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USERS' MANUAL

DATALOGGER FOR DIGITAL SENSORS – OPERATION

(Suitable for sensors with SDI-12 digital output)

MODEL ESDL-30

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.

FCC Caution:

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

IMPORTANT NOTE:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

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)
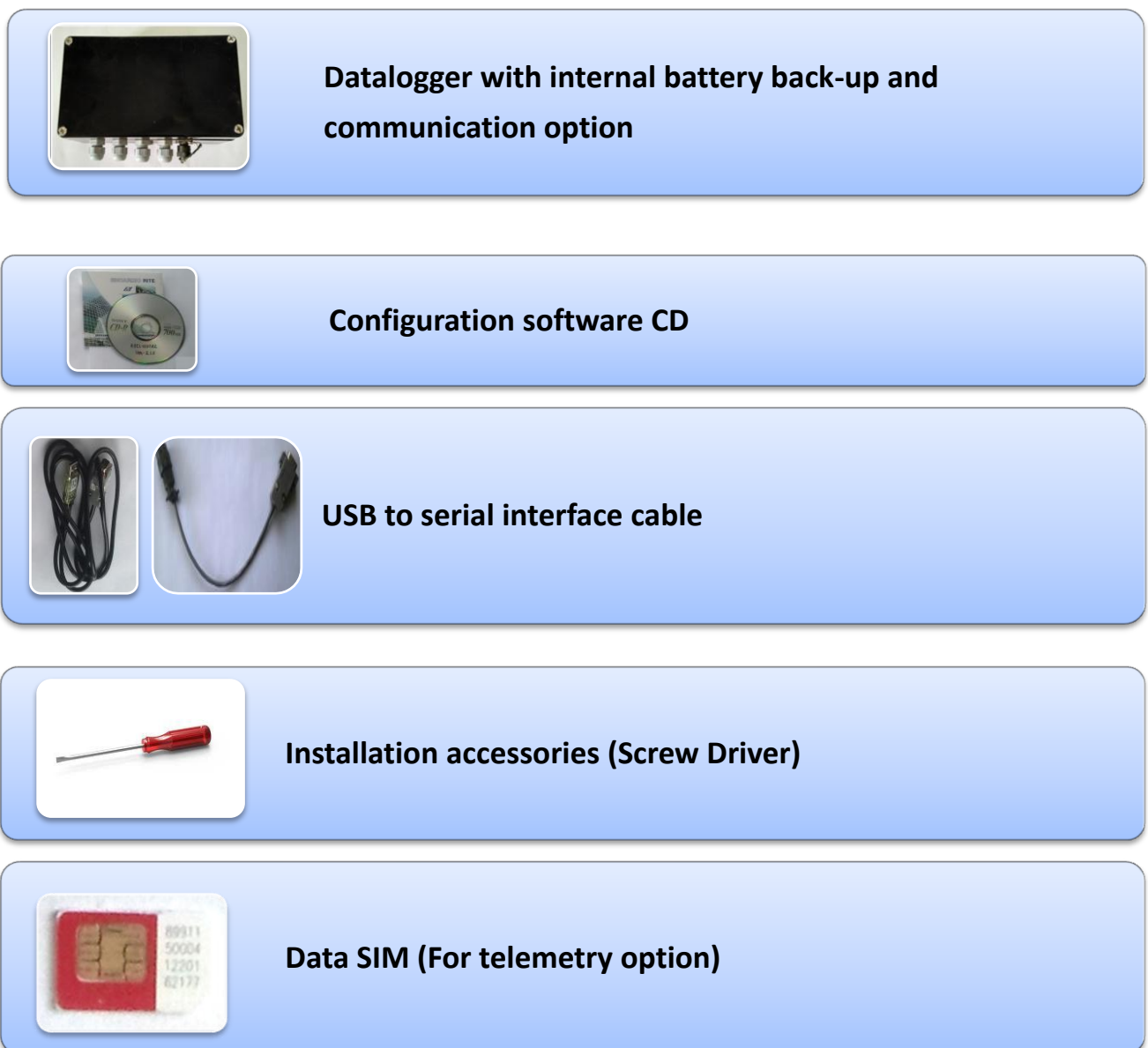
Data SIM (For telemetry option)

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

2   OPERATING PRINCIPLE

ESDL-30, 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. 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-30 with built in LTE 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.
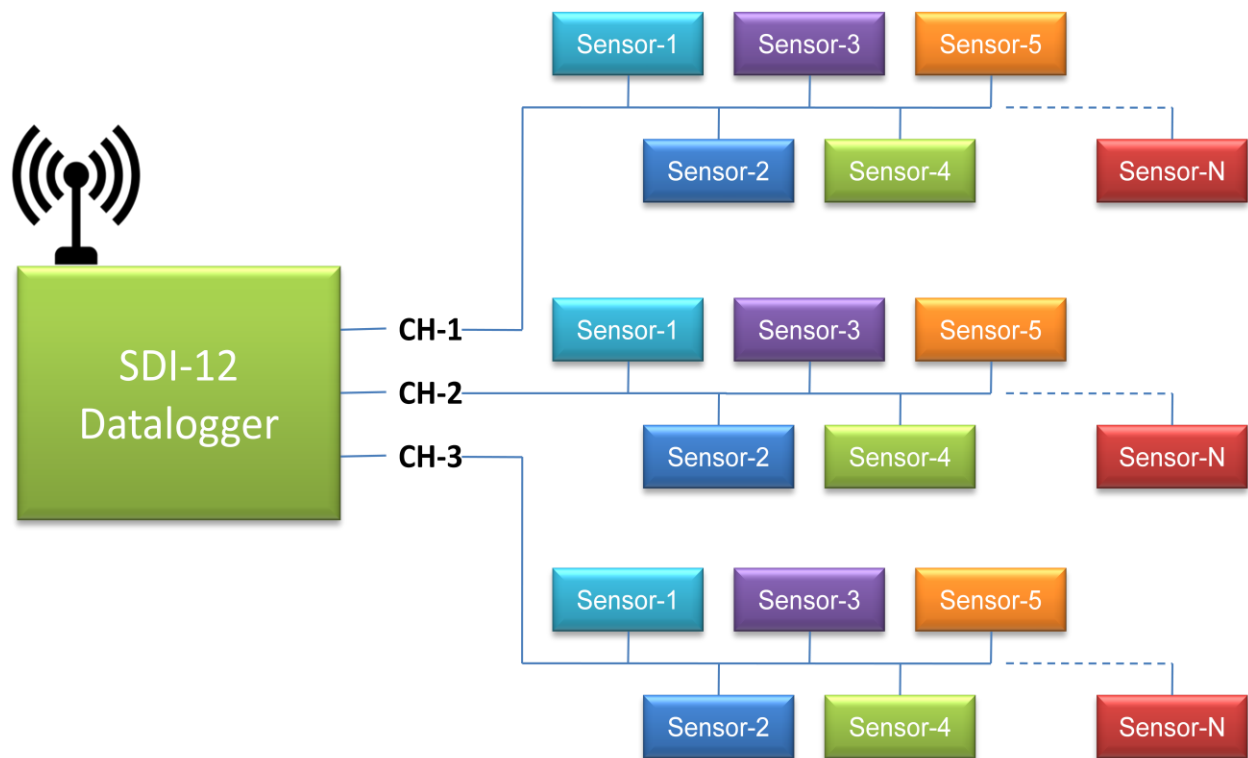
3   DATA LOGGER SETUP

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

Cable Gland
(CG-1)

Cable Gland (CG-4)
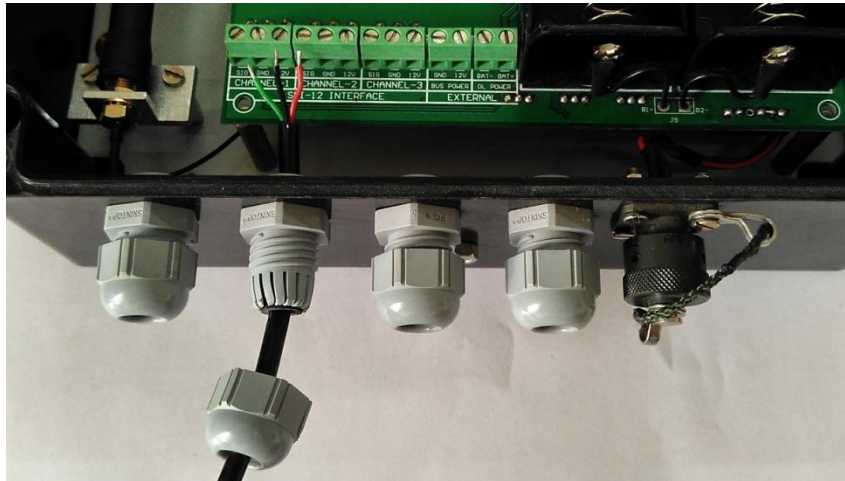
Figure 3-2: Pull out – top cover

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

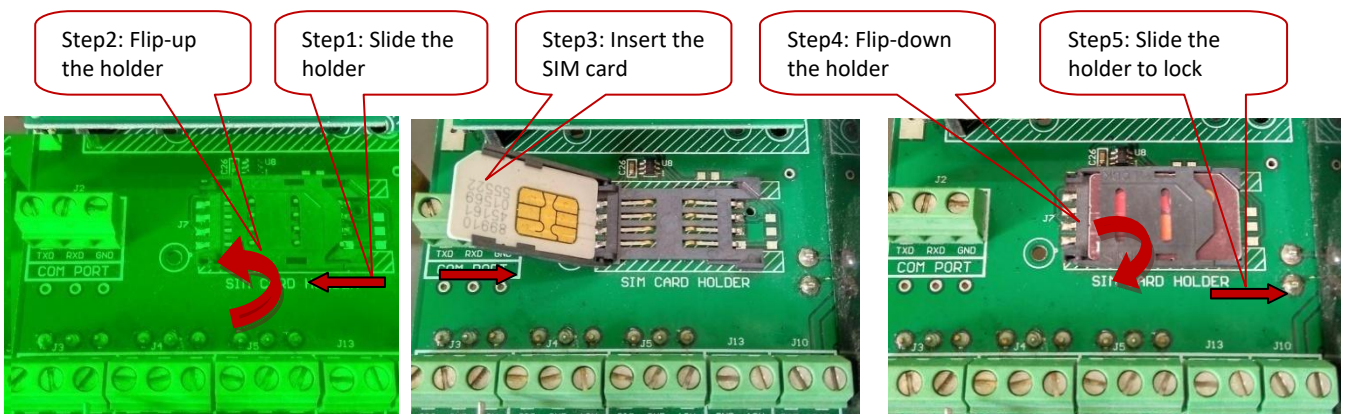**Figure 3-5**   **Figure 3-6**   **Figure 3-4**

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 (+/-).
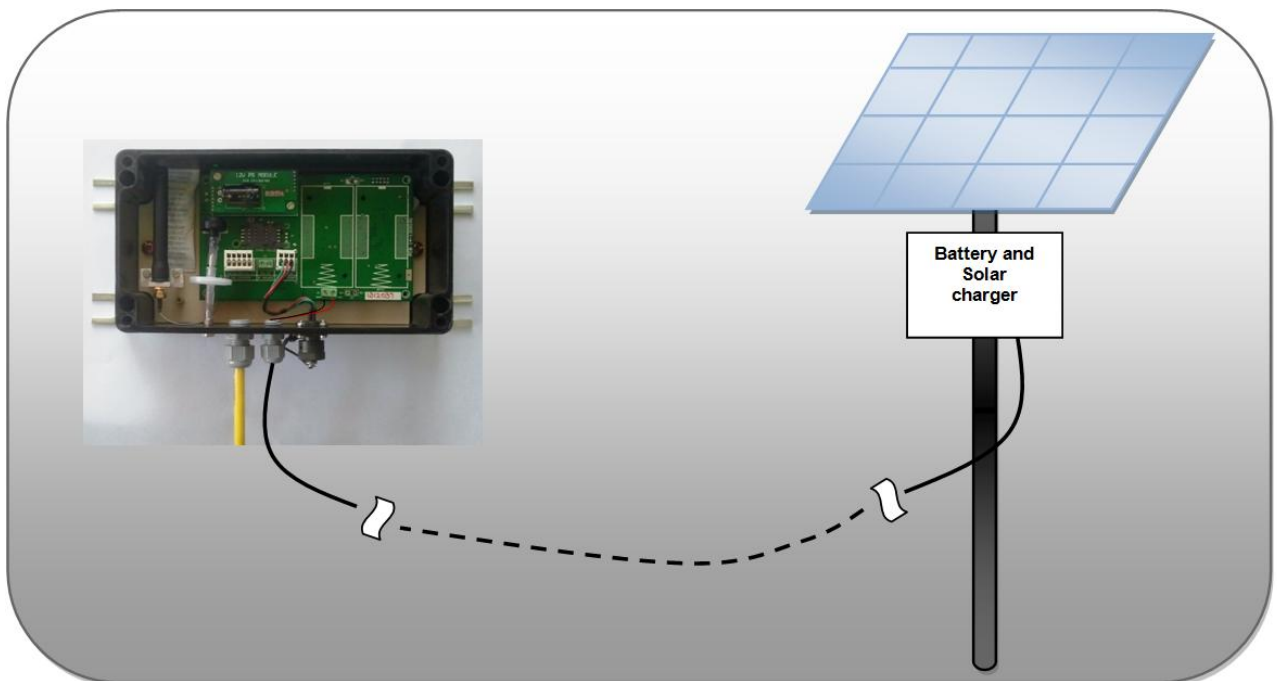

Figure 4-3 Datalogger powered with 12 V Solar powered

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

5   DATALOGGER SDI-12 BUS POWER OPTIONS

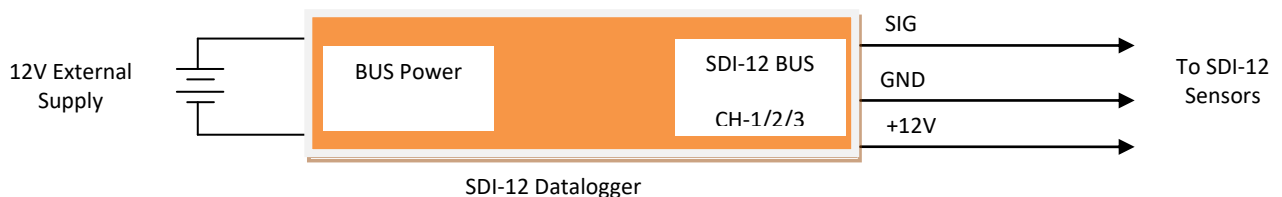SDI-12 Bus can be powered by either of 3 options.

- 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
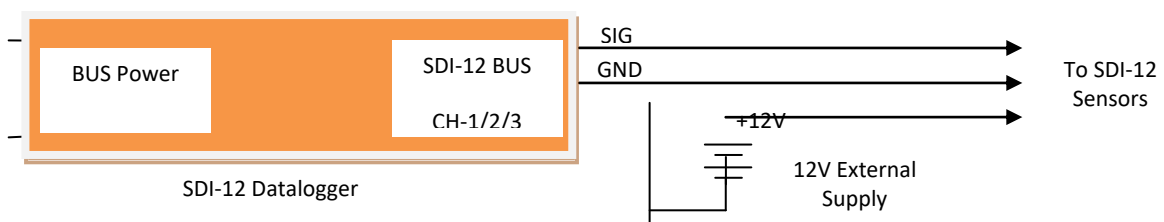
6   COMMUNICATION INTERFACE

Data logger can be configured by application software using communication cable. 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

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   : LTE

Antenna   : Built-in Stub Antenna

                                                     (Optional) External Whip Antenna

Communication Ports   : RS-232 (Standard) 115 kbps

Data Transfer   :   Via RS232

Configuration & Data Retrieval   : **Laptop running Windows OS**-

                                                          using RS-232

                                                  FTP   : using LTE

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.
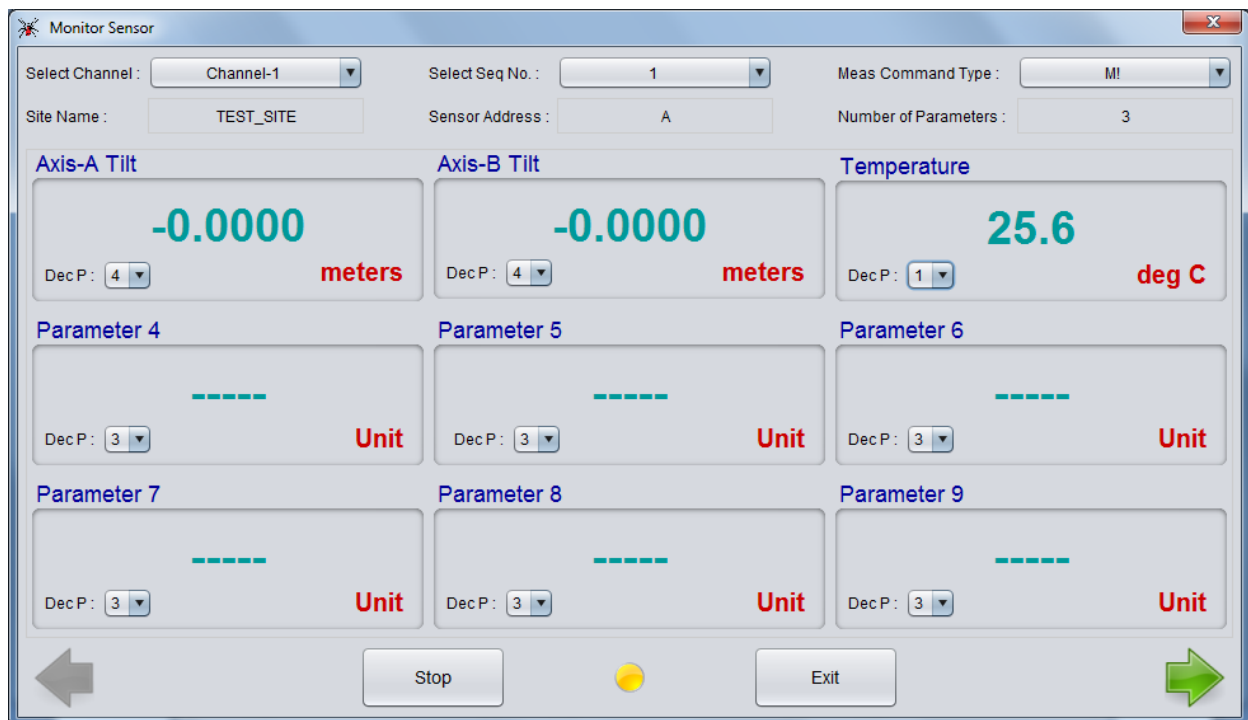

Figure 8-1 ESDL-30UNI Configuration Manager Application running on PC

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 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.