ENCARDIO RITE

USERS' MANUAL

DATALOGGER FOR DIGITAL SENSORS – OPERATION

(Suitable for sensors with SDI-12 digital output)

MODEL ESDL-30

Doc. # WI 6002.111.1 R01 | Jan 2017

Contents

CARE OF BATTERY

Data logger's Battery

The ESDL-30 SDI-12 Datalogger with internal battery uses two primary D-cell non-rechargeable batteries as a power source.

If the ESDL-30 SDI-12 Datalogger 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.

1   INTRODUCTION

1.1   Overview

The ESDL-30 SDI-12 Datalogger 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 ESDL-30 SDI-12 Datalogger consists of the following system components and accessories:

	Datalogger with internal battery back-up and communication option
	Configuration software CD
	USB to serial interface cable
	Installation accessories (Screw Driver)
	Data SIM (For telemetry option)

**Figure 2-1: Data logger and sensors connection diagram**

2   OPERATING PRINCIPLE

ESDL-30UNI, SDI-12 Universal Datalogger is designed to record data produced by the sensors connected to SDI-12 bus. Datalogger is having 3 SDI-12 ports (channels). Sensors having SDI-12 interface can be connected on a common SDI-12 bus. This bus can be connected to any SDI-12 port of the Datalogger. Each reading is stamped with date and time at which the measurement was taken. It has non-volatile flash memory to store up to 2 million data points.

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 downloaded files can be transferred to FTP server using internet connection. It can be processed on any common available spreadsheet like Microsoft-Excel.

ESDL-30UNI with built in GSM/GPRS 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.

Figure 2-1 shows the Datalogger and sensor connection diagram.
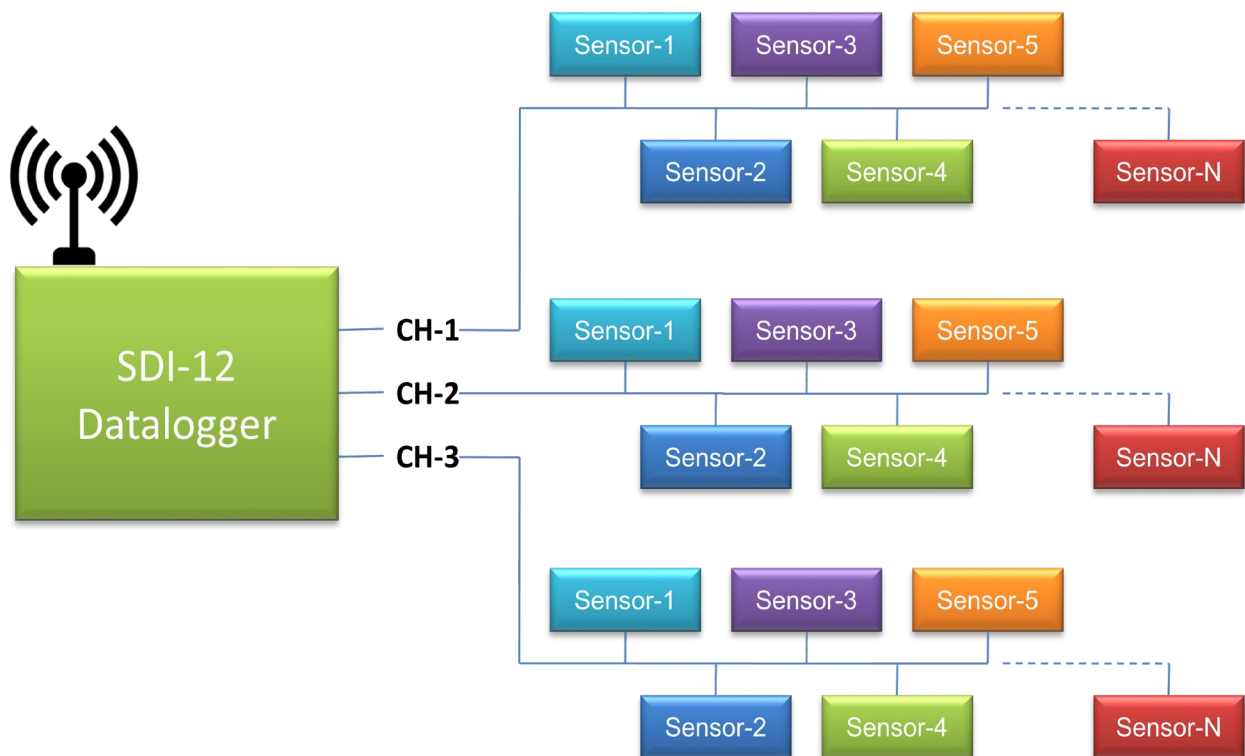
3   DATA LOGGER SETUP

Refer following steps to setup data logger for first time.

3.1   Connecting Sensor Cable

Refer following steps to connect SDI-12 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   Connect the SDI-12 Bus and power cable as per connection shown in following table.

Figure 3-1: Data logger

CH-1 Terminal	Wire Color
SIG	Green
GND	Black
+12V	Red

CH-2 Terminal	Wire Color
SIG	Green
GND	Black
+12V	Red

CH-3 Terminal	Wire Color
SIG	Green
GND	Black
+12V	Red

BUS Power	Wire Color
GND	Black
+12V	Red

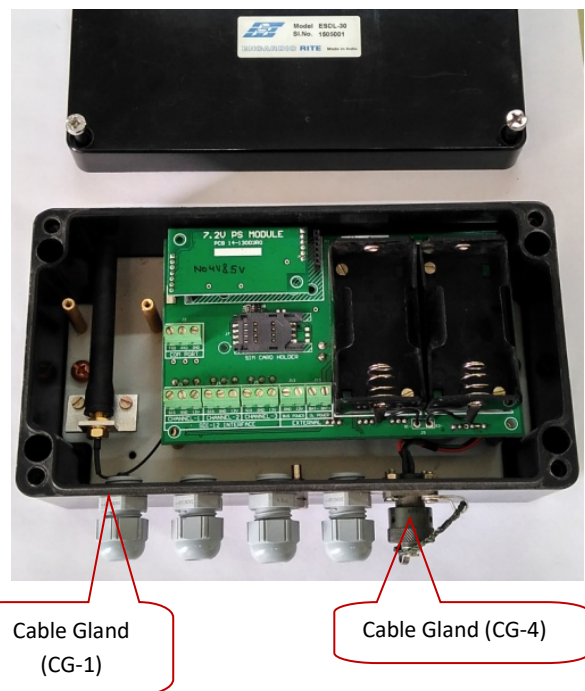| Datalogger Power	Wire Color
GND	Black
+12V	Red

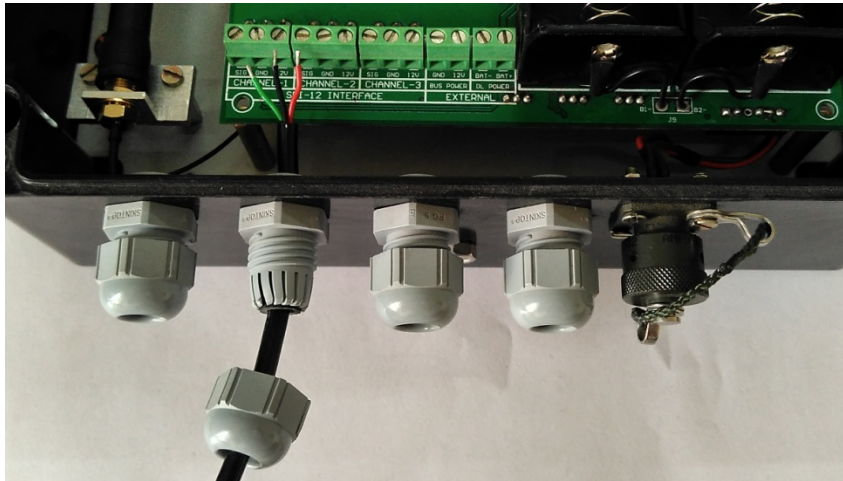
Figure 3-2: Pull out – top cover

Figure 3-3: Connecting the sensor cable to sensor end connector

3.2   Inserting SIM Card

A GPRS 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 3-4.

3   Insert the SIM card into slot of SIM card holder as direction shown in Figure 3-5.

4   Close the SIM holder by pushing from the opposite side keeping the SIM pushed down as shown in Figure 3-6. Slide the holder to Lock.

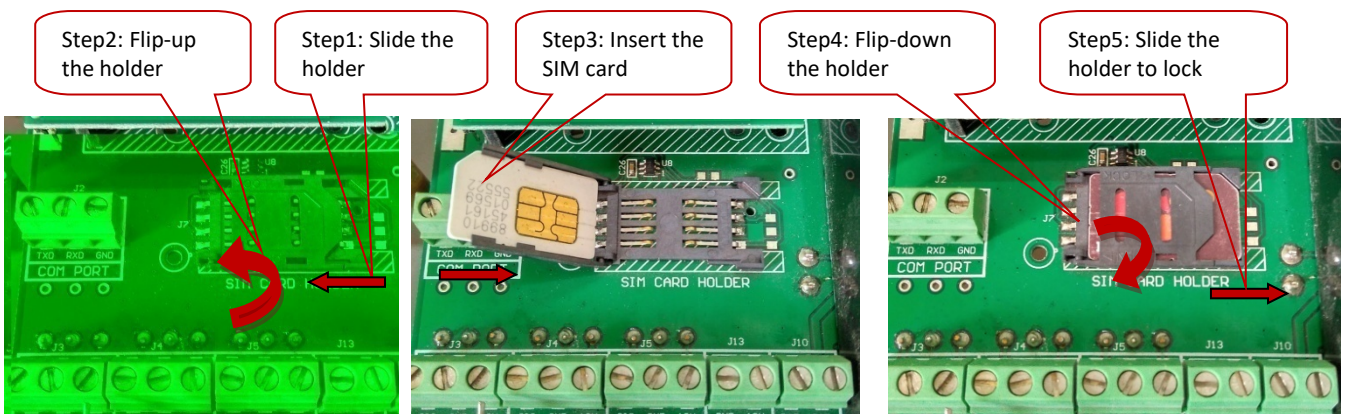| Step2: Flip-up the holder | Step1: Slide the holder | Step3: Insert the SIM card | Step4: Flip-down the holder | Step5: Slide the holder to lock |

Figure 3-5   **Figure 3-6**   **Figure 3-4**

4   POWER SUPPLY

ESDL-30 SDI-12 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.

4.1   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. If user don't want to use D-size batteries alternatively; user can use 3 V uninterrupted power supply (3 V/2 A battery backed PS). For this option, connect 3 V external supply at Datalogger Power Terminals (+/-).

Figure 4-1 Datalogger powered with 2 x 1.5 V Alkaline Batteries

4.2   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. If user don't want to use D-size batteries alternatively; user can use 7.2 V uninterrupted power supply (7.2 V/1 A battery backed PS). For this option, connect 7.2 V external supply at Datalogger Power Terminals (+/-).

Figure 4-2 Datalogger powered with 2 x 3.6 V Lithium Batteries

4.3   12V 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/ 1A from Mains Adaptor

- 12 V/1 A from solar panel

- 12 V/1 A from Battery backed power supply etc

Following Figure (Figure 4-3) showing an example of external power supply option. Connect 12 V external supply at Datalogger Power Terminals (+/-).
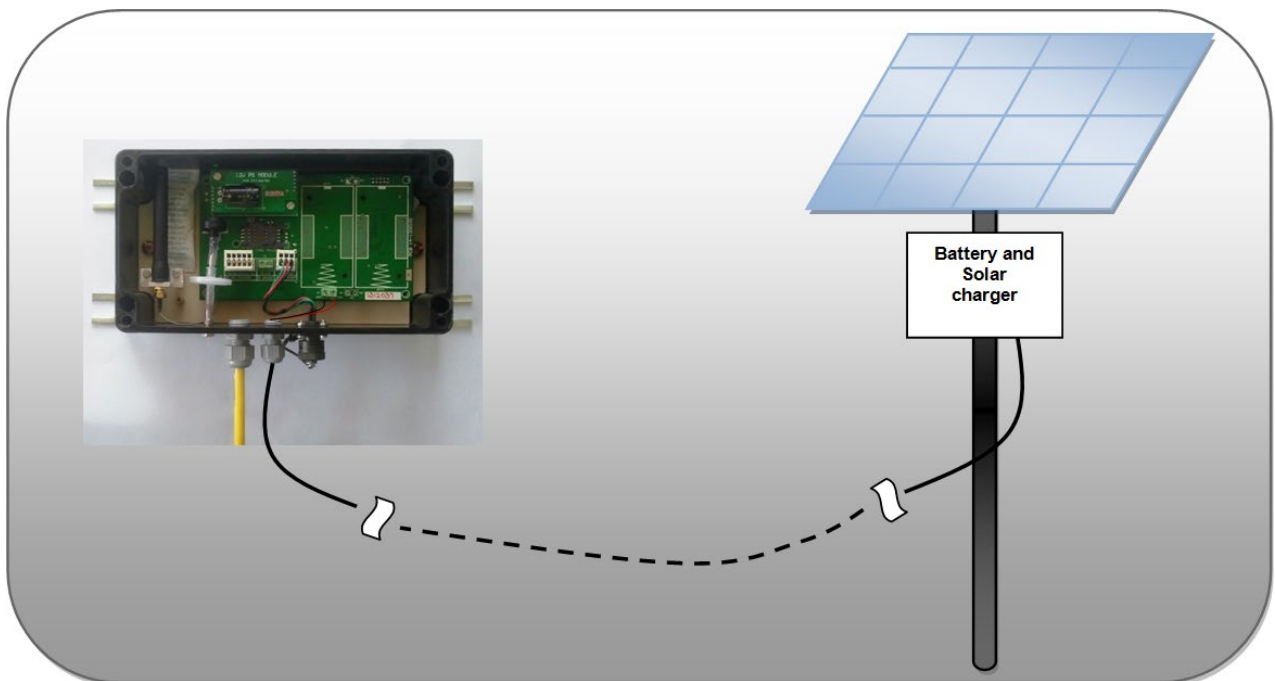

Figure 4-3 Datalogger powered with 12 V Solar powered

Important   Do not insert batteries into battery holder if Datalogger is powered with external power source.

5   DATALOGGER SDI-12 BUS POWER OPTIONS

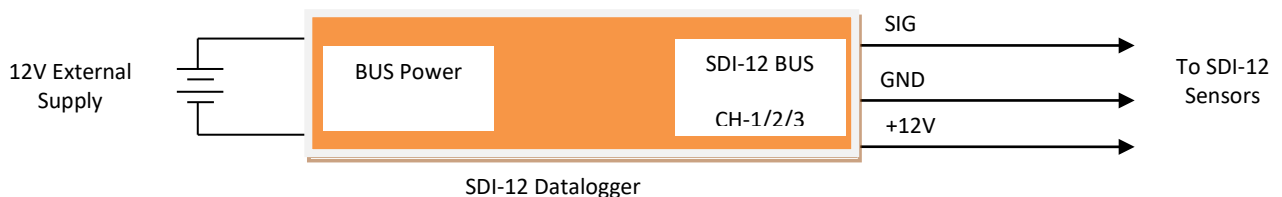SDI-12 Bus can be powered by either of 3 options.

- Using 12 V Internal Power Supply

- Using 12 V External Supply (with ON/OFF Control)

- Using 12 V External Supply (without ON/OFF Control)

5.1   Using 12 V Internal Power Supply Option

Datalogger with this option uses internal power supply to generate 12 V power supply to power the SDI-12 Bus. This 12 V supply is generated either from 3 V in 3 V Datalogger PS option or from 7.2 V in 7.2 V Datalogger PS option or from 12 V in 12 V Datalogger PS option. SDI-12 Datalogger when idle keeps SDI-12 bus power disable to save the power. It enables 12 V Bus power when required either for scanning or for other queries. There is no need of any 12 V external PS to power the bus with this option. This 12 V Bus power option has limited current capacity. It can power the SDI-12 Bus up to 70 mA current at any channel (CH-1, 2 or 3). SDI-12 Bus with Internal 12 Power supply option is suitable for low power SDI-12 sensors or few sensors connected to SDI-12 Bus. If Bus current is exceeding 70 mA then user can opt for 12 V external to power up the Bus. 12V external Bus power is recommended if large numbers of sensors are connected to SDI-12 Bus or when Datalogger is scanning at fast scan intervals because it will affect battery backup.

5.2   Using 12 V External Supply (with ON/OFF Control) option

Datalogger with this option uses 12 V external power supply to power the SDI-12 Bus. Connect 12 V external supply at Bus Power Terminals (+/-). This 12V Bus power option can power the SDI-12 Bus up to 3 A current at any channel (CH-1, 2 or 3). SDI-12 Datalogger when idle keeps SDI-12 bus power disable to save the power. It enables 12 V Bus power when required either for scanning or for other queries'.

5.3   Using 12 V External Supply (without ON/OFF Control) option

Datalogger with this option uses 1 2V external power supply to power the SDI-12 Bus. Connect 12 V external supply at SDI-12 Bus. Keep the Bus Power Terminals (+/-) at Datalogger open. The entire SDI-12 Bus will always be powered ON with this option. SDI-12 Datalogger will not control the 12 V Bus power. This option is suitable for SDI-12 sensors application where SDI-12 sensor to be kept ON always
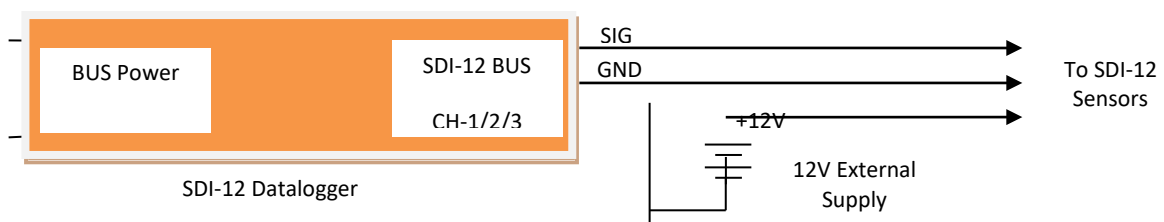
6   COMMUNICATION INTERFACE

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   Bluetooth™ 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 6-6: Bluetooth modem DIP switch settings

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.
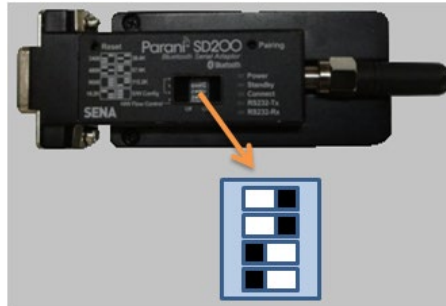

Figure 6-5: Inserting Batteries into Battery holder

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 6-7.

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.

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.

Figure 6-7: Connecting Datalogger with Laptop using Bluetooth Modem

7 SYSTEM SPECIFICATIONS

7.1 Single Channel Data Logger

Sensor type	: Any Sensor with SDI-12 interface
No. of Channels	: 3
No. of Sensors at each Channel	: 61 (max)
SDI-12 Version	: 1.3
Bus Power Output (Internal Batt. Powered)	: 12 - 13V / 70mA (max)
Power Supply	: 2 x 3.6V D-size Lithium cells (19AH)
	2 x 1.5V D-size Alkaline cells (15AH)
	12V External Powered (Mains / Solar)
Current Consumption	: (Does not include sensors excitation current)

		3V Alkaline Cell	7.2V Lithium Cell	12V External
Standby Current	:	0.30 mA	0.15 mA	1.5 mA
Active Current	:	10 mA	4 mA	5 mA
GPRS Upload Current	:	200 mA	70 mA	80 mA

Scan Interval	: 5 seconds - 168 Hours
Upload Interval	: 5 minutes - 168 Hours
Memory	: FRAM (2-Mbit) & Flash Memory (64-Mbit)
Data Storage Capacity	: 2 Million data points
Wireless Modem	: GSM/GPRS Quad Band
Antenna	: Built-in Stub Antenna
	(Optional) External Whip Antenna
Communication Ports	: RS-232 (Standard) 115 kbps
Data Transfer	: Via RS232
	Via GSM/GPRS cellular network
Configuration & Data Retrieval	: **Laptop running Windows OS**-
	using RS-232 or Bluetooth (see Note)
	FTP : using GSM/GPRS

Note: Data transfer via Bluetooth requires add-on   Bluetooth dongle for Datalogger

Dimensions (mm)*	: L= 220mm, W= 140mm, H= 90mm

Weight*   : Approx 1.7 kg (with Battery)

                                                            Approx 1.4kg (without Battery)

Environmental:

Operating Temperature Range   : -30°C to 70 °C

Humidity   : 100 % Max

Environmental Protection   : IP-65

Reference Specification:

*   Reference information only, units not meeting or exceeding these specifications or limits shall not lead to automatic rejection provided that the ability of the unit to function is not impaired.

8   DATA LOGGER INTERFACE SOFTWARE

8.1   ESDL-30 SDI-12 Datalogger Configuration Manager for PC/Laptop

The application is configuration manager software for ESDL-30 SDI-12 Datalogger. The data logger can be configured through this software. It analyzes the data files produced by the ESDL-30 SDI-12 Datalogger. 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.

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.
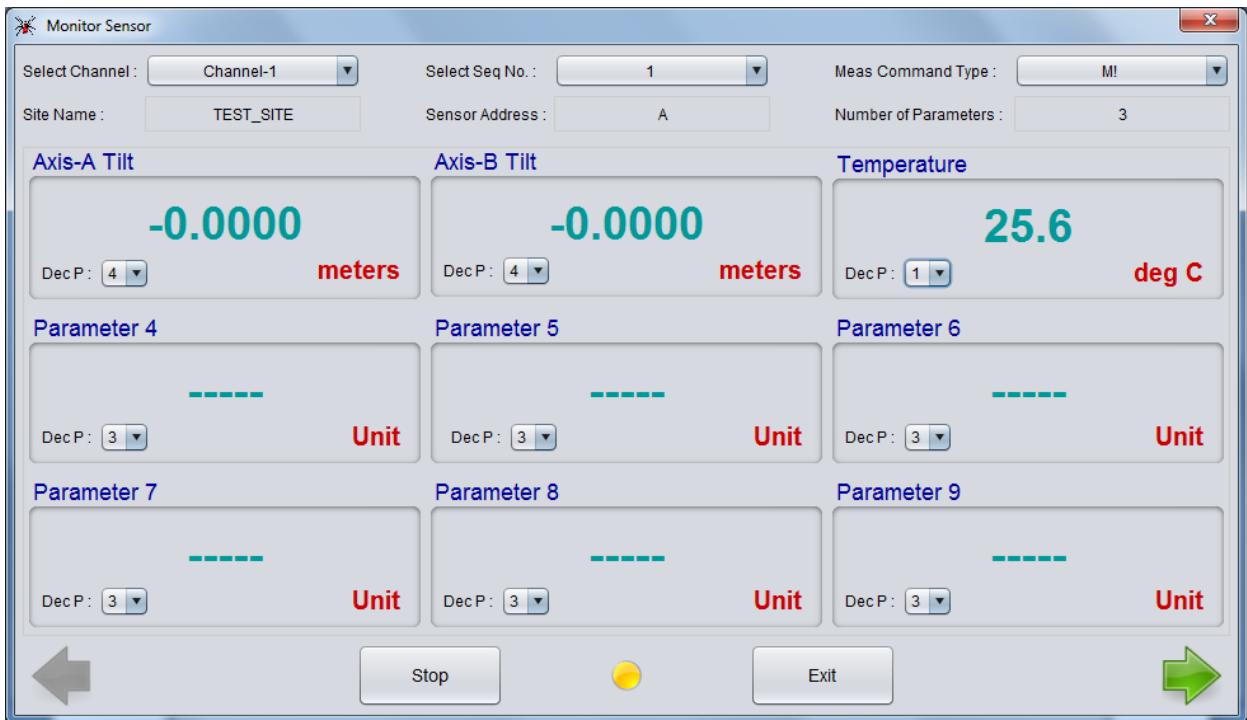
Figure 8-1 ESDL-30UNI Configuration Manager Application running on PC

9   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 9-1 showing an example of Borehole data presented in graphical form.

Figure 9-1: 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.

10   OPERATION AND MAINTENANCE

Although the ESDL-30 SDI-12 Datalogger 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.

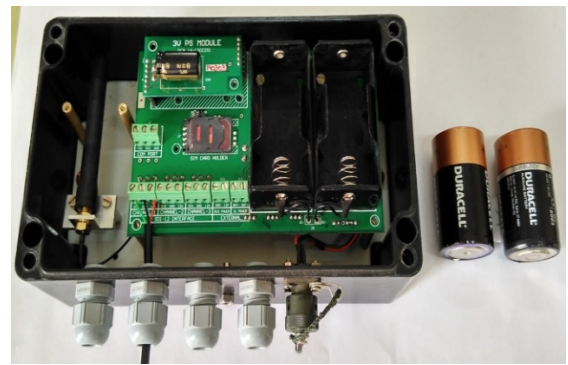3   Hold data logger in the position as shown in Figure 10-1(left). Open the top cover.

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 Laptop / PC.

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

- Bluetooth modem's battery may be discharged.

- Check Bluetooth modem baud rate settings. It must be configured for 115200 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.

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DATALOGGER FOR DIGITAL SENSORS
CONFIGURATION MANAGER FOR WINDOWS

MODEL ESDL-30
(Version 3.2 – For Windows)

Doc. #WI 6002.111.2 R01 | Jan 2019

Contents

1   INTRODUCTION

The application is a configuration manager for ESDL-30 SDI-12 Universal Datalogger. The data logger can be configured through this software. It reports the data files produced by the ESDL-30UNI. The application displays sensor readings. 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 form.

1.1   Introduction about the Manual

1.1.1   Purpose of this document

The purpose of this document is to show the entire functionality of the application for the device ESDL-30UNI. 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.

1.1.2   What the manual contains

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

1.1.3   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, configuring the Datalogger, scanning tilt sensors, downloading the records and analyzing the readings. 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.

1.1.4   List of Abbreviations

APN   Access Point Name
CSV   Comma Separated Values
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
SDI-12 Serial Digital Interface at 1200 baud rate
SIM   Subscriber Identity Module
URL   Uniform Resource Locator
UNI   Universal
USB   Universal Serial Bus
UTC   Coordinated Universal Time
WDMS Web based Data Monitoring Service

1.2   Overview of the configuration manager software

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.

1.3   What is SDI-12?

SDI-12 stands for serial data interface at 1200 baud. It is a standard to interface battery powered data recorders with micro-processor based sensors designed for environmental data acquisition (EDA).

EDA is accomplished by means of a sensor, or sensors, and a data recorder which collects and saves the data. SDI-12 is a standard communications protocol which provides a means to transfer measurements taken by an intelligent sensor to a data recorder. An intelligent sensor typically takes a measurement, makes computations based on the raw sensor reading, and outputs the measured data in engineering units. For example, an SDI-12 pressure sensor may take a series of pressure measurements, average them, and then output pressure in psi, inches of mercury, bars, millibars, or Ttorrs. The sensor's micro-processor makes the computations, converts sensor readings into the appropriate units, and uses the SDI-12 protocol to transfer data to the recorder.
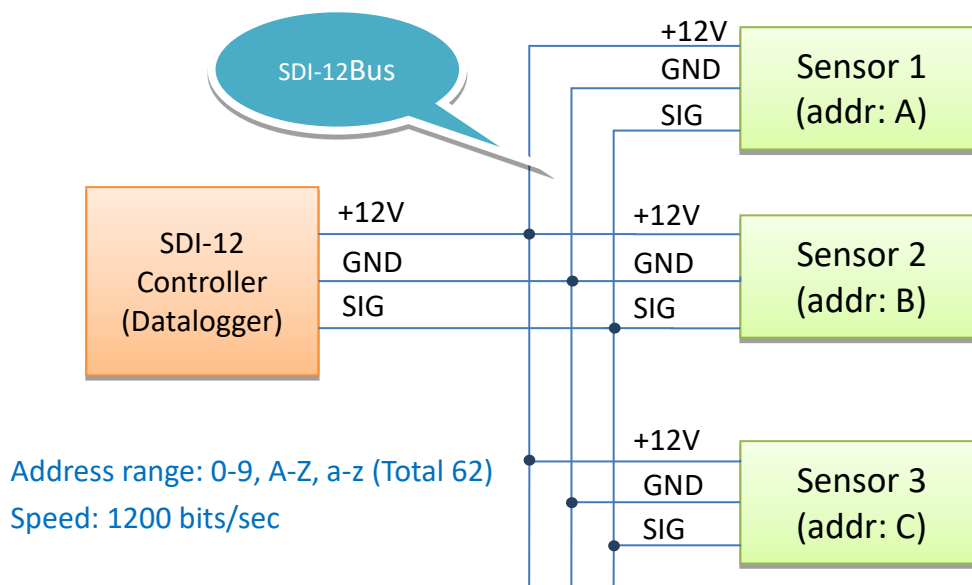

Figure 1-1: SDI-12 Bus connections for single channel

The SDI-12 electrical interface uses the SDI-12 Bus to transmit serial data between SDI-12 data recorders and sensors. *Figure 1-1* is showing SDI-12 interface connections. The SDI-12 Bus is the cable that connects multiple SDI-12 devices. This is a cable with three conductors:

- 12 Volts

- Ground

- Serial data

The address can be customized to any value from "0" to "9", "A" to "Z", or "a" to "z", giving a total of 62 unique addresses. Sensors can be connected to SDI-12 Bus with suitable SDI-12 Interface unit. An example of SDI-12 sensors block diagram shown in following *Figure 1-2* to understand the sensor interface.
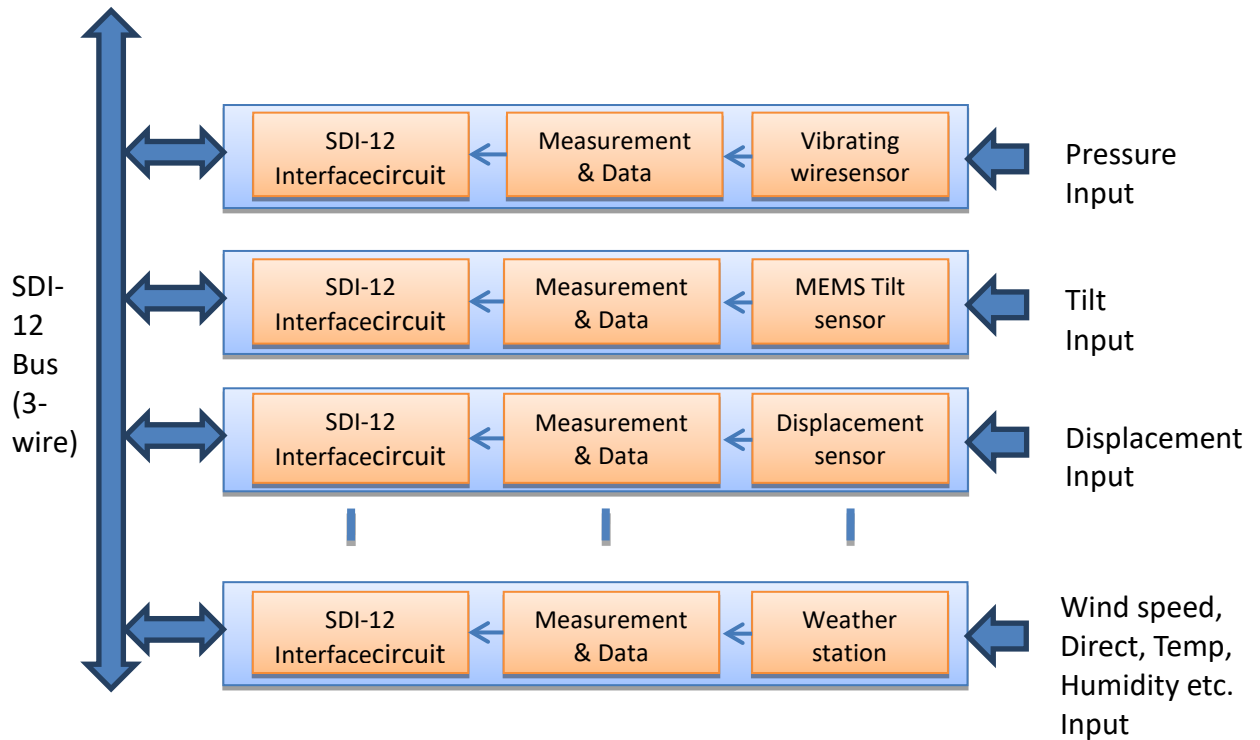
Figure 1-2: SDI-12 sensors block diagram

1.4   Operating Principle

ESDL-30UNI, SDI-12 Universal Datalogger is designed to record data produced by the sensors connectedto SDI-12 bus. Datalogger is having 3 SDI-12 ports (channels). Sensors having SDI-12 interface can be connected on a common SDI-12 bus. This bus can be connected to any SDI-12 port of the Datalogger. Each reading is stamped with date and time at which the measurement was taken. It has non-volatile flash memory to store up to 2 million data points.

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 downloaded files can be transferred to FTP server using internet connection. It can be processed on any common available spreadsheet like Microsoft-Excel.

ESDL-30UNI with built in GSM/GPRS 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.

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 be enough to support the Operating System of the PC

- 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.

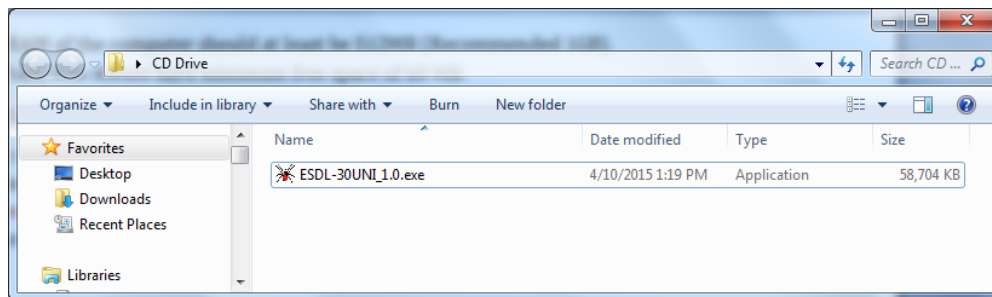- Insert the disk into the CD-ROM drive.

Figure 2-1: 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.
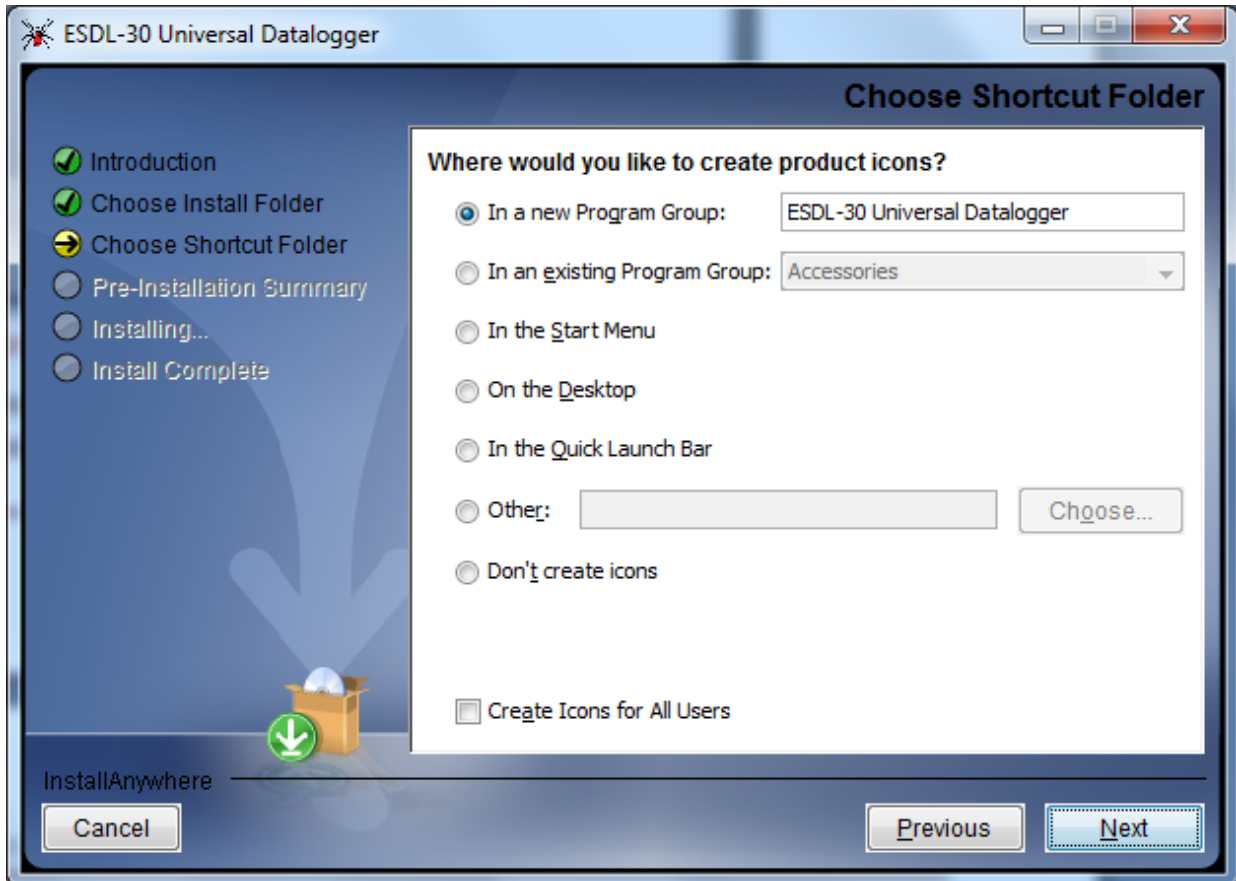
Figure 2-2: Installation Introduction

- 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.

1.1.1 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

1.1.2 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.

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.
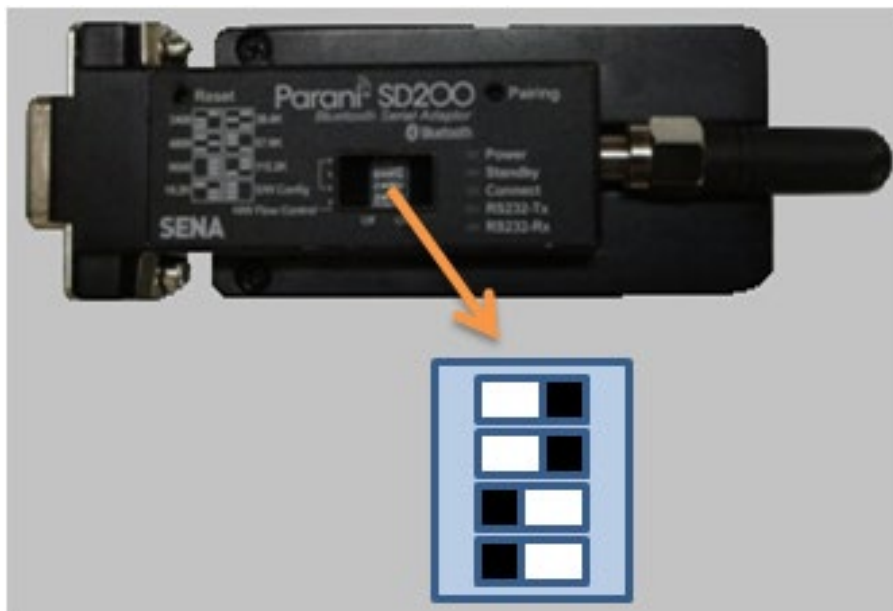

Figure 2-4: Bluetooth modem DIP switch settings

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 iconESDL-30UNI from desktop to run the application.

Figure 2-6: Application software shortcut

Application asks for data file storage location if application runs for first time. Refer Figure-2-7. Browse the folder path to set the data file storage location. It is recommended that data files must be kept to user accessible area.
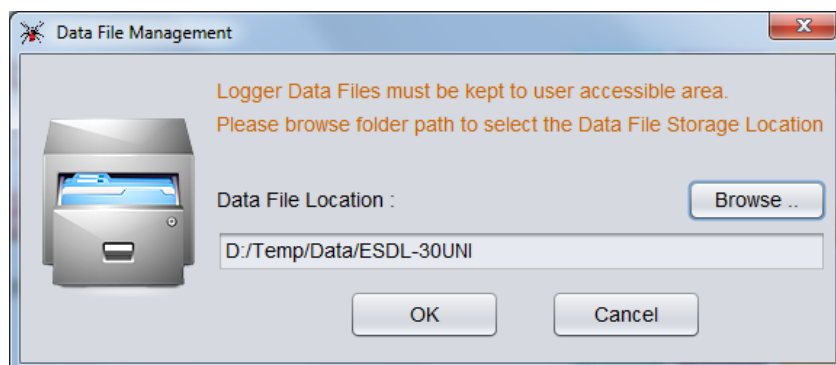

Figure 2-7: Data File storage location

2.5   Viewing the Main Screen

Entering the application, the main screen of the application appears as displayed in Figure 2-8.
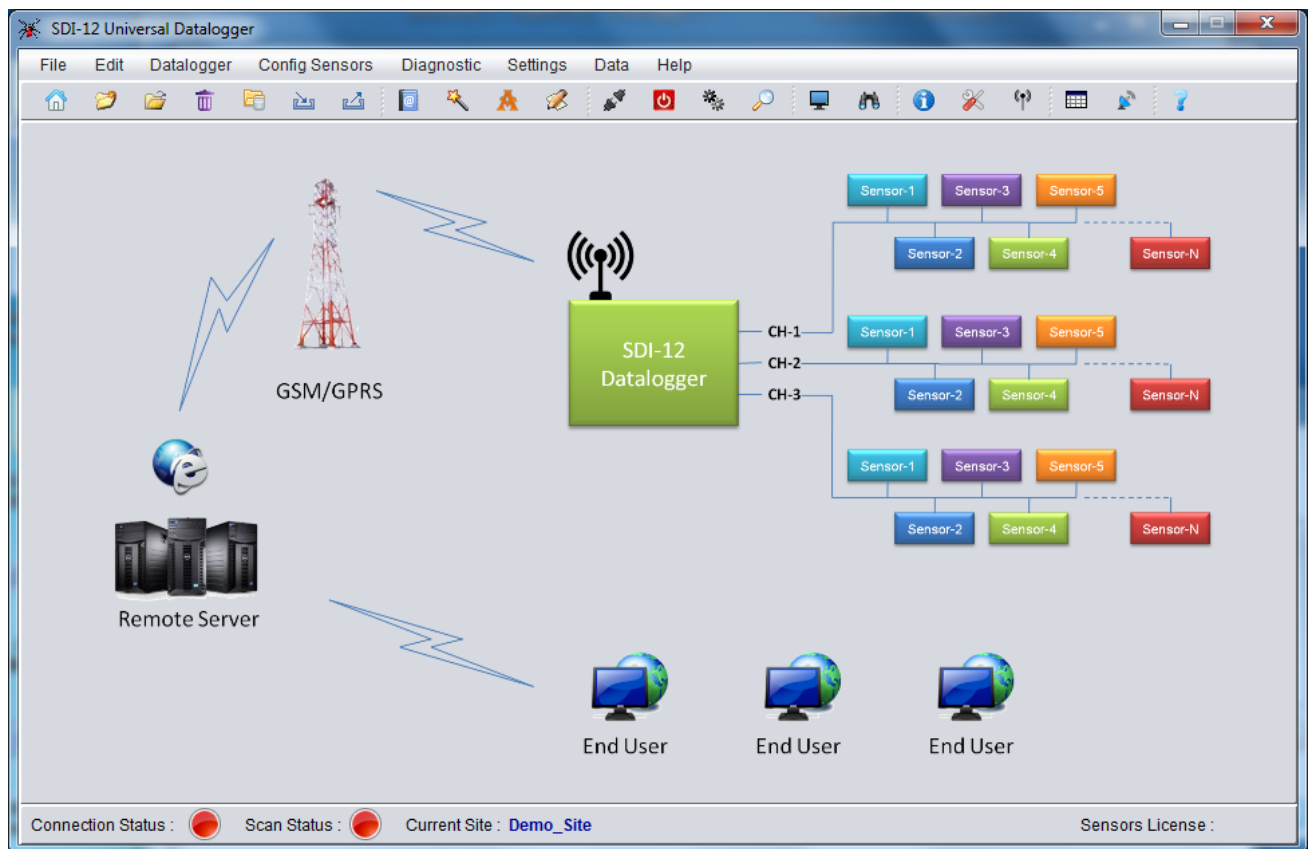

Figure 2-8: Main Screen

2.6   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.

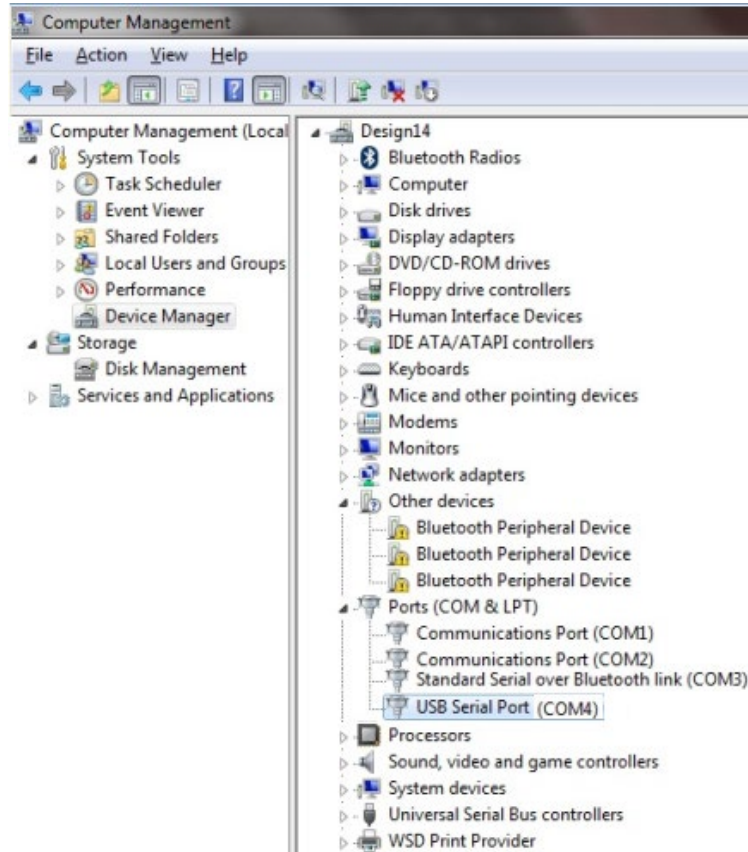Figure 2-9 displays an example of available ports through device manager.

Figure 2-9: Device Manager (Computer Management)

2.7   Connecting Data Logger

Go to "Connection" and then select "Connect Datalogger" option. A dialog will open for selecting serial port as shown in Figure 2-10. After selecting the Serial Port, click *Connect to* connect to the data logger. The progress bar appears on the screen as the application takes few seconds to get connected.

Figure 2-10: Connection Dialog

After successful connection, information message pops up on the screen confirming successful connection. Press OK to proceed.
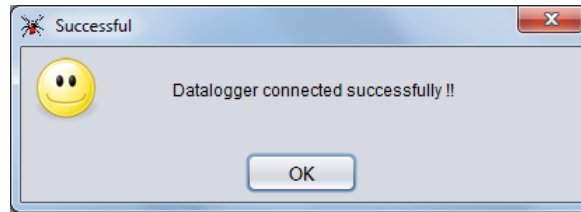
Figure 2-11: Information message

Application checks data logger's battery health. Application displays information message pops up on the screen if battery voltage found low.
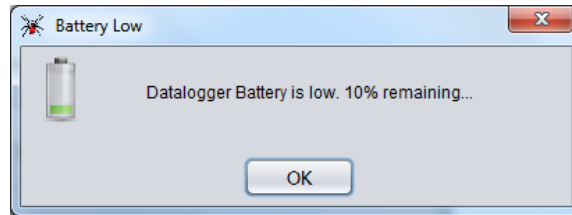

Figure 2-12: Battery low alert message

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.
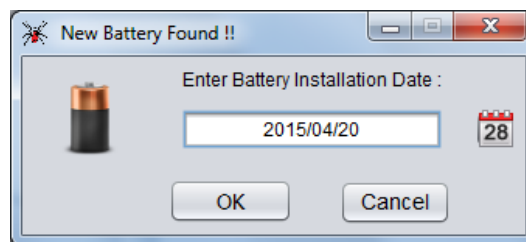

Figure 2-13: Battery installation date entry

Now application displays "*Open site*" dialog to select the site. Select the appropriate site and then click on "*Open*" button to open the site for Datalogger. You can choose "*Demo site*" for first time.
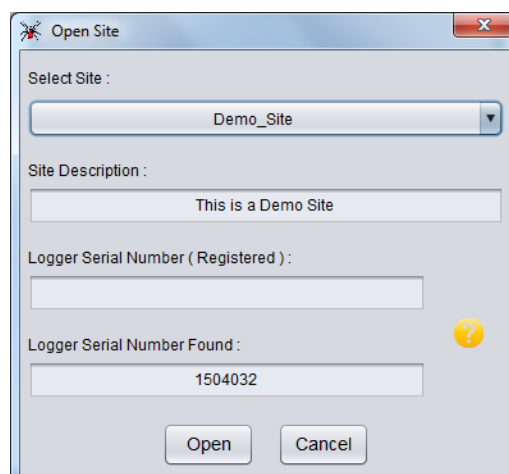

Figure 2-14: Select site to Open

3   QUICK START GUIDE

SDI-12 Datalogger (ESDL-30) is having 3 independent channels (SDI-12 Bus) for connecting SDI-12 sensors. Each channel can support up to 61 SDI-12 sensors means total 183 sensors (3x61) can be connected to a Datalogger. SDI-12 Sensors (smart sensors) can be directly connected to SDI-12 Bus whereas sensors those are not having SDI-12 interface can be connected to SDI-12 Bus using suitable SDI-12 interface unit.

3.1   Preparing Setup

Use step by step procedure to prepare the setup connections.

Step 1:   Plan the sensors Bus map (which sensor to be connected to which channel)

Step 2:   Plan the sensors address (Each sensor should have unique address connected to a single BUS)

Step 3:   Connect the Datalogger and open the "Set sensor address" screen

Go to Edit>>Set sensor address

Step 4:   Connect each sensor one by one to Channel-1 and repeat the following steps for each sensor

- ▪ In "Single sensor connected to SDI-12 Bus" panel, select Channel-1.

- ▪ Choose the address (which is to be assigned to this sensor)

- ▪ press update button to set the new address to the sensor

- ▪ Disconnect the sensor and connect another sensor which address to be changed

Step 5:   Now connect the sensors to the SDI-12 Bus as per your BUS map. Refer Figure 1-1 and Figure 3-1 to make connections.
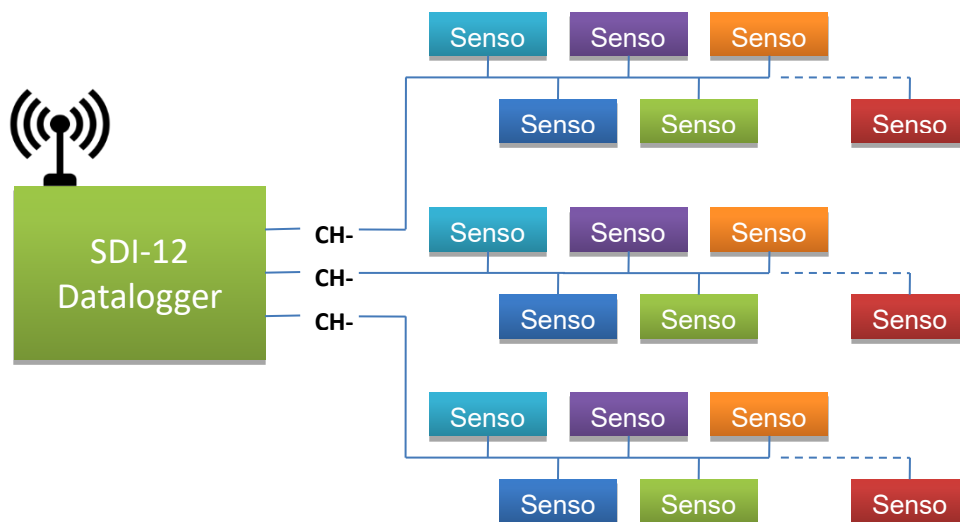

Figure 3-1: SDI-12 Sensors connected at different BUS

Step 6: Now your setup connections has been ready to configure the Datalogger.

⚠ **Warning !!**

Each sensor should have unique address connected to a single BUS (Channel-1, 2 or 3).The address can be customized to any value from "0" to "9", "A" to "Z", or "a" to "z", giving a total of 62 unique addresses at each channel.

3.2   Configuring Sensor's Coefficients and information

SDI-12 sensor's coefficients are preloaded by the factory however; user configurable coefficients and information can be changed. Use step by step procedure to configure the sensor's parameters like model, coefficients, sensor serial number, sensor tag etc.

Step 1:   Note down the channel number, address and model number of SDI-12 sensor or SDI-12 interface which is to be configured.

Step 2:   Connect the Datalogger and open the "sensor configuration" screen

Go to Config sensors>>[Model Number] >> Sensor Configuration

Step 3:   Select the Channel Number (at which it is connected), select address (address of that sensor/interface which is to be configured) and press Read button to get the sensor's parameters

Step 4:   Edit the coefficients or information and then press Update button. (Please do not change coefficients values if not known)

Step 5:   Press Monitor button to see sensors live reading

Step 6:   Repeat the steps from 2 to 5 to configure all sensors which are to be configured.

Step 7:   Now all the sensors are ready.

3.3   Preparing Sensor Table, Configuring FTP and start scanning

Use step by step procedure to configure the Datalogger for sensor table, FTP upload settings, FTP upload schedule and sensors scan schedule.

Step 1:   Connect the Datalogger and open the "Site Setup Wizard" screen

Go to Edit>>Site setup wizard

Step 2:   Type site name and site description in text box provided under "Create New Site" panel and press Create New Site button

Step 3:   New menu shows sensors connected at SDI-12 BUS. Press Next button to start automatically searching sensors connected to different BUS. It will take few minutes to get sensor's information. It will automatically create sensors table and upload sensors table into Datalogger.

Step 4:   New menu shows FTP server credentials for uploading data file to FTP server. Choose upload interval and next upload start time and then press Next button. (Press skip button if FTP credential not known)

Step 5:   New menu shows Sensor's scan schedule. Choose scan interval and next scan start time and then press Next button to start scanning.

Step 6:   A detailed PDF report about sensor table will be generated upon completion of Site setup wizard.

Step 7:   Now Datalogger is running.

Refer Section-19 for more information about Site Setup Wizard

3.4   Downloading and Viewing Data

Datalogger uploads Sensor's data to remote FTP server as per programmed upload schedule. However; data can be downloaded locally using PC/Laptop. Use step by step procedure to download and view the logged file.

Step 1:   Connect the Datalogger and open the "Scan" screen

Go to Datalogger>>Scan

Step 2:   Press Download button under Logger Memory panel. Downloaded data will be saved in CSV

(comma separated values) format at specified file path.

File path: [root]\EncardioRite\ESDL-30UNI\CsvFiles\Site\TEST_SITE\Downloaded*.CSV

File path: [root]\EncardioRite\ESDL-30UNI\CsvFiles\Site\[TEST_SITE]\TableView*.CSV

Step 3: Downloaded file can be directly opened to view data or alternatively it can be viewed in table format using following steps

Step 4: Open "Table View" screen

Go to Data>>View

Step 5: Select File, Record date and Record time to see sensor's data

Refer Section-14 for more information about Data Download

4   HOME

Connecting to Data Logger, the Connect status indicator turns to green as shown in Figure 4-1. Site can be created/modified or deleted under File menu options. Sensor Table can be edited using Edit menu options. Sensors address can also be set through this menu. Datalogger can be connected or disconnected through Datalogger menu option. Sensors can be directly accessed through Diagnostic menu options. Datalogger settings and GPRS upload options can be viewed/configured using Settings menu options. Sensors scanning can be done through Datalogger menu options. Logger records can also be downloaded through this menu. Records of Downloaded file can be viewed and these files can be manually uploaded to remote FTP server under Data menu options.
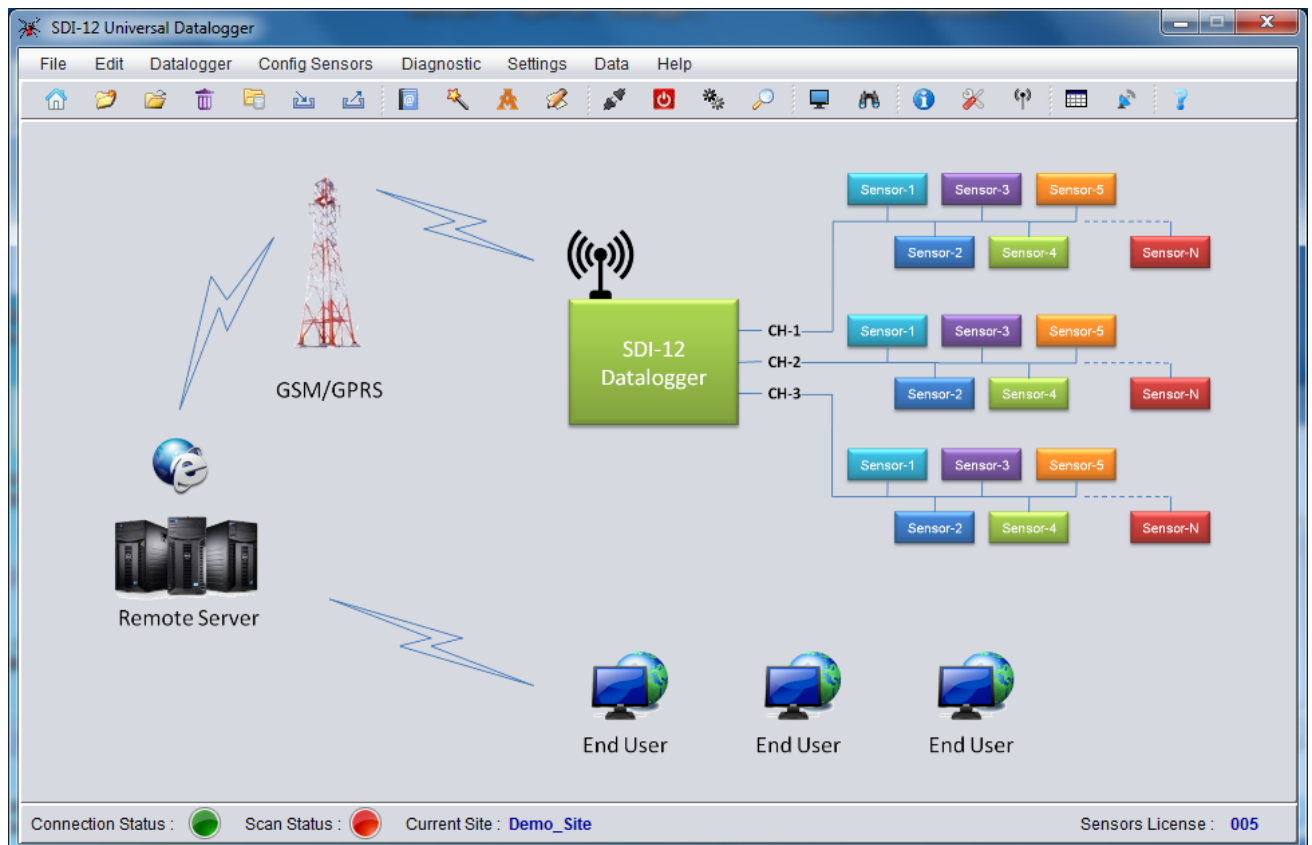

Figure 4-1: Home Screen

5   SET SENSOR ADDRESS

A characteristic inherent to all SDI-12 devices is that each has an internal SDI-12 address. The SDI-12 address is used as a reference for issuing commands from a master device such as a SDI-12 Universal Datalogger. Thus, each SDI-12 device that is connected must have a unique address.

The address setting can be changed by issuing SDI-12 commands through *Set Sensor Address* screen. In some cases, it may be necessary to change the address to interface multiple SDI-12 sensors to a SDI-12 Universal Datalogger.
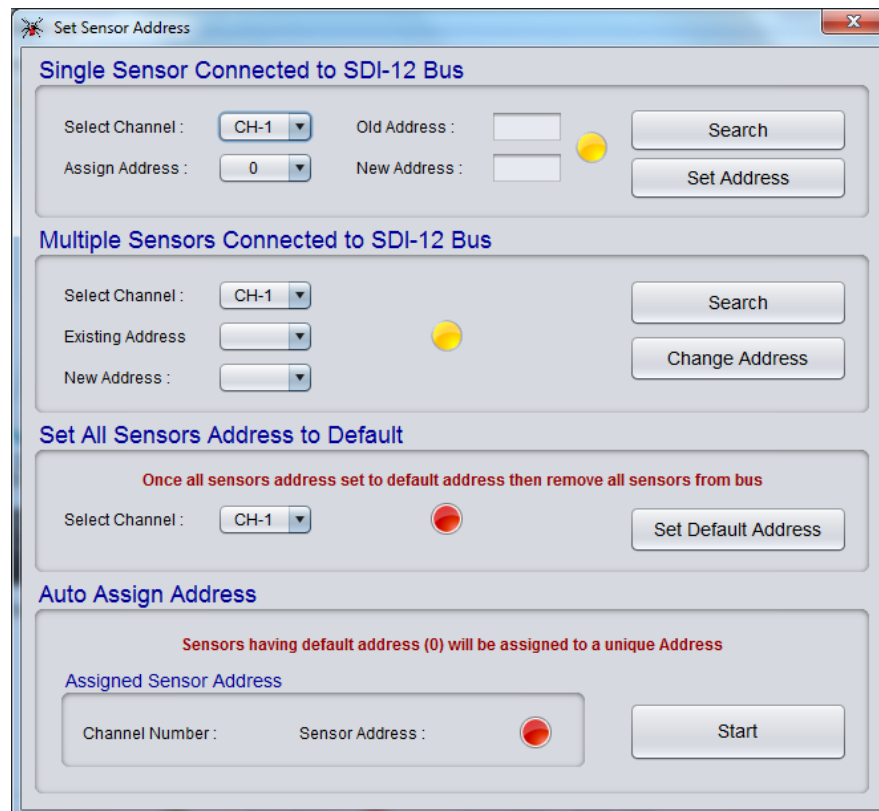

Figure 5-1: Set sensor address screen

5.1   When single sensor connected to SDI-12 Bus

In this option, only one SDI-12 sensor must be connected at SDI-12 Bus. Remove all SDI-12 devices from the SDI-12 Universal Datalogger except for the SDI-12 sensor that address will be changed. This is to avoid accidentally changing settings on the wrong SDI-12 sensor or possibly changing a sensor to an SDI-12 address that is already being used by another sensor.

User can check number of sensors connected at particular SDI-12 Bus by selecting channel number and then clicking on search button as shown in Figure 5-3. After search is complete, application will show total number of sensors connected at Bus. Refer Figure 5-2 for information message. Ensure that it should be 1.
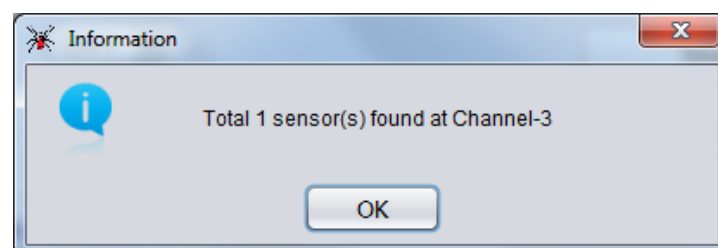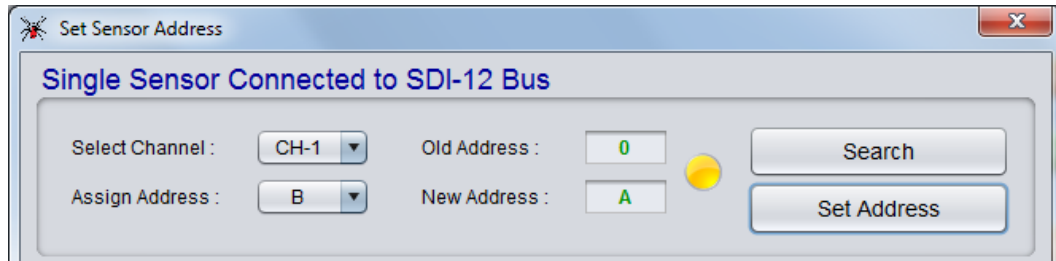
**Figure 5-2: Information message after searching sensors at Bus**

Select the address which is to be assigned from drop down option. Click on *Set address* button to set the new address. Sensor's old address and new address are shown on screen. Refer Figure 5-3. *Green indicator* means address has been updated while *Red indicator* means address has not been changed due to any problem. Remove the sensor, connect another sensor, select the address and then press set address button to assign the new address. Similarly, do it for other sensors.

Figure 5-3: Single sensor option

5.2   When Multiple sensors connected to SDI-12 Bus

In this option, a single SDI-12 sensor's address can be changed among many sensors connected at SDI-12 Bus. Once, search the sensors by pressing search button to let the Datalogger know about addresses existing on SDI-12 bus. This is required for first time to avoid assigning duplicate SDI-12 address that is already being used by another sensor.

Select the existing address of the sensor which is to be changed. Select the new address which is to be assigned from drop down option. Click on Set address button to set the new address. Refer Figure 5-4. Green indicator means address has been updated while Red indicator means address has not been changed due to any problem. Similarly, do it for other sensors.
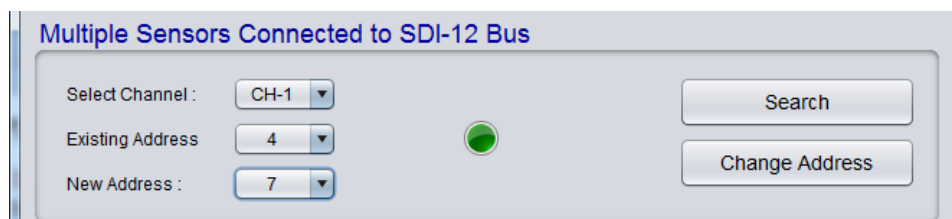
Figure 5-4: Multiple sensor option

5.3   Setting all sensors address to default

In SDI-12 protocol, "0" is the default address for any SDI-12 sensor. It is a good practice to keep sensor's address to default when it is stored or not installed. Sometimes, when the work is completed at site, the user may wants to set default sensor address while uninstalling the sensors. It is not compulsory but it is a feature.

Select the SDI-12 channel from application and press Set Default Address button. Datalogger searches the sensors connected at Bus and set their addresses to default. After completing the process, indicator status becomes changed. Green indicator means all the sensor's address have been set to default while Red indicator means addresses have not been changed due to any problem.
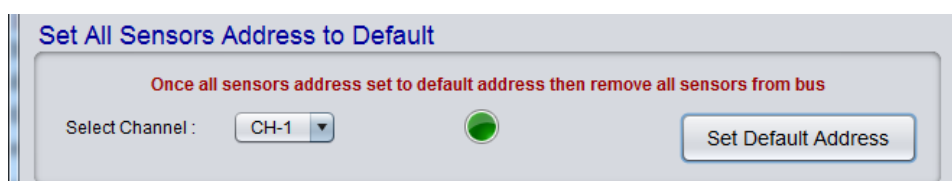
Figure 5-5: Set sensor addresses to default

NOTE: Remove all the sensors from Bus after making all sensors addresses to default.

WARNING: Sensors default address is "0". After setting all sensors address to default ("0"), all the sensors must be removed from bus as each sensor should have unique address connected to a single BUS (Channel-1, 2 or 3) for sensor identification.

5.4   Auto Assign Address

Each SDI-12 device that is connected at Bus (for any channel) must have a unique address. It is user's responsibility to ensure Bus (of any channel) must not have sensors having duplicate addresses. When large number of sensors are going to connect with Datalogger, to avoid accidentally changing settings on the wrong SDI-12 sensor or possibly changing a sensor to an SDI-12 address that is already being used by another sensor, user can use auto assign address option.

Remove all SDI-12 sensors from the SDI-12 Universal Datalogger. All the sensors which are going to connect to Datalogger must have default address. Press Start button to start the process. Connect a sensor to a SDI-12 Bus of any channel. Datalogger will assign a unique address for that channel. Assigned address can be seen on screen. Connect another sensor to any SDI-12 Bus to assign the address. Similarly do it for all sensors. Press Stop button to stop the process.
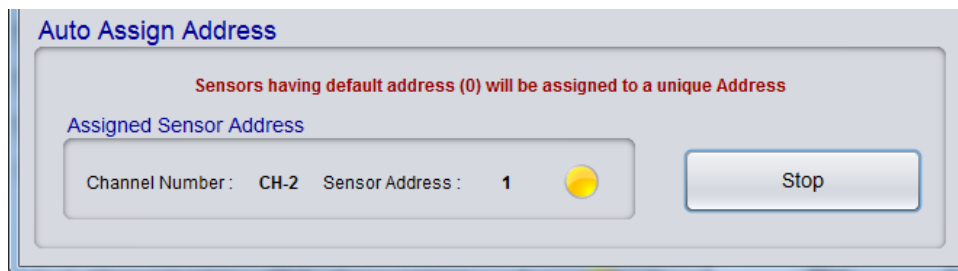

Figure 5-6: Auto assigns sensor address

6   SDI-12 TERMINAL

Many SDI-12 sensors are connected to SDI-12 Bus at different channels. User can directly access the SDI-12 Bus of any channel and communicate with sensors through SDI-12 command sets. Go for SDI-12 Terminal option from Diagnostic menu from Home screen to open SDI-12 Terminal window. Figure 6-1 is showing an example of SDI-12 Terminal window.
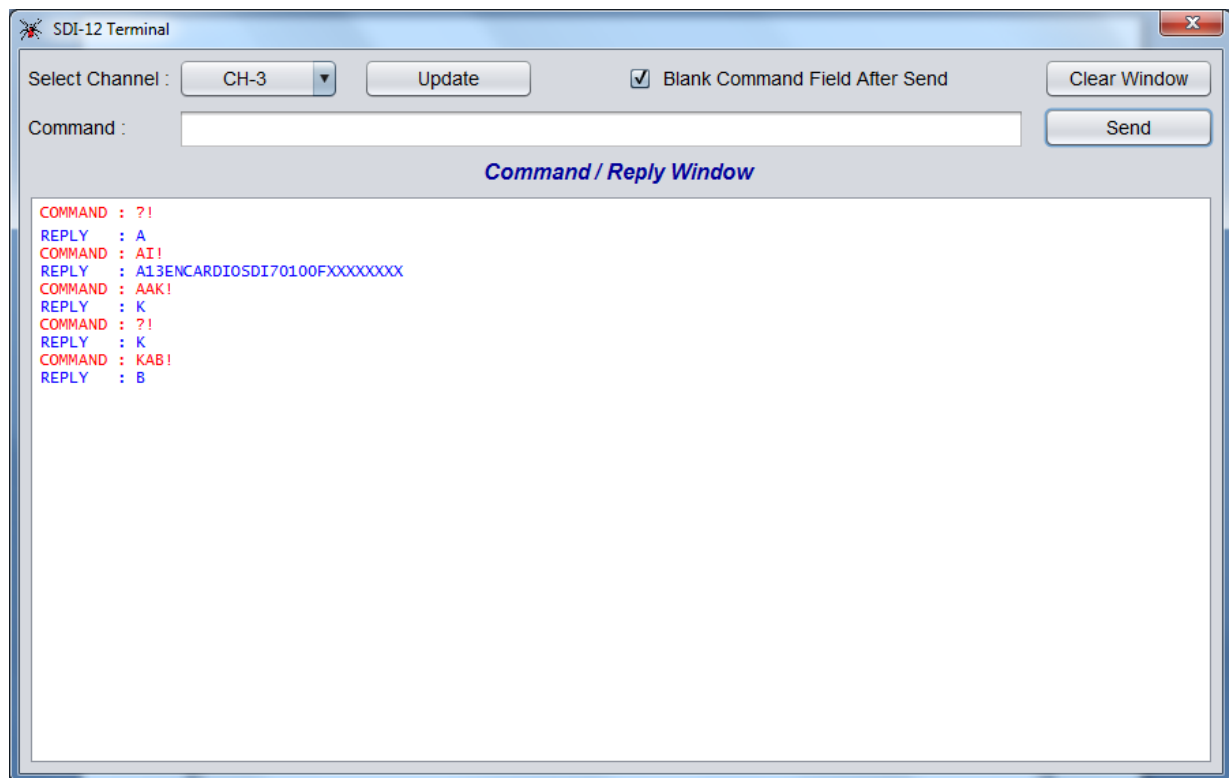

Figure 6-1: SDI-12 Terminal Window

Select the SDI-12 channel from drop down option and click on Update button to enable the SDI-12 Bus of particular channel. Type the command into text box provided for entering the command. Press on send button to send the command. Command and their reply displays under command/ reply window.

Pressing on Clear Window button will clear the command/reply window. Contents of command/ reply window can be copied to notepad, MS-word or any other editor.

7   SEARCH SENSORS

Sensors connected to all 3-channels of SDI-12 Bus can be searched through *search sensors screen*. Go to *Search Sensors* option from *Diagnostic menu* from *Home* screen to open *Search sensors* screen. *Figure 7-1* is showing an example of *search sensors screen*.
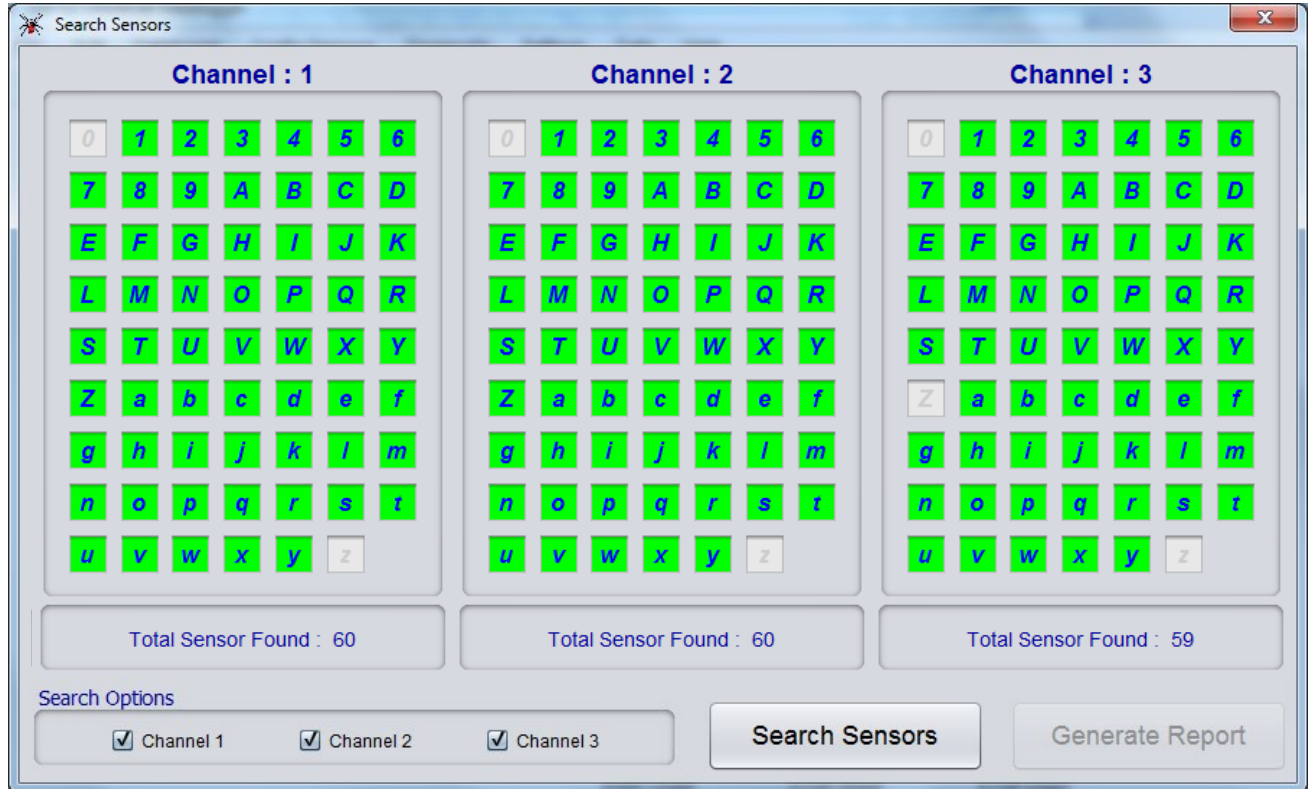

Figure 7-1: Search Sensors screen

Press the *Search Sensors* button to start searching the sensors connected to SDI-12 Bus. After completing the search process, application displays available sensor addresses for respective channels with Green indicators. Application also displays *Total sensors found* at respective channels. Press *Generate Report* button to generate detailed report of sensors connected to SDI-12 Bus. *Figure 7-2* is showing an example of Sensors Report.
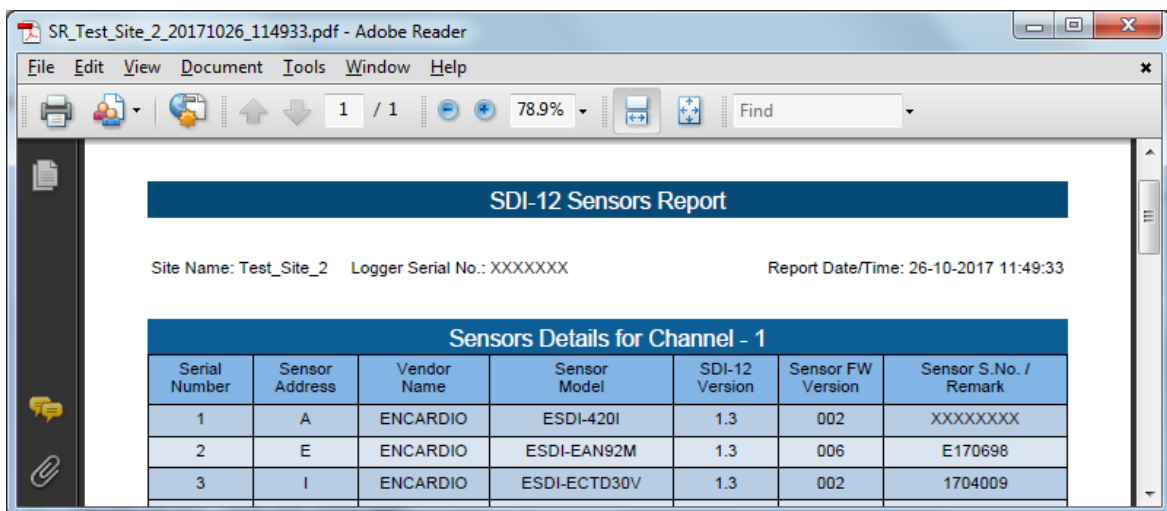

Figure 7-2: Sensors Report

8   SYSTEM INFORMATION

ESDL-30UNIUniversal Datalogger is a very interesting product. When selecting *Logger info* option from *Settings* menu, application gets system information from Datalogger. *Figure 8-1* showing an example of *system info* screen. Fields are not editable.

Data logger serial number, Model number, Data logger ID (station ID), Data logger's Firmware information and GPRS modem option can be seen in *Logger info* panel.

SDI-12 Bus related information like Bus power supply option and number of channels can be seen in *SDI-12 Bus* panel.

Data log related information like Scan status, data logging interval, next scan start time and number of records 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.
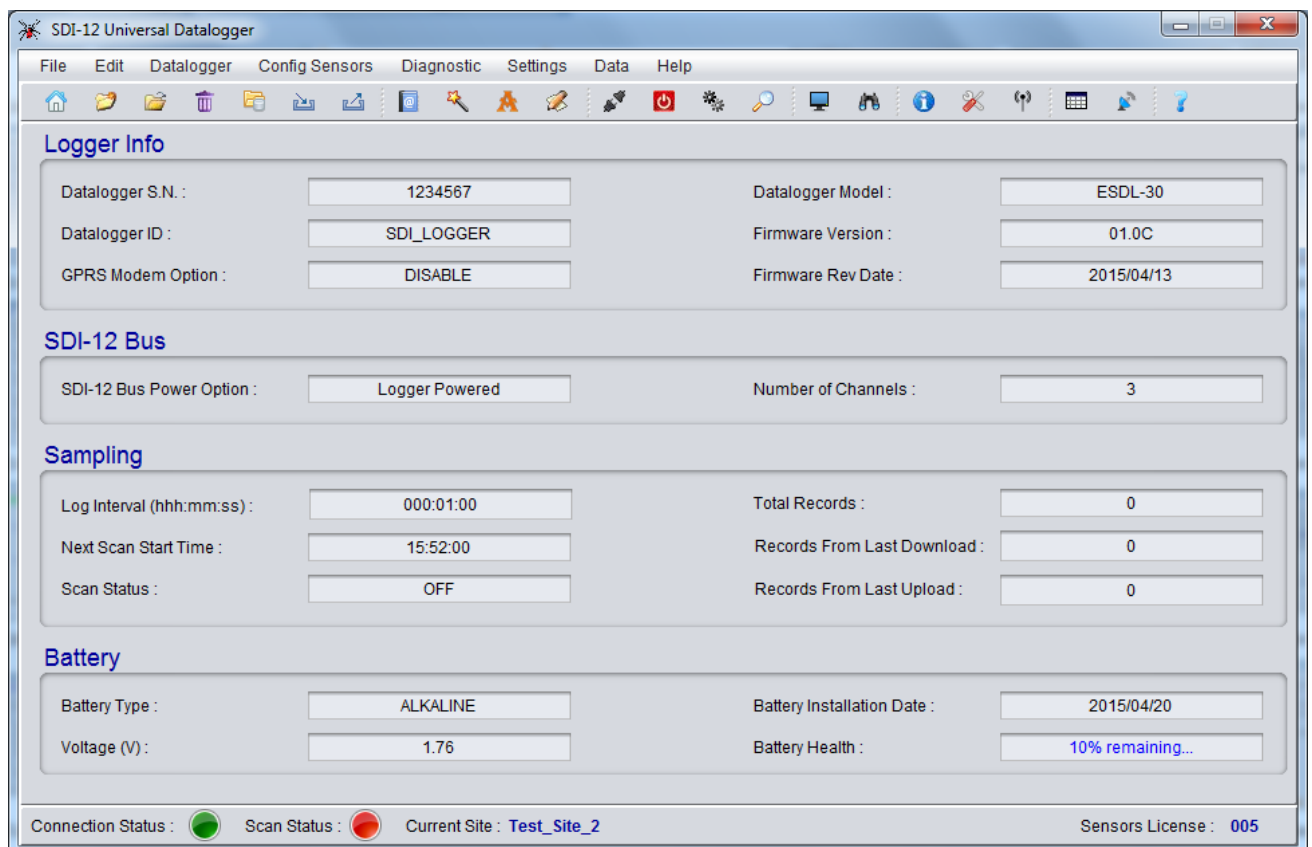
Figure 8-1: System Info screen

9   CREATING SITE

Go to *File menu* and then click on *Create Site* option to create site menu. Refer *Figure 9-1*. Click on *Create Site* button to open create site menu. Enter Site name and description and then click on *Save* button to create new site. Refer *Figure 9-2*.
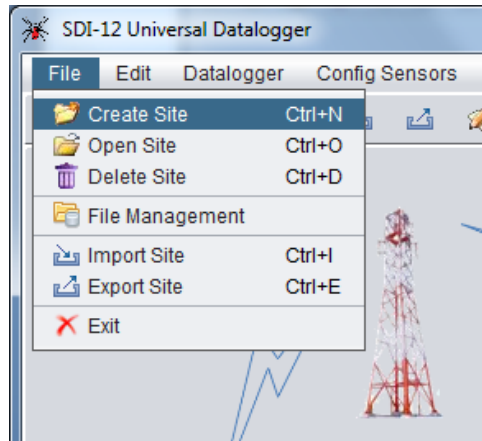

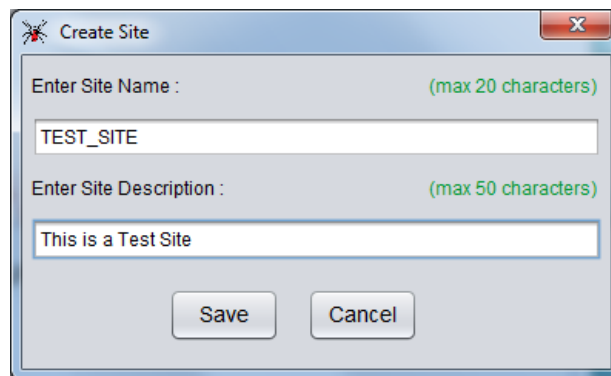**Figure 9-1: File menu options**

Figure 9-2: Create Site menu

Any site can be deleted by *Delete Site* option from *Figure 9-3*. Select the site and then click on *Delete Site* button to delete the site. Selected site will be removed completely from application's database. Please make sure before deleting any site.
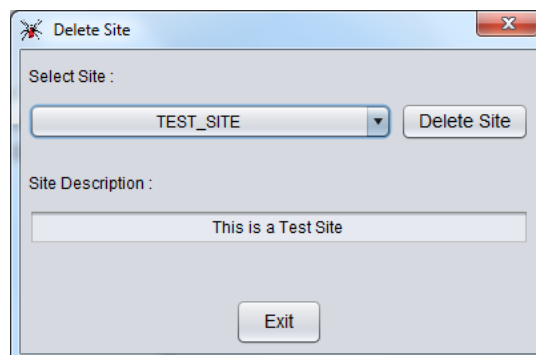

Figure 9-3: Delete Site menu

10 OPEN SITE

Go to *File menu* from *Home screen* and then click on *Open Site* option to open the site for Datalogger. *Figure 10-1* is showing an example of open site screen. Select the Site from drop down option.
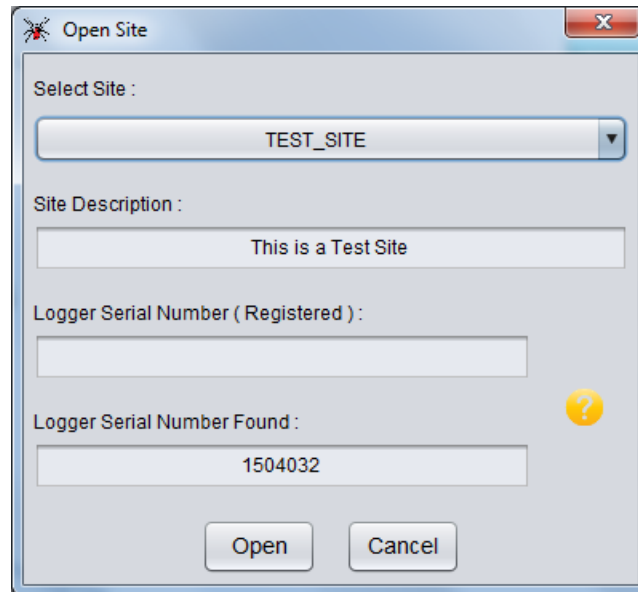

Figure 10-1: Select the Site from drop down list

There are two fields showing Logger serial numbers in above figure. "*Logger serial number found*" showing connected Datalogger's serial number. "*Logger serial number (registered)*" is showing registered Datalogger's serial number for that site. Logger serial number is not registered (linked) for new sites. Application will link (register) Datalogger's serial number for that site once Sensor table has been configured. Click on *Open* button to open the site. See the *current site* showing in *status bar* has been changed.

Figure 10-2: Status bar

Single laptop can be used to configure many Datalogger's at different sites. Datalogger and application both keeps the settings for selected site. Application and Datalogger both works in a pair for selected site. While scanning, Datalogger saves the sensors reading into its memory according to Sensor table. It is possible that user may select wrong site for any Datalogger. Application remembers the Datalogger with its serial number so the application registers the serial number for that site once Sensor table has been updated (saved into Datalogger's memory).

Yellow Indicator showing in *Figure 10-1*that selected site doesn't have any registered serial number. This indicator comes for new sites if Sensor table has not been updated for at least once.

Green Indicator showing in *Figure 10-3* that connected Datalogger serial number is matching with registered serial number for selected site. This is the correct site for this Datalogger. Always select the correct site.
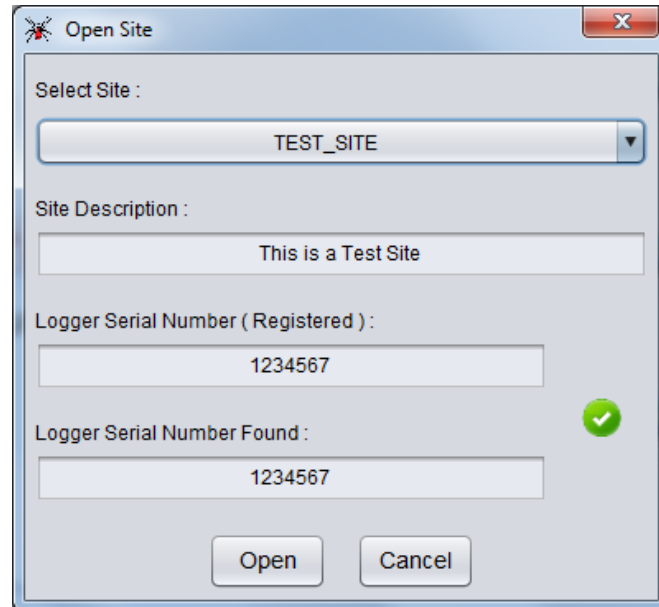
Figure 10-3: Correct site selection for connected Datalogger

Red Indicator showing in *Figure 10-4* that connected Datalogger serial number is not matching with registered serial number for selected site. This is the wrong site for this Datalogger. Always select the correct site.
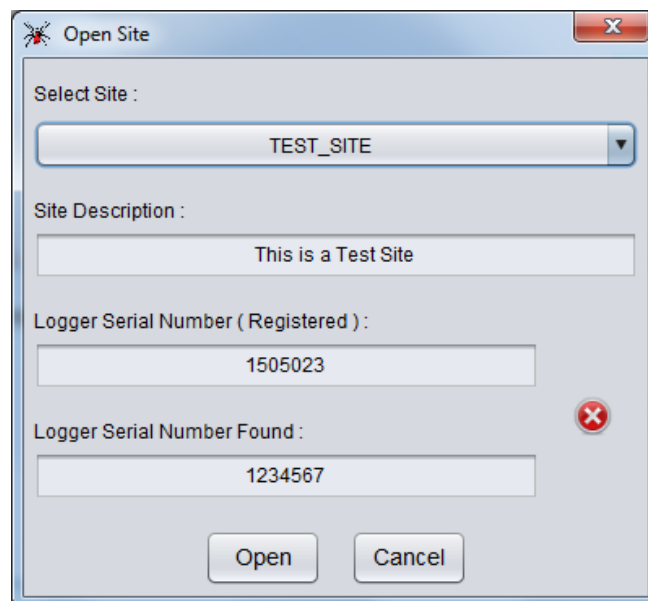

Figure 10-4: Wrong site selected for connected Datalogger

11   SENSOR TABLE

SDI-12 Universal Datalogger is having 3 SDI-12 buses (channels). Sensors having SDI-12 interface can be connected to a common bus. This bus can be further connected to Datalogger's SDI-12 channel (channel 1, 2 or 3). *Figure 11-1* is showing how to connect sensors to the Datalogger. Each sensor connected to any channel (Bus) must have *unique address*. Sensors connected to different channels may have same address. It is a good practice to assign Sensor address in a sequence within a channel but it can be randomly assigned.
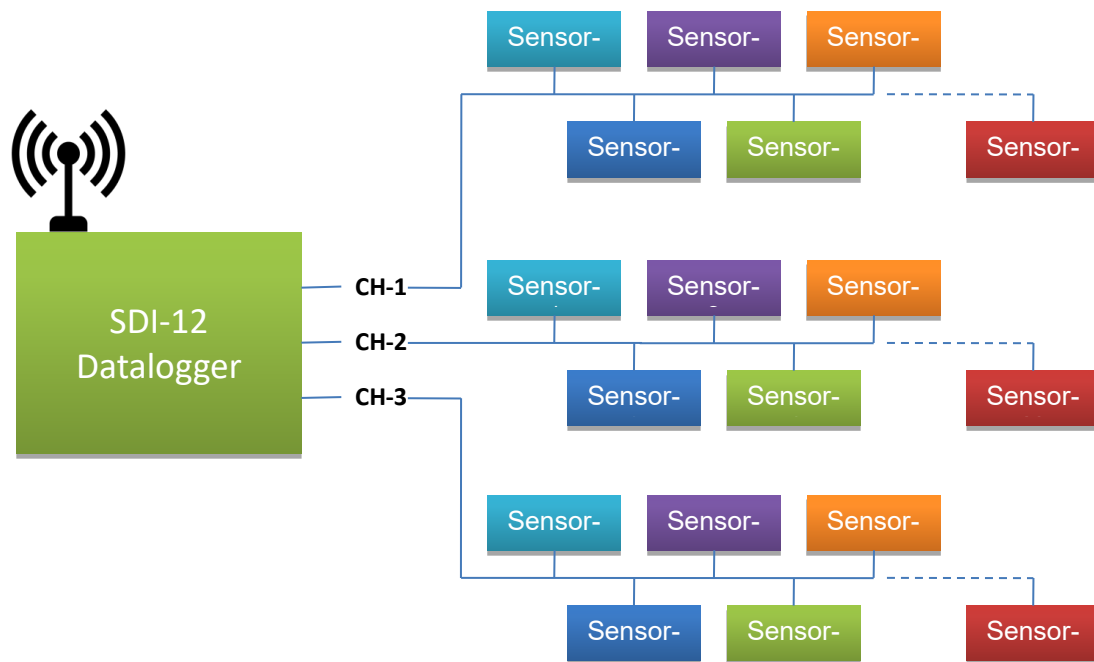

Figure 11-1: Sensors connected to Datalogger

It is required for Datalogger to know like which sensor is connected to which channel, what is the measurement type, how many parameters a sensor will return, what is the parameter name, measurement unit etc. Therefore a sensor table is required to program into Datalogger's memory to let the Datalogger know about sensors connected.

A sensor having SDI-12 interface may be asked to measure different parameters by initiating a measurement command from Datalogger. Default command to start measurement is "aM!". According to SDI-12 standard, there can be more command types for measurement like aM1!, aM2!, …… aM9!Additional M commands provide a means to request different types of measurements from a sensor or to instruct a sensor to do a calibration or a control function. For example, a sensor could measure pressure and temperature: M tells it to measure pressure and M1 tells it to measure the temperature.

If a sensor is asked to start measurement, it will start measurement immediately. After finishing measurement procedure, sensor returns measured values. A sensor may return multiple values. According to SDI-12 standard, a sensor may return up to 99 parameters (values) on a single measurement command. SDI-12 Universal Datalogger is designed to handle up to 99 parameters for any command type (aM!, aM1!, …….aM9!).

Go to Edit menu from Home screen and then click on Sensor Table option to create/edit Sensor Table. Figure 11-2 is showing an example of Sensor Table. Select the Channel from drop down option. Sensor sequence number will be 1 (first). Select the sensor address for first sensor from drop down menu. Select the Sensor model from drop down list. Type the sensor's serial number and sensor tag. Select the

measurement command type for that sensor (by default, select measurement command type M!). Then select number of parameter (number of values returned by the sensor after completing the measurement). Enter parameter name and unit for each parameter by pressing Edit parameter unit button corresponding to measurement command type. Press next button to enter information for second sensor (sequence number 2). Enter the required details and click next to enter information for 3rd sensor, 4rth sensor and so on. Press back button to see information of previous sensor. Select channel 2 for entering sensor information for channel-2 and similarly for channel-3.

Sensor Models listed in drop down list can be edited using "Edit sensor model" button. Default number of parameters for each model type and tool tip message information can be edited using this option.

Figure 11-2: Sensor Table

Figure 11-3is showing an example of Parameter unit screen. Parameter's name and their unit can be entered through this screen. Application has provision to select parameter's name and their units for up to 99 parameters for each command type. Use next or previous buttons to enter/see next or previous parameters. New parameter name or unit can be added or removed from Edit Parameter List option. Press Exit button to close the parameter entry screen.

Click on Update button to save the Sensor Table in application's database and to update the Sensor Table into Datalogger's non-volatile memory. Updating the Sensor table will erase old table from logger's memory as well as from application's configuration file. Old settings will be superseded by new table. So it is recommended to please download previous records/data from logger's memory prior to updating the Sensor Table. Old records will get misaligned after updating the Sensor Table. So please erase logger's memory after updating the Sensor Table.

Figure 11-3: Parameter unit entry

On pressing *Update* button from *Figure 11-2*, a warning message will appear. See *Figure 11-4*. It will warn you to download previous records from logger's memory prior to updating the Sensor Table. Press "No" to abort the Sensor Table updating and "Yes" to update the Sensor Table.
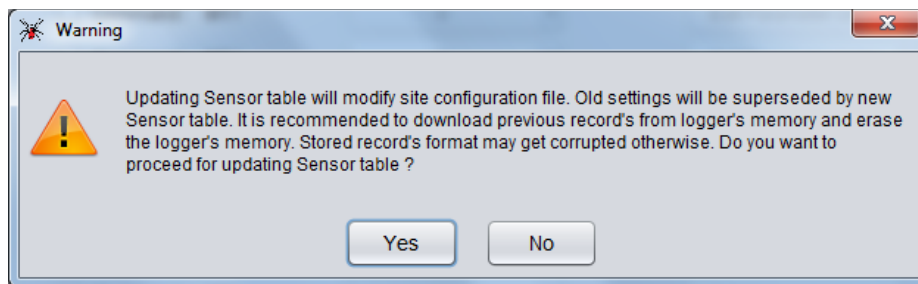

Figure 11-4: Warning message

After completing the table updating process, application asks for erasing the logger's memory. Press "Yes" to erase the memory.
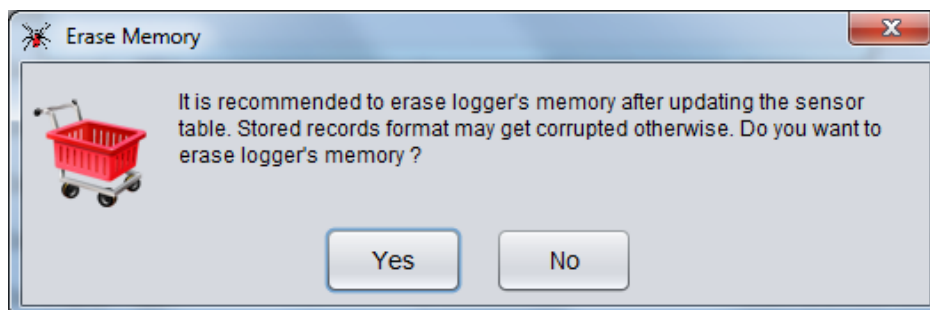

Figure 11-5: Erasing logger's memory

Click on *Generate Report* button from *Figure 11-2*to generate report of Sensor Table. This report is useful to get Sensor sequence information and to understand records from downloaded/uploaded CSV file. *Figure 11-6* is showing an example of Sensor Table report.

Figure 11-6: Example of Sensor Table Report

12 DATALOGGER SETUP

Data logger settings can be configured using *Setup* screen which can be opened on pressing *setup icon* or go to *settings* menu and then *Logger setup* option from *Home screen*. *Figure 12-1* shows an example of setup screen. Fields can be edited to modify the settings.
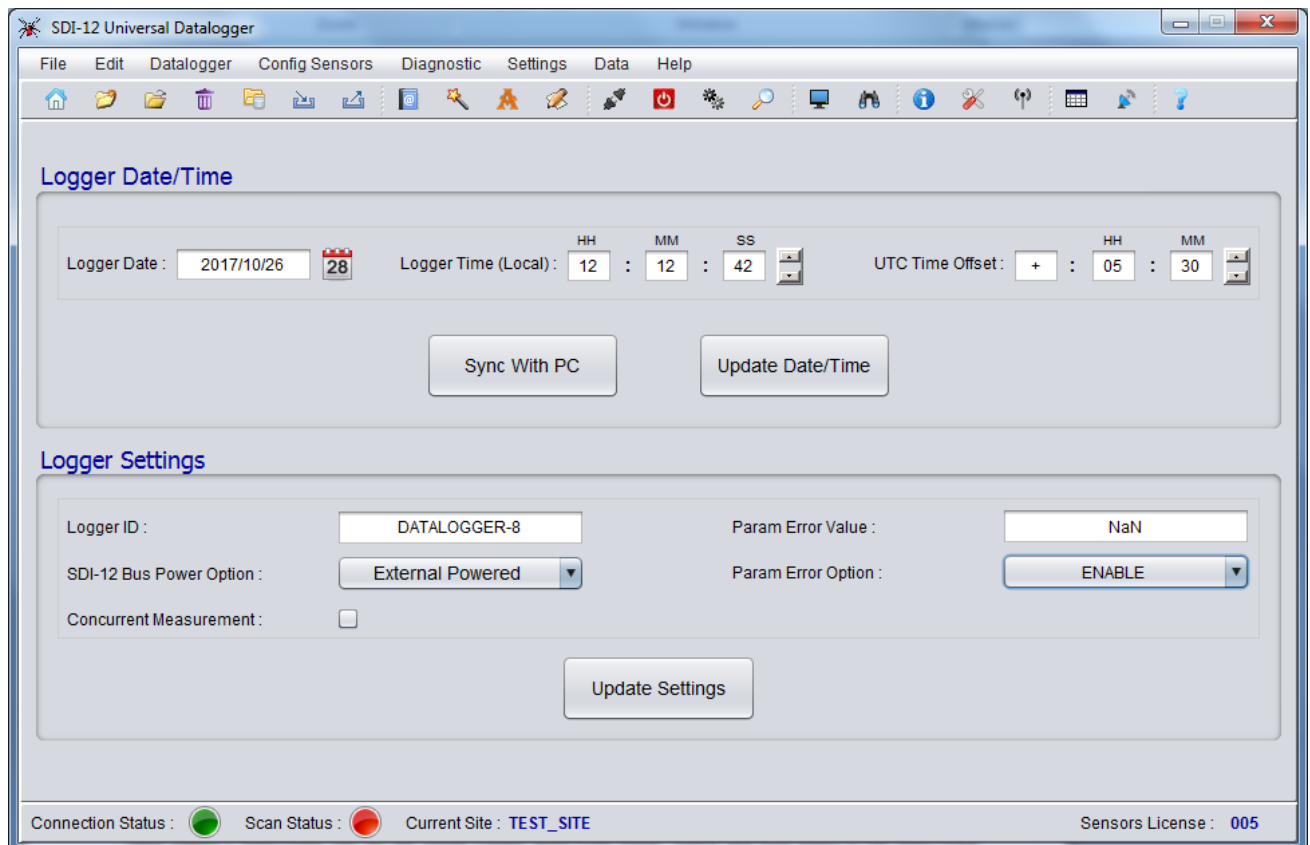
Figure 12-1: Setup Screen

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 12-2* shows an example of acknowledge dialog after data logger clock synced with PC.
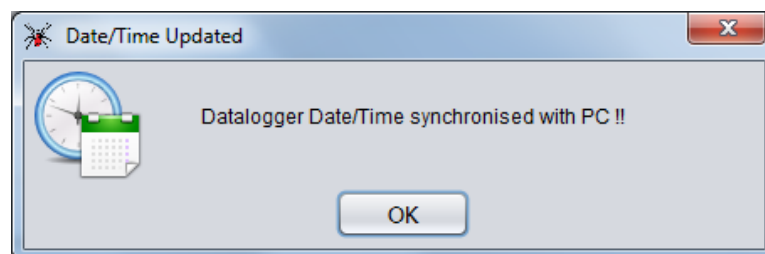
Figure 12-2: Data logger clock sync message

Data logger's ID or station ID can be entered under *data logger's ID*. Choose SDI-12 Bus power option from dropdown menu. External powered option must be selected if SDI-12 bus is power with external 12V power supply. Select Logger Powered option if external power is not available to power SDI-12 bus. In this case, whole SDI-12 Bus will be powered with Datalogger's internal Battery (Lithium/Alkaline/External). It is recommended to use external power supply option for SDI-12 Bus if large numbers of sensors are connected to Datalogger because Battery life will get decreased.

It has been observed that in case of over range or faulty sensor many sensors show very large quantities or garbage values. It is very difficult for user or viewer software to identify those values. An error code can enable to report *Error Value* in data records if sensor reads values beyond its operating range for any reason. To enable *Parameter Error option* select *Enable* or *Disable* from drop down menu. Enter *Parameter Error Value* (Error code) which is to be reported in case of measurement error.

Datalogger has provision to do concurrent measurements. When selecting the concurrent measurement option, the Datalogger issues measurement commands to all the sensors simultaneously while scanning. All the sensors take measurements at the same time. Datalogger will scan sensors to take readings one by one if "concurrent measurement" option is disabled (not selected).

Datalogger supports CRC (Cyclic Redundancy Check) to detect error in SDI-12 communication. To ensure error free communication, CRC must be selected.

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

13   MONITOR SCREEN

Sensors reading can be monitored for diagnostic purpose. Go to Datalogger menu then click on Monitor Sensors option from Home screen to open Monitor Sensors screen. Figure 13-1 showing an example of Monitor sensors screen. This screen shows live data from data logger. Select the Channel number, Sensor sequence number and Measurement command type from drop down menus and then click on Start button to start measurements.

Parameter names and their units are also showing to make the application user friendly. After measurement is over, Sensor returns measured values. In the following example, a sensor returns 3 parameters after completing the measurement. These are Axis-A Tilt, Axis-B Tilt and Temperature. Monitor screen can display 9 parameters at a time. If a sensor returns more than 9 parameters then press next button to see next parameters (10-99). Press back button to see previous parameters.

Data refresh rate will depend upon measurement time taken by the sensor. Reading's decimal point can be adjusted by selecting decimal digits from drop down options.

Click on Stop button to stop the measurements. It is recommended to monitor readings before finalizing the setup for automatic scanning.
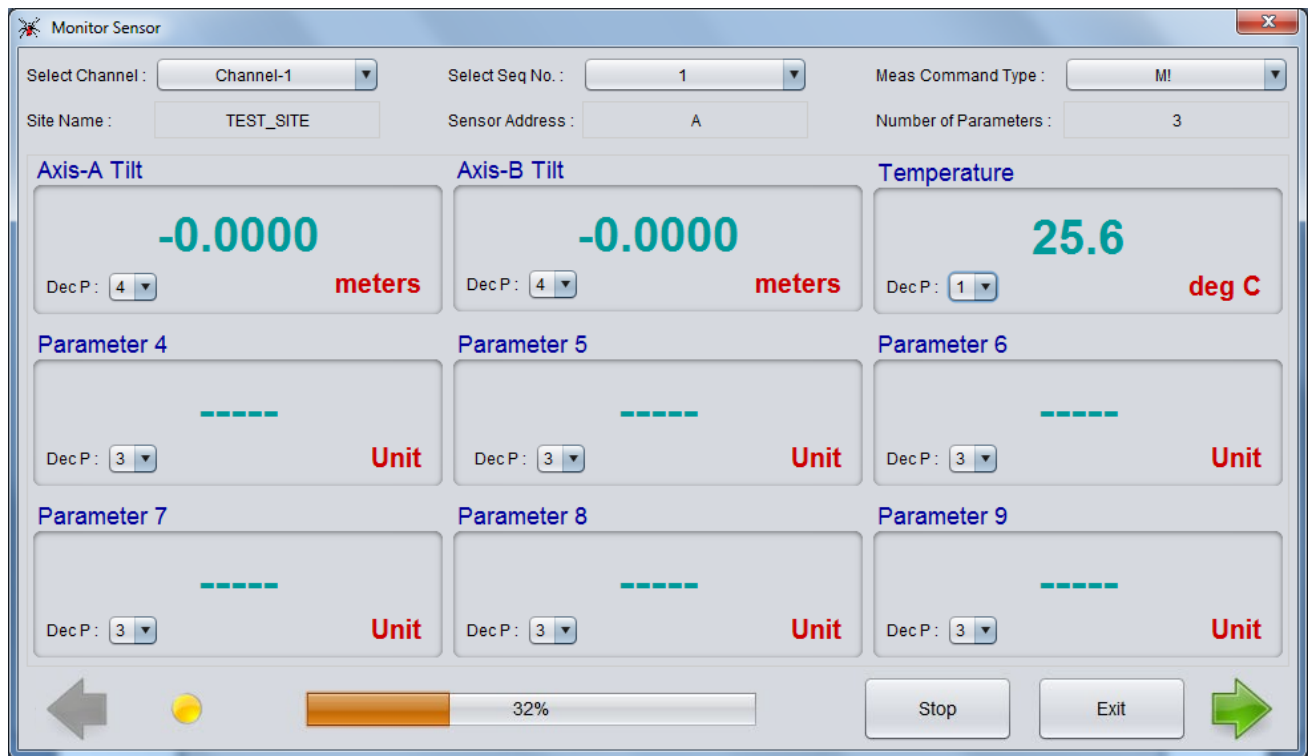

Figure 13-1: Monitor Sensors screen

14 SCAN

Datalogger can be configured to take automatic measurements at a specified interval. Go to Datalogger menu then click on Scan option from Home screen to open Scan Status screen. Figure 14-1 shows an example of scan screen. Data scan and download 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.

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.
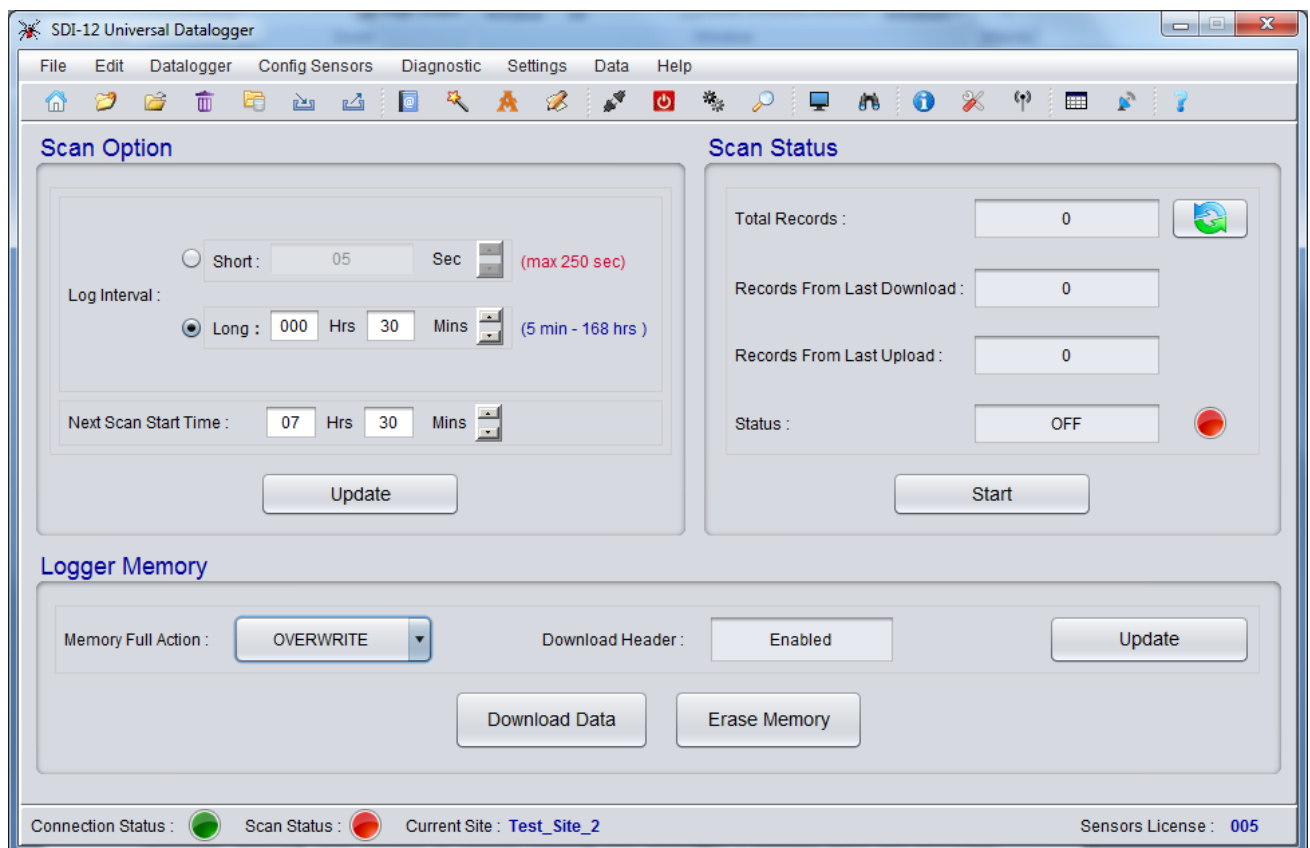
Figure 14-1: Scan screen

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 14-2: 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.

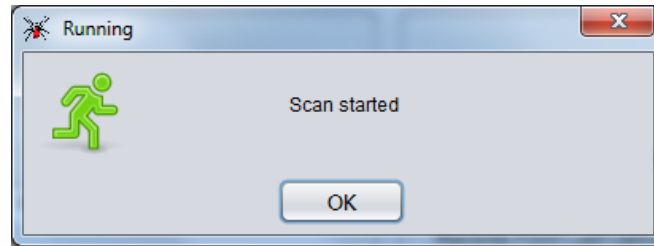Readings (data) can be downloaded from data logger's memory by pressing *Download Data* button. A dialog will open for selecting download option. User can download complete records from memory since last erase by selecting download option "*From Beginning*". If a user wants to download only recent records from last download then select "*From Last Download"* option. Click OK to start the download.
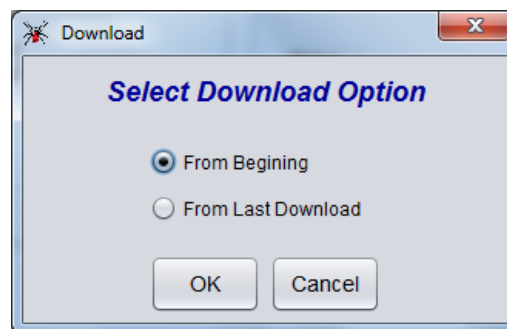
Figure 14-3: Select Download Option

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.
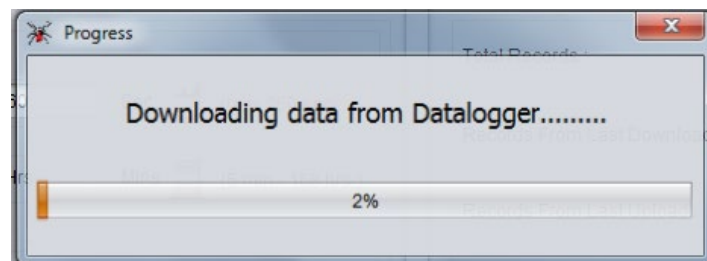
Figure 14-4: Download progress

Another window asks a confirmation to erase data logger memory. Press NO option to abort the deletion or press yes to confirm deletion.
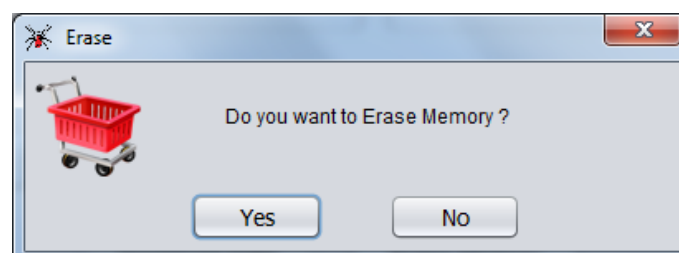
Figure 14-5: Erasing data logger memory

Application will show memory empty dialog if number of records are zero in Datalogger's memory.
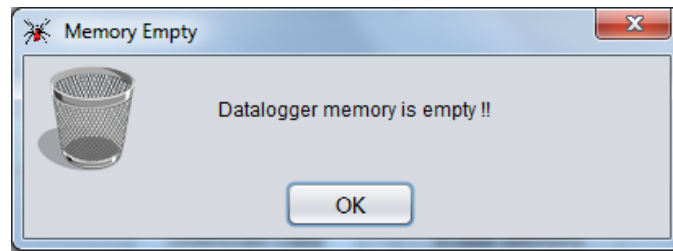
Figure 14-6: Datalogger memory empty message

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.

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 14-5. Click Yes to proceed or No to abort. Clicking Yes, data logger's memory will be erased which will not affect other settings.

Data can be downloaded only if connected Datalogger's serial number is matching with the registered logger serial number for current site. If a user tries to download records from connected Datalogger for different site (wrong site) by mistake, application will not allow doing so. Application will show an error dialog that logger serial number is not matching.
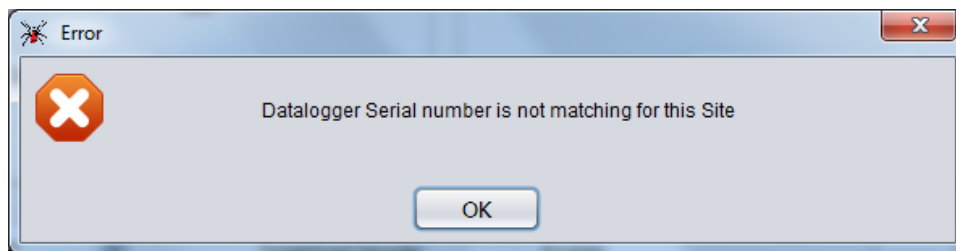
Figure 14-7: Datalogger serial number mismatch error

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

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

       File path: [root]\EncardioRite\ESDL-30UNI\CsvFiles\Site\[TEST_SITE]\Downloaded*.CSV

       File path: [root]\EncardioRite\ESDL-30UNI\CsvFiles\Site\[TEST_SITE]\TableView*.CSV

15 GPRS/3G/4G MODEM SETTINGS

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

Pressing on GPRS Modem from Settings menu from Home screen will open Modem settings screen. Modem settings screen is disabled for data loggers which don't have built GSM/GPRS modem. Figure 13-1showing an example of Modem settings screen.
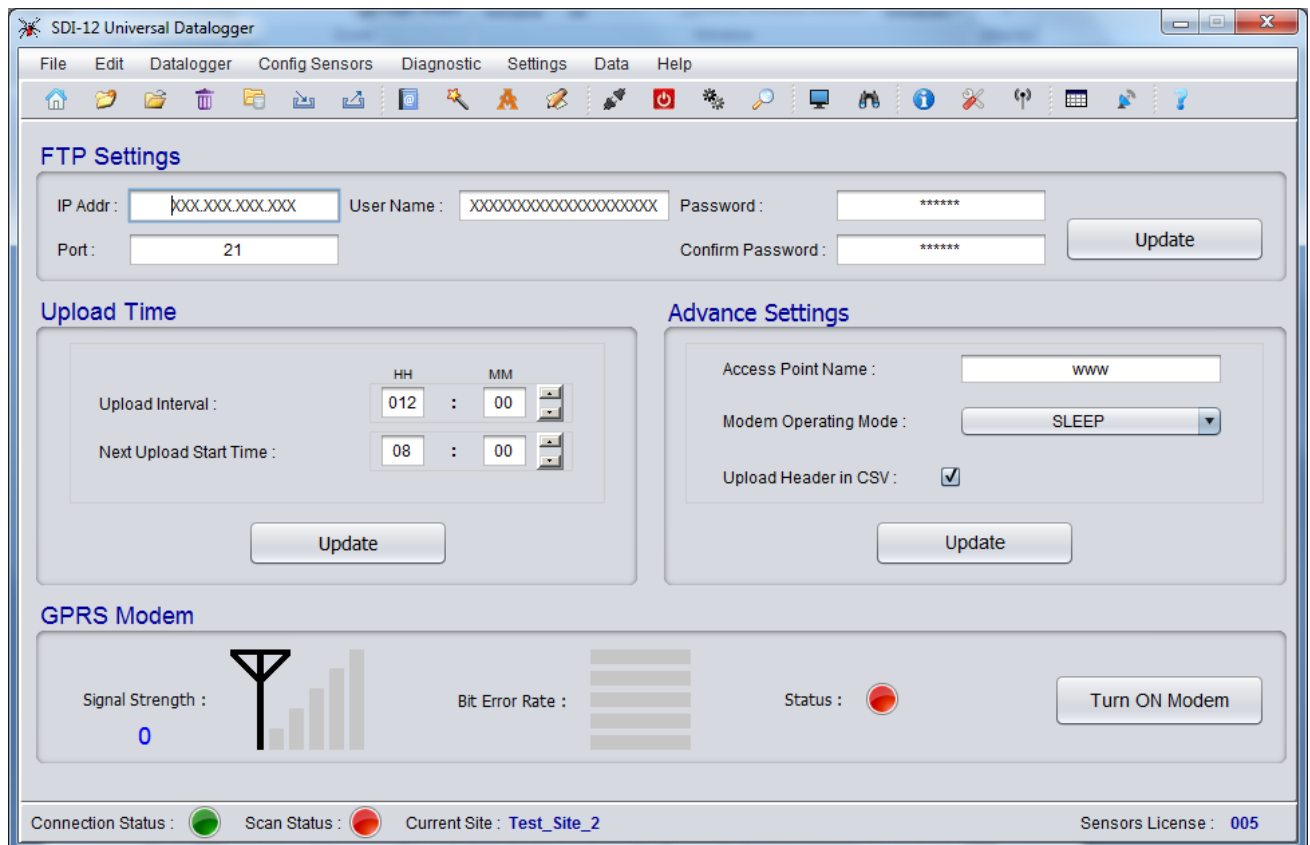
Figure 15-1: Modem settings screen

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 Datalogger.

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.

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.
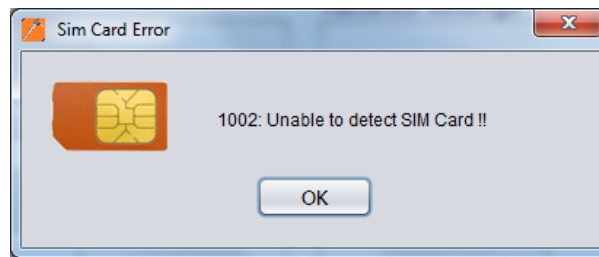
Figure 15-2: SIM Card not Found Message

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.
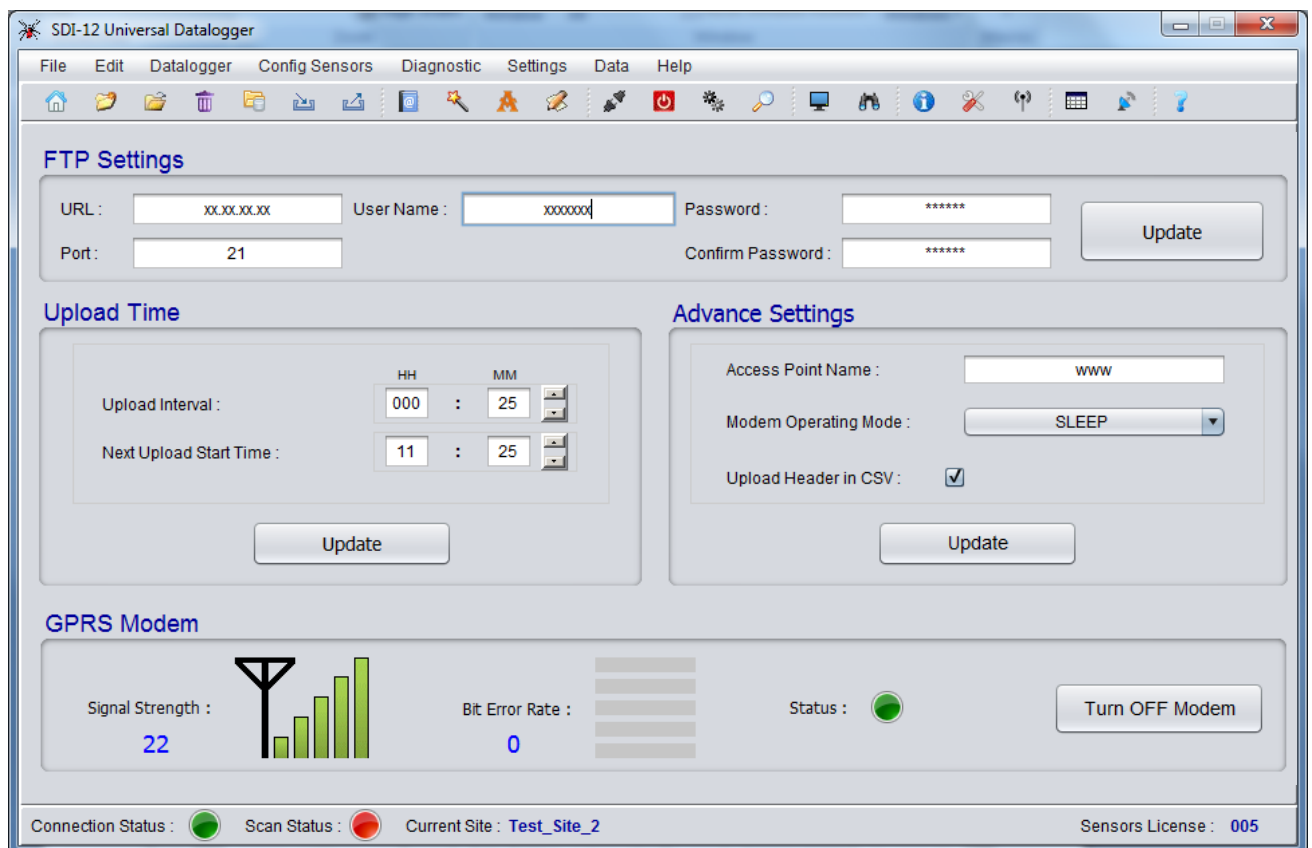
Figure 15-3: GPRS (2G) Modem Setting

Figure 15-4 is showing 3G/4G modem setting screen. Auto sync RTC feature is given to sync Datalogger clock with network provided time every time while uploading data to server.

Normally Datalogger remains in sleep mode to extend battery life. Datalogger wakes up and upload the CSV file (records) to remote FTP server when upload time occurs. Datalogger becomes busy while upload process is in progress. If a user wants to connect the Datalogger to communicate, an information dialog will show that Datalogger is busy in uploading. Refer Figure 15-5.
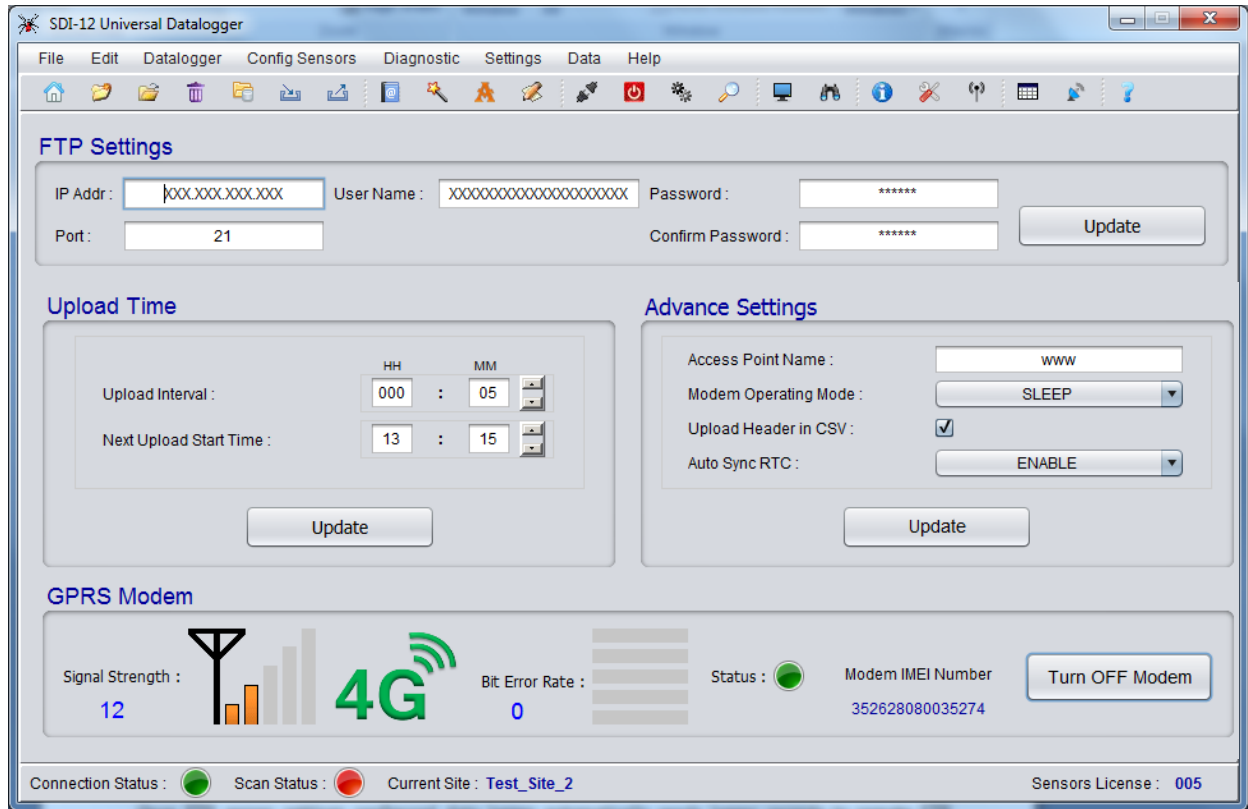
Figure 15-4: 3G/4G Modem Setting
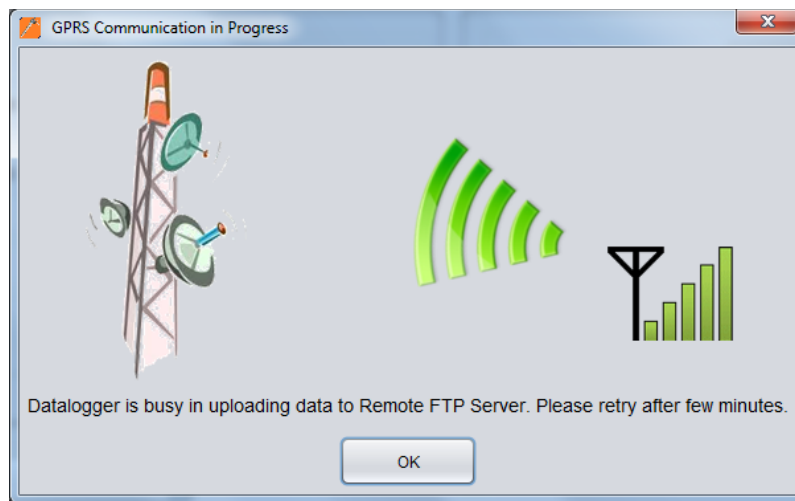
Figure 15-5: Datalogger is busy in uploading data to remote server

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.

16   VIEW DATA

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

Table view screen shows readings of selected Sensor file of *current site*. If user wants to see the readings of different *site* then go to *open site* option from *Home screen* and select another *site*.

Any Sensor file in the given example, the file BH1_150204_1530.csv is selected for interpretation. *Logger Battery Voltage* is showing Datalogger's Battery voltage when reading was taken. Select decimal digits to adjust decimal places of measured values. Use the vertical scroll bar to scroll the readings.
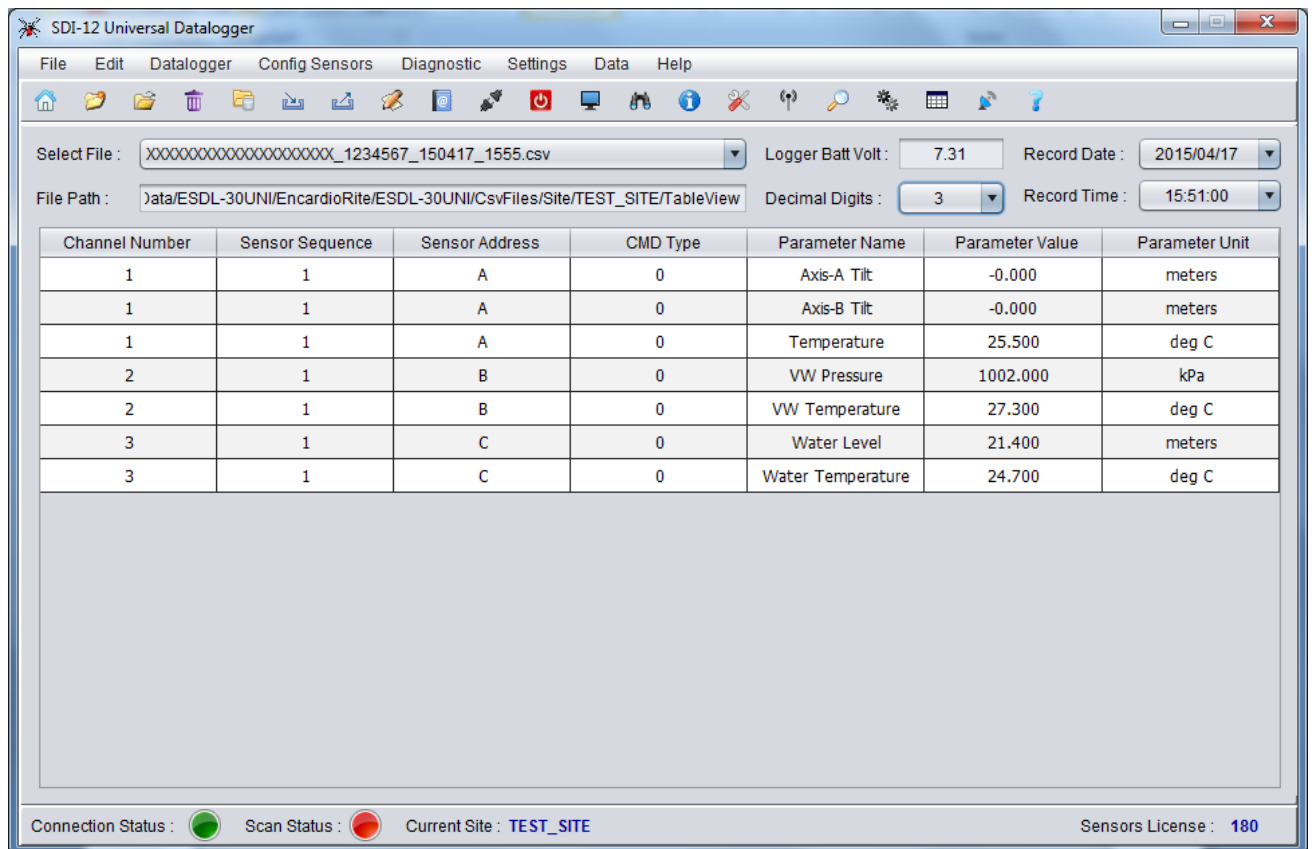
Figure 16-1: Viewing readings

17 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 option from Data menu from Home screen, the upload window appears with the list of data logger files if it has been downloaded.
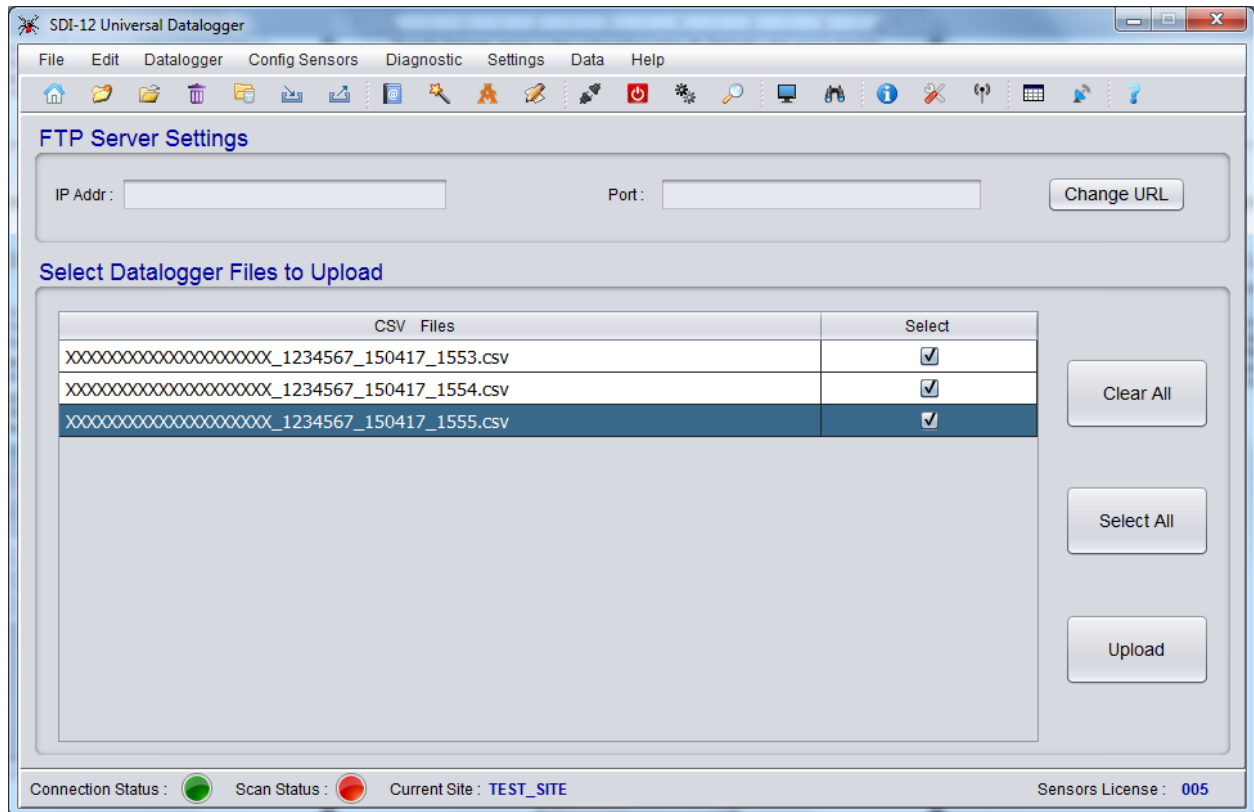
Figure 17-1: Files Upload Menu

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.
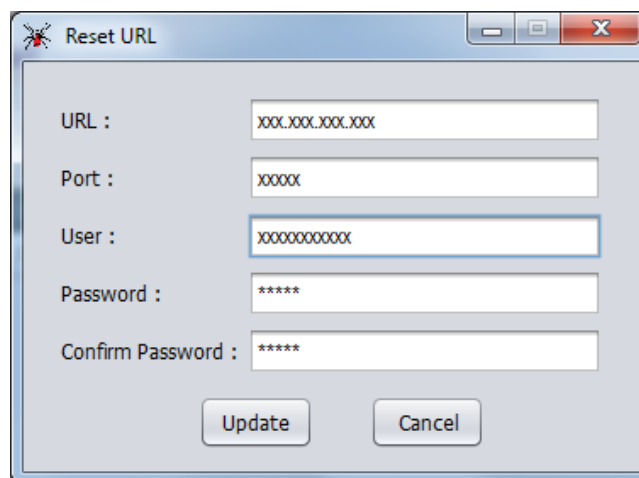
Figure 17-2: Reset URL screen

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.

18   AUTO CREATE SENSOR TABLE

Sensor Table is required for Datalogger to identify the sensors connected at different channels for automatic scanning. It is recommended to create the sensor table manually as described in *Section-11*. Creating sensor table manually takes few minutes but user has flexibility to configure sensor details as per the requirements (like Sensor Tag, Parameter name, Parameter unit etc). However; sensor table can be created automatically using *Auto Create Sensor Table* screen.

Connect the sensors at different BUS remember that each sensor should have unique address at each channel. Sensors connected to different channels may have same address. Go to *Edit* then *Auto Create Sensor Table* option to open *Auto create sensor Table* screen.

Pressing on generate Table button will start searching all SDI-12 sensors connected at different channels. After searching it will get sensor model and parameter information and build a sensor table for opened site. This sensor table is uploaded into Datalogger. A PDF report will be generated after successful completion of the whole process.
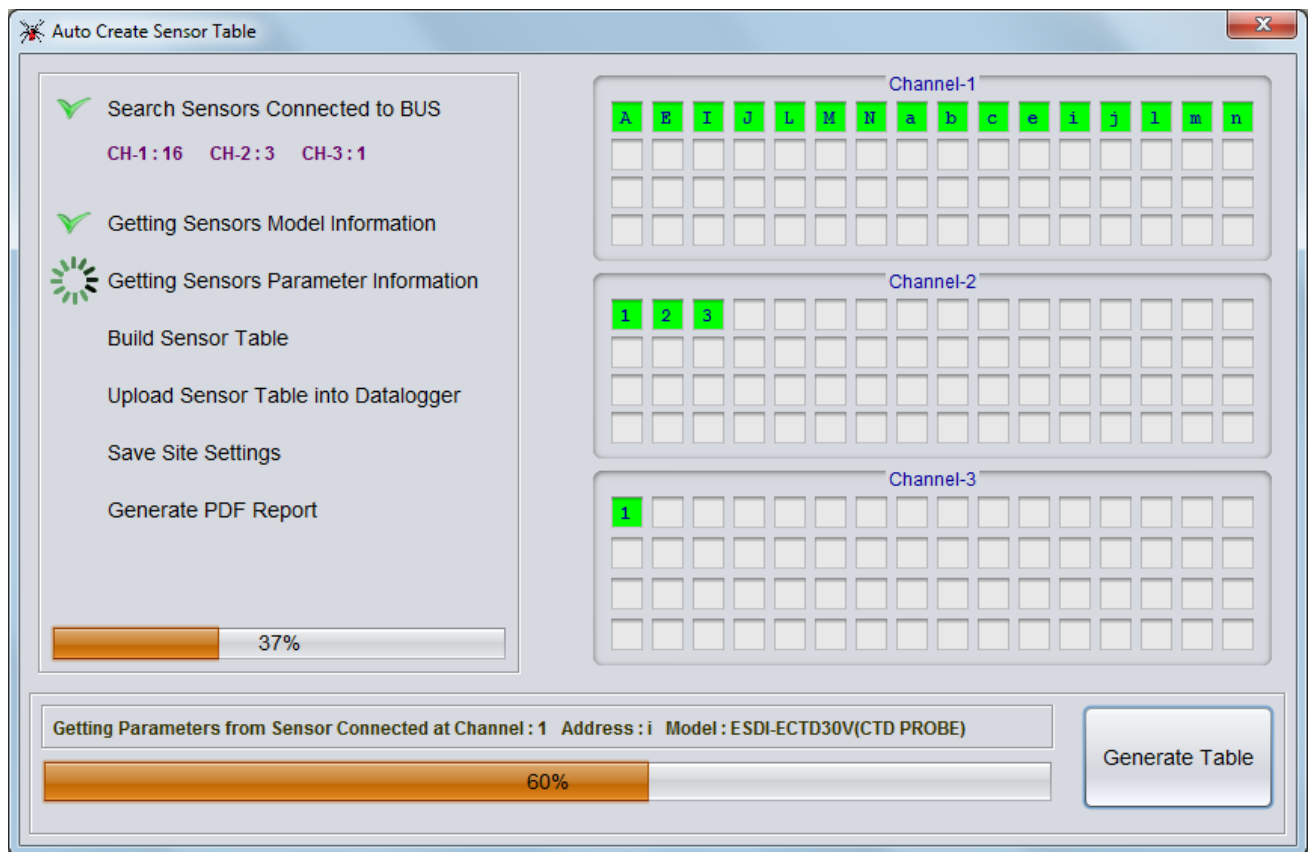
Figure 18-1: Auto Create Sensor Table screen

19   SITE SETUP WIZARD

Datalogger is configured for SDI-12 sensors for a site. It is recommended to configure the Datalogger manually as explained in Section-9 to 15. However Datalogger can be configured for a site quickly by running Site Setup Wizard.

Connect the sensors at different BUS remember that each sensor should have unique address at each channel. Sensors connected to different channels may have same address. Go to *Edit* then *Site Setup Wizard* option to open *Site Setup Wizard* screen as shown in *Figure 19-1*.
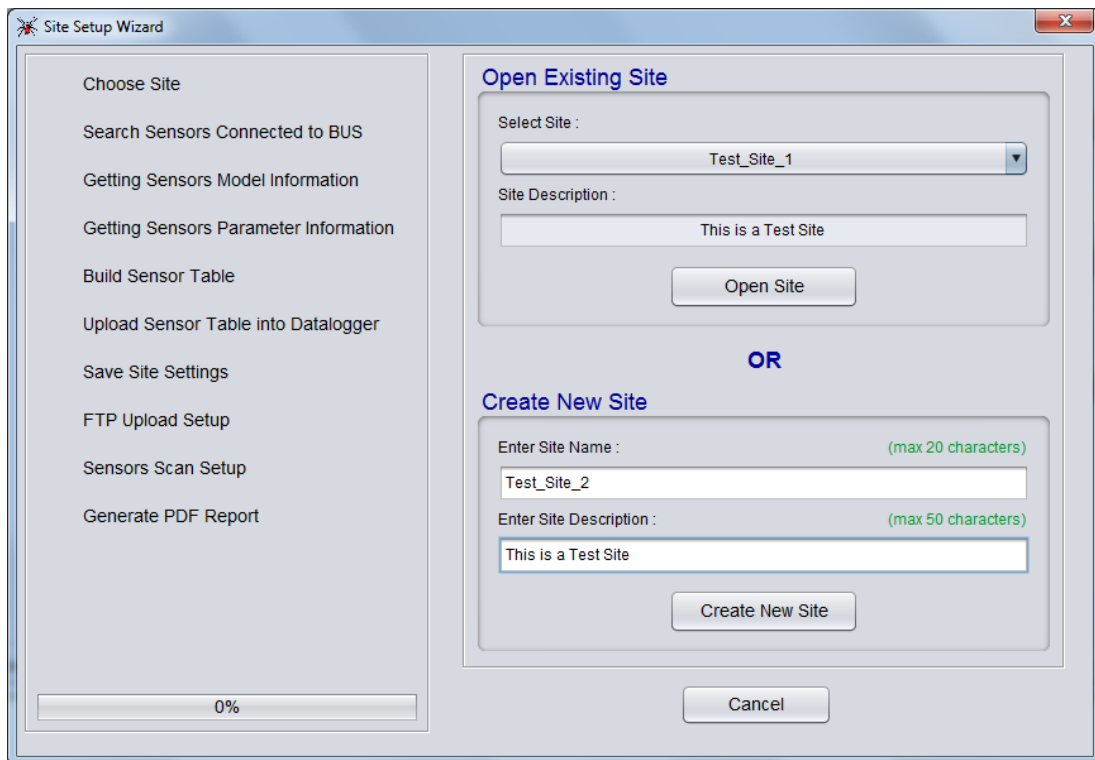
Figure 19-1: Site setup wizard screen

Type the Site name and site description in text box provided under create new site panel and press *create new site* button. Alternatively; select site from drop down menu for existing site and press *Open site* button. The site will be selected and a new screen will show the sensors connected at different channels.

Pressing on *Next* button will start searching all SDI-12 sensors connected at different channels. See *Figure 19-2*. After searching it will get sensor model and parameter information and build a sensor table for opened site. This sensor table is uploaded into Datalogger.
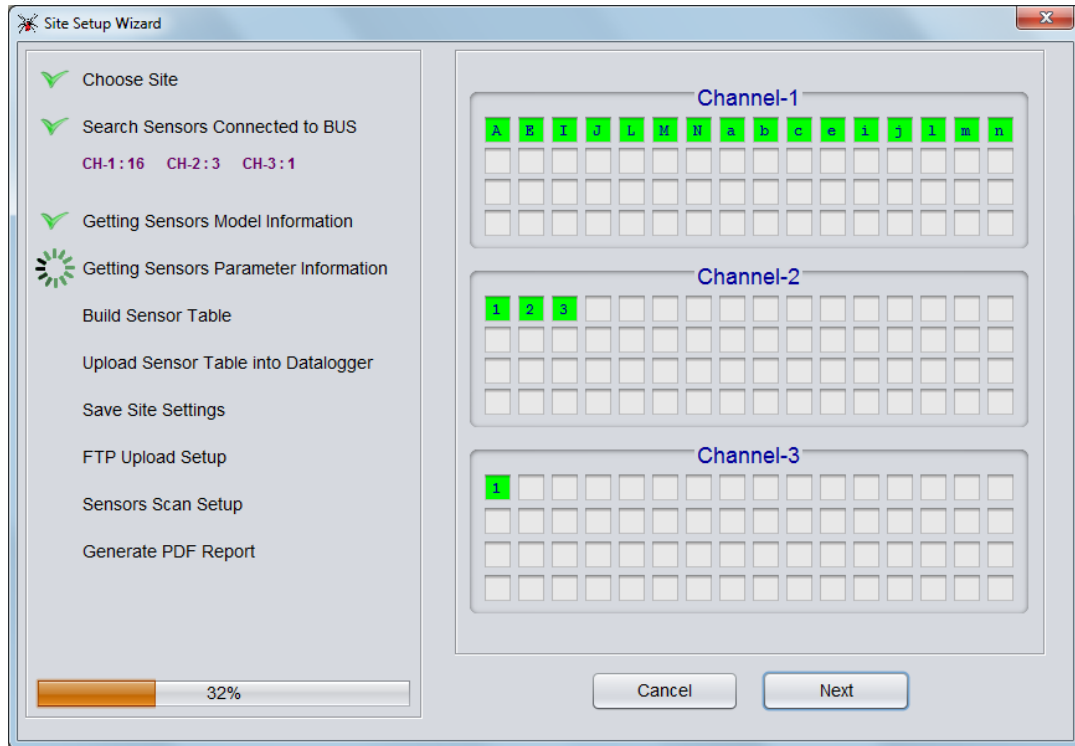
Figure 19-2: Sensors found at different channels

Next screen will show the FTP upload settings for 2G/3G/4G modem. Provide the remote FTP server credentials, SIM service provider APN and FTP data upload schedule and press *next* button to proceed. Press *skip* button if FTP credentials are not known at this stage. Refer *Figure 19-3*.
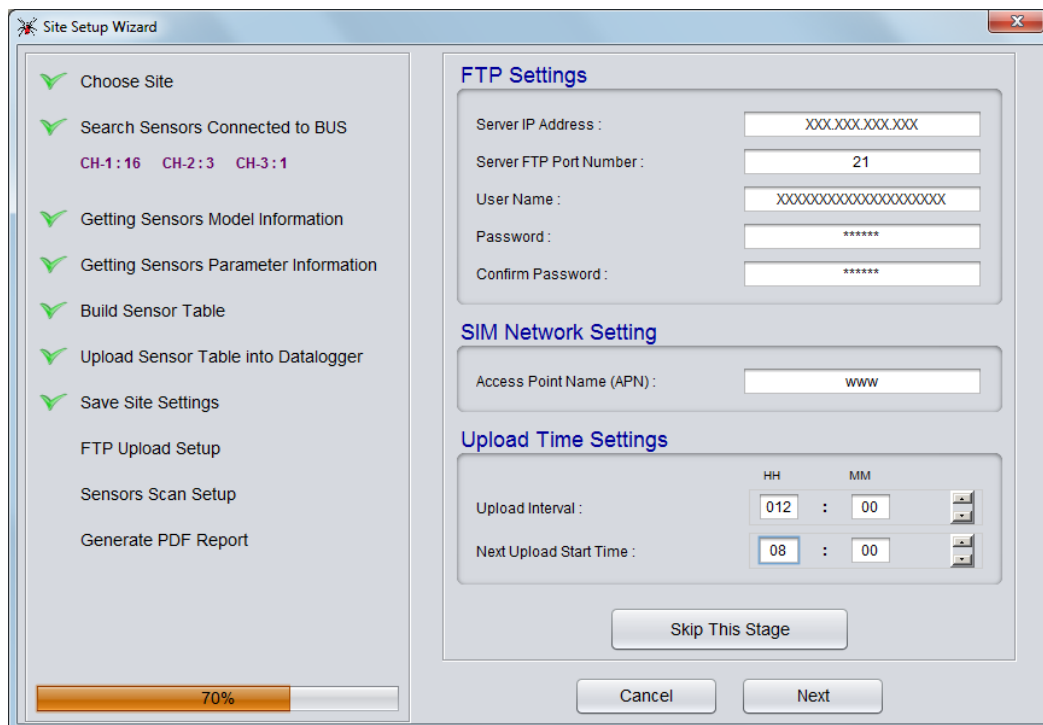
Figure 19-3: FTP Upload settings

Next screen will show the sensors scan schedule settings for automatic data logging. Provide the scan schedule and press next button to proceed. Refer Figure 19-4.
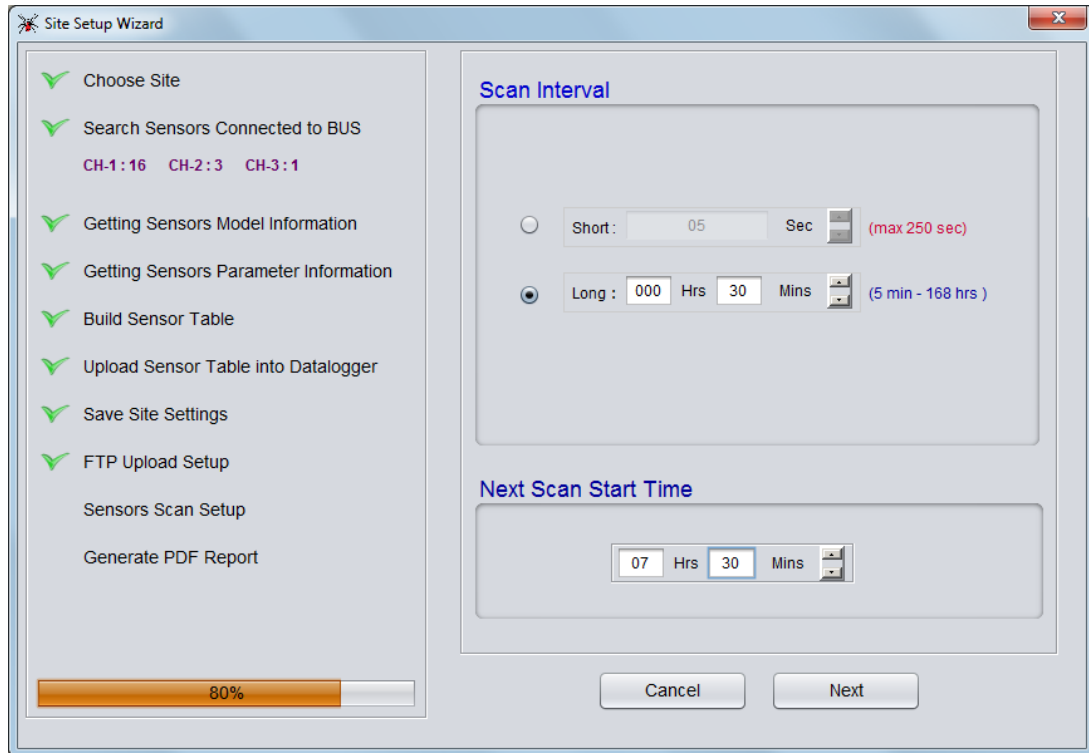
Figure 19-4: Sensors scan schedule

A PDF report will be generated after successful completion of the whole process.

20 IMPORT/EXPORT SITE

Datalogger and application works in a pair. Application keeps the site and Sensor Table settings for every site. Site and sensor table settings are required to configure the Datalogger and to download the records from Datalogger.

SDI-12 Universal Datalogger is configured through a laptop/PC. Application running on laptop/PC keeps the site and Sensor Table settings for that site. It is possible that the same laptop/PC will not be available for next time due to any problem. Records cannot be downloaded from Datalogger if the site is not available in the new laptop/PC. So the user needed to create exactly the same site with same sensor table and profile to continue with new laptop/PC.

There is an easier way of doing that. Application supports export and import facility of site settings for Datalogger. Go to *export site* option from *File menu* from *Home screen*. Refer *Figure 20-1* for export file dialog. Select the *site* which is to be exported. Select the path from Browse Folder button and then click on *Export Site* button to export the settings of selected site. Settings are saved in CSV File format.
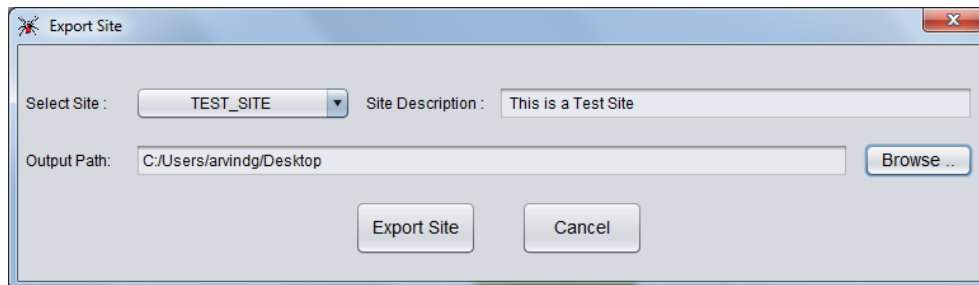
Figure 20-1: Export File dialog

Transfer this file to a new laptop/PC through USB pen drive or email or any other medium. Run the application on new laptop/PC and go to *import site* option from *File menu* from *Home screen*. Refer *Figure 20-2* for import file dialog. Browse File button and select the settings file (*.CSV) then click on *Import Site* button to import the settings. Now the *site* with required settings has been created. Go to *Open site* and select the new site top open.
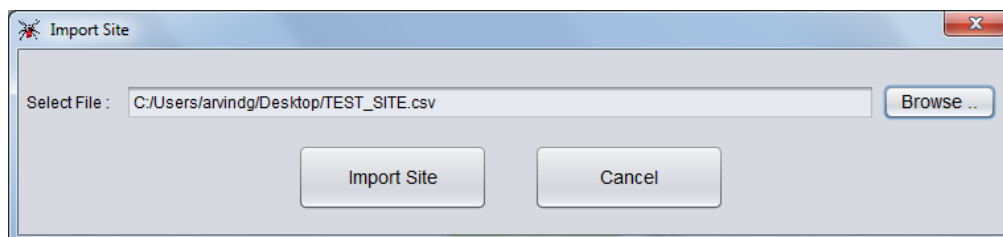
Figure 20-2: Import File dialog

21 DATA FILE MANAGEMENT

Application asks for data file storage location if application runs for first time, alternatively it can be opened from selecting *Data File Management* option from *File menu* from *Home Screen*. See*Figure21-1*. Browse the folder path to set the data file storage location. It is recommended that data files must be kept to user accessible area.
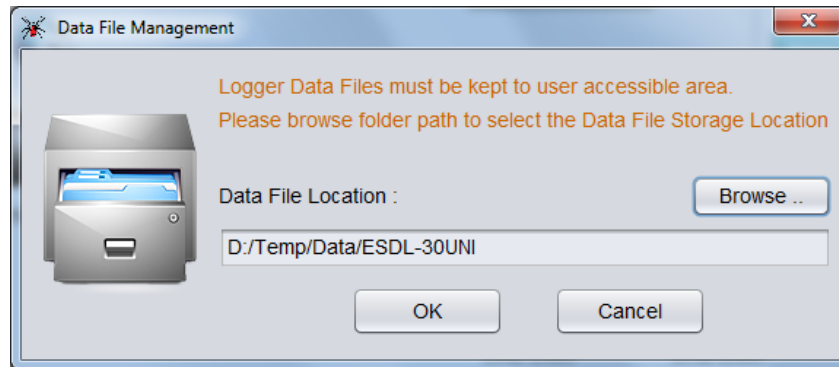
Figure 21-1: Data File storage location

22 REPLACING DATALOGGER'S BATTERY

Although the ESDL-30UNI SDI-12 Universal Datalogger is almost maintenance free system for long time monitoring, however it may require battery replacement.

Run the application, connect the Datalogger and select Shutdown Datalogger option from Connection menu from Home screen.
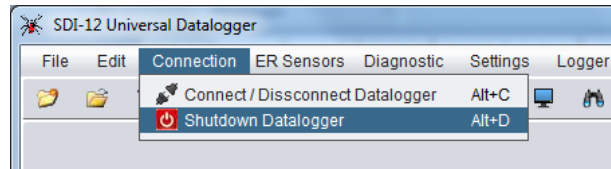
Figure 22-1: Files Upload Menu

Application asks for confirmation. Click yes to shutdown the Datalogger.
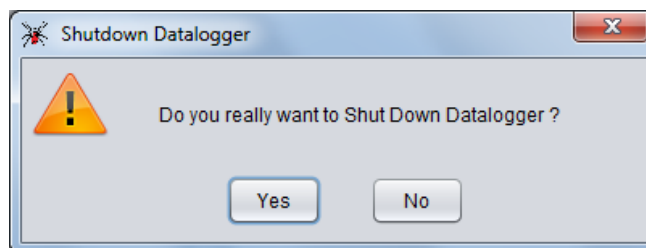
Figure 22-2: Files Upload Menu

Open the top cover of Datalogger and replace the Batteries. Now close the cover and connect the Datalogger. Datalogger detects the new battery and while connecting, application asks for updating battery installation date. Choose the date from calendar and then press OK save the information.
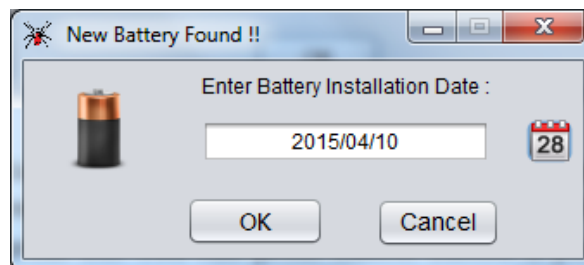
Figure 22-3: Battery installation date entry

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

23 REPLACING DATALOGGER

Datalogger may get faulty after use for any reason. Faulty Datalogger may be needed to replace with new Datalogger. When connecting with new Datalogger, the Datalogger serial number will not match with existing site. New Datalogger doesn't have Sensor table for this site. Open site menu shows Red Indicator for this Datalogger.
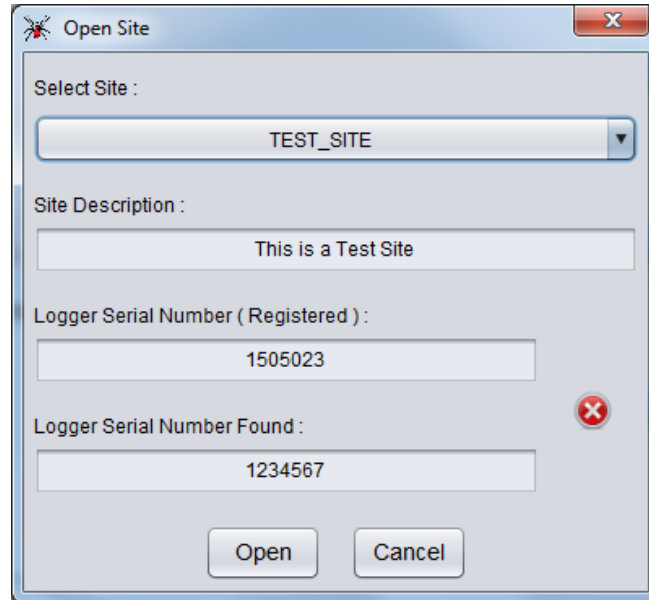
Figure 23-1: New Datalogger for existing site

Click on Open button from Figure 23-1. Clicking on open button will show a warning dialog that Datalogger serial number is not matching. See Figure 23-2. Click on Yes button to proceed with new Datalogger.
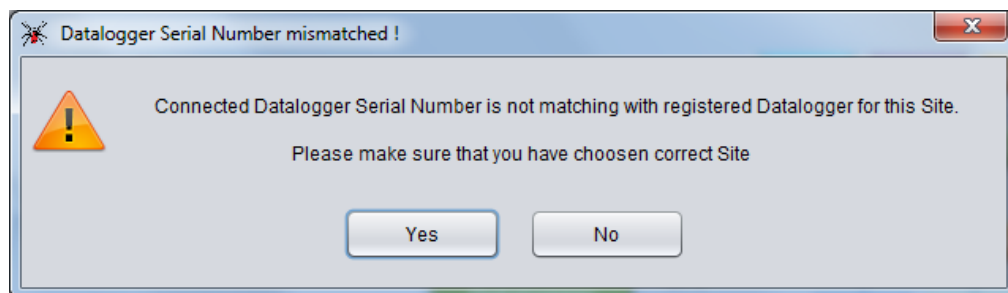
Figure 23-2: Warning message for Datalogger serial number mismatch

Go to Edit Sensor Table and update the Sensor Table once to register the new Datalogger's serial number for this site and to update the Sensor table into Datalogger's memory. Then go to Scan screen and erase the logger's memory to manage the logger's memory according to this Sensor Table. Now the new Datalogger is ready for use with this site.

24 DATALOGGER LICENSE

Datalogger is capable to interface 183 sensors (3-channel x 61 sensors). However, number of sensors can be used with the Datalogger are licensed. When purchasing the Dataloggers, these are configured to free access up to few sensors. If a user wants to connect more sensors, he can ask manufacturer/ supplier for purchasing license to extent the number of sensors uses limit.

License information can be seen from License info menu. Clicking the License info option from License menu from Home screen, the license information menu appears as shown in Figure 24-1.
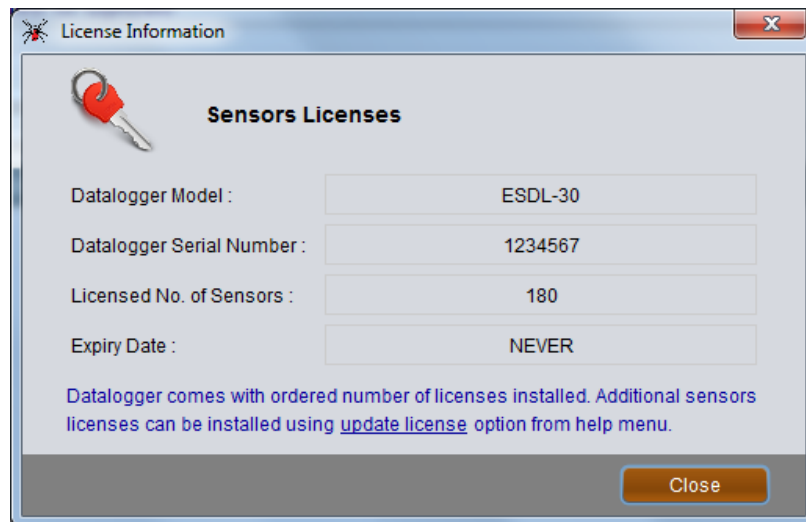
Figure 24-1: License Information

User can contact manufacturer with Datalogger model, serial number and number of sensors limit to purchase the license. Manufacturer will generate a license key. License key will be in 32-characters. The license key will be unique and it will be valid for that Datalogger only. Purchased license validity will be for lifetime. The license key will be send through email.
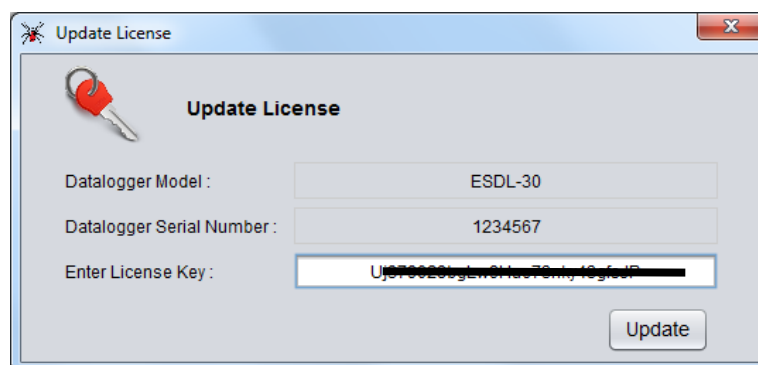
Figure 24-2: Warning message for Datalogger serial number mismatch

Go to Update License option from License menu from Home screen. Enter the 32-characters long license key into space provided for key entry without putting any space or extra characters. Characters are case sensitive so enter the key carefully. Refer Figure 24-2. Press update button to update the license.

25   CONFIGURE SENSORS

In SDI-12 protocol, there are some standard command types for start measurement, get measured values, address query, address change, sensor ID etc. All sensors having SDI-12 interface must support these standard command sets irrespective of manufacturer and sensor types. Different manufacturer or sensor types use non-standard command sets to configure/calibrate their sensors. If those commands are known then one can configure the sensor with the help of SDI-12 Terminal as explained in Section 6 (Figure 6-1).

However, the application supports special feature for Encardio-rite make sensors. User can view or configure sensor settings like Sensor Model, Firmware version, sensor serial number, coefficients, offsets, Full scale values etc with the help of graphical user interface.
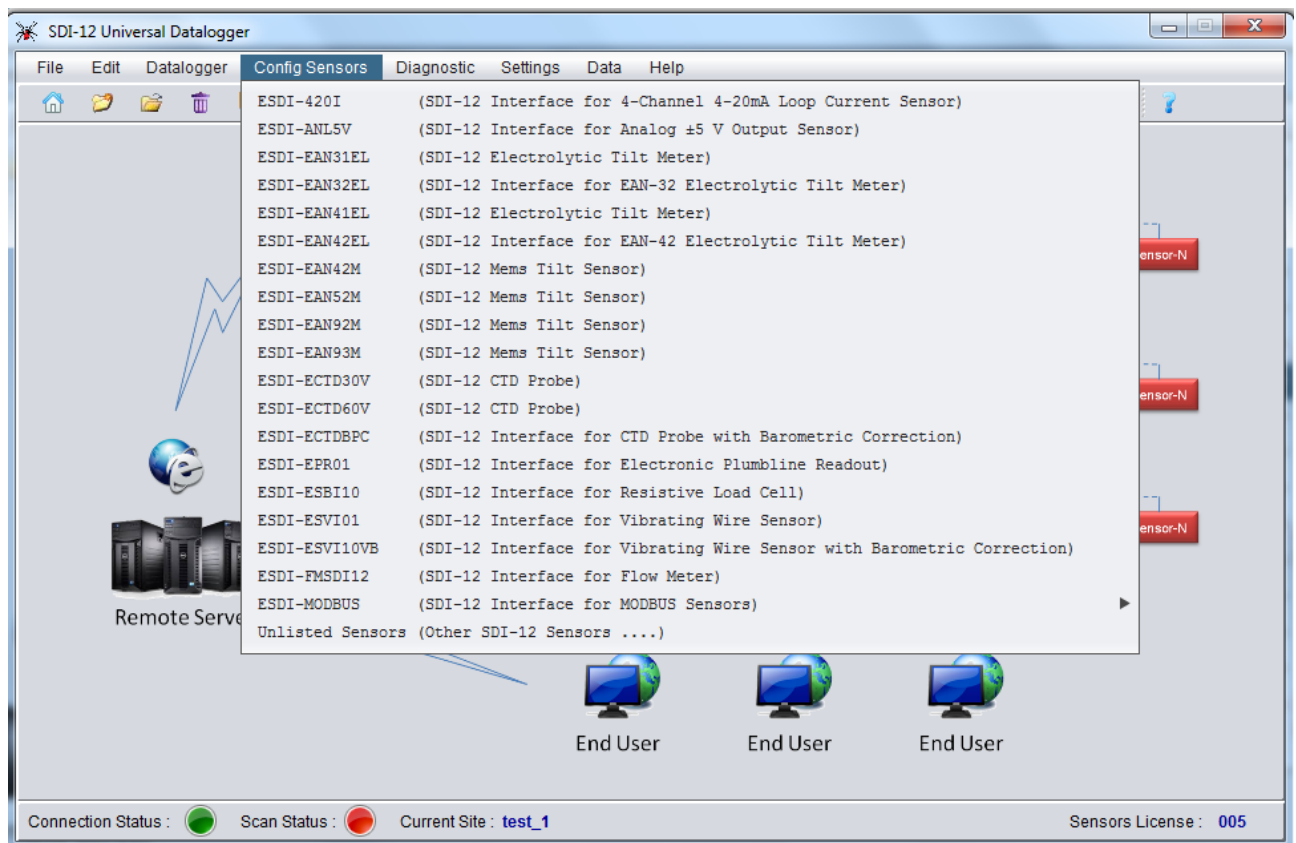
Figure 25-1: Selecting sensors from Config Sensors menu

Go to ER Sensors menu from Home screen and select the sensor model which information to be viewed or configured as shown in Figure 25-1.

25.1   SDI-12 Tilt meter (ESDI-EAN42M/52M/92M/93M)

Select ESDI-EAN42M/52M/92M/93M then Sensor configuration from Figure 25-1 to configure sensor's offset of a Tilt meter. Select channel number at which the sensor is connected. Select the sensor's address and click on Read button. On pressing this button, application will fetch the information from sensor. Figure 25-2 is showing an example of sensor configuration screen. Change the values and then click on Update button to update new values into sensor's non-volatile memory. Click Monitor button to view instant reading of the sensor.

Figure 25-2: ESDI-EAN92M Sensor Configuration Screen

25.2 SDI-12 Interface for Electrolytic Tilt Meter (ESDI-EAN31/41EL)

Select ESDI-EAN31/41 then Sensor configuration from *Figure 25-1* to configure sensor's offset of an Electrolytic Tilt meter. Select channel number at which the sensor is connected. Select the sensor's address and click on *Read* button. On pressing this button, application will fetch the information from sensor. *Figure 25-3* is showing an example of sensor configuration screen. Change the values and then click on *Update* button to update new values into sensor's non-volatile memory. Click *Monitor* button to view instant reading of the sensor.

Figure 25-3: ESDI-EAN31EL Sensor Configuration Screen

25.3 SDI-12 Interface for Electrolytic Tilt Meter (ESDI-EAN32/42EL)

Select ESDI-EAN32/42 then Sensor configuration from Figure 25-1 to configure sensor's offset of an Electrolytic Tilt meter. Select channel number at which the sensor is connected. Select the sensor's

address and click on Read button. On pressing this button, application will fetch the information from sensor. Figure 25-4 is showing an example of sensor configuration screen. Enter the coefficient values provided for the sensor and then click on Update button to update new values into sensor's non-volatile memory. Click Monitor button to view instant reading of the sensor.

Figure 25-4: ESDI-EAN32EL Sensor Configuration Screen

25.4   SDI-12 Interface for Vibrating Wire (ESDI-ESVI01)

Select ESDI-ESVI01 then Sensor configuration from *Figure 25-1* to configure sensor's offset of a SDI-12 interface for Vibrating Wire sensor. Select channel number at which the sensor is connected. Select the sensor's address and click on *Read* button. On pressing this button, application will fetch the information from sensor. *Figure 25-5* is showing an example of sensor configuration screen. Select the Vibrating Wire sensor model from drop down list. It will automatically fill the start and end frequency of sweep or user can change. Enter the sensor coefficients A0, A1 and A2. Change the values and then click on *Update* button to update new values into sensor's non-volatile memory. Click *Monitor* button to view instant reading of the sensor.

Parameter $P = A_0 + A_1 * X^2 + A_2 * X^4 - \text{Offset}$

Where X= measured frequency of VW sensor

Figure 25-5: ESDI-ESVI01 Sensor Configuration Screen

25.5   SDI-12 Interface for VW Absolute Pressure Sensor (ESDI-ESVI10VB)

Select ESDI-ESVI10VB then Sensor configuration from *Figure 25-1* to configure sensor's offset of a SDI-12 interface for Vibrating Wire Absolute Pressure Sensor. Select channel number at which the sensor is connected. Select the sensor's address and click on *Read* button. On pressing this button, application will fetch the information from sensor. *Figure 25-6* is showing an example of sensor configuration screen. Select the Vibrating Wire sensor model from drop down list. It will automatically fill the start and end frequency of sweep or user can change. Enter the sensor coefficients A0, A1 and A2.Change the values and then click on *Update* button to update new values into sensor's non-volatile memory. Click *Monitor* button to view instant reading of the sensor.

Water level $L = A_0 + A_1*X^2 + A_2*X^4$ -Barometric correction coeff - Offset

Where X= measured frequency of VW sensor

Barometric correction coefficient is calculated automatically by measuring

Actual Barometric pressure

Offset value is the VW sensor installation depth in the borehole

Figure 25-6: ESDI-ESVI10VB Sensor Configuration Screen

25.6   SDI-12 CTD Probe (ESDI-ECTD30V/60V)

Select ESDI-ECTD30V/60V then Sensor configuration from *Figure 25-1* to configure sensor's offset of a CTD Probe. Select channel number at which the sensor is connected. Select the sensor's address and click on *Read* button. On pressing this button, application will fetch the information from sensor. *Figure 25-7* is showing an example of sensor configuration screen. Change the values and then click on *Update* button to update new values into sensor's non-volatile memory. Click *Monitor* button to view instant reading of the sensor.

The temperature coefficient is the amount of change in conductivity per °C, expressed as a decimal part of the conductivity at some reference temperature. In this case, as in most modern instruments, the reference temperature is 25°C. Atypical value for α is 0.02, although it can vary from that figure by a factor of 2 or more in either direction and is actually a function of both temperature and chemical concentration.

$C_t = C_{25} (1 + α(t - 25))$

Where C_t = conductivity at $t°$ C

C_{25} = conductivity at $25°$ C

t = operating temp. in$°$ C

α = temperature coefficient

As mentioned above electrical conductivity is strongly temperature dependent. It increases with increasing temperature. It is affected by the nature of the ions and by the viscosity of the water. If it is not possible to make measurements at the reference temperature (25.0°C) the temperature correction to 25 °C as a reference is needed. The temperature correction coefficient varies depending upon the nature, composition and concentration of the dissolved electrolytes. The lower the concentration, the higher the correction coefficient. The temperature effect is largely due to the improved ionic mobility at higher temperature, which is due to the decreasing viscosity of water. For this reason most salts in water have about the same

temperature correction coefficient. The temperature correction coefficient for different solutions is almost always positive and of magnitude from about 0.5-3 %/°C. Ultra pure water has by far the largest coefficient 4.55-5.2 %/°C. The temperature coefficients of the following electrolytes generally fall into the ranges shown below:

Acids: 1.0 - 1.6%/°C

Bases: 1.8 - 2.2%/°C

Salts: 2.2 - 3.0%/°C

Drinking water: 2.0%/°C

Ultrapure water: 5.2%/°C

Conductivity Gage Factor is *cell constant* correction factor of the conductivity probe. This correction factor is given for conductivity cell calibration for laboratory use. Please do not change if not known.

Figure 25-7: ESDI-ECTD30V Sensor Configuration Screen

25.7   SDI-12 Interface for CTD Probe with Barometric Correction (ESDI-ECTDBPC)

Select ESDI-ECTDBPC then Sensor configuration from Figure 25-1 to configure sensor's offset of a Barometric Pressure Corrector for CTD Probe. Select channel number at which the sensor is connected. Select the sensor's address and click on Read button. On pressing this button, application will fetch the information from sensor. Figure 25-8 is showing an example of sensor configuration screen. Change the values and then click on Update button to update new values into sensor's non-volatile memory. Click Monitor button to view instant reading of the sensor.
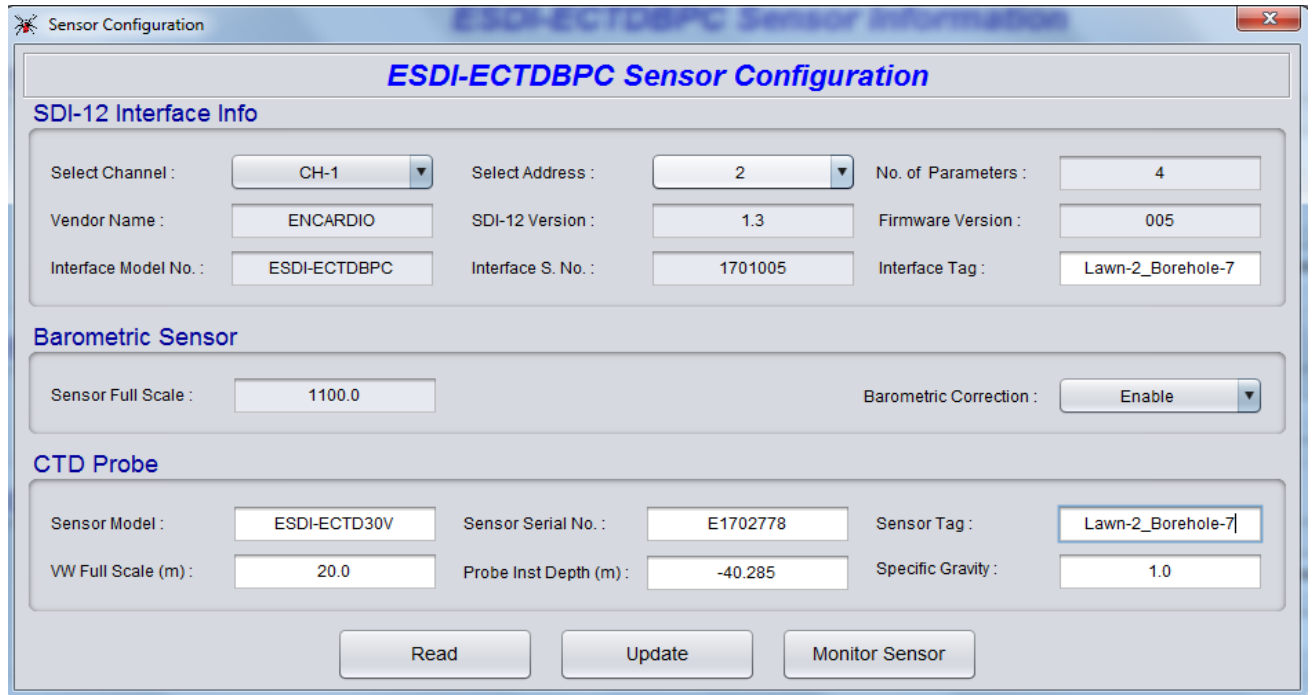
Figure 25-8: ESDI-ECTDBPC Sensor Configuration Screen

25.8   SDI-12 Interface for Strain Gauge Load Cell (ESDI-ESBI10)

Select ESDI-ESBI10 then Sensor configuration from Figure 25-1 to configure sensor's offset of a SG Load Cell Sensor. Select channel number at which the sensor is connected. Select the sensor's address and click on Read button. On pressing this button, application will fetch the information from sensor. Figure 25-9 is showing an example of sensor configuration screen. Change the values and then click on Update button to update new values into sensor's non-volatile memory. Click Monitor button to view instant reading of the sensor.

Figure 25-9: ESDI-ESBI10 Sensor Configuration Screen

Parameter   P = mX + C

Where X = measured differential voltage of strain gage load cell

m = Parameter Gage Factor

C = Parameter Offset value

25.9   SDI-12 Interface for 0-5 V Analog Output Sensors (ESDI-ANL5V)

Select ESDI-ANL5V then Sensor configuration from *Figure 25-1* to configure sensor's offset of a 0-5 V Analog Output Sensor Interface. Select channel number at which the sensor is connected. Select the sensor's address and click on *Read* button. On pressing this button, application will fetch the information from sensor. *Figure 25-10* is showing an example of sensor configuration screen. Change the values and then click on *Update* button to update new values into sensor's non-volatile memory. Click *Monitor* button to view instant reading of the sensor.


Figure 25-10: ESDI-ANL5V Analog Output Sensor Interface Configuration Screen

Parameter   P = mX + C

             Where   X = measured voltage
                     m = Parameter Gage Factor
                     C = Parameter Offset value

25.10 SDI-12 Interface for 4-20 mA Current Loop Sensors (ESDI-420I)

Select ESDI-420I then Sensor configuration from Figure 25-1 to configure sensor's offset of a 4-20 mA Sensor Interface. Select channel number at which the sensor is connected. Select the sensor's address and click on Read button. On pressing this button, application will fetch the information from sensor. Figure 25-11 is showing an example of sensor configuration screen. Change the values and then click on Update button to update new values into sensor's non-volatile memory. Click Monitor button to view instant reading of the sensor.
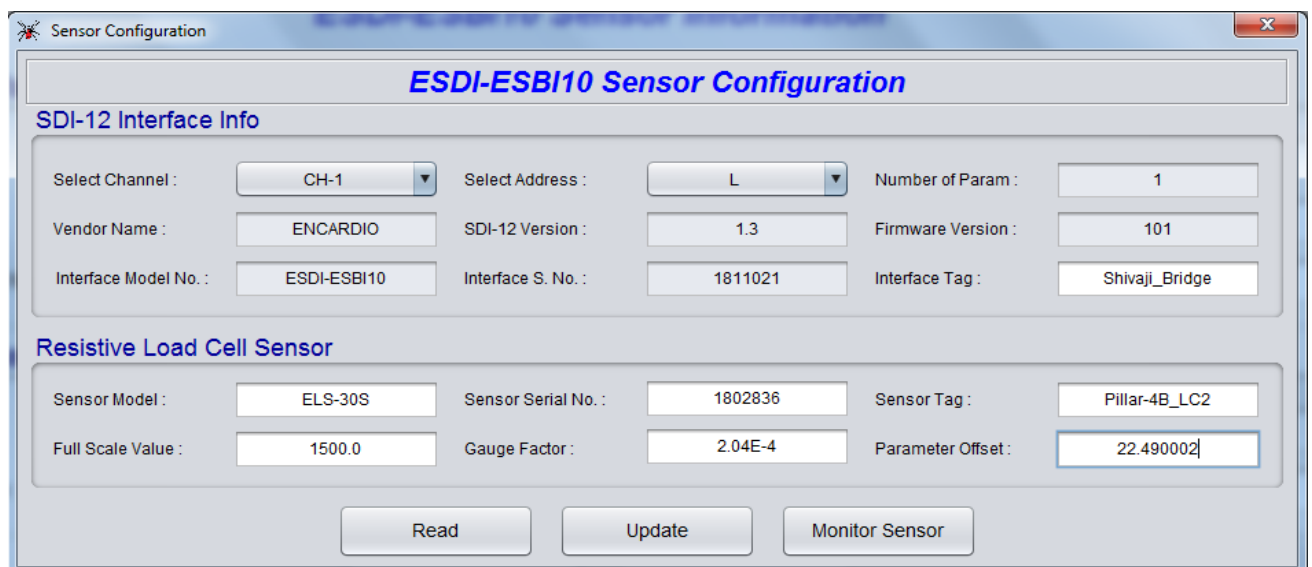
Figure 25-11: ESDI-420I Sensor Configuration Screen

Parameter   P = m(X - 4) + C

Where   X = measured current in mA
m = Parameter Gage Factor
C = Parameter Offset value

25.11 SDI-12 Interface for Electronic Plumb Line (ESDI-EPR01)

Select ESDI-EPR01 then Sensor Information from *Figure 25-1* to see sensor information of Electronic Plumb line Sensor Interface. Select channel number at which the sensor is connected. Select the sensor's address and click on Get Sensor Info button. On pressing this button, application will fetch the information from sensor. *Figure 25-12* is showing an example of sensor information screen. Change the values and then click on *Update* button to update new values into sensor's non-volatile memory. Click *Monitor* button to view instant reading of the sensor.
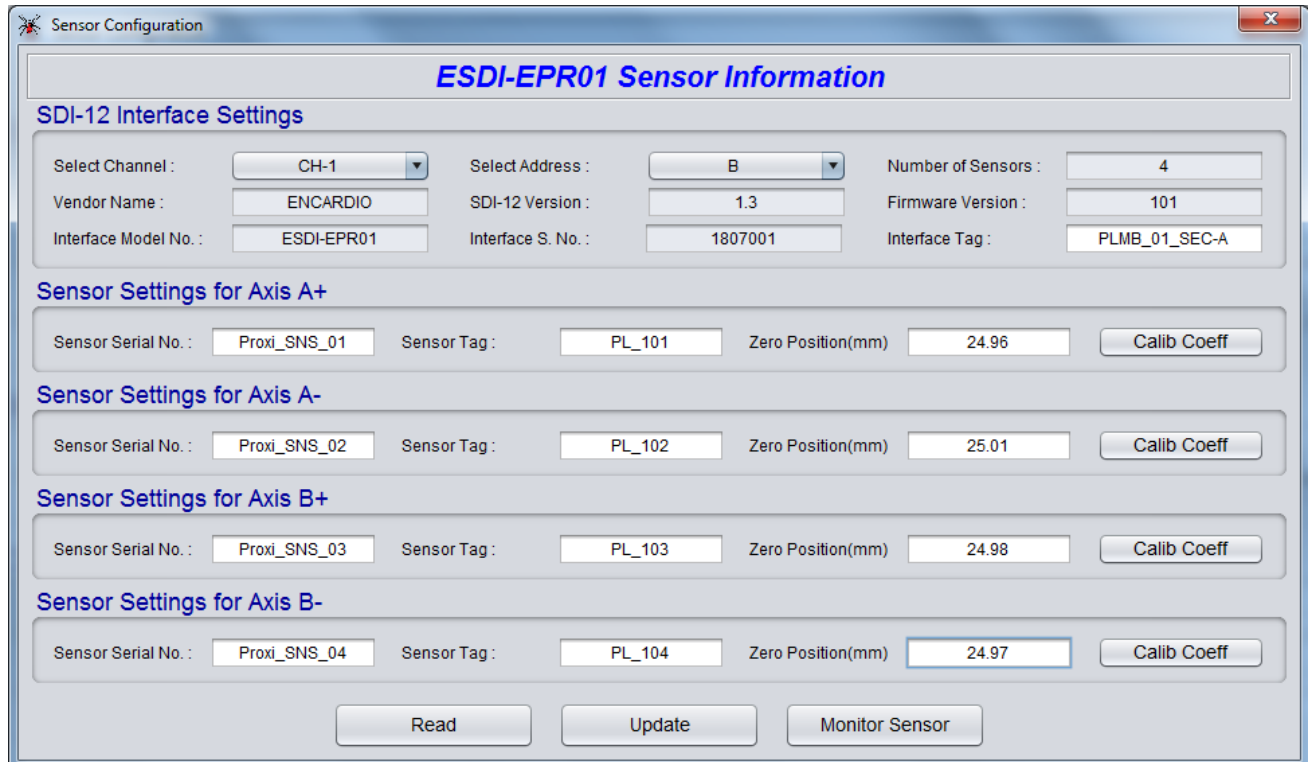
Figure 25-12: ESDI-EPR01 Sensor Information Screen

Open the Sensor calibration coefficients screen by clicking *calib coeff* button for any axis. Click on *Read* button to get stored calibration coefficients. On pressing this button, application will fetch the information from sensor. *Figure 25-13* is showing an example of sensor configuration screen. Do not change any coefficient unless proximity sensor has been changed. If required so, change the values and then press on Update button to update new values into sensor's non-volatile memory.
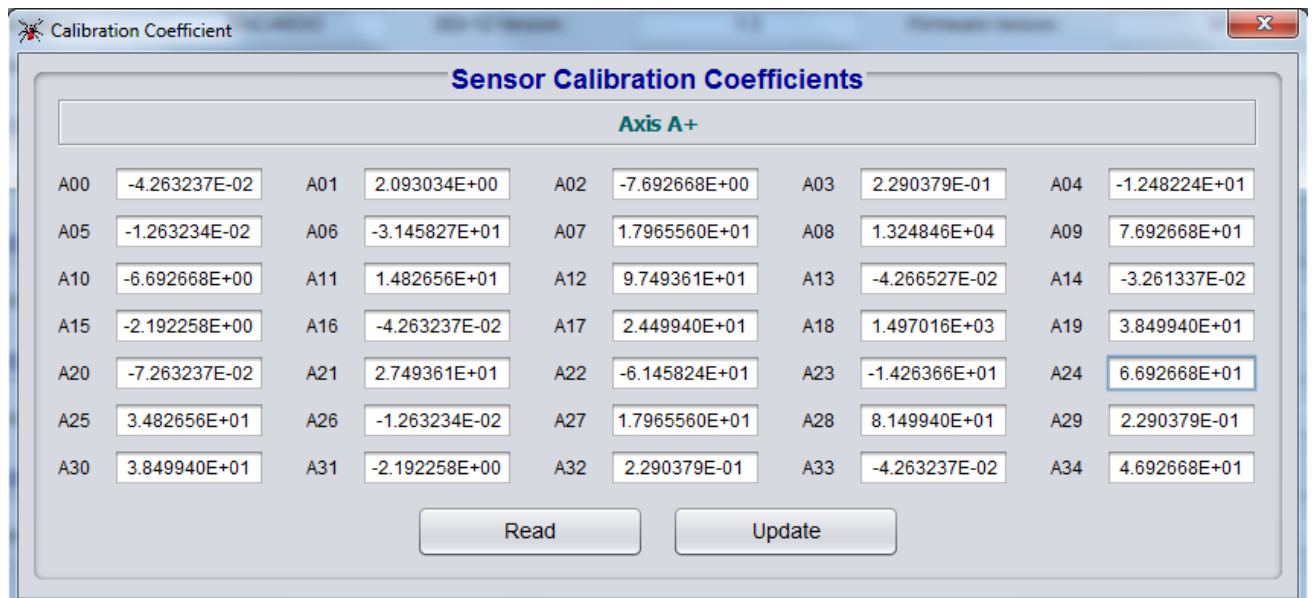
Figure 25-13: ESDI-EPR01 Sensor Calibration Coefficients Screen

25.12   SDI-12 Interface for Flow Meter (ESDI-FMSDI12)

Select ESDI-FMSDI12 then Sensor configuration from *Figure 25-1* to configure sensor's offset of a Flow meter. Select channel number at which the sensor is connected. Select the sensor's address and click on *Read* button. On pressing this button, application will fetch the information from sensor. *Figure 25-14* is

showing an example of sensor configuration screen. Change the model number, serial number and sensor tag if required and then click on *Update* button to update new values into sensor's non-volatile memory. Click *Monitor* button to view instant reading of the sensor.


Figure 25-14: ESDI-FMSDI12 Sensor Configuration Screen

26 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) Remove the batteries, wait for 5 seconds and then mount the batteries. Now try to connect.

- 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) Remove the batteries, wait for 5 seconds and then mount the batteries. Now try to connect.

- Files not uploading to FTP server

  a) Internet connection may not be available.

  b) URL or port setting may be incorrect.

  c) Check GSM/GPRS/3G/4G signal strength at *Modem settings* screen.

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

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

- Datalogger is reporting "NaN" or Error code while scanning

  a) Check SDI-12 sensor connection

  b) Check SDI-12 sensor address

  c) Check SDI-12 sensor address and channel number in sensor table

  d) Check sensors *license* for number of sensors in use

27   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 24-1 is showing an example of Downloaded/Uploaded CSV file Format. Header information contains Datalogger's ID, Records Date/Time, Logger's Battery Voltage when record is taken and parameters. For example, Parameter CH2_a13 showing 3rd parameter of measurement command type aM1! /aC1! (Measurement command type for SDI-12 interface) of sensor connected at channel-2(SDI-12 Bus) and the sensor's address is "a". These files are kept into Site folder under CSV Files folder which path is set through Data File Management menu.

Figure 27-1: Downloaded/Uploaded CSV File Format

While downloading, application automatically extracts Sensor records from downloaded CSV file to represent it in a tabular form. After separating Sensor records, application generates a CSV Files that is used for Table view. This file contains parameter name and unit information to make it easy to understand. These files are kept into Table view folder under CSV Files folder which path is set through Data File Management menu.

Figure 27-2: Generated CSV File for Table view

28   WEB BASED DATA MONITORING SERVICE (WDMS)

The heart of the online structural monitoring instrumentation system is a Web Data Monitoring Service offered by Encardio-rite. It is a web-based data-management and presentation tool for data collected through the ESDL-30UNI SDI-12 Universal Datalogger from sensors with an integral SDI-12 interface. WDMS consists of software such as a data collection agent, a data base server and a web server hosted on a high reliability server computer. The host computer periodically collects data from the remote data logger over cell phone networks. Users interact with the software using their web-browser, when connected to the Internet. The only requirement is that the data logger site is covered by a cell phone service provider who can provide reliable GSM/GPRS enabled cellular data connection locally.

Multiple authorized users at different locations assigned with an individual password are allowed to view any data or report from the structure simultaneously. Graphs & reports can be viewed using popular web browsers like Microsoft internet explorer or Mozilla Fire fox amongst others. The server for the above WDMS services is located at Encardio-rite premises and is maintained 24 x 7.

Details like sensor identification Tag, last recorded sensor reading, and the values of the programmed alert level scan be viewed on the first page of site that shows location of installation. If any one of the alarm level exceeds, the sensor location turns to a red dot. Clicking the pop up table brings up an associated data window where the sensor data can be seen either as a table or as a graph. *Figure 28-1* showing an example of Sensor data presented in graphical form.

Site administrators can set two alarm limits which are generally considered as "alert level" and "evacuate level". WDMS can also be programmed to send SMS alert messages or e-mail to selected users as soon as any sensor data crosses its predefined alarm levels, either while going above or going below the alarm level. The web browser interface is very simple to use and intuitive. A user who is only interested in viewing the data and reports will take just a few minutes to get familiar with the operation of the system.
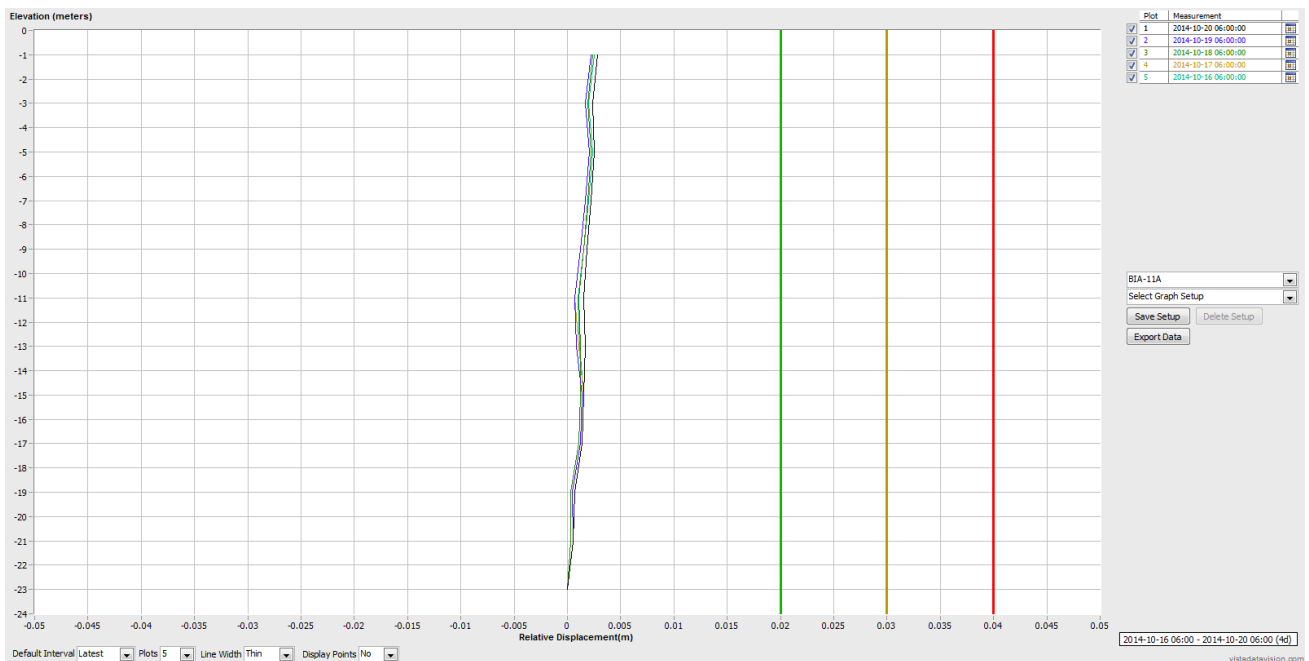

Figure 28-1: Data display on remote PC

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.

─── USERS' MANUAL ───

DATALOGGER WITH INTEGRAL TILT METER

MODEL ESDL-30MT - Addendum

Contents

1   INTRODUCTION

Encardio-rite model ESDL-30MT consists of a tilt meter integrated with an automatic datalogger. The unit has biaxial MEMS tilt sensor mounted inside it. It is a complete unit in itself for online monitoring of tilt at any location. It is of rugged construction and can be used in a variety of applications to provide accurate reliable data.

ESDL-30MT datalogger with inbuilt tilt meter also has provision to connect nearby installed crack meter, another tilt meter or any others vibrating wire, resistive strain gage type sensor with SDI-12 interface.

1.1   Specifications of inbuilt tilt meter

The inbuilt MEMS tilt meter has a measurement range of $\pm 15°$ from vertical. It provides a full-scale output of ± 4 V (nominal) at $\pm 15°$ and has an accuracy of $\pm 0.1\%$ fs and sensitivity of ± 10 arc seconds.

2   DESCRIPTION

Figure 1 shows model ESDL-30MT datalogger with an inbuilt tilt meter. The biaxial tilt sensor is connected at Channel 1. Channel 2 and Channel 3 can be used for other sensors to measure different parameters. In figure below an interface suitable for vibrating wire, resistive strain gage type or 4-20 mA output sensor is shown connected to channel 2 and an IPI sensor/tilt meter with SDI-12 output is shown connected to channel 3 as an example.

SIM card slot

Tilt sensor - Bi-axial

Biaxial tilt sensor connected at Channel 1

SDI-12 interface unit at Channel 2 (for VW, resistive strain gage type or 4-20 mA output sensor

IPI or tilt sensor (with SDI-12 output) at Channel 3

Batteries holder

Amphenol Connector for connection with PC/Laptop
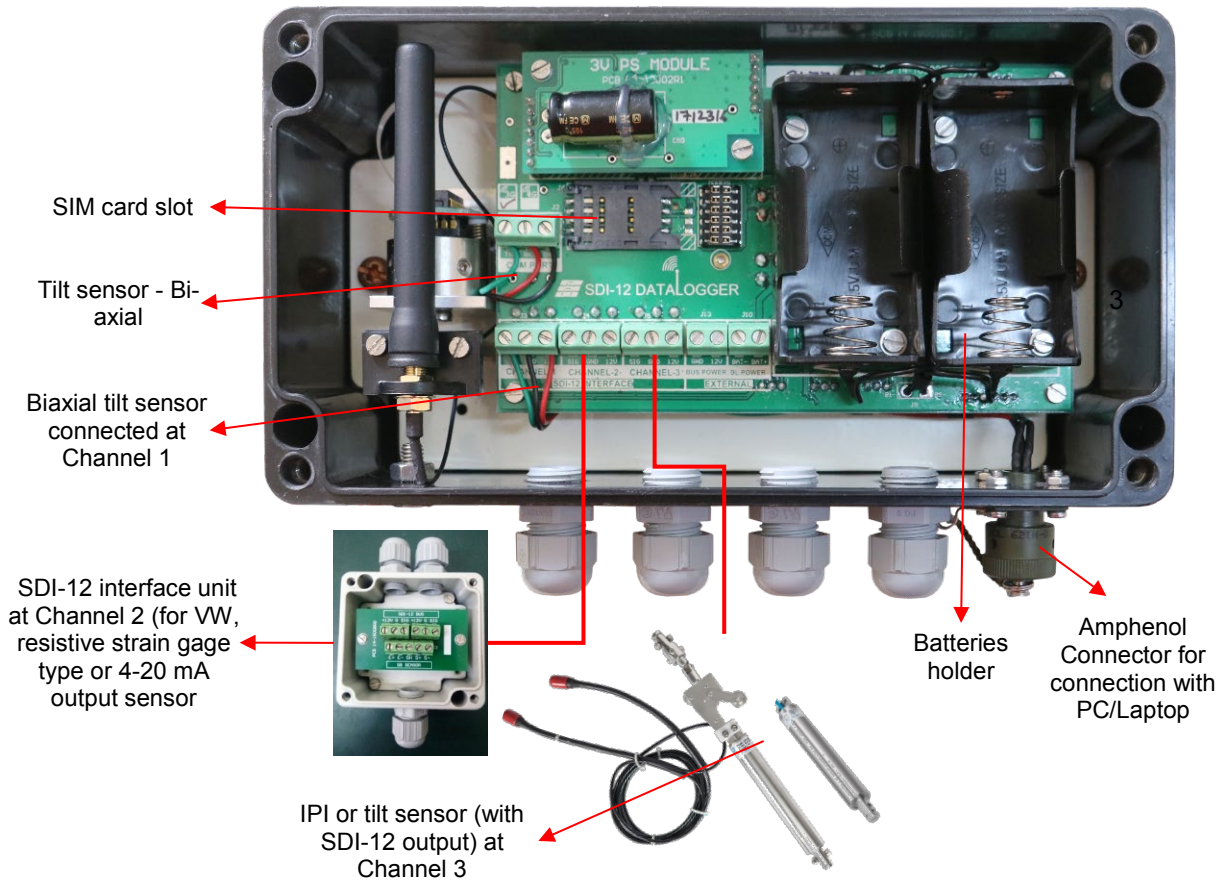
Figure 1: Details of model ESDL-30MT datalogger with inbuilt biaxial tilt meter

3   INSTALLATION

Typical mounting arrangement of model ESDL-30MT tilt meter (inside datalogger) on wall is shown in figure 2 below. Mounting arrangement of the same may differ depending on the location at which it is being installed. Please contact factory in case any special mounting arrangement is required.
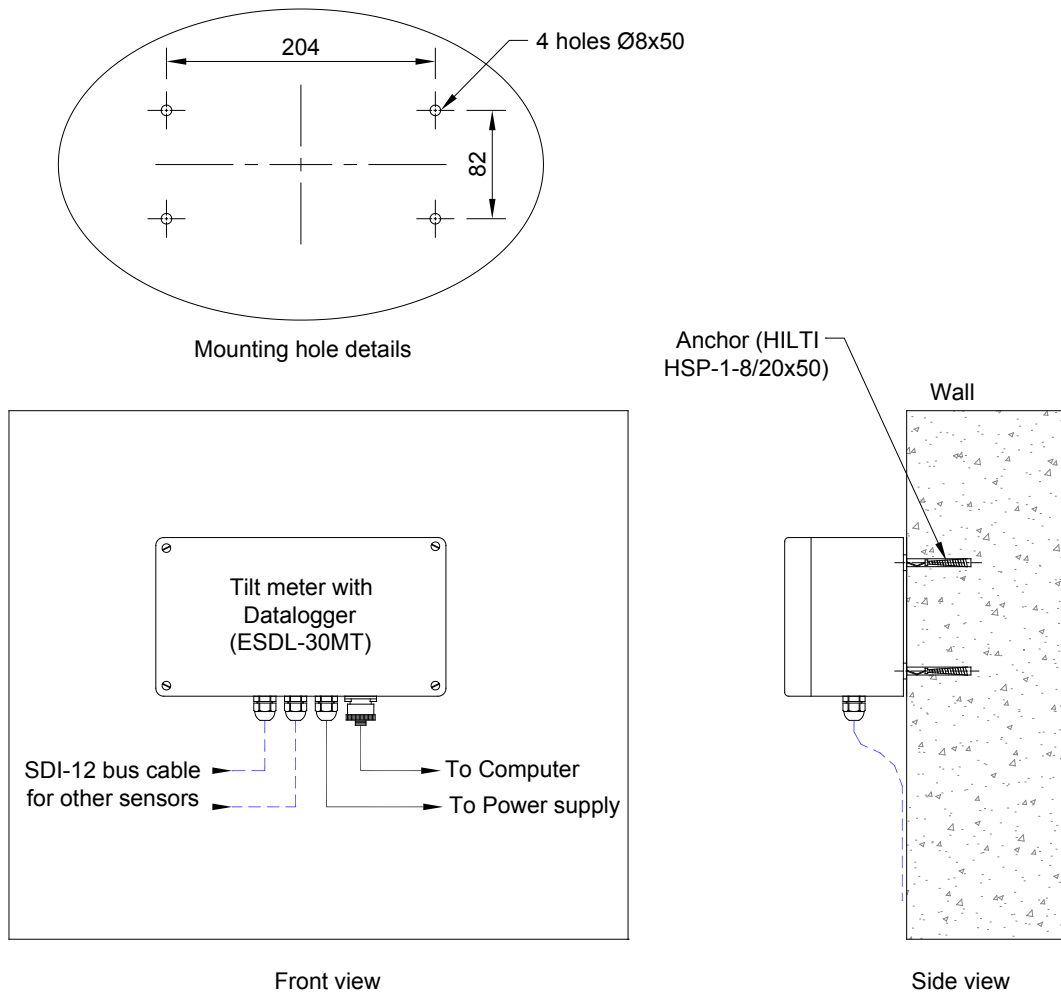
Figure 2: Installation details of model ESDL-30MT datalogger

4   CONFIGURATION, DATA RETRIEVAL

4.1   Configuration

For configuration of ESDL-30MT datalogger with inbuilt tilt meter, please refer to manual # WI 6002.110 for model ESDL-30 datalogger. The configuration is same for both models.

4.2   Online data via telemetry transmission through GSM/GPRS modem

In a location covered by any GSM/GPRS service provider, data from the automatic datalogger can be transmitted remotely to any server/cloud. A data SIM card is required for each datalogger (in customer's scope).

4.3   Readout/data retrieval using laptop PC

The logged data from datalogger installed in field can be directly downloaded to a laptop. Data can be then transferred to central PC or server from the laptop using either a USB pen drive or through Internet.

5   PROTECTION

Avoid installation of tilt meter in parts of the structure exposed to direct sunlight. If this is not feasible, a box made from Thermocole or similar heat insulating material should be installed covering the tilt meter and protecting it from direct sunlight. If certain degree of mechanical protection is also required, wooden or fibreglass protection boxes may be considered. Heat insulating tape can be fixed to the inner surface of such boxes for thermal insulation.

6   SAMPLE CERTIFICATE

TEST CERTIFICATE
(for 'A' axis calibration)

Item	:	SDI-12 datalogger with built in tilt meter (Biaxial)
Model	:	ESDL-30R1 MT
Range	:	±15º
Serial No.	:	1803501

Date   :   02.01.2019
Temperature :   17 ºC

Next calibration due on :01.01.2020
Test data

Test position Arc degrees(B)	Corresponding SinA	Observed SinA 'A' axis	Offset corrected SinA 'A' axis	Non-conformance (% fs) 'A' axis
15	0.2588	0.2593	0.2590	0.0695
12	0.2079	0.2081	0.2079	0.0119
9	0.1564	0.1567	0.1564	0.0013
6	0.1045	0.1049	0.1046	0.0211
3	0.0523	0.0526	0.0523	0.0043
0	0.0000	0.0003	0.0000	0.0000
-3	-0.0523	-0.0519	-0.0522	0.0483
-6	-0.1045	-0.1042	-0.1045	0.0079
-9	-0.1564	-0.1560	-0.1562	0.0763
-12	-0.2079	-0.2076	-0.2078	0.0292
-15	-0.2588	-0.2586	-0.2588	0.0093

Max non-conformance (% fs):   0.08

Calculation of tilt value (arc degree) :

$$A = Sin^{-1}(observed\ output)$$

Wiring colour code :

Wire colour	Signal	Marking on PCB
Red	+ 12 V (supply)	12V
Black	0 V (supply)	GND
Green	Output signal	signal

(1) One no. In-built Biaxial tilt meter has been connected at channel # 1.

Tested by :   (2) Channel # 2 & 3 are free for other SDI sensors.

TEST CERTIFICATE
(for 'B' axis calibration)

Item	:	SDI-12 datalogger with built in tilt meter (Biaxial)			
Model	:	ESDL-30R1 MT			
Range	:	±15º	Date	:	02.01.2019
Serial No.	:	1803501	Temperature :		17 ºC

Next calibration due on :01.01.2020

Test data

Test position Arc degrees(B)	Corresponding SinA	Observed SinA 'B' axis	Offset corrected SinA 'B' axis	Non-conformance (% fs) 'B' axis
15	0.2588	0.2584	0.2586	0.0808
12	0.2079	0.2075	0.2077	0.0992
9	0.1564	0.1560	0.1561	0.1153
6	0.1045	0.1042	0.1043	0.0693
3	0.0523	0.0521	0.0523	0.0093
0	0.0000	-0.0002	0.0000	0.0000
-3	-0.0523	-0.0524	-0.0522	0.0378
-6	-0.1045	-0.1046	-0.1045	0.0268
-9	-0.1564	-0.1567	-0.1565	0.0191
-12	-0.2079	-0.2082	-0.2081	0.0561
-15	-0.2588	-0.2590	-0.2589	0.0135

Max non-conformance (% fs):   0.12

Calculation of tilt value (arc degree) :

$$B = Sin^{-1}(observed\ output)$$

Wiring colour code :

Wire colour	Signal	Marking on PCB
Red	+ 12 V (supply)	12V
Black	0 V (supply)	GND
Green	Output signal	signal

(1) One no. In-built Biaxial tilt meter has been connected at channel # 1.

Tested by :   (2) Channel # 2 & 3 are free for other SDI sensors.