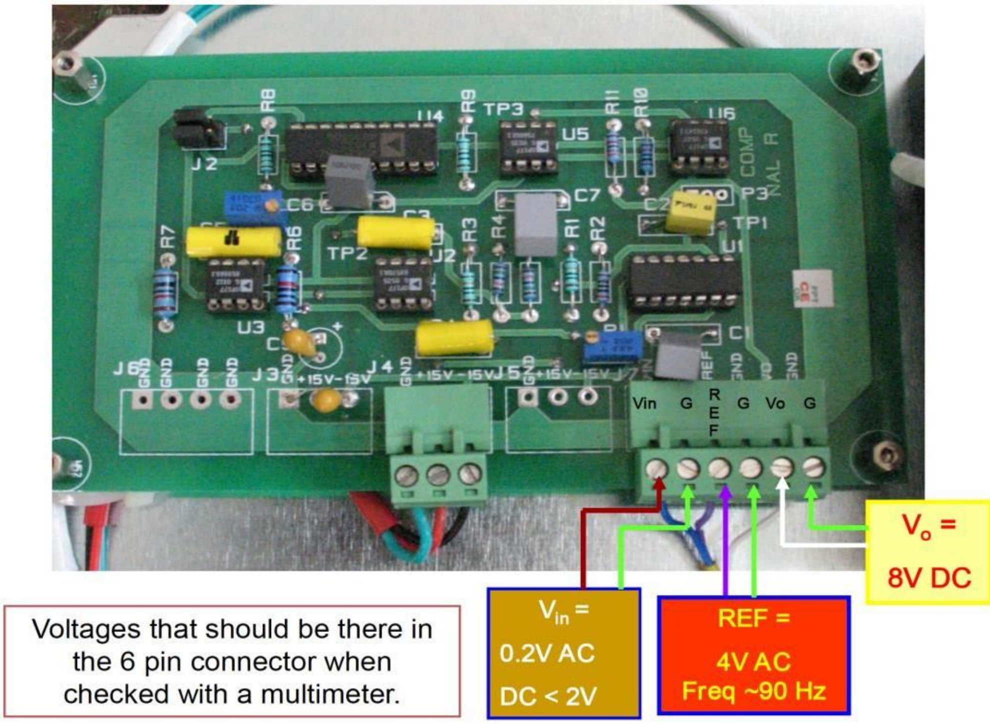
a.) Receiver side electronics box



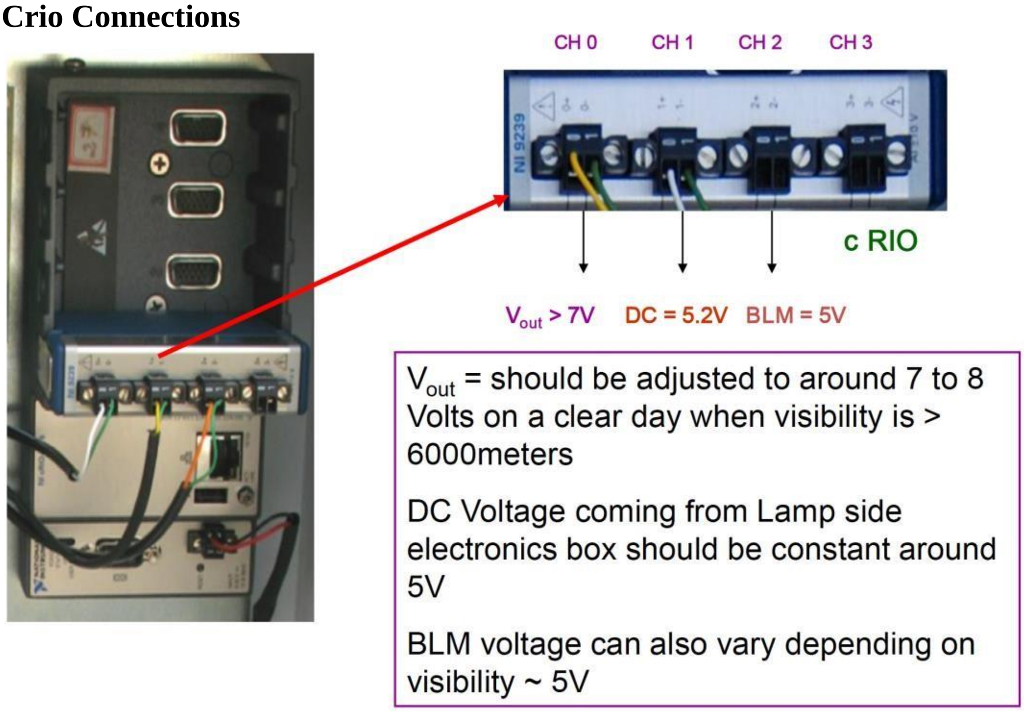
b.) Wiring diagram between receiver side PCB and optics



c.) Receiver side PCB



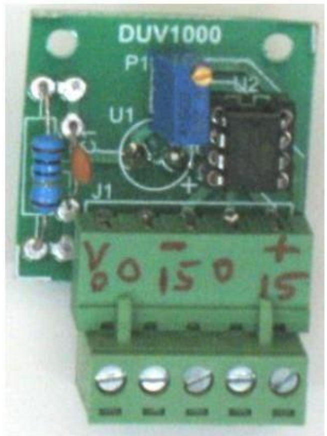
4.6) Crio Connections



4.7 Background Luminance Monitor (BLM)

BLM is attached to the Receiver side pillar

BLM CARD

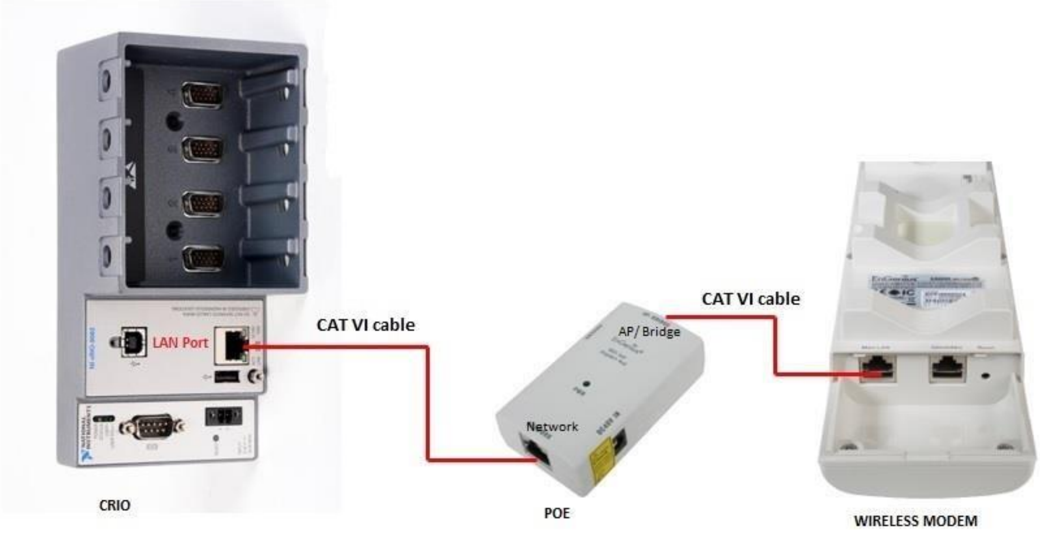


On a bright day the BLM will read ~ 5V at Channel 2 of cRIO.

a.) Steps to check the BLM

1. Close the BLM (with an opaque shield or paper). It should read 0V at channel 2 (+ -) of cRIO.
2. Open the BLM, It should read ~5V on a bright day at Channel 2 (+ -) of cRIO
3. If the above criterion is not met, Turn off the power at the Receiver side box. Open the BLM cover.
4. Check the power supply voltages on the BLM PCB in the BLM unit . It should be (+15) –0 -(-15V) [by keeping the multimeter in the DC mode and in voltage range].
5. If it is ok, measure Vo with respect to Ground in the DC mode. It should read few volts if the visibility is good.
6. If Power supply is OK and Vo is not showing 5V, then replace the amplifier.
7. Even after replacing amplifier, Vois not recorded , Change the BLM card
8. Close the BLM front end. Voshould read 0V. If there is some small voltage, make it zero by turning the potentiometer.

4.8) Communication setup at runway site



4.9) Steps to replace the LED lamp

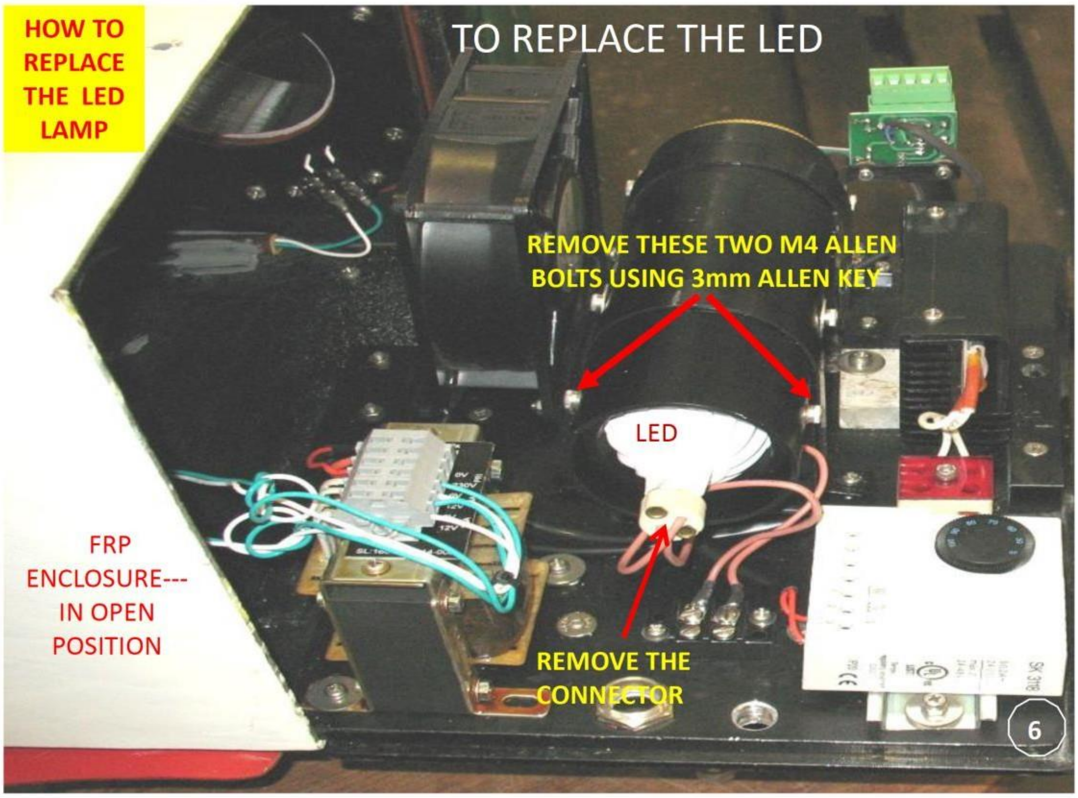


Fig.1

HOW TO REPLACE THE LED LAMP

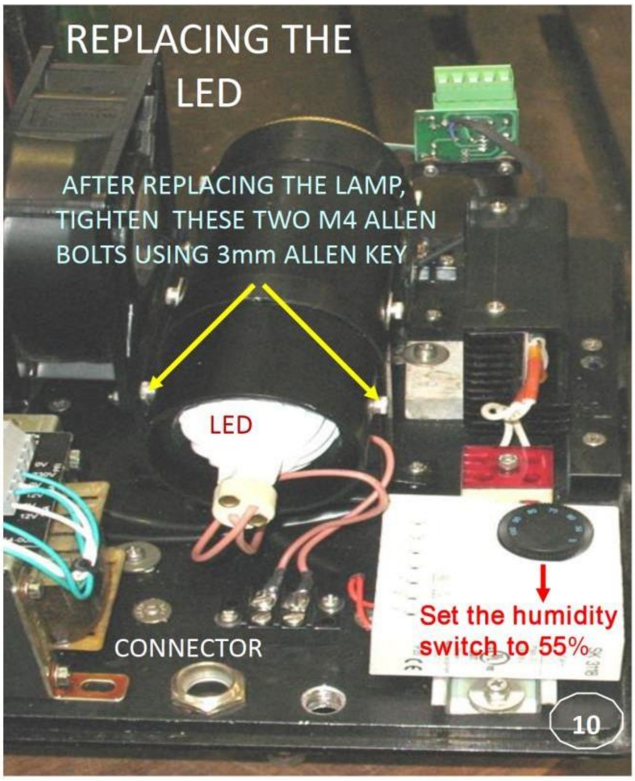
Fig 7 LED Lamp holder being removed

Fig 8 Remove the LED Connector & Ring Nut

Replace the New LED Lamp

Fig 9. New LED Lamp assembled

Fig .2



FRP ENCLOSURE SHOULD BE IN OPEN POSITION

Switch on the Mains

Check whether Lamp is burning after replacing the LED.

If it is burning then Switch off the Mains

Close the FRP Box.

Fig 3

4.10 Steps to replace reference detector

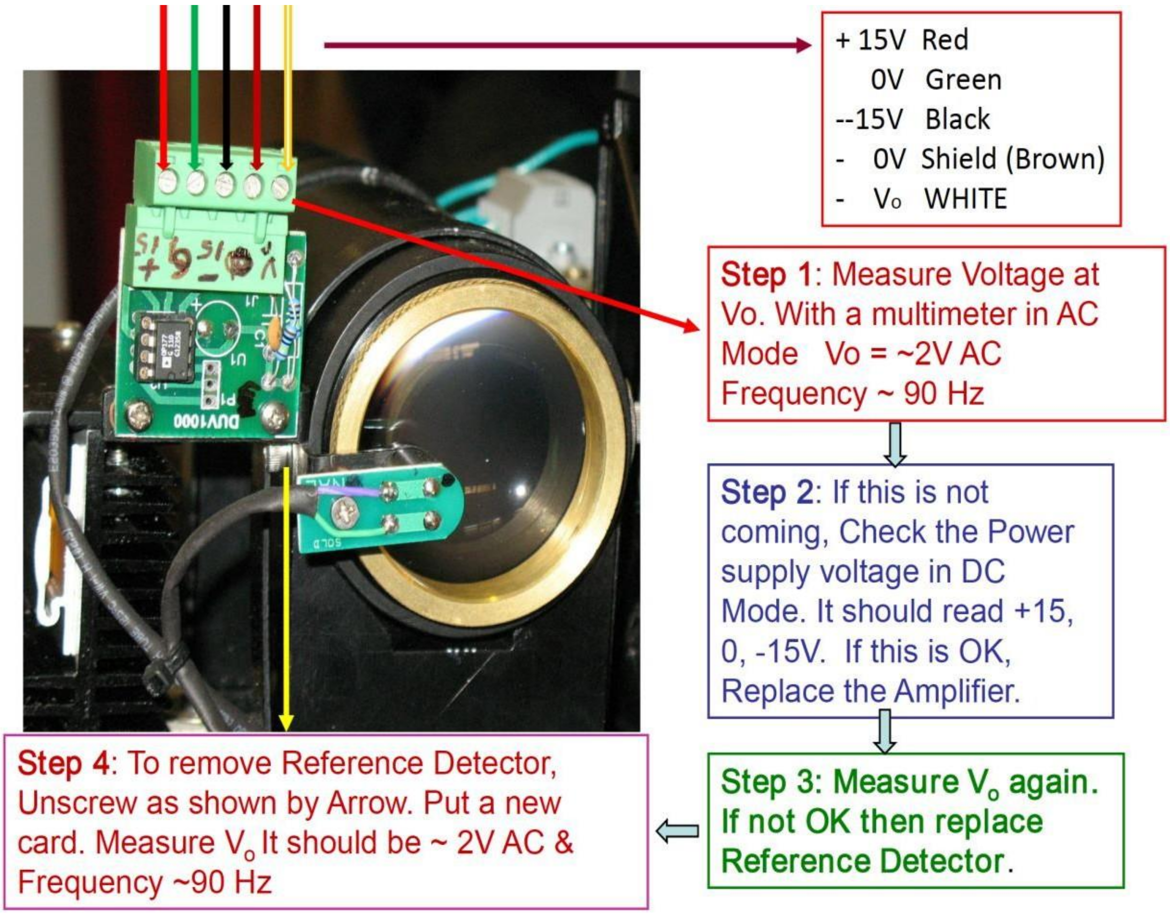


Fig .1

4.11 Steps to replace photo detector on receiver side

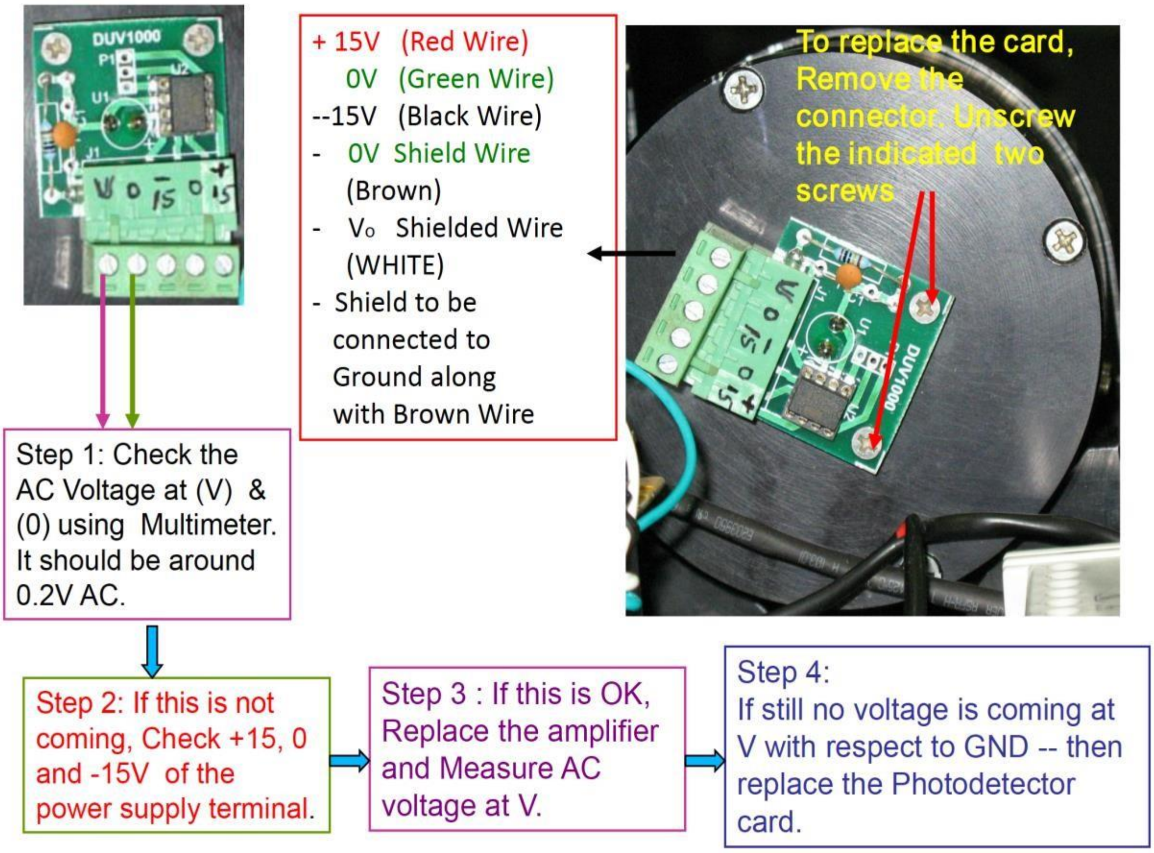


Fig 1.

4.12 Drishti Software manual

A DVD and a CD is supplied with the system.

CD ---contains three folders viz.,
1)Runtime Engine,
2) Drishti RVR software and
3) Integrated Drishti Software

DVD –contains Instrument drivers.

a.) Installing runtime engine

1. Insert the CD in the CD Driver.
2. Open the “Runtime Engine” folder and there will be a Zip file (RTE LV 2014)
3. Unzip the file and install the “Runtime Engine” .
4. After successful installation, it will prompt for Restart or Cancel.
5. Select Cancel.

b.) **Procedure to Load Instrument Drivers.**

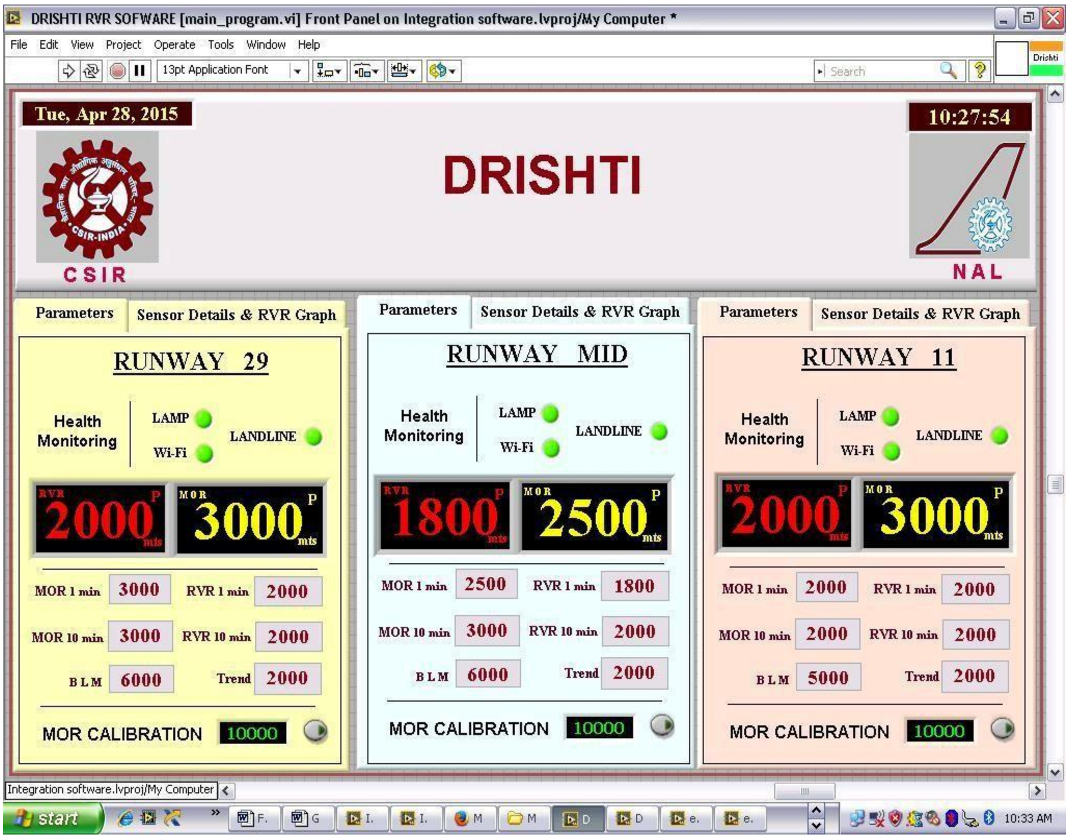
1. Remove the CD from the PC and load the DVD.
2. Open the DVD on the screen
3. You will see --Autorun.exe file
4. Double click on Autorun.exe
5. It will prompt you with an option for „Next‟ or „Cancel‟.
6. Click on “Next‟ for all the pop up windows that get displayed.
7. Only for, License agreement click on “I accept “
8. Go to “Next‟
9. After the successful installation of the driver software, Pop window will open up as “Restart” or “Cancel”
10. Click on Restart.
11. Copy and Paste the folder named DRISHTI from CD to the Desktop of the PC at the MBR
12. For RVR Computation at MBR, Double click on the Drishti.exe program

For Multiple display

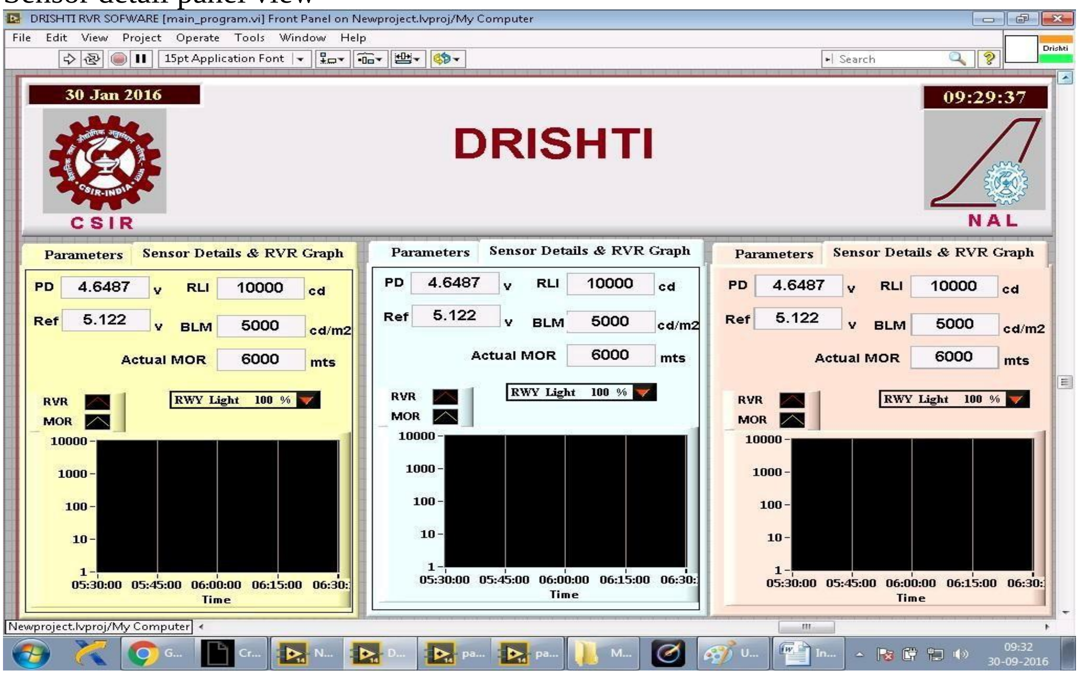
1. Copy and Paste the folder named Integrated Drishtifrom CD to the Desktop.
2. To run the integrated display software, double click on integrateddrishti.exe’

c.) Drishti RVR Display

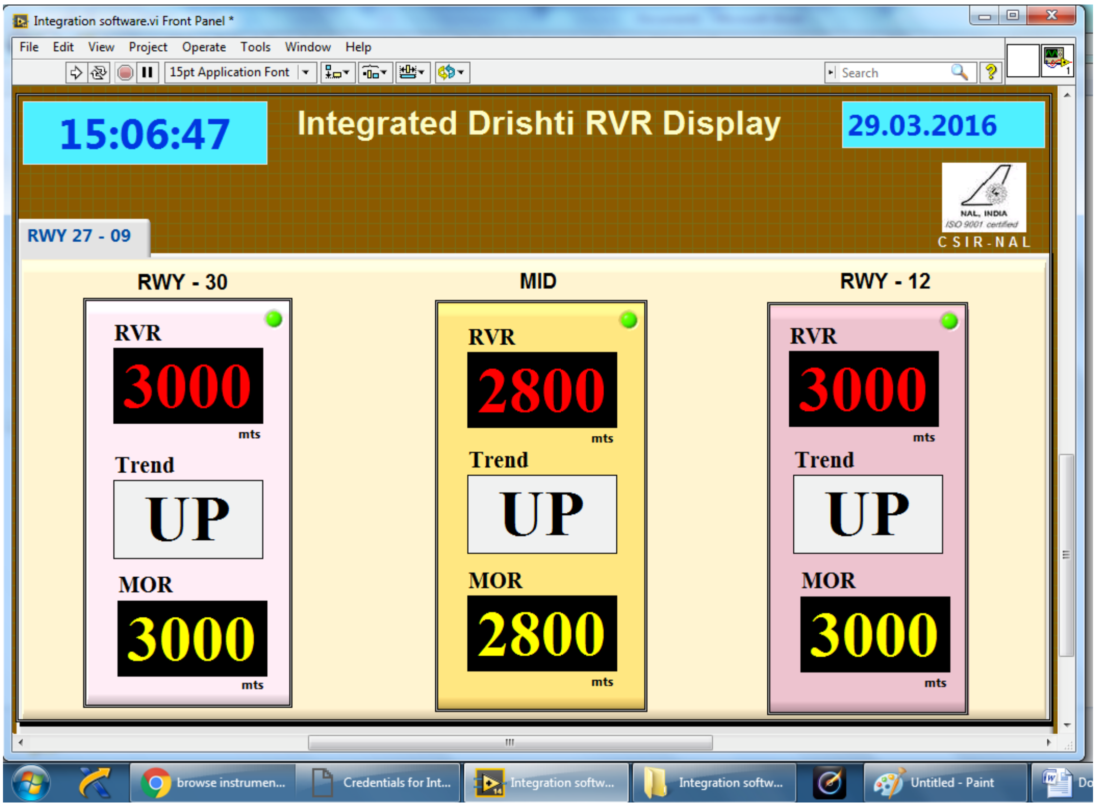
The drishti RVR computation software window for 3 RVR system will appear as below



Sensor detail panel view



d.) Integrated RVR Display



Chapter 5
Ceilometer

5.1 Introduction

The ceilometer is designed for the outdoor environment. The electronic circuits and the optic lenses are protected by a box consisting of a bottom plate, on which the electronic/optical unit is bolted, and a covering hood. The hood has a gasket for sealing against the bottom plate.
On the top pf the hood are two windows, one for the transmitter and one for the receiver. The is also a window for the local display to show the current cloud base and vertical visibility or diagnostic status if an error situation exists. The hood has two handles for comfortable transportation.

The bottom plate is supplied with four feet and two bolts for mounting the ceilometer on a console or pedestal stand at fixed installation. Underneath the bottom plate there are connectors for mains, blower and communications (data port and service port).

The ceilometer measures cloud height or vertical visibility uptp 7600m (25000 feet), The cloud height is measured continuously and can be displayed on several types display units depending upon different needs

The ceilometer functions according to the LIDAR principle LIDAR - Light Detection and Ranging where short laser pulses are sent out in a vertical direction and the time of returned reflections are measured continuously. The amplitude of reflected light, the backscatter signal caused by haze, fog, mist, precipitation and clouds is measured as the laser pulses traverse the sky. The resulting backscatter profile, i.e signal strength versus time, is stored and then processed to determine the height or cloud bases. Knowing the speed of light, the time delay between the launch of the laser pulse and the detection of its backscatter signal indicates the cloud has high

$$\text{Cloud base} = \frac{\text{Time x speed of light}}{2}$$

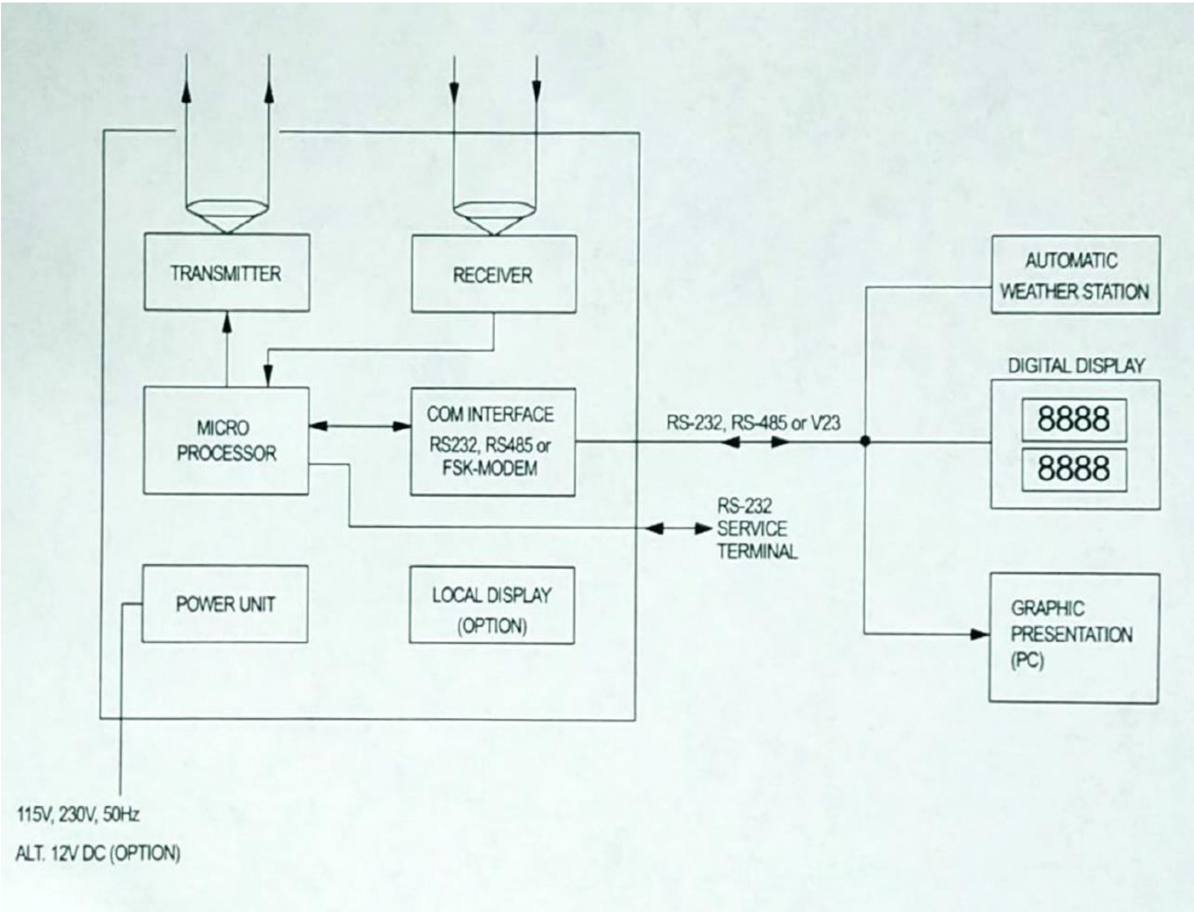
The transmitter in the ceilometer is a semiconductor laser diode. The output power is limited to a level not dangerous for the human eyes provided that the emitted radiation is not concentrated and viewed with the aid of an optical system

The CBMESDB is able to detect up to three cloud heights simultaneously, Additionally, the sky coverage algorithm can calculate up to four cloud layers and amount. Besides cloud bases, it detects whether there are other obstructions to vision i.e. vertical visibility. No adjustments in the field are
needed. The embedded software includes service and maintenance functions and gives continuous status information from internal monitoring

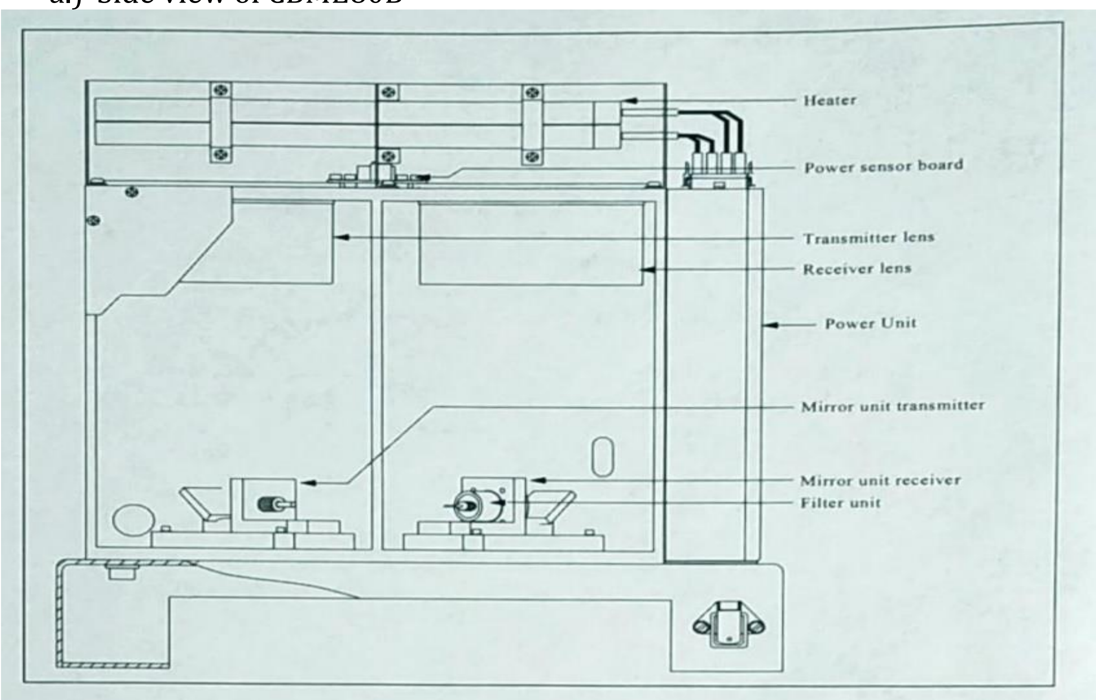
CBMESOB consists of the following parts

- Power unit
- Master unit
- Processor unit
- Power sensor
- Internal heaters
- Optics

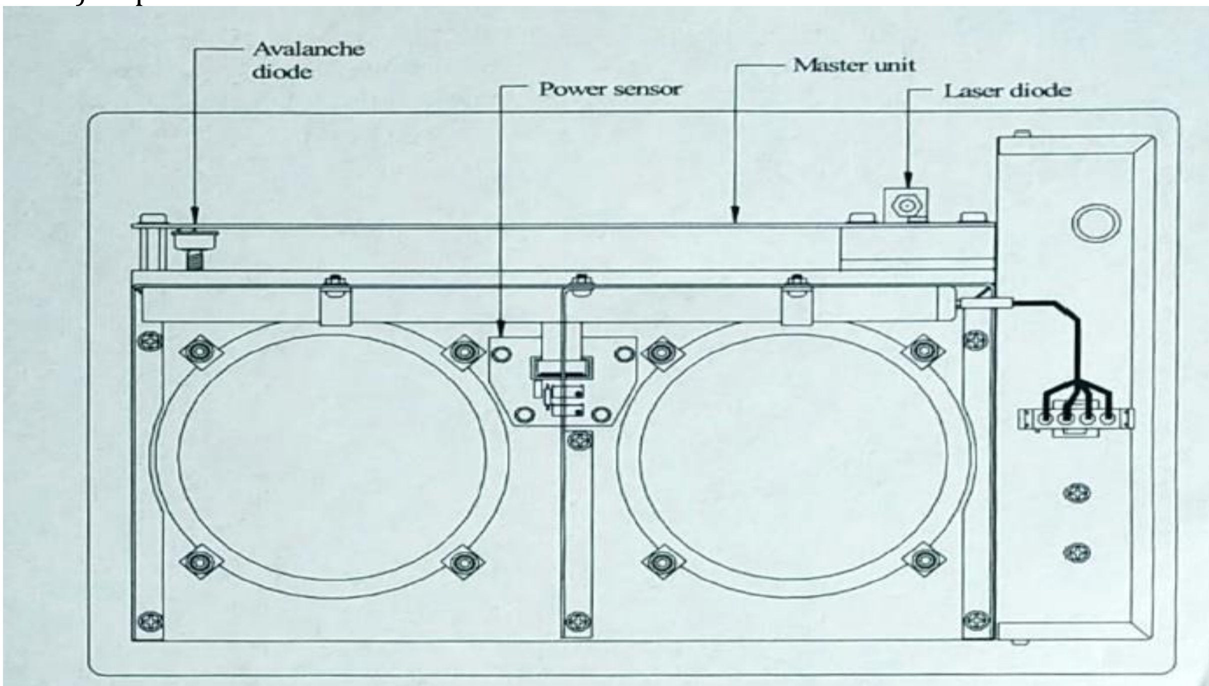
5.2 Block diagram of Ceilometer



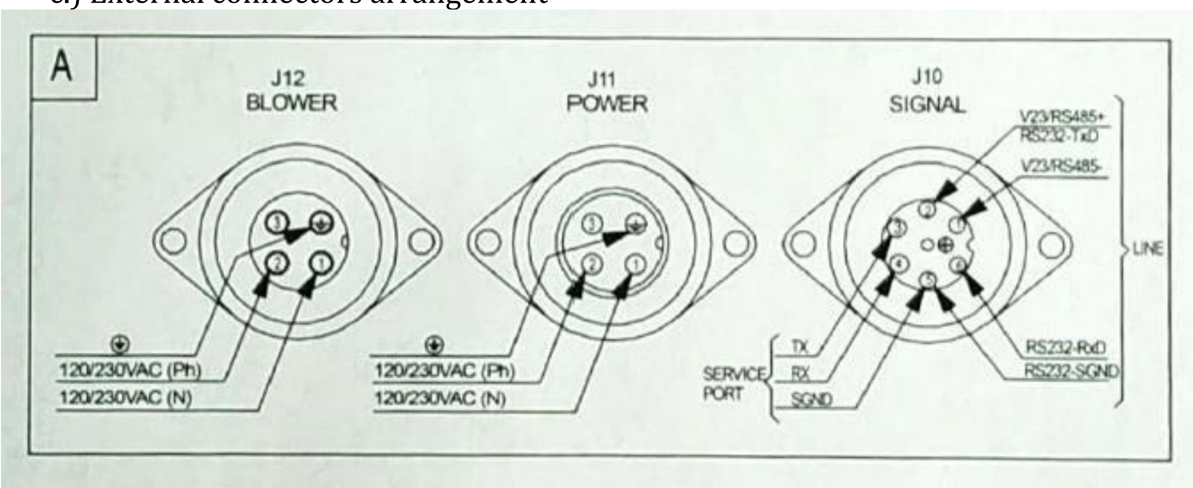
a.) Side view of CBME80B



b.) Top view



c.) External connectors arrangement



The electronic and the optical units are mounted on the bottom plate and consist of the following sub units

- Hood
- Case
- Transmitter lens
- Receiver lens
- Mirror unit for transmitter

- Mirror unit for receiver
- Master unit
- Power sensor
- Power unit
- Heater
- Local display (option)

5.3 Location

- At location of the ceilometer, the following rules should be considered:
- The ceilometer must have free sight straight upwards.
- Do not locate the ceilometer in the vicinity of trees. Leafs and branches from the trees can fall down on the windows of the ceilometer and disturb the function.
- Avoid location in the vicinity of buildings.
- A shady location is to prefer to a location in direct sunshine, as the stress/aging of the components inside the ceilometer will be less on behalf of lower temperature.
- The "window side" of the hood should be faced from the sun to minimize the light noise.
- The ceilometer should be mounted straight vertical. If it incline there will be a measuring error, which is negligible under 5 (+0.4%), but will be approximately 2% at 10° inclination.
- Avoid locations with lots of dust particles in the air that ma cause increasing maintenance concerning window cleaning an filter replacement in blower unit CBFL40.

5.4 Equipment Grounding

Equipment grounding protects the electronics of the ceilometer against lightning and prevents radio frequency interference.

The ceilometer shall be grounded by a 16 mm² earth cable connected to one of the two bolts on the bottom plate; the other end of the grounding cable should be connected to earth rods driven into the ground.
The grounding principals are:

- Install the earth rod as close as possible to the stand i.e. minimize the length of the earth cable.
- Earth rod length depends on local groundwater level. The lower end of the earth rod should continuously touch moist soil.

The quality of the grounding can be checked with a geo resistance meter. Ensure resistance is according to national telecom standards, typical 5 ohms or less

5.5 Power Connection

The ceilometer is designed to be supplied from mains, 115V or 230V AC (see label at the power connector at the bottom of the equipment) or alternatively 12V DC (option). It is important that the connection is correct (see section 3.7 for details)

At the connection of the ceilometer, consideration shall be taken to the following points:

- Power cable should be suitable for its purpose (environment, security requirements etc.).
- Check the power supply voltage at the ceilometer.
- Protective earth shall be connected.

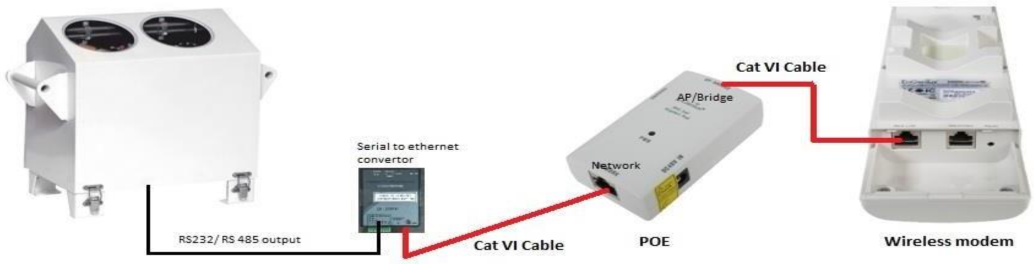
5.6 Startup procedure

The ceilometer is delivered ready for start-up and set to factory defaults form message number (102) and baud rate if not anything else is specified in the order
The startup is done according to the following procedure:

- Prepare and connect data receivers, display units, etc. (if there are any) to mains and data line according to respective manual
- Check that the mains voltage corresponds to the label on the ceilometer and blower unit (option).
- Connect data line to the ceilometer.
- Connect blower cable to ceilometer if optional blower unit exist
- Connect power cable (optional power on switch may exist).

.
During the first 1 - 15 minutes from the connection of mains, depending of the ambient temperature, the laser temperature is adjusted to its set point value by the microprocessor. When the temperature is stable and within about 1°C from its set point the cloud, measurement is started. During the startup time, the ceilometer sends data messages containing status errors at least every 30-second until all regulations has become ready. If the output data are incorrect or there are no measured data due to status errors, an "E" (for error) followed by an error code is presented on the local display (option). For a description of the error codes refer to the ceilometer manual.

5.7 Communication setup at runway site



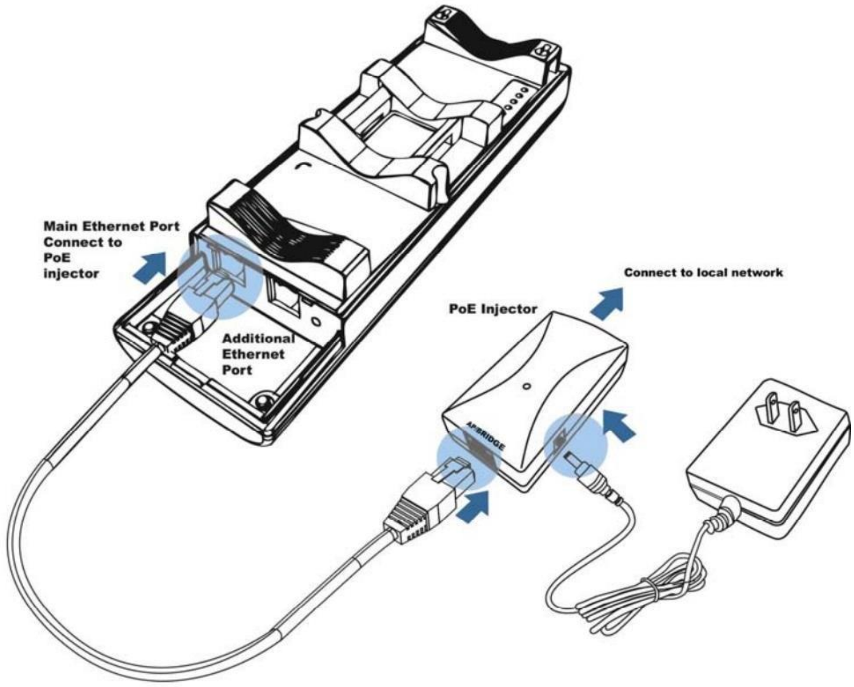
Chapter 6
Wireless modem configuration

6.1 Introduction

The wireless modems installed at airports are used in point-to-point setup in access point/client bridge mode
The steps below describe how to configure a modem as access point and Client Bridge. The configuration setup below described is for Engenius 202 wireless modem. The following IP addresses will be allotted
Access point : 192.168.1.100
Client Bridge: 192.168.1.101

The default IP address of engenius modem is 192.168.1.1. Default IP address of modem is generally mentioned in the manual or printed on the modem. The station may use any private class IP depending on the requirement.

Connect the wireless modem to a laptop as shown below



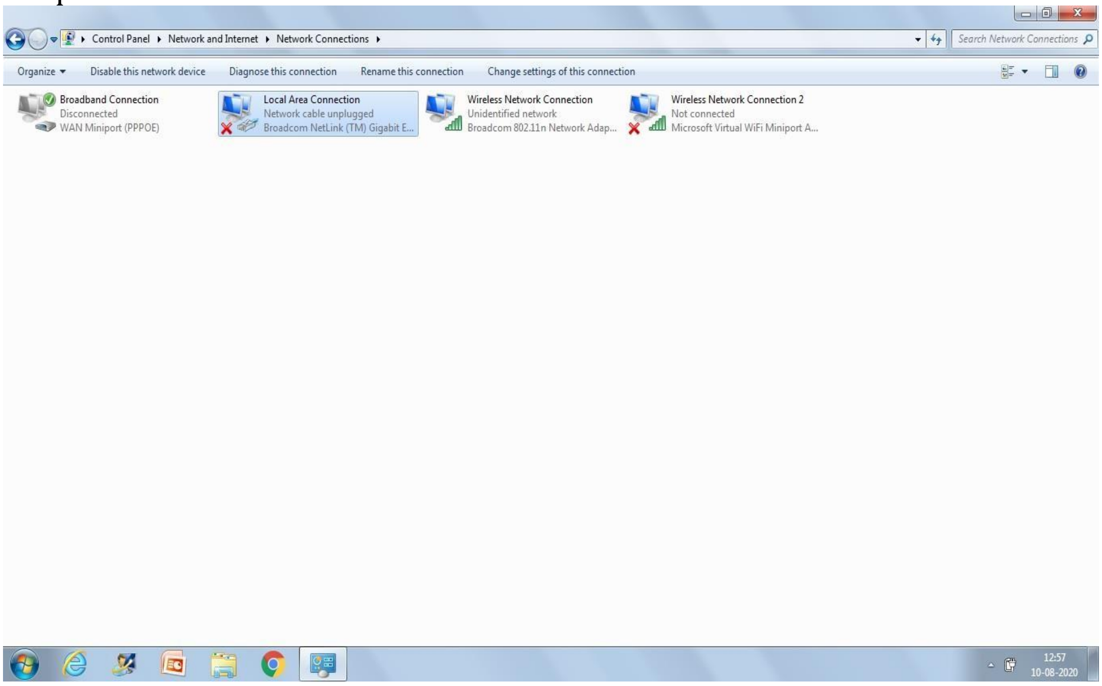
6.2 Steps to create an access point

The settings to create access point can be broadly summarized as

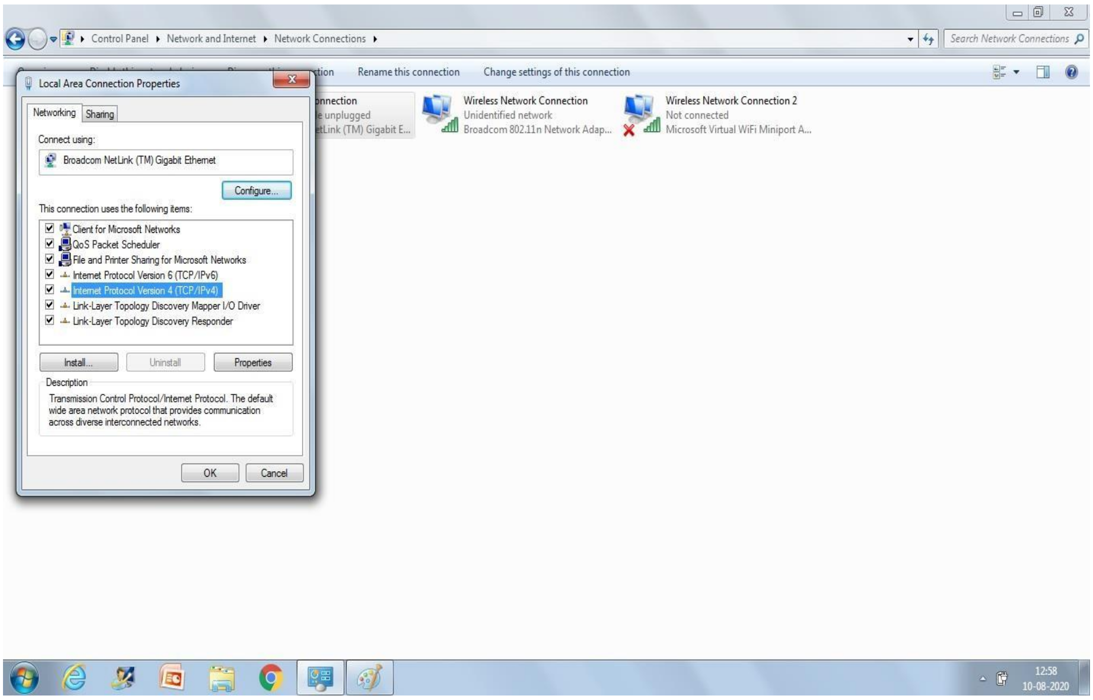
1.) Choosing the mode of operation
2.) Allotting the IP address
3.) Creating a SSID network with password protection
4.) Setting the transmitted power and distance

**Please note that the procedure to configure wireless modem for other make models is similar. The broader settings remain same, only the layout/ nomenclature of settings may vary*

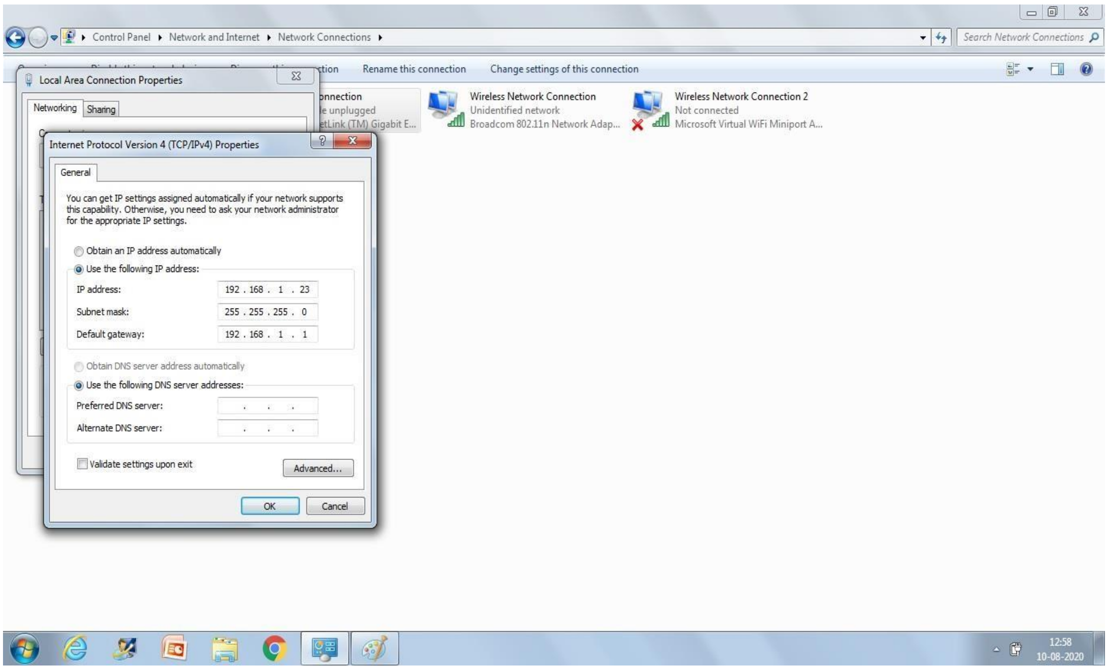
1. Open Control Panel->Network & Internet -> Network connections



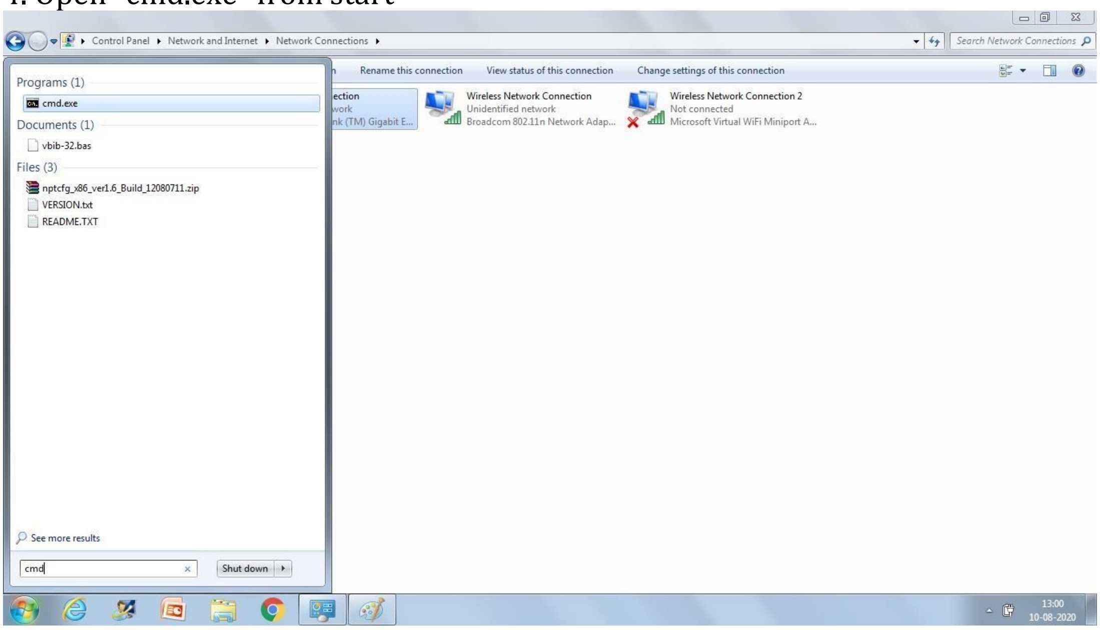
2. Double click on Local area connection



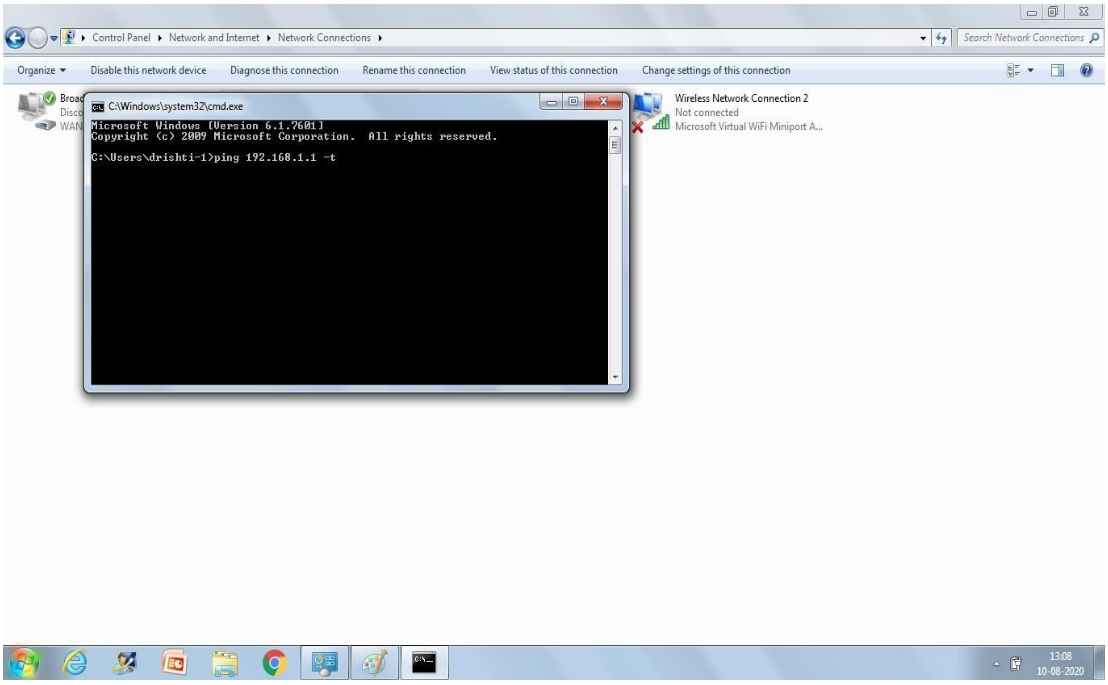
3. Double click on Internet protocol version (TCP/IP4)
   Select " Use the following IP address" & enter following settings
   IP address : 192.168.1.23
   Subnet mask : 255.255.255.0
   Default gateway: 192.168.1.1
   Click on OK



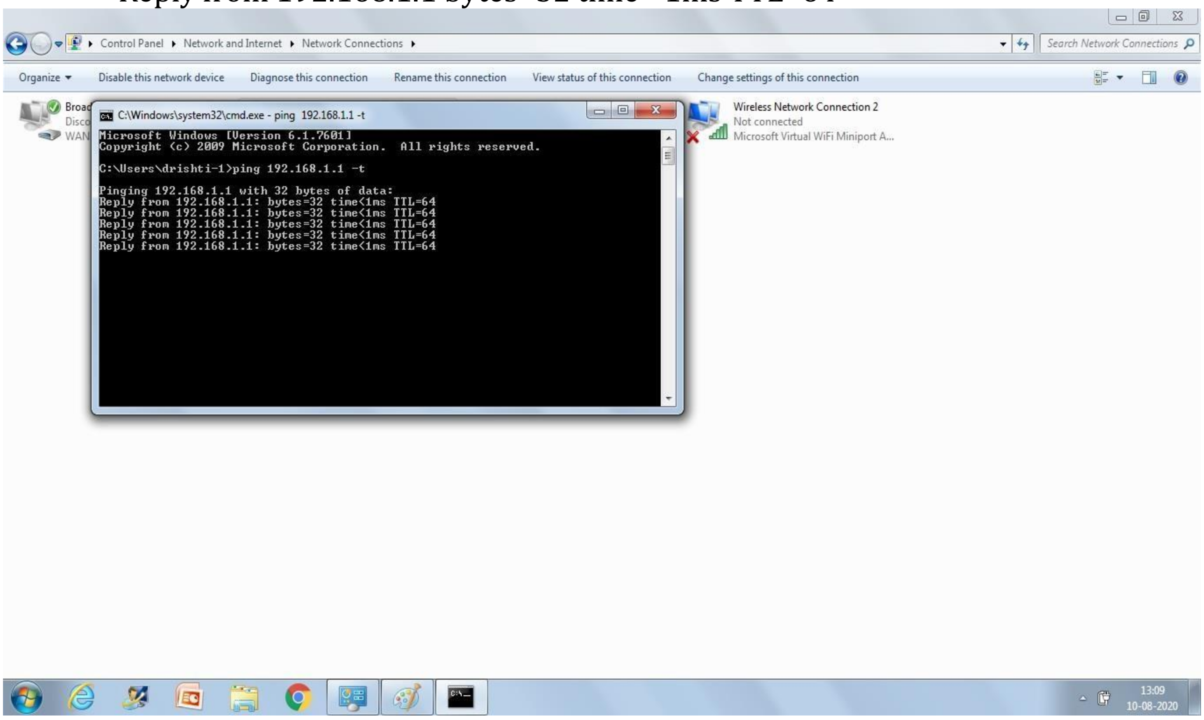
4. Open "cmd.exe" from start



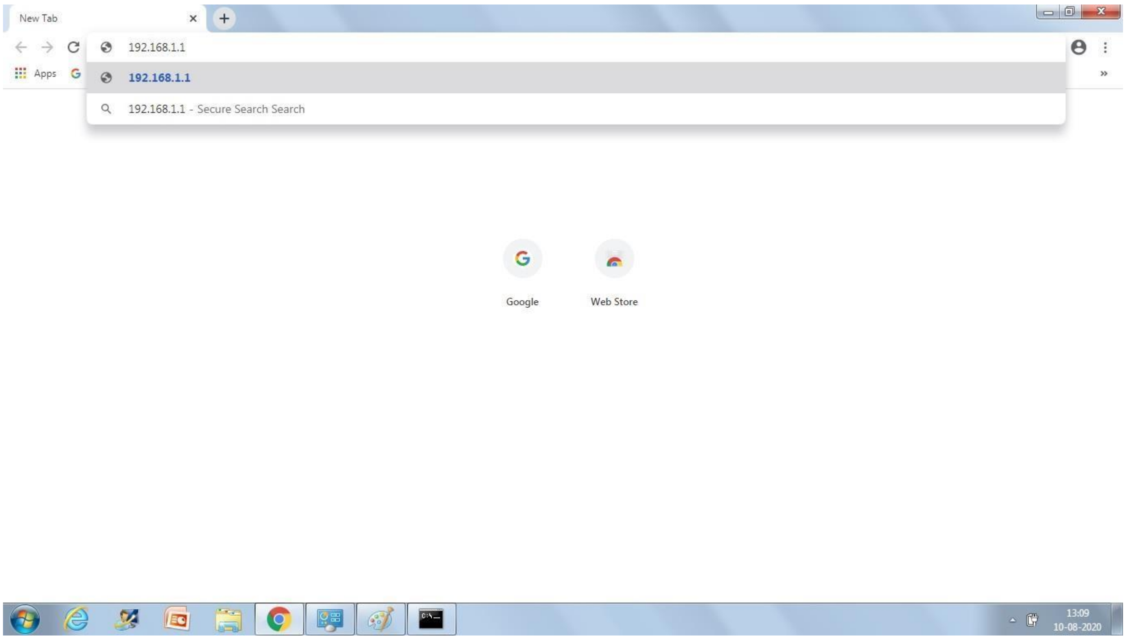
5.) Now check the connectivity between the laptop & wireless modem by using " ping 192.168.1.1"



6. The reply should appear as
" Reply from 192.168.1.1 bytes=32 time <1ms TTL=64"



7. Open any browser and enter the default IP address of wireless modem. Here the default IP address is 192.168.1.1

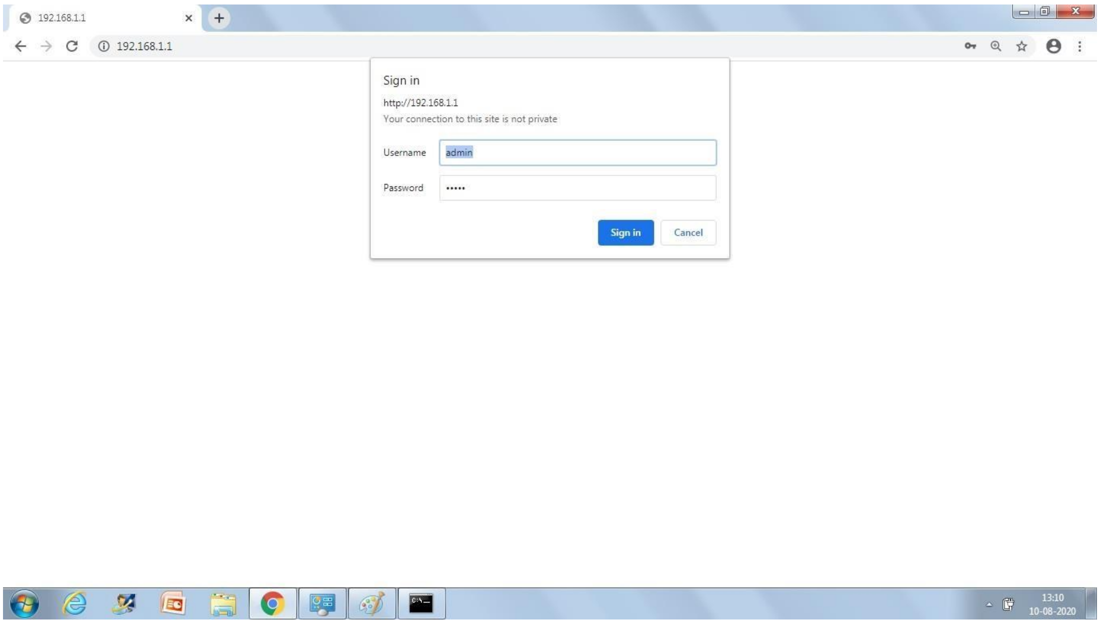


8. A pop up window will appear to enter username and password.

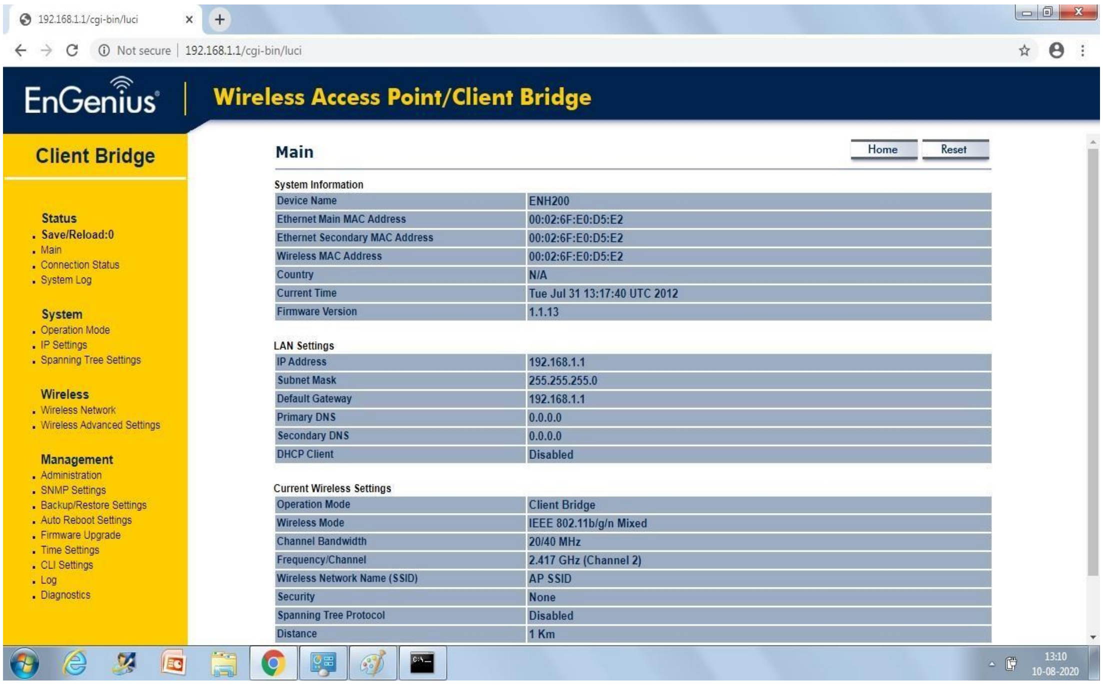
The default settings are normally mentioned in the installation guide.

Username: admin

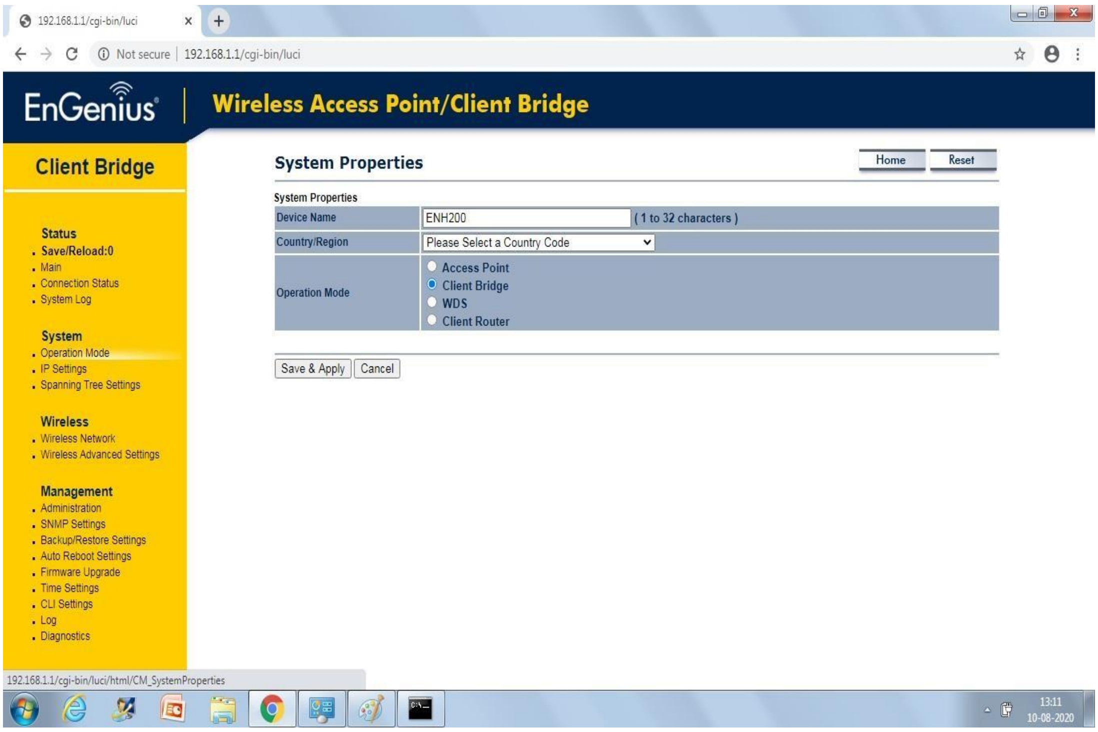
Password: admin



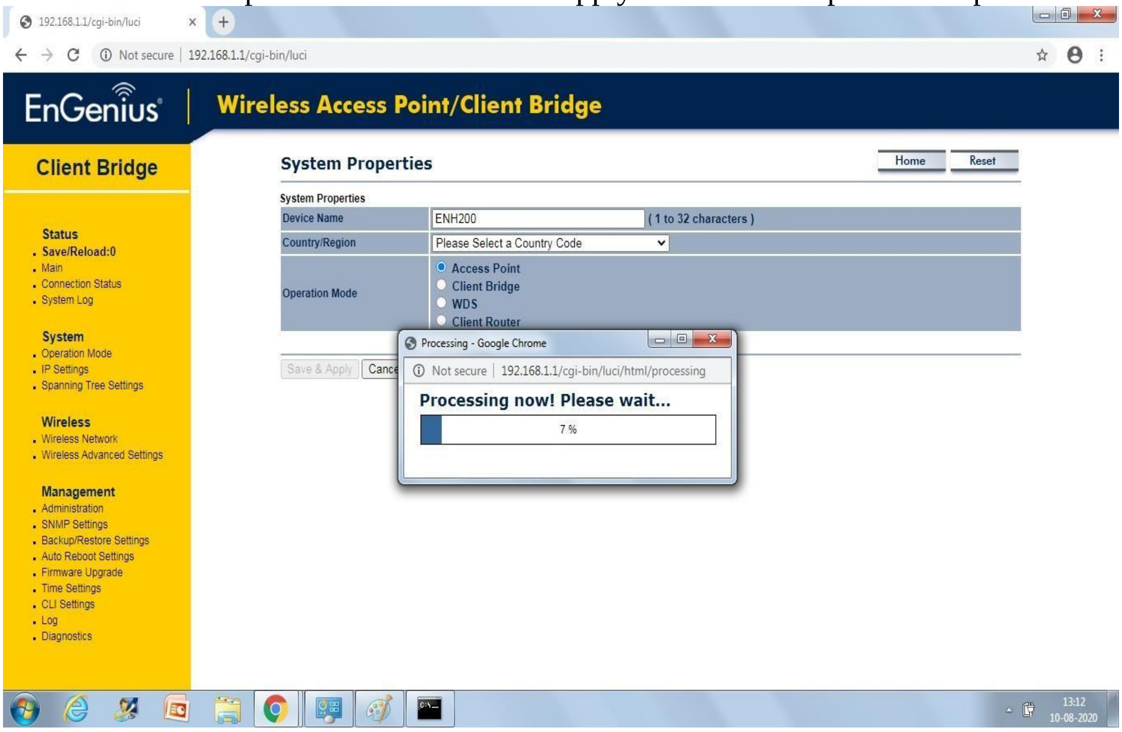
9. Home page will appear as shown below with main settings on left side



10. Click on operation mode. The windows will appear as shown below



11. Choose access point-> Click on save & apply. Wait for the operation to process 100%

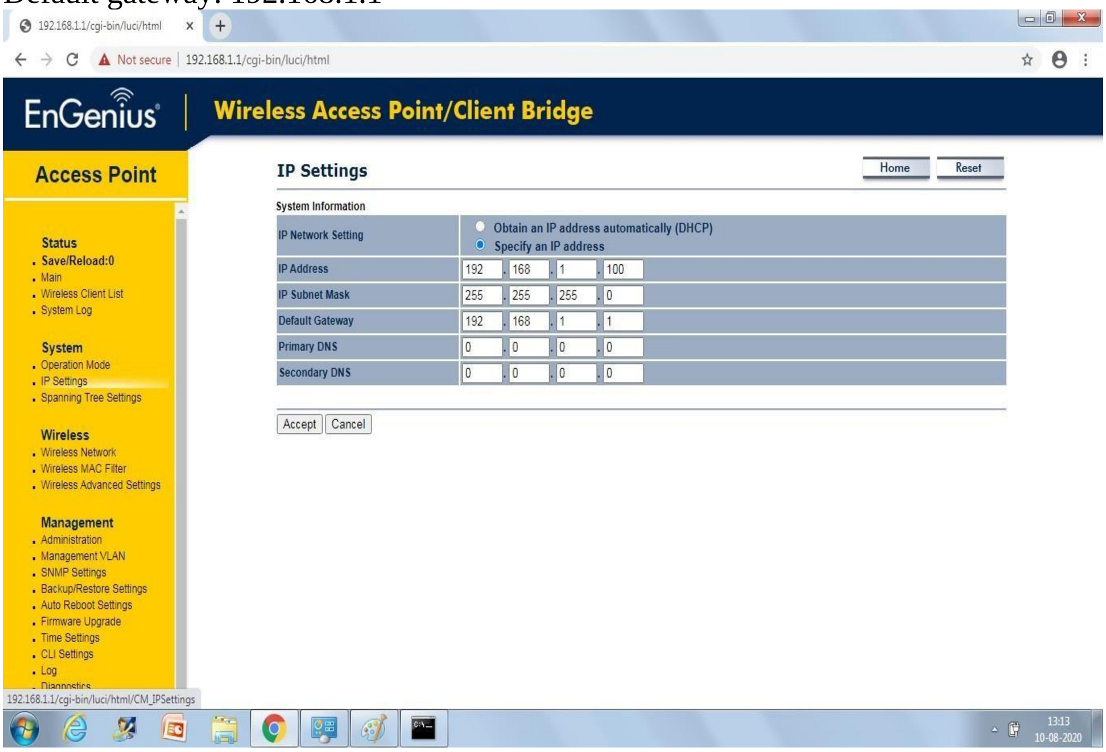


12. Click on IP settings and enter the new IP settings. In this example following settings have been used.

IP address: 192.168.1.100

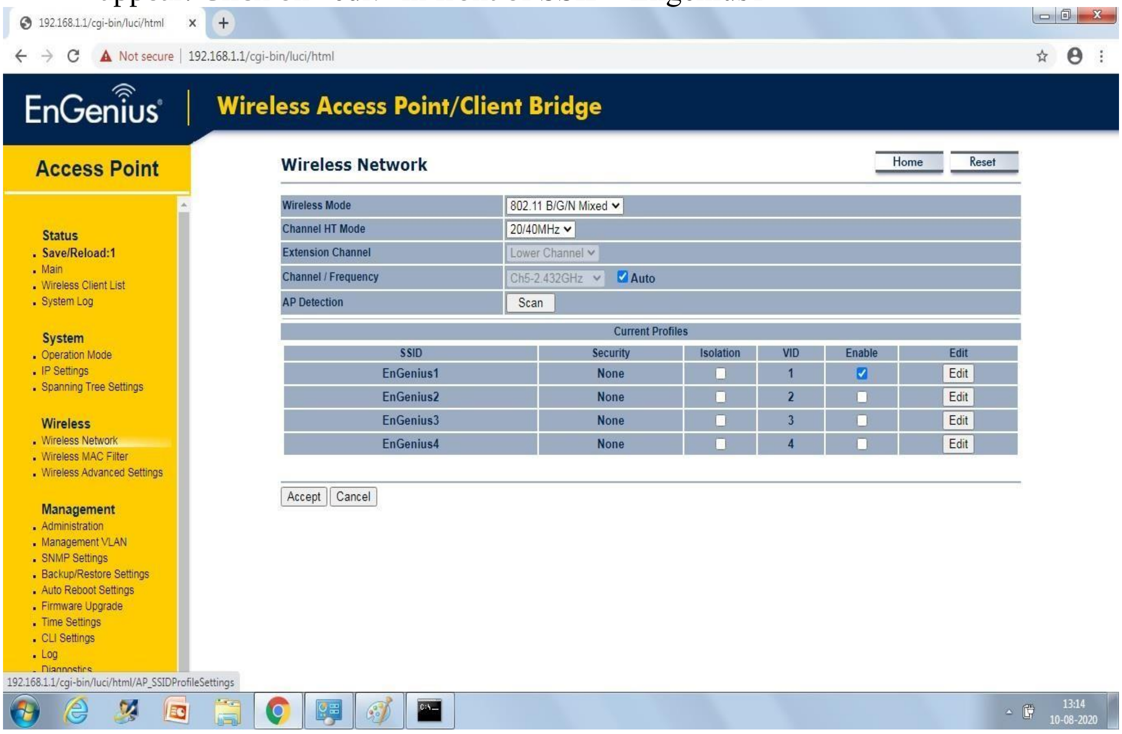
Subnet mast: 255.255.255.0

Default gateway: 192.168.1.1

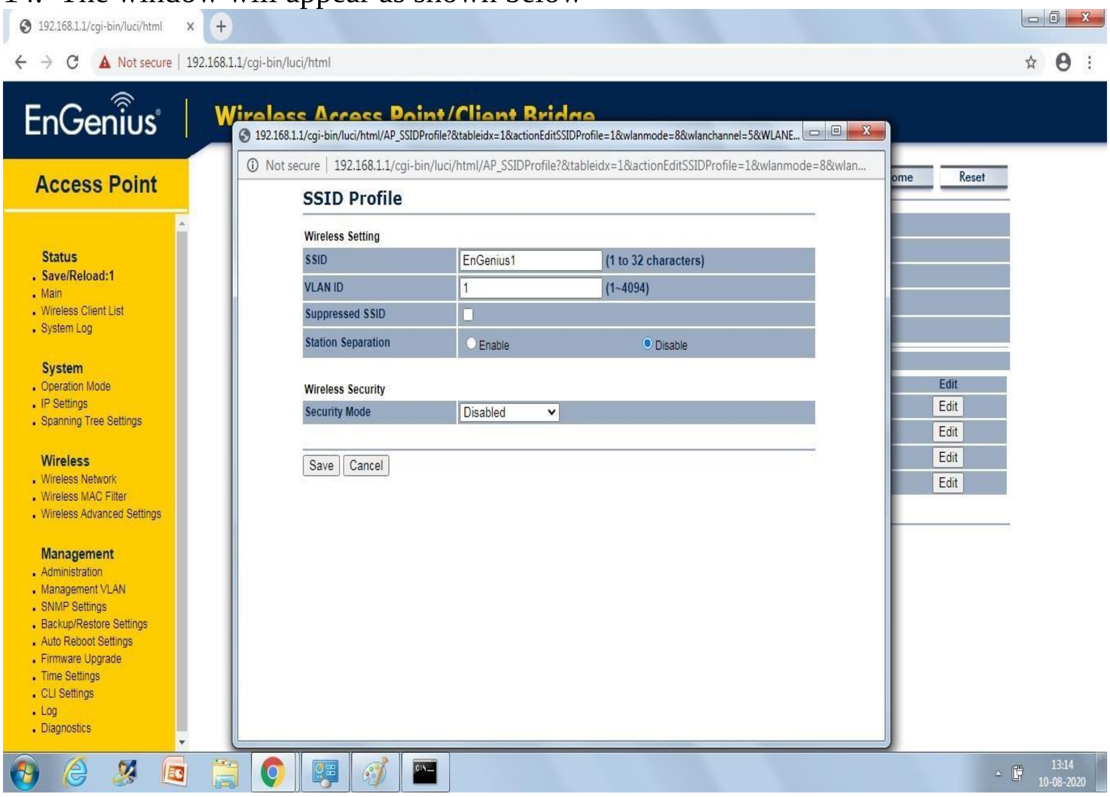


13. Click on wireless network to create SSID. The following windows will

appear. Click on “edit” in front of SSID” Engenius1”

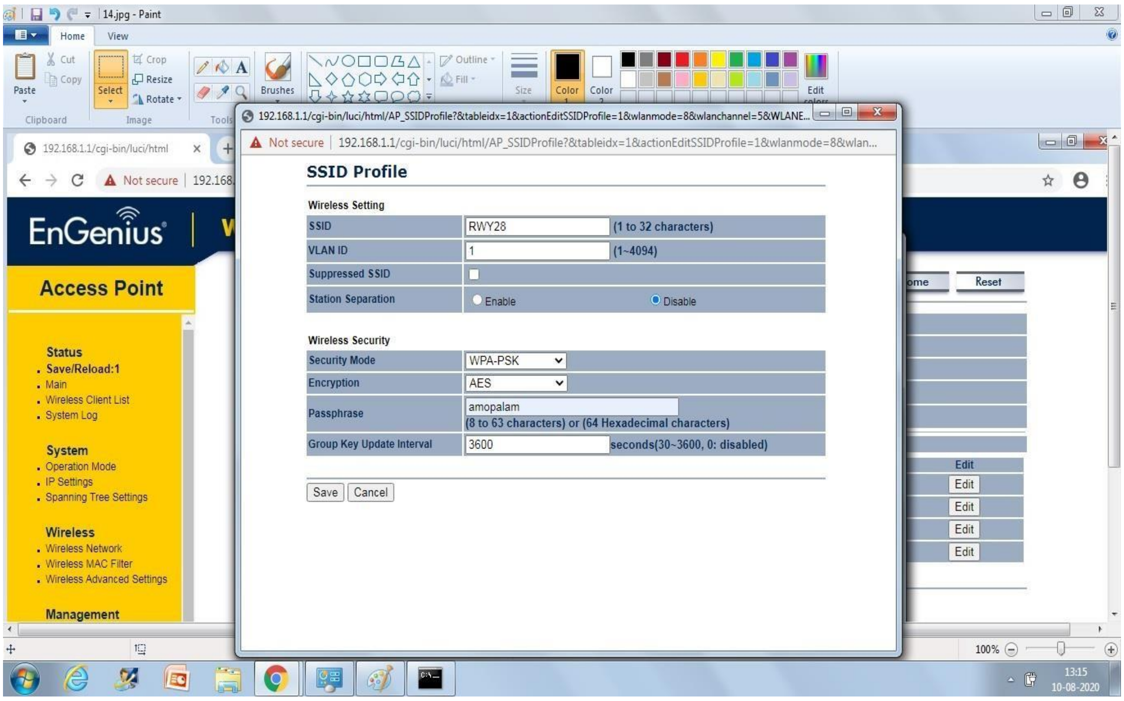


14. The window will appear as shown below

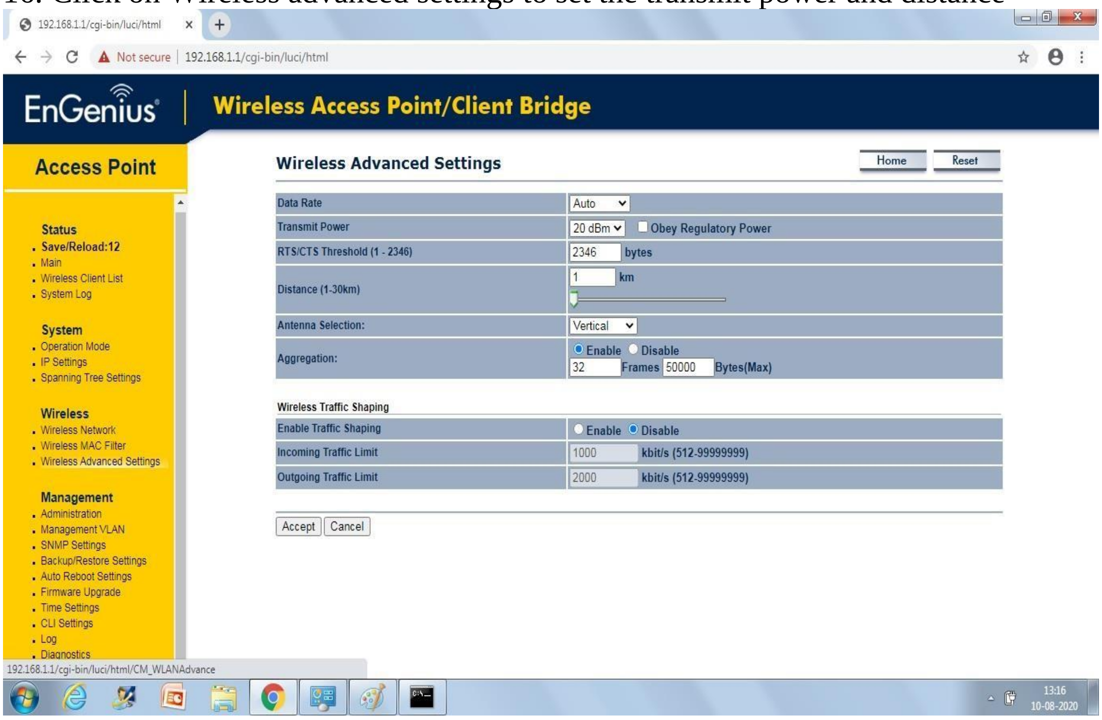


15. Change the name of SSID and wireless security as per requirement. Here following setings have been used

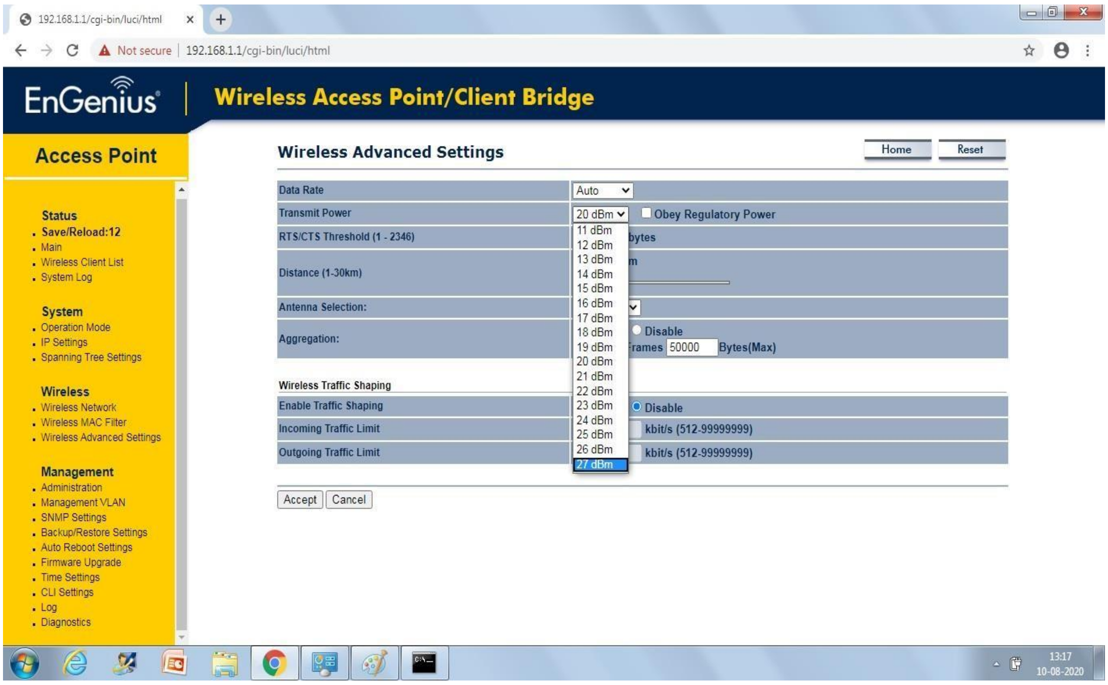
SSID: RWY28
Security mode: WPA-PSK
Encryption: AES:
Passphrase: amopalam
Click on Save



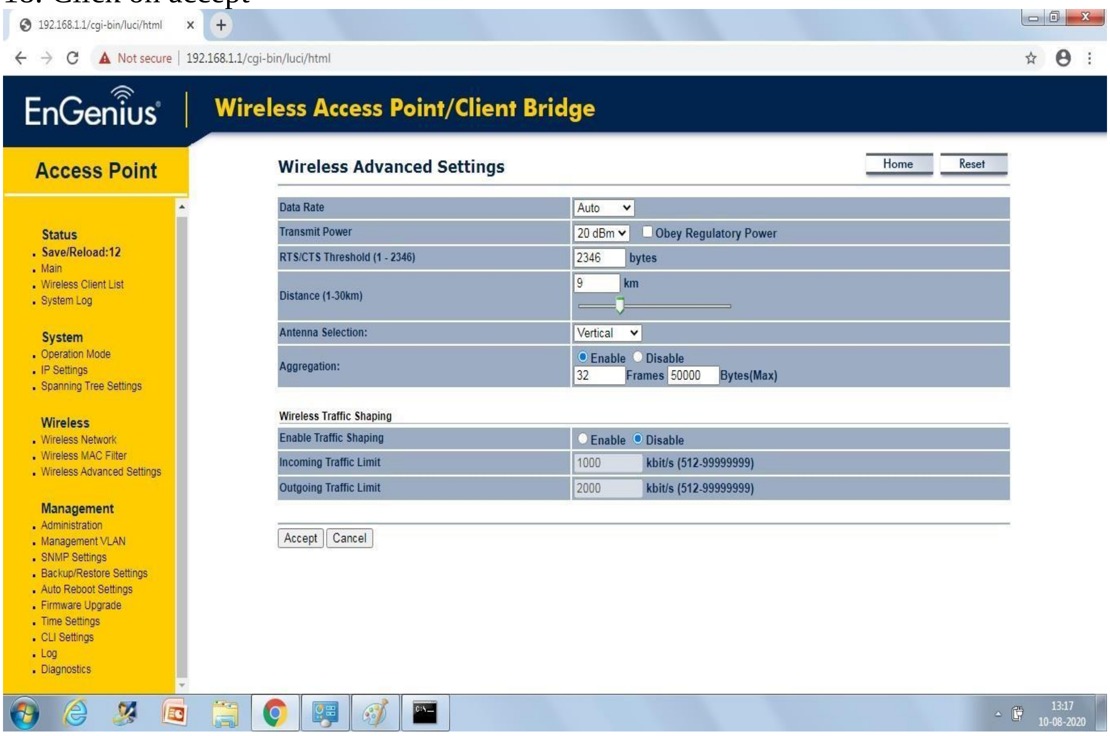
16. Click on Wireless advanced settings to set the transmit power and distance



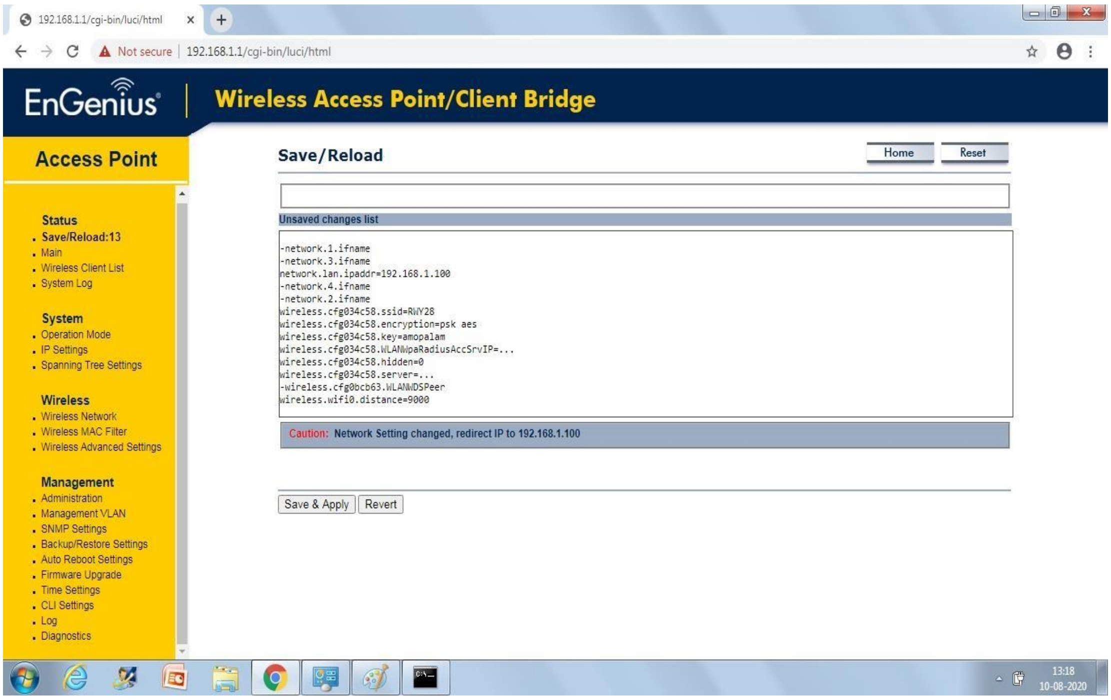
17. Choose transmit power as maximum (here 27 dBm) and distance as per requirement (here 9 Km)



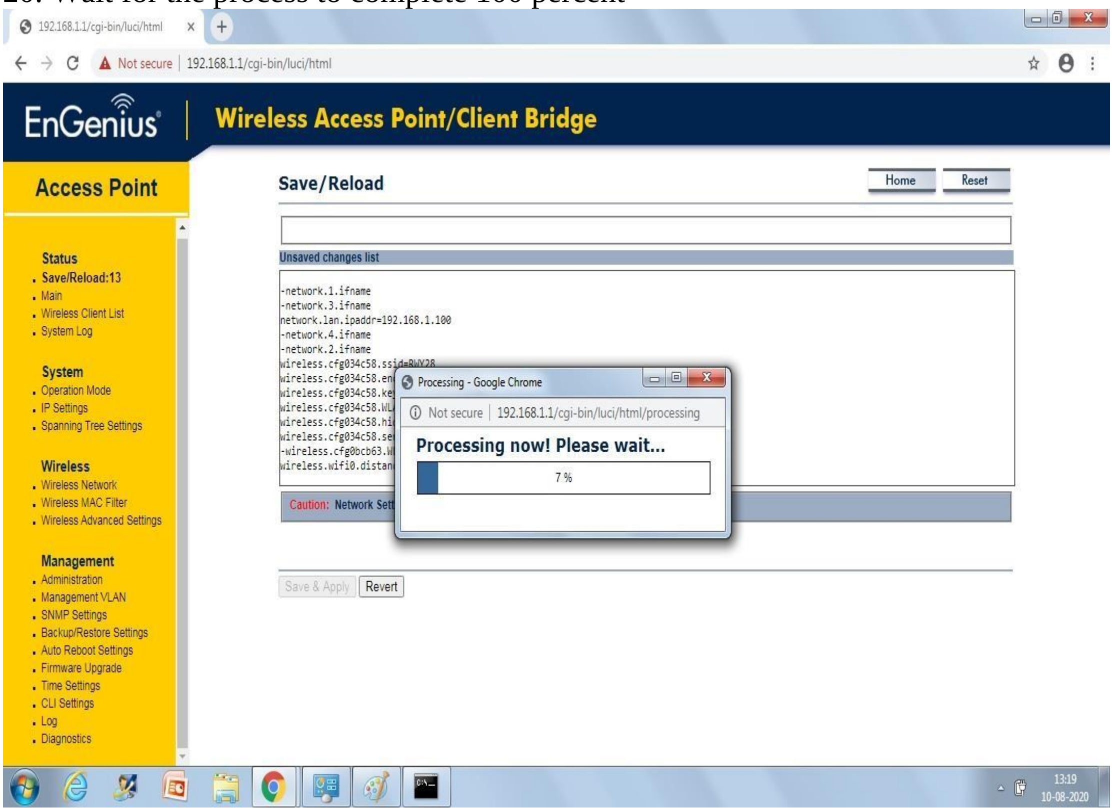
18. Click on accept



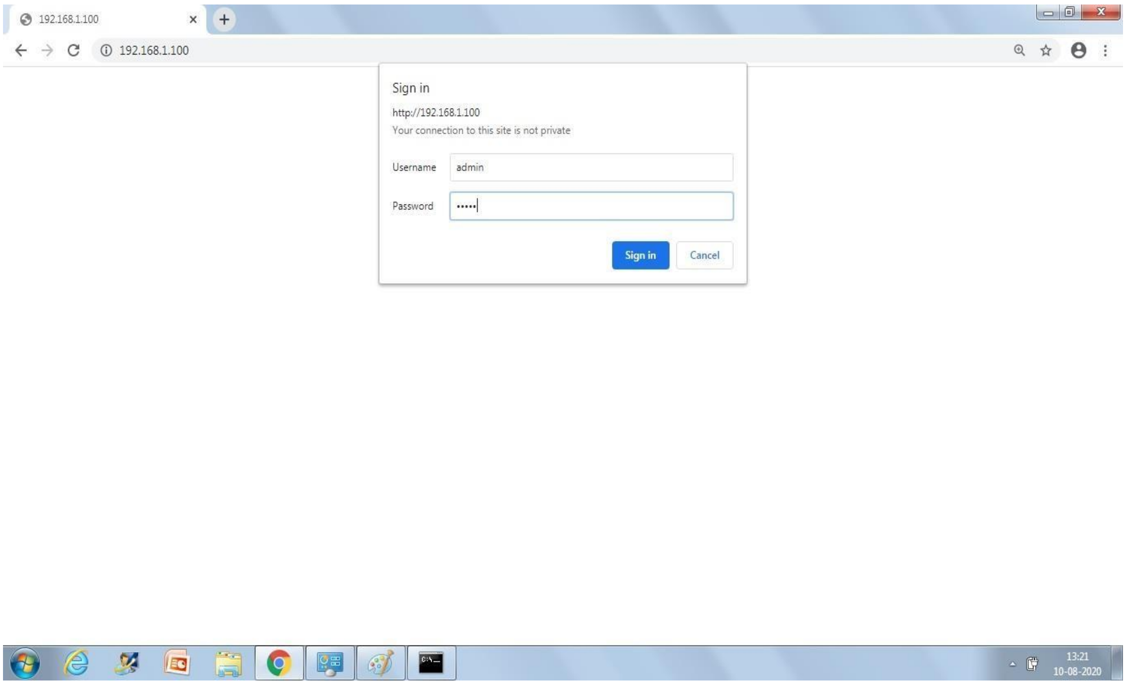
19 Click on Save/reload to save all the settings permanently from step 1to 18 above. Click on save & apply



20. Wait for the process to complete 100 percent



21. The browser will be directed to new IP address of the modem (here 192.1681.100). Enter the user name and password to access the modem



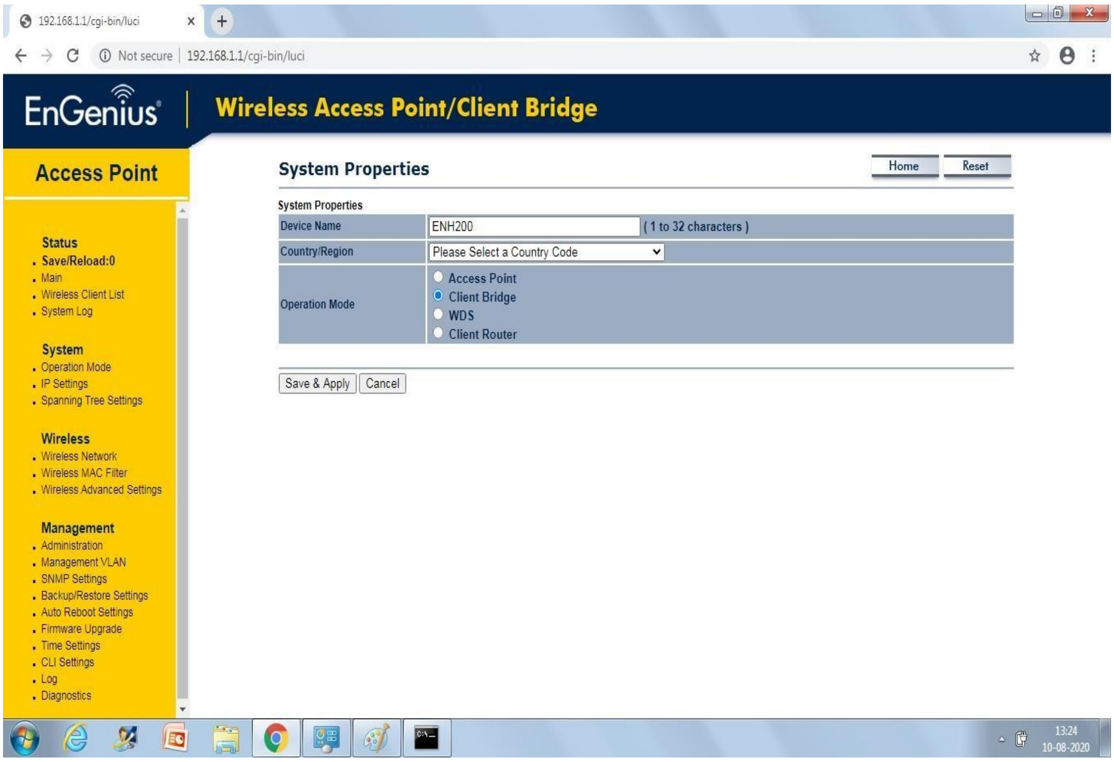
6.3 Steps to create client bridge

The settings to create client can be broadly summarized as

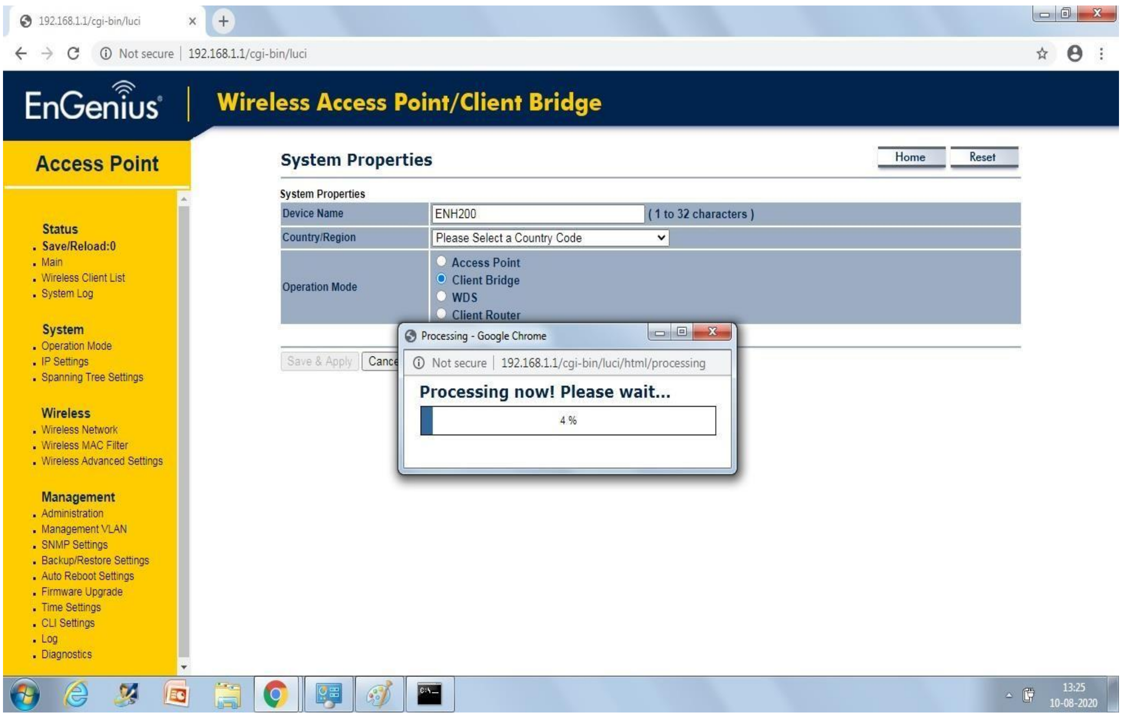
1.) Choosing the mode of operation
2.) Allotting the IP addresss
3.) Scanning the client bridge for the available acess points in the vicinity and pairing it with the required Access point.

**Please note that the procedure to configure wireless modem for other make models is similar. The broader settings remain same, only the layout, nomenclature of settings may vary.*

1 Open the main page and set operation mode to client bridge

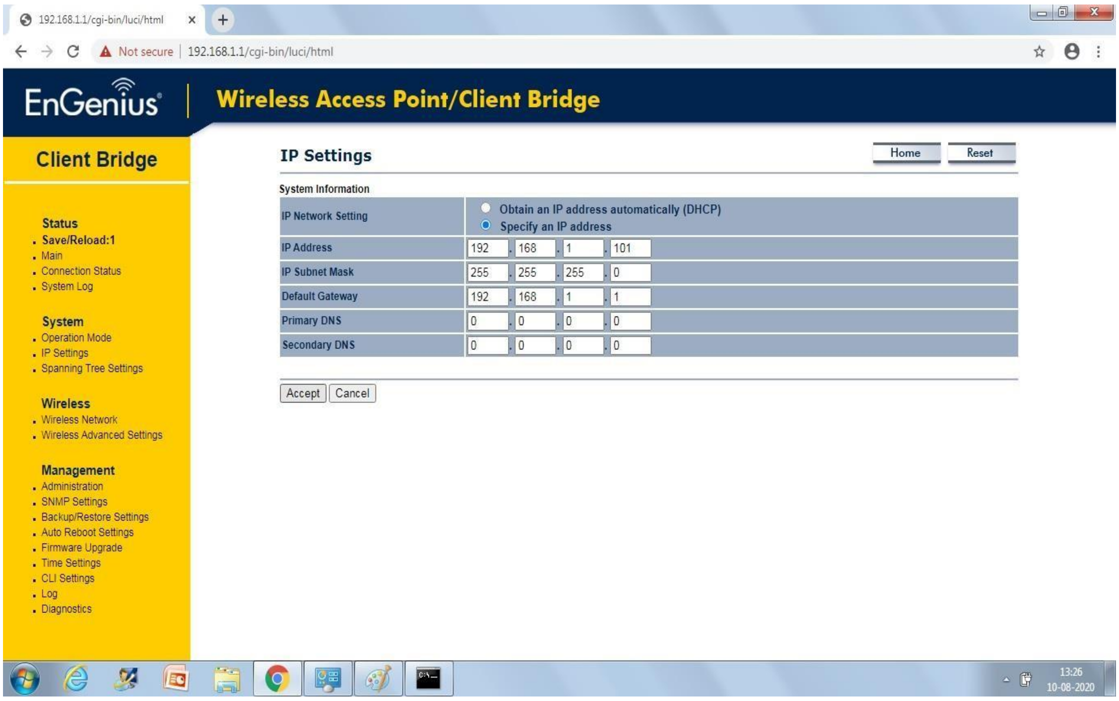


2 Click on save & apply. Wait for the process to finish 100 %

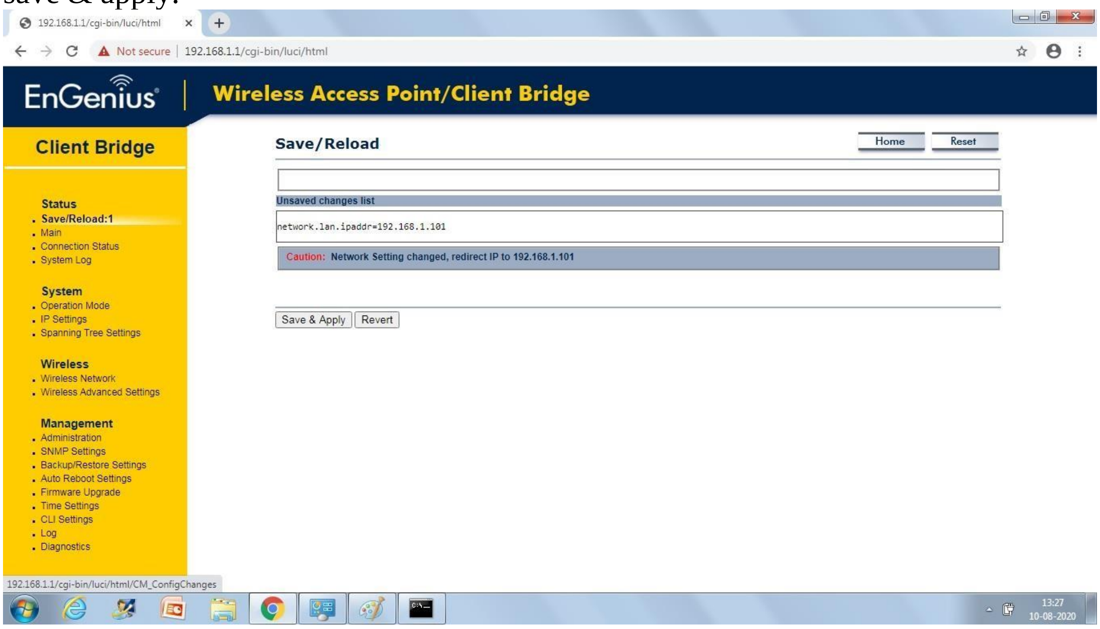


3 Click on IP settings and enter the new IP settings. In this example following settings have been used.

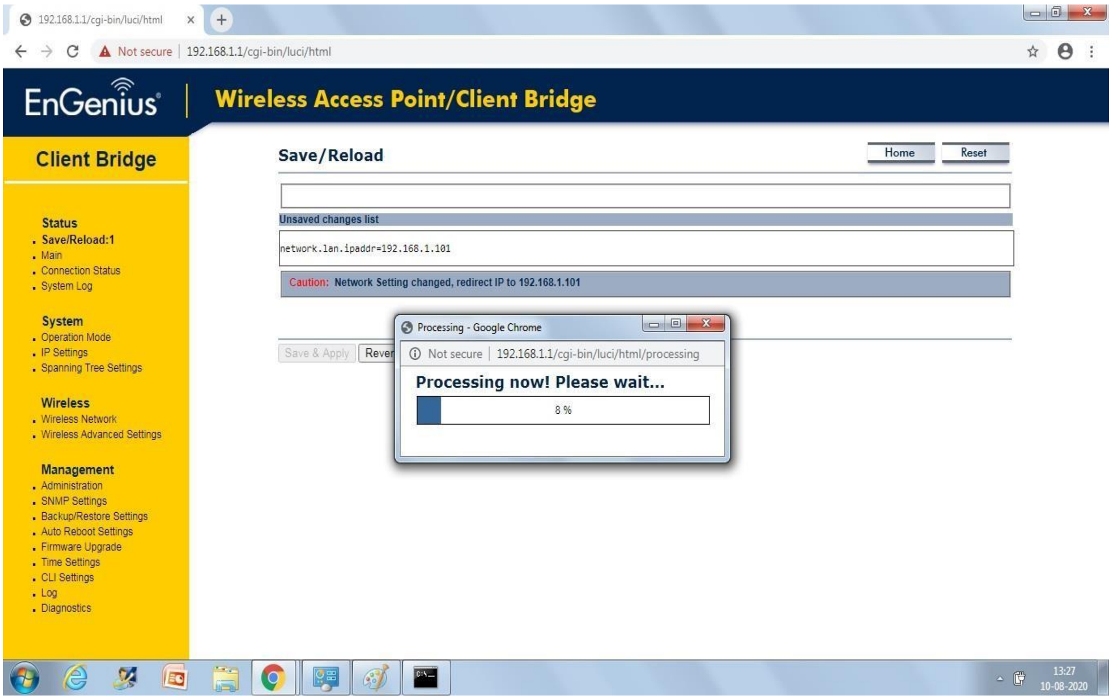
IP address: 192.168.1.101
Subnet mast: 255.255.255.0
Default gateway: 192.168.1.1



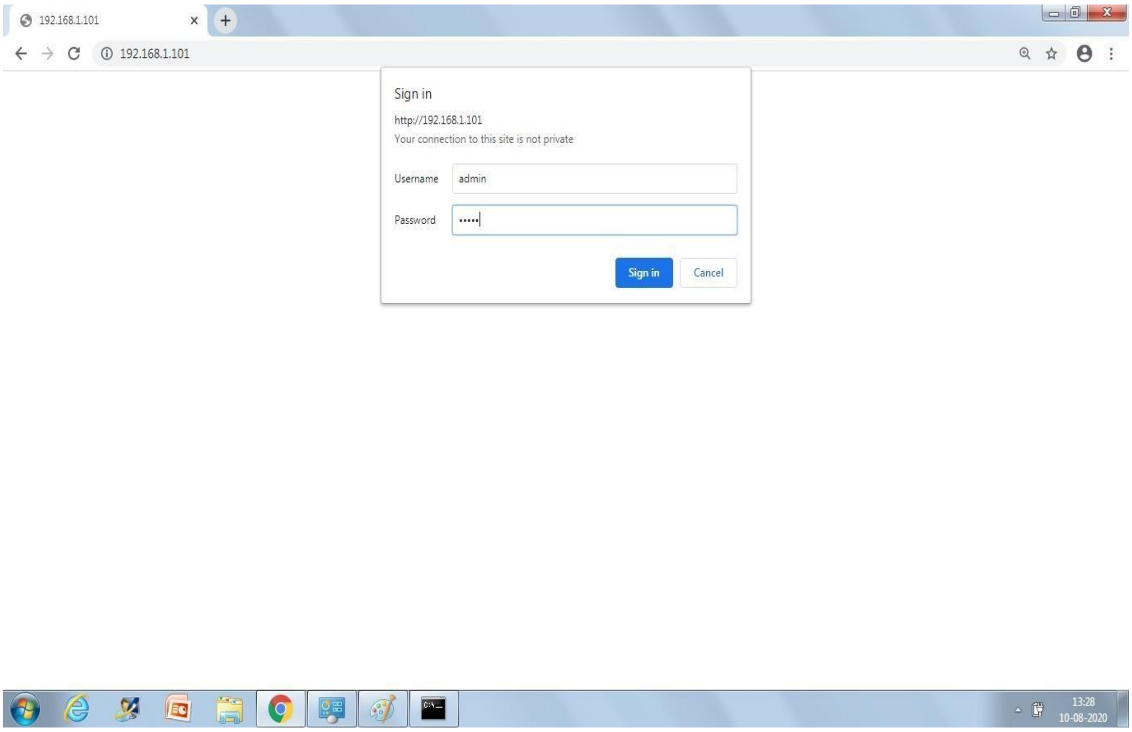
4 Click on save/reload on left hand side to permanently save the new settings. Then click on save & apply.



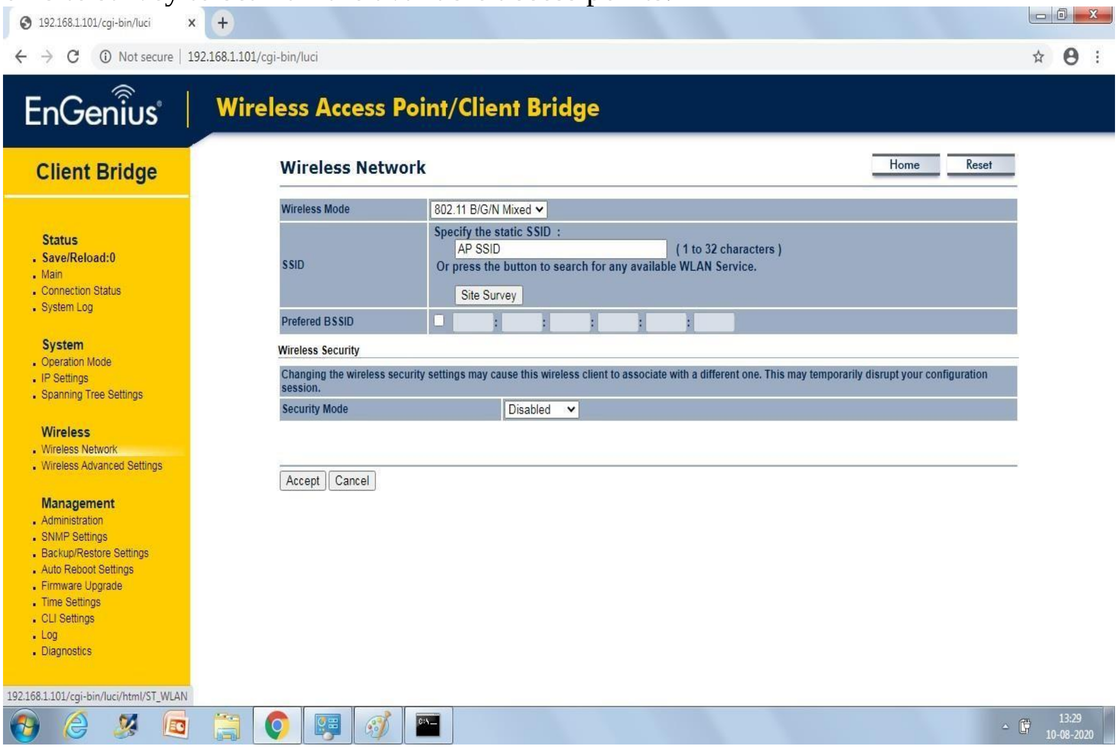
5 Wait for the process to finish 100 %



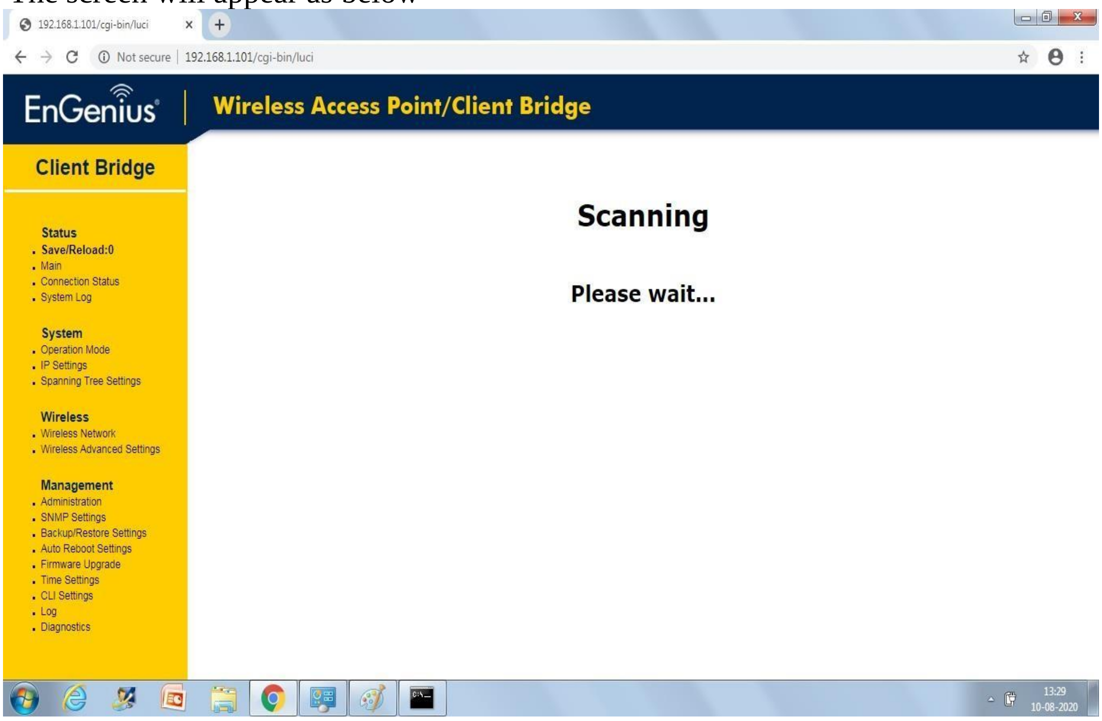
6. The webpage will be redirected to new IP address of the modem (Here 192.168.1.101). Enter the username (admin) and password (admin)



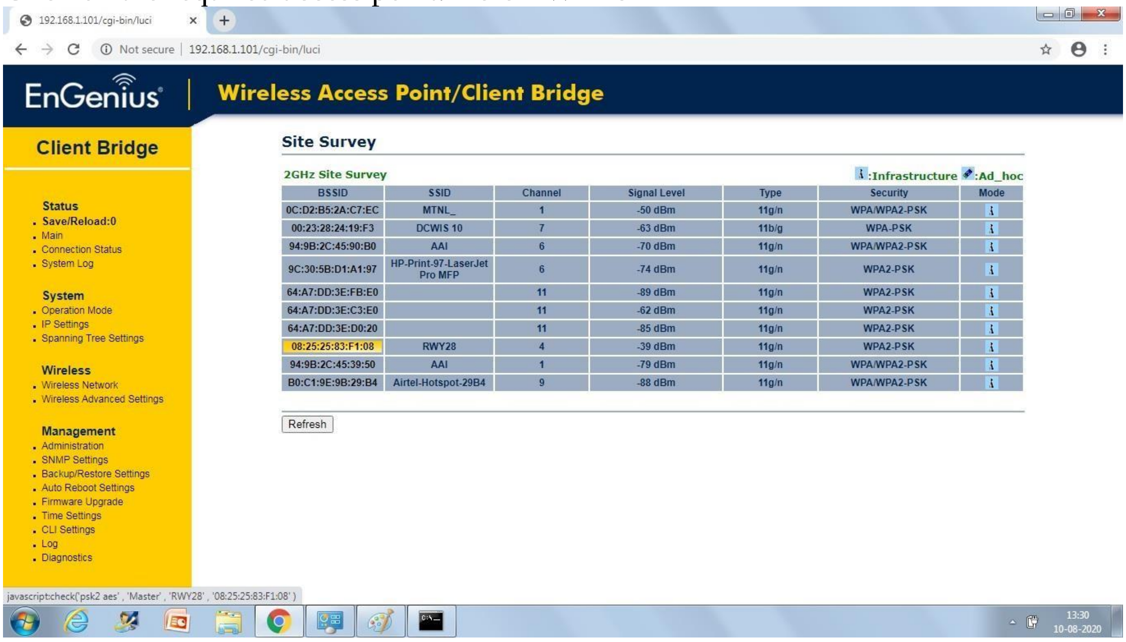
7. Click on wireless network on left hand side. The page will appear as shown below. Click on site survey to scan all the available access points.



8 The screen will appear as below



9 After scanning all the available access points in the vicinity of Client Bridge will appear. Click on the required access point. Here RWY28



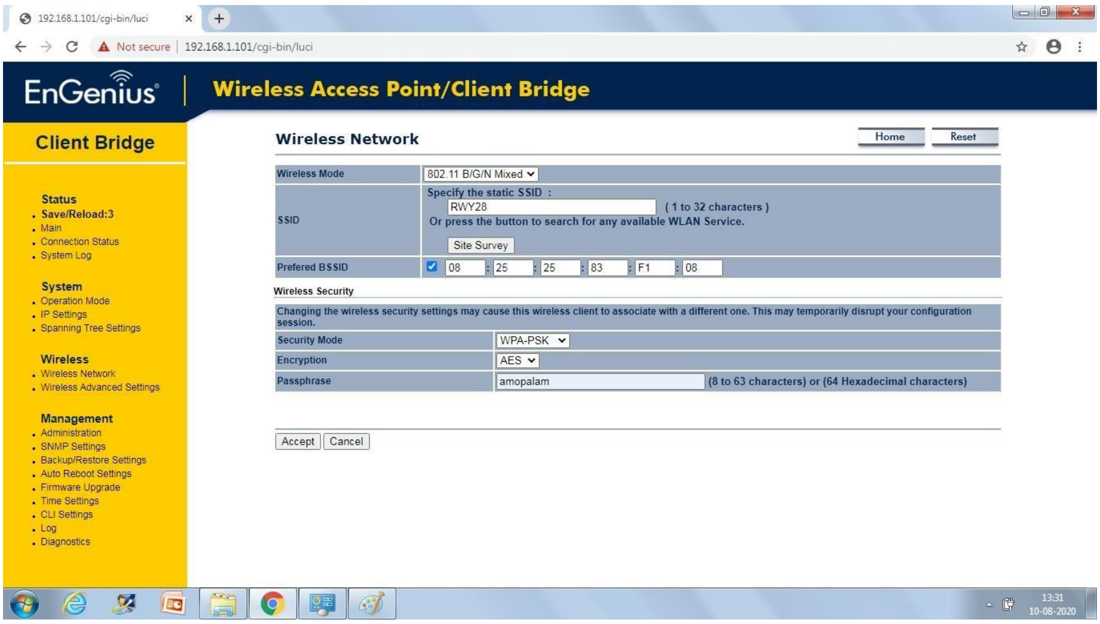
10 The page will appear for entering the security parameters. Enter the security settings as entered in access point in step 15 of access point

SSID: RWY28

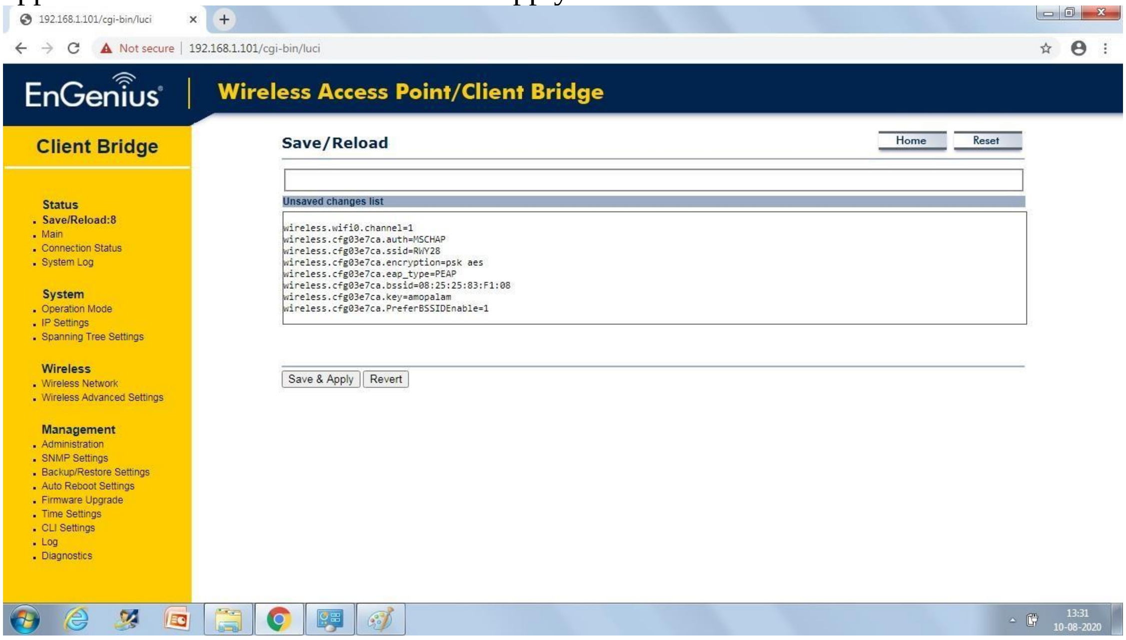
Security mode: WPA-PSK

Encryption: AES:

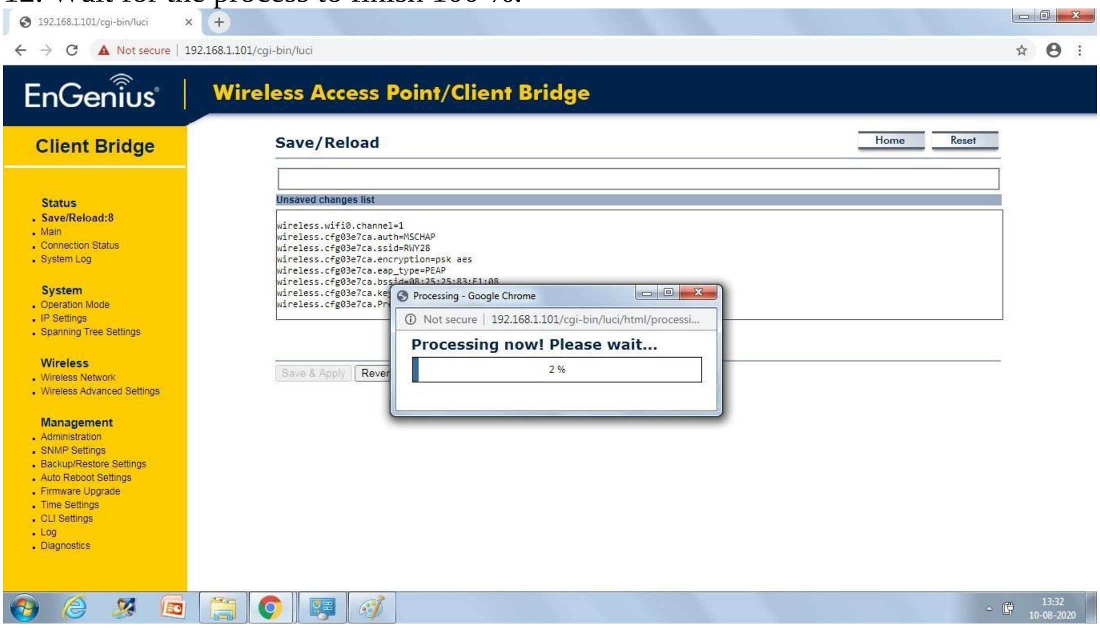
Passphrase: amopalam



11 Click on save/reload on left hand side to permanently save the new settings. The page will appear as below. Then click on save &apply



12. Wait for the process to finish 100 %.

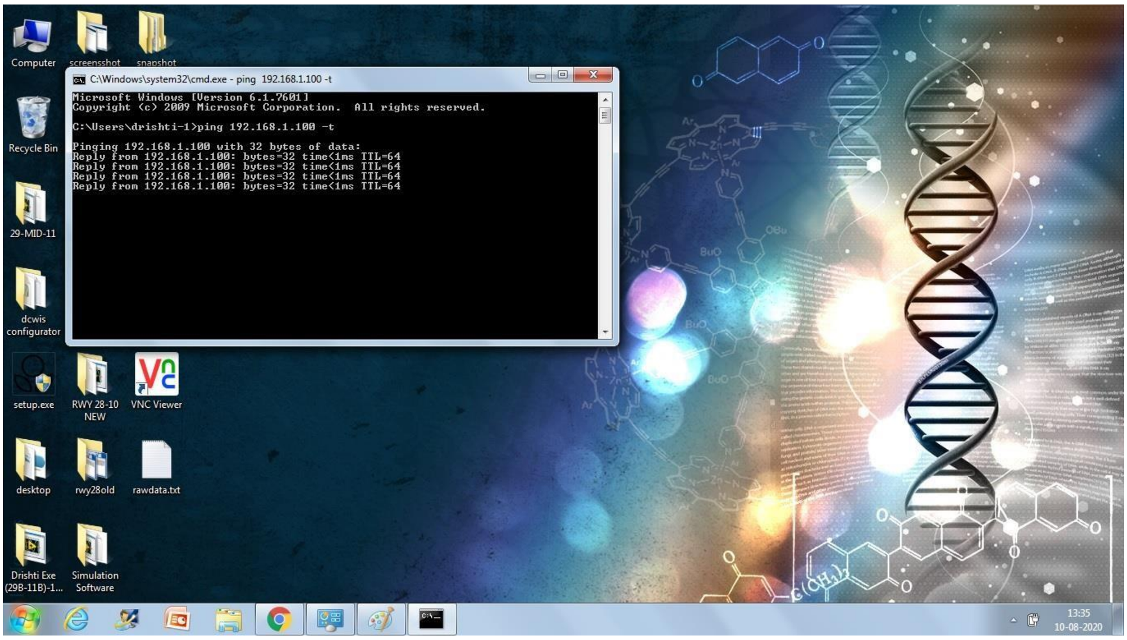


13 To confirm the communication between AP and CB.

By connecting laptop to Client Bridge modem try to ping the IP address of Access point through command prompt.

e.g here we have typed “Ping 192.168.1.100” & we should get

“ Reply from 192.168.1.100 bytes=32 time <1ms TTL=64”



**Please note that the procedure to configure wireless modem for other make models is similar. The broad settings remain same, only the layout, nomenclature of settings may vary.*

Chapter 7

Calibration, maintenance schedule and registers

7.1 Quarterly maintenance checklist

Quarterly maintenance of all airport meteorological instruments must be carried out in controlled corrective manner.

a.) CWIS & DIWE:

1. Physical observation for rusting, damage on all equipment, fixtures, installation bolt, screws and nuts.
2. Checking of the power supply provided at the field site including earth-neutral voltage, condition of earthing
3. Checking of free movement of wind vane.
4. Checking wind vane north setting for true NORTH.
5. Checking of free movement of optical wind anemometer.
6. Checking and cleaning of Temperature / Humidity sensor.
7. Checking and recording of pressure values (QFE/QNH)
8. Checking of data communication facilities (both wireless and with cable)
9. Checking of DCWIS digitizer and display of data values.
10. Cleaning of enclosure at site.
11. General cleanliness at site and in MBR/ATC

b.) Drishti Transmissometer:

1. The window glasses of the transmitter and receiver to be cleaned.
2. The lamp voltage to be checked as per instruction manual for both AC & DC voltages and frequency if the lamp indicator in the front panel of software appears red. Physically check whether the lamp is glowing or not.
3. BLM voltages to be checked at the data acquisition system as per instructions given in the manual.
4. Main photodetector voltages to be checked at the data acquisition system or at the V_0 of the PCB as per the instructions given in the manual.
5. Filter tests to be done as and when required to check the linearity of the system. This frequency can be once in three months or as and when required.
6. Checking of cable/radio modems proved for data communication.

7.2 Instruments maintenance register format:

Date & time	Description of Preventive Maintenance/ Nature of Problem	Reasons for fault/ deficiency.	Service Details/ Corrective action taken	Signature of the maintenance personnel with Date and time	Signature of the Duty officer / in-charge with Date and time
				IMD Duty official/In charge Remark	

7.3 Calibration/ Field Test Schedule:

Calibration / field testing of installed sensors with travelling standards should be done as per schedule given below.

a. Wind instruments: Once in six months

b. Temperature/ Dew point/ humidity: once in 12 months.

c. Pressure: Once in 12 months

d. Transmissometer: Once in six months and prior to commencement of fog season

e. Ceilometer: Once in 12 months

7.4 Procedure of field testing:

Field testing report/calibration should be done by concerned MWO/AMO.AMS.

a.) For Wind/Temperature/Pressure sensors:

Installed sensors readings should be compared with travelling standards.

1. Minimum four set of observations at interval of three hours should be recorded.
2. Duly signed calibration/ field test report should be maintained in format (enclosed annexure I)
3. WMO quality checks on incoming data from field sites.
   a. Range Check (min and max value of parameter)
   b. Temporal Check (one-minute maximum change in parameter)
   c. Spatial Check (parameter value difference between 2 locations)

b.)For Drishti Transmissometer

1. The window glasses of the transmitter and receiver to be cleaned at least once in two months and prior to winter season.
2. The calibration of the system through software to be done when the visibility is more than 6000 meters. Calibration has to be done if significant difference is there between the general visibility and instrumental visibility.
3. The lamp voltage to be checked as per instruction manual for both AC & DC voltages and frequency if the lamp indicator in the front panel of software appears red. Physically check whether the lamp is glowing or not.
4. If the indicator glows red against Wi-Fi connectivity in the front panel of the software, Wi-Fi connectivity between field site and ATC to be checked.
5. If the indicator glows red against landline connectivity in the front panel of the software, landline connectivity between field site and ATC to be checked
6. BLM voltages to be checked at the data acquisition system as per instructions given in the manual.
7. Main photodetector voltages to be checked at the data acquisition system or at the V_0 of the PCB as per the instructions given in the manual.
8. Filter tests to be done as and when required to check the linearity of the system. This frequency can be once in three months or as and when required.
9. Duly signed calibration/ field test report should be maintained in format (enclosed annexure II)
10. PD voltage for different visibilities (Ideal conditions):

Serial No.	Visibility	P.D Voltages (volts)
1	10000	8.0
2	9000	7.992
3	8000	7.982
4	7000	7.970
5	6000	7.952
6	5000	7.929
7	4000	7.893
8	3000	7.834
9	2000	7.717
10	1000	7.378

c.) For Ceilometer calibration

Ceilometer has to be calibrated once in 12 months.

1. Place the ceilometer horizontally.
2. Keep a reflector at a known horizontal distance from ceilometer.
3. Note down the reading shown on ceilometer.
4. Repeat steps 2 & 3 with reflector kept at some other known distances.
5. Minimum three reading to be taken at 3 different known distances.

6. Calculate offset/calibration factor by comparing the reading shown by ceilometer and actual distance of reflector.
7. For making changes to offset/calibration factor refer to instructions given in the manual.

7.5 Operationally Desirable Accuracy of Measurement:

Serial No	Parameter	Desirable Accuracy
1	Wind Direction	± 10 °
2	Wind Speed	± 1kt up to 10kt ± 10% above 10 kts
3	Air temperature and dew point	± 1°
4	Pressure (QFE/QNH)	± 0.5 hPA
5	Visibility	±50 m up to 600 m ± 10% between 600m and 1500m ±20% above 1500m
6	Runway visual range	±10 m up to 400 m ±25 m between 400m and 800 m ± 10 % above 800m

Annexure I

Field test report on calibration and inter comparison with travelling standard kit.

1. Name of instrument/sensor:
2. Serial Number:
3. Make and model:
4. Field test observations

Date & Time	**Actual Value**	**Value in travelling standard kit**	**Difference**
		Mean difference	
		Accuracy as per ICAO	

Remarks:

a. The above instruments/sensor are field tested against travelling standards traceable to the standards maintained at Surface laboratory, Surface Instruments Division, CRS, Pune.

b. Above field test report is valid for One year.

Signature of Calibration/Field test Team

Annexure II

Examples of Field Test Report on calibration and inter comparison with Travelling Standard Kit of DCWIS:

a.) Temperature & dew point

1. Name of instrument/sensor: Temperature
2. Serial Number:
3. Make and Model: KOMOLINE KAS-011 (TT/RH)
4. Field test observations:

Date and time	Mean Actual Value	Mean Value in travelling standard kit	Difference
06.01.2020; 0830	14.5	14.4	+ 0.1
1130	19.0	18.8	+ 0.2
1430	21.0	21.2	- 0.2
1730	17.1	17.0	+ 0.1
		Mean difference	+ 0.2
		Accuracy required as per ICAO	± 1^0 C

1. Name of instrument/sensor: Dew Point
2. Serial Number:
3. Make and Model: KOMOLINE KAS-011 (TT/RH)
4. Field test observations:

Date and time	Mean Actual Value	Mean Value in travelling standard kit	Difference
06.01.2020; 0830	13.0	13.2	- 0.2
1130	12.4	12.6	- 0.2
1430	13.2	13.0	+ 0.2
1730	11.4	11.6	- 0.2
		Mean difference	- 0.4
		Accuracy required as per ICAO	± 1^0 C

Signature of Calibration/Field test Team

b.)Wind direction and Wind speed

1. Name of instrument/sensor: Wind Direction
2. Serial Number: 282/16
3. Make and Model: IMD
4. Field test observations:

Date and time	Actual Value (Mean)	Value in travelling standard kit (Mean)	Difference
11.06.2020; 0830	081	080	+1
1130	102	100	+2
1430	107	110	-3
1730	068	070	- 2
		Mean difference	- 2
		Accuracy required as per ICAO	± 10°

1. Name of instrument/sensor: Wind Speed
2. Serial Number: 100 - 03
3. Make and Model: IMD
4. Field test observations:

Date and time	Actual Value (Mean)	Value in travelling standard kit (Mean)	Difference
11.06.2020; 0830	6.2	6.0	+ 0.2
1130	4.9	5.0	- 0.1
1430	3.8	4.0	- 0.2
1730	4.4	4.5	- 0.1
		Mean difference	- 0.2
		Accuracy required as per ICAO	± 0.5 m/s (1 kt) up to 5 m/s (10 kt) ± 10% above 5 m/s (10 kt)

Remarks:

i) The above instruments/sensor are field tested against Travelling standards traceable to the standards maintained at Surface laboratory, Surface Instruments Division, CRS, Pune.

ii) Above field test report is valid for One year.

Signature of Calibration/Field test Team

Annexure III

Drishti Transmissometer field test reports

a.) Voltage level table

Tx-Voltages	Acceptable Values	Pre-Maintenance	Post-Maintenance	Remarks
L-N (V ac)	230 ± 5 V			
L-E (V ac)	230 ± 5 V			
N-E (V ac)	Less than 2 V			
Power Supply +15 V	+15 ± 0.2			
Power Supply -15 V	-15± 0.2			
Lamp (AC)	Better than 3.5			
Lamp (DC)	Better than 4			
Frequency Hz	As per card			
Vin (AC)(V)	>2V			
Dc(V)	5± 0.2			
V ref (AC)(V)	Better than 3.5 and <5V			
Rx - Voltages				
L-N	230 ± 5 V			
L-E	230 ± 5 V			
N-E	Less than 2 V			
Power Supply +15 V	+15 ± 0.2			
Power Supply -15 V	-15± 0.2			
C –RIO +24 V	+24 ± 0.5			
Vin (AC) (mV)	Better than 200mv			
PD (DC) Channel 0	As per prevailing visibility			
REF (DC) Channel 1	5 ± 0.2			
BLM (DC) Channel 2	Depending on the prevailing visibility			

Filter test report:

Date & Time	**Atmos pheric MOR**	**Filter %**	**Effective transmittance**	**Calculated MOR**	**Drishti MOR**	**Diff. in MOR**	**Drishti transmit tance**	**Error %**

Transmissometer Calibration

Date	RWY	Observed Visibility in metres	Data from Transmiss-ometer in metres	Transmissometer Calibrated at (in meter)	Remark	Sign. Of attending personal	Signature of Section I/C
	RVR 01						
	RVR 02						
	RVR 03						
	RVR 04						
	RVR 05						
	RVR 06						

Signature of Calibration/Field test Team

Annexure IV

Fortnightly preventive maintenance of (CWIS/RVR) ____________________

Date & time	Description of Preventive Maintenance / Nature of Problem	Reasons for fault / deficiency.	Service Details / Corrective action taken	Signature of the maintenance personnel with Date and time	Signature of the Duty officer / in-charge with Date and time
	Physical observation for rusting, damage on all equipments, fixtures, installation bolts, screws & nuts.				
	General cleanliness at field site				
	Internal checking for all the cables connections, modules, units.				
	Checking connections of all sensor ,if any loose connection				
	Checking of the commercial power supply provided at the field site including Earth-Neutral voltage, condition of earthing				
	Checking of UPS supply and batteries provided at the field sites				
	Checking of Radio modems and connections provided for data communication				
	Checking of signal condition status at the site				
	Cleaning of Enclosure at site.				
	Cleaning of window glass of Transmissometer				
	Similar checking at MBR / ATC including signal cable connectivity, identification of wires with proper marking / tag, cleanliness etc.				

Annexure V

Quarterly controlled corrective maintenance of (CWIS/RVR) ___________

Date & time	Description of Preventive Maintenance / Nature of Problem	Reasons for fault / deficiency.	Service Details / Corrective action taken	Signature of the maintenance personnel with Date and time	Signature of the Duty officer / in-charge with Date and time
	Physical observation for rusting, damage on all equipments, fixtures, installation bolts, screws & nuts				
	Checking of the commercial power supply provided at the field site including Earth-Neutral voltage, condition of earthing				
	Checking of free movement of wind vane				
	Checking wind-vane north setting with true NORTH				
	Checking free movement of optical wind anemometer.				
	Checking and cleaning of Temperature/ Humidity sensor.				
	Checking and recording of pressure values (QFE/QNH)				
	Checking of data communication facilities with wireless.				
	Checking of Data Logger and their interfaces provided for data display				
	Cleaning of enclosure at site.				
	General cleanliness at site and in MBR/ATC				

Annexure VI

FAULT OBSERVATION AND MAINTENANCE DIARY

Date & Time of complaint	Complaint received from	Fault observed	Action taken		Remarks	Signature of attending personnel	Signature of Section I/C
			Description	Date & Time attended			

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