Data-Logger/51-C2 Kit
Quick Start Guide

Document Revision: 1.05

Date: 13 November 2012

BiPOM Electronics

WARRANTY:

TABLE OF CONTENTS

1. Overview

This document describes how to use the Data-Logger/51-C2 Kit for various data logging applications. Data-Logger/51-C2 Kit by BiPOM Electronics is a low-cost, yet powerful and flexible data acquisition and logging system. It supports multiple analog channels. The Data-Logger/51-C2 Kit is based on the MINI-MAX/51-C2 microcontroller board. The Data-Logger/51-C2 Kit can be customized for a variety of data logging applications. The complete application package for the Data-Logger/51-C2 Kit includes:

- MINI-MAX/51-C2 Microcontroller Board
- MMC-RTC-1 board
- DAQ-2543-DA1 board (11 analog channels, 12-bit ADC)
- 128 MB MMC (MultiMedia Card or SD Card, may be higher capacity based on availability)
- Open Source Software

MMC-RTC-1 board

This board is designed specifically for storage/data logger applications. A Multi Media Card (MMC) with high capacities up to 2GB can be installed on the built-in MMC socket. MMC-RTC-1 board also includes a DS1307 low power, battery-backed Clock/Calendar.

DAQ-2543-DA1 board

The DAQ-2543-DA1 board is an ADC/DAC peripheral board with TLC2543, 11-channel, 12-bit Analog-To-Digital Converter from Texas Instruments and a LTC1663, 10-bit Digital/Analog Converter from Linear Technology. All the channels are available on terminal blocks. The current version allows logging 11 analog signals from the DAQ-2543 board within 0V - 4V range along with timestamp. The logging period (how frequently a sample is taken) is programmable between 1 second and 65,535 seconds.

2. Hardware Setup

The individual boards that comprise the Data-Logger/51-C2 Kit are stacked together through the expansion connector (bus) of each board using plastic standoffs. The hardware implementation of the Data-Logger/51-C2 Kit is shown in the figure below:

- The MINI-MAX/51-C2 microcontroller board is the brain of the data logger and it is the bottom board of the Data-Logger/51-C2 Kit.
- The MMC-RTC-1 board is the middle board in the stack. This contains SD/MMC card and clock.
- The DAQ-2543-DA1 is the top board of the stack and contains the analog to digital converter.
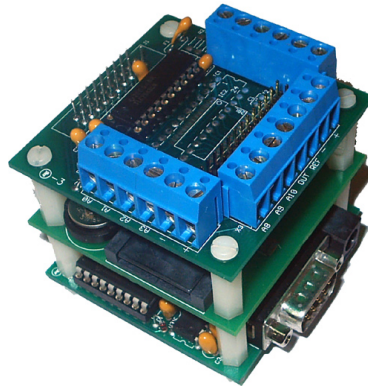
- Connect one end of the RS232 serial cable to an available serial port (usually COM1) on the PC.
- Connect the other end of the serial cable (RS-232) to the Data Logger serial port.
- The MINI-MAX/51-C2 uses a 6V DC power adapter. The adapter is connected to the power jack of Data Logger.
- Current consumption of Data-Logger/51-C2 Kit is under 50mA. The data logger can be operated from a battery instead of a power adapter.

5

3. Software Setup

At first you should download Data-Logger/51-C2 Kit Software from BiPOM web:

http://www.bipom.com/files/data_logger.exe

When you downloaded this file then run it.

You will see **Welcome** window of DataLogger setup. Click **Next** button to continue.

The next window will ask you for **Destination Folder**. You can select desired destination folder. When you entered **Destination Folder** path then click **Next** button.
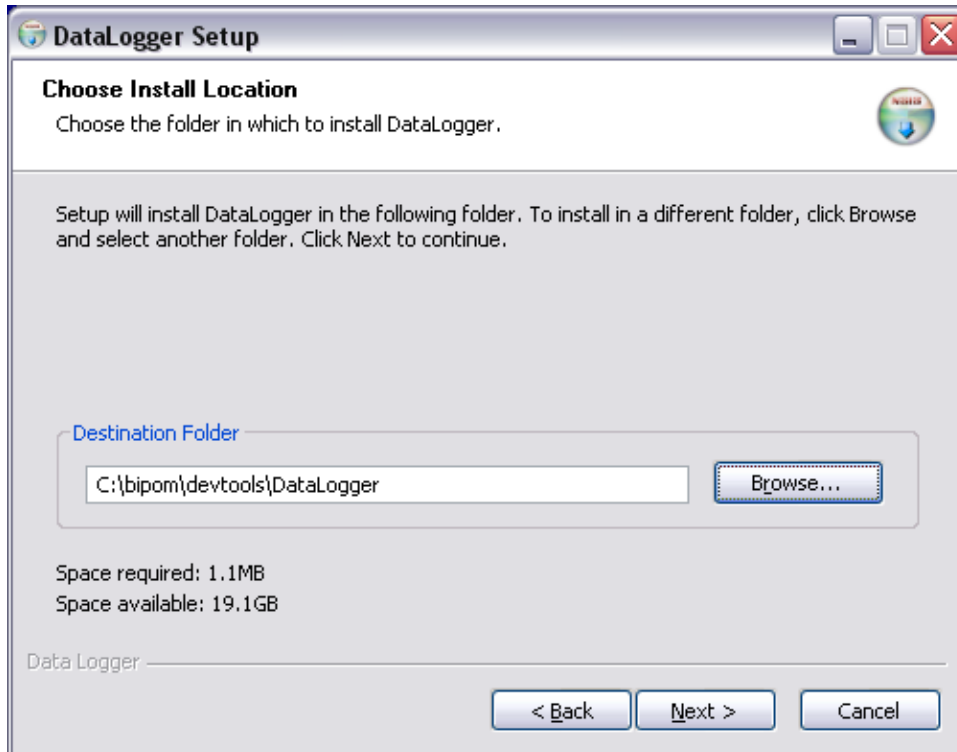
Next window will ask you for Start Menu Folder name. Enter desired name (or leave it as is) and click **Install** button.
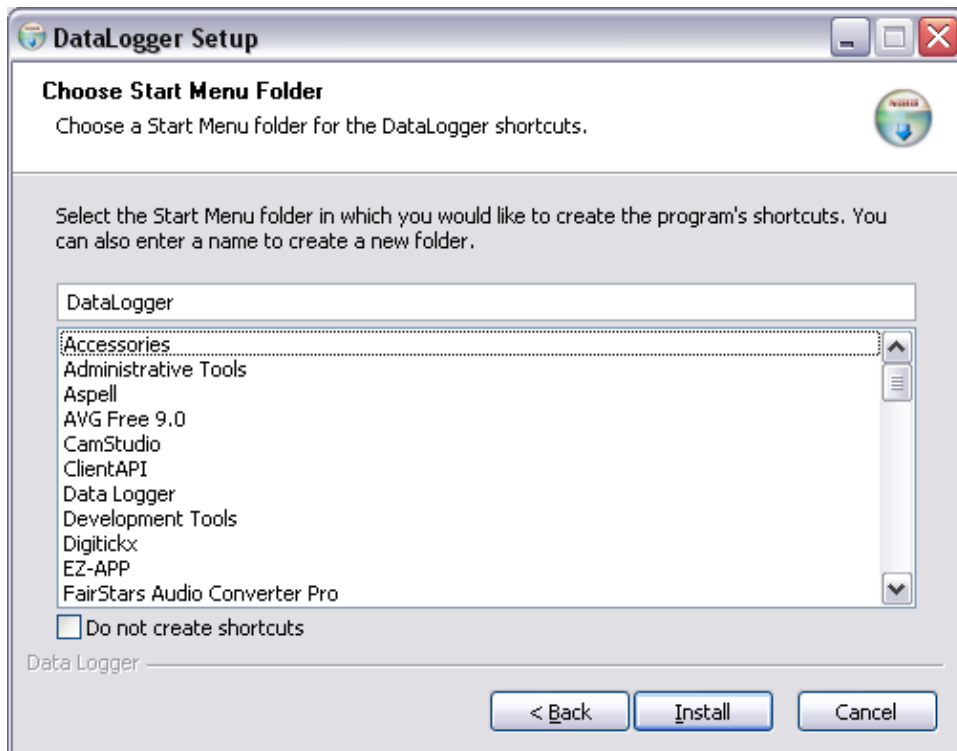
After this all Data Logger software files will be installed to your PC.
Click **Close** button on last window to close installation program.
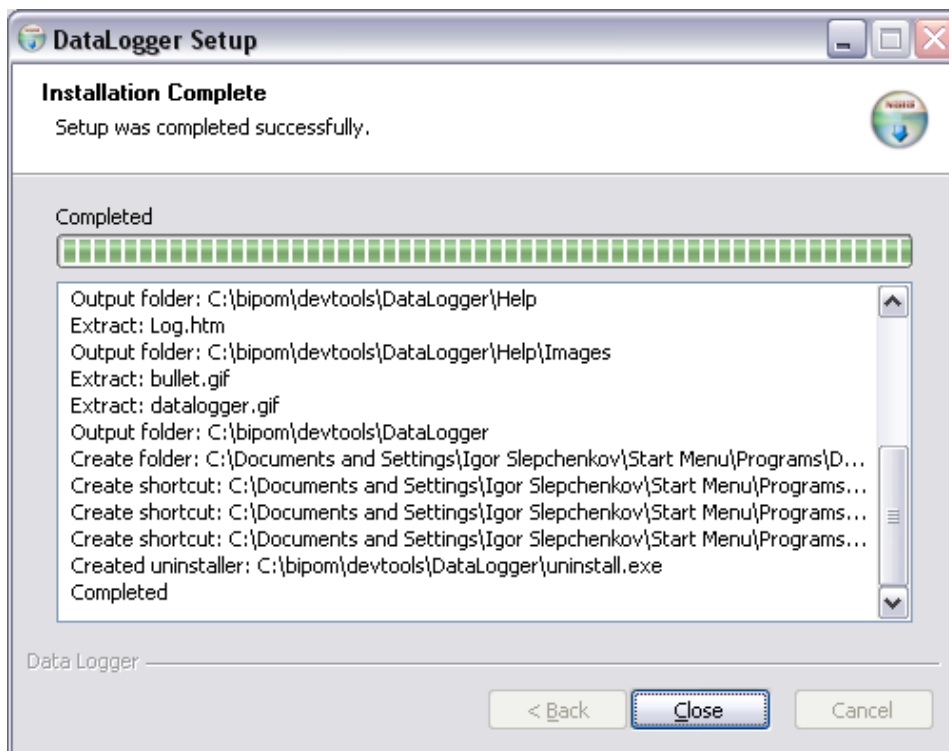
When DataLogger software is installed you can run it from Windows **Start** menu.

Start à All Programs à DataLogger à Data Logger

Please see **4. Using Data Logger Software** section for more information how to work with software.

4. Using Data Logger Software

A Windows application called **Log.exe** is the graphical user interface to the Data-Logger/51-C2 Kit. The voltage range applied to the logger is 0 – 4Volts. All the Analog channels are grounded except for Analog channel 0. If none of the channels are grounded then the logger will show some floating values at each channel. In order to obtain the precise value at either of the channel, apply 0 – 4Volts at the desired channel and ground the rest of the channels. The "Record" values are independent of the values at the channel.

In order to run **Log.exe** please to go to main Windows menu:

Start à All Programs à Data Logger à Data Logger

This command will start Log.exe software.

Apply a known voltage to one of the channels of Data Logger and you should see the voltage reading for that channel in Log.exe software. For example, the voltage applied at **Channel 1** is around **1.059 Volts** and the result is as shown:
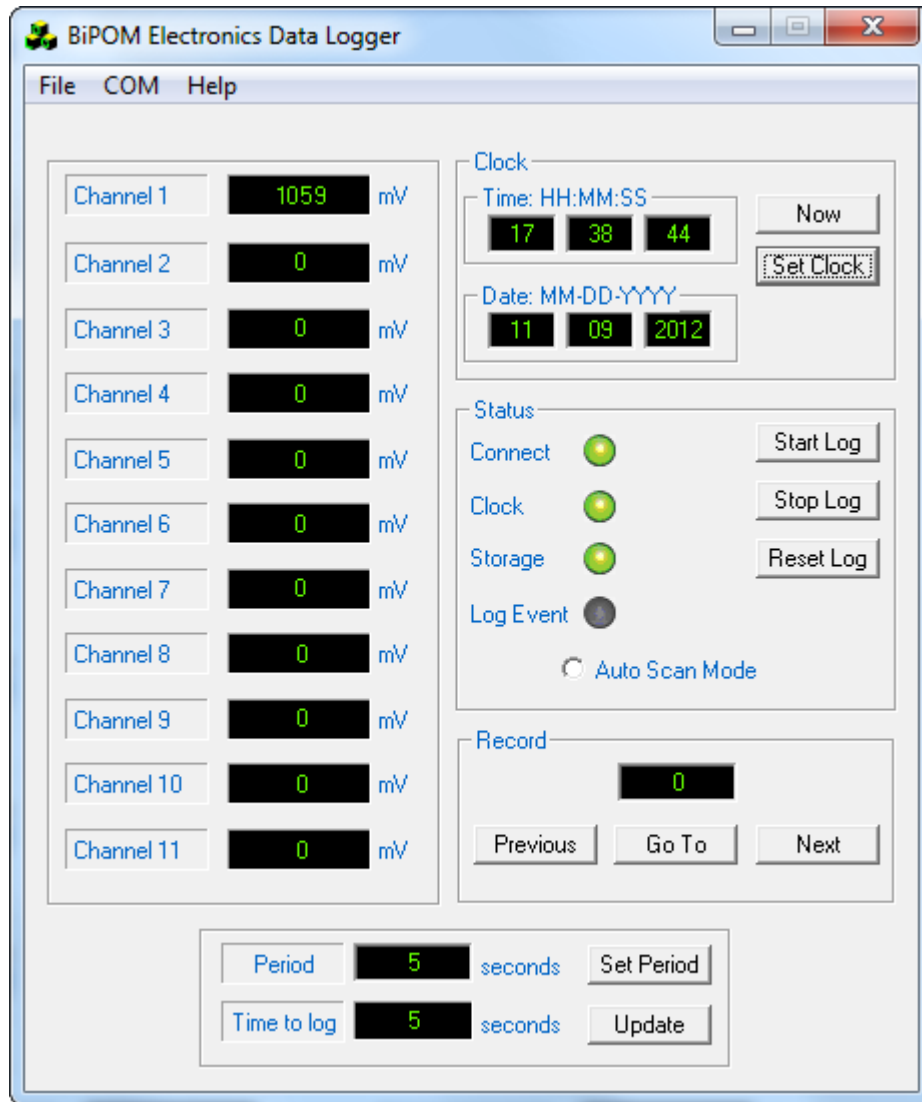
The voltage applied at **Channel 1** is around **4.076 Volts** and the result is as shown. As mentioned earlier the values at the channel will be independent of the values in "Record", "Counter" and "Period" fields.
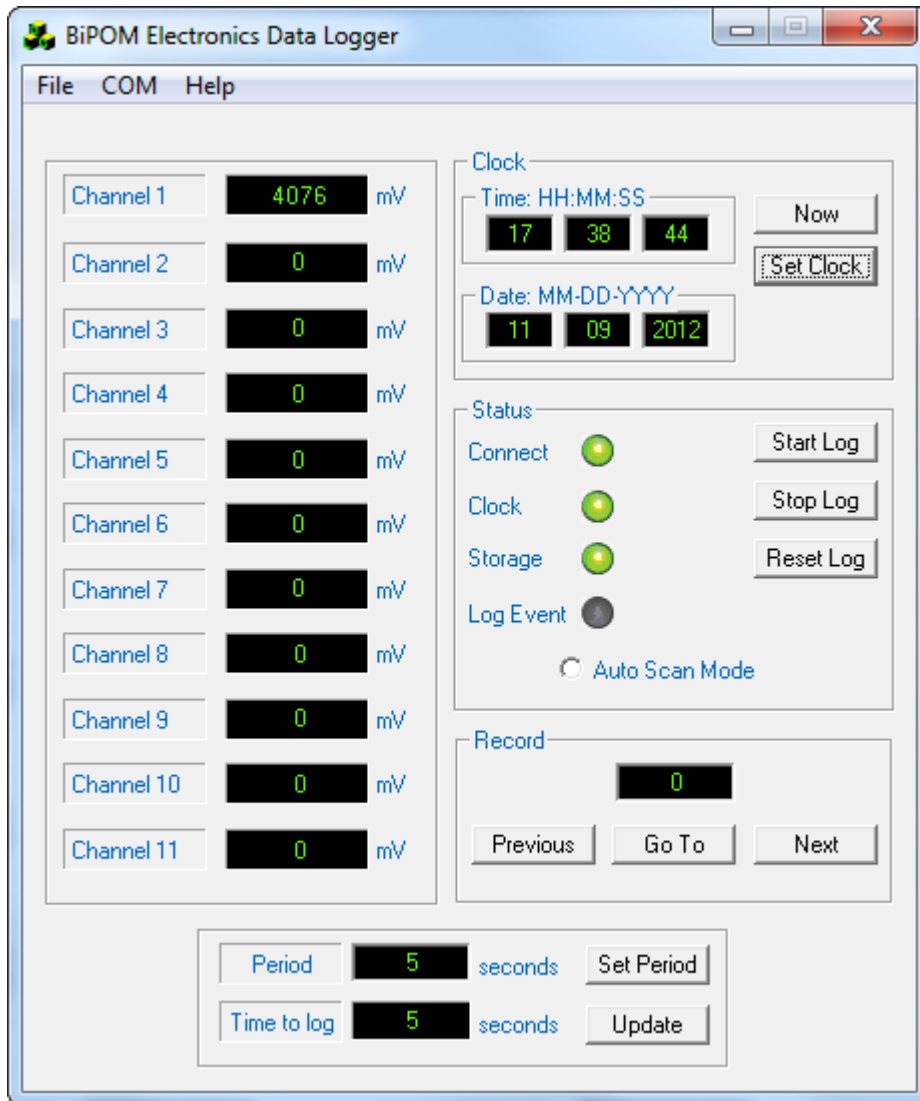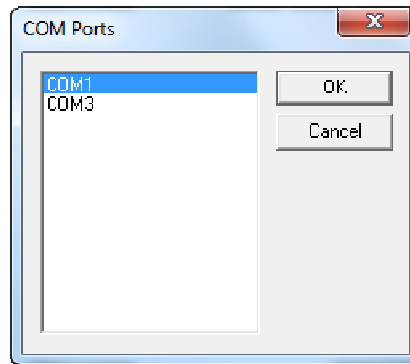
Initial configuration:

As first step you should select correct serial port where Data Logger hardware is connected. By default Data Logger try to use COM1. But this can be not correct if you use another port.
To change serial port go to menu **COM à Select COM Port…**
The dialog will appear

The list will include all available COM ports on your PC. Select correct one and click **OK** button. If you don't want change port then click **Cancel**. Software immediately opens new port and use it for communication.

In order to get the desired voltage at any one of the channels, follow the steps below:

- If you look at the above screenshot of the Log software, it shows voltage at analog channel 0 of DAQ2543; the voltage is applied at channel 0 and rests all the channels are grounded. Thus, one can apply 0-4 V at any of the channels that are required to be used and the channels are not required could be grounded.

- When the Log software file is opened for the first time, set the time. Click mouse inside black edit box in **Time: HH:MM:SS** section in top left corner of window. The first edit box set **Hours** (valid range is 0-23). Second edit box set **Minutes** (valid range is 0-59). The third edit box set **Seconds** (valid range is 0-59). Then enter date. Enter three numbers in **Date MM-DD-YYYY** section. The first edit box set **Month** (valid range is 1-12). Second edit box set **Day** (valid range is 1-31). The third edit box set **Year** (valid range is 2000-2099). You can fill all Date/Time boxes with current date / time just click **Now** button. Then click **Set RTC** and Log software will write entered values to the Data Logger RTC. For example on the screenshot above the time is **15:10:35** and date is **7 April 2010**. Once the clock is set, it keeps ticking even when power to the Data-Logger/51-C2 Kit is lost because the clock is battery backed.

- Next click **Reset Log** in order to reset any previous data logged. This is not a requirement but should be done in order to get the precise reading on the channels in the application.

- Set logging period. Enter number of seconds into field **Period** on main window and click **Set Period** button. The allowed range is from 1 second to 65565 seconds. It is time after which next record will be written to storage.

- Apply 0-4V at any of the channels, grounding the rest of the channels. Click **Start Log**, enter '0' in the **Record** field and click **Update** or **Next**. This will show the output voltage on the channels the voltage is being applied to.

Note: In any case, if a problem occurs, restart the log.exe utility, disconnect the power to the board and reconnect the power.

Data Logger Modes:

The data logger software can work in two modes – standard and Auto Scan mode.

Standard mode

In this mode software doesn't watch the data logger hardware. You can start / stop logger, you can set clock on the board and read logged records with **Previous**, **Next** and **Go To** buttons.
Also if logger is started you will see **Log Event** yellow LED activity when next record is written to the storage.
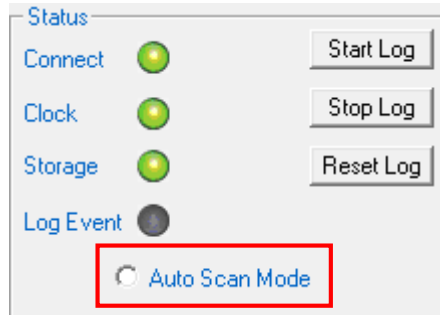
Auto Scan Mode

In this mode software watching data logger hardware and show following information:

- Number of current record in **Record** field
- Time to next record will be logged in **Time to log** field
- **Log Event** LED will be on when next record is logged

You can start/stop/reset log in this mode.

You can enable this mode clicking **Auto Scan Mode** radio button on main window.

Saving Logged Data to PC:

In order to save the logged data, you can use commands from **File** menu.

File menu has the following commands:

**Save As …**   - Saves all selected records to file in **text** format.
Save Records - Saves all selected records to file in **packet** format.

In order to select range of records to save, enter number of records in the **Record** field (or just leave it as is if it already contains the correct record number).
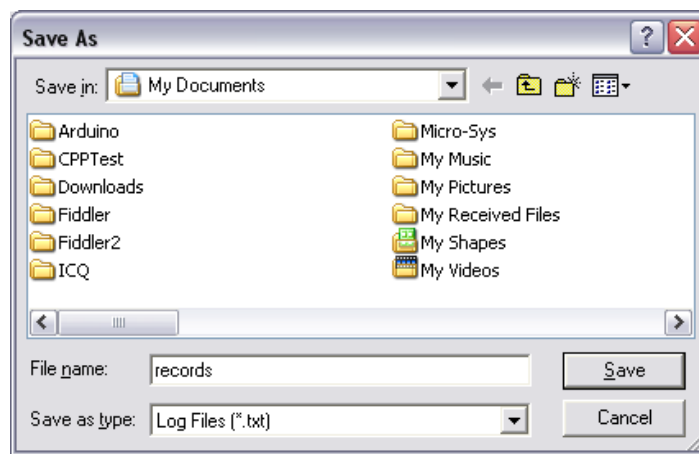
The next screenshot shows how to save the first 1000 records:
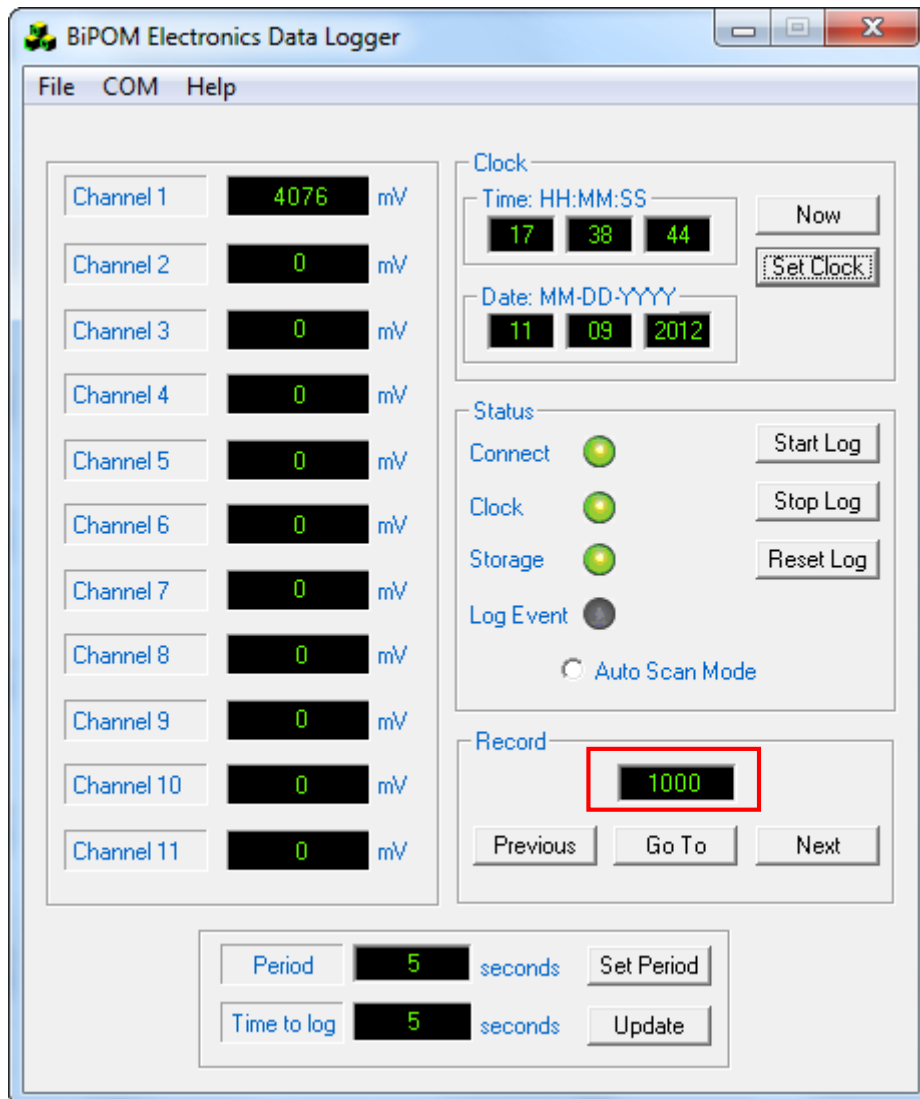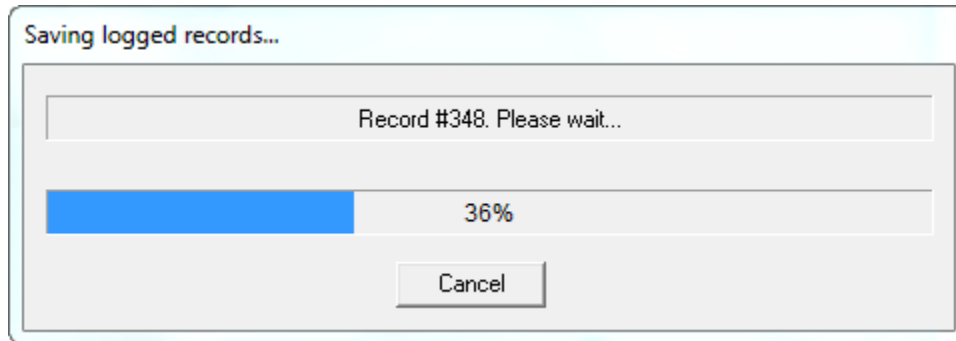
After entering the number of records to save, go to **File** menu and select either **Save As** or **Save Records**. The following message window appears:
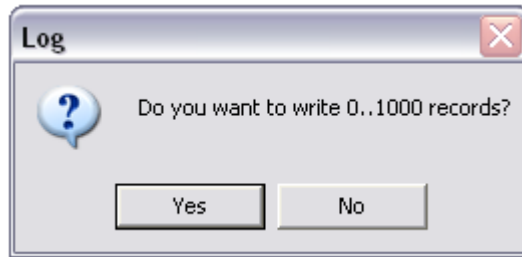
Click **Yes**. Select the filename to use:

Type file name and click **Save**. The records will be saved to file. The process will be shown on progress dialog like below:


You can click **Cancel** button to stop process. In this case the target file, which you selected on previous step, will be deleted.

NOTE: the actual record on data logger storage will not be deleted. You can import them later if need. **Cancel** button only stop saving data to file on PC. It doesn't do anything with data stored on hardware.

No Connection Error States

If you see red blinking Connect LED this means that software cannot get reply from Data Logger board.
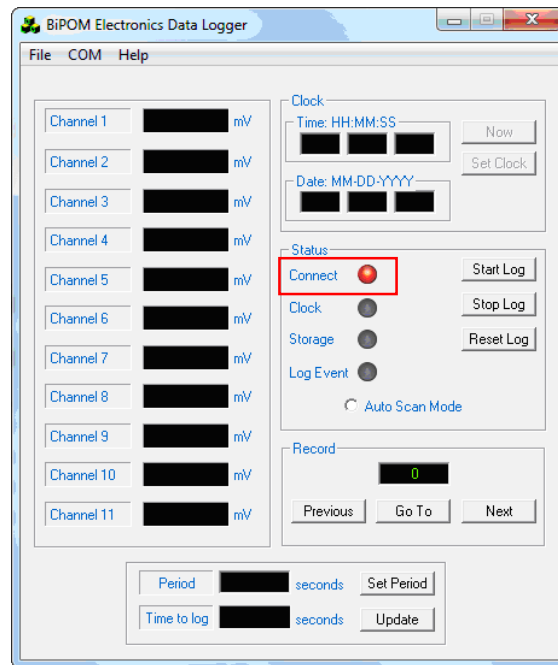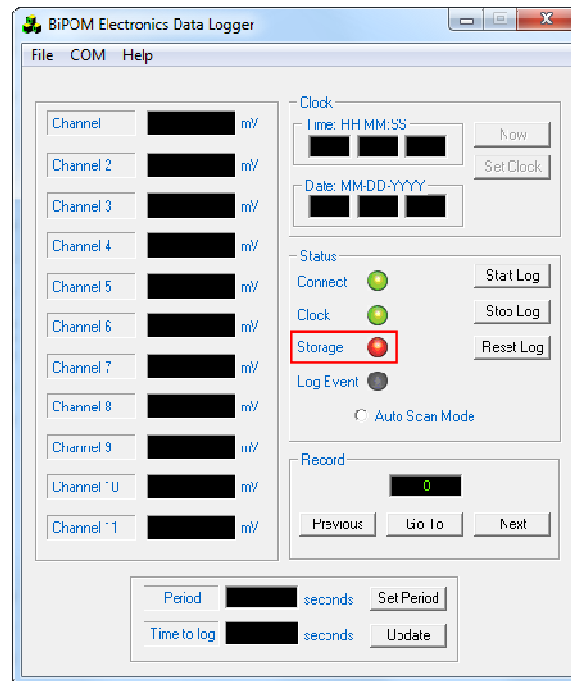

Possible reasons:

- Data Logger board is not powered on

- Data Logger board is not properly connected to PC

- Wrong serial port selected in software

- Serial port is already opened by another program. The most possible case when you download latest Log firmware to the board and leave port opened in Micro-IDE

- Serial cable is broken

Date Storage Error State

If you see red blinking Storage LED this means that firmware reported about problem with accessing SD/MMC card.
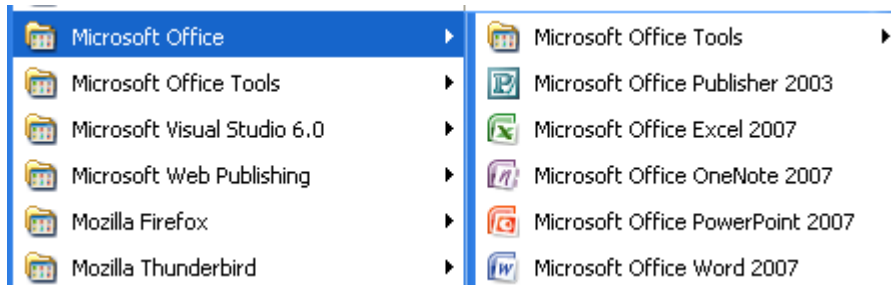

Possible reasons:

- SD/MMC card is not inserted

- SD/MMC card is broken

- In rear cases SD/MMC card has previously stored data which detected as corrupted data format by logger firmware. In this case you can try to format SD/MMC card on PC before use with Data logger
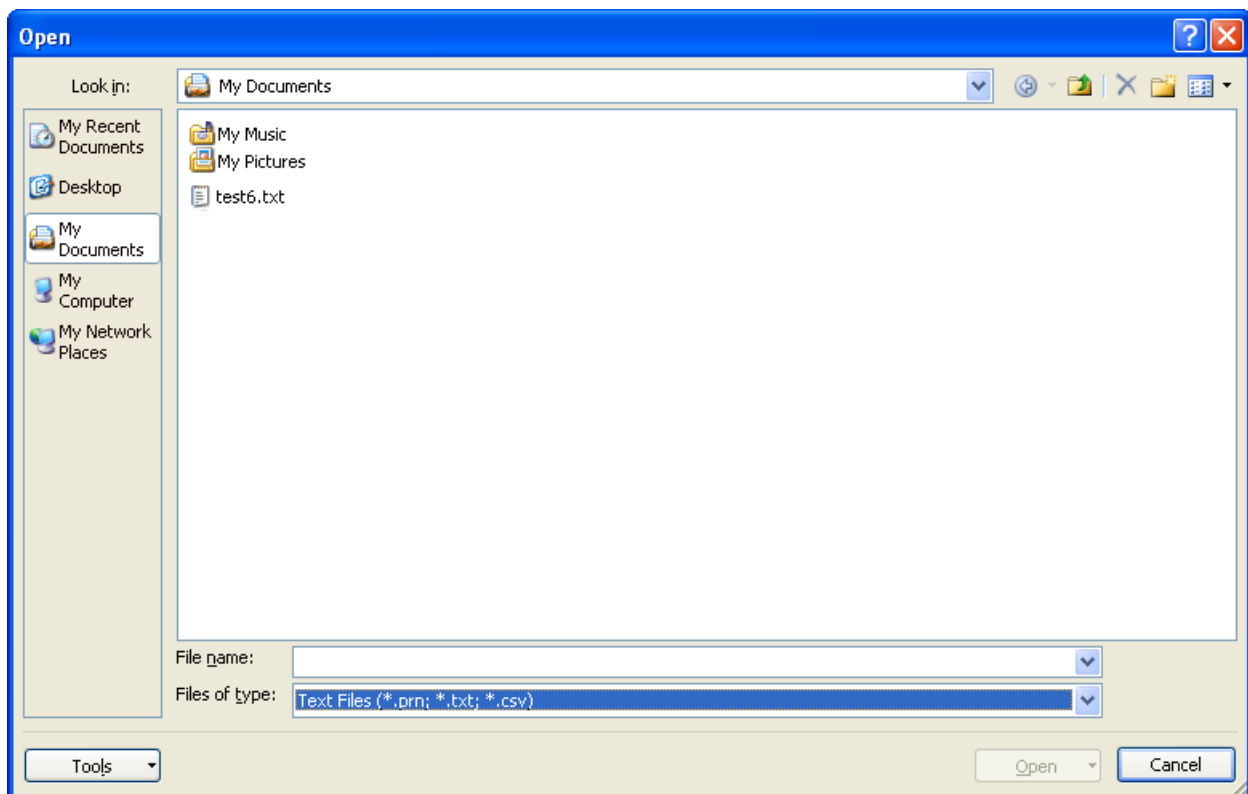
5. Viewing Data Records Using Excel

These instructions apply to Excel 2007 but the instructions are similar for other versions of Excel.
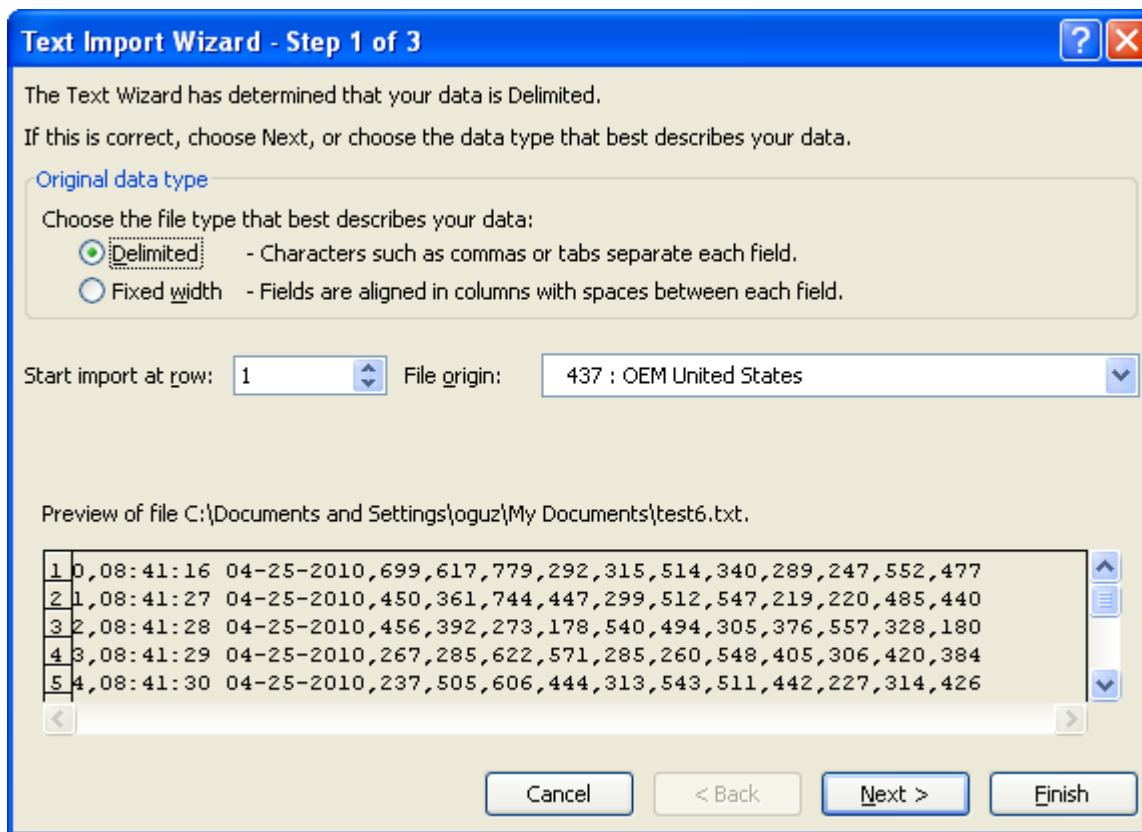
Start **Excel 2007** from *Startà Programs*:

Microsoft Office	▶	Microsoft Office Tools	▶
Microsoft Office Tools	▶	Microsoft Office Publisher 2003	
Microsoft Visual Studio 6.0	▶	Microsoft Office Excel 2007	
Microsoft Web Publishing	▶	Microsoft Office OneNote 2007	
Mozilla Firefox	▶	Microsoft Office PowerPoint 2007	
Mozilla Thunderbird	▶	Microsoft Office Word 2007	

Open File

Select Files of type: `Text Files ( *.prn, *.txt, *.csv )` and open the log file (a text file) that was generated by **Data Logger**.

18

Select **Delimited** as the separator option:

Click **Next**.

Checkmark **Comma** as the delimiter :

Click **Next**.

Click on the second column that shows timestamps:

Text Import Wizard - Step 3 of 3

This screen lets you select each column and set the Data Format.

Column data format

- ⦿ General
- ○ Text
- ○ Date: MDY
- ○ Do not import column (skip)

'General' converts numeric values to numbers, date values to dates, and all remaining values to text.

Advanced...

Data preview

Gener	General		Gener	Gener	Gener	Gener	Gener	Gener	Gener	Gener	Gener	Gener
0	08:41:16 04-25-2010		699	617	779	292	315	514	340	289	247	552
1	08:41:27 04-25-2010		450	361	744	447	299	512	547	219	220	485
2	08:41:28 04-25-2010		456	392	273	178	540	494	305	376	557	328
3	08:41:29 04-25-2010		267	285	622	571	285	260	548	405	306	420
4	08:41:30 04-25-2010		237	505	606	444	313	543	511	442	227	314

Cancel   < Back   Next >   Finish

Click the radio button that says **Date:**
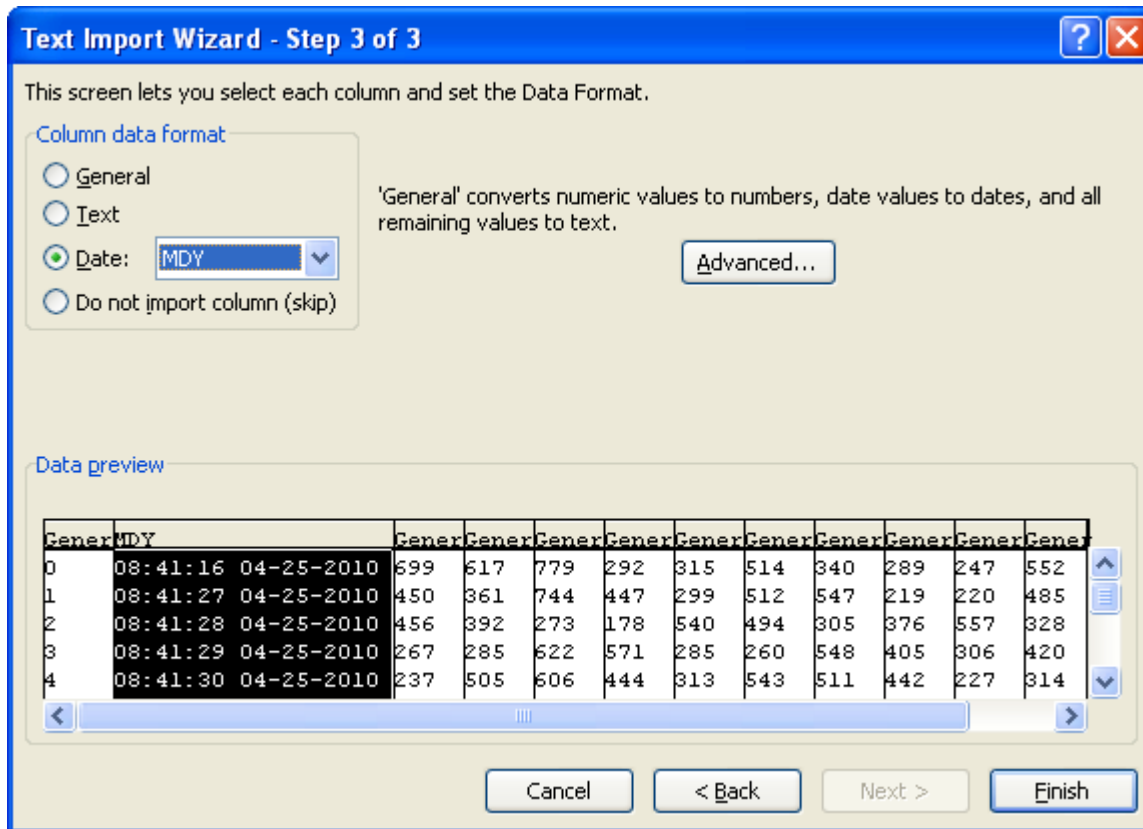
Click **Finish**.

You should now see all the values from the log file in **Excel**:

Click on a column header on any of the columns that have the channel values:

Select **Insert** tab, click the **Line** button in the charts area and select the **2-D Line** chart:
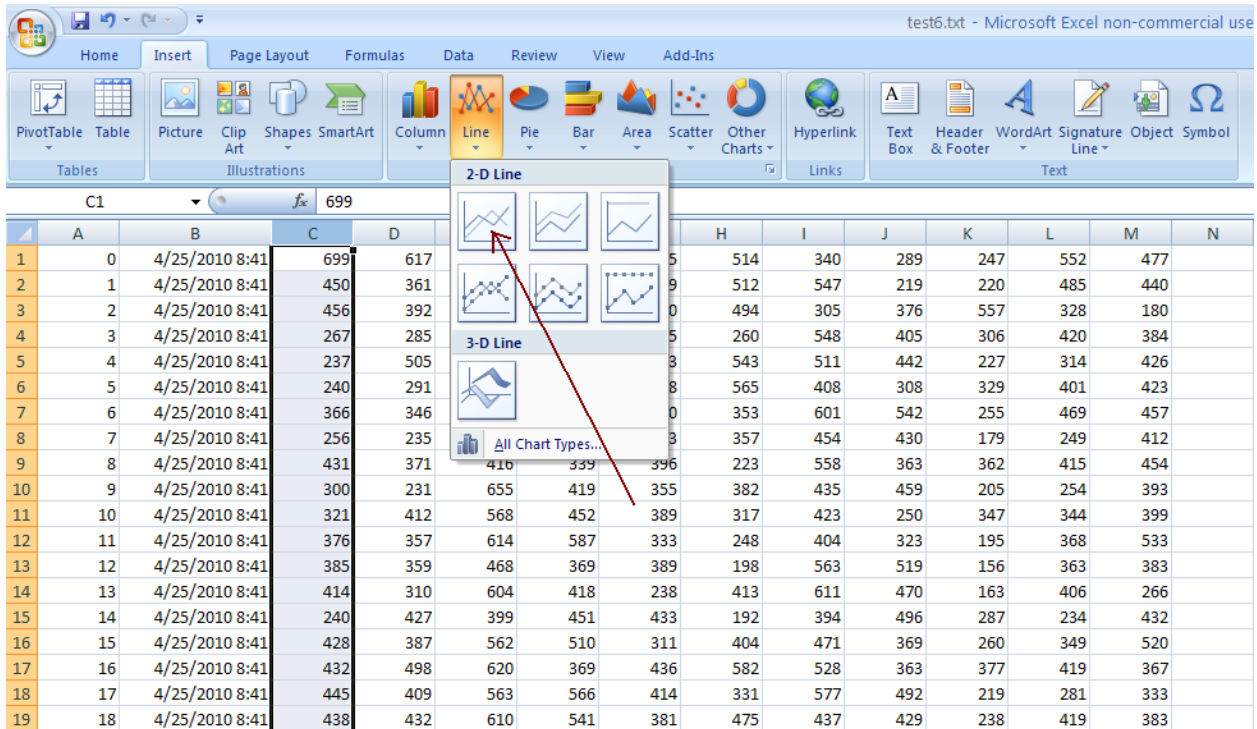
You will see the data plotted:
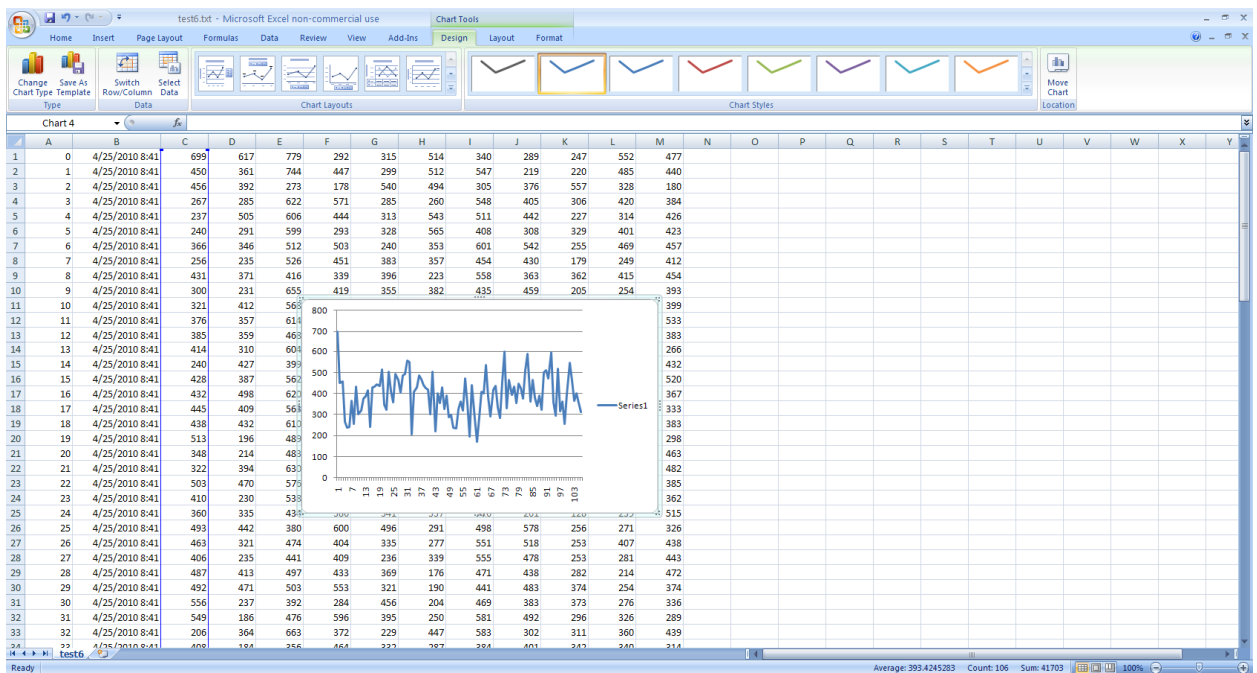
6. Data Logger Record Structure

Text format description:

Each record is written on a separate line. The line has the following format:

`RecordNumber,Hour:Minute:Second Month-Day-Year,Channel1,…,Channel11<LF><CR>`

`RecordNumber`	Number of record
`Hour:Minute:Second`	Time when this record was logged
`Month-Day-Year`	Date when this record was logged
`Channel1,…,Channel11`	Data for each of 11 channels

Example:

0,10:20:32 11-17-2009,2095,3010,0,0,0,0,0,0,0,0,0
1,10:20:33 11-17-2009,2095,3012,0,0,0,0,0,0,0,0,0
2,10:20:34 11-17-2009,2095,3034,0,0,0,0,0,0,0,0,0
3,BAD:BAD:BAD BAD-BAD-BAD,BAD,BAD,BAD,BAD,BAD,BAD,BAD,BAD,BAD,BAD

Note: Record #3 has **BAD** instead of values. This means that this record was not read from Data Logger correctly (some error occurred or the record was not logged).

Packet format description:

Each record is written on a separate line. The line has following format:

Record = RECORD_NUMBER ec = ERROR_CODE ERROR_DESCRIPTION<LF><CR>
        BINARY_DATA<LF><CR>

RECORD_NUMBER   - record number (decimal number)

ERROR_CODE   - error code (decimal number)

ERROR_DESCRIPTION - text description of the error of last operation. This can be one of following:

OK
Record was read successfully.

LOG CHECKSUM
Checksum of LOG data is incorrect.

REPLY
Wrong command in reply. Data may be corrupted.

STATUS
Reply packet is correct but Data Logger hardware was not able to read the record.

PACKET CHECKSUM
Checksum of reply packet is wrong.

COMMUNICATION
Error when reading/writing data through the communication port (COM port is not opened, not initialized or timeout).

BINARY_DATA - ASCII string which represents each byte of reply packet from data logger as a HEX byte value. Each reply packet has 34 bytes in binary packet:

Byte	Description
1	Always is 8
2	Should be 0 if record was read successfully or 1 if some error occurred
3-34	32 byte Log Record

The following table describes the 32-byte Log Record Structure:

Byte	Description
0	Channel 0 Reading High Byte
1	Channel 0 Reading Low Byte
2	Channel 1 Reading High Byte
3	Channel 1 Reading Low Byte
4	Channel 2 Reading High Byte
5	Channel 2 Reading Low Byte
6	Channel 3 Reading High Byte
7	Channel 3 Reading Low Byte
8	Channel 4 Reading High Byte
9	Channel 4 Reading Low Byte
10	Channel 5 Reading High Byte
11	Channel 5 Reading Low Byte
12	Channel 6 Reading High Byte
13	Channel 6 Reading Low Byte
14	Channel 7 Reading High Byte
15	Channel 7 Reading Low Byte
16	Channel 8 Reading High Byte
17	Channel 8 Reading Low Byte
18	Channel 9 Reading High Byte
19	Channel 9 Reading Low Byte
20	Channel 10 Reading High Byte
21	Channel 10 Reading Low Byte
22	Seconds (0 to 59)
23	Minutes (0 to 59)
24	Hours (0 to 23)
25	Month (1 to 12)
26	Day (1 to 31)
27	Year (e.g. 2010 is 10)
28	Current Address Low Byte
29	Current Address Middle Byte
30	Current Address High Byte
31	Checksum (sum of all bytes)

NOTE: In order to calculate Record Number from 3 bytes you should use following formula:

`REC_NUMBER = BYTE33 * 65536 + BYTE32 * 256 + BYTE31 / 32`

NOTE: In order to calculate correct channel value from 2 bytes you should use following formula:

```
CHANNEL_VALUE_01 = BYTE3 * 256 + BYTE4
CHANNEL_VALUE_02 = BYTE5 * 256 + BYTE6
CHANNEL_VALUE_03 = BYTE7 * 256 + BYTE8
CHANNEL_VALUE_04 = BYTE9 * 256 + BYTE10
CHANNEL_VALUE_05 = BYTE11 * 256 + BYTE12
CHANNEL_VALUE_06 = BYTE13 * 256 + BYTE14
CHANNEL_VALUE_07 = BYTE15 * 256 + BYTE16
CHANNEL_VALUE_08 = BYTE17 * 256 + BYTE18
CHANNEL_VALUE_09 = BYTE19 * 256 + BYTE20
CHANNEL_VALUE_10 = BYTE21 * 256 + BYTE22
CHANNEL_VALUE_11 = BYTE23 * 256 + BYTE24
```

Example:

```
Record = 0 ec = 0  *OK*
 08 00 01 02 03 01 02 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
01 02 03 01 02 03 00 00 00
Record = 1 ec = 0  *OK*
 08 00 01 02 03 01 02 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
01 02 03 01 02 03 00 00 32
Record = 2 ec = 0  *OK*
 08 00 01 02 03 01 02 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
01 02 03 01 02 03 00 00 64
Record = 3 ec = 5019  *STATUS*
 08 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00
```