--- USERS' MANUAL ---

SINGLE CHANNEL DATALOGGER - OPERATION

Single channel datalogger suitable for
Model EWLR-101 automatic water level and rainfall monitoring system

MODEL ESCL-10VT-R4

Contents

Battery charging and care of battery

Data logger's Battery

The ESCL-10VT R4 Single channel data logger with internal battery uses two primary D-cell non-rechargeable batteries as a power source.

If the ESCL-10VT R4 data logger is not going to be used for more than 30 days, remove the batteries from battery compartment.

When battery voltage is showing 10 percent of battery capacity left in system information screen (at Readout unit), replace the battery at the first opportunity to avoid data loss.

WARNING: Always SHUTDOWN Data logger before removing battery from the Data logger. Data may be lost otherwise.

Readout unit's (Mobile Phone's) Battery

The ESCL-10VT R4 relies on an Android Mobile Phone as a readout unit. The mobile phone generally has an internal sealed rechargeable Li-ion battery as a power source. A separate battery charger/adaptor unit operating from universal AC mains supply is optionally (available separately) supplied with ESCL-10VT R4 Readout unit. This battery charger operates from 90 to 260 V AC, 50 or 60 Hz which makes it suitable for operation from AC mains available throughout the world.

On receiving the mobile phone for the first time discharge the battery fully and then recharge the battery for 2 hours using the supplied mains powered battery charger.

If the mobile phone is not going to be used for more than 10 days, fully charge the battery and switch OFF the phone before storing the mobile phone. Also fully charge the battery before use if the mobile phone has not been used for more than 10 days.

The user is strongly advised to read the instructions and user's manual supplied with the mobile phone on how to take care of its battery.

1   INTRODUCTION

1.1   Overview

The ESCL-10VT R4 Single Channel Data logger is designed to be very simple to use, be deployable in harsh environments and to be as compact as possible. The user-friendly software and standard D-cell batteries allow easy downloading of the data and maintenance in the field. Even users with very little experience with Geotechnical Instruments will be able to connect, download data and change settings with a matter of a few inputs.

1.2   System Components

The automatic water level monitoring system model ESCL-10VT R4 consists of the following system components and accessories:

- Datalogger with internal battery back-up and communication option

- Pressure sensor with attached cable and connector for connecting to data logger end connector

- Configuration software CD

- USB to serial interface cable

- Installation accessories including screw driver, safety wire rope with holder, cable looping holders

- Data SIM (client scope)

2   OPERATING PRINCIPLE

The ESCL-10VT R4 automatic water level monitoring system, works on simple principle; the water pressure is sensed by the pressure sensor at the diaphragm when water head is maintained above the sensor diaphragm. The pressure and temperature sensed by the pressure sensor is transferred to data logger. The data logger with built-in barometric pressure sensor processes this data to read and record all the parameters using various coefficients. The current/logged data from the data logger in the field can be viewed on the laptop. In telemetry system the logged /scanned data is transmitted to FTP server to view through Internet.

The parameters recorded by data logger:

- Water Level
- Barometric pressure
- Temperature
- Battery Voltage
- Hourly Rain Fall
- Daily Rain Fall

Data can be stored in engineering units. Data logger calculates the pressure in terms of water column (in mWc) after correcting for the measured barometric pressure and water density, it stores the values together with the current date, time and battery voltage as a data record in its internal non-volatile memory. It has 64 Mb non-volatile flash memory to store up to 3,145,728 data points.

The use of individual barometric pressure sensor with piezometer allows the water level to be corrected barometrically. The use of barometric pressure sensor eliminates the apparent variation in water pressure due to variation in atmospheric pressure.

Data logger with built in 3G/4G cellular has capability to upload data records directly to remote FTP server. Upload schedule can be set in Data logger. The data logger can be programmed to take a measurement from every 5 sec to every 168 hours in linear or event sampling mode.

Figure 2-1 Data logger with sensor cable

Figure 2-2 shows the Datalogger and Piezometer installation diagram.
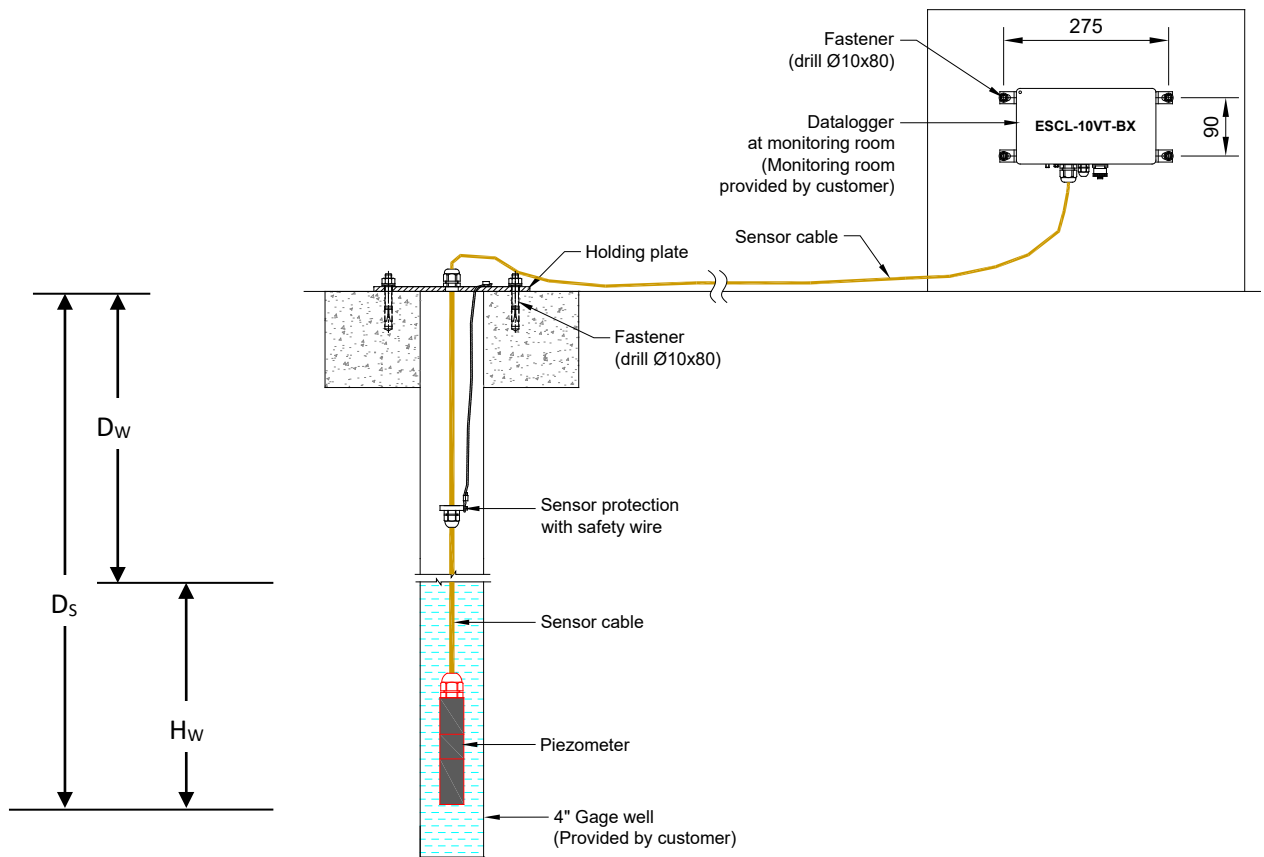
Figure 2-2 Data logger and Sensor installation

Where: D_S = Sensor Installation Depth from Ground Level
                D_W = Water Level from Ground Level
                H_W = Water table above pressure sensor

Water level can be calculated by:

$$D_W = D_S - H_W$$

3   DATA LOGGER SETUP

Refer following steps to setup data logger for first time.

3.1   Connecting Sensor Cable

Refer following steps to connect Piezometer sensor with data.

1   Open the data logger by unscrewing the 4 screws provided at top cover.

2   Unscrew the cable gland (CG-1) of data logger cable gland holder and pass sensor cable end through cable gland assembly as in Figure 3-3.

3   Take the sensor end connector and push tool provided for connecting the sensor end cable.

4   Check step 2 in Figure 3-4, hold and press down push tool to connect cable.

5   Connect Black (B) in the first slot, Red (R) in the second slot, Shield (S) in the third slot, White (W) in fourth slot and Green(G) in fifth slot. See Figure 3-5.

Terminal	Wire Color
T+	Green
T-	White
GND	Shield
S+	Red
S-	Black

6   Wrap the strengthening thread around the screw and tight the screw on stud.

7   Pull the cable out to transfer cable load on the strengthening thread.

8   Plug the connector into socket provided on board as shown in Figure 3-7.

9   Push the cable gland holder in place by applying sideways pressure.

10   Screw back the cable gland.

Figure 3-1: Data logger

Figure 3-2: Pull out – top cover
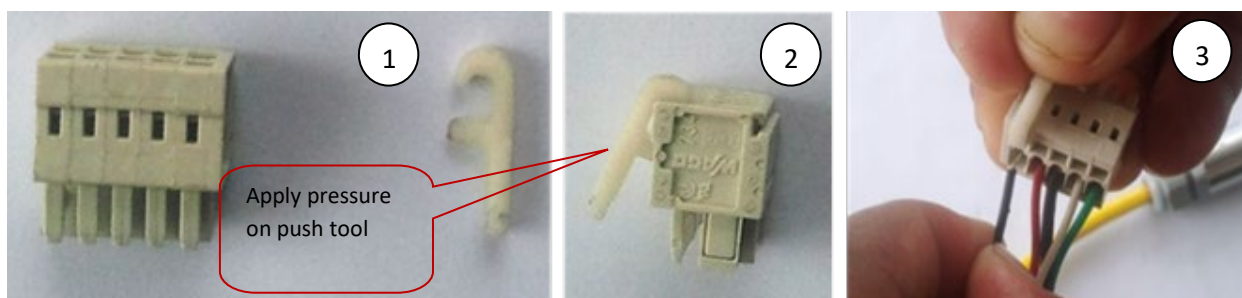

Figure 3-3: Sliding cable gland assembly

Apply pressure on push tool

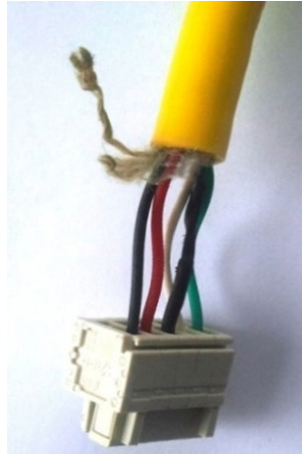**Figure 3-4: Connecting the sensor cable to sensor end connector**
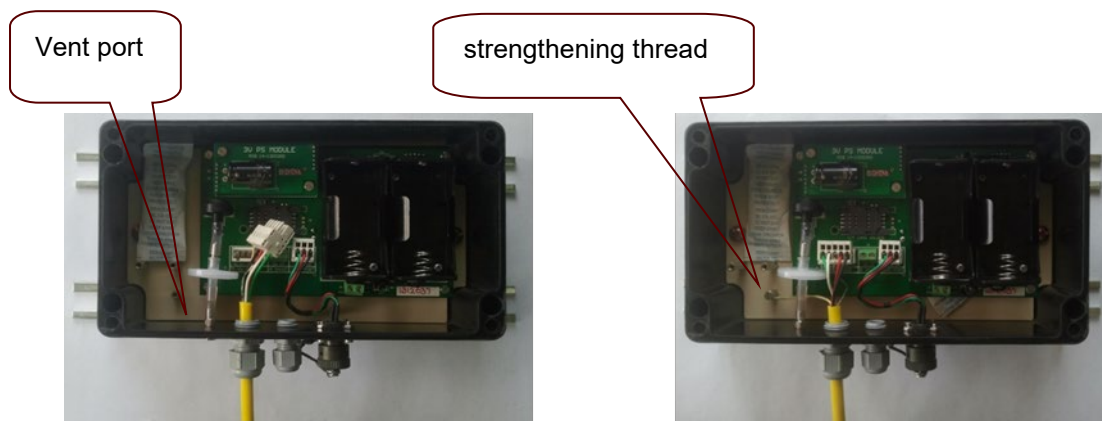
Figure 3-5: Connector wiring

Figure 3-6: Connecting the sensor cable   **Figure 3-7: Data logger to sensor cable assembly**

3.2   Connectng Rain Gauge

Now connect the wires for rain gauge connection. Connect the two wires comming from rain gauge to screw connector J3 as shown in Figure 3-8.

Figure 3-8: Connecting Rain Gauge cable

3.3   Inserting SIM Card

A 3G/4G enabled SIM card is required for Dataloggers those are having telemetry option to upload logged data to remote FTP server. Refer following steps to insert SIM card into Datalogger.

1   Remove the top cover of data logger by un-screwing the four screws on the top cap of the data logger.

2   Unlock the SIM card holder by applying the force from side way and pull to flip–up the SIM card holder as explaned in Figure 3-9.

3   Insert the SIM card into slot of SIM card holder as direction shown in Figure 3-10.

4   Close the SIM holder by pushing from the opposite side keeping the SIM pushed down as shown in Figure 3-11. Slide the holder to Lock.
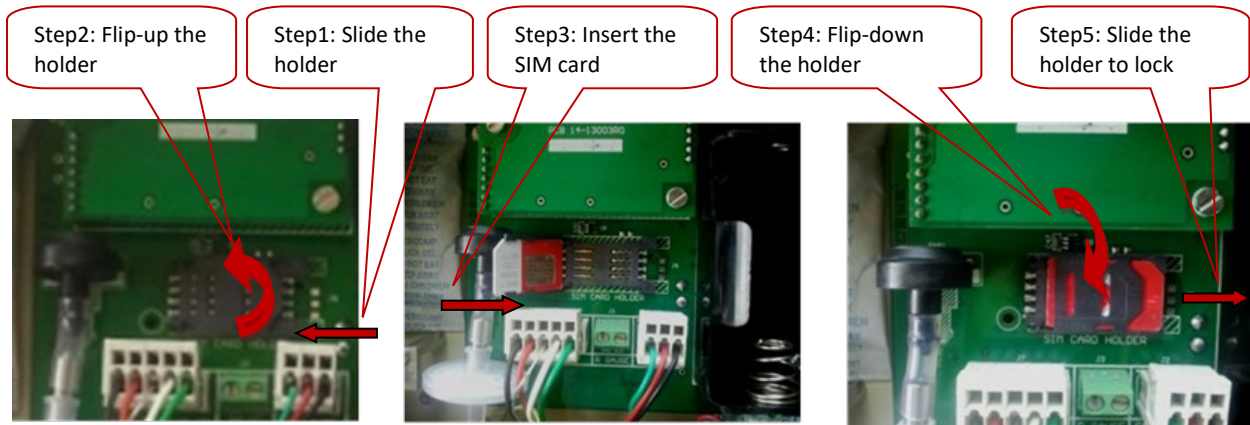
Step2: Flip-up the holder

Step1: Slide the holder

Step3: Insert the SIM card

Step4: Flip-down the holder

Step5: Slide the holder to lock

Figure 3-9

Figure 3-10

Figure 3-11

4   RAIN GAUGE

Encardio-rite model ERG-200 rain gauge with a proven tipping bucket mechanism provides a cost effective reliable method for measuring and recording rainfall. It is easy to use, durable and precision automated to provide long term, trouble free operation with a minimum of maintenance. It is corrosion resistant having a stainless steel outer housing. It is designed for many years of trouble free operation.

Inside each rain gauge is a balanced tipping bucket mechanism with a magnet and switch assembly. Collection of rain is through a 200 mm diameter catchment through a debris filtering screen. A funnel inside the rain gage feeds collected rain water into one of the two buckets. As soon as the preset amount of water has been collected in the bucket, it tips the other way, automatically emptying the water and positioning the other bucket for collecting rainfall. The measured water exits through drain tubes provided at the base of the rain gage. The tipping bucket mechanism activates a sealed magnet sensitive switch that produces a contact closure for each 0.2 mm of rainfall. Two adjustable screws provide calibration of buckets by changing position of the bucket stop point.

High vertical sidewalls of the model ERG-200 prevent splash-out of rain from the catchment thus resulting in better accuracy. Each rain gauge is individually calibrated for optimum accuracy. Three adjustable legs allow the rain gauge to be fastened permanently onto a platform or deck using standard fasteners.

Figure 4-1: ERG 200 Rain Gauge

4.1   Installing Rain Gauge

Refer following steps to install the Rain gauge unit.

1   Grout/Fix the Rain Gauge unit by 3 Anchors/Bolts on a horizontal plane.

2   Unscrew the allen bolts using allen key as shown in Figure 4-2.

3   Remove the outer housing as in Figure 4-3.

4   Adjust 6 hex nuts as shown in Figure 4-4 to make the bubble level in centre as shown in Figure 4-5.

5   Cut and remove the safety rubber as shown in Figure 4-6. (As this safety rubber is to avoid the movement of bucket during shipment)

6   Place the outer housing and tighten the allen bolts.

7   Now connect the two wires of rain gauge unit to the Datalogger as shown in Figure 4-7.

Unscrew the Allen Bolt

Figure 4-2

Figure 4-3

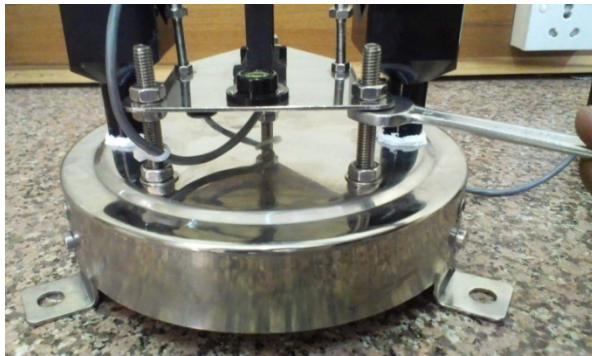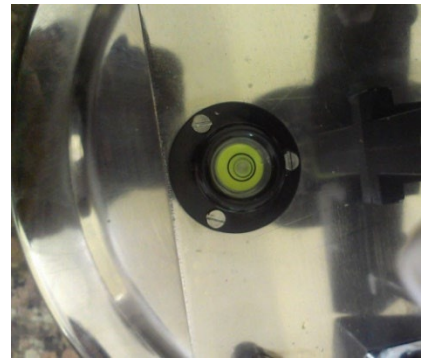**Figure 4-4**
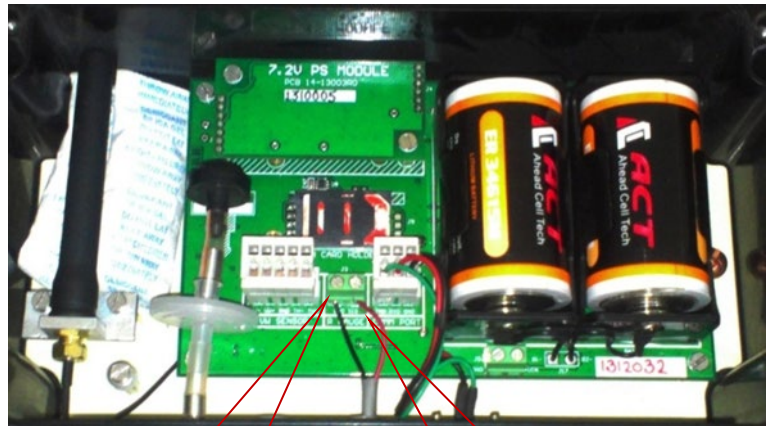

Figure 4-5

Figure 4-6

Figure 4-7

Connect Black wire at GND terminal

Connect Red wire at SIG terminal

5   POWER SUPPLY

ESCL-10VT R4 Datalogger can be powered by either of 3 options.

- Using 1.5 V Alkaline Batteries

- Using 3.6 V Lithium Batteries

- 12 V external powered.

5.1   2 X 1.5 V Alkaline battery option

Datalogger with this option uses 3 V powered power supply module. In this option, two D-size 1.5 V standard Alkaline Primary Batteries can be used to power-up the Datalogger.

Figure 5-1 Datalogger powered with 2 x 1.5 V Alkaline Batteries

5.2   2 X 3.6 V Li battery option

Datalogger with this option uses 7.2 V powered power supply module. In this option, two D-size 3.6 V standard Lithium Primary Batteries can be used to power-up the Datalogger.

Figure 5-2 Datalogger powered with 2 x 3.6 V Lithium Batteries

5.3   12 V External Powered (Mains/Solar)

Datalogger with this option uses 12 V powered power supply module. This 12 V supply can be fed through either of various options like.

- 12 V from Mains Adaptor

- 12 V from solar panel

- 12 V from Battery backed power supply etc

Following Figure (Figure 5-3) showing an example of external power supply option.
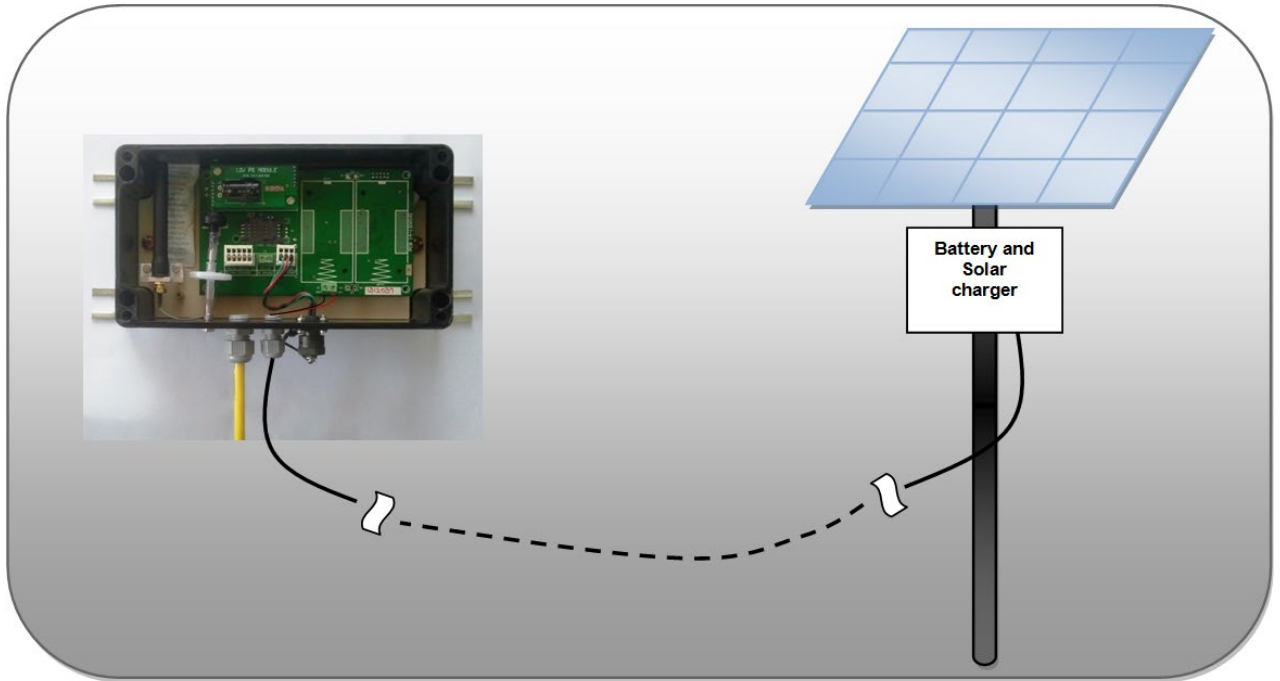
Figure 5-3 Datalogger powered with 12 V Solar powered

6   COMMUNICATION INTERFACE

Data logger can be configured by application software using communication cable or via Bluetooth. These methods are explained in following sections.

6.1   Communication Cables

Communication cable has 4 pins USB connector at one end and 9 pins D-sub connector at another end. Connect 9 pins D-sub connector of the Interface Cable to the Data Logger and other end with USB socket at PC/Laptop. If communication cable is unavailable, standard USB to RS-232 Converter can be used. Cable wire details are given in following table.

Figure 6-1: Communication Cable

9-Pin D-Sub Female	FTDI cable wires
2	Orange
3	Yellow
5	Black
7	Brown
8	Green

RS-232 Interface Cable has 3 pins circular connector at one end and 9 pins D-sub connector at another end. Connect 3 pins circular connector of the Interface Cable to Datalogger and other end with 9-pin D-sub socket to communication cable. Cable wire details are given in following table.

Figure 6-2: RS-232 Interface Cable

9-Pin D-Sub Male	3-Pin Circular Connector
2	Orange
3	Yellow
5	Black

6.1.1   Connecting Data Logger with Laptop/PC using communication cable

Connect the Datalogger with Laptop/PC using communication cable as shown in Figure 6-3. Run the application on Laptop/PC to interface the Datalogger.

Figure 6-3: Datalogger connection using communication cable

6.2   BluetoothTM Modem

The Datalogger can also be connected using Bluetooth™ modem for communicating with PC/Laptop/Mobile. Take one Bluetooth™ modem supplied by Encardio-rite. Remove the battery cover. Insert two standard 'AA' 1.5V Alkaline batteries into the holder as shown in Figure 6-5.

Figure 6-4: Bluetooth Modem

Figure 6-5: Inserting Batteries into Battery holder

Make sure that modem must be configured for 115200 baud rate and hardware flow must be OFF. Verify DIP switch settings with following Figure 6-6.
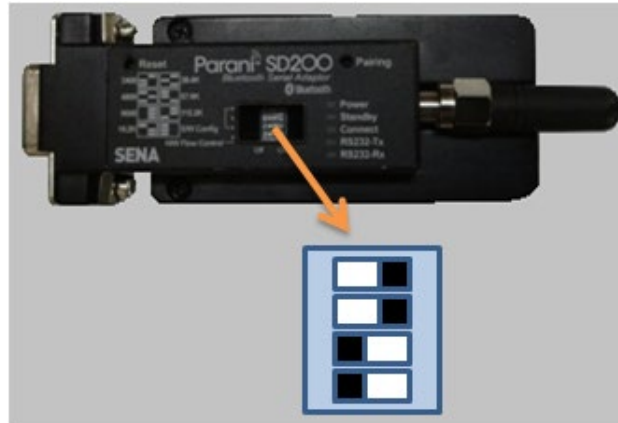

Figure 6-6: Bluetooth modem DIP switch settings

6.2.1   Connecting Data Logger with Laptop/PC using Bluetooth^TM Modem

Take a Bluetooth modem and plug it at 9-pin D-sub connector of RS-232 Interface cable as shown in Figure 6-8.

Turn ON the Bluetooth modem by pressing ON/OFF switch provided near modem's battery compartment. The power indicator of Bluetooth modem will glow in GREEN colour to ensure that Bluetooth modem is ON. Turn ON the Bluetooth of the PC/laptop and search Bluetooth devices in the network. Once searching gets completed, a list of Bluetooth devices found is displayed. Find the Bluetooth modem's serial number in the list of devices found and click for pairing the PC/Laptop with the Bluetooth modem.

Once pairing button is pressed it will ask to enter passkey for authentication. Enter pairing code "**69836776**" and then press OK. On successful authentication it will show that device is paired. Now the PC/Laptop is paired with Bluetooth modem. This activity is required for first time connection with the Bluetooth modem.

Figure 6-8: Connecting Datalogger with Laptop using Bluetooth Modem

Run the application software at PC/Laptop. Go to home screen and select the assigned virtual COM port and press connect Datalogger button to connect the Datalogger.

6.2.2   Connecting Data Logger with Mobile Phone using Bluetooth^{TM} Modem

Take a Bluetooth modem and plug it at 9-pin D-sub connector on RS-232 comms card of Datalogger as shown in Figure 6-9.

Turn ON the Bluetooth modem by pressing ON/OFF switch provided near modem's battery compartment. The power indicator of Bluetooth modem will glow in GREEN colour to ensure that Bluetooth modem is ON. Turn ON the Bluetooth of the Mobile Phone and search Bluetooth devices in the network. Once searching gets completed, a list of Bluetooth devices found is displayed. Find the Bluetooth modem's serial number in the list of devices found and click for pairing the Mobile Phone with the Bluetooth modem.
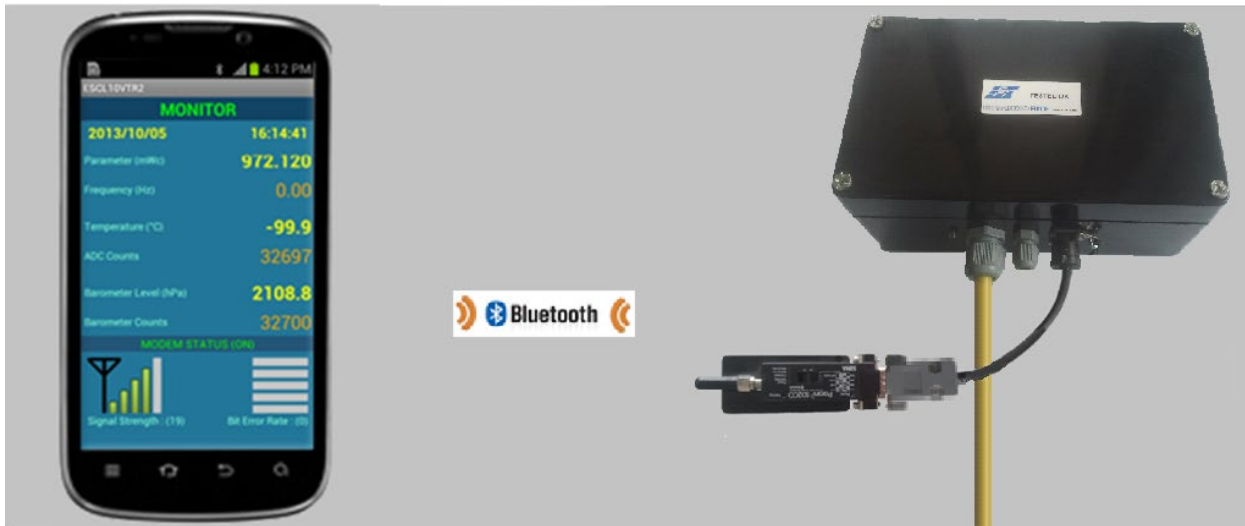

Figure 6-9: Connecting Datalogger with Mobile Phone using Bluetooth Modem

Once pairing button is pressed it will ask to enter passkey for authentication. Enter pairing code "**69836776**" and then press OK. On successful authentication it will show that device is paired. Now the Mobile Phone is paired with Bluetooth modem. This activity is required for first time connection with the Bluetooth modem.

Run the application software at Mobile Phone. Go to main menu screen and select the Bluetooth modem's serial number from device list. Device list can be viewed by pressing connection button from main menu screen. On selection, Datalogger will get connected to mobile phone automatically.

7   DATA LOGGER INTERFACE SOFTWARE

7.1   ESCL-10VT R4 Configuration Manager for Mobile Phone

The ESCL-10VT R4 single channel data logger system is using Mobile Phone as a Readout unit. Phone is running on Android operating system for providing powerful platform to manage applications efficiently. Readout has so many features like phone calls, SMS, MMS, GPRS/3G/4G, Wi-Fi, Bluetooth ™, USB and high resolution Camera. User can use Readout as mobile phone for making calls. Readout has GPRS/3G/4G which enables user to access internet from site to upload/download files and checking E-mails. Wireless Bluetooth can be used to send files to PC or any other Bluetooth device. High resolution camera can be helpful to take site conditions' photographs and send them to the back office by sending MMS. It has higher capacity external memory card of 8GB which can store lots of data. Data backup can be taken on regular basis by connecting phone with PC through USB cable.
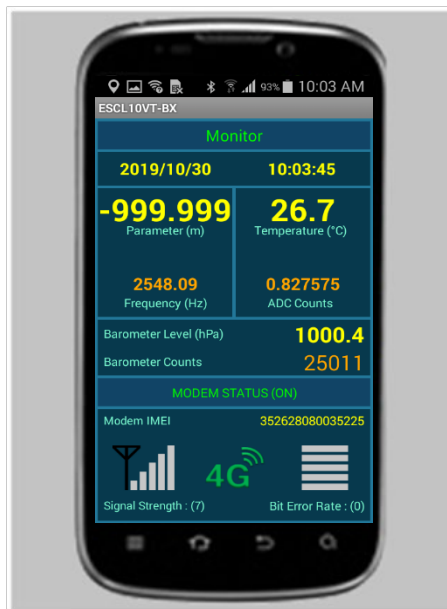

Figure 7-1 ESCL-10VT R4 Configuration Manager Application running on Phone

The ESCL10VT software running on phone can take sensor readings and store them into memory. The data logger can be configured through this software. ESCL10VT software has ability to show sensor reading logs in tabular/graphical format instantly after download reading is complete. CSV files are created automatically while saving downloaded data. These CSV files can be uploaded to remote server through GPRS/3G/4G/Wi-Fi.

Running ESCL-10VT application is very simple. It is as simple as playing games in mobile phone. The graphic user interface makes it users friendly and thus easy to operate.

7.2   ESCL-10VT R4 Configuration Manager for PC/Laptop

The application is configuration manager software for ESCL-10VT R4 Single Channel Data logger. The data logger can be configured through this software. It analyses the data files produced by the ESCL-10VT R4 Single Channel Data logger. The application displays raw data and parameter as per set monitor interval. By setting the log interval for scanning, the readings can be scanned which gets saved in the logger's non-volatile memory. After download, the application allows the user to analyse the readings obtained from the data logger in tabular and graphical form.
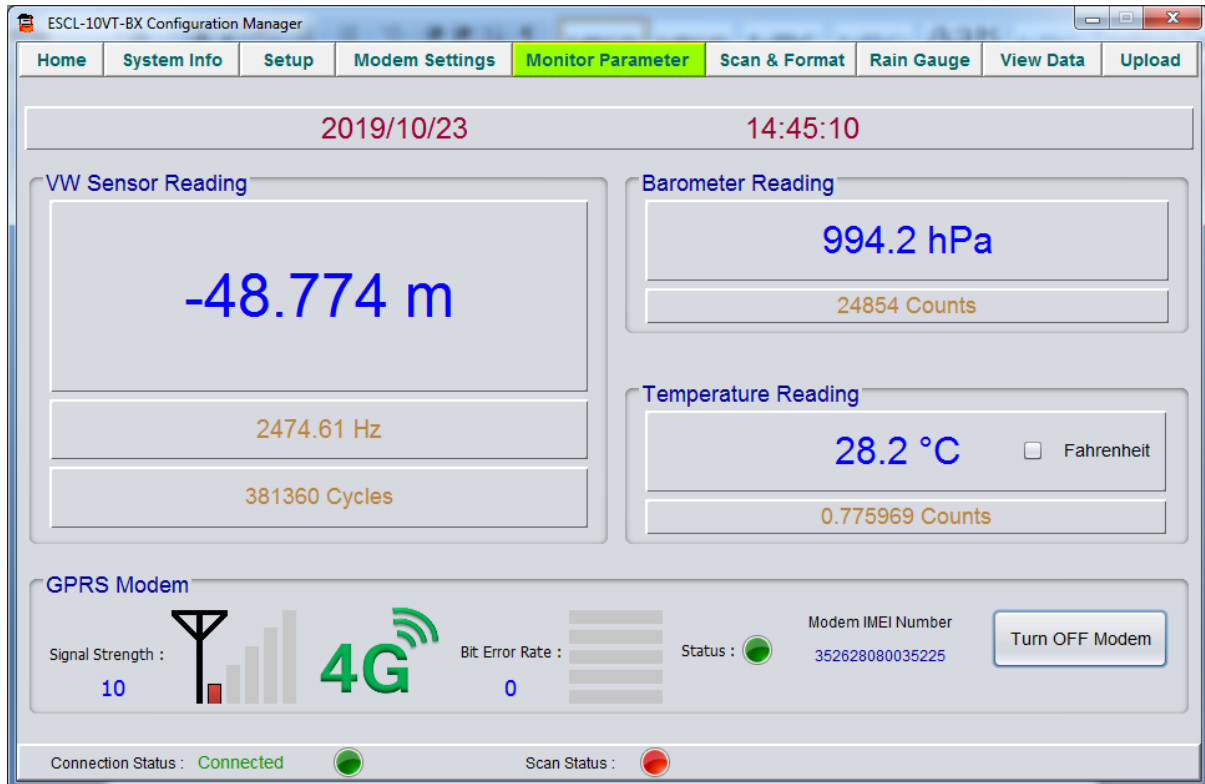
Figure 7-2 ESCL-10VT R4 Configuration Manager Application running on PC

The software is designed in a very user friendly manner which can be operated very easily for downloading of the data and analysing the readings. Even users with little experience with Geotechnical Instruments can connect, download data and change settings as and when required.

8   WEB BASED DATA MONITORING SERVICE (WDMS)

The data on variation of water level collected from a large number of boreholes need to be presented as time Vs water level graphs or as tables for visualization or further analysis. Also the data may be required by a number of people sitting at different geographical locations simultaneously.

Web Data Monitoring software provided by Encardio-rite aids in the above process. It looks at the collected data and makes them immediately available in the form of time vs level plots or in tabular form.

The user will have to maintain a desktop PC with an internet connection with static IP and running windows operating system and Microsoft IIS (*Internet Information Service*) server to run this software.

Authorized users from anywhere in the world can then login the website using the supplied user name and password and access the graphs and tables using any internet connected computer and a standard web browser like Microsoft Explorer, Google Chrome, Firefox etc. Figure 8-1 showing an example of Borehole data presented in graphical form.

Figure 8-1: Data display on remote PC

In case a user does not want to host his own server, Encardio-rite can provide this as a service at a low cost. This service is known as Web based Data Monitoring Service (WDMS) and is available to users throughout the world.

9   SETTING SENSOR'S GAUGE FACTOR

ESCL-10VT R4 single channel data logger has capability to calculate parameter values using a second order polynomial equation.

$Y = A_2X^2 + A_1X + A_0$

Where, Y is the parameter value in engineering units and X is some function of the sensor frequency output.

Different manufacturers specify the value of X in different units in their test/calibration certificates supplied along with the sensor.

Case 1 : 'X' specified in terms of frequency

If the manufacturer specifies X in terms of frequency, then choose the value of "X-parameter" in SETUP screen as "FREQUENCY" from the drop down box.

Enter the value of A_0, A_1 and A_2 as mentioned in the manufacturer's calibration certificate without any modification.

Case 2 : 'X' specified in terms of frequency^2 (i.e. frequency squared)

If the manufacturer specifies X in terms of frequency^2 (frequency squared), then choose the value of "X-parameter" in SETUP screen as "FREQUENCY SQUARED" from the drop down box.

Enter the value of A_0, A_1 and A_2 as mentioned in the manufacturer's calibration certificate without any modification.

Case 3 : 'X' specified in terms of digits

This is a legacy case. Many manufacturers specify the value of X in terms of "digits" as defined below

Digits = (frequency)^2 / 1000

In this case replace A_1 with the value A_1/ 1000 and A_2 with the value A_2/10,00,000 when entering these coefficients in the data logger. A_0 will remain the same.

Value of A_0

The value of A_0 is generally known as offset. It may be specified in the sensor's calibration/test certificate in which case it can be entered directly in the data logger without any modification.

However, it is more common to determine the value of A_0 at site just before or just after installation.

Enter the value of A_1 (and A_2 if required) and check the parameter value just before or after installation of the sensor (as the case may be) with zero input or reference input that should be considered as zero. Now reverse the sign of the observed parameter value and enter it in place of A_0.

Recheck the parameter value to ensure that it is now showing zero. If however, a non-zero value is required then add that non-zero value to the value of A_0 and check whether you can see that particular non-zero value with zero or reference input.

9.1   Installation Depth

Sensor installation depth is the location of VW sensor diaphragm from ground level.

Installation depth = - sensor location from ground level

Example: Installation depth = -10.5 for water level sensor mounted 10.5 meter below ground level.

10   OPERATION AND MAINTENANCE

Although the ESCL-10VT R4 automatic water level monitoring system is almost maintenance free system for long time monitoring, however it may require battery replacement.

10.1   Battery Replacement

1   Launch the configuration manager and connect the data logger.

2   Shut down the data logger from applications home screen and remove the USB to RS232 cable.

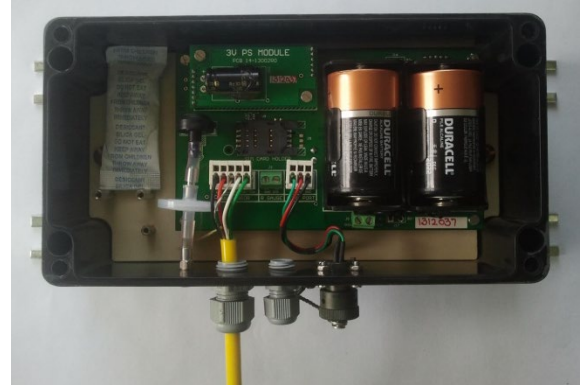3   Hold data logger in the position as shown in Figure 10-1(left). Open the top cover.

Figure 10-1: Battery replacement for Alkaline battery option

4   Replace batteries (Alkaline/Lithium) with the new one as shown in Figure 10-1(right) and close the top cover.

5   Connect the datalogger with PC/Laptop/Mobile.

6   Update the *battery installation date* using configuration manager software.

Figure 10-2: Battery replacement for Li battery option

11   TROUBLESHOOTING

11.1   Unable to connect Bluetooth

- Phone's or PC's Bluetooth may not be enabled.

- Bluetooth modem may not be turned ON.

- Bluetooth modem may be out of Bluetooth range from phone / PC.

- Bluetooth modem may not be paired with phone / PC.

- Bluetooth modem's battery may be discharged.

- Check Bluetooth modem baud rate settings. It must be configured for 9600 and hardware flow control should be OFF.

11.2   Unable to connect to the Data logger

- RS232 interface connector may be loose.

- Check the RS232 interface cable's connector for damage.

- RS232 interface cable may be broken.

- Data logger's battery may be discharged.

ENCARDIO RITE

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USERS' MANUAL

SINGLE CHANNEL DATALOGGER - CONFIGURATION MANAGER (For Android)

Single channel datalogger suitable for
Model EWLR-101 automatic water level and rainfall monitoring system

MODEL ESCL-10VT-R4

Doc. # WI 6002.141.2 R01 | Feb 2021

Contents

1   INTRODUCTION

The application is a configuration manager for ESCL-10VTR3 and ESCL-10VTR4 Automatic Water Level Recorders. The data logger can be configured through this software. It analyzes the data files produced by the ESCL-10VTR3 / ESCL-10VTR4. The application displays raw data and parameter as per set monitor interval. By setting the log interval for scanning, the readings can be scanned which gets saved in the logger's non-volatile memory. After download, the application allows the user to analyze the readings obtained from the data logger in tabular and graphical form.

1.1   Overview

The software is designed in a very user friendly manner which can be operated very easily for downloading of the data and analyzing the readings. Even users with little experience with Geotechnical Instruments can connect, download data and change settings as and when required.

1.1   Operating Principle

ESCL-10VT, Automatic water level recorder is designed to monitor water level using a single vibrating wire pressure sensor. Data logger can store calibration coefficients, x-parameter, units of measurement, specific gravity, sensor installation depth etc. Data can be stored in engineering units. Each reading is stamped with date and time at which the measurement was taken. It has non-volatile flash memory to store up to 599K records.

These data files can be downloaded to PC using Configuration Manager by connecting logger with data cable or Bluetooth. The downloaded readings get stored in the PC's Home Directory in CSV format. The files can be transferred to FTP server using internet connection. It can be processed on any common available spreadsheet like Microsoft-Excel.

ESCL-10VT with built in 2G/3G/4G modem has capability to upload data records directly to remote FTP server. Upload schedule can be set in Data logger using this software for automatic data upload to FTP server. Schedule can be set as fast as 5 minutes.

1.2   Introduction about the Manual

1.2.1   Purpose of this document

The purpose of this document is to show the entire functionality of the application for the device ESCL-10VTR3 and ESCL-10VTR4. Please refer to *Introduction* section to know about the application.

This document serves as a help guide by showing the workflow of the entire processes. The document guides its user by providing a clear idea about how things have to be done in the application. All efforts have been made to clarify each and every step.

1.2.2   What the manual contains

The document is designed to provide step-by-step guidance using actual screenshots from the application.

1.2.3   How to use the manual

The document is intended to guide the user in a step-by-step manner starting from installing the application, accessing the application, analyzing the readings, viewing and manipulating the plots. The screenshot guides to complete the task.

NOTE: Although the best effort has been made to ensure the completeness and accuracy of the information provided in this document, Encardio Rite instruments reserves right to change the information at any time and has no liability for accuracy.

1.2.4   List of Abbreviations

APN	Access Point Name
CSV	Comma Separated Values
EWLR-101	Automatic Water Level Monitoring System
FTP	File Transfer Protocol
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
MSL	Mean Sea Level
PC	Personal Computer
SIM	Subscriber Identity Module
URL	Uniform Resource Locator
USB	Universal Serial Bus
UTC	Coordinated Universal Time
VW	Vibrating Wire
WDMS	Web based Data Monitoring Service

2   GETTING STARTED

2.1   System Configuration

The application runs on Android Smartphone. The mobile specifications are:

- o   Mobile OS   -   Android version 2.2 or above
- o   RAM   -   512MB (Recommended 1GB).
- o   External memory   -   2 GB or above
- o   Display size   -   480x800, 720x1280, 1080x1920 pixels
- o   Display Type   -   Touch screen
- o   CPU   -   1 GHz.
- o   Blue tooth   -   Version 3.0 with A2DP

2.2   Application Installation

It is strongly recommended to exit all programs before installation. Follow the steps below for installing the application for the first time.

Note   Please make sure that option for *Unknown sources* (*allow installation of non-Market apps)* in Setting-> Security must be checked.

- ▪   Copy the "ESCL-10VT-BX.apk" into the mobile via Bluetooth or USB cable.
- ▪   Go to copied location in tap on ESCL-10VT-BX.apk. Then tap on install refer fig 2.1 and 2.2.
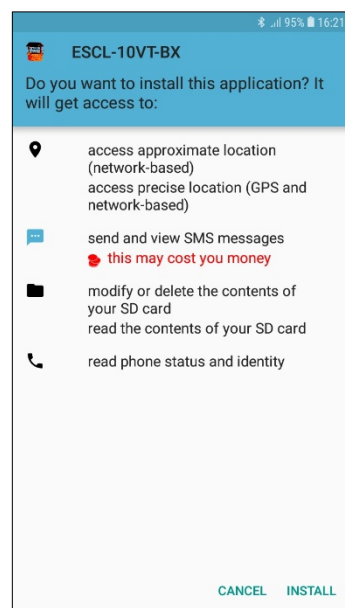
Fig 2-1: Installation   Fig 2-2: Installation
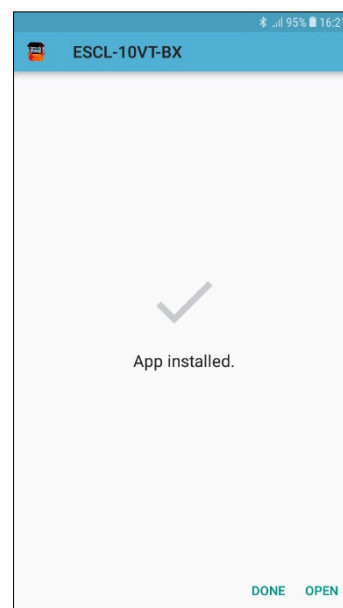
After installing press *DONE* or application can be opened directly by pressing *OPEN.* User can open the application through application launcher also. *See Fig 2-3.*
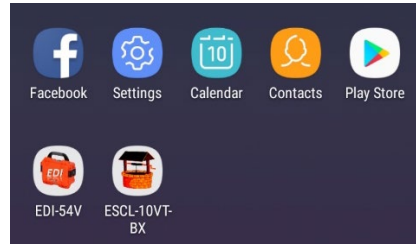
Fig 2-3 Application launcher

2.3   Connecting Data Logger with Android mobile

It has already been briefed that the data logger's reading can be monitored using the application. To do so, the data logger should be connected with the mobile and the application should be installed. The data logger can be connected with mobile by using Bluetooth. Plug Bluetooth modem at 9 pins D-sub connector of the Data Logger. Make sure that modem must be configured for 115200 baud rate and hardware flow must be OFF. Verify DIP switch settings with following *Fig 2-4*.
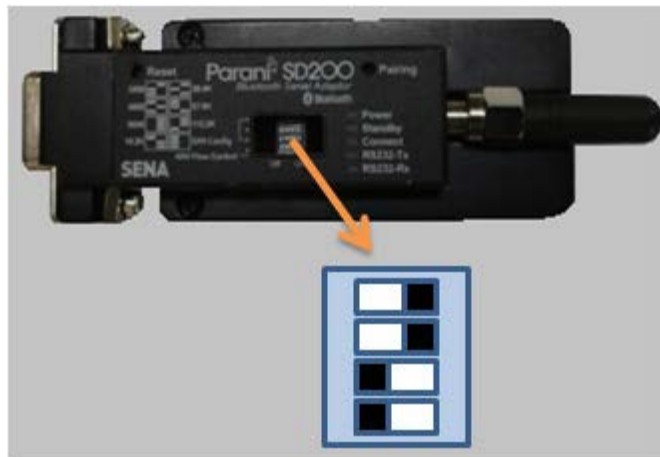
Figure 2-4: Bluetooth modem DIP switch settings

Turn-on the Bluetooth modem by pressing ON/OFF switch located near modem's battery compartment. The power indicator of Bluetooth modem will glow in GREEN color to ensure that Bluetooth modem is ON.

Turn ON the Bluetooth of the mobile and search Bluetooth devices in the network. Once searching gets completed, a list of Bluetooth devices found is displayed. Find the Bluetooth modem's serial number in the list of devices found and click for pairing the mobile with the Bluetooth modem.

Figure 2-5: Connecting data logger using Bluetooth

Once pairing button is pressed it will ask to enter passkey for authentication. Enter pairing code "**69836776**" and then press OK. On successful authentication it will show that device is paired. Now the Android mobile is paired with Bluetooth modem. This activity is required for first time connection with the Bluetooth modem.

2.4   Running the Application

Start the Application by a single tap on the icon ESCL-10VT-BX from mobile screen to run the application.
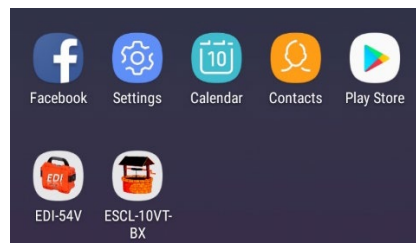
Fig 2-6: Application launcher

2.5   Viewing the Main Screen

Entering the application, the main screen of the application appears as displayed in *Fig 2-7*.
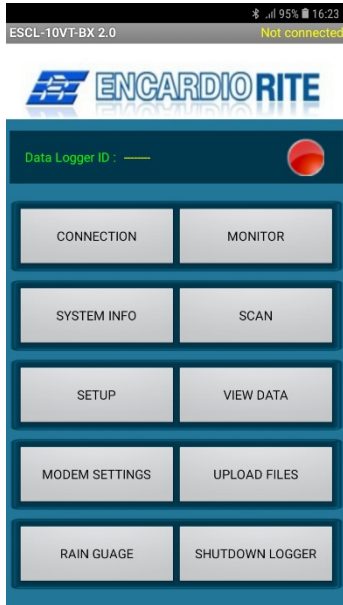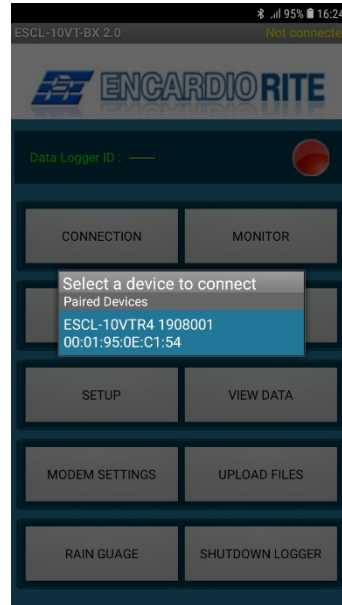
Fig 2-7: Home Screen   **Fig 2-8: Device list**   **Fig 2-9 Device connectivity**
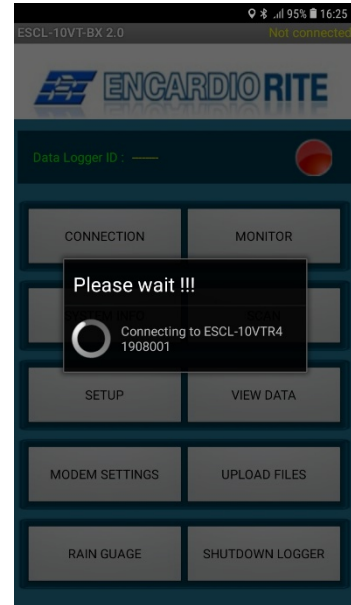
2.6   Connecting with Data Logger

Application will start establishing connection if only one Bluetooth Module is paired, otherwise it shows list of paired connection. *See Fig 2-8.* Data logger can be connected using *Connection* button from *Home screen.* Tap on Bluetooth Module name to connect data Logger. The progress bar appears on the screen as the application takes few seconds to get connected. *See Fig 2-9.* After successful connection, application checks data logger's battery health. Application displays alert message if battery voltage found low. *See Fig 2-10.*

Application asks to enter Battery installation date if battery found replaced/re-installed. Choose battery installation date from calendar and then press OK. Press Cancel button if you are not sure about battery installation date. In this case application will ask for battery installation date next time when connecting to data logger. *See Fig 2-11.*
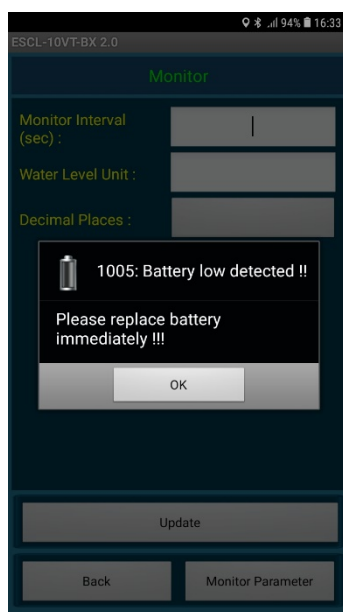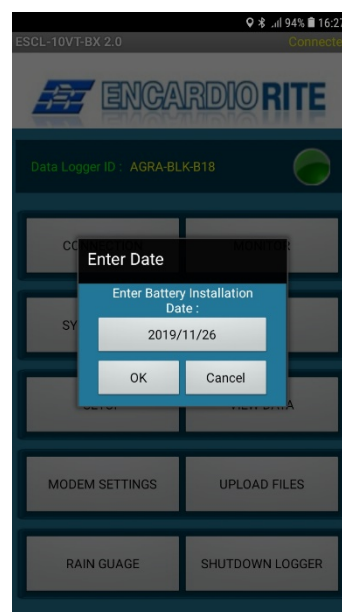

Fig 2-10: Battery Low   **Fig 2-11: Set Date**

3   HOME

Fig 3-1 shows an example of Home screen after successful connection with data logger. Data logger connection status indicator becomes *GREEN* from *RED*. Connected Data logger *ID* can be seen on home screen. Various functions can be performed through home screen. System information can be seen by pressing *System Info* button. Data logger settings can be configured using *Setup* button. GPRS modem can be configured using *Modem Settings* button. Sensor live readings and GPRS modem signal strength can be monitored using *Monitor* button. Logger scanning and data download activities can be performed using *Scan* button. Downloaded files can be viewed in tabular or graphical form by pressing *view data* button. Downloaded files can be uploaded to remote FTP server using *Upload files* button. User can go to *help* screen for viewing help topics for troubleshooting. Connected data logger can be shut down by pressing *shut down Datalogger* button. Datalogger preserves the records and configurations into its non-volatile memory while shutting down. Datalogger goes into deep sleep mode and becomes idle after shut down.
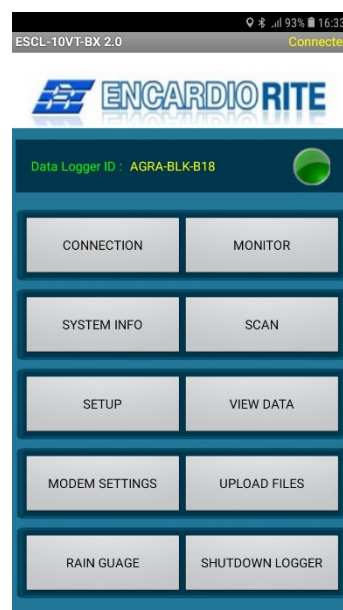

Fig 3-1: Home screen

WARNING: Always SHUTDOWN Data logger before removing battery from the Data logger. Data may be lost otherwise.

4   SYSTEM INFORMATION

After pressing s*ystem info* button from Home screen, application displays system info screen. Application fetches information from Datalogger to display on the screen.

Datalogger related information can be viewed using *Logger Information* button. Sensor related information can be viewed using *Sensor Information* button. Scan related information can be viewed using *Sampling Information* button. Bluetooth related information can be viewed using *Bluetooth Information* button. Similarly, Phone related information can be viewed using *Phone Information* button.

| (a) | (b | (c) |

Fig 4-1: System info.

5   SETUP

Data logger settings can be configured using *Setup* screen which can be opened on pressing *SETUP* button from Home screen.
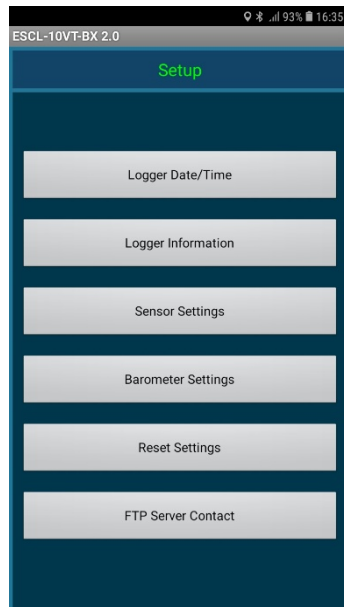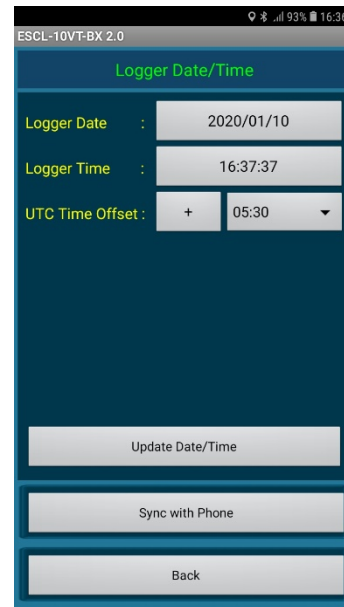

Fig 5-1: Set Up.   Fig 5-2: Logger Date/Time.

5.1   Logger Date/Time

Data logger's date/time can be set using *Logger date/time* screen. Choose the date, set the time and UTC offset and then press *Update date/time* button to update logger's clock manually. User can opt for second option that is press *Sync with mobile* button. Data logger's calendar and clock will set to Mobile's date/time. *See Fig 5-2*.

5.2   Logger Information

Data logger's ID or station ID can be entered under *data logger's ID*. Data logger's installation location coordinates (latitude and longitude) can be entered under *location* fields. Data logger's installation location above MSL (mean sea level) can be entered under *Top elevation*. Data logger has capability to store readings by averaging of reading samples. User can set samples for averaging ranging from 2 to 250. Keep samples for averaging to 1 if averaging not needed. *See Fig 5-3*.

5.3   Sensor Setting

Sensor related settings can be set through *Sensor* screen. *See Fig 5-4.* Enter sensor *serial number*, *model* and *measuring range* of Piezometer. Specific gravity of water must be entered under *specific gravity* field. Specific gravity of 1.0 (the specific gravity of pure water at 4°C) is adequate for many ground water applications. Sensor installation depth (from ground level) in meters must be entered under *installation depth* field. Keep *x-parameter* to *frequency squared* for Piezometer. Enter Piezometer sensor coefficients A0, A1 and A2. Refer section 13 to know more about sensor coefficients.
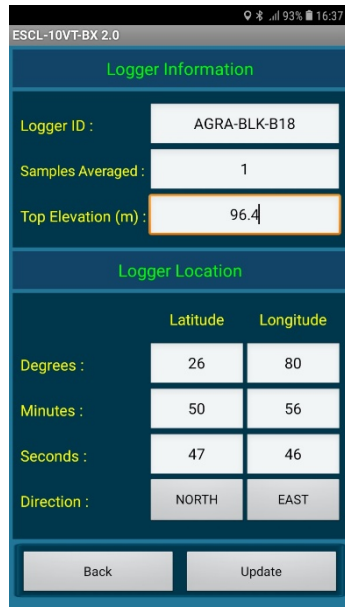
Fig 5-3: Logger info.

Fig 5-4: Sensor setting.

5.4   Barometer Setting

Data logger with built in barometric sensor can measure barometric pressure to apply barometric correction in measured value from absolute pressure sensor to eliminate effect of barometric pressure. User can choose option to enable/disable barometric correction. Barometric sensors coefficients are programmed from factory during calibration. See Fig 5-4.

5.5   Reset Data Logger

Data logger can be reset to Factory defaults using 'Reset Settings' button. Pressing on Reset settings button will show a warning message. Press NO option to abort the reset or press YES to continue.

Pressing 'Yes', the application will prompt for a password. Type password "**4TfZ9q7X**" and press OK to reset data logger settings. Kindly remember that on pressing 'Yes', all previous values will be erased and factory settings will be restored. See Fig 5-6.
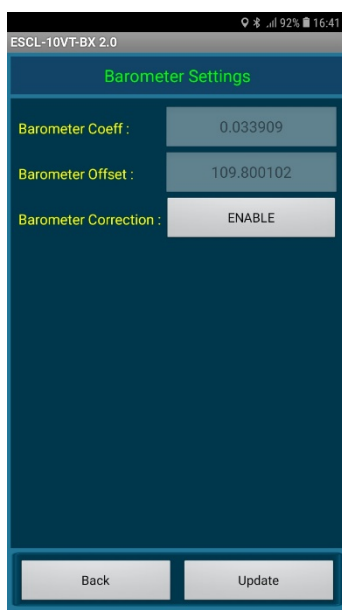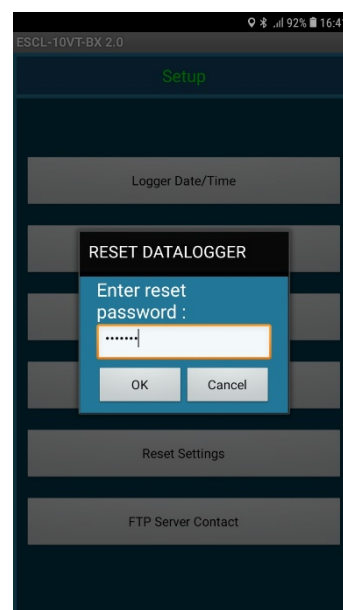

Fig 5-5: Barometer Setting

Fig 5-6: Reset Data Logger

WARNING: Reset settings will erase all custom settings and data logger will be set to factory defaults.

Reset settings will erase all custom settings and data logger will be set to factory defaults.

6   MODEM SETTINGS

Data loggers with built-in 2G/3G/4G modem have capability to upload logger records to remote FTP server through mobile network. For using this feature, a GPRS enabled SIM card must be inserted into SIM card socket of data logger.

Pressing on Modem Settings button from the menu will open Modem settings screen. Fig 6-1 is showing an example of modem settings screen. Modem settings screen is disabled for data loggers which don't have built-in 3G/4G modem.
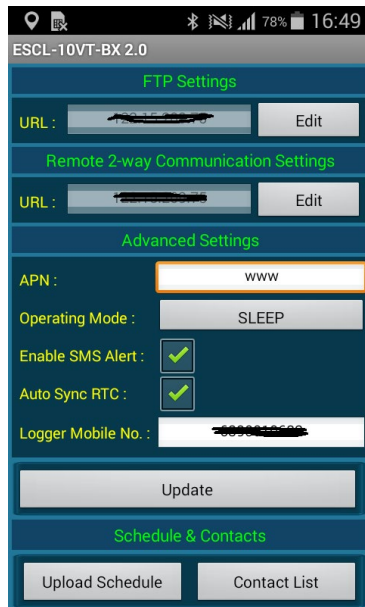
Fig 6-1: Modem Setting   **Fig 6-2: Configure FTP**
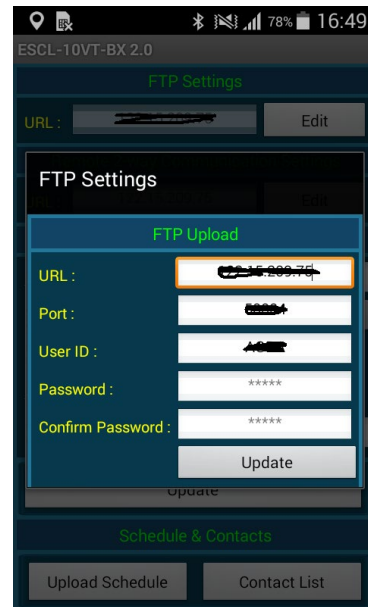
Enter Network service providers *APN* for GPRS enabled SIM. GPRS modem operating mode can be configured in either of two modes OFF or sleep. Modem operating mode can be set to *OFF* where mobile network is not available or automatic upload is not required. In this mode, modem always remains OFF. This option is opt to extend battery backup.

Modem operating mode can be set to '*Sleep'* mode. In this mode, modem normally remains in OFF state and wake when scheduled upload time occurs. It will upload the data to remote FTP server and then goes into OFF state. This option is opt to improve battery backup.

Data logger files can be uploaded to FTP server automatically by providing FTP server authentication and upload time schedule.

Auto sync RTC feature is given to sync Datalogger clock with network provided time every time while uploading data to server.

6.1   Configure FTP

Press *update* button from *FTP settings* panel to set FTP server credentials. A pop up dialog will open as shown in Fig 6-2. Enter FTP server URL, port number, user and password. Press *Update* button to update FTP server settings to data logger. Once FTP server settings are configured, data logger automatically sends logger records to remote FTP server when upload time occurs.

Datalogger ESCL-10VTR4 settings can be set from remote server using Remote Configuration Manager Application on server. Same FTP credential can be used for remote 2-way communication as well as data upload. Different FTP credential on same server can be used for remote 2-way communication or a

different server can be used for remote 2-way communication. But it is recommended to use different credential/server for remote 2-way communication.

6.2   Upload Schedule

Press upload schedule button from schedule & contacts panel to set the upload schedule. Upload schedule can be set through Upload Time panel. User has option to set upload schedule in local time or UTC time.

Once FTP server settings configured data logger automatically sends logger records to remote FTP server when upload time occurs. Upload schedule can be set through Upload Time panel. Upload time can be set as fast as 5 minutes. Upload interval can be set ranging from 5 minutes to 7 days. Press Update button to update schedule.

A successful FTP upload depends upon mobile network. It has been observed that data unable to upload to FTP server sometimes due to mobile network problem. User can enable upload retry option to attempt two retries at 1 hour interval each when a scheduled upload fails to upload for any reason.
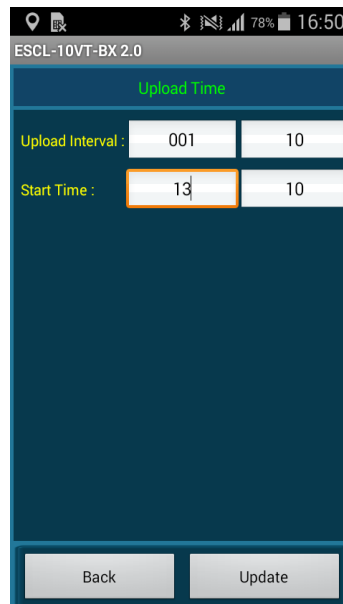
Fig 6-2 Upload schedule

6.3   Contact List

Data logger can send SMS alerts to some contact numbers if battery voltage goes low or water level crossed alarm limit. These contact numbers can be entered into contact list. Maximum 8 contact numbers can be stored in Data logger's memory. SMS facility must be available in SIM card to avail this feature. Tick in check box under *GPRS settings* panel to enable SMS alert feature.

Fig 6-3: Contact List

It is recommended that do not communicate with the Datalogger if upload process is in progress otherwise GPRS link to remote server may get broken. GPRS upload time depends upon the record size being uploaded.

7   MONITOR PARAMETER

User can monitor sensor's live data through *Monitor parameter* screen. Tap on *Monitor* button from Home screen will open *Monitor* screen. A dialog will ask to *Turn On modem* if the modem is turned off. This dialog will not appear if GPRS modem is already turned ON or GPRS modem not available in the data logger. Press *Yes* to turn ON the modem.

Readings refresh rate can be set under *monitor interval* field. Monitor interval can be set from 2 seconds to 255 seconds. Parameter unit can be set under *parameter unit* field. Decimal digits for parameter reading can be set under *Decimal places* field. Press *Update* button to update the fields. See Fig 7-1 (a) & (b)
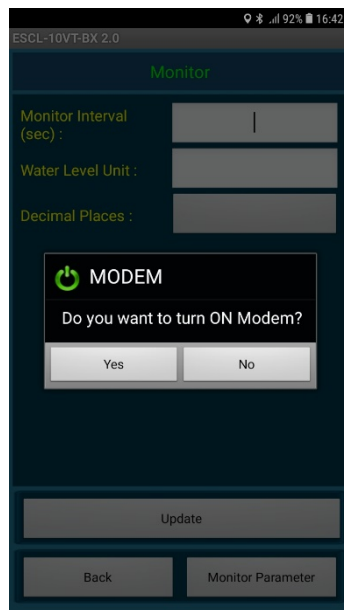
Fig 7-1 (a) Modem Turn ON   **Fig 7-1 (b) Monitor Set up**
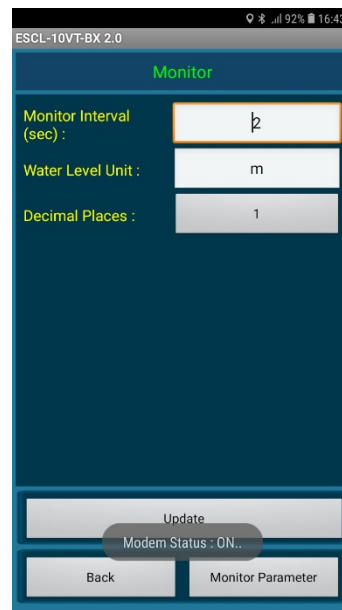
Press *Monitor Parameter* button to open the monitor parameter screen. Fig 7-2(a) is showing an example of *monitor parameter* screen. Datalogger current date/time is showing under *Monitor* panel. Reading under parameter is showing current water level with respect to ground level in mWC. The corresponding Piezometer sensor frequency and cycle counts are also displaying for diagnostic purpose.

The *Temperature Reading* panel shows water temperature and digital counts. ADC Counts are given for diagnostic purpose only. Temperature reading shows -99.9 in error conditions like sensor reading out of range or sensor not connected.

The *Barometer Reading* panel shows barometric pressure in *hPa* (hecto Pascal) and digital counts. Barometer Counts are given for diagnostic purpose only.

The Modem panel shows 2G/3G/4G modem status for diagnostic. GSM signal strength and bit error rate can be monitored. Signal strength should be greater than 11 (out of 31) to ensure successful FTP upload. External antenna is recommended where signal strength is below 12. Bit error rate less than 2 is good for error free communication. See Fig 7-2 (a)
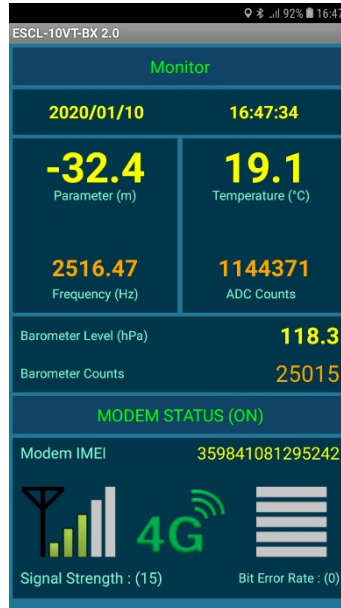
Fig 7-2(a) Monitor Parameter screen

8   SCAN

Data logging schedule and alarms can be set through scan screen. Data logger records can also be downloaded or erased through this screen. Tap on Scan button from Home screen opens Scan screen. See Fig 8-1.

Scan option panel showing scan related information. Log interval can be set in either of two modes short or long. For fast scanning, select short option. In this option scan interval can be set from 5 sec to 250 seconds. For slow scanning, select long option. In this option scan interval can be set from 5 minutes to 7 days (i.e. 168 hrs). Once log interval is set, data logger scanning can be started. Data logger will start scanning from *next scan start time*.

NOTE: Scan Interval will be 1:00:00 and it can't be edited if Rain Gauge option is enabled from factory. It is set for hourly recording of Rain Fall.

Though data logger memory is very large with respect to record size, memory can get full if scan interval is very fast and memory not erased since a long time. What to do if memory gets full? There are two options. Choose memory full action either stop or overwrite. Scanning will get stopped in case of data logger memory full if STOP option is selected. In this case the readings will not be recorded further once the memory is full. The other option is to overwrite if the memory becomes full, the readings will be recorded but it will overwrite from oldest record in a cyclic manner.
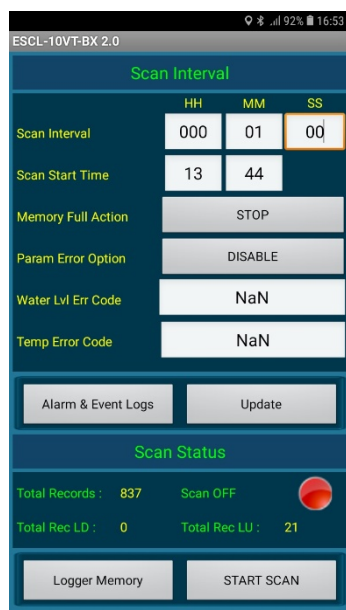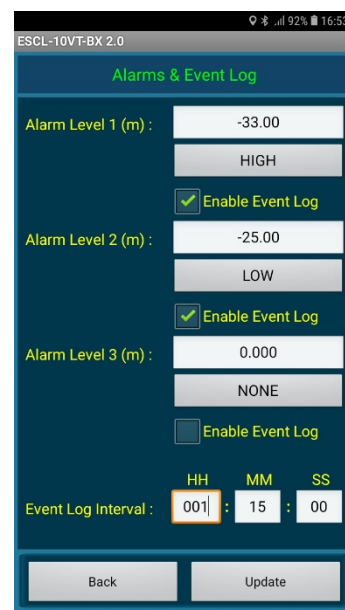
Fig 8-1 Scan Screen	Fig 8-2 Alarms & event

It has been observed that in case of over range or faulty sensor many data logger shows very large quantities or garbage values. It is very difficult for user or viewer software to identify those values. An error code of -999.999m for water level and -99.99 degC for water temperature will be reported in data records if sensor reads values beyond its operating range for any reason. To enable user defined Error code enter the error code value for water level and temperature and then select Parameter Error code option Enable from drop down menu.

Scan status panel showing total number of records stored in data logger's memory. Data logger scanning can be started by pressing START button once. Pressing the start button starts the scanning and scan status becomes ON. Status indicator becomes GREEN. While scanning, the Start button becomes Stop. During scanning, the data logger scans sensor at specified log interval and the sensor readings gets stored in data logger's memory.

Data logger scanning can be stopped by pressing Stop button once. Pressing on *stop* button stops the scanning and scan status becomes OFF. Status indicator becomes RED. *Stop* button becomes *start* again.

8.1   Alarm & Event log

Many times we require an alert when an alarm condition occurs. We can set alarms limits for SMS alerts. Tap on *Alarm & Event Log* button. Enter water levels at which alerts are required. Choose Up, Down or None option. *Up* option means alarm condition occurs when water level goes up with the limit specified. *Down* option means alarm condition occurs when water level goes below the limit specified. *None* option can be selected to disable the alarm. *See Fig 8-2.*

Sometimes we need to do fast logging when an alarm condition occurs. To do so there is a provision in software to *enable event log*. On enabling event log data logger do fast scanning while an alarm condition remains and does normal scanning if alarm condition passed.

8.2   Download Data

Readings (data) can be downloaded from data logger's memory using *Logger Memory* button. On tap on this button, application opens *Logger memory* screen that contains information about headers of Download data. Downloaded data are stored in CSV (comma separated values) file. Data may contain header information if CSV header is enabled from *CSV header option* panel. Some Header fields are locked for editing rest is editable. User can modify editable fields. Press *Update* button to update header information. *See Fig 8-3.*
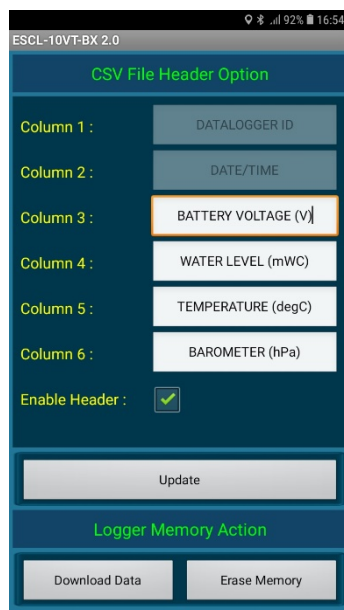

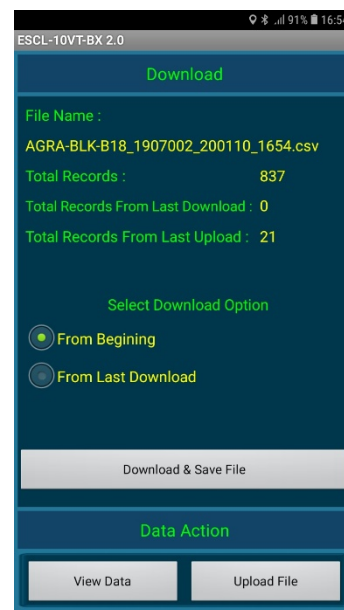Fig 8-3 CSV File headers   Fig 8-4 Download File

To continue for download data tap on Download Data button. A screen opens which contains information about number of records and file name which is going to download. "Total Records" showing total number of records stored in Datalogger's memory since last erase. "Records from last download" showing total number of records reaming into Datalogger's memory since last download while "Records from last upload" showing total number of records reaming into Datalogger's memory since last upload. Data logger scanning can be started by pressing START button once. Tap on Download & Save File button to download the CSV file. Data download time depends on records size of data logger's memory. See Fig 8-4. A progress bar appears to display the download progress. See Fig 8-5. Data gets successfully downloaded on completion of this progress bar.
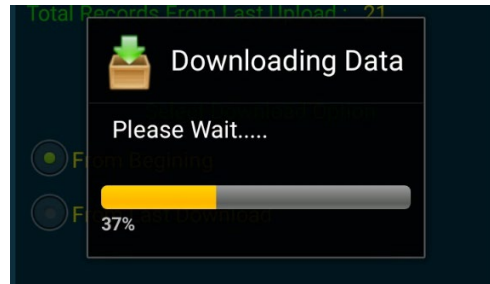
Fig 8-5 Download progress

Another dialog asks to erase data logger memory after download. Press NO option to abort the deletion or press yes to confirm deletion.

Figure 8-6: Erasing data logger memory

8.3   Erase Memory

Erase the data logger's records by pressing *Erase Memory* button in Logger memory screen. It will erase all previous readings and the *No. of Records* would become zero (Kindly note that this activity is exactly same to what has been explained in the context of Figure 8-6). Pressing '*Yes*'; data logger's memory will be erased which will not affect other settings.

9 RAIN GAUGE

Encardio-rite model ERG-200 rain gauge with a proven tipping bucket mechanism provides a cost effective reliable method for measuring and recording rainfall. It is easy to use, durable and precision automated to provide long term, trouble free operation with a minimum of maintenance. It is corrosion resistant having a stainless steel outer housing. It is designed for many years of trouble free operation.

Inside each rain gage is a balanced tipping bucket mechanism with a magnet and switch assembly. Collection of rain is through a 200 mm diameter catchment through a debris filtering screen. A funnel inside the rain gage feeds collected rain water into one of the two buckets. As soon as the preset amount of water has been collected in the bucket, it tips the other way, automatically emptying the water and positioning the other bucket for collecting rainfall. The measured water exits through drain tubes provided at the base of the rain gage. The tipping bucket mechanism activates a sealed magnet sensitive switch that produces a contact closure for each 0.2 mm of rainfall. Two adjustable screws provide calibration of buckets by changing position of the bucket stop point.

High vertical sidewalls of the model ERG-200 prevent splash-out of rain from the catchment thus resulting in better accuracy. Each rain gage is individually calibrated for optimum accuracy. Three adjustable legs allow the rain gauge to be fastened permanently onto a platform or deck using standard fasteners.

Figure 9-1: ERG 200 Rain Gauge

Clicking Rain Gauge button from main menu opens the Rain Gauge screen. Figure 9-2 shows an example of Rain Gauge screen. This screen is used to view the live status of Rain Fall.

Hourly Rain Fall, Daily Rain Fall and Rain Fall rate can be seen under Rain Fall panel. Hourly Rain Fall shows amount of rain fall status at current hour. Daily Rain Fall shows current status of total rain fall amount since 00:00:00 Hrs.
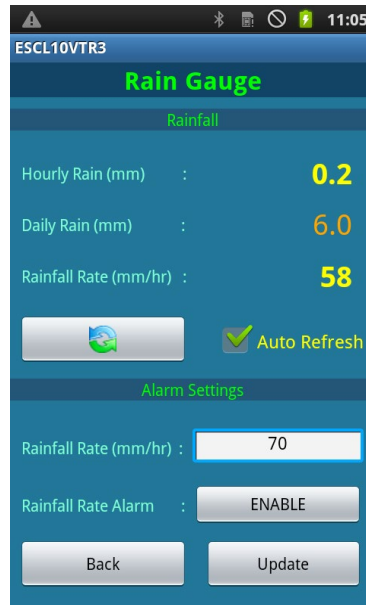
Figure 9-2: Rain Gauge Screen

Rain Fall Rate shows current status of Rain Fall Rate. Rain Fall rate is calculated by the Datalogger at every 5 minutes. Refresh button can be pressed to get the current status or Auto Refresh option can be selected for automatic refresh of the screen in every 5 minutes.

Alarm can be generated if Rain Fall Rate exceeds the specified limit. When Rain Fall rate exceeds the specified limit, Datalogger will automatically sends Heavy Rain Fall SMS to the mobile numbers listed at "Modem settings" screen.

10   VIEW DATA

This screen allows the user to view data logger's reading and interpret the data in tabular and graphical form. Select the file through the drop down menu. On selecting file, readings automatically get updated in table.

10.1   View Table

In the given example, the file WARLORD-01_1312004_131212_1415.csv is selected for interpretation. The readings are displayed in the Fig 10-1. Data in table represents date/time stamp of reading, Parameter value, Sensor Temperature, Data logger's Battery Voltage Hourly Rain Fall and Daily Rain fall.
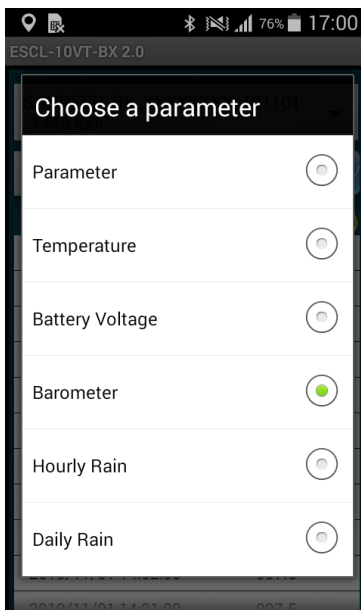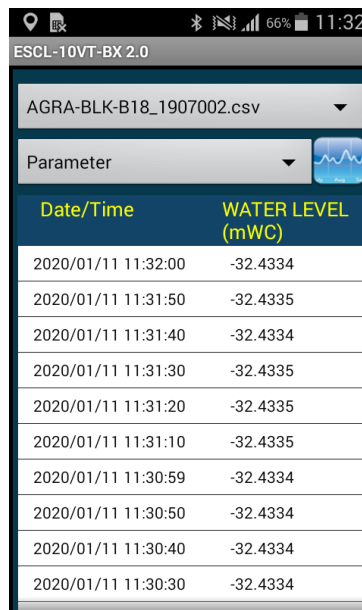
| **Fig 10-1(a)** | **Fig 10-1(b)** | **Fig 10-1(c)** |

10.2 View Graph

Press on graph icon from table view to see the selected file data in graphical form. Pressing on Graph icon from table view, opens data range selection screen. See Fig 10-2.

Data range shows the records date/time range of selected file. Select X-axis range using calendar and time icon for which you want to view on graph.
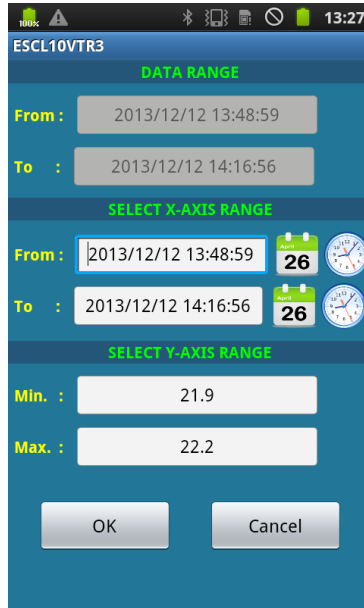
Fig 10-2 Data Range Selection screen

Select Y-axis range and then press OK button to open the graph screen. Fig 10-3 & Fig 10-4 are showing an example of graph screens. Graph customization can be done like zoom-in, zoom-out or pan through icons on right bottom corner of the screen.
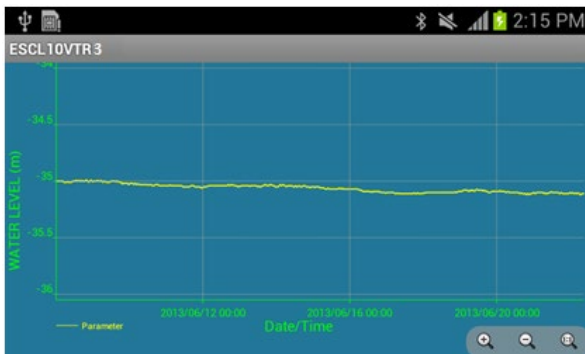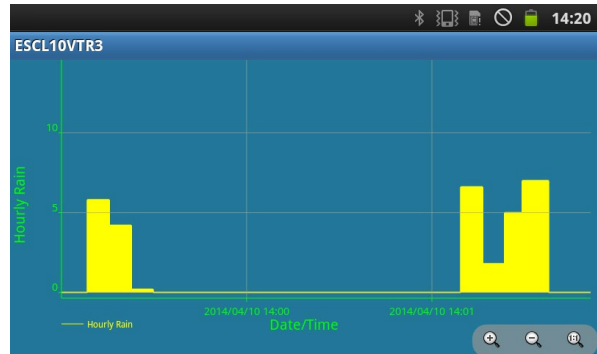

Fig 10-3 Water Level Vs Time

Fig 10-4 Hourly Rain Fall Vs Time

11   UPLOAD

The upload feature allows the user to upload the *downloaded data* to the FTP server from anywhere using the internet connection. Phone must have internet connectivity for using this feature. Pressing the *Upload* button in the Home screen, the upload screen appears with the list of data logger files which are downloaded from data loggers.

Figure 11-1: Upload files	Fig 11-2 URL setting

Press on *Reset URL* button to enter the FTP credentials like URL, port, user and password. See Fig 11-2. Type FTP server URL address. Provide port number of the FTP server. Enter user name and password for authentication. After providing all credentials press on *save* button to update URL settings. Make sure that the mobile has internet access. Once *update* button is pressed, application will try to connect to the server. URL setting will be updated on successful connection to the server. URL settings will be restored to old one in case of connection failure.

Select the data logger file which are to be uploaded. Files can be selected by ticking on check boxes. In the given example, two files are selected to be uploaded. Pressing on *upload* button will start uploading selected files to the FTP server. After successful upload, an information message pops up on the screen confirming successful file upload.

12 HELP

Pressing *Help* button from Home screen will open help screen. Help feature is very useful for user while troubleshooting. Help contents are as follows:

12.1 Establishing Bluetooth connection

- Check that mobile phone's Bluetooth function is enabled.

- Check that Bluetooth modem dongle is connected to data logger and is turned ON.

- Check if distance between data logger and mobile phone is within Bluetooth range (less than 5 meters).

- Check if data logger's Bluetooth modem is properly paired with mobile phone.

- Check that Bluetooth modem's battery is not discharged.

- Check if data logger's Bluetooth modem is configured correctly. Baud rate should be 115200 and hardware flow control should be OFF.

- Turn OFF the Bluetooth modem then turn it ON after a few seconds. Reconnect mobile phone to data logger.

- Reset data logger by shorting RST jumper once using tweezers near data logger's serial port connector.

12.2 Bluetooth connection Failure

- Phone's Bluetooth may not be 'Enabled'.

- Bluetooth modem may not be properly inserted into Data logger socket.

- Bluetooth modem may not be paired with phone.

- Bluetooth modem may be out of Bluetooth range from Phone.

- Bluetooth modem's battery may be discharged.

- Data logger battery may be discharged.

12.3 System Information

- Data logger Info. , Sensor information, Sampling, Battery, Bluetooth modem Phone information can be seen on 'System Information' screen.

12.4 Monitor Data

- Data can be monitored from 'Monitor Parameter' menu.

- This feature is mostly used for diagnostic purpose.

- Parameters can be monitored from 'Monitor Parameter' menu.

- This feature is used to check sensor data or connectivity.

- Monitor log interval can be set by editing monitor interval from 'monitor' screen.

12.5 Scanning

- Data logger scanning can be started or stopped using 'Scan' screen.

- Logging interval can be set using 'Scan' screen.

- Data logger memory full action can be set.

▪   Data logger storage memory can be erased.

12.6   Downloading logged data

▪   Logged data can be downloaded into phone using 'Download Data' option from

Scan screen-->Logger memory option-->Download Data.

▪   Press 'Download & Save' button from 'Download' screen to download and save logged data into phone's memory.

▪   Downloaded data are saved in CSV format at 'ESCL10VTR4 Files' folder on SD card.

12.7   Viewing Downloaded Data

▪   Downloaded logged data can be viewed by pressing 'View Data' button from Home screen or from download.

▪   Select file and choose parameter to view logged data at 'View Data' screen.

12.8   Uploading files

▪   Data logger files can be uploaded to remote folder on FTP server using 'Upload Files' menu option.

▪   Type URL settings carefully while resetting the URL settings.

12.9   Files not uploading on FTP server

▪   Check if internet connection is available and working properly.

▪   Check whether URL and port settings are correctly configured.

▪   Check 3G/4G signal strength on 'monitor parameter' screen.

▪   Check Battery voltage and health on 'system info' screen.

▪   Check if GPRS service is not deactivated by SIM card service provider for any reason.

12.10 Files storage on SD card

▪   Downloaded data are saved in CSV format at ESCL10VTR4 Files' folder on SD card.

13 SETTING SENSOR'S GAUGE FACTOR

ESCL-10VT single channel data logger has capability to calculate parameter values using a second order polynomial equation.

$Y = A_2X^2 + A_1X + A_0$

Where, Y is the parameter value in engineering units and X is some function of the sensor frequency output.

Different manufacturers specify the value of X in different units in their test/calibration certificates supplied along with the sensor.

Case 1: 'X' specified in terms of frequency

If the manufacturer specifies X in terms of frequency, then choose the value of "X-parameter" in SETUP screen as "FREQUENCY" from the drop down box.

Enter the value of A_0, A_1 and A_2 as mentioned in the manufacturer's calibration certificate without any modification.

Case 2: 'X' specified in terms of frequency^2 (i.e. frequency squared)

If the manufacturer specifies X in terms of frequency^2 (frequency squared), then choose the value of "X-parameter" in SETUP screen as "FREQUENCY SQUARED" from the drop down box.

Enter the value of A_0, A_1 and A_2 as mentioned in the manufacturer's calibration certificate without any modification.

Case 3: 'X' specified in terms of digits

This is a legacy case. Many manufacturers specify the value of X in terms of "digits" as defined below

$Digits = (frequency)^2 / 1000$

In this case replace A_1 with the value $A_1 / 1000$ and A_2 with the value $A_2/10,00,000$ when entering these coefficients in the data logger. A_0 will remain the same.

13.1   Value of A0

The value of A_0 is generally known as offset. It may be specified in the sensor's calibration/test certificate in which case it can be entered directly in the data logger without any modification.

However, it is more common to determine the value of A_0 at site just before or just after installation.

Enter the value of A_1 (and A_2 if required) and check the parameter value just before or after installation of the sensor (as the case may be) with zero input or reference input that should be considered as zero. Now reverse the sign of the observed parameter value and enter it in place of A_0.

Recheck the parameter value to ensure that it is now showing zero. If however, a non-zero value is required then add that non-zero value to the value of A_0 and check whether you can see that particular non-zero value with zero or reference input.

13.2   Installation Depth

Sensor installation depth is the location of VW sensor diaphragm from ground level.

Installation depth = - sensor location from ground level

Example: Installation depth = -10.5 for water level sensor mounted 10.5 meter below ground level.

14   FILE FORMATS

The data files used for transferring data logger data to other software have the following format. All data is in standard ASCII text format (7 bit). Variables are separated with commas (,).This format is suitable for direct import in Microsoft Excel (All versions) or other commercially available spread sheet programs for formatted printing and graphical plotting. Numeric values may or may not have a leading plus (+) sign but a minus (-) sign is always explicitly included. The contents of the data file are printed in Courier mono space font below.

Figure 14-1: Standard File Format

15 WEB BASED DATA MONITORING SERVICE (WDMS)

The data on variation of water level collected from a large number of boreholes need to be presented as time Vs water level graphs or as tables for visualization or further analysis. Also the data may be required by a number of people sitting at different geographical locations simultaneously.

Web based Data Monitoring software provided by Encardio-rite aids in the above process. It looks at the collected data and makes them immediately available in the form of time vs level plots or in tabular form.

The user will have to maintain a desktop PC with an internet connection with static IP and running windows operating system and Microsoft IIS (*Internet Information Service*) server to run this software.

Authorized users from anywhere in the world can then login the website using the supplied user name and password and access the graphs and tables using any internet connected computer and a standard web browser like Microsoft Explorer, Google chrome Firefox etc. Figure 15-1 showing an example of Borehole data presented in graphical form.

Figure 15-1: Data display on remote PC

In case a user does not want to host his own server, Encardio-rite can provide this as a service at a low cost. This service is known as *Web based Data Monitoring Service* (WDMS) and is available to users throughout the world.

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— USERS' MANUAL —

SINGLE CHANNEL DATALOGGER - CONFIGURATION MANAGER (For Windows)

Single channel datalogger suitable for
Model EWLR-101 automatic water level and rainfall monitoring system
MODEL ESCL-10VT-R4

Doc. # WI6002.141.3 R01 | Feb 2021

Contents

1   INTRODUCTION

The application is a configuration manager for ESCL-10VTR3 and ESCL-10VTR4 Automatic Water Level Recorders. The data logger can be configured through this software. It analyzes the data files produced by the ESCL-10VTR3 / ESCL-10VTR4. The application displays raw data and parameter as per set monitor interval. By setting the log interval for scanning, the readings can be scanned which gets saved in the logger's non-volatile memory. After download, the application allows the user to analyze the readings obtained from the data logger in tabular and graphical form.

1.1   Overview

The software is designed in a very user friendly manner which can be operated very easily for downloading of the data and analyzing the readings. Even users with little experience with Geotechnical Instruments can connect, download data and change settings as and when required.

1.2   Operating Principle

ESCL-10VT, Automatic water level recorder is designed to monitor water level using a single vibrating wire pressure sensor. Data logger can store calibration coefficients, x-parameter, units of measurement, specific gravity, sensor installation depth etc. Data can be stored in engineering units. Each reading is stamped with date and time at which the measurement was taken. It has non-volatile flash memory to store up to 599K records.

These data files can be downloaded to PC using Configuration Manager by connecting logger with data cable or Bluetooth. The downloaded readings get stored in the PC's Home Directory in CSV format. The files can be transferred to FTP server using internet connection. It can be processed on any common available spreadsheet like Microsoft-Excel.

ESCL-10VT with built in 2G/3G/4G modem has capability to upload data records directly to remote FTP server. Upload schedule can be set in Data logger using this software for automatic data upload to FTP server. Schedule can be set as fast as 5 minutes.

1.3   Introduction about the Manual

1.3.1   Purpose of this document

The purpose of this document is to show the entire functionality of the application for the device ESCL-10VTR3 and ESCL-10VTR4. Please refer to *Introduction* section to know about the application.

This document serves as a help guide by showing the workflow of the entire processes. The document guides its user by providing a clear idea about how things have to be done in the application. All efforts have been made to clarify each and every step.

1.3.2   What the manual contains

The document is designed to provide step-by-step guidance using actual screenshots from the application.

1.3.3   How to use the manual

The document is intended to guide the user in a step-by-step manner starting from installing the application, accessing the application, analyzing the readings, viewing and manipulating the plots. The screenshot guides to complete the task.

NOTE: Although the best effort has been made to ensure the completeness and accuracy of the information provided in this document, Encardio Rite instruments reserves right to change the information at any time and has no liability for accuracy.

1.3.4   List of Abbreviations

APN	Access Point Name
CSV	Comma Separated Values
EWLR-101	Automatic Water Level Monitoring System
FTP	File Transfer Protocol
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
IIS	Internet Information Service
MSL	Mean Sea Level
PC	Personal Computer
SIM	Subscriber Identity Module
URL	Uniform Resource Locator
USB	Universal Serial Bus
UTC	Coordinated Universal Time
VW	Vibrating Wire
WDMS	Web based Data Monitoring Service

2   GETTING STARTED

2.1   System Configuration

The application runs on Windows XP, Windows-7, Windows-8 and Windows-10. The minimum system configurations are:

- The RAM of the computer should at least be 512MB (Recommended 1GB).

- The hard disk should have minimum free space of 60 MB.

2.2   Application Installation

It is strongly recommended to exit all programs before installation. Follow the steps below for installing the application for the first time.

Note The *user account type* should be the Administrator.

- Insert the disk into the CD-ROM drive.
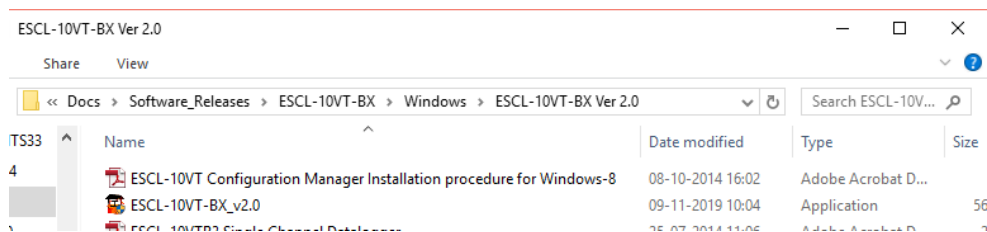
Figure 2-1: Example of Running the Setup file

- Clicking the Setup file, the application prepares to install.

- Click *Next* on the *Introduction* window to choose destination of installation folder.
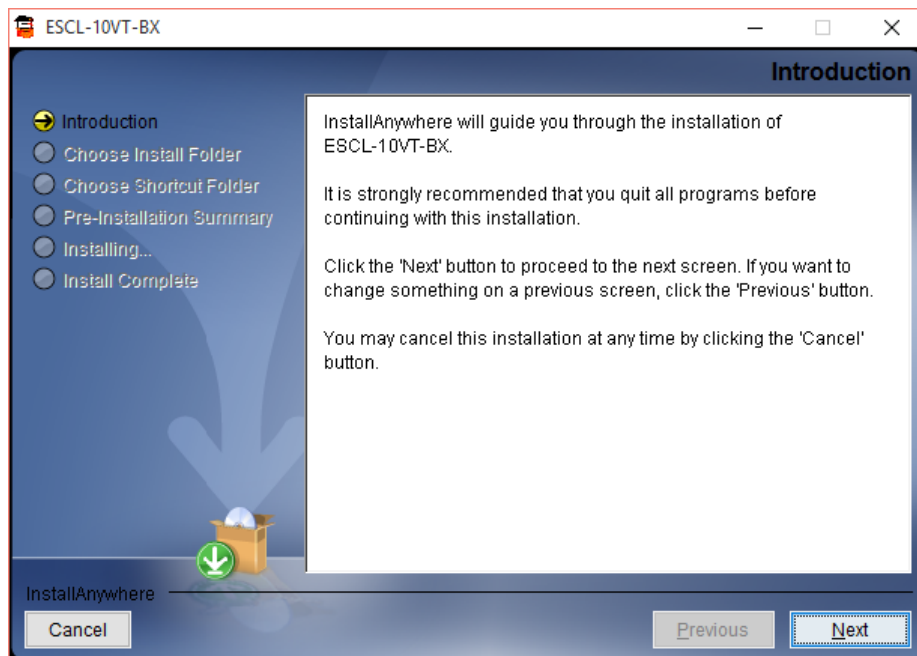
Figure 2-2: Installation Introduction

- By default the destination of installation is Program Files in C Drive. Select the destination folder for the installation and click on next.

- Click in front of the radio button where the product icon has to be created. Click *next.*

- Next window displays the pre-installation summary. Click *Install* to continue.

- Press *Done* to finish the installation.

Now, the application can be launched by choosing it from the program list in the Start Menu. For convenience purpose, a desktop shortcut can be created.

2.3   Connecting Data Logger with PC

It has already been briefed that the data logger's reading can be monitored using the application. To do so, the data logger should be connected with the PC and the application should be installed. The data logger can be connected with PC by two methods, firstly by using interface cable and secondly by using Bluetooth. Each of these is explained in separate section below.

2.3.1   Using Interface Cable

Interface cable has 4 pins USB connector at one end and 9 pins D-sub connector at another end. Connect 9 pins D-sub connector of the Interface Cable to the Data Logger and other end with USB socket at PC. Secondly if Interface cable is unavailable, standard USB to RS-232 Converter can be used.

Figure 2-3 : Connecting data logger using interface cable

2.3.2   Using Bluetooth Connection

The sensor readings taken can also be shared using Bluetooth connection for communicating PC with Data logger unit. Plug Bluetooth modem at 9 pins D-sub connector of the Data Logger. Make sure that modem must be configured for 115200 baud rate and hardware flow must be OFF. Verify DIP switch settings with following Figure 2-4.

Figure 2-4: Bluetooth modem DIP switch settings

Turn ON the Bluetooth modem by pressing ON/OFF switch provided near modem's battery compartment. The power indicator of Bluetooth modem will glow in GREEN colour to ensure that Bluetooth modem is ON.

Turn ON the Bluetooth of the PC/laptop and search Bluetooth devices in the network. Once searching gets completed, a list of Bluetooth devices found is displayed. Find the Bluetooth modem's serial number in the list of devices found and click for pairing the PC/Laptop with the Bluetooth modem.

Figure 2-5: Connecting data logger using Bluetooth

Once pairing button is pressed it will ask to enter passkey for authentication. Enter pairing code "**69836776**" and then press OK. On successful authentication it will show that device is paired. Now the PC/Laptop is paired with Bluetooth modem. This activity is required for first time connection with the Bluetooth modem.

2.4   Running the Application

Start the Application from the "Programs" menu or Double click on the icon ESCL-10VTR4 from desktop to run the application.
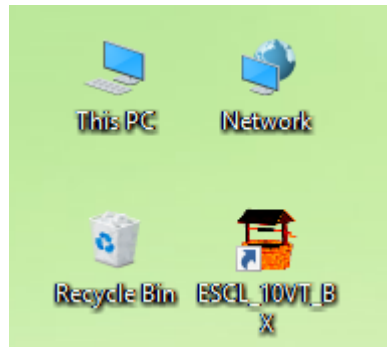
Figure 2-6: Application software shortcut

2.5 Viewing the Main Screen

Entering the application, the main screen of the application appears as displayed in Figure 2-7. The menus *Home, Upload* and *View Data* are enabled while the rest are disabled.
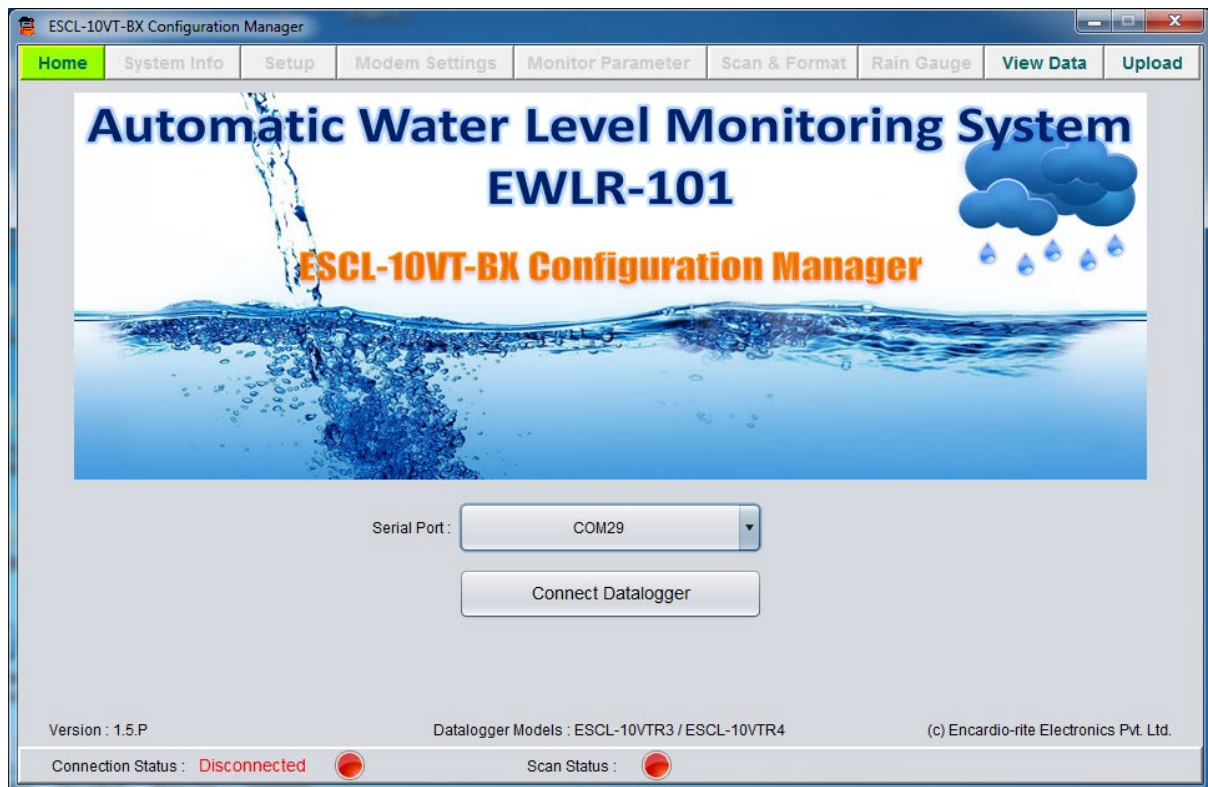
Figure 2-7: Main Screen

2.5.1 *Selecting Serial Port*

The serial port can be selected using drop down menu which displays the list of available serial ports. Select port as per the cases discussed below:

Case I: If the physical comport is inserted, select COM1 or COM2 wherever 9 pins D-sub Connector of Interface cable is inserted.

Case II: In case if the Data Logger is connected through USB Serial Port, the port can be known by following the path mentioned below:

Go to Computer → Right Click → Manage → Device Manager → Ports

Select the appropriate USB Serial Port.

Case III: If the Data Logger is connected through Bluetooth, the port can be known by following the path mentioned below:

Go to Computer → Right Click → Manage → Device Manager → Ports

Select the appropriate standard serial over Bluetooth link.

Figure 2-8 displays an example of available ports through device manager.
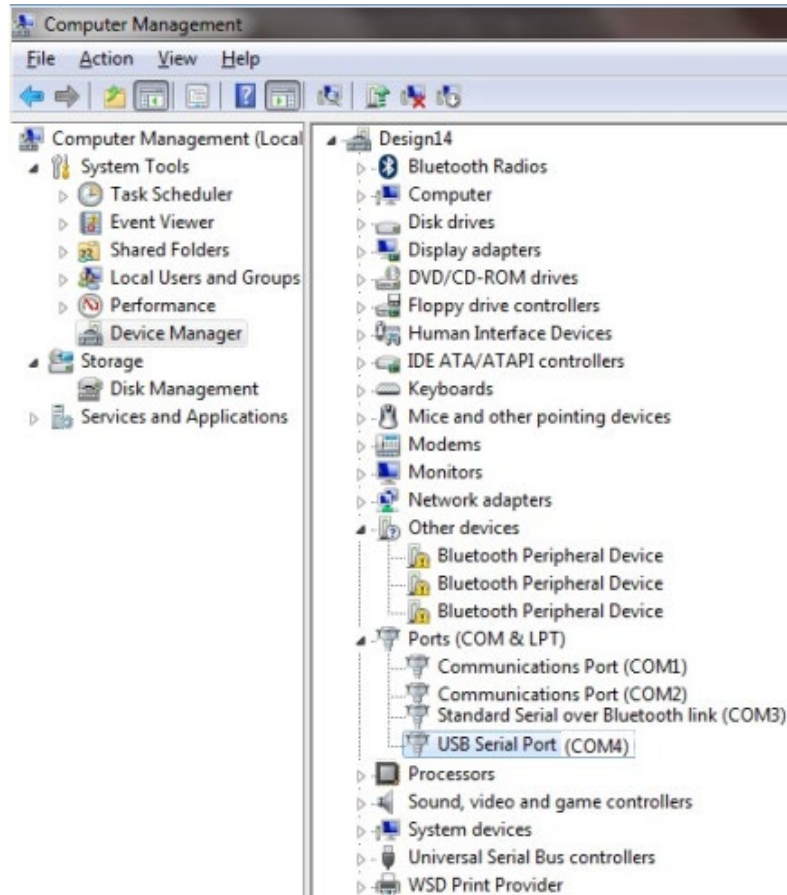
Figure 2-8: Device Manager (Computer Management)

2.5.2   Connecting Data Logger

After selecting the Serial Port, click *Connect Data Logger* to connect to the data logger. The progress bar appears on the screen as the application takes few seconds to get connected. Every time whenever a command is given and the application takes few seconds, the progress bar appears on the screen.

After successful connection, information message pops up on the screen confirming successful connection. Press OK to proceed.
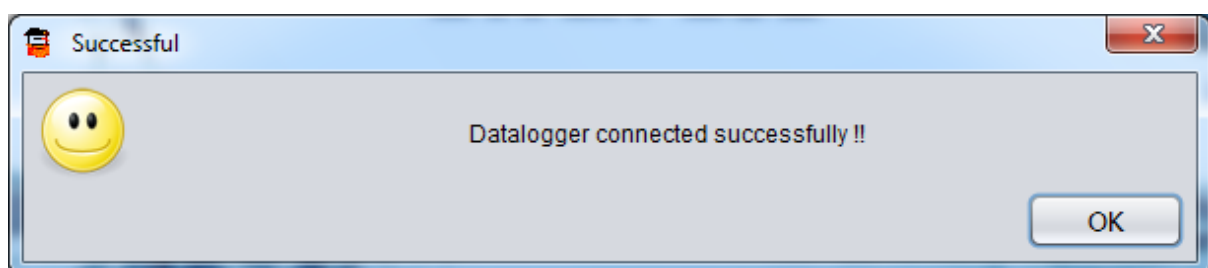
Figure 2-9: Information message

Application checks data logger's battery health. Application displays information message pops up on the screen if battery voltage found low.
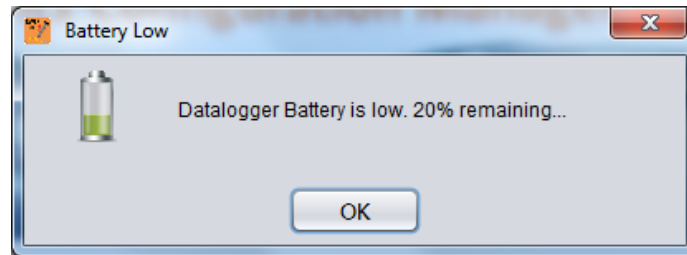
Figure 2-10: Battery low alert message

Now application checks data logger's battery installation information. Application displays information message pops up on the screen if battery found replaced / re-installed. Choose battery installation date from calendar and then press OK. You can press Cancel button if you are not sure about battery installation date. In this case application will ask for battery installation date next time when connecting to data logger.
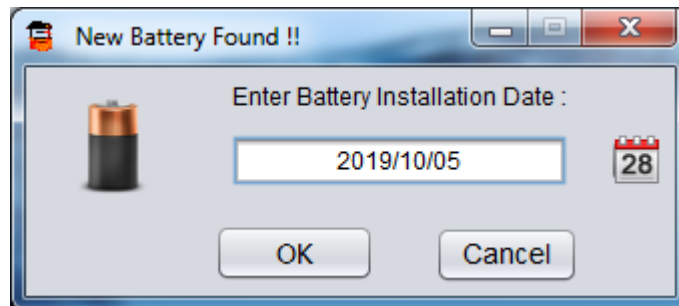
Figure 2-11: Battery installation date entry

3   HOME

Connecting to Data Logger, the *Connect Data Logger* button turns to *Disconnect* and an additional button *Shutdown Data Logger* appears. Click *Disconnect* to disconnect the data logger. Pressing on 'shutdown data logger' button, the data logger gets shutdown.

Figure 3-1: Home Screen

System information can be seen by clicking *System Info* Tab. It will show the information about Data logger. Data logger settings can be configured using *Setup* Tab. GPRS modem can be configured using *Modem Settings* Tab. *Monitor Parameter* Tab shows live data from data logger. Different Sensors reading can be observed with this tab. Logger scanning and data download activities can be performed using *Scan & Format* Tab. Downloaded files can be uploaded to remote server using *Upload* Tab. The data can be viewed in tabular or graphical form by pressing *View Data* Tab.

WARNING: Always SHUTDOWN Data logger before removing battery from the Data logger. Data may be lost otherwise

4   SYSTEM INFORMATION
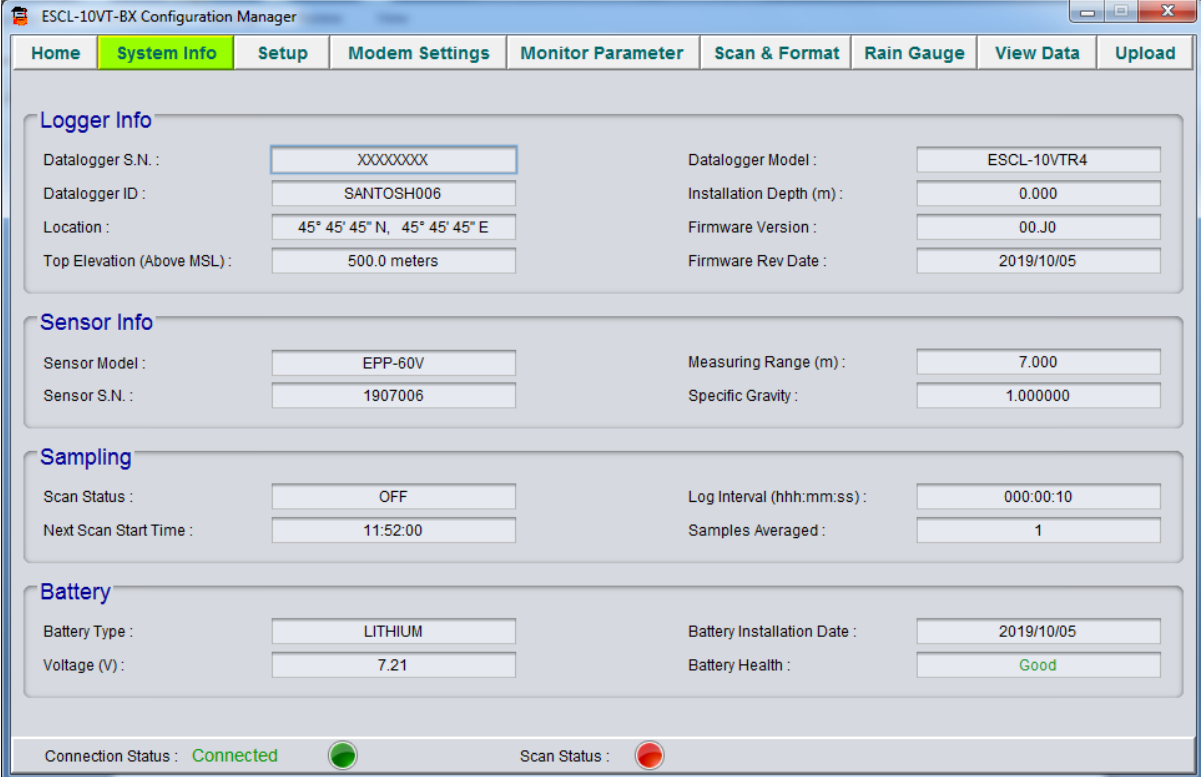
When selecting *system info* tab, application gets system information from data logger. Figure 4-1 shows an example of *system info* tab. Fields are not editable.

Data logger serial number, Model number, Data logger ID (station ID), Data logger installation location coordinates (latitude and longitude), Data logger's position above MSL (mean sea level), Sensor installation depth and Data logger's Firmware information can be seen in *Logger info* panel.

Sensor related information like Sensor model, Sensor serial number, sensor's measuring range and specific gravity of water can be seen in *Sensor info* panel.

Data log related information like Scan status, data logging interval, next scan start time and number of samples averaged can be seen in *Sampling* panel.

Data logger's battery related information like Battery type, Battery installation date, battery's present voltage and battery health can be viewed in *Battery* panel.

Figure 4-1: System Info screen

5   SETUP

Data logger settings can be configured using *Setup* tab which can be opened on pressing SETUP button in the main menu. Figure 5-1 shows an example of setup screen. Fields can be edited to modify the settings.
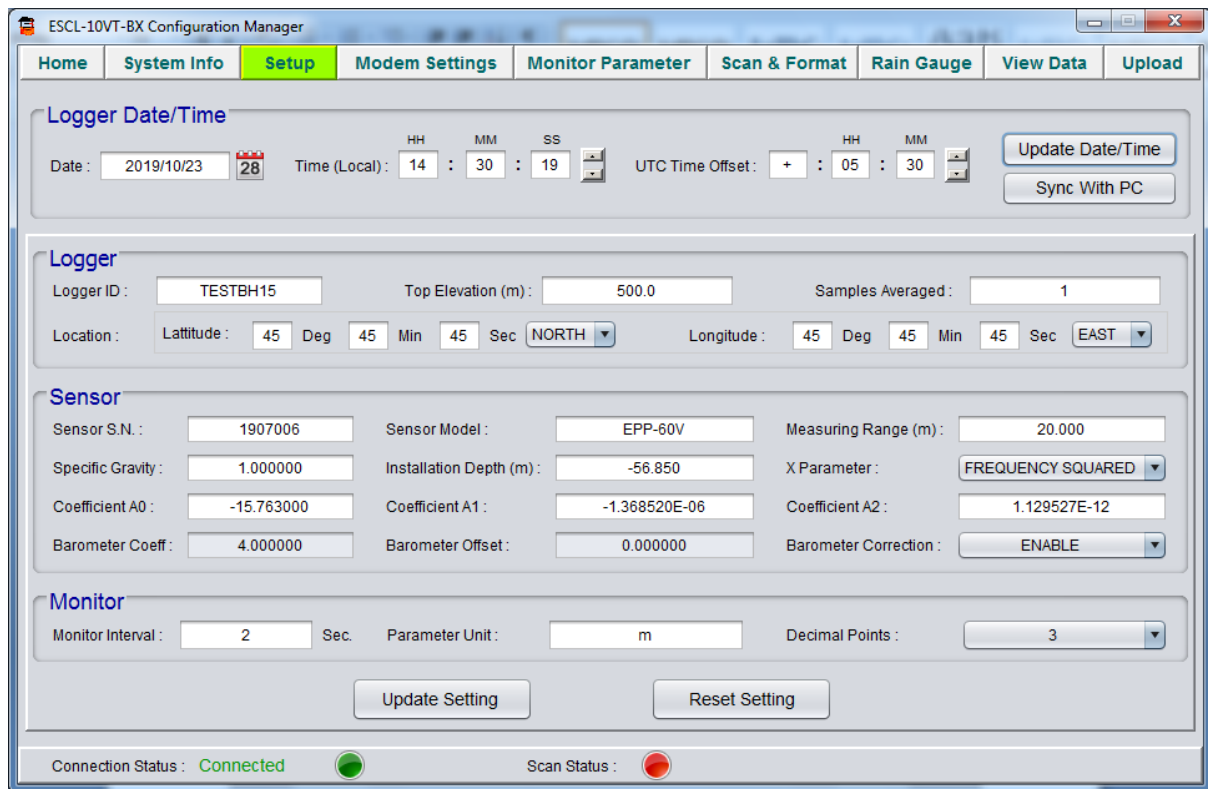
Figure 5-1: Setup Screen

Data logger's date/time can be set using *Logger date/time panel.* There are two ways to set date/time manual or sync. You can select logger date, choose local time and UTC offset and then press Update date/time button to update logger's clock manually. You can opt for second option that is press *Sync with PC* button. Data logger's calendar and clock will set to PC's date/time. Figure 5-1 shows an example of acknowledge dialog after data logger clock synced with PC.
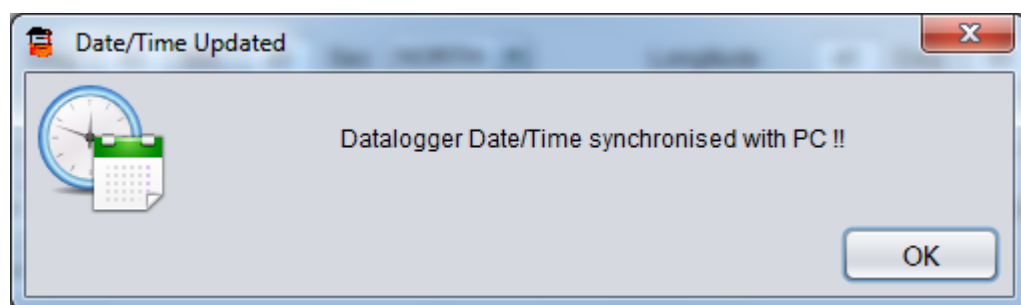
Figure 5-2: Data logger clock sync message

Data logger's ID or station ID can be entered under *data logger's ID*. Data logger's installation location coordinates (latitude and longitude) can be entered under *location* fields. Data logger's installation location above MSL (mean sea level) can be entered under *Top elevation*. Data logger has capability to store readings by averaging of reading samples. User can set samples for averaging ranging from 2 to 250. Keep samples for averaging to 1 if averaging not needed.

Sensor related settings can be set through *Sensor* panel. Enter sensor *serial number*, *model* and *measuring range* of vibrating wire sensor. Water specific gravity can be must be entered under *specific gravity* field. Specific gravity of 1.0 (the specific gravity of pure water at 4°C) is adequate for many ground water applications. Sensor installation depth (from ground level) in meters must be entered under *installation depth* field. Keep *x-parameter* to *frequency squared* for vibrating wire sensor. Enter vibrating wire sensor coefficients A0, A1 and A2. See section 13 to know more about sensor coefficients.

Data logger with built in barometric sensor can measure barometric pressure to apply barometric correction in measured value from vibrating wire pressure sensor to eliminate effect on barometric pressure. User can choose option to enable/disable barometric correction. Barometric sensor coefficients are programmed from factory during calibration so do not change these values unless required.

Data refresh rate for *monitor parameter screen* can be set through *monitor interval* field from *monitor* panel. Monitor interval can be set from 2 to 255 seconds. Measurement parameter unit can be set under *parameter unit* field. Decimal points for parameter to be viewed in *monitor parameter screen* can be set from 0 to 4 decimal places under *decimal points* field.

NOTE: Pressing on UPDATE button will update data logger with new settings.

5.1   Reset Data Logger to Factory Default

Data logger can be reset to Factory defaults using '*Reset Settings'* button. Pressing on Reset settings button will show a warning message. Press NO option to abort the reset or press YES to continue.

Clicking *Yes*, the application will prompt for a password. Type password "**4TfZ9q7X**" and press *OK* to reset data logger settings. Kindly remember that clicking *Yes*, all previous values will be erased and factory settings will be restored.
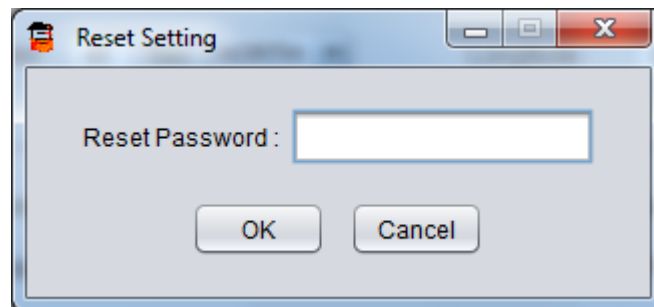

Figure 5-3: Entering reset password

WARNING: Reset settings will erase all custom settings and data logger will be set to factory defaults.

6   MODEM SETTINGS

Data loggers with built-in GPRS/3G/4G modem have capability to upload logger records to remote FTP server through mobile network. For using this feature, a GPRS enabled SIM card must be inserted into SIM card socket into data logger.

Pressing on *Modem Settings* tab in the menu will open *Modem settings screen*. *Modem settings* tab is disabled for data loggers which don't have built GPRS/3G/4G modem. Figure 6-1 shows an example of *Modem settings screen*.

Figure 6-1: Modem settings screen

For configuring FTP server settings correct FTP server URL, port number, user and password must be entered into specified fields. Press *Update FTP settings* button to update FTP server settings to data logger.

Datalogger ESCL-10VTR4 settings can be set from remote server using Remote Configuration Manager Application on server. Same FTP credential can be used for remote 2-way communication as well as data upload. Different FTP credential on same server can be used for remote 2-way communication or a different server can be used for remote 2-way communication. But it is recommended to use different credential/server for remote 2-way communication.

Once FTP server settings configured data logger automatically sends logger records to remote FTP server when upload time occurs. Upload schedule can be set through Upload Time panel. Upload time can be set as fast as 5 minutes. Upload interval can be set ranging from 5 minutes to 7 days. Press Update button to update schedule.

Network service providers *APN* for GPRS enabled SIM card must be entered under APN field in *advance settings* panel. GPRS modem operating mode can be configured in either of two modes OFF or Sleep. Modem operating mode can be set to *OFF* where mobile network is not available or automatic upload is not required. In this mode, modem always remains OFF. This option is opt to extend battery backup. Modem operating mode can be set to *Sleep* mode. In this mode, modem normally keep switch OFF and

wake when scheduled upload time occurs. It will upload the data to server and then switch OFF the modem to improve battery backup. Datalogger mobile number can be entered in provided field for information purpose.

Records are uploaded to FTP server in CSV (comma separated values) file format. Data may contain header information if CSV header is enabled for uploaded file from advanced settings panel.

The GPRS Modem panel shows GPRS modem status for diagnostic. Click on turn ON modem button to turn ON GPRS modem. After turning ON the modem status indicator becomes GREEN from RED. GSM/GPRS signal strength and bit error rate can be monitored.
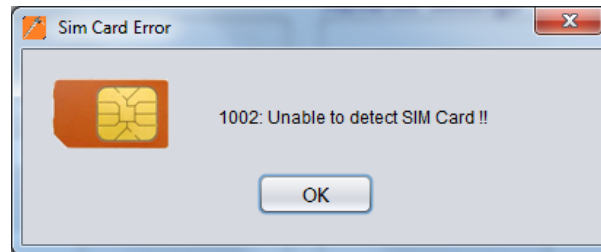
Figure 6-2: SIM Card not Found Message

Auto sync RTC feature is given to sync Datalogger clock with network provided time every time while uploading data to server.

SMS alerts can be set to receive SMS alerts on your phone when battery goes low or water level crossed alert limits. To avail this feature SMS facility in SIM card must be enabled. Tick in check box under *advance settings* panel to enable SMS alert feature. Contact numbers where SMS to be sent can be entered into contact list. SMS alerts will be sending to all contact numbers which are entered in contact list. Maximum 8 contact numbers can be entered. Send test SMS can be used to check whether SMS feature is working properly or not.

It is recommended that do not communicate with the Datalogger if upload process is in progress otherwise GPRS link to remote server may get broken. GPRS upload time depends upon the record size being uploaded.

NOTE: Pressing on UPDATE button will update data logger with new settings.

7   MONITOR PARAMETER

Pressing on *Monitor Parameter* tab will open Parameters screen. Figure 7-1 shows an example of parameter screen. This screen shows live data from data logger. One can monitor sensor reading and temperature with data logger's present date and time. Data refresh rate can be set through *monitor interval* field from *setup* tab.
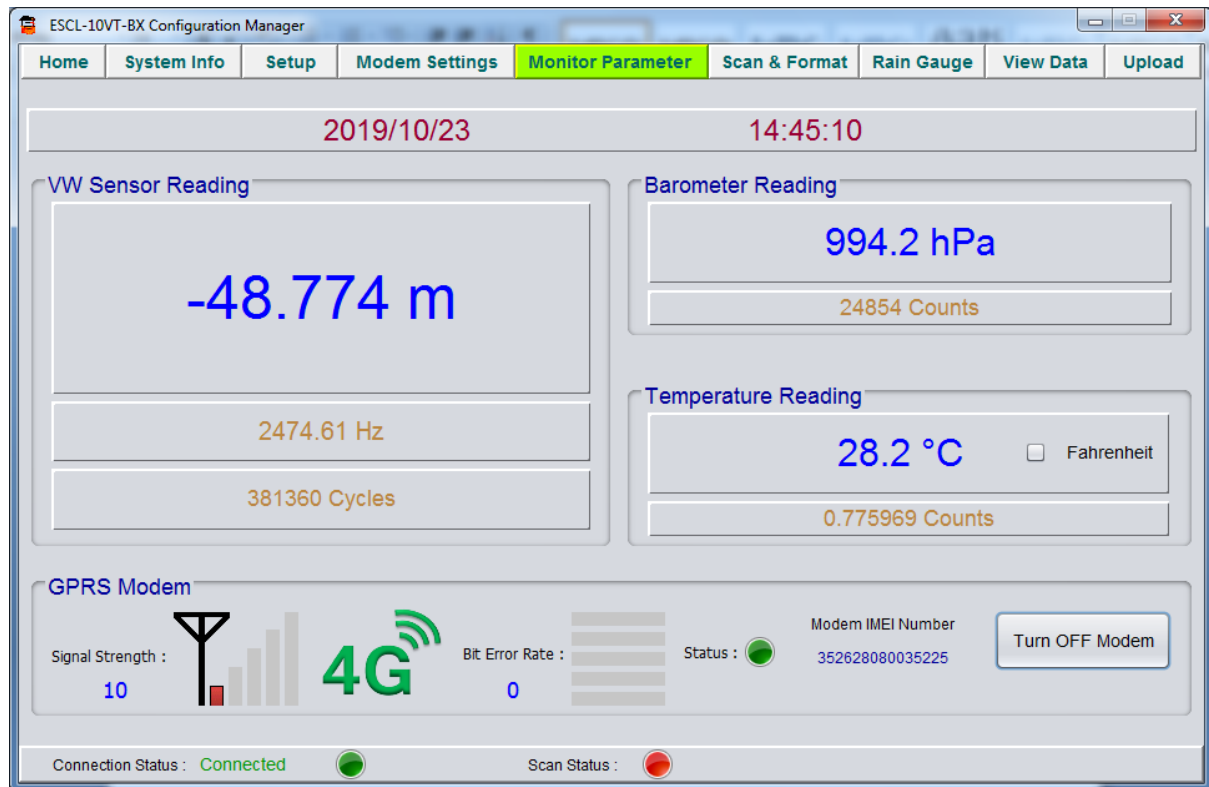

Figure 7-1: Monitor Parameter screen

The *Sensor Reading* panel shows water level from ground level, vibrating wire pressure sensor frequency and cycle counts. Frequency and cycle counts are given for diagnostic purpose only. Water level value can be decimally adjusted through *decimal points* setting from *setup* tab.

The *Barometer Reading* panel shows barometric pressure in *hPa* (hecto Pascal) and digital counts. Counts are given for diagnostic purpose only.

The *Temperature Reading* panel shows water temperature and digital counts. Counts are given for diagnostic purpose only. Temperature can be monitored in *Degrees* or in *Fahrenheit*. Temperature reading shows -99.9 if sensor not connected.

The *GPRS Modem* panel shows GPRS modem status for diagnostic. Click on turn ON modem button to turn ON GPRS modem. After turning ON the modem status indicator becomes GREEN from RED. 3G/4G signal strength and bit error rate can be monitored. Signal strength should be greater than 11 (out of 31) to ensure successful FTP upload. External antenna is recommended where signal strength is below 12. Bit error rate less than 2 is good for error free communication.

8   SCAN

Clicking *Scan & Format* tab opens Scan screen. Figure 8-1 shows an example of scan screen. Data scan and alarms settings can be done here.

Scan option panel showing scan related information. *Log interval* can be set in either of two modes *short* or *long*. For fast scanning, select *short* option. In this option scan interval can be set from 5 sec to 250 seconds. For slow scanning, select *long* option. In this option scan interval can be set from 5 minutes to 7 days (i.e. 168 hrs). Once log interval is set, data logger scanning can be started. Data logger will start scanning from *Next scan start time*.

NOTE: Scan Interval will be 1:00:00 and it can't be edited if Rain Gauge option is enabled from factory. It is set for hourly recording of Rain Fall.

Though data logger memory is very large with respect to record size, memory can get full if scan interval is very fast and memory not erased since a long time. What to do if memory gets full. There are two options. Choose memory full action either *stop* or *overwrite*. Scanning will get stopped in case of data logger memory full if STOP option is selected. In this case the readings will not be recorded further once the memory is full. The other option is to overwrite where if the memory becomes full, the readings will be recorded but it will overwrite from oldest records in a cyclic manner.

It has been observed that in case of over range or faulty sensor many data logger shows very large quantities or garbage values. It is very difficult for user or viewer software to identify those values. An error code of -999.999 m for water level and -99.99 degC for water temperature will be reported in data records if sensor reads values beyond its operating range for any reason. To enable user defined *Error code* enter the error code value for *water level* and *temperature* and then select *Parameter Error code* option *Enable* from drop down menu.

Many times we require an alert when an alarm condition occurs. We can set alarms limits for SMS alerts. Enter water levels at which alerts are required. Choose Up, Down or None option. *Up* option means alarm condition occurs when water level goes up with the limit specified. *Down* option means alarm condition occurs when water level goes below the limit specified. *None* option can be selected to disable the alarm.

Sometimes we need to do fast logging when an alarm condition occurs. To do so there is a provision in software to *enable event log*. On enabling event log data logger do fast scanning while an alarm condition remains and does normal scanning if alarm condition passed. Scan interval for alarm condition can be set through *Event log interval* field.

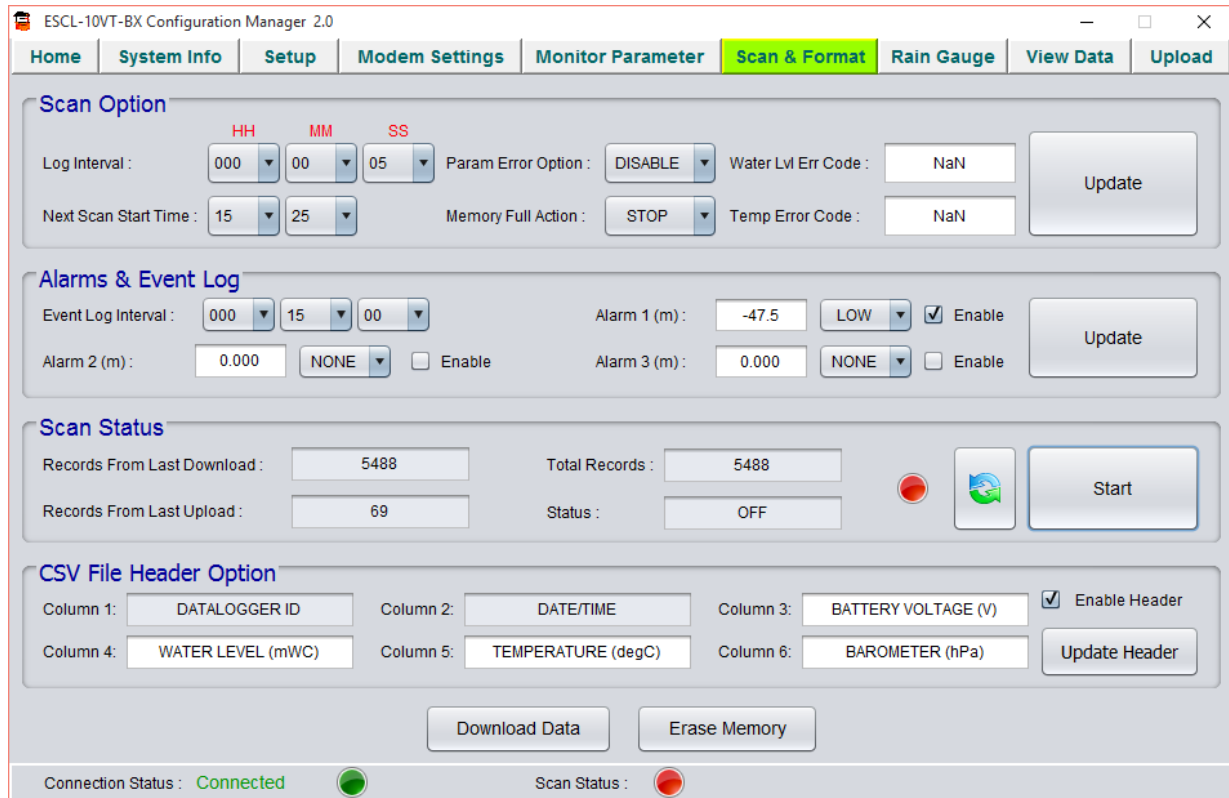**NOTE:**   Press *Update* button to update the settings.

Figure 8-1: Scan & Format screen

Scan status panel showing total number of records stored in data logger's memory. "*Total Records*" showing total number of records stored in Datalogger's memory since last erase. "*Records from last download*" showing total number of records reaming into Datalogger's memory since last download while "*Records from last upload*" showing total number of records reaming into Datalogger's memory since last upload. Data logger scanning can be started by pressing *START* button once. Pressing the *start* button starts the scanning and scan status becomes ON. Status indicator becomes GREEN. While scanning, the *Start* button becomes *Stop*. During scanning, the data logger scans sensor at specified log interval and the sensor readings gets stored in data logger's memory.

Figure 8-2: Scanning started information message

Data logger scanning can be stopped by pressing *Stop* button once. Pressing on stop button stops the scanning and scan status becomes OFF. Status indicator becomes RED. *Stop* button becomes *start* again.

Refresh button can be pressed to refresh number of records stored in data logger's memory.

Readings (data) can be downloaded from data logger's memory by pressing *Download Data* button. A dialog will open for selecting download option. User can download complete records from memory since last erase by selecting download option "*From Beginning*". If a user wants to download only recent records from last download then select "*From Last Download*" option. Click OK to start the download.
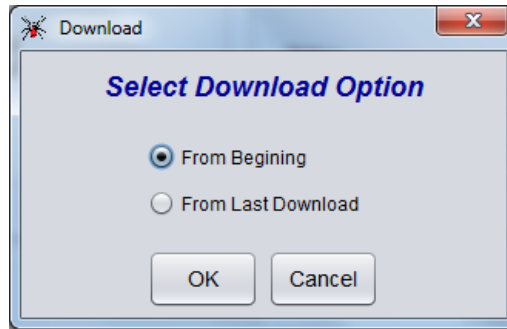
Figure 8-3: Select Download Option

Data download time depends on records size of data logger's memory. Progresses bar dialog displays download progress. It can take several minutes also in case of large number of records. After successful download, an information window pops-up.
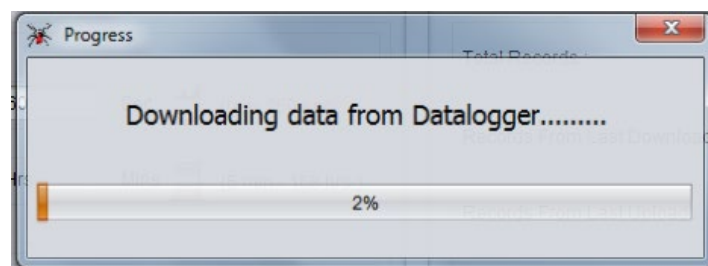
Figure 8-4: Download progress

Another window asks a confirmation to erase data logger memory. Press NO option to abort the deletion or press yes to confirm deletion.
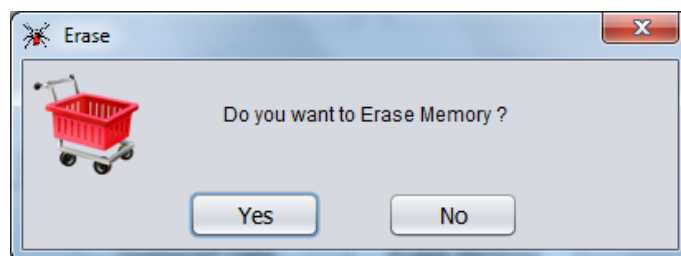

Figure 8-5: Erasing data logger memory

Application will show memory empty dialog if number of records are zero in Datalogger's memory.
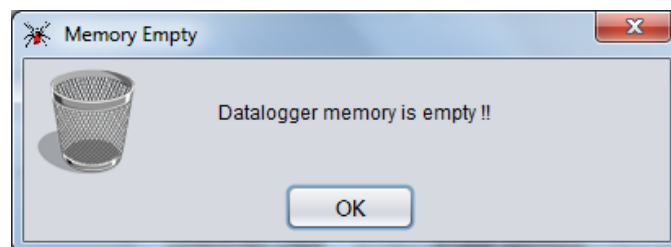
Figure 8-6: Datalogger memory empty message

Downloaded data are stored in CSV (comma separated values) file. Data may contain header information if CSV header is enabled from *CSV header option* panel. Some Header fields are locked for editing rest are editable. User can modify editable fields. Press *Update header* button to update header information.

Erase data logger memory by pressing *Erase Memory* button. It would erase all previous readings and the *No. of Records* would become zero. The application seeks permission to erase logger memory as already shown in *Figure 8-5*. Click *Yes* to proceed or *No* to abort. Clicking *Yes*, data logger's memory will be erased which will not affect other settings.

NOTE: It is recommended to erase memory each time after downloading records.

Downloaded data will be saved in CSV (comma separated values) format at specified file path. An example of file path is given below

File path: [root]\ESCL-10VT-BX\CsvFiles\Site*.CSV

9   RAIN GAUGE

Encardio-rite model ERG-200 rain gauge with a proven tipping bucket mechanism provides a cost effective reliable method for measuring and recording rainfall. It is easy to use, durable and precision automated to provide long term, trouble free operation with a minimum of maintenance. It is corrosion resistant having a stainless steel outer housing. It is designed for many years of trouble free operation.

Inside each rain gage is a balanced tipping bucket mechanism with a magnet and switch assembly. Collection of rain is through a 200 mm diameter catchment through a debris filtering screen. A funnel inside the rain gage feeds collected rain water into one of the two buckets. As soon as the preset amount of water has been collected in the bucket, it tips the other way, automatically emptying the water and positioning the other bucket for collecting rainfall. The measured water exits through drain tubes provided at the base of the rain gage. The tipping bucket mechanism activates a sealed magnet sensitive switch that produces a contact closure for each 0.2 mm of rainfall. Two adjustable screws provide calibration of buckets by changing position of the bucket stop point.

High vertical sidewalls of the model ERG-200 prevent splash-out of rain from the catchment thus resulting in better accuracy. Each rain gage is individually calibrated for optimum accuracy. Three adjustable legs allow the rain gauge to be fastened permanently onto a platform or deck using standard fasteners.

Figure 9-1: ERG 200 Rain Gauge

Clicking *Rain Gauge* tab from application opens the Rain Gauge screen. Figure 9-2 shows an example of Rain Gauge screen. This screen is used to view the live status of Rain Fall.

Hourly Rain Fall, Daily Rain Fall and Rain Fall rate can be seen under Rain Fall panel. Hourly Rain Fall shows amount of rain fall status at current hour. Daily Rain Fall shows current status of total rain fall amount since 00:00:00 Hrs.
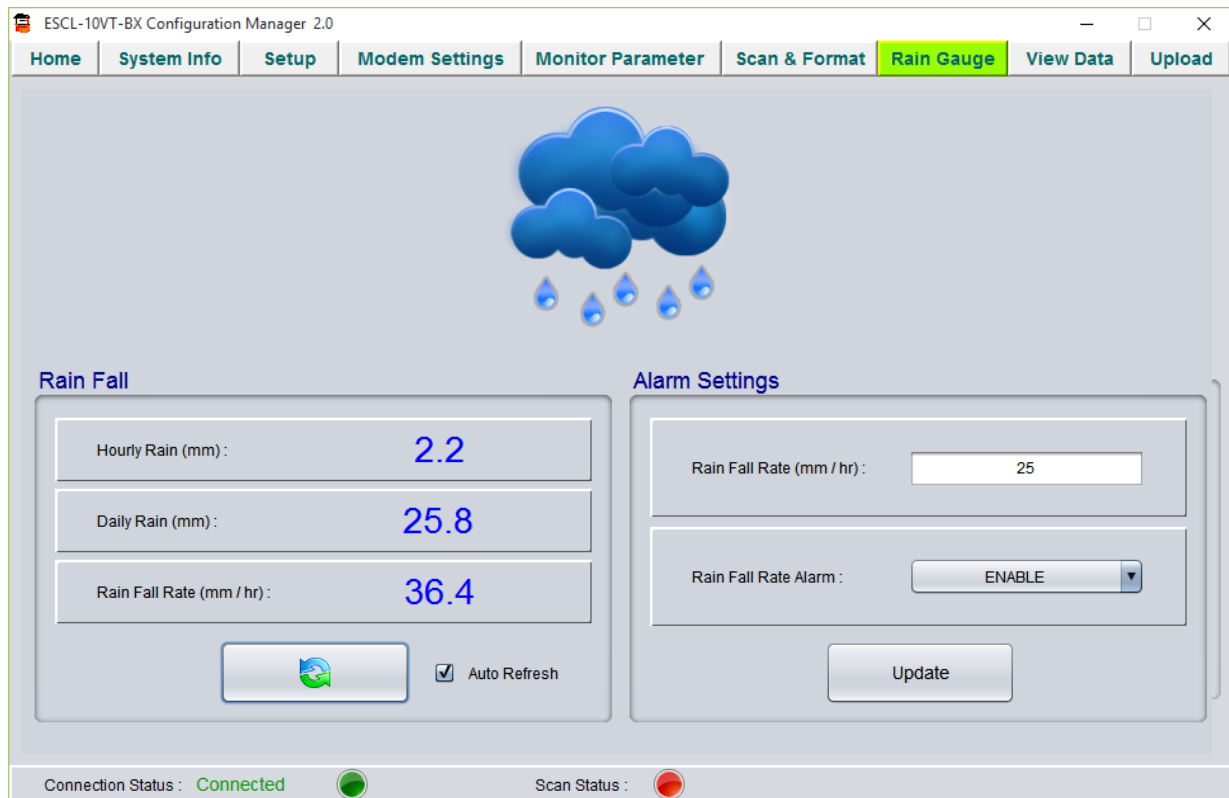
Figure 9-2: Rain Gauge Menu

Rain Fall Rate shows current status of Rain Fall Rate. Rain Fall rate is calculated by the Datalogger at every 5 minutes. Refresh button can be pressed to get the current status or *Auto Refresh* option can be selected for automatic refresh of the screen in every 5 minutes.

Alarm can be generated if Rain Fall Rate exceeds the specified limit. When Rain Fall rate exceeds the specified limit, Datalogger will automatically sends *Heavy Rain Fall* SMS to the mobile numbers listed at "Modem settings" screen.

10 UPLOAD

The upload feature of the application allows the user to upload the *downloaded data* to the FTP server from anywhere using the internet connection. Clicking the *Upload* button in the main menu, the upload window appears with the list of data logger files if it has been downloaded.
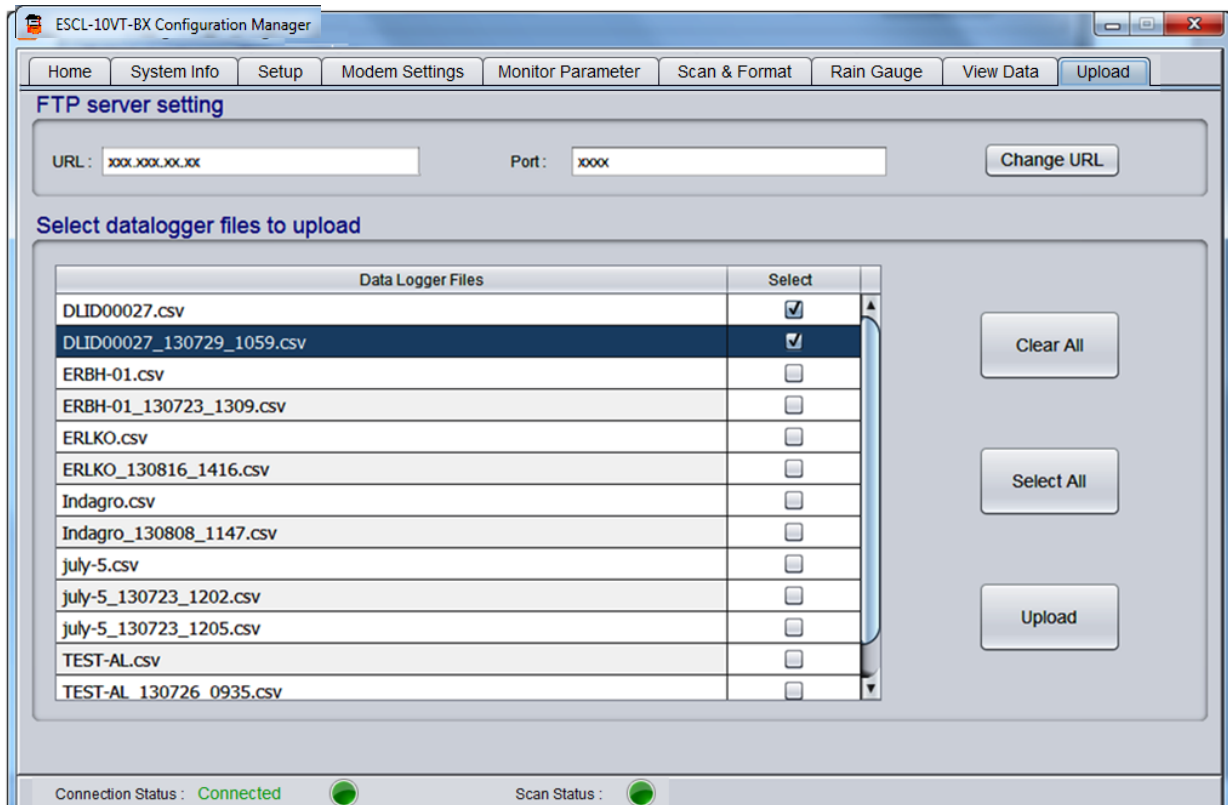
Figure 9-1: Files Upload Menu

To reset URL, click on *Change URL* button (If the user is entering the upload menu for the 1st time, the text boxes for URL and Port will be empty but if once entered, the application takes the previously entered values of its own). The application will open URL settings menu.
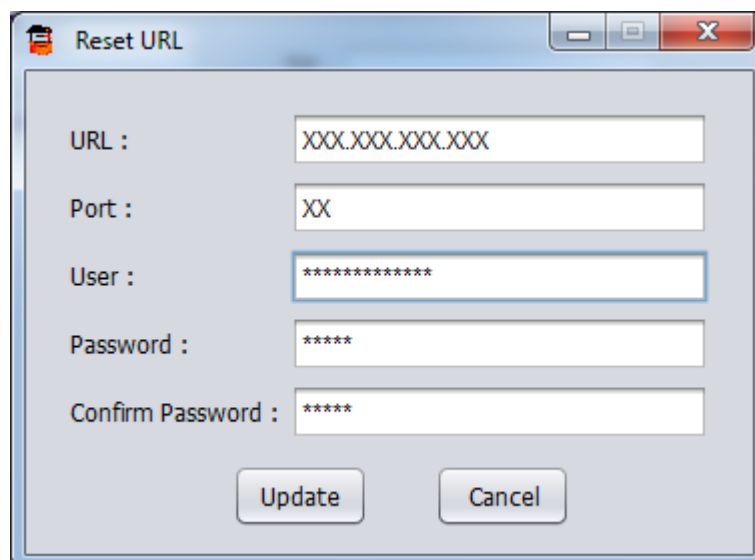
Figure 9-2: Reset URL screen

Type FTP server URL address. Provide port number of the FTP server. Enter user name and password for authentication. After providing all credentials press on *update* button to update URL settings. Make sure that the PC has internet access. Once *update* button is pressed, application will try to connect to the server. URL setting will be updated on successful connection to the server. URL settings will not be changed in case of connection failure.

For files upload, select the data logger file which has to be uploaded. Files can be selected by ticking on check boxes. In the given example, two files are selected to be uploaded. If all the files have to be uploaded, click *Select All* button. To deselect all the files, click *Clear All* button. Click *Upload Files* button to upload the file/files. Press *Upload* button to upload the selected files. After successful upload, an information message pops up on the screen confirming successful file upload.

11   VIEW DATA

This tab allows the user to view data logger's reading and interpret the data in tabular and graphical form. Select the file through the drop down menu. On selecting file, readings automatically get updated in table.

11.1   View Table

In the given example, the file ERBHLKO-391_130520_1025.csv is selected for interpretation. Folder can be selected from *Browse* button. The readings are displayed in the Figure 11-1. Data in table represents date/time stamp of reading, Parameter value, Barometric pressure, Sensor Temperature, Data logger's Battery Voltage, Hourly Rain Fall and Daily Rain Fall.

Figure 11-1: Viewing readings

11.2   Export Table

Table data can be exported to CSV file that can be viewed in any spreadsheet viewer. To do so click at export table icon. Clicking on export table will open a dialog asking for file format. Figure 11-2 showing an example of file format dialog. Table can be exported in either of two file formats *Standard* and *Extended*. Standard format may have data header information while extended format contains file header information. Refer section 14 to know more about file formats. Choose appropriate file format and output file path where data file to be exported and then press OK button to generate the CSV file.
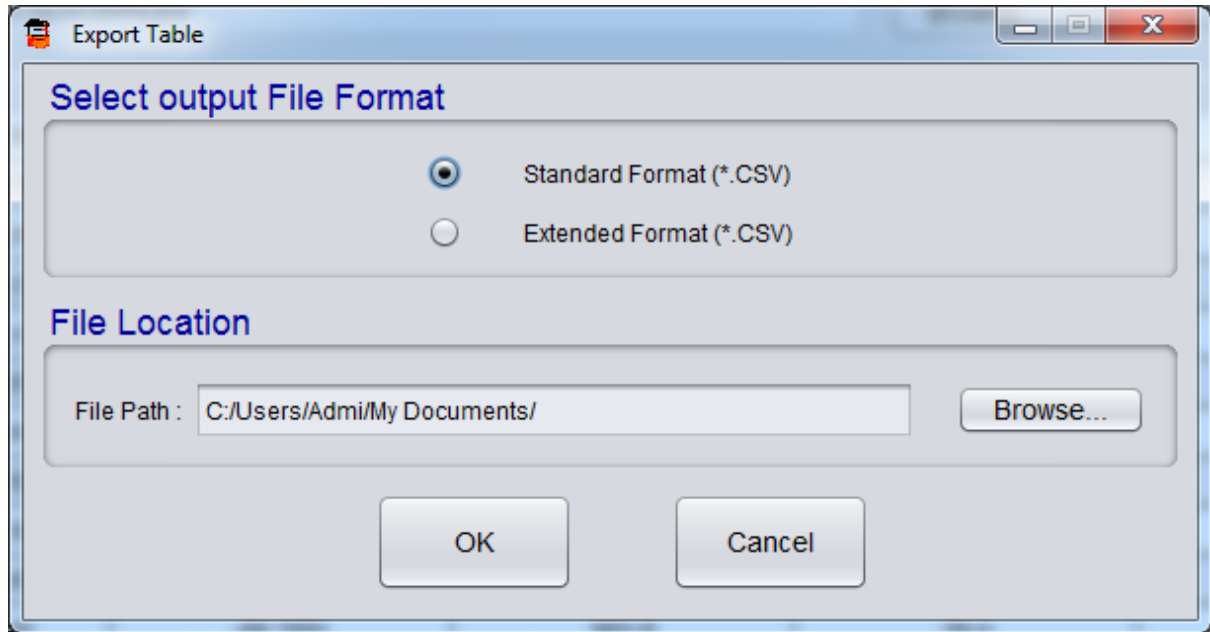
Figure 11-2: Selecting File Format

11.3   View Graph

To see the graph, click on *View Graph* button from *view data* screen. On clicking view graph, application shows a dialog to select data range. Figure 11-3 showing an example of data range selection menu. Choose X-axis and Y-axis range and then click on OK to view the graph.
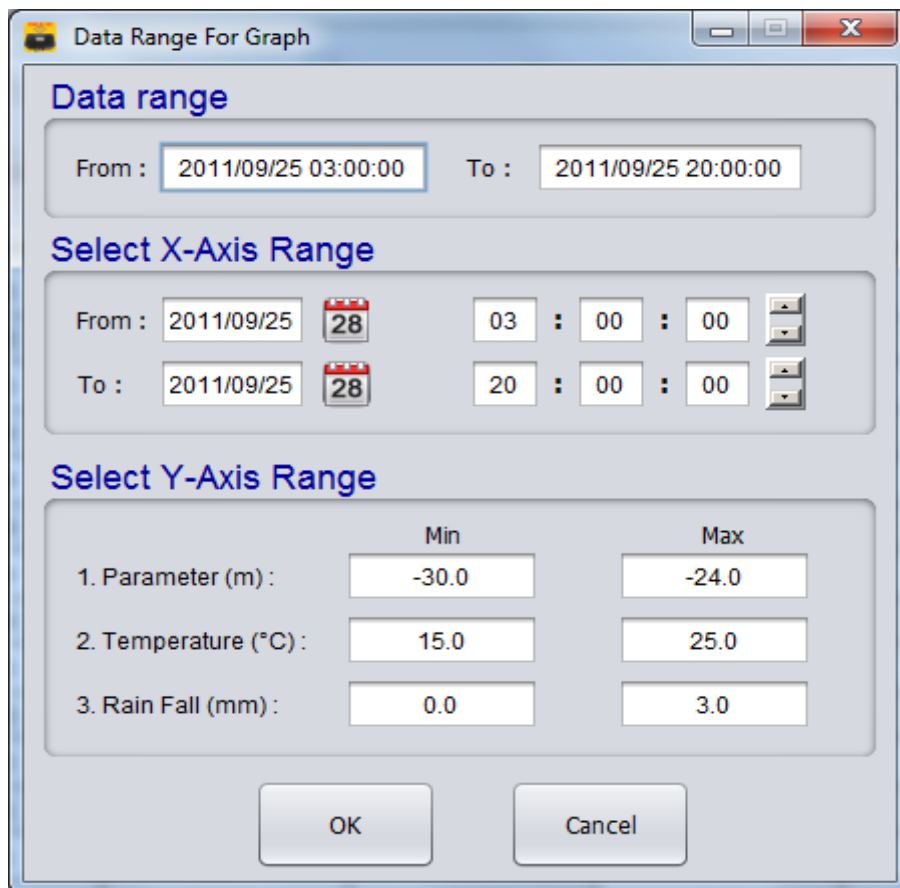

Figure 11-3: Data range selection for graph

Figure 11-4 showing an example of graph screen. There are 3 tabs in graph menu. First tab is showing graph of Water Level (Parameter) Vs Time. Battery Voltage tab will show Datalogger's Battery status Vs Time. Figure 11-5 showing an example of Hourly Rain Fall Vs time.
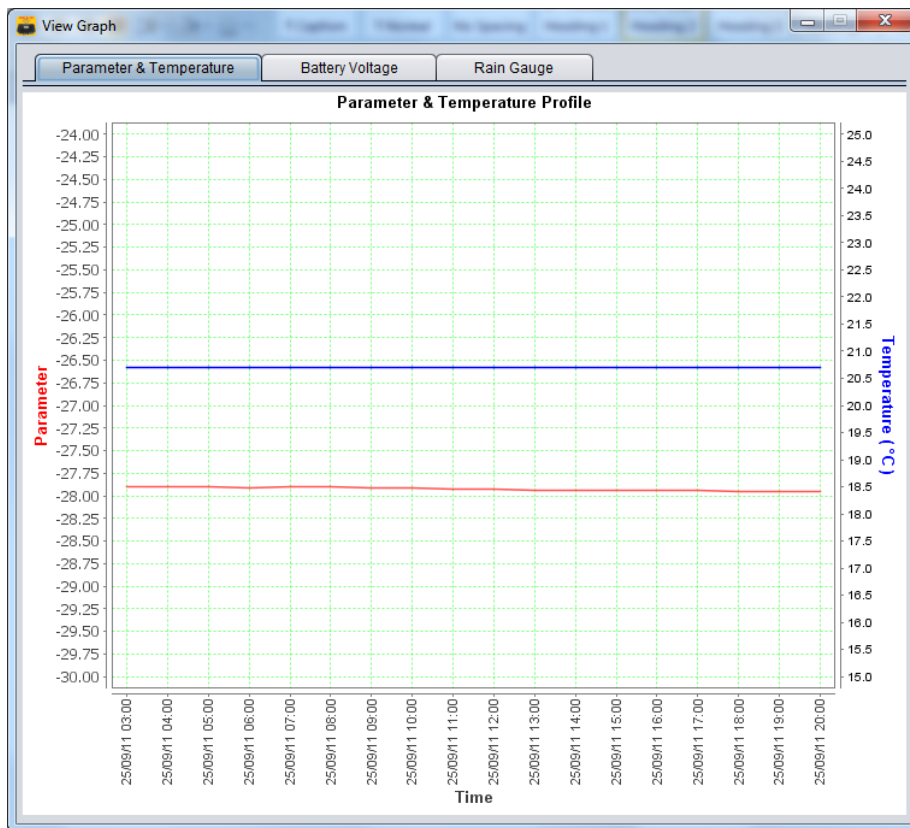
Figure 11-4: Parameter and Temperature Vs Time plot
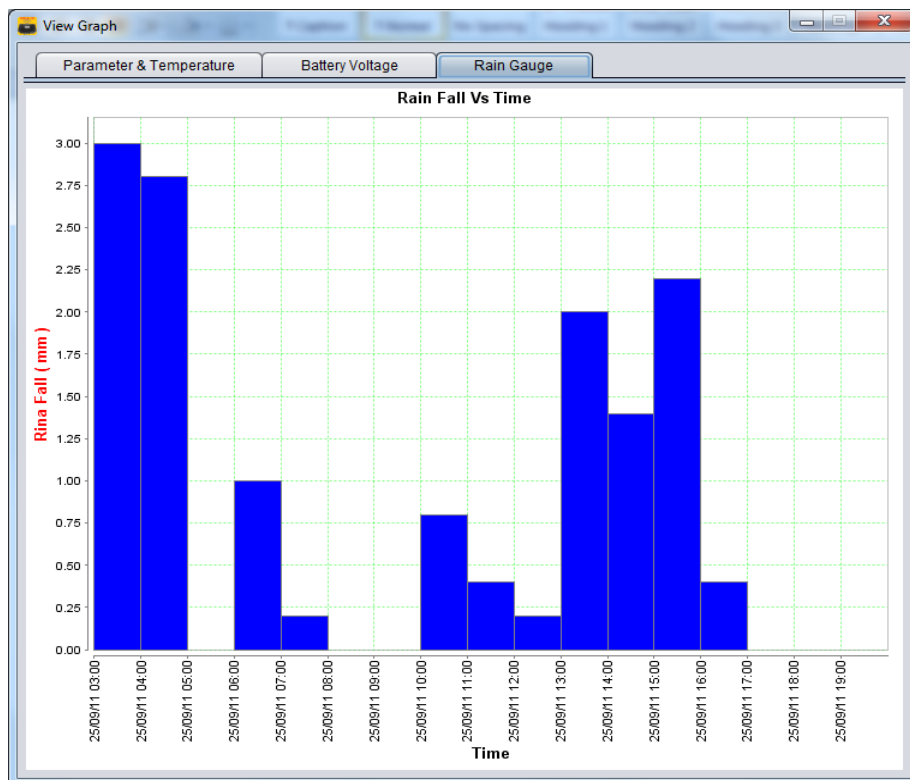
Figure 11-5: Hourly Rain Fall Vs Time plot

11.4   Graph Customization

This section allows the user to customize the graph as and when required. At any time, right clicking the mouse on the plot area will bring the options discussed separately in this section.
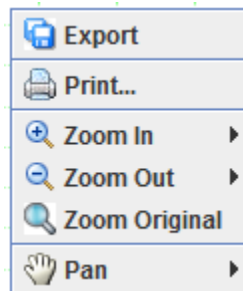
Figure 11-6: Graph customization

11.4.1 Export Graph

The application offers the facility to export a data logger file in graphical form. The file is saved as a *png* image file.
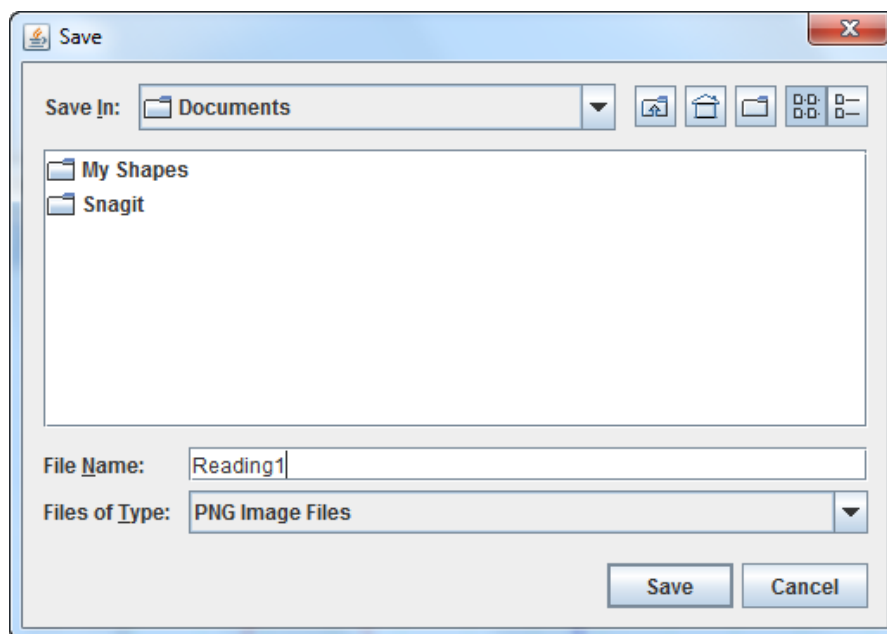

Figure 11-7: Saving the exported file

11.4.2 Print

Giving the print command would give the print of the graph. To take the print of the graph, follow the steps below:

  I.   Right click and select Print.

  II.   Select/enter entries as required on the *Page Set-Up* dialogue. Click Ok to go to the *Print* page.

  III.   Select/enter entries required on the *Print* page.
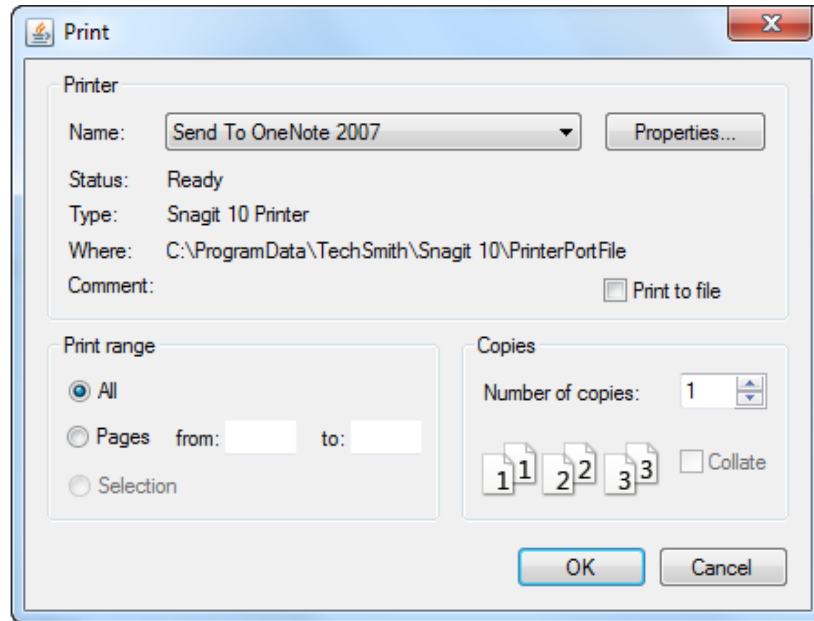
Figure 11-8: Print Settings

11.4.3 Zoom In

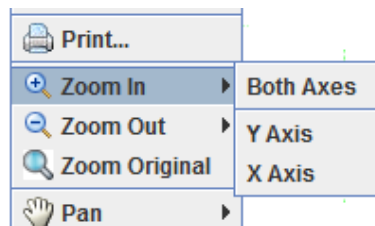This feature allows the user to *Zoom* single or both axes.

Figure 11-9: Zoom In Option

11.4.4 Zoom Out

It allows the user to *Zoom* out single or both axes.

11.4.5 Zoom Original

Any time to see the actual view of the plot if it has been zoomed in/out, click zoom original.

11.4.6 Pan

Pan option allows the user to choose between panning (press CTRL key to allow panning) in the x only, y only or both x and y direction simultaneously.

12 TROUBLESHOOTING

- Unable to connect data logger over Bluetooth

a) PC's Bluetooth may not be enabled.

b) Bluetooth modem may not be turned ON.

c) Bluetooth modem may be out of Bluetooth range from PC.

d) Bluetooth modem may not be paired with PC.

e) Bluetooth modem's battery may be discharged.

f) Check Bluetooth modem baud rate settings. It must be configured for 115200 and hardware flow control should be OFF.

g) Turn OFF the Bluetooth modem and then turn ON.

h) Reset data logger by shorting RST jumper once using tweezers near data logger's serial port connector.

- Unable to connect Data logger with RS-232 Cable

a) USB to RS-232 cable driver may not be installed properly.

b) RS232 interface connector may be loose.

c) Check the RS232 interface cable's connector for damage.

d) RS232 interface cable may be broken.

e) Data logger's battery may be discharged.

f) Reset data logger by shorting RST jumper once using tweezers near data logger's serial port connector.

- Files not uploading on FTP server

a) Internet connection may not be available.

b) URL or port setting may be incorrect.

c) Check 3G/4G signal strength at *monitor parameter* screen.

d) Check Battery voltage and health at *system info* screen.

e) GPRS service may be deactivated from SIM card service provider.

13   SETTING SENSOR'S GAUGE FACTOR

ESCL-10VT single channel data logger has capability to calculate parameter values using a second order polynomial equation.

$Y = A_2X^2 + A_1X + A_0$

Where, Y is the parameter value in engineering units and X is some function of the sensor frequency output.

Different manufacturers specify the value of X in different units in their test/calibration certificates supplied along with the sensor.

Case 1 : 'X' specified in terms of frequency

If the manufacturer specifies X in terms of frequency, then choose the value of "X-parameter" in SETUP screen as "FREQUENCY" from the drop down box.

Enter the value of A_0, A_1 and A_2 as mentioned in the manufacturer's calibration certificate without any modification.

Case 2 : 'X' specified in terms of frequency^2 (i.e. frequency squared)

If the manufacturer specifies X in terms of frequency^2 (frequency squared), then choose the value of "X-parameter" in SETUP screen as "FREQUENCY SQUARED" from the drop down box.

Enter the value of A_0, A_1 and A_2 as mentioned in the manufacturer's calibration certificate without any modification.

Case 3 : 'X' specified in terms of digits

This is a legacy case. Many manufacturers specify the value of X in terms of "digits" as defined below

Digits = (frequency)^2 / 1000

In this case replace A_1 with the value A_1 / 1000 and A_2 with the value A_2/10,00,000 when entering these coefficients in the data logger. A_0 will remain the same.

13.1   Value of A0

The value of A_0 is generally known as offset. It may be specified in the sensor's calibration/test certificate in which case it can be entered directly in the data logger without any modification.

However, it is more common to determine the value of A_0 at site just before or just after installation.

Enter the value of A_1 (and A_2 if required) and check the parameter value just before or after installation of the sensor (as the case may be) with zero input or reference input that should be considered as zero. Now reverse the sign of the observed parameter value and enter it in place of A_0.

Recheck the parameter value to ensure that it is now showing zero. If however, a non-zero value is required then add that non-zero value to the value of A_0 and check whether you can see that particular non-zero value with zero or reference input.
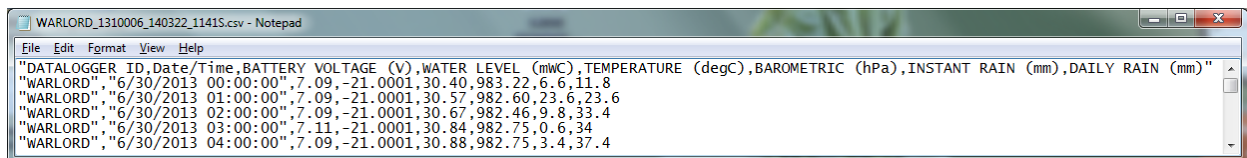
13.2   Installation Depth

Sensor installation depth is the location of VW sensor diaphragm from ground level.

           Installation depth = - sensor location from ground level

Example: Installation depth = -10.5 for water level sensor mounted 10.5 meter below ground level.

14 FILE FORMATS

The data files used for transferring data logger data to other software have the following formats. All data is in standard ASCII text format (7 bit). Variables are separated with commas (,).This format is suitable for direct import in Microsoft Excel (All versions) or other commercially available spread sheet programs for formatted printing and graphical plotting. Numeric values may or may not have a leading plus (+) sign but a minus (-) sign is always explicitly included. The contents of the data file are printed in Courier mono space font below.

Figure 14-1: Standard File Format

Figure 14-2: Extended File Format

15 WEB BASED DATA MONITORING SERVICE (WDMS)

The data on variation of water level collected from a large number of boreholes need to be presented as time Vs water level graphs or as tables for visualization or further analysis. Also the data may be required by a number of people sitting at different geographical locations simultaneously.

Web Data Monitoring software provided by Encardio-rite aids in the above process. It looks at the collected data and makes them immediately available in the form of time Vs level plots or in tabular form.

The user will have to maintain a desktop PC with an internet connection with static IP and running windows operating system and Microsoft IIS (*Internet Information Service*) server to run this software.

Authorized users from anywhere in the world can then login the website using the supplied user name and password and access the graphs and tables using any internet connected computer and a standard web browser like Microsoft Explorer, Google chrome Firefox etc. Figure 15-1 showing an example of Borehole data presented in graphical form.

Figure 15-1: Data display on remote PC

In case a user does not want to host his own server, Encardio-rite can provide this as a service at a low cost. This service is known as Web based Data Monitoring Service (WDMS) and is available to users throughout the world.