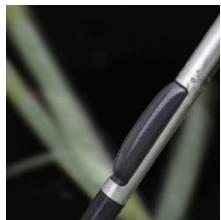
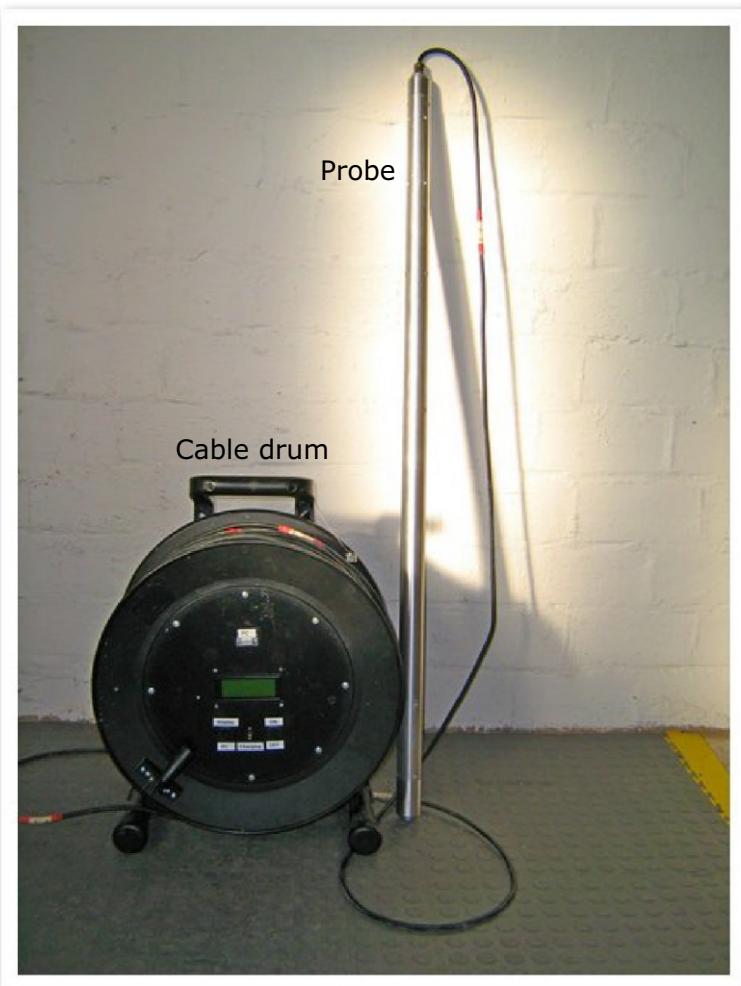


**Manual for**  
**Deviation Probe**





## Borehole Deviation Probe



Front panel





## Borehole Deviation Probe - Operation

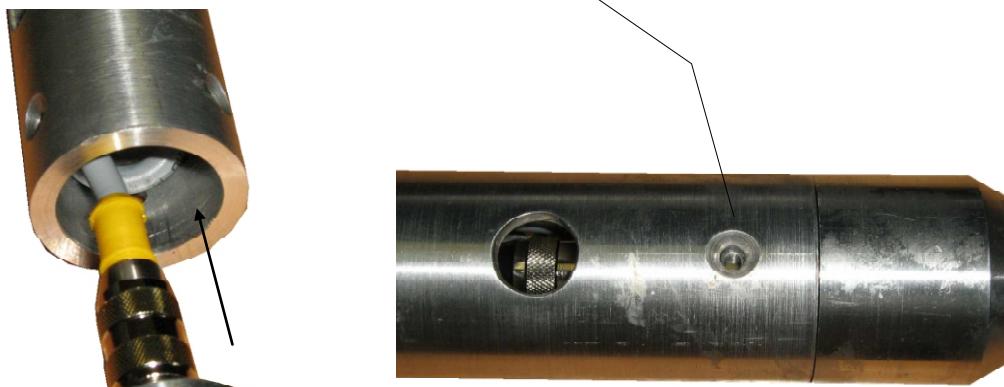
**Handle probe with extreme care. Do not hit probe or expose to shock.  
Internal tilt sensor will be damaged in this case !**

The borehole deviation probe DevProbe1 comes in a ruggedized hardcover case. The probe consists of a downhole probe part and a cable drum with connector. A 3-axis magnetometer with a dual tilt sensor is housed inside the plastic body of the downhole probe. A 50cm spiral cable links the magnetometer probe to the cable connector. Once connected the unit has to be switched ON (DISPLAY) and readings can be taken.

(1) Connect cable and connector



(2) Push back cable and screw in connector tightly



### Battery Charging:

- Disconnect probe first !
- Use charger (one hour for fully charging)
- During charging no surveying possible
- Fully charged probe works ~ 6 hours

(3) Switch ON, Switch to Displ. and read values  
or use software to store data



## Deviation Logger Software Tool for DevProbe1(Rev. October 2014)

### 1. Introduction

The Deviation Logger software in connection with the DevProbe1 borehole probe enables the user to perform borehole deviation measurements in a semi-automatic way. The readings of tilt and direction angles can be recorded on a notebook computer running Microsoft Windows (tested on XP and Windows 7). Computer and borehole probe will be connected by a serial connection. The depth of the deviation probe needs still to be measured manually.

Besides the software supported way of logging, the user can perform a manual measurement, where the tilt and direction values are copied manually from the display of the deviation probe. The manual measurement does not require a computer at the testing site.

### 2. Installation and start of software

The installation of the software requires the following steps:

1. Installation of the driver software for the USB-serial-adapter in order to connect the DevProbe1 to the computer. Please follow the instructions of the adapter manufacturer. If the driver is not already included in the Windows standard installation it is provided on a separate data medium. Driver software for some types of adapters can be found also in the “WinDriver\_SerialToUSB\_Adapter” folder of the USB-stick containing this manual.
2. The Deviation Logger software requires that an installation of Microsoft .NET Framework 3.5 (or higher) is present. Windows 7 always contains this runtime environment. In case of Windows XP and Vista the user may need to download the .NET framework 3.5 from the Microsoft webpage and to install it by hand. (One can check which version of the .NET framework is already installed by using the control panel->software.)
3. Installation of a Matlab Run Time Environment for the Deviation Logger software. This environment can be installed by running the provided “MCRInstaller.exe”. (provided on CD or USB stick)
4. Please copy of “DevLogger.exe”, “LaunchDevLogger.exe” and “putty.exe” into a directory of your choice.
5. Run “LaunchDevLogger.exe” to start the software. It is recommended to generate a link to the file on the desktop or in the program folder for convenience.

### 3. Recording of borehole deviation data

At the beginning the DevProbe1 needs to be connected to the computer by means of the provided USB-serial-adapter. Please note the USB driver needs to be installed before connecting to the computer. Wait until Window is ready for it if the connection is made for the first time. Sometimes Windows requires a re-boot additionally. The USB-side of the adapter fits into a USB port of the computer. The serial plug (D -Sub-Plug) needs to be connected to the socket in the cable drum of the DevProbe1. The switches on the drum should be set to ‘ON’ and ‘PC’.

Before starting the software it is recommended to determine the number of the virtual serial port (COM port) the driver of the USB-serial adapter has created. This can be done using the “Windows Device Manager” (Windows XP: System Settings / System / Hardware) while the adapter is connected to the computer. Please see an example in Fig. 1.

One can start the logger software by running “LaunchDevLogger.exe”. The Fig. 2 shows the interface of the Deviation Logger. After selecting the proper COM port the software will connect to the DevProbe1. If the connection can be established the current values of tilt and direction angle are displayed and continuously updated. In case a wrong port is selected or the connection is broken an appropriate error message will appear.

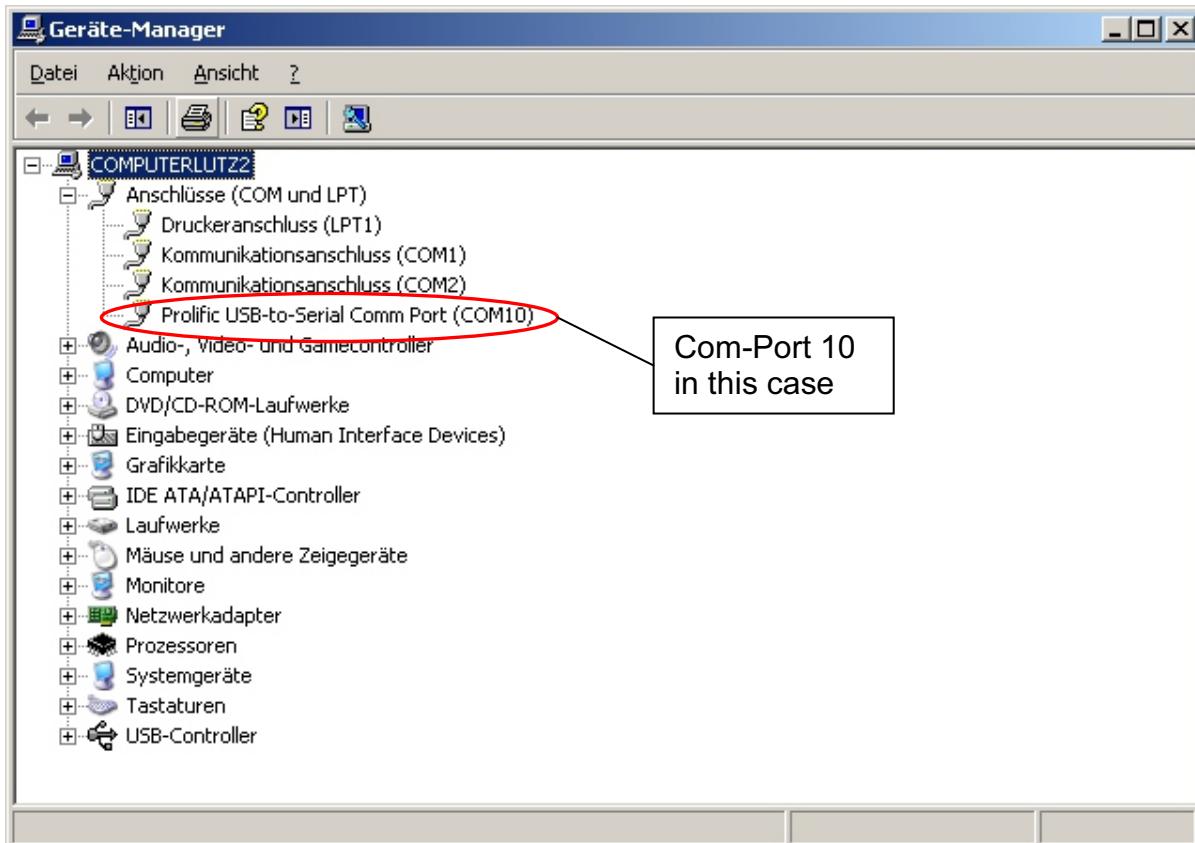


Fig. 1: Generated virtual serial interface in Windows Device Manager

Tilt and direction readings can be recorded into an ASCII file with “log” extension. Create a new log-file by means of the “Start New Log File” button or open an existing file by the “Load Log File” button. In case an existing file was opened, its contents will be shown in the table at the bottom of the program window. New readings will be added to the old data. Old data will remain unchanged.

For the depth registration enter the starting probe depth into the “Depth” field. The value entered in the “Depth Increment” field is added to the value in the “Depth” field when the reading of a certain depth is completed. Only the value displayed in the “Depth” field will be recorded. This means in case of not equally spaced reading points the depths can be assigned for each point individually by entering the depth of each point manually.

Readings typically vary slightly. Averaging will be used to estimate stable direction and tilt values. In order to start collecting data push the “Take Reading” button. The current data values are averaged and displayed as long as the button is in switched position. As soon as the averaged values are close to stable they can be stored into the log-file by pushing the green “Save to Log File” button. One can stop averaging also by releasing the “Take

Reading” button and pressing the green button afterwards. This may give a better control over the stored values. Notice that the depth value will jump automatically to the next measuring depth after saving a set of data according to the value of the “Depth Increment” field.

The content of the log file is shown in the table at the bottom of the program window. Erroneous data lines can be deleted by checking the line in the last column of the table and pushing “Delete Checked Readings” button.

In case an error message concerning a lost connection appears check the physical connection and reselect the COM port in the “Serial Port” menu. By reselecting the COM port the open connection is closed and newly established. This procedure helps also around occasional communication errors between Deviation Logger and DevProbe1.

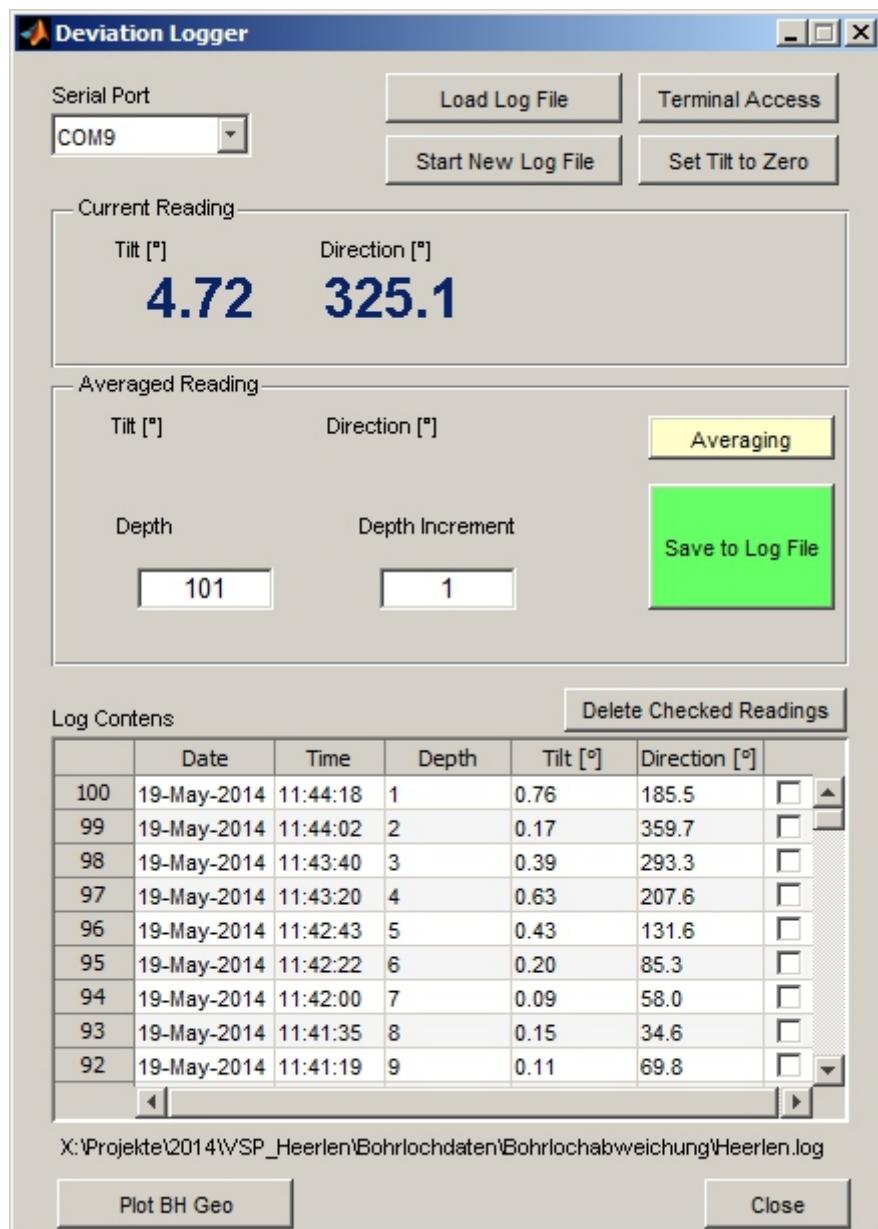


Fig. 2: User interface of Deviation Logger software

#### 4. Calculation of borehole deviation

The borehole deviation in terms of x (Easting), y (Northing) and z (Elevation) can be calculated based on the logged values of tilt and deviation. After the “Plot BH Geo” button is pushed the borehole geometry is displayed. At the bottom of the window several options for turning the 3D display and zooming are available. The origin of the coordinate system can be moved along the borehole if the value for the “Extension of Casing” is different from 0. This is especially useful if the tilt and direction values are logged with reference to the top of the casing but the deviation has to be calculated with reference to the surface level. The “Update”-Button redraws the figure with the current number of readings and the actual value given in the “Extension of Casing” field. The numerical values of the deviation can be exported to an ASCII-file by means of the save button.

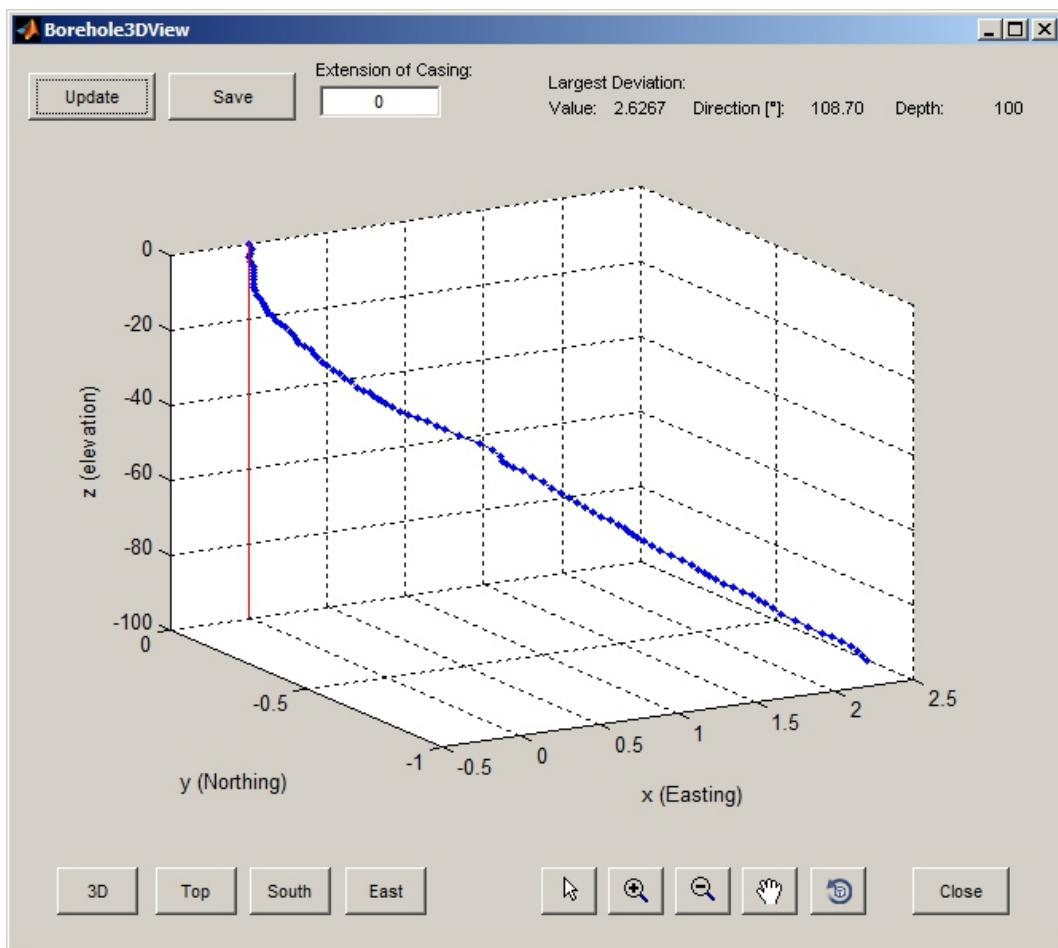


Fig. 3: 3D view of the borehole deviation

#### 5. Reset of tilt value

It is recommended to check the correctness of the tilt reading from time to time. This is done by bringing the DevProbe1 in an absolute perfect vertical position.

If the value of the current tilt reading is almost steady and higher than approximately  $0.1^\circ$  the tilt sensors should be set to zero using the ‘Set Tilt to Zero’ button. If this is done the tilt reading should be randomly around  $0.01^\circ$ .

## 6. Advanced control of the DevProbe1 using a terminal connection

Certain settings of the DevProbe1 can be accessed using a terminal program only. Such a terminal connection is established using the “Terminal Access” button. This interface is used to send commands to DevProbe1 for debugging and calibration purposes only. Please don't send any command except the commands for the “Hardiron Calibration”, which is described below, to the downhole probe until you are certain about its meaning or if you are instructed from Geotomographie GmbH to do so.

## 7. Hard Iron Calibration

The DevProbe1 downhole probe contains a 3-axial sensor for the magnetic field of the earth. The readings of this sensor are used for calculating the direction of the probe with reference to north. Metallic components of the probe housing tend to affect the readings of the magnetic field. This is compensated by a so called “Hard Iron Calibration”. The calibration is performed prior to the delivery of the probe. However, in case the user notices unreasonable direction readings the calibration should be repeated using a terminal program such as the program included in the Deviation Logger software. The user needs to perform the following steps:

1. Bring the probe in an almost vertical position.
2. Establish a terminal connection to the DevProbe1 either by the Deviation Logger software (“Terminal Access” button) or another terminal program (e.g. HyperTerminal in Windows XP).
3. Stop the continuous output of data stream by sending “h” or “Esc”.
4. Type “HARDIRON CAL” and hit [Enter]. Values of the magnetic field sensor are displayed.
5. Slowly rotate the DevProbe1 at least one full revolution for about 1 to 2 minutes while it collects the surrounding magnetic field. Keep the DevProbe1 as vertical as possible while rotating. The computer will display four lists of data. Continue rotating until no more new points are printed. Upon completion press any key to stop calibration. The computer will display four correction coefficients.
6. In order to activate hard iron calibration please type: “HARDIRON ON” and hit [Enter].



## Borehole Deviation Probe

**Handle probe with extreme care. Do not hit probe or expose to shock.  
Internal tilt sensor will be damaged in this case !**

The deviation probe itself is made of two rods of aluminium which have to be screwed together before starting the borehole logging operation.

The lower part serves as stabilizer of the probe to give weight and keep the probe vertical. Another function of the lower probe part is to extend the probe to about 1.2m length to support the inclination accuracy. The upper probe part contains the deviation sensor, the connecting cable and plug as well as a shock indicator.

The shock indicator is placed in the lower section of the upper probe part right above the thread and indicates if the probe undergoes an external mechanical shock during operation or transportation. It is white in general. Once it turns completely red it indicates an external shock. In this case warranty expires as the sensor might get damaged to hard handling or wrong transportation. Anyhow, it is most likely that the probe will still work and readings will be taken properly but we recommend a return to our manufacturing office in this case upon your convenience.

### Shock Indicator

