MultiLogPRO
User Guide

July 2012
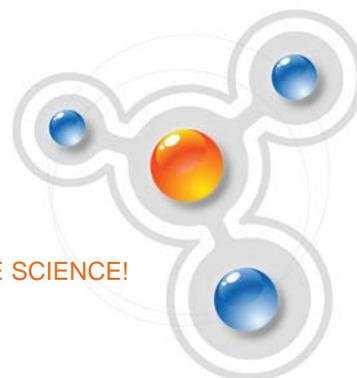
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Contents

Introduction

The MultiLogPRO is a powerful standalone 12-bit data logger with a clear LCD graphic display and a 128K internal memory. Recorded data is displayed in the form of graphs, tables, meters or digital displays, and can be analyzed with a number of pre-programmed analysis functions.

The MultiLogPRO's internal memory stores experiment notes and instructions for carrying out the experiment, which can be edited or expanded at any time. These features enable MultiLogPRO to function independently from a computer - a perfect solution for when there is a shortage of computers in the laboratory.

MultiLogPRO can record data from up to 8 sensors simultaneously; it is capable of recording at rates of up to 21,000 samples per second, and of collecting up to 100,000 samples in its internal memory.

MultiLogPRO is very easy to use because all its functions are broken down into 8 icon menus, and its four buttons can browse every menu and execute any of the commands. In addition, when a sensor is plugged in, the MultiLogPRO automatically recognizes the type of sensor, and will record the data with the appropriate units.

A rechargeable battery powers the data logger, which shuts off automatically after 15 minutes have passed since the time of the last data recording, since the time the last button was pressed, or since the time the last communication with the PC.

MultiLogPRO includes a built-in, easy to use, accurate Timer module that enables the measuring of several types of timing events.

Together with the TI–83 Plus calculator, MultiLogPRO becomes a complete portable, handheld data collection and analysis system.

The large variety of sensors with which MultiLogPRO is compatible makes the unit a true *digital Lab*, which can measure scientific phenomena from the fields of Physics, Chemistry, Biology and the environmental sciences.
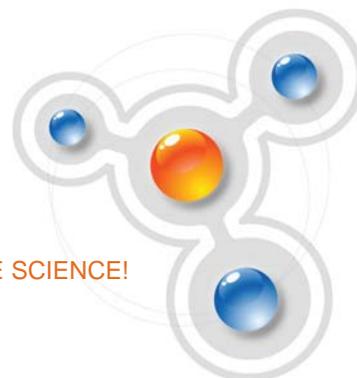
Chapter 1: MultiLogPRO

This chapter will focus on the MultiLogPRO data collection device and includes sections on:

- How to operate the MultiLogPRO keypad
- How to set up MultiLogPRO
- How to connect MultiLogPRO to your computer

General

MultiLogPRO System Contents

The following list indicates the items included with the MultiLogPRO.

1. The MultiLogPRO data logger
2. USB or Serial Communication cables (see your package list)
3. MultiLab software installation CD
4. AC-DC adaptor

External Connections

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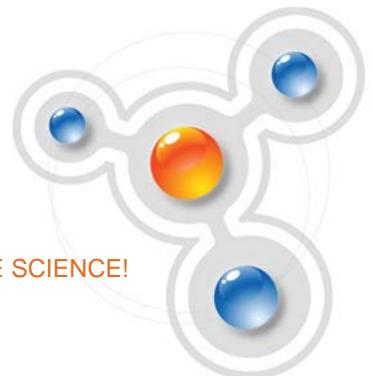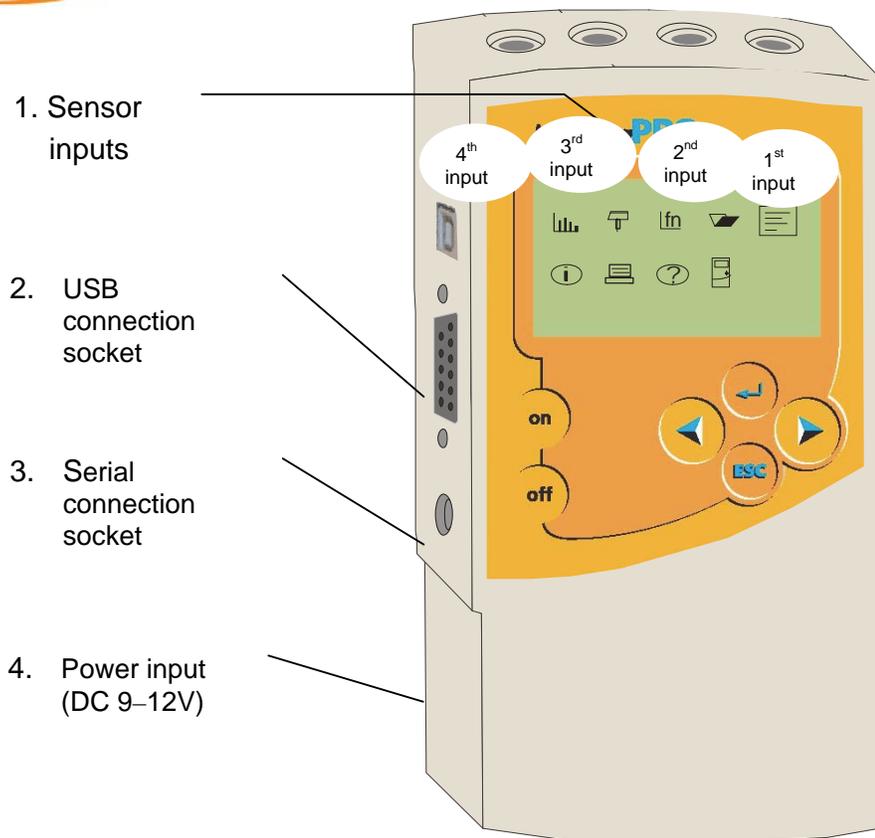
Figure 1: MultiLogPRO external connections

Labels on figure:
1. Sensor inputs
2. USB connection socket
3. Serial connection socket
4. Power input (DC 9–12V)

4th input, 3rd input, 2nd input, 1st input

1. Sensor Inputs

Sensor input/output (I/O) sockets are marked on the MultiLogPRO casing as I/O-1, I/O-2, I/O-3 and I/O-4. These sockets are used to connect the sensors. Normally, all four sockets can be used simultaneously.

To connect a sensor to the MultiLogPRO use one of the mini-din cables. Plug one end of the cable into the data logger - arrow facing up, and the other end into the sensor - arrow facing down.

If you are using one sensor only connect it to input 1. If you are using two sensors connect them to inputs 1 and 2, and so on.

In order to connect more than 4 sensors at a time, use Fourier splitter cables (Part Number DT011), which will enable the connection of up to 8 sensors simultaneously. When a splitter cable is connected, it must be connected to the socket in the correct numerical order (e.g. for 5 sensors, connect the splitter cable to I/O-1). One of the
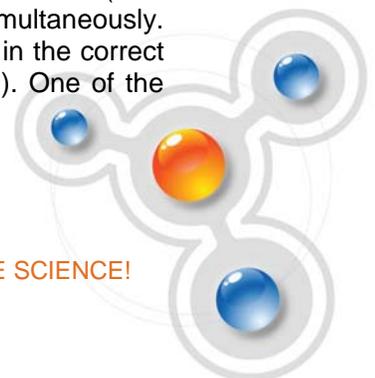
two splitter cables is marked with arrows - that is the main input (the lower I/O number), the second line is marked with the letter S (split) - indicating that it is the secondary input (the higher I/O number). Connect up to four input splitters to split the MultiLogPRO's inputs starting with I/O-4 (the splitters **must** be connected in order):

- I/O-1 splits into I/O-1 and I/O-8
- I/O-2 splits into I/O-2 and I/O-7
- I/O-3 splits into I/O-3 and I/O-6
- I/O-4 splits into I/O-4 and I/O-5

> **Note:** Before connecting the mini-din cable to the data logger or the sensor sockets, make sure that the mini-din plug is correctly positioned in front of the socket. Connecting the cable in an awkward position might cause damage to the cable pins.

2. Computer USB communication socket

For USB communication between logger and the computer, connect the USB Type B plug to the MultiLogPRO and the USB Type A plug to the computer.
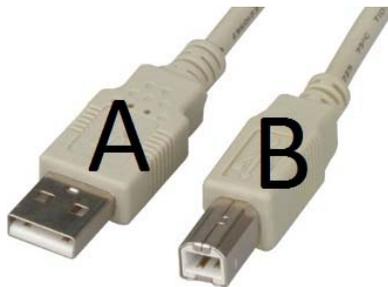
3. Computer serial communication socket

For Serial communication between logger and computer, connect the 9-pin Type D cable between this port and one of the computer's COM ports. At the back of the computer you will find a 9-pin Type D male socket. If your computer is using this port for the mouse, look for a 25-pin D shell male socket near the mouse. Use the RS-232 9 to 25-pin adaptor to connect the MultiLogPRO serial cable to the 25-pin port (the adaptor is included with the MultiLogPRO).

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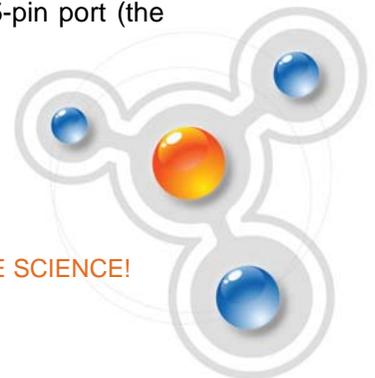
4. External DC power supply socket

Plug in an AC/DC 9-12V adaptor whenever you want to save battery power, or to charge the battery when necessary. Connecting external power to the MultiLogPRO automatically charges the internal battery. The adaptor should meet the required specifications (see section 0).

Battery

MultiLogPRO is equipped with a 7.2V NiCad rechargeable battery. Before you first start working with MultiLogPRO, charge the unit for 10 to 12 hours while it is turned off. Battery life is approximately 24 hours between charges.

If the data logger's main battery runs out, the internal 3V Lithium battery backs up the memory, so no data will be lost.

Note: Before storing the data logger make sure you have unplugged all the sensors and pressed the OFF key.

AC/DC Adaptor

- Output: Capacitor filtered 9 to 12 VDC, 400 mA
- Female plug, center Negative

Automatic Shut-off

MultiLogPRO shuts off automatically after 15 minutes have passed since the time of the last data recording, the time the last button was pressed, or the time the last communication was made with the computer.

Standalone Operation

One way to program the MultiLogPRO is to use its keypad and screen (the other way is to use the MultiLab software - see **Error! Reference source not found.**). The keypad allows us to set all the parameters for data collection, while the LCD screen displays the setting values.

Front Panel Layout
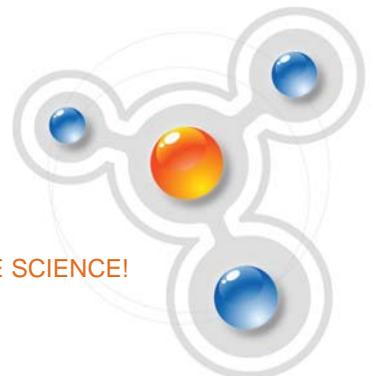
Figure 2: MultiLogPRO front panel

Labels on figure:
- LCD Display
- Backward Button
- Enter/Run Button
- On/Off Buttons
- Forward Button
- Escape/Stop Button

Display shows:
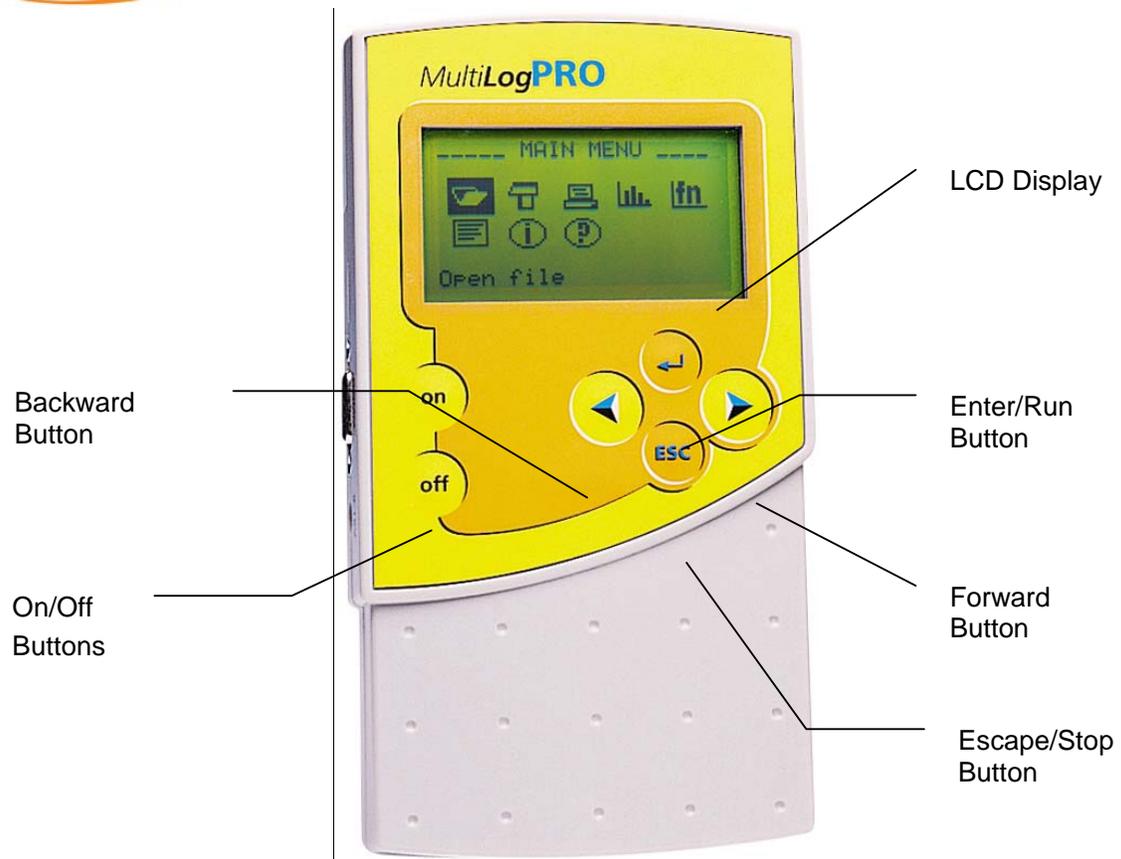MAIN MENU
Open file

Input Modes

MultiLogPRO has two Input Modes. The default mode is **Auto ID** and the MultiLogPRO is in this mode when turned on for the first time. When using more than 4 sensors, when using third-party sensors, or if you've defined your own sensor, switch to the **8 inputs** mode. Select the **system configuration** menu in the **MAIN MENU** and choose the mode you want (see page 21).

MultiLogPRO saves the current mode selection and will open in that mode the next time you turn it on.

Auto ID

Automatic sensor identification – just plug in the sensors and the MultiLogPRO prepares itself to collect data from these sensors.

While in this mode you can work with up to 4 sensors simultaneously.

8 Inputs

This mode enables data logging from up to 8 sensors simultaneously. Connect up to four input splitters (DT011) to multiply the MultiLogPRO's inputs starting with I/O-4 (the splitters **must** be connected in order):

- I/O-1 splits into I/O-1 and I/O-8
- I/O-2 splits into I/O-2 and I/O-7
- I/O-3 splits into I/O-3 and I/O-6
- I/O-4 splits into I/O-4 and I/O-5

In the splitter cable, one of the two wires is marked with arrows - that is the main input (the lower I/O number). The second wire is marked with the letter S (split) - indicating that it is the secondary input (the higher I/O number).

To learn how to switch to 8 inputs mode please refer to section 0 on page 21.

In this mode there is no automatic sensor identification. Select the sensors manually either from the MultiLogPRO setup menu (see section 0 on page 15) or using the MultiLab software (see section **Error! Reference source not found. Error! Bookmark not defined.**).

Use this mode if you want to work with more than 4 sensors or if you are using third-party sensors.

Quick-Start
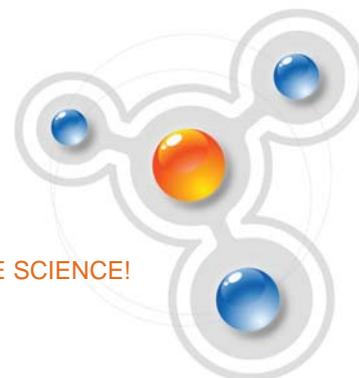
Before you first use MultiLogPRO, charge the unit for 10 to 12 hours while it is turned off.
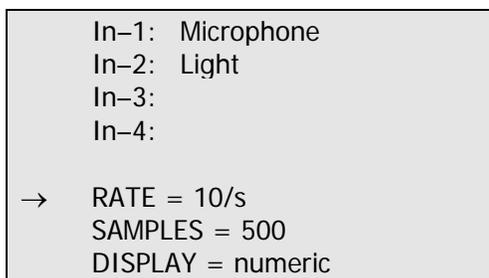
Turn on MultiLogPRO

Press the **on** button . You will see the initialization screen. MultiLogPRO performs a brief self-check and displays its status including battery level. At this point you can load the last setup you used (see page 20). If you need a new setup wait until you see the Main Menu screen:
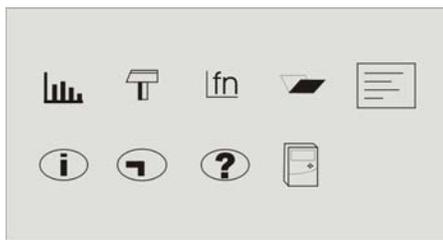
Plug in the Sensors

Start with the first input on the right. If MultiLogPRO is in Auto ID mode (the default mode) it will display the setup menu and will identify the sensors you've plugged in.

```
        In–1:   Microphone
        In–2:   Light
        In–3:
        In–4:

→       RATE = 10/s
        SAMPLES = 500
        DISPLAY = numeric
```

Note: Sensors must be added successively, starting with input-1. If a single sensor is used it must be connected to I/O-1. If two sensors are used in an experiment, they must be connected to I/O-1 and I/O-2.

The arrow indicates that MultiLogPRO is ready to accept a new sampling rate.
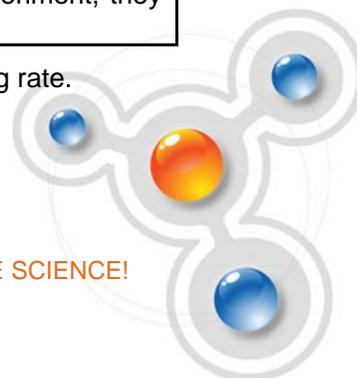
If the MultiLogPRO is in 8 input mode, you have to select the sensors manually (see page 15).

Select Rate

Use the **Forward** and **Backward** arrow buttons to select the desired

rate, and then press the **Enter** button .

```
        In–1:  Microphone
        In–2:  Light
        In–3:
        In–4:

        RATE     = Every sec
   →    SAMPLES  = 500
        DISPLAY  = numeric
```

MultiLogPRO automatically switches to the next step in the setup process and the arrow moves to the *samples* row.

Select Total Number of Samples

Use the **Forward** and **Backward** arrow buttons to select the number

of samples, and then press the **Enter** button .

```
        In–1:  Microphone
        In–2:  Light
        In–3:
        In–4:

        RATE     = Every sec
        SAMPLES  = 200
   →    DISPLAY  = numeric
```
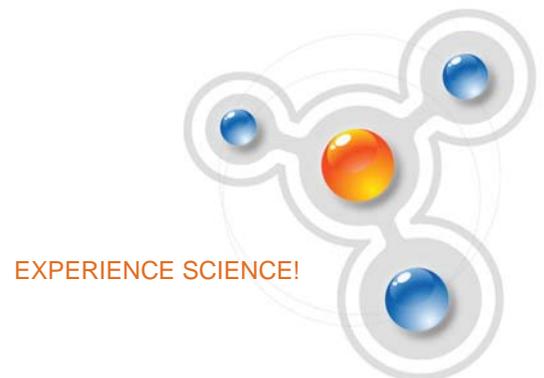
Choose Display

Use the **Forward** and **Backward** arrow buttons to select the type of

display, and then press the **Enter** button .

```
    In–1:  Microphone
    In–2:  Light
    In–3:
    In–4:

    SAMPLES  = 200
    DISPLAY  = graphic
→   START    = ( > ).
```

Start Recording

Press the **Forward** arrow button to start recording.
Or press the **Enter** button if you want to go back to the first item (Rate).

You can stop recording any time by pressing the **Escape** button .

Working with the MultiLogPRO Menus
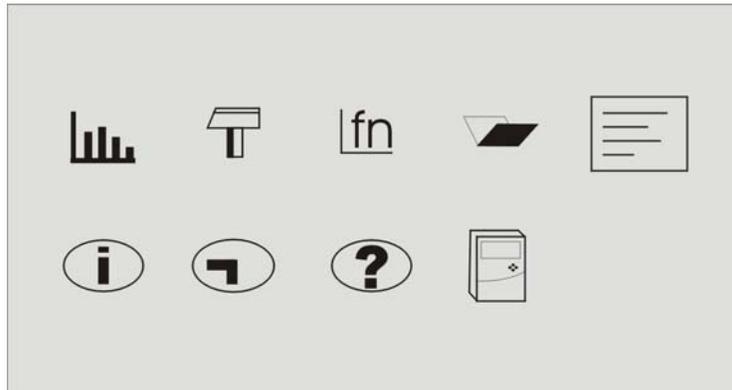
Turning MultiLogPRO On and Off

| on | **On** | Turn MultiLogPRO on |

| off | **Off** | Turn MultiLogPRO off |

> **Note:** Pressing OFF **will not** erase the sample memory. The data stored in the memory will be kept for up to 10 years.

Main Menu Display

When turned on, MultiLogPRO opens with a system information window and then displays the main menu:

MultiLogPRO has 9 menus. Use the Forward or Backward **Arrow** buttons to highlight a menu and press the **Enter** button to select it. Then use the **Arrow** buttons to scan the options. Press the **Enter** button to select an option. The MultiLogPRO automatically executes the command.

Menu Buttons

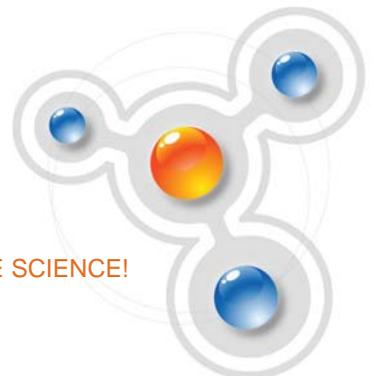|		
	Forward	Move to the next menu or to the next menu options
	Backward	Move to the previous menu or menu options
	Enter (Start)	Enter the selected menu or select the current menu option and move to the next menu command or start recording

| | **Escape (Stop)** | Return to the main menu or stop recording |

Menu Icons and Commands

| | **Start** | Start recording |

Press the **Enter** button to start recording

| | **Setup** | Setup MultiLogPRO in 4 steps: |

Rate – Select recording rate

Samples – Select the total number of recording points

Display – Select the way MultiLogPRO will display the data (at a rate of up to 10 samples per second):

- Numeric - Displays the sensor values and the sample number
- Meter - Displays all active sensors in a bar meter display along with their values
- Table - Displays the last 6 values of all the active sensors in a table
- Graphic - Displays a graphic representation of the sampled sensors

At rates higher then 10/s the MultiLogPRO will display the data in a graph at the end of the logging period.
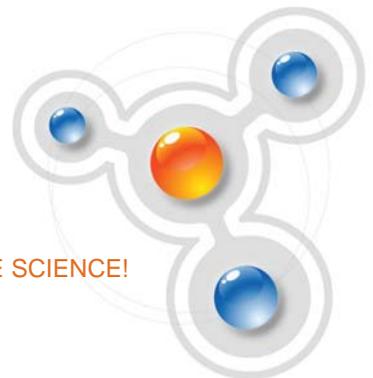
Start – Press the Forward **arrow** to start recording

| | **Function** | Display statistics of the current data |

- Minimum – The minimum graph value
- Maximum – The maximum graph value
- Average – The graph average

Open   Open a stored data in graphic display

Use the Forward and Backward **Arrow** buttons to browse the stored files,
press the **Enter** button to open a file

Notes   Display experiment notes and instructions

Use the **Arrow** buttons to browse the notes.
You can use the MultiLab software to edit the notes or to write new notes

Info   Display system information:

- Number of experiments stored in MultiLogPRO's internal memory
- Memory usage
- MultiLogPRO version
- Battery level (unplug any sensor and external power supply)
- Current date and time

Note: When turning off the MultiLogPRO, the date and time is reset. You restore the current date and time whenever the logger communicates with MultiLab.
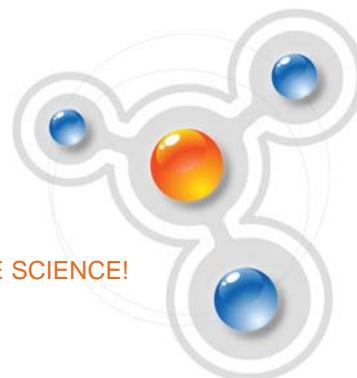
Timing   Enter to the timing module

You can select between the following timing events:
- Stopwatch
- Time and speed in one photogate
- Time and speed between two photogates
- Time, speed and acceleration between two photogates

Help   On-line help and specifications

Configuration   Configure the MultiLogPRO:

Input Mode – Select Input Mode: Auto ID or 8 inputs

Clear memory – Delete the stored data files

DO2 – Press the **Forward arrow** button to enter the DO_2 menu

Contrast – Use the **arrow** buttons to tune the screen contrast

Comm. – Press the **Forward arrow** button to connect to a computer or the **Backward arrow** button to connect to TI calculator

Graphic Display

MultiLogPRO will automatically use a graphic display in three cases:

- If the recording rate is 10/s or less and you selected Graphic Display in the setup menu
- Once logging has ended for an experiment with a data recording rate of over 10/s
- When opening a stored recording

The graphic display is available for recordings with up to 4 sensors simultaneously.

The Cursor

Use the Cursor in Graphic Display mode to read data values or to zoom in to the area around a selected point. The cursor is displayed automatically after logging has ended, or when opening a stored recording.

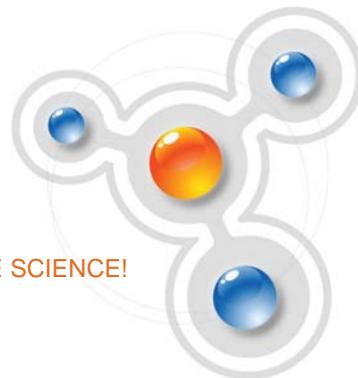Use the **Forward** and **Backward** **arrow** buttons to move the cursor.

MultiLogPRO displays the point coordinates at the bottom of the graph.

If there is more then one sensor, press the **Enter** button to move the cursor to another plot on the graph.

Zooming

Position the cursor in the area you want to zoom into.

Press the two arrow **buttons**, ◀ and ▶, simultaneously.
You will zoom in around the cursor in a 2:1 ratio.

Press the **Escape** button **ESC** to zoom out.

Measuring Timing Events

MultiLogPRO incorporates an accurate Timer module with resolution of 0.1ms. The timer can measure several types of events triggered by Fourier Systems' photogates:

- Time and speed with one photogate
- Time and speed between two gates
- Time, speed and acceleration between two gates
- Stopwatch

To learn more about the different measurement types see page **Error! Bookmark not defined.** and page **Error! Bookmark not defined.**.

While in Timer mode MultiLogPRO does not store data. To save timing data in the computer operate the Timer module via MultiLab.

To learn how to use the timer with MultiLab software please see section 4.9.

To use the photogates together with other sensors operate MultiLogPRO as a data logger and then analyze the photogate data with the aid of MultiLab's Timing Wizard (see page **Error! Bookmark not defined.**).
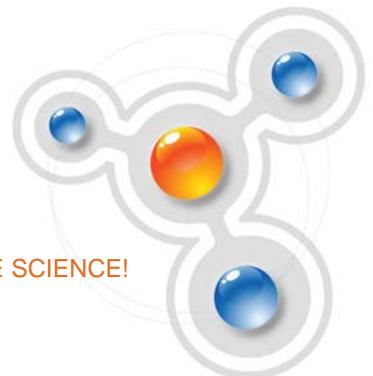
To perform a timing measurement:

Connect one or two photogates to MultiLogPRO

Use the **Forward** ▶ and **Backward** ◀ arrow buttons to navigate to the Timing ⌐ menu

Press **Enter** ↵ to display the timing menu:

```
_ _ _ _ _TIMING _ _ _ _ _

→ Mode: Time Speed
  Measure: In1
  Card width: 30mm
```

```
Gates distance: 20cm
Start   ( > )
```

The arrow indicates that MultiLogPRO is ready to accept the timing mode

Use the **arrow** buttons to select the desired timing mode: **Stopwatch**, **Time Speed** or **Time Speed Acc**

Stopwatch

```
_ _ _ _ _TIMING _ _ _ _ _

→ Mode: Stopwatch
  Measure:    _ _ _
  Card width: _ _ _
  Gates distance:   _ _ _
  Start  ( > )
```

In this mode MultiLogPRO operates as a standard stopwatch with resolution of 0.01s.

Press **Enter** four times, then press the **Forward** arrow to enter the stopwatch mode

Press the **Forward** arrow to start measuring time

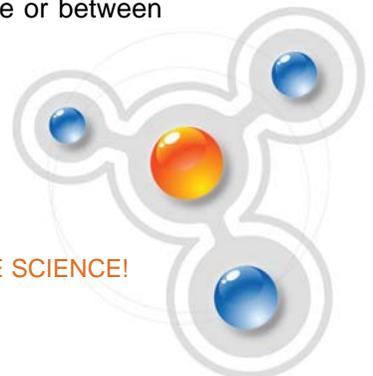Press the **Forward** arrow a second time to stop the watch

Press the **Backward** arrow to reset the watch

Press **Escape** to exit the stopwatch mode and return to the timing menu

Press **Escape** a second time to return to the main menu

Time and Speed

In this mode MultiLogPRO measures time and speed either in one gate or between gates.

```
_ _ _ _ _TIMING _ _ _ _ _

→ Mode: Time Speed
  Measure: In1
  Card width: 30mm
  Gates distance: _ _ _
  Start ( > )
```

Press **Enter** to select this mode. The arrow moves to the **Measure** row.

Use the **Forward** and **Backward** arrow buttons to select **In1** if you want to measure time and speed in one gate or **In1 → In2** if you want to measure time and speed between two gates.

Time and speed at one gate	**Time and speed between gates**
MultiLogPRO measures the time between blocking and unblocking the photogate at input 1	MultiLogPRO measures the time between blocking the photogate at input 1 and blocking the photogate at input 2

```
_ _ _ _ _TIMING _ _ _ _ _

  Mode: Time Speed
→Measure:   In1
  Card width: 30mm
  Gates distance:  _ _ _
  Start ( > )
```
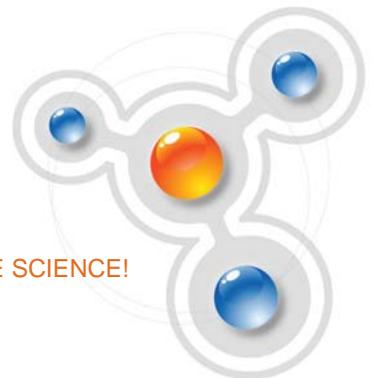
```
_ _ _ _ _TIMING _ _ _ _ _

  Mode: Time Speed
→Measure:   In1 -> In2
  Card width: _ _ _
  Gates distance:  20cm
  Start ( > )
```

Time and speed at one gate

1. Press **Enter**, then use the arrow buttons to select the card (the body that blocks the gate) width in mm between 0 to 59mm

2. Press **Enter** twice, then use the **Forward** arrow button to enter to a timing standby mode

Time and speed between gates

1. Press **Enter** twice, then use the **Forward** arrow button to select the distance between the photogates in cm between 0 to 99cm

2. Press **Enter**, then use the **Forward** arrow button to enter to a timing standby mode

3. Timing begins each time a body blocks the photogate and ends when unblocking the photogate. MultiLogPRO then displays the elapsed time between entering and leaving the gate and the speed of the body

4. Use the arrow buttons to scroll between the time and speed results

5. Press **Escape** [ESC] to return to the timing menu

6. Press **Escape** [ESC] a second time to return to the main menu

3. Timing begins each time a body enters the first photogate (input 1) and ends when leaving the second photogate (input 2). MultiLogPRO then displays the elapsed time between entering the gates and the body's average velocity

4. Use the arrow buttons to scroll between the time and speed results

5. Press **Escape** [ESC] to return to the timing menu

6. Press **Escape** [ESC] a second time to return to the main menu

Time, Speed and Acceleration

In this mode MultiLogPRO measures the crossing time at the first gate, the time it takes the body to move from one gate to the second gate and the crossing time at the second gate and returns the time between gates, the average speed and the average acceleration.

```
_ _ _ _ _TIMING _ _ _ _ _

→ Mode: Time Speed  Acc
  Measure: In1 –>    In2
  Card width: 30mm
  Gates distance: 20cm
  Start  ( > )
```

Press **Enter** [↵] twice, then use the arrow buttons to select the card (the body that blocks the gate) width in mm between 0 to 59mm

Press **Enter** [↵], then use the **Forward** [►] arrow button to select the distance between the photogates in cm between 0 to 99cm

Press **Enter** [↵], then use the **Forward** [►] arrow button to enter to a timing standby mode
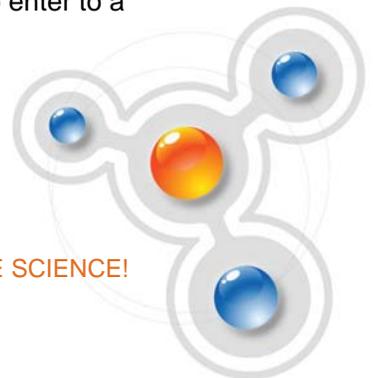
Timing begins each time a body enters the first photogate (input 1) and ends when leaving the second photogate (input 2). MultiLogPRO then displays the elapsed time between entering the gates and the body's average velocity and acceleration

Use the arrow buttons to scroll between the time, speed and acceleration results

Press **Escape** to return to the timing menu

Press **Escape** a second time to return to the main menu

Select Sensors Manually

You must be in 8 input mode to be able to select the sensors manually (see page 7).

In the Main Menu screen, use the arrow buttons to select the **setup**

menu icon .

Press the **Enter** button to enter the setup menu:

```
→    In–1:   Empty
     In–2:   Empty
     In–3:   Empty
     In–4:   Empty

     RATE = 10/s
     SAMPLES = 500
     DISPLAY = numeric
```

Use the **Forward** and **Backward** **arrows** to select the

sensor in input 1 and then press the **Enter** button . The arrow indicator will move to the second input.

Repeat this procedure with all the sensors you plugged in.
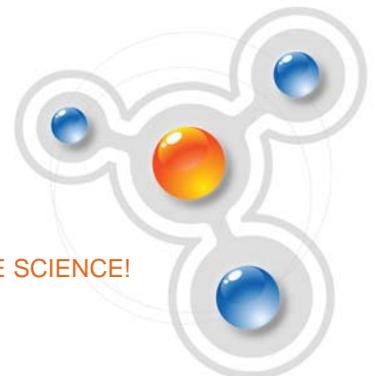
After the fourth sensor has been selected, the screen will list the next 4 sensors:

```
→    In–5:  Empty
     In–6:  Empty
     In–7:  Empty
     In–8:  Empty

     RATE = 10/s
     SAMPLES = 500
     DISPLAY = numeric
```

You can press the **Enter** button in the last input if you want to go back to the first input.

When you've finished selecting the sensors press the **Escape** button

ESC
. The arrow indicator will point to the **Rate** command and you must complete the setup, as detailed in section 0.

Note: When you turn the MultiLogPRO off it will save the setup for the next session.

Load the Last Setup

When you turn MultiLogPRO on, once the self testing has been completed, it will display:

```
___INITIALIZATION___

Init. Display
Init. ADC
Init. RAM
Batt. 99%

ENTER – load setup
```

Press the **Enter** button   to load the last setup.

Configure Your MultiLogPRO

Use the **System configuration** menu to select the Input Mode, to clear the MultiLogPRO's memory, to change the screen contrast, or to calibrate the DO_2 sensor.

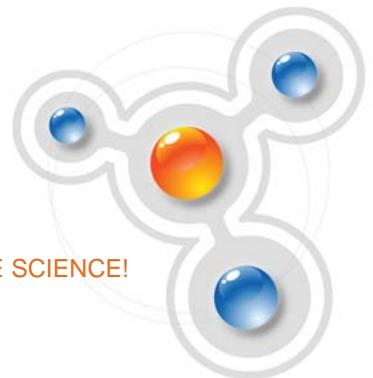In the **MAIN MENU** screen, select the **System configuration** icon to display the configuration screen. The default configuration is:

$\rightarrow$ Input Mode: Auto ID
Clear memory (>)
Distance 10m
DO2 calibration (>)
Contrast (<) (>)

Use the **Forward** and **Backward** **arrows** to select the mode and

then press the **Enter** button to move to the next item. You can press the

Escape button to leave the configuration menu at any time, saving the new changes you made. Press **Enter** button in the last item (Contrast) if you want to go back to the first item (Input Mode).
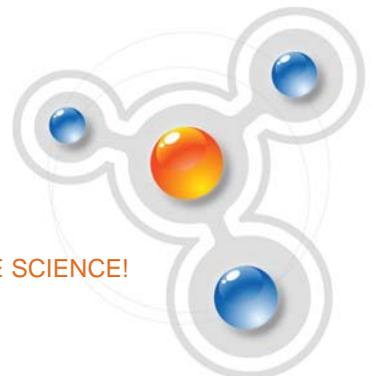
Input Mode

Select between **Auto ID** – automatic sensor identification and **8 inputs** – manual sensor selection (See also page 7).

The new configuration will be the default mode until the next time you change it.

Clear Memory

Press the **Forward** arrow button if you want to delete all previous data files from the MultiLogPRO.

Distance Sensor

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Press the **Forward** arrow button to choose between the 2m and 10m distance sensor you are using.

DO₂ Sensor Calibration

If you need to calibrate a DO₂ sensor press the **Forward** arrow button to enter the DO₂ calibration screen:

```
_ _ _ _ _   D O 2   C A L   _ _ _ _ _
U s e   t h e   f o l l o w i n g
m e n u   t o   c a l i b r a t e
t h e   D O 2   e l e c t r o d e .

S a l i n i t y :   0   p p t
```

Use the **arrow** buttons to select between 0, 5, 10, 15, 20, 25, 30 and 35 ppt and press the **Enter** button to confirm and move to *calibrate altitude*.

Use the arrow buttons to select between 0, 500, 1000, 1500, 2000, 2500, 3000 and 3500 ft and press the **Enter** button to confirm.

MultiLogPRO will display the calculated upper limit of the calibrated range and will exit the DO₂ calibration screen.

The new calibration parameters will be saved until the next time you change them.

Screen Contrast

Use the **arrow** buttons to adjust the LCD screen contrast.

Any contrast adjustment will be saved until the next time you change it.

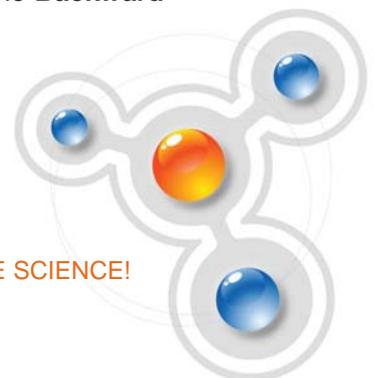### Connect to a Computer or to a TI Calculator

Press the **Forward arrow** button to connect to a computer or the **Backward arrow** button to connect to a TI calculator

Internal Clock and Calendar

The internal clock is set the first time you use the **Setup** command from the MultiLab software to program the MultiLogPRO. The clock is automatically updated to the computer's time and date whenever you connect your MultiLogPRO to a computer and perform Setup in MultiLab.

When you shut off the MultiLogPRO, the internal clock and calendar is not saved. To restore the clock and calendar, you must reconnect the MultiLogPRO to the computer and Setup the logger again.

Clear the Memory

If you want to start recording and the MultiLogPRO's internal memory is full you will see this message at the bottom of the display:

```
→    In–1:  Microphone
     In–2:  Light
     In–3:  Empty
     In–4:  Empty


     SAMPLES = 200
     DISPLAY = graphic
Mem full,  clear = ( > )
```

Press the **Forward** arrow button to clear the memory

In order to clear the MultiLogPRO's memory when it is not full, use the **Memory clear** command from the **Configuration** menu (see page 21), or clear the memory from the **Logger** menu in the **MultiLab software** (see page **Error! Bookmark not defined.**).

Choose the Right Setup

1. **Sampling rate** - The sampling rate should be determined by the frequency of the phenomenon being sampled. If the phenomenon is periodic, sample at a rate of at least twice the expected frequency. For example, sound recordings should be sampled at the highest sampling rate – 20,800/sec, but changes in room temperature can be measured at slower rates such as once per second or even slower, depending on the speed of the expected changes.
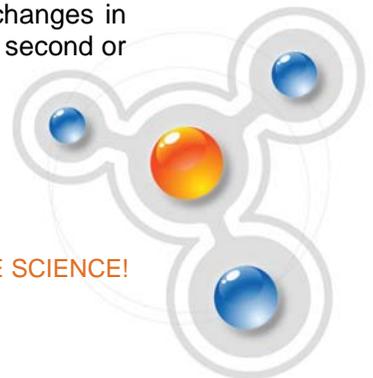
There is no such thing as over-sampling. For extremely smooth graphs, the sampling rate should be about 20 times the expected frequency.

> **Note:** Sampling at a rate slower than the expected rate can cause *frequency aliasing*. In such a case, the graph will show a frequency much lower than expected. In Figure 3 below, the higher frequency sine wave was sampled at 1/3 of its frequency. Connecting the sampled points yielded a graph with a lower, incorrect frequency.
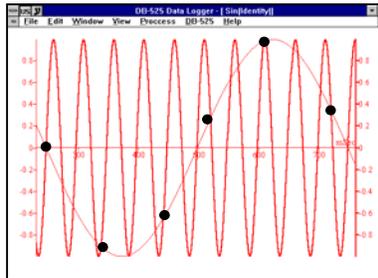

Figure 3: Frequency Aliasing

Manual sampling - use this mode for:

- Recordings or measurements that are not related to time.
- Situations in which you have to stop recording data after each sample obtained, in order to change your location, or any other logging parameter (**Note:** During the experiment *no changes* can be made to the MultiLogPRO's configuration).

To start an experiment using manual data logging, set the **RATE** to *manual* and press the **Enter** button once to start the data recording, then press the **Enter** button each time you want to collect a sample.

You can also perform manual logging via MultiLab (see page **Error! Bookmark not defined.**).

2. **Sampling Points -** After you have chosen the sampling rate, choosing the number of points will determine the logging period: Samples / Rate = Logging time. You can also choose the duration of an experiment first, and then calculate the number of samples: Samples = Logging time × Rate.

Continuous

In the Continuous mode, MultiLogPRO does not save data, and can continue logging indefinitely.
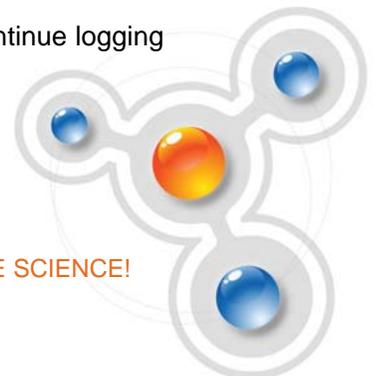
If MultiLogPRO is connected to the computer and the MultiLab software is running, the data is automatically saved to the computer and displayed in a real-time graph.

To operate in Continuous mode select **RATE** equal to or less than 100/s and **SAMPLES = Continuous**.

You can also select Continuous mode directly from the MultiLab software.

Note: MultiLogPRO must be set to a display mode other than graphic in order to enable the Continuous mode.

Programming Rules and Limitations

The following are some rules and limitations you must take into account when programming the MultiLogPRO, as MultiLogPRO integrates all programming limitations automatically. MultiLogPRO will only allow the programming of settings that comply with the rules below.

Sampling Points

- Increasing the number of active inputs limits the number of sampling points one can choose. The following condition must be always satisfied: Samples $\times$ Active Inputs < Memory. MultiLogPRO's memory is sufficient for 100,000 samples. However, when sampling at rates faster than 100 samples per second the memory can store only two experiments of 32,000 samples each.

- Selection of 100,000 sampling points will create 2 files of 50,000 points each in the data logger's memory

Sampling Rate

The number of sensors in use limits the maximum sampling rate:

Number of Sensors	Maximum Sampling Rate
1	20,800 samples per second
2	3,701 samples per second
3	2,631 samples per second
4	2,041 samples per second
5	1,667 samples per second
6	1,409 samples per second
7	1,220 samples per second
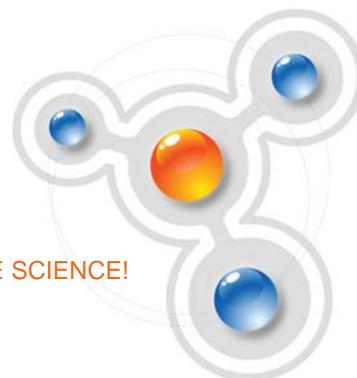
8	1,076 samples per second

Continuous Sampling

- Continuous sampling is possible up to a maximum sampling rate of 100/s.
- The data must be presented in a display mode other than graphical.

Sensor Calibration

In this section you will learn how to increase the MultiLogPRO system accuracy using calibration. Most of the sensors are linear, i.e. the output level of each sensor changes according to the equation:

$$Y = aX + b$$

Where:

Y - Output of the sensor (voltage level changing from 0 to 5V)

X - Sensor input

a - Sensor gain

b - Sensor offset

The calibration process allows us to control the offset, and in some cases even the gain, of a sensor. The MultiLogPRO system offers four types of calibration:

- Hardware offset calibration
- MultiLogPRO automatic zero calibration
- MultiLab *Sensor calibration*
- Factory calibration (no manual calibration required)

Hardware Offset Calibration

On some of the sensors there is a screw controlling the sensor offset. To calibrate the sensor, rotate this screw until the sensor shows the correct measured value (obtain the actual *correct value* from another source that is known to be accurate).

MultiLogPRO Automatic Zero Calibration

MultiLogPRO is able to automatically calibrate the sensor offset for all analog sensors accurately, quickly, and for every new experiment conducted.

The calibration method is very simple. Whenever you plug in a sensor, the data logger checks to see if the selected sensor measures a value within ±2% of its *zero value*. If so, MultiLogPRO sets that value as zero.

To enable this feature, make sure that the sensors are at their zero values when you plug them in. To ensure the most accurate zero value, follow these instructions for the following sensors:

- Shorten the Voltage sensor plugs
- Leave the Current sensor plugs open
- Cover the Light, Photo Gate, and Microphone sensors

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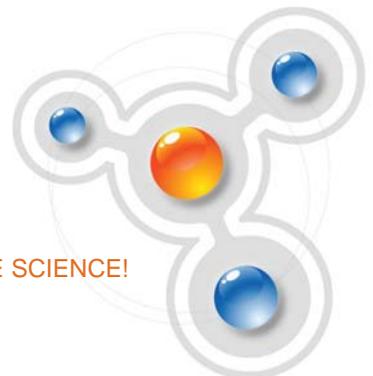
- Insert the pH sensor in a pH 7 solution
- Unload the Force Transducer
- Place the Accelerometer on a stationary surface
- Place the Temperature probes in ice water
- Place the Pressure sensor in a 1 ATM (1013 mb) chamber

pH Temperature Compensation

To compensate a pH sensor for temperature changes, plug the temperature sensor into Input 1, and the pH sensor in Input 2. MultiLogPRO will then display the compensated pH value.

DO_2 Calibration

To calibrate your DO_2 sensor with the right salinity and altitude parameters, use the **DO_2 Calibration** command from the **Configuration** menu (see page 21).

MultiLab Sensor Calibration

The sensors can also be calibrated using the **Calibrate Sensors** option in MultiLab's **Logger** menu. Please refer to section **Error! Reference source not found.** for more information.

Factory Calibration (No Calibration Required)

All digital sensors that are essentially timers leave the factory fully calibrated, and do not suffer from any accuracy degradation. An example of such a sensor is the Sonic Ranger distance sensor, which measures the time passed from the transmission of a sound pulse to its echo reception.

Chapter 2: Troubleshooting Guide

Symptom	Cause of Problem
I pressed the ON key on MultiLogPRO and it did not turn on.	- Try charging the battery, it may be weak. - You are using an unsuitable AC/DC adaptor (see page 5). - The internal 3V disk battery is dead.
MultiLab was unable to connect to MultiLogPRO.	- MultiLogPRO is turned off. - The communication cable is not connected properly. - The communication cable is not connected to the correct computer COM Port. - There is no available Serial COM Port. - The Logger USB driver was not installed.
I downloaded *unexpected* data from the MultiLogPRO.	There may be up to 100 experiments stored in the MultiLogPRO. Performing a Download means loading one of them in sequential order. You have probably loaded an old experiment accidentally. Try using **Selective download** from MultiLab (see page **Error! Bookmark not defined.**)
While running with an active trigger, MultiLogPRO does not complete the data logging.	The trigger condition has not been fulfilled.

	• The trigger condition was fulfilled, but the time period was too short (less than 300μS).
I started a new logging session and the data logger stopped immediately afterwards.	• First check if the sampling rate was so fast that the experiment began and ended in less than a second. If this is not the reason, recharge the 7.2 V battery of the MultiLogPRO and try again. MultiLogPRO monitors the battery power during the logging. If the battery voltage is less then 5V, the logging is stopped automatically.
MultiLogPRO's memory is empty – there are no stored files or experiment notes.	• The internal 3 V disk battery is dead. Replace the battery.

Technical Support:

Fourier Help Desk:
E-mail: support@fourieredu.com

Contact information:
1 866 771 6682 (toll-free from within USA only)
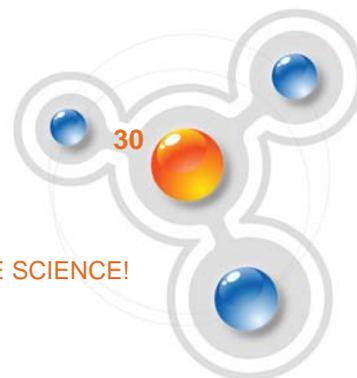1 708 478 5333
Hours of Operation:
Monday - Friday, 9AM to 5PM (UTC -06:00)

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Chapter 3: Specifications

The MultiLogPRO Data Logger

Input

    4 Mini-Din sensor port interface

    Auto ID mode:

        Any combination of digital and analog inputs, with maximum of 2 digital inputs and 4 analog inputs

        Automatic sensor identification across 4 inputs

    8 inputs mode:

        Any combination of digital and analog inputs, with maximum of 2 digital inputs and 8 analog inputs

Outputs

    RS-232 computer Host Interface at 19,200 bps

    USB 1.1 specification compliant

    4 Digital Control Outputs

Sampling

    Capacity: Up to 100,000 Samples

    Analog sampling rate: From one sample per hour to 20,800 samples per second
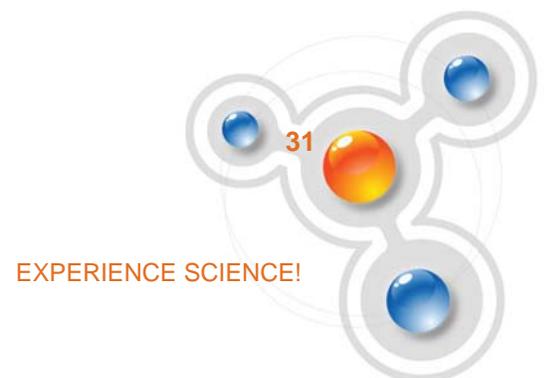
    Digital sampling rate: >200 kHz

Resolution

    12-bit (4096 Levels)

Timer Module

    Time velocity and acceleration

        Range: 0.0014 s to 6.5535 s

        Resolution: 0.1 mS

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Card width: 0 to 59 mm

Distance between gates: 0 to 99 cm

Stopwatch

Range: 0 to 99.99 s

Resolution: 10 mS

Man-machine Interface

- Full keypad operation enabling manual programming of the MultiLogPRO
- Graphic LCD
- Display uses: displaying the logger setup, displaying experiment instructions and notes and displaying the data measurements in graphs, meters, tables or digital display

Features

- Standalone operation - Working and sampling without connection to a computer.
- Automatic or manual sensor identification
- Saving and loading of last setup
- Automatic self-test that reports system status to the user including battery level in percentage of power remaining.
- Trigger: programmable or manual
- Automatic calibration of offset sensors
- Backup memory battery: 3V replaceable Lithium battery saving samples data for up to 10 years
- Automatic data recovery if there is a power failure
- Built in clock & calendar that keeps track of time and date for each data recording
- Built in battery charger for charging the 7.2V internal battery
- Automatic shut off after 15 minutes
- Screen contrast control
- Event recording
- 10 user defined sensors
- Online notes editing
- Post experiment graphical analysis

Power Supply

Fourier Systems Ltd.
16 Hamelacha St., POB 11681, Rosh Haʻayin 48091,
Tel: +972-3-901-4849, Fax: +972-3-901-4999
www.FourierEdu.com   EXPERIENCE SCIENCE!

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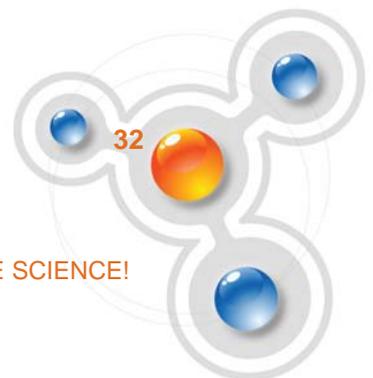
Internal rechargeable 7.2V NiCad battery or external 9V to 12V DC input
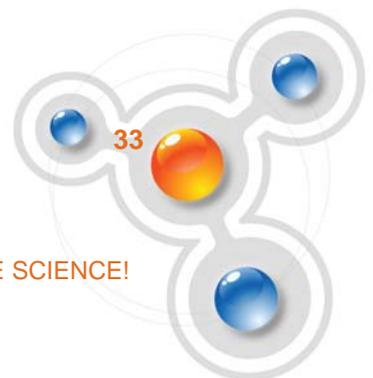Battery life: 750 mAH, 24 hours between charges

Operating temperature range: 0 to 50 °C

Dimensions: 182 x 100 x 28 mm

Weight: 450 gr

Standards compliance: CE, FCC

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