MODEL DL-1 and TRAC^4 Software

User Guide

Unpacking Checklist

The Model DL-1 Data Logger Kit includes the following:

1	Model DL-1 Logging Unit w/ battery	1	6A Half Cell Reference Electrode
1	**TRAC^4** Configuration & Analysis Software CD	1	4-Channel Data Collection Cable
1	USB Computer Communications Cable	1	Charger, *9v DC output****
1	Screwdriver, Standard & Phillips	1	Carrying Case with foam
1	Warranty Registration Card		

*** DO NOT USE THE SUPPLIED CHARGER WITH ANY OTHER DEVICE. THE PLUG MAY FIT INTO ANOTHER DEVICE, BUT IT WILL DAMAGE THAT DEVICE ***

The information contained in this document is subject to change without notice and does not represent a commitment on the part of Tinker & Rasor.

All listed trademarks and trade names are the property of their respective owners.

Any and all reproduction or transmission of any part of this manual, in any form or by any means and for any purpose other than the personal use by the purchaser is strictly forbidden without the express written authorization of Tinker & Rasor.

This manual contains User Information for the Tinker & Rasor Model DL-1 and the Tinker & Rasor TRAC^4 software package.
For software updates, please visit our website:
http://www.trac4.com

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
2
Sponsoring members of NACE International, NACE Foundation

1.0 Computer Software Setup

NOTE: *Do not attach the USB cable or DL-1 unit to the computer until the software setup is finished and the on -screen instructions direct you to* **Power ON your DL-1 before plugging it in.

1.1 Computer System Requirement

- PC Compatible running Windows ® XP, Vista, 7, 8, 8.1
- CD-ROM, DVD-ROM, CD-R or MultiRead CD Drive
- 256 MB RAM minimum (1GB Recommended)
- 5 MB available hard disk space

NOTE: If you do not have a CD drive on the target computer system, a self installing file is available for downloading from the world wide web: http://www.trac4.com

The DL-1 system is capable of collecting large amounts of data and presenting the information graphically (1 million reads). Because of this, we recommend that you install the Tinker & Rasor **TRAC⁴** Configuration and Analysis software on a PC with a fast microprocessor (2 GHz or faster) and at least 512 MB of memory (RAM).

1.2 Software Installation

Insert the installation disk in the appropriate disk drive.

1. The CD installation will begin automatically. If the installation program does not open, select *Run* from the Start menu and type in or *Browse to D:\Autorun\autorun.exe*, where *D:* is your CD drive.
2. Double click the **TRAC⁴** Setup icon in the installation window.
3. Follow the on-screen instructions.
4. To begin, select the **TRAC⁴** program from the Start | Programs menu, or double-click on the trac4.exe file from Windows Explorer in the directory where you installed the program (default directory – C:\Program Files\TRAC4\TRAC4.exe)

1.3 USB Setup

Figure 1 – USB Cable

Unlike in previous versions of the DL-1 software, the communication setup is done automatically. The new DL-1 and **TRAC⁴** software uses a USB cable to communicate between the logging unit and the host PC.

The procedure to use to connect the DL-1 to the pc is as follows:
1. Connect (screw on) the USB communication cable to the datalogger.
2. Press and hold the On/Off button on the datalogger until it powers *ON*. Approximately 3 seconds. Note the Green *POWER* LED blink.
3. Open the TRAC⁴ software program and wait until it loads on the PC.
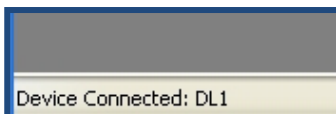4. Connect the USB communication cable to an available USB port on the host computer (PC).

Figure 2 - Status Bar

Sponsoring members of NACE International, NACE Foundation

The TRAC[4] software program will automatically recognize the datalogger and show connection status in the Status bar of the program. (Fig. 2) The Status Bar is located in the lower Left hand corner of the **TRAC[4]** window.

If the USB is not recognized by the host PC, refer to **Appendix C: Software Troubleshooting**.
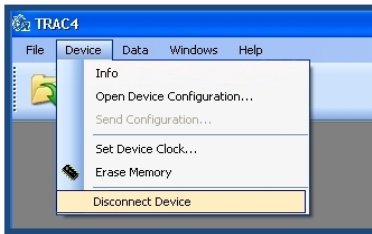
While USB greatly simplifies the setup and configuration of the logging unit, it also changes the way the user disconnects and removes the logging unit from the computer.

As with most USB devices, the DL-1 now must be disconnected by using a command within the **TRAC[4]** software, prior to physically removing the cable from the computer.

Figure 3 - Disconnect DL-1

When you are ready to disconnect the unit, click on the *Device* pull down menu and click on *Disconnect Device*. (Fig. 3). A message window will appear when it is safe to remove the device. When this message appears, unplug the USB cable from the computer and push and hold the On/Off button, approximately 3 seconds, on the datalogger until it powers *OFF*.

NOTE: the Red *MEMORY FULL* LED will blink when powered down

2.0 Quick Start

2.1 Quick Start Introduction

The Model DL-1 logging unit can sample up to 4 analog channels simultaneously, as fast as 1000 times per second or as slow as one time every 99 minutes, with the capacity to store 1,000,000 readings.

The Tinker & Rasor **TRAC[4] (True Recording and Capture)** Configuration and Analysis software was designed to be intuitive, so that you can put this capability to work, right out of the box. The next section, "Quickstart "(section 2.2), will give you fast information to allow you to do this. The remainder of the guide will go into greater detail on the operation of the software (sections 3.0, 4.0 and 5.0) and the instrument itself (section 6.0)

By understanding the basic framework of the DL-1 system, you will find that each time you put the system to work; your experience will not be one of constant "relearning" but one of increasing convenience. Tips are listed in this introduction and throughout the User's Guide to help you save even more setup time in future applications.

> ****Tip:** You may use the system for many different applications, or you may use it for the same application every time. In either case, it will be valuable for you to be able to reuse any work you have done in the past. The **TRAC[4]** software gives you the capability to do this by allowing you to save configuration files to your hard drive. Choose meaningful file names for configuration files so that you may easily find them and use them again in the future, either for reference or for additional data acquisition tasks.

> ****Tip:** Notes can be typed directly into the configuration window for reference. This is an extremely valuable feature, and the notes are saved and stored to disk along with ALL configuration settings in data and graph files. In the same way, all raw data that is retrieved from the logging unit is stored in the graph file. The **TRAC[4]** software allows you to recreate a configuration or a complete

raw data file from a graph file. This capability makes it easy to organize data and assures that you can always duplicate a setup, effortlessly.

2.2 Quick Start
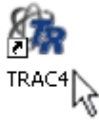
Open the TRAC software program, using the icon on the desktop, or look in the program listing under the Start button for the folder, "**TRAC4**" and click on **TRAC⁴**.
__Do not connect the DL-1 before opening the TRAC⁴ program.__

You will be reminded to power ON the DL-1 before connecting it to the computer. To conserve battery life in the DL-1 unit, it is recommended that you only power ON the DL-1 when you are ready to send a configuration file, or receive collected data.
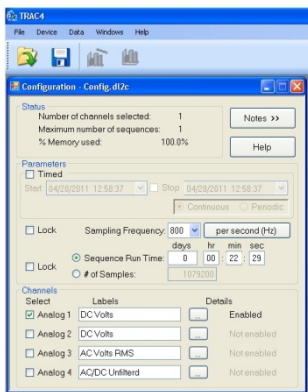
Figure 4

When the **TRAC⁴** program loads and is ready, select "New Configuration…" from the *File* pull-down menu. The configuration window will open. (see Fig. 4) This window will allow the user to configure the DL-1 datalogger for data collection.

Choose which channels will be used for the data collection. To make a channel active, click in the *Select* box to the Left of each channel, near the bottom of the configuration window. When a channel is made active, a check mark will appear in the *Select* box to the Left and the word, "Enabled" will appear to the Right.
Once the channel(s) has been selected, the *Label* field for each channel can be modified to describe the data to be collected. By default, the *Label* field will show the type of data that channel collects.

Once the channels have been selected, the sampling parameters need to be set. This is done in the middle of the configuration window in the *Parameters* area. There are three main choices for deciding sampling parameters:

- Time between samples (Frequency or Interval)
- Length of time to run the sampling program
- Number of samples to collect

In most circumstances, the user will want to program the DL-1 based upon the sampling frequency or interval. By clicking on the button located on the Right side and middle of the configuration window, the timing range available will change. The ranges are:

Figure 5 - Save As...

- per second (Hz)
- 1/100 sec (1-99)
- Seconds (1-99)
- Minutes (1-99)
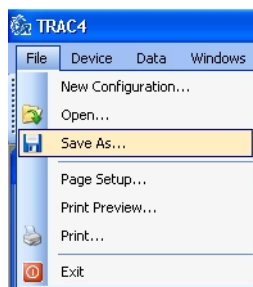
Once a range has been selected, the timing can be entered. If using the "*per second*" range, a pull-down menu is available to choose how many times per second the unit will record. 1000 times per second is the maximum frequency. On the other range choices, the timing *interval* can be entered manually. The *interval* is the amount of time that will elapse between taking samples. For example, if the user wanted to have the DL-1 take a sample four times per second, the selected range would be *1/100 sec (1-99)*, and the interval to enter would be 25. If the user wanted to take a sample every two seconds, then the range selected would be *seconds (1-99)* and the interval to enter would be 02.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
5
Sponsoring members of NACE International, NACE Foundation

After selecting the sample parameters, the new configuration is ready to be sent to the DL-1 unit. It is recommended that the configuration be saved prior to sending it to the unit. Choose, "*Save As…*" from the *File* pull-down menu. (Fig. 5)

2.3 The Battery

The latest version of the Model DL-1 (Beginning serial # 2558) comes standard with an internal Li-Ion battery. This battery is sealed into the instrument case and is non removable. The Yellow end cap on the DL-1 is engraved "DO NOT REMOVE" and has a security sticker over the end cap to prevent removing cover and exposing the battery. The battery requires no maintenance, other than charging.

Older versions of the DL-1 data logger came with removable / replaceable batteries. Installation of the batteries in this older version is described below.
Remove the yellow battery access end cap by removing the four (4) Phillips head screws. The gasket material should keep the screws in place, but be careful not to lose any, as they will be needed to replace the cover.
With the cover removed, the battery sled can slide out of the case. Use the included screwdriver to lever the sled out of the case, as this is a very tight fit.

Placing the DL-1 in front of you, looking down on the bright yellow overlay, the data collection and computer cable connection is to your Left and the battery access is then on your Right. Remove the four (4) Phillips head screws securing the battery access end cap to the case and set aside for reuse. Remove the battery access end cap and gasket. Inside the case, you will see the batteries and the yellow plastic battery sled. Using the supplied screwdrivers standard head end, carefully lever the battery sled out of the case. Replace the batteries observing polarity. The 9v battery has a wide connector (-) and a smaller connector (+) at one end. These connectors will fit into the battery sled only one way, with the wide, negative connector on the Right, wider slot of the sled and the smaller, positive connector on the Left. (See below)
Once the batteries have been installed into the battery sled, slide the sled into the case. The closed end of the sled goes into the DL-1 case first. Notice that in Fig. 15 the positive (+) symbol shows on all four (4) batteries.
The instrument needs to be powered by battery to operate in the field, and also when communicating with the computer.

Figure 6 – slide battery in observing polarity

Figure 7 – all batteries must be installed the same way

Figure 8 – slide battery sled back into case, closed end first

NOTE: DO NOT EVER SET THE SLED ON A CONDUCTIVE SURFACE EVER.

2.4 Connecting the DL-1 to the Computer

Push and hold the power ON button on the DL-1 unit until the Green *POWER* LED blinks on (approximately 3 seconds). The unit is now powered and ready to be connected to the computer.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
6
Sponsoring members of NACE International, NACE Foundation

Using the computer interface cable with the USB connector on one end and the round, screw -on connector at the other, screw the round connector onto the end of the DL-1 unit, and plug the USB connector into an available USB connector on the host computer. Wait up to 10 seconds for the **TRAC⁴** program to recognize the connected DL-1 unit. Once the unit is recognized by the **TRAC⁴** software program, the Status Bar in the lower Left corner on the **TRAC⁴** window will change to show *Device Connected: DL-1*. (see Fig. 2 above)

Once the DL-1 datalogger is connected and recognized by the **TRAC⁴** program, the configuration can be sent to the unit. To send the configuration, the configuration window must be open and on top of any other open windows inside the **TRAC⁴** program. Click, "*Send Configuration…*" from the *Device* pull-down menu. (Fig. 8)

The DL-1 datalogger is now configured.
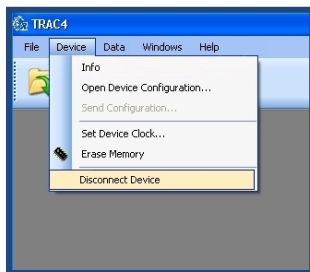
To disconnect the DL-1 unit from the host computer, DO NOT SIMPLY REMOVE THE CABLE. The DL-1 needs to be disconnected from the host, as is common with other types of USB devices. Click, "*Disconnect device…*" from the *Device* pull-down menu. (Fig. 8)

When the *Status Bar* shows, "*Device Connected: NONE*" it is safe to unplug the DL-1 from the computer. Once the DL-1 has been configured and disconnected, remember to turn the unit off by pressing and holding the Power button until the Red *MEMORY FULL* LED blinks on.

For more information regarding configuration, see *Configuration,* found under the Index.

2.5 Connect the DL-1 in the Field

Connect the Data Logger in the field using the included data collection cable with four pairs of booted clamps. The clamps make it easy to connect to test station binding posts and terminals. Be sure to observe polarity when making connections. (Black booted clamps for Negative, Red booted for Positive).

It is also important to ensure the clamp is making a good, low resistance connection to the terminal post or reference electrode. Ensure that the connection is secure and will not drop off or change due to any environmental issues during the recording period. (Freezing, wind, cows, etc)

Press and hold the ON/OFF button on the DL-1 to power the unit ON. Once the DL-1 is powered, look at the LED status lights and ensure the instrument is programmed as you would like. If the program includes an automatic Start or Trigger, the appropriate LED should show at this time. Also, look for a low battery condition LED now. The DL-1 is now ready to start recording.

Press and hold the START/STOP button. All configurations are done through the computer. This makes the DL-1 the easiest data logger to deploy. Press Start/Stop and leave. Come back and press Start/Stop and you are done. (You do not have to press the button at all if you have configured a start and stop date/time.)

2.6 View Collected Data

To download the collected data from the DL-1 to the host computer, start the **TRAC⁴** program.

Once the program has loaded and is ready to use, connect the DL-1 to the host PC using the included cable. The 4-pin (round) end of the cable connects to the DL-1; the USB (A) end connects to the computer. (Fig 1)

When the **TRAC⁴** program has recognized the DL-1 is connected (about 10 seconds), the *Status Bar* will show "*Device Connected: DL-1*".
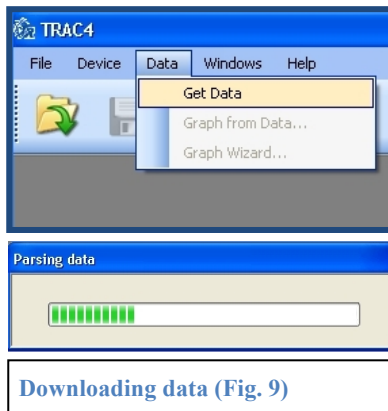
To download the data from the DL-1 unit to the **TRAC⁴** program, click "*Get Data…*" from the *Data* pull-down menu. (Fig. 9) As the data is downloaded into the program, you will see the "*Parsing Data*" message (Fig. 9). Depending upon the amount of data in the DL-1 datalogger, this process can last between 5 and 60 seconds.

Once the data has been downloaded, it will be displayed on the screen in a spreadsheet view. The collected data will be displayed in the table on the Right side of the window, and the data summary will be shown on the Left.

The data summary includes configuration information, total number of reads, and channel statistics. The collected data side of the window displays each sample consecutively and with its interval information. Each row also shows the data collected for each channel and the time and data stamp for that sample. For more information regarding the data view, see *Data View,* found under the Index.

Downloading data (Fig. 9)

The collected data can also be graphed, using the *Graph* icon button on the toolbar. When the *Graph* icon button is clicked, the data will be graphed and displayed in a new window inside the **TRAC⁴** program. Depending upon the amount of data in the DL-1 datalogger, the graphing process can last between 5 and 60 seconds.

In the graph window, the mouse pointer will become a cross. This allows the user to pin point individual data points and also to accurately click, hold and drag the mouse to zoom in on the graph. There are also toolbar buttons for
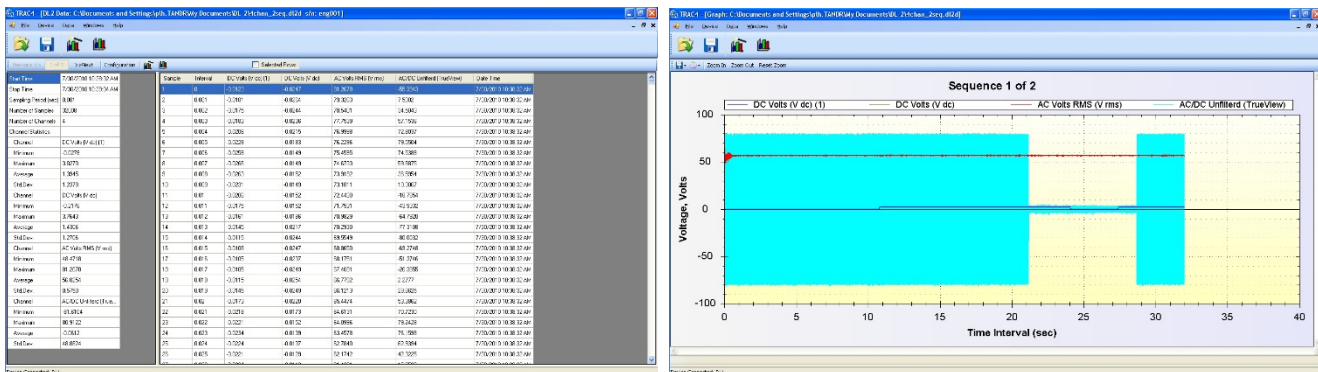
Zoom In, *Zoom Out* and *Reset Zoom*. The Y axis will show the type of data collected (eg volts) and the X axis shows the time interval by default.

If the *Graph Wizard* icon button is used to graph the data, instead of the *Graph* icon button, the user can make changes to the default settings of the graph. The line color and data point icon for each channel can be configured, the X axis data type and label can be changed, and a background picture can be added, as well. After the wizard configurations are complete, click on *Finish* and the graph will be displayed. For more information regarding the Graph View, see *Graph View,* found under the Index.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
8
Sponsoring members of NACE International, NACE Foundation

The data can be saved in either the spreadsheet or graph format. When saved, the resulting file can be opened and the graph, spreadsheet and configurations can all be retrieved from that single file. This means that only one file needs to be saved, not three.

There are also different file formats available in the *Save As...* dialog box which can allow the data to be imported into other programs, such as a comma separated value format for import into Microsoft® Excel® or a graphic file such as a bitmap or jpg. The configuration file can only be saved in the **TRAC⁴** program format.

For more information regarding the saving of files, see *Saving* found under the Index.

3.0   TRAC⁴ SOFTWARE USE

3.1 Operation Overview

This overview covers the five (5) steps involved in collecting and reviewing data. This section also covers the features offered in each area.

Step 1:   Create a Configuration Document **3.2**
Step 2:   Communication - Send a configuration **3.3**
Step 3:   Recording Data - Hardware **3.4**
Step 4:   Spreadsheet Data View - Receive data **3.5**
Step 5:   Graph Data View - Generate a graph **3.6**

3.2 The Configuration Document

Open the **TRAC⁴** program, using the icon on the desktop, or look in the program listing under the Start button for the folder, "TRAC4" and click on TRAC4.
Do not connect the DL-1 before opening the TRAC⁴ program.

You will be reminded to power ON the DL-1 before connecting it to the computer. To conserve battery life in the DL-1 unit, it is recommended that you only connect and Power ON the DL-1 when you are ready to send a configuration file, or receive collected data.

When the **TRAC⁴** program loads and is ready, select "New Configuration…" from the *File* pull-down menu. The configuration window will open. This window will allow the user to configure the DL-1 datalogger for data collection.

Figure 10

The Configuration window is broken up into three groupings:
- Status
- Parameters
- Channels

3.2.1.   Status Area

The top group is the *Status* area. In the Status area, a summary of the configuration is shown.
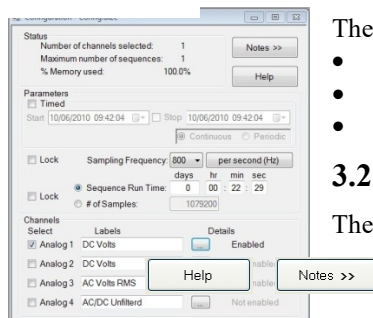
Figure 11

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
9
Sponsoring members of NACE International, NACE Foundation

The Notes button extends the configuration window with a notepad that can be used to write up to 1800 characters of information regarding the data this configuration will collect. This can include location information, assumptions, type of testing, name or location of pipelines or foreign contacts, etc.

**Tip: the Notes area can be an extremely valuable feature, when used. Notes, along with ALL configuration settings, are stored in the recorded data and graph files and can be retrieved and edited at any time, even after recording.

Help
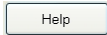
The button will take you back to this user guide.

3.2.2.   Parameters Area

The *Parameters* area is used to set the sampling range and rate. The Parameter area gives the user four main methods for setting up a configuration for the DL-1:
Timed Operation
Sample Rate & Range
Run Time
Number of Samples

Timed Operation

The **TRAC**[4] program allows the user to set the DL-1 to start and stop collecting data at a specific date and time. This can be used in a variety of applications, such as when a DL-1 needs to be deployed into the field well ahead of planned operation. When a Timed or Trigger configuration is programmed into the DL-1, the Trigger LED will blink when the DL-1 powered ON. The DL-1 will be in sleep mode to conserve battery when waiting to reach a Time start. Timed operation uses the clock programmed in the DL-1. It is recommended that the clock on the DL-1 be set while connected to the computer. To set the clock, use the Device pull down menu, and choose "Set Device Clock…". The DL-1 clock will be set per the computer system clock. Setting the clock also sets the date. Trigger is also discussed in Section 5.2 of this manual.

NOTE: When deploying a DL-1 with a Timed start or Trigger program, turn the instrument ON by pushing and holding the Power button for approximately 3 seconds, but DO NOT push the START / STOP button. Pushing the START / STOP button will override the Timed or Trigger programming and the unit will operate as though the Timed or Trigger function was not programmed.

When a check mark is clicked on the check box next to "Timed", near the top of the Parameters area box, the Start text area becomes active. Clicking on the down arrow of the pull-down menu brings up a calendar that can be used to select the Start date. After selecting the Start date, click on the hour (time shown in 24 hour format) to highlight and then type in the Start time. You can click between the day, month, year, hour, minute and second, or use the arrow buttons on your keyboard to move the highlighted area.

A Stop time can also be entered. When a check mark is clicked into the check box next to Stop, the Stop text box becomes active. Using the same steps as with the Start time, the Stop time can be easily programmed.
When a Stop time is used, the Continuous and Periodic choice menu becomes active.

Continuous is used when it is meant for the DL-1 datalogger to run its program to record data from the Start date and time until the Stop date and time are reached. Periodic should be selected when it is advantageous for the DL-1 datalogger to only record during certain times of day during the date range entered. This means that the DL-1 will begin recording on the date and at the time shown in the Start text box and Stop recording at the time shown in the Stop text box, each day of the date range shown in the Start and Stop text boxes.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
10
Sponsoring members of NACE International, NACE Foundation

Continuous Example: Start is 01/01/2011 08:00:00 and Stop is 01/05/2011 17:00:00.
The DL-1 would begin recording on January 1, 2011 at 8am and continue running for five days, until the Stop date and time is reached, January 5, 2011 at 5pm.

Periodic Example: Start is 01/01/2011 08:00:00 and Stop is 01/05/2011 17:00:00.
The DL-1 would begin recording on January 1, 2011 at 8am and stop recording January 1, 2011 at 5pm. The DL-1 would begin recording again on January 2, 2011 at 8am and stop recording January 2, 2011 at 5pm. This would continue until the final Stop date and time is reached.

NOTE: The DL-1 may end its recording prior to the programmed Stop date and time if the memory becomes full or the battery life is exceeded.

Sampling Range and Rate

The **TRAC⁴** program has four Sampling Ranges:
- per second (Hz)
- 1/100 sec (1-99)
- seconds (1-99)
- minutes (1-99)

per second is the fastest sampling range the DL-1 can provide. When using the *per second* range, the **TRAC⁴** program uses the term *Frequency* to describe how often a sample will be collected. A pull-down menu is provided giving the options for Rate as 1000, 800*, 533, 500, 400, 356, 320, 250, 200, 160, 125 and 100. (* 800 is the default setting) These numbers refer to the frequency of samples to be taken. So, selecting 1000 in the pull-down menu means the DL-1 will collect 1,000 samples every second. With 1,000,000 samples of memory, the memory will be full in eighteen (18) minutes at this rate.

1/100 sec (1-99), and the rest of the available ranges, the term, *Interval* is used to describe the amount of time that will elapse between samples being taken. 1/100 refers to .001 seconds. This range is not preconfigured and the user can enter any two digit number between 01 and 99 as the Rate in this text box. Entering 25 into this text box would equal 25/100, or .250 seconds and result in a sample being taken four (4) times per second.

seconds (1-99) is the next available range and it is rather self explanatory. The user can again enter any two digit number between 01 and 99 as the Rate and the result will be that number of seconds elapsing between each sample being taken.

minutes (1-99) is the final range available, and is similar to seconds, except that the two digit number entered into this text box will result in that number of minutes elapsing between samples being taken.

Clicking on the range button will change the range in the order shown above. When a range is selected and the rate is entered, the Sequence Run Time will display the maximum run time given the number of Channels selected, the 1,000,000 reads available and Sample Range and Rate entered. Once the Range and Rate have been programmed, the **TRAC⁴** program will automatically *Lock* the data into the configuration.

The *Sequence Run Time* and the *# of Samples* options can also be used to program the instrument. A Sequence is determined by the data that is recorded each time the DL-1 unit Start / Stop button is pushed and the instrument records. The **TRAC⁴** program shows each Sequence as its own data file and graph.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
11
Sponsoring members of NACE International, NACE Foundation

By clicking on the radial button next to Sequence Run Time, the text box of Days, Hours, Minutes and Seconds becomes active. Click in one of the boxes and enter a number of Days, Hours, Minutes and/or Seconds. Note that the Status area gets updated with this information.
Sequences are covered in more detail in Section 3.5.2 of this manual.

The *# of Samples* is a way to set the Range and Rate as you would like, but not have the datalogger record until the memory is full or batteries die. This can keep the amount of data smaller and more manageable so that the user does not become overwhelmed with data. To use this, first set the Range and Rate for samples and then click on the Lock check box and the radial button next to *# of Samples* and the text box will become active. Enter the total number of samples you want to see in this text box. Note that the Status area gets updated with this information.
# of Samples is covered in more detail in Section 4 of this manual.

<u>Channels Area</u>

Choose which channels will be used for the data collection. To make a channel active, click in the *Select* box to the Left of each channel, near the bottom of the configuration window. When a channel is made active, a check mark will appear in the *Select* box to the Left and the word, "Enabled" will appear to the Right.
Once the channel(s) has been selected, the *Label* field for each channel can be modified to describe the data to be collected. By default, the *Label* field will show the type of data that channel collects.

Channel 1: -5.0 to 5.0 volt range. This channel will record DC volts and will actively filter out any AC in the connection. The range is +/- 5 volts and has very good resolution, down to a millivolt. This channel can be configured for use with a shunt. Impedance of this channel is greater than 200 MΩ.

Channel 2: -5.0 to 5.0 volt range. This channel will record DC volts and will actively filter out any AC in the connection. The range is +/- 5 volts and has very good resolution, down to a millivolt. This channel can be configured for use with a shunt. Impedance of this channel is greater than 200 MΩ.

Channel 3: 0.5 to 150.0 volt range (RMS). This channel will record AC volts and will actively filter out any DC in the connection. The range is 150 volts and has good resolution: 0.5v (RMS). This channel cannot be configured for use with a shunt. This channel can be used as a trigger. This channel can be used to read Amps, with a third party amp clamp. Impedance of this channel is greater than 200 MΩ.

Channel 4: -100.0 to 100.0 volt range. This channel will record DC and AC volts and has no active filters. This channel is referred to as the TrueView channel as it has a large range and no filters allowing the unit to record everything on the connection. The range is +/- 100 volts and has good resolution, down to 1 volt. This channel cannot be configured for use with a shunt. This channel can be used as a trigger. Impedance of this channel is greater than 200 MΩ.

To the Right of the four (4) available channels in the **TRAC[4]** program is the *Details* area and a button labeled "...". Clicking on this button will bring up a new, pop up window with channel details for each of the channels.

<u>Channel Details</u>

The *Channel Details* window is made up of three main areas:
- Channel
- Shunts
- Triggering

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
12
Sponsoring members of NACE International, NACE Foundation

Channel

The Channel Area has a pull-down menu that includes the channel description of each channel. Choose a channel and certain parameters can be set, depending on the channel. It is important to note that making configuration changes in the Channel Details window will not automatically enable a channel. That can only be done in the main Configuration window.

Shunts

Channels 1 and 2 can be used as shunts. Choosing one or both channels to act as shunts will apply the Ohms Law formula to turn the volt readings into amps. When this option is programmed, **TRAC⁴** will automatically display Amps in the Data View instead of Volts. Once data has been recorded with a shunt programmed, **TRAC⁴** will not allow the user to view the collected data as volts.
Shunt values available for this use are 0.001 Ω, 0.01 Ω, 0.1 Ω, and 1.0 Ω.

Triggering

A Trigger is a defined threshold event, where voltage either rise above, or fall below a specified voltage threshold. The trigger can be used by the DL-1 as a method to begin recording after an event takes place. When the event occurs, the DL-1 will begin recording on all programmed channels. A trigger can be set to look for either a rise or a drop in voltage, across a set threshold. Any of the four (4) channels may be set as a trigger, but only one channel can be programmed as a trigger at a time.
Triggering is covered in more detail in Section 5.1 of this manual.

After selecting the sample parameters and channels, the new configuration is ready to be sent to the DL-1 unit. It is recommended that the configuration be saved prior to sending it to the unit. To do this, choose, "*Save As…*" from the *File* pull-down menu. (Fig. 4)

3.3 Communication

Communication between the host computer and the DL-1 instrument is made using the supplied USB cable. USB is a much faster and easier to use communication type than previously used with the DL-1 (serial port cable), however, USB does require some additional steps for proper use that may not be understood by some users. The order of operation to connect and disconnect the DL-1 datalogger from the host computer is of great importance.

Connect the DL-1 to the Host (Computer)

The first step in connecting the DL-1 to the computer is to open the **TRAC⁴** software program.
Once the program is open, turn the DL-1 instrument ON. The instrument is turned ON by pressing and holding the POWER button until the Green POWER LED comes on.
Connect the USB cable to the DL-1 by screwing on the round connector to the mating connector on the DL-1 instrument case.
Next, plug the USB connector end of the cable into an available USB port on the host computer.
After a few seconds, the **TRAC⁴** program will recognize the DL-1 unit and the display in the *Status Bar* will change to read:

Device Connected: DL-1

If the above message does not appear, refer to **Appendix C: Software Troubleshooting**.

3.3.1.   Send Configuration

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
13
Sponsoring members of NACE International, NACE Foundation

NOTE: Sending the configuration file to the DL-1 will erase all information on the instrument. If data has been logged on the unit but not yet received into a data window, this should be done before re-configuring the logging unit (see **Section 3.3.2: Receive Data).

To send a configuration to the logging unit, the Configuration window must be the active window, meaning it is on top of any other windows inside the **TRAC⁴** software main window. Also, the top bar of the Configuration window must be highlighted in its color, showing it is active. (Default color in Windows® is Blue, but may differ on some computers.)

From the *Device* pull-down menu, click *Send Configuration . . .* It takes approximately 10 seconds to send the configuration and to program the logging unit. Select "OK" at the warning prompt to proceed. The warning prompt helps avoid accidental loss of data, as this process overwrites the previous configuration and memory is erased.

If you have any problems, refer to **Appendix C: Software Troubleshooting**.
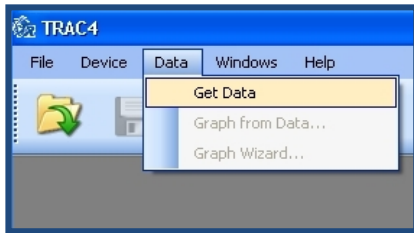
3.3.2. Receive Data

Figure 12 – Download data

To receive the recorded data, make sure the logging unit is connected to a USB port on the host computer with the supplied USB communications cable. From the *Data* pull-down menu, select *Get Data . . .* While data is being transferred, the progress level is displayed on screen. (See Fig. 12)

Once the data is received, a variable-size spreadsheet is created, based on channels configured and the number of samples recorded. This is the Data View window, which is specially formatted with the channel names that were specified in the configuration.

3.4 Recording Data – Hardware Overview

This section gives only a brief overview of the DL-1 logging unit and its use for recording data. For more complete information regarding the use of the DL-1 hardware, refer to Section 6.0 – The DL-1 Instrument.

3.4.1. Connecting the Sampling Interface Cable

Connect the 4-channel data collection cable (included in the shipping package) to the connector on the end of the datalogger. The eight (8) labeled leads and clips connect to the equipment being tested. All leads are color-coded and labeled and all clips are marked for polarity.

3.4.2. Datalogger Panel

The panel of the logging unit includes a color legend for the LED displays. This legend describes the operating mode associated with each color displayed by each LED and the corresponding text in the same color. All the LED's on the panel face flash instead of staying lit to conserve battery life.
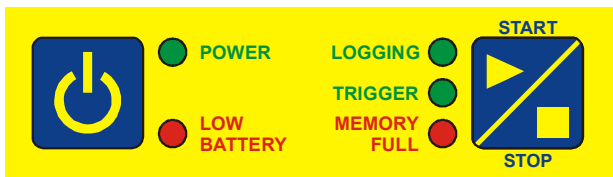
Figure 13 – Interface Panel

Tel: (830) 253-5621
2828 FM 758, New Braunfels, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
14
Sponsoring members of NACE International, NACE Foundation

The POWER Green LED will stay on steady (not flashing) when showing notification that the instrument is turning ON. The MEMORY FULL Red LED will stay on steady when the instrument is turned ON and the memory is full. The MEMORY FULL Red LED will stay on steady when showing notification that the instrument is turning OFF. To further conserve battery life, the LED's on the unit will automatically shut off, even while the unit is in operation. To determine if the DL-1 is ON and in operation, press the Power button once, quickly, and the display will light if the unit is powered ON. If no LED's show after a quick push of the Power button, the instrument is turned OFF and not operating.

Power Button

The DL-1 Power button turns the instrument ON if pressed and <u>held</u> for three (3) seconds. This delay ensures that the instrument will not be powered OFF inadvertently. The Power button may also be pressed and quickly released to energize the LED displays, if the instrument is ON but the LED's have gone to sleep. (See above)

Start / Stop Button

Data recording is controlled by the Start / Stop button. Under normal programming, the Start / Stop button is pushed to begin recording. When the Start / Stop button is pushed again, the DL-1 stops recording. The Start / Stop button does NOT need to be held for any length of time, as with the Power button.

The Start / Stop button has a somewhat different function when the unit is programmed with a threshold Trigger. When the unit has been programmed with a Trigger, the first push of the Start / Stop button will arm the trigger function and the unit will begin waiting for the Trigger event. Once the Trigger event happens, the DL-1 begins recording, per its programming. When the DL-1 is recording, the next push of the Start / Stop button stops the recording and cancels the threshold Trigger. If the threshold Trigger has been armed, but the event has not occurred, pushing the Start / Stop button will cancel the threshold Trigger, and the DL-1 will immediately begin recording.

> **NOTE:** Using the Start/Stop button when the instrument has been programmed with a Timed Start will disable that programming, and the DL-1 will being recording immediately, ignoring the Timed Start program.
> If the DL-1 has been programmed with a Timed Start, the Start / Stop Button is not used in the field to begin operation. The Power button is pressed and held for three (3) seconds to turn the instrument ON, indicated by the power LED, and left to await its Start time. Timed Start programming is indicated by the blinking Trigger LED.

3.4.3. Charging the Battery
DO NOT USE THE SUPPLIED BATTERY CHARGER WITH ANY OTHER PRODUCT THAT THE MODEL DL-1. IF USED ON OTHER ELECTRONICS, SUCH AS A CELL PHONE, IT WILL DAMAGE THE DEVICE!

The internal Lithium Ion battery in the Model DL-1 requires charging using the supplied battery charger only. The supplied battery charger comes with an adapter plug to connect to the usb battery charger connector in the Yellow end cap of the DL-1. This adapter may fit into other types of electronics, such as cell phones and other consumer electronic devices, and if used, will damage those devices.
Do not connect the Model DL-1 Data Logger to a usb port using the micro usb connector on the Yellow end cap. Use the supplied cable with round connector to connect the DL-1 to a computer.

The internal battery will completely charge overnight. It is suggested that the DL-1 be fully charged before each use. The internal battery will last up to 30 days, or longer, depending upon the setting selected in the configuration file.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
15
Sponsoring members of NACE International, NACE Foundation

3.4.3.2 Changing the Batteries (OLDER VERSIONS)

The Model DL-1 Data Logger is powered by 9v alkaline batteries. These batteries are found throughout the world and are usually easily obtained. It is recommended that only replaceable, alkaline batteries be used in the DL-1. Rechargeable batteries of this size are actually only 7.2v. This type of battery may be sufficient to operate the instrument, however a Low Battery condition will probably be indicated, and battery life may not be as long as with the alkaline types.

The instrument can take up to four (4) 9v batteries, but can also run on just two (2). The uniquely designed battery sled holds the batteries in place very tightly so that no bumps or jarring of the instrument will cause a battery disconnect.

Placing the DL-1 in front of you, looking down on the bright yellow interface panel, the data collection and computer cable connection is to your Left and the battery access is then on your Right.

Remove the four (4) Phillips head screws securing the battery access end cap to the case and set aside for reuse. Remove the battery access end cap and gasket. Inside the case, you will see the batteries and the yellow plastic battery sled.

Carefully slide the battery sled out of the case.

Replace the batteries observing polarity. The 9v battery has a wide connector (-) and a smaller connector (+) at one end. These connectors will fit into the battery sled only one way, with the wide, negative connector on the Right, wider slot of the sled and the smaller, positive connector on the Left. (See below)

Once the batteries have been installed into the battery sled, slide the sled back into the case. The closed end of the sled goes into the DL-1 case first. Notice that in Fig. 15 the positive (+) symbol shows on all four (4) batteries. The instrument needs to be powered by battery to operate in the field, and also when communicating with the computer.

Figure 14 – slide battery in observing polarity

Figure 15 – all batteries must be installed the same way

Figure 16 – slide battery sled back into case, closed end first

3.5 View Data

3.5.1. Download data from the DL-1 to the computer

Open the **TRAC⁴** software program on the computer. Attach the USB cable to the DL-1, turn the DL-1 ON and plug the USB cable into the computer. The Status area will show DL-1 Connected once the **TRAC⁴** program recognizes the unit.

Click on the pull down menu along the top of the AC4 window labeled Communication. Scroll down with the mouse and click on the option labeled Get Data. The **TRAC⁴** program will now retrieve the data from the DL-1 unit. A pop up window will appear during the download showing progress. The time it takes to download of the data will vary depending upon the amount of reads stored on the DL-1, but shouldn't take longer than one minute with full memory.

Once the data download has completed, the data will displayed in spreadsheet format.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
16
Sponsoring members of NACE International, NACE Foundation

3.5.2. Data View Window Header

The top of the Data View window contains information and options specific to the Data View window. The window header is comprised of two bars of information. The top bar shows the name and saved location of the file (if saved), unit serial number and unit name. The lower bar contains icons, explained below.

Sequences

Each time the Start / Stop button is pressed a new Sequence is created. If the unit is started and stopped multiple times, a new sequence of data is created. It is advisable to note the specifics of each start/stop sequence so that information can be used in analyzing the data.

To move between sequences, click the Previous Sequence and Next Sequence buttons. The data will refresh with the new sequence data in the window for each sequence selected.

Open Configuration

The Open Configuration button will open the configuration file for the data being viewed. This is useful to see the Notes section of the configuration file, as well as to confirm the settings. However, the Summary window contains most of the configuration information.

Graph Icons

The two icons shown above will produce a graph of the data in the Data View. The first icon is the Graph Wizard, and will allow the user to set options for the graph. This is explained in more detail in the next section – Graph. The other icon, without the wizard's wand, will immediately graph the data using default graph settings. Once a graph is produced with default settings, no options can be set later. A new graph using the Graph Wizard will need to be produced.

Selected Rows

The Selected Rows button can be very useful for printing as well as graphing. When rows are selected individually, the Select Rows checkmark is placed when it is desired that just the selected rows be graphed or printed.

To select specific rows, move your mouse to the first row to be selected and click that row to highlight it. To select consecutive rows, after highlighting the starting row, press and hold the Shift button on the keyboard and use the arrow keys to expand the highlighted area to the desired row. Alternatively, you can use only the mouse, by clicking on the first row and while holding down the Left mouse button, drag the mouse down to the last row to be selected and release. Non consecutive rows can be selected also. To do this, click the mouse on the first row to be selected to highlight and release the mouse button. Next move the mouse to the next row, and press and hold the control (ctrl) button on the keyboard and then click with the mouse on the row. Now both rows are highlighted. Continue in this method until all desired rows have been selected.

Adjust the Data View

The size of each column and row can be adjusted. Hover the mouse over either the horizontal or vertical line of a row or column cell and the mouse icon will change to a line with arrows at each end. When this mouse icon appears, click and hold the right mouse button and drag the line to the desired position.

In this way, the width of the Summary window and the Data window can also be adjusted.

3.5.3. Summary Window

The Data Summary is displayed along the Left side of the **TRAC**[4] window. The Summary shows information about the data set, such as name of instrument, serial number, start and stop date and time, number of channels used, channel labels, sampling rate, and minimum and maximum voltages recorded, voltage average and standard deviation for each channel used.

Voltage Average and Standard Deviation

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
17
Sponsoring members of NACE International, NACE Foundation

The **TRAC⁴** program uses mean method to determine the voltage average of the data set. Mean method adds up the total of the values and divides it by the number of samples.

Standard Deviation

Standard deviation is a measurement of the distance from the Mean Average point of the voltage range to the XXX average point of the majority of the data points. A definition of standard deviation is offered below:

> *Standard deviation is a concept in statistics that tells you how spread out a set of values is. It can be calculated by considering how far away each value is from the average of all the values.*
> *Standard deviation can be used to measure how consistent or how precise a set of data is.*

3.5.4.   Data Window

The Right side of the data window in **TRAC⁴** displays the voltages recorded. The data is displayed in a spreadsheet view, with columns showing categories of data , such as channels and time & date stamps, and rows, showing the values of each category.

Column 1 – Sample

The far Left column in the data window shows the sample count. This is the number of each sample record, starting at 1 and counting up consecutively. The number displayed in the last row of this column is the total number of reads recorded.

Column 2 - Interval

This column displays the time between sampling, counting up from zero.

Columns 3 – 6

The next column to the right is the actual voltage recorded on Channel 1. If more than 1 channel was selected for recording, the other channels would be displayed in columns to the Right.

Last Column – Date Time

The last column, all the way to the Right, shows the Time and Date of each sample record.

3.5.5.   Analyzing Data

The data may be viewed in this spreadsheet form, and a window scroll along the Right side of the data window allows the user to view specific data records. The data displayed in this window cannot be changed in any way. This is a Read Only window.

Depending upon the screen resolution of the computer **TRAC⁴** is installed on, anywhere from 20 to 100 records may be displayed on screen at the same time. With the capability of storing up to one million reads in memory, only a very small percentage of the data can be displayed at the same time. As the user scrolls through the data, there may be a lag noticed between moving the scroll bar and the new data being displayed. This is due to the program reading the data stored in memory and determining the rows to display next. This is likely to be noticed with a full one million reads.

3.5.6.   Printing

Printing the data in the spreadsheet view is not recommended. Approximately 30 rows of data are printed per sheet. With a possible one million rows, this will certainly overwhelm any printer and possibly a network. For this reason, printing of the entire data view window is not recommended in **TRAC⁴**.

It is possible to print only a selection of the data. Select the rows to be printed (Selected Rows section above) and click the Selected Rows checkbox. The highlighted range of rows can now be printed It is important to note how

Tel: (830) 253-5621
2828 FM 758, New Braunfels, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
18
Sponsoring members of NACE International, NACE Foundation

many rows have been selected to determining how much paper will be required for the print job. To print, click the pull down menu labeled File and select Print. Many printers will show you the total number of pages a print job will require on the print dialog box that comes up to start a print job.

3.6 Create Graph

The **TRAC⁴** program also has a graphing option that allows the data to be presented in a graph form. The graph can be produced from the Data View window. To make a graph, click on the Graph or Graph Wizard icons on the Data View window header, or click on the pull down menu labeled Data and choose "Graph for Data…" or "Graph Wizard…". If it is desired to only graph selected rows of data, highlight the selection and click the Selected Rows checkbox on the Data View window header, then graph using either of the two methods described above. It is important to note that unlike the Configuration or Data View windows, the Graph window can be closed without saving.

3.6.1.　　　Graph from Data…

Using either the Data pull down menu command, "*Graph from Data…*" or the Data View window header icon, a graph can be easily created from the all the data in the Data View window or, if a checkmark is placed in the Selected Rows box, only the highlighted rows in the Data View window.

> **NOTE:** Only the data currently displayed in the Data View window will be graphed. This means that only one Sequence can be graphed at a time.

3.6.2.　　　Graph Wizard…

Using either the Data pull down menu command, "*Graph Wizard…*" or the Data View window header icon, a graph can be created after making user selected options to the graph. The options available include:

Choose which channels to graph: When multiple channels exist in the Data View window, use the Graph Wizard to graph only selected channels.

Line Color of each channel: Each channel to be graphed from the Data View window can have its own selected line color. Twenty-three line colors are available.

Data point symbol: Each channel being graphed can have a unique data point symbol to allow for easier recognition of individual data points to use the mouse hover option of seeing the recorded voltage and Time & Date stamp of a data point. Ten symbols are available.

X axis data type: select from interval, sample number, time or date and time. Time and Time & Date is not available when the sample frequency of the recorded data is more frequent than once per minute.

X axis label: custom data label field. Use this to label the graph page.
Custom background image: click and checkmark in this field and browse to an image to include as the background on the graph page being created.

Custom Background Image: **TRAC⁴** software allows the user to set a background image on the graph page. This maybe a contrasting color image or a logo or any other type of image file. Most image formats accepted.

3.6.3.　　　Graph View Window Header

The top of the Graph View window contains information and options specific to the Graph View window. The top bar shows the name and saved location of the file (if saved). The lower bar contains icons, explained below.

Tel: (830) 253-5621
2828 FM 758, New Braunfels, TX 78130
Web: www.tinker-rasor.com　　　E-mail: Info@tinker-rasor.com
19
Sponsoring members of NACE International, NACE Foundation

3.6.4. Save & Print

These icons are placed here for the convenience of the user. These functions can also be found under the pull down menu labeled File. Clicking on these icons will bring up options to choose from.

3.6.5. Zoom

By default, the graph will display with all data show in a single window, without scrolling. The Zoom In, Zoom Out and Reset Zoom icons allow the user to adjust the view to see more or less data, as desired. Zoom can also be done using the mouse, by clicking and holding down the Left mouse button in the graph area and dragging a box to zoom. When the Zoom feature is in use, a horizontal scroll bar will appear to move through the complete graph.

3.6.6. Graph Area Data Display

The Graph View window shows the Sequence(s), the channel labels and the labels for the X and Y axis.

3.6.7. Right Click Menu

The Graph View window has a mouse Right click menu. When the Right mouse button is clicked in the graph area, a menu appears giving the user a variety of options. Most of the options in this menu are simple and self explanatory. The Show Point Values option can be very helpful, and should be explained further. The Show Point Values turns on and off the pop up display of data values for individual data points in the graph when the mouse hovers over the data point. This can be very useful or distracting, so the option of turning this feature on or off is included here.

3.6.8. Mouse Hover

Hovering the mouse icon over a data point in the graph will display information about that data point in the lower Left corner of the Graph window. If the Show Point Values option is turned on, the mouse hover over a data point will show information in a pop up window, as well. The information displayed is shown as X axis value, Y axis value.

4.0 Menus

Like many Windows compatible programs, **TRAC**[4] uses pull down menus to allow the user to interact with the program. In most of the pull down menus, there may be options that are not available, based upon the Active Window or connected device at any given time. If an option is not available, it will appear grayed out and when the mouse hovers over the option, it will be outlined in black, but not highlighted in yellow. Options that are available will appear in black text and when the mouse hovers over the option, it will be highlighted in yellow. Depending upon the windows color scheme used, the above mentioned colors may differ.

4.1 File Menu

The File pull down menu contains options for Opening, Saving and Printing.

4.1.1. New Configuration…

To start a new configuration file, the "New Configuration…" option is used from the File pull down menu. When a new configuration window is created in this manner, it is not automatically saved. It is recommended that the new configuration be saved before closing it or sending it to the DL-1 unit.

4.1.2. Open…

To open a file, either a previously saved configuration file (), data file () or graph file (), use the "Open…" command from the File pull down menu. This will open the familiar windows File Browser to allow you to search for a specific file. **TRAC**[4] starts in its own directory under Program Files by default. For this reason, it may be convenient to store files in this directory.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
20
Sponsoring members of NACE International, NACE Foundation

4.1.3. Save As…

The "Save As…" option allows the user to both save files in **TRAC**[4] format or, in some cases, to save in a different format. When using the "Save As…" option, the active (top) window inside the **TRAC**[4] program will be the window saved. To change the active window, use the Windows pull down menu to arrange all open windows, click the window size options in the upper Right corner of the active window to either minimize, Restore Down the window or close the active window to get to other open windows.

"Save As…" options include:

Configuration as Active Window:
- *.dl2c file type. This is a proprietary file type, read only by **TRAC**[4] software

Data View as Active Window:
- *.dl2d file type. This is a proprietary file type, read only by **TRAC**[4] software
- *.csv file type. This is a common text file, frequently used to import data into excel or another spreadsheet type of program.
- *.html file type. This is a common web file, typically read using a web browser.

Graph View as Active Window:

All the below file types are common and may be opened by a variety of picture viewing programs, from web browsers to graphic editors to other types of viewers:
- *.emf
- *.png
- *.gif
- *.jpg
- *.tif
- *.bmp

NOTE: * is a placeholder for file name.

4.1.4. Page Setup…, Print Preview… and Print…

Page Setup…" allows the user to set certain page properties for printing purposes.

Print Preview…" shows what a printed version of the Active Window will look like when printed.

Print…" is the command to open the Print dialog, where a printer may be selected.

NOTE: When Data View is the Active Window, it is recommended that particular attention be paid prior to sending the document to a printer. It is estimated that a Data View with one channel of full memory of information will take approximately **950 pages** to print. If available on your computer, a PDF printer is suggested to print and save a Data View of records.

4.1.5. Exit…

"Exit…" closes the program window. If any open windows are not saved, **TRAC**[4] will prompt to save the files before closing. The prompt window will allow the user to access the "Save As…" option, choose not to save the unsaved data and continue closing the program window and lose that information, or Cancel the Exit command and return to the program window.

4.2 Device Menu

The "Device Menu…" is where options to interact with the connected device are located.

Tel: (830) 253-5621
2828 FM 758, New Braunfels, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
21
Sponsoring members of NACE International, NACE Foundation

4.2.1. Info…

The "Info…" command will open a small window showing the details of the connected DL-1 device. The details include:

Device Time:

This display shows the date and time the DL-1 device clock is using. This may be updated to the date and time on the host computer, using the Device pull down menu and the *Set Device Clock…* command.

Firmware Version:

This is the version of the software installed in the DL-1 device, not the version of the TRAC4 software being used. This information may be requested by Tinker & Rasor technicians to assist in troubleshooting issues regarding the DL-1.

Battery (Volts):

This shows the current battery voltage and percentage of remaining life. Battery voltage is also displayed on the Data View at the start and stop of each Sequence. (Li battery version only)

Serial Number:

This shows the serial number of the connected DL-1 device. This information may be requested by Tinker & Rasor technicians to assist in troubleshooting issues regarding the DL-1.

4.2.2. Open Device Configuration…

Choosing the "Open Device Configuration…" option, the configuration currently stored on a connected DL-1 data logger will be downloaded and displayed. Any changes made to the downloaded configuration file will need to be sent back to the DL-1 by using the "Send Configuration…" option.

4.2.3. Send Configuration…

Clicking on "Send Configuration…" will upload the Active Window configuration file to the connected DL-1. This operation will overwrite the configuration file stored on the connected DL-1 and will also erase all data stored on the DL-1 device. A confirmation dialog box will open and the user will need to confirm sending the configuration file to the connected DL-1. After the device has received the configuration, a confirmation dialog box will appear.

4.2.4. Set Device Clock…

Each DL-1 unit has an internal clock that can be set using the **TRAC⁴** program. When this option is used, the connected DL-1 unit will overwrite the internal clock setting with clock settings of the computer it is connected to. This is the information that is displayed at the Right end of the Windows task bar, or in the Info window, as described above.

4.2.5. Device Name…

Each DL-1 instrument can be given a name. This is a name that can be set to any DL-1 unit and the user can give each unit a unique name, or the same name. The only unique identifier for each DL-1 is its serial number, which cannot be changed. The name of the unit will appear on the Data View and Graph View once data has been downloaded back into **TRAC⁴**.

4.2.6. Disconnect Device…

This is one of the most important changes from the last version to the current version of the DL-1 and TRAC software. Because the current DL-1 and **TRAC⁴** program communicate using USB, the DL-1 must be disconnected in software, prior to disconnecting from the computer. This will allow any communication between the computer and DL-1 device to finish and end properly. If a device is removed with using the "Disconnect Device…" option,

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
22
Sponsoring members of NACE International, NACE Foundation

there is a possibility that configuration data on the DL-1 unit might become corrupt. Always use the "Disconnect Device…" option when removing the DL-1 from the computer.

4.3 Data Menu

The Data pull down menu has options for retrieving and graphing recorded data from a DL-1.

4.3.1. Get Data…

"Get Data…" is the command used to download data from a connected DL-1 data logger. This option is not available (grayed out) if a DL-1 is not connected to the computer.

When this command is clicked by the mouse, a dialog box appears stating, "Parsing data". This shows that the download is in process. The download time will vary depending upon the amount of samples recorded. A full memory download can take up to approximately 30 seconds.

4.3.2. Graph from Data…

To create a graph from downloaded data, use the "Graph from Data…" command under the Data pull down menu. When this command is only available with the Data View is the active window. The graph will be created using default settings only. To create a graph with customized settings, use the "Graph Wizard…" command.

4.3.3. Graph Wizard…

"The Graph Wizard…" command allows the user to customize the graph before it is created. A new window will open that contains the graph options. Options available include:

Choose which channels to graph

Line Color of each channel

Data point symbol selection for each channel graphed

X Axis Options:

X axis data type: select from interval, sample number, time or date and time. Time and Time & Date is not available if the data was recorded on only one day.

X axis label: custom data label field

Custom background image: click and checkmark in this field and browse to an image to include as the background on the graph page being created.

4.4 Windows Menu

The Windows pull down menu allows the user to view multiple windows of information at the same time, and / or move between multiple windows. This can be especially helpful with graph windows, as each sequence is graphed in its own window. If a user has a configuration file, data view file and multiple graphs open at the same time, this can lead to difficulty in moving between windows. Using the available commands in the Windows pull down menu can help in managing this and getting the desired window to become the active window.

4.4.1. Cascade

The Cascade command in the Windows pull down menu will automatically arrange all open windows into an orderly cascade so that each window becomes accessible to the mouse and may be clicked by the user to become active. As more and more windows are opened in the **TRAC**[4] program main window, this can be very helpful in locating a specific file window to make it the active window.

4.4.2. Tile Horizontal

The "Tile Horizontal" command will arrange all the open windows into rows. This will allow the user to see each full window at the same time. Horizontal layouts are convenient, especially with graph windows, as the entire graph can be seen stretched out, Left to Right.

4.4.3. Tile Vertical

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
23
Sponsoring members of NACE International, NACE Foundation

The "Tile Vertical" command will arrange all the open windows into columns. This will allow the user to see each full window at the same time. Vertical layouts are convenient, especially with data and configuration windows.

4.5 Help Menu

At this time, the only item in the Help pull down menu is the "About…" command. Clicking on "About…" will bring up a new window showing the **TRAC⁴** splash screen with the version number and a link to the Tinker & Rasor website.

The **TRAC⁴** version will be important to all users. As **TRAC⁴** is a new software program, it is anticipated that new versions will be available frequently. Due to a variety of reasons, it has been decided that the **TRAC⁴** software program will not automatically look for updates on the **TRAC⁴**.com website. It is recommended that users frequently go to www.TRAC4.com to see what the current version of the **TRAC⁴** software is, and compare that version number to the version number installed on the user's computer. This is done by clicking on the "About…" command in the Help pull down menu and looking for the version information on the **TRAC⁴** splash screen.

5.0   Advanced Features

5.1 Triggering

As mentioned previously, a Trigger is a defined threshold event, used to begin recording on the programmed selected channels. To program a Trigger, one of the four channels must be selected as the Trigger channel. Any of the four may be selected for this purpose, but only one channel may serve as a Trigger channel in the configuration file. Programming a Trigger is done in the Channel Details area, and a checkmark is required under Event Triggering.

The Trigger programming requires a threshold level of voltage and a Rising Edge or Falling Edge across that threshold. An example would be if it was desired that the DL-1 begin recording only when the voltage drops below -0.85v, a Trigger would be programmed as a Falling Edge with a threshold of -.085v.

To deploy a DL-1 in the field with a Trigger, the unit is connected and powered ON, and the Start / Stop button is pushed. The Green TRIGGER LED will confirm that the instrument is in Trigger mode and is waiting for the Trigger event. When the event occurs, the DL-1 will begin recording, per its configuration file, and the Trigger is cancelled.

5.1.1.   START / STOP Button and TRIGGER Mode

When the DL-1 has been programmed with a Trigger (or a Timed Start, another type of Trigger), pushing Start / Stop will show the Green TRIGGER LED, not the Green LOGGING LED on the instrument panel. Pushing Start / Stop when in Trigger mode, will CANCEL the Trigger and DL-1 will begin recording immediately. Recording will continue as programmed from this point. The Trigger will need to be reset using TRAC4 and sending a configuration file to the DL-1 again is required.

5.1.2.   Battery Life

While waiting for the Trigger event, the DL-1 is in operation and actively receiving the voltage data from all selected channels, however it is not recording and saving the data at this time. It is not in sleep mode, so battery life will be affected just as it would if it were storing the data to memory. This means that if the configuration file is set for sampling once per minute, the DL-1 sleeps between sample times, then wakes up, reads the data, if the event has not occurred, the Trigger remains in effect, and the DL-1 goes back to sleep until the next sample period.

5.1.3.   Re -Arming the Trigger

Sponsoring members of NACE International, NACE Foundation

Event Triggers are meant simply to begin recording when a specific event occurs. It may be desired to have the event Trigger re-arm itself and wait to capture a future event, instead of simply executing its programming until battery life is exhausted or memory becomes full. This can be done manually pushing the Start / Stop button, thereby creating a new Sequence, or by using the "# of Samples:" option on the main page of the Configuration file.

When manually re -arming the Trigger, it is important to note that the Green LOGGING LED is flashing. If the instrument panel is in sleep mode, and therefore no LEDs are shown, quickly press the Power button to wake the panel and note that the LOGGING LED is flashing. When in LOGGIN mode, pushing the Start / Stop button will return the instrument to TRIGGER mode. Pushing the Start / Stop button when in TRIGGER mode cancels the Trigger and the instrument immediately goes into LOGGING mode.

In the #of Samples method, for instance, if it is desired to note many events over a period of time, the configuration # of Sample: can be set to a low number, such as "1" (one). This would mean that when the threshold event occurs, the DL-1 would record one sample then stop recording. When the specified event reverses itself, meaning the voltage on the Trigger channel crosses back across the threshold again, the Trigger is re-armed and will record the specified number of samples again, if the threshold is crossed again. Each time the DL-1 records data in this manner, a new Sequence will be created.

> *An Example:*
> A pipeline is being influenced from a foreign structure. In order to determine when this event occurs, a Trigger is set to record the event and capture the time and date stamp of when this foreign influence occurs. A DL-1 is programmed as follows:
>
> The Sampling Interval is set to 01 second (1-99) and a checkmark placed next to Lock.
> # of Samples: is clicked to select, and "1" is entered into the field.
> Analog 1 and Analog 3 and Analog 4 are selected for recording, and labeled as to what or how they will be connected.
> Any of the Channel Details buttons are clicked to bring up the Channel Details window.
> In the Channel area at the top of the window, Analog 1 is selected from the pull down menu.
> Enable Triggering is checked.
> This channel is a trigger is checked.
> Rising Edge (Low to High) is selected by clicking.
> Threshold is set to "1"
> Click OK.
> Analog 1 is now shown as a trigger on the main configuration page.
>
> In the field, the DL-1 connected, powered ON and the Start / Stop is pushed. The TRIGGER LED confirms the unit is in Trigger mode.
>
> The DL-1 will now only record when voltage on Analog 1 channel rises above 1.00v DC. Each time this event occurs, the DL-1 will record one (1) sample on channels Analog 1, Analog 3 and Analog 4. When the voltage on Analog 1 falls below the 1.00v DC threshold, the Trigger is reset, and waiting for the voltage to rise above 1.00v again.

The Trigger function in **TRAC**[4] can be a powerful tool. When it is understood well, it can be used to capture very specific data using the DL-1.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
25
Sponsoring members of NACE International, NACE Foundation

NOTE: Only one Trigger can be set per configuration file. This means that only one channel can act as a Trigger. Also, Timed Operation, being a Trigger function, cannot be used if a channel is set to act as a Trigger.

5.2 Timed Operation

The Timed start and stop function in the DL-1 may be helpful if DL-1 units are to be deployed at varying times or when recording is not yet important to the application. The Timed start is used to begin logging data per the configuration programming at a specified date and time. Timed Start is another type of Trigger function, so cannot be used if a channel is also set as a Trigger. Only one Trigger function can be programmed at a time.

5.2.1.   START / STOP Button and TRIGGER Mode

When the DL-1 has been programmed with a Timed Start, the Start / Stop is not used. With a Timed Operation program, when the DL-1 is Powered ON, the Green POWER LED will flash once, and then the Green TRIGGER LED will begin to flash. Pushing the Start / Stop button will CANCEL the Timed Start operation and the DL-1 will immediately begin to record data, showing the Green LOGGING LED, not the Green TRIGGER LED on the instrument panel. Recording will continue as programmed from this point. The Timed Start and Stop will need to be reset using TRAC4 and sending a configuration file to the DL-1 again is required.

5.2.2.   Continuous and Periodic Programming

Timed Operation gives users great flexibility of when to start, and also to stop, recording data.
Continuous operation will start the data logger recording it program at a specific Date and Time. When this Date and Time are reached, the DL-1 will begin to record data and will do so until it reaches the Stop Date. If no Stop Date has been programmed, then the recording will continue until the DL-1 reached the end of memory, battery life or # of Samples, per the configuration file.
Periodic operation uses both the Start and Stop Date and Times. The Stop is not an option as in Continuous operation. With Periodic Operation chosen, the DL-1 will begin recording data when the Start Date and Time is reached, but then stop recording data when the Stop <u>Time</u> is reached, each day, until the Stop <u>Date</u> and <u>Time</u> is reached. When the Stop Date and Time are reached, the DL-1 will stop recording data.

An Example:
A Close Interval Survey is being conducted on a pipeline. A data logger is going to be connected to each current interrupter to monitor its functions during the survey. The survey will only be done during daylight hours, so the DL-1 will be setup using the Timed, Periodic Operation mode. The DL-1 is programmed as follows:

Open new Configuration window.
A checkmark is placed next to Timed, under the Parameters section of the configuration window.
A Start Date of the next day, and a time of 07:00:00 (7 am in 24 hour format) is entered.
A checkmark is placed next to Stop and a Timed Stop date of 5 days later and Stop Time of 17:00:00 (5:00 pm in 24 hour format) is entered.
The Periodic option is chosen by clicking the radial button.
The Sampling Interval is set to 01 second (1-99) and a checkmark placed next to Lock.
Analog 1 is selected for recording, and labeled as to what or how it will be connected.

In the field, the DL-1 connected, powered ON and the Start / Stop is pushed. The TRIGGER LED confirms the unit is in Trigger mode.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
26
Sponsoring members of NACE International, NACE Foundation

The DL-1 will now begin recording voltages on Analog 1 channel when the Start Date and Time is reached. Recording will take place each day of the period between 7:00 am and 5:00 pm, until the 5:00 pm on the Stop Date. Then the DL-1 will stop recording.

The Timed Start and Stop Trigger can be very useful, but a good understanding of the deployment and DL-1 interface is necessary. Practice is recommended before deploying this Trigger mode, to ensure the data desired is captured.

6.0   The DL-1 Instrument

The Model DL-1 instrument is a very sophisticated recording instrument. The unit can record up to four channels of information simultaneously.

6.1 Understanding the Instrument Interface Panel

The DL-1 instrument uses an interface consisting of two (2) buttons and five (5) LED lights. While this seems rather simple at first glance, there is a lot going on here and a good understanding of this interface is critical when deploying the DL-1 in the field.

To conserve battery life, the interface panel goes into a sleep mode. The instrument interface panel will wake and display an appropriate LED when something changes, such as memory full, low battery, or beginning logging from a trigger. When the panel is awake, the appropriate LED will slowly blink ten (10) times before the panel goes into sleep mode. Whenever the instrument is powered ON and the panel is awake, an LED will indicate what the unit is doing.

6.1.1.   Interface Buttons

Previous versions of the DL-1 data logger had only one (1) button: Start / Stop. This meant that the unit was always "On", and the user had only to push the button in the field to begin operation. The latest version of the DL-1 instrument has two (2) buttons: Power and Start / Stop.

Power Button

The Power button has two functions:

1. Turning the instrument ON and OFF by pressing and holding the button for approximately three (3) seconds.
2. Waking the instrument panel by quickly pressing the button, but not holding it down.

The Start / Stop button also has two functions:

1. To begin recording data, or in the case of a threshold Trigger, to begin watching the threshold for the Trigger event.
2. To end recording data.

To know and understand what pressing the Start / Stop button will do at any given time, requires that the user observe which LEDs are lit when the button is depressed. Because the instrument panel goes into sleep mode to converve battery life, it is always recommended that the Power button be quickly pressed to wake the panel prior to using the Start / Stop button. When the panel comes awake, the active function of the instrument will be indicated by which LED is flashing.

6.1.2.   Understanding the Panel LEDs

The instrument interface panel has five (5) LED lights to indicate a variety of information. Most of the LED's will slowly blink ten (10) times before the panel goes into sleep mode. There are some events that will show a steady light for approximately one (1) second, and these area described below. It is also important to note that when a function changes state, that is, starts or stops, the panel wakes and the appropriate LED will begin to slowly blink.

Power LED

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
27
Sponsoring members of NACE International, NACE Foundation

The Green POWER LED is the main indicator when the instrument is Power ON. When the Power button is pressed and held for approximately three (3) seconds, the instrument changes state, either powering ON or OFF. When the instrument powers ON, the Green POWER LED will show a steady light for approximately one (1) second.
When the instrument is powered ON, and the unit is in standby, the Green POWER LED will slowly blink.

Low Battery LED

The Red LOW BATTERY LED indicates a low battery condition. This means that the voltage of the battery supply has dropped below a factory set acceptable level, and charging of the battery is suggested. If the interface panel is in sleep mode when the battery levels drop below the Low Battery threshold, the panel will wake and the Red LOW BATTERY LED will slowly blink ten (10) times before the panel goes back into sleep mode. This LED may by lit at the same time as other LEDs on the panel.

Logging LED

The Green LOGGING LED, indicates that the instrument is reading data, per its programming. This behaves as the others do, in that when the DL-1 goes into the Logging mode, the Green LOGGING LED will slowly blink ten (10) times before the interface panel goes into sleep mode. Pressing the Start / Stop button when the instrument is in this Logging mode will end the data recording and will cancel a Timed trigger. For this reason, it is always recommended to wake the interface panel by pressing the Power button, to see if the Green LOGGING LED is blinking.

Trigger LED

The Green TRIGGER LED indicates that a Trigger function is operating and the DL-1 is in the Trigger mode. Trigger mode is indicated by the Green TRIGGER LED slowly blinking ten (10) times, if the interface panel is awake. Because pressing the Start / Stop button when the instrument is in Trigger mode will cancel all Triggers, it is recommended that the interace be woken by quickly pressing the Power button to see if the Green TRIGGER LED is flashing.

Memory Full LED

The Red MEMORY FULL LED has two functions.
1. When the instrument is powered OFF, by pressing and holding the Power button for approximately three (3) seconds, as the DL-1 tuns off the Red MEMORY FULL LED will show a steady light for approximately one (1) second.
2. The Red MEMORY FULL LED will slowly blink ten (10) times when the interface panel is awake and all available memory has been used. When all memory has been used, the instrument cannot record any more data. To free the memory, a configuration file must be uploaded to the instrument using the **TRAC^4** program.

6.2 The Power Supply

The Model DL-1 Data Logger is powered by an internal 9v Li-Ion battery (older versions use 9v alkaline batteries). The supplied battery charger is to be used on the DL-1. Do not use any other type of charger on the DL-1. Also, do not use the DL-1 battery charger any other device. It will cause damage to other devices.

6.3 Cables

The DL-1 comes with two (2) cables. See Appendix B – Recording and Data Transfer Connections for more
1. Data Collection Cable – single round connector screws onto instrument end connector. Single Gray color lead breaks out into 4 pairs (8 leads) of color coded and channel labeled wire sets, terminated with polarity coded clamps.
   Black booted clamps denote Negative (-) polarity
   Red booted clamps denote Positive (+) polarity

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
28
Sponsoring members of NACE International, NACE Foundation

2. USB Computer Interface Cable – single round connector screws onto instrument end connector. Single Black cable terminated with a standard "A" USB connector.

Each cable may be purchased separately, or replaced, as needed. See Appendix B for more.

7.0 Other Information

7.1 Privacy Information

The **TRAC⁴** software program and this user guide will be updated often. Due to privacy and security concerns, the **TRAC⁴** software program does not allow for automatic updating. This program does not connect to any outside servers or collect any data from computers it is installed on.

7.2 User License

The **TRAC⁴** software program is offered at no charge to the general public. This program is available on CD upon request from Tinker & Rasor, and comes included with the purchase or rental of a Model DL-1 Data Logger.
The software is also available for download from www.trac4.com. The software may be downloaded by any person for the purposes of using the software in conjunction with the DL-1 Data Logger or for the purpose of viewing data that has been collected by the Model DL-1 Data Logger.
The software is offered as is and no warranty of its suitability for any type of computer or operating system is implied. The full license agreement is included with the software and viewable upon install of the software program.

7.3 Updates

The **TRAC⁴** software program will be updated periodically to include software fixes and/or program updates and new features. The **TRAC⁴** software program does not allow for automatic updates, and it is recommended that the user check the website: www.trac4.com for updates on a regular basis. This website is part of the Tinker & Rasor group of websites. You may also contact Tinker & Rasor by e-mail: Info@tinker-rsaor.com, phone: +1 (909) 890-0700 or fax +1(909) 890-0736 to find out if your version of the software is up to date. To find the version of your software, click on the pull down menu labeled Help and choose About.

7.4 Warranty

The DL-1 Data Logger comes with a 90 day warranty. The details of the warranty are included on the warranty card that comes with a new DL-1.

Repairs
The DL-1 Data Logger can be repaired by Tinker & Rasor technicians at the main factory in New Braunfels, Texas, USA.

To send an instrument in for repair, please ship the instrument via a courier such as UPS or FedEx, pre-paid to:

Tinker & Rasor
ATTN: Repairs
2828 FM 758
New Braunfels, TX 78130 USA

Tinker & Rasor repairs are done on a 24 hour turn around. Please include your contact information, including e-mail address, along with the instrument when returned for repair.

112-277

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
29
Sponsoring members of NACE International, NACE Foundation

APPENDIX A

Appendix A: Technical Specifications

Electrical & Mechanical Specifications

INPUTS	
Analog	4 Analog Channels
Input Voltage Range	+/-5v ch 1 &2, 0.5 - 150V$_{RMS}$ ch 3, +/- 100v TrueView ch 4
Resolution	1mV ch 1 & 2, 500mV ch 3 & 4
Input Impedance	< 200 Meg Ohms
Sampling Frequency	Fast as 1 KHz, Slow as 1/99 min. (All channels)
DATA STORAGE	
Data Storage	1,000,000 samples
Recording Duration	0.001 seconds to years
Data Memory Battery Life	10 years
OPERATING	
Voltage	8.4V battery, LiFePO, rechargeable
Current	43 mA
Standby	1.7mA
BATTERY LIFE	Up to 1 month, internal Li-Ion (1/min sampling)
Temperature	
Operating	-15 to 55 degrees Celsius
Storage	-15 to 55 degrees Celsius
COMMUNICATION	USB Interface
DIMENSIONS	1 ½ in. X 1 ½ in. X 10 ¼ in.
WEIGHT	10 OZ. (283 G)

Tel: (830) 253-5621
2828 FM 758, New Braunfels, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
30
Sponsoring members of NACE International, NACE Foundation

Appendix A: Technical Specifications continued

DL-1 Channel Specifications:
Analog - Four isolated channels simultaneously recording AC or DC voltages.

CH1 - Isolated DC input, - 5 V to + 5 V range
- Input Sensing Range, Full Scale: - 5 VDC to + 5 VDC.
- Input Impedance: >200 M-Ohms.
- Resolution/Sensitivity as Percent of Full-Scale: 0.01%
- Resolution/Sensitivity in Volts: +/- 1mV.
- Accuracy, Calibrated, Ta = 25C / 77F: +/- 1mV.
- Filter Specs: Low-Pass, BW$_{-3db}$ = 10Hz, 4 pole low-pass filter for rejection of AC power line frequency and harmonics. Configured by manufacturer for 50Hz or 60Hz noise rejection. Frequency 60Hz attenuation ≥75dB, for frequencies higher then 60Hz attenuation is >75dB.
- Input Overload Protection: up to +/-60 VDC, across input leads, without damage.
- Isolated Channel.

CH2 - Isolated DC input, - 5 V to + 5 V range
- Input Sensing Range, Full Scale: - 5 VDC to + 5 VDC.
- Input Impedance: >200 M-Ohms.
- Resolution/Sensitivity as Percent of Full-Scale: 0.01%
- Resolution/Sensitivity in Volts: +/- 1mV.
- Accuracy, Calibrated, Ta = 25C / 77F: +/- 1mV.
- Filter Specs: Low-Pass, BW$_{-3db}$ = 10Hz, 4 pole low-pass filter for rejection of AC power line frequency and harmonics. Configured by manufacturer for 50Hz or 60Hz noise rejection. Frequency 60Hz attenuation ≥75dB, for frequencies higher then 60Hz attenuation is >75dB.
- Input Overload Protection: up to +/-60 VDC, across input leads, without damage.
- Isolated Channel.

CH3 - Isolated AC input, 3 V$_{RMS}$ to 150 V$_{RMS}$ AC range.
- Input Sensing Range, Full-Scale: 150 V$_{RMS}$ AC, minimum usable input 0.5 Vrms AC.
- Input Impedance: >200 M-Ohms.
- Resolution/Sensitivity as Percent of Full-Scale: 0.33%.
- Resolution/Sensitivity in Volts: 0.5 V$_{RMS}$ AC.
- Accuracy, Calibrated, Ta = 25C / 77F: +/- 0.5 V$_{RMS}$.
- AC Measurement Type: DC-blocking, calibrated to read RMS value of any type of a waveform.
- Frequency Range: 45Hz to 400Hz.
- Input Overload Protection: Up to 500V maximum, DC plus peak AC voltage, across input leads, without damage.
- Isolated Channel: Up to 500V maximum, DC plus peak AC voltage.

CH4 - Isolated True-View: - 100 VDC to + 100 VDC or 100VAC$_{PP}$
- Input Sensing Range, Full-Scale: - 100 VDC to + 100 VDC.
- Input Impedance: >200 M-Ohms.
- Resolution/Sensitivity as Percent of Full-Scale: 0.25%
- Resolution/Sensitivity in Volts: 0.5 V.
- Accuracy, Calibrated, Ta = 25C / 77F: +/- 0.5 VDC.
- Filter Specs: 500Hz low-pass, 4 poles.
- Input Overload Protection: Up to 300V max., DC plus peak AC voltage, across input leads, without damage.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
31
Sponsoring members of NACE International, NACE Foundation

APPENDIX B

Appendix B: Recording and Data Transfer Connections

The Model DL-1 includes cables necessary for data recording and data transfer. The cables are distinct and easily identified.

Data Collection Cable (Sampling Interface Cable)

The Data Recording cables have a serial connector at one end and four pairs of color-coded and labeled clamps at the other end.

Part No. 026-065

Data Transfer Cables

The Data Transfer cable included with the Model DL-1 is a USB cable with a standard USB pin connector at one end and a 3-pin round connector at the other. The round connector (3-pin) is always attached to the Model DL-1 and the USB connector is always attached to the computer. Be sure to turn the DL-1 ON prior to attaching the cable to the computer.

Part No. 026-087

Appendix C: Software Troubleshooting

Symptom: Status area shows Device Connected: 5, Cannot download data or send configuration

1. The DL-1 unit has firmware software version newer than the TRAC4 program.
2. Visit www.trac4.com and navigate to the Software Download page.
3. Download the latest version of the software and install on your computer.
4. After installation, open the TRAC4 program, turn DL-1 ON and connect DL-1 to the computer.
5. Verify Device Connected: DL-1 is shown in lower Left corner of TRAC4 window.
6. Use TRAC4 normally.

Symptom: Windows shows an error message when closing the TRAC4 program.

1. If the computer is running a 64-bit version of windows, you will need to always start TRAC4 as an Administrator.
2. Locate the TRAC4 icon on the computer desktop.
3. Right click the mouse on the icon.
4. Left click on "Run as administrator" in the menu.
5. TRAC4 will open and operate normally.

Symptom: Status area shows Device Connected: None, but my DL-1 is connected!

6. Unplug the USB cable from the computer. Make sure the DL-1 unit is powered ON. Quickly press the Power button and ensure that an LED lights up. If no LED lights, the DL-1 is OFF or the batteries are depleted. Power ON or charge (older units, replace) the batteries, and connect to the computer.
7. If LED lights, close and re-open the TRAC4 software program and re-connect the cable to the computer. After 10 – 15 seconds, the Status Area will show *Device Connected:DL-1*
8. If DL-1 is not shown, the USB device driver may not have installed properly.

Symptom: DL-1 USB Device Driver did not install properly, or Windows shows an error message, "Device Not Recognized" when the DL-1 is plugged into the computer.

1. Unplug DL-1 from the computer and turn instrument off.
2. Close the TRAC4 program.
3. Insert the TRAC4 CD that came with the DL-1 instrument. ***
4. Browse to the FDI USB driver file on the CD.
5. Install the driver.
6. Restart the computer.
7. Open TRAC4, turn the DL-1 on and plug the USB cable into the computer.

   *** If your CD does not contain this file or you do not have a CD, go to www.trac4.com and download and install the driver from the website.

Symptom: When downloading data to the computer using TRAC4, an error message appears, "Cannot Parse Data".

1. Unplug DL-1 from the computer and turn instrument off.
2. Close the TRAC4 program.
3. Restart the computer.

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
33
Sponsoring members of NACE International, NACE Foundation

4. Open TRAC4.
5. Turn on and connect the DL-1.
6. Wait for the instrument to be connected by TRAC4 and try to download again.

Symptom: I cannot tell if my DL-1 is ON or OFF.

Press the Power button and release immediately, do not hold for three seconds.

If the DL-1 is ON, an LED will start flashing indicating what is happening with the instrument.

Power LED blinking means the instrument is ON but not running a program.

Trigger LED blinking means the instrument is waiting for a trigger or scheduled event.

Logging LED blinking means the instrument is running its program and logging data.

If the DL-1 does not show a blinking LED when the Power button is briefly pressed, the instrument is OFF.

If you have experienced other troubles, or have suggestions on Symptoms to add here, please contact Tinker & Rasor: +1(830) 253-5621 or info@tinker-rasor.com

Tel: (830) 253-5621
2828 FM 758, NEW BRAUNFELS, TX 78130
Web: www.tinker-rasor.com   E-mail: Info@tinker-rasor.com
34
Sponsoring members of NACE International, NACE Foundation