Chroma

Thermal / Multi-function Data Logger

51101-1

User's Manual

Thermal/Multi-function Data Logger
51101-1
User's Manual

Version 1.0
June 2012

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This warranty does not apply to any products repaired or altered by persons not authorized by Chroma, or not in accordance with instructions furnished by Chroma. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, repairs will be billed at cost.

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Material Contents Declaration

The recycling label shown on the product indicates the Hazardous Substances contained in the product as the table listed below.

: See **<Table 1>**.

: See **<Table 2>**.

<Table 1>

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
PCBA	O	O	O	O	O	O
CHASSIS	O	O	O	O	O	O
ACCESSORY	O	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

“O” indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

“×” indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.

<Table 2>

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
PCBA	×	O	O	O	O	O
CHASSIS	×	O	O	O	O	O
ACCESSORY	×	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

"O" indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

"×" indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

1. Chroma is not fully transitioned to lead-free solder assembly at this moment; however, most of the components used are RoHS compliant.
2. The environment-friendly usage period of the product is assumed under the operating environment specified in each product's specification.

Disposal

Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.

CE

SPORTON LAB.

Certificate No: CB10104042

Report No.: EC232610

CERTIFICATE

- **EQUIPMENT: 1-Channel Data Logger**
  MODEL NO. : 51101-1
  APPLICANT : CHROMA ATE INC.
  66 Hwaya 1st Rd., Kueishan Hwaya Technology Park,
  Taoyuan County 33383, Taiwan

SPORTON LAB.

I HEREBY CERTIFY THAT:

THE MEASUREMENTS SHOWN IN THIS TEST REPORT WERE MADE IN ACCORDANCE WITH THE PROCEDURES GIVEN IN **EUROPEAN COUNCIL DIRECTIVE 2004/108/EC.** THE EQUIPMENT WAS **PASSED** THE TEST PERFORMED ACCORDING TO
European Standard EN 61326-1:2006,
(EN 55011: 2009/A1:2010 Class A,
EN 61000-3-2:2006/A2:2009, EN 61000-3-3:2008,
IEC 61000-4-2:2008, IEC 61000-4-3:2006/A1:2007/A2:2010, IEC 61000-4-4:2004/A1:2010, IEC 61000-4-5:2005, IEC 61000-4-6:2008, IEC 61000-4-8:2009, IEC 61000-4-11:2004).
THE TEST WAS CARRIED OUT ON **Mar. 30, 2012 ~ Apr. 06, 2012** AT **SPORTON INTERNATIONAL INC.** LAB.

Jordan Hsiao

Jordan Hsiao

SPORTON INTERNATIONAL INC. No.8, Lane 724, Bo Ai Street, Zhubei City, Hsinchu County 302, Taiwan, R.O.C.

Safety Summary

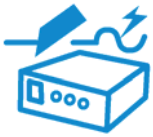
The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the instrument. *Chroma* assumes no liability for the customer's failure to comply with these requirements.

BEFORE APPLYING POWER

Verify that the power is set to match the rated input of this power supply.

PROTECTIVE GROUNDING

Make sure to connect the protective grounding to prevent an electric shock before turning on the power.



NECESSITY OF PROTECTIVE GROUNDING

Never cut off the internal or external protective grounding wire, or disconnect the wiring of protective grounding terminal. Doing so will cause a potential shock hazard that may bring injury to a person.

FUSES

Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. The instrument should be used in an environment of good ventilation.

DO NOT REMOVE THE COVER OF THE INSTRUMENT

Operating personnel must not remove the cover of the instrument. Component replacement and internal adjustment can be done only by qualified service personnel.

Safety Symbols

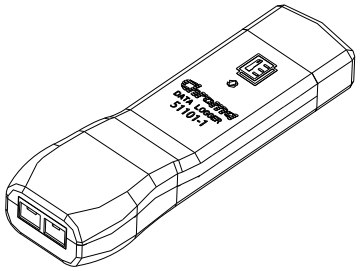
	DANGER – High voltage.
	Explanation: To avoid injury, death of personnel, or damage to the instrument, the operator must refer to an explanation in the instruction manual.
	High temperature: This symbol indicates the temperature is now higher than the acceptable range of human. Do not touch it to avoid any personal injury.
	Protective grounding terminal: To protect against electrical shock in case of a fault. This symbol indicates that the terminal must be connected to ground before operation of equipment.
WARNING	The **WARNING** sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** sign until the indicated conditions are fully understood and met.
CAUTION	The **CAUTION** sign denotes a hazard. It may result in personal injury or death if not noticed timely. It calls attention to procedures, practices and conditions.
Notice	This indicates important information or tips for the procedures and applications, etc. The contents should be read carefully.

Inspection and Examination

Before the instrument exit the factory, we have a series of inspection and measurement on mechanical and electrical characteristics. Make sure its function of operating for the quality warranty of the product. As soon as the instrument is unpacked, inspect for any damage that may have occurred in transit. Save all packing materials in case that the instrument has to be returned. If damage is found, please file claim with carrier immediately. Do not return the instrument to Chroma without prior approval.

Standard Package

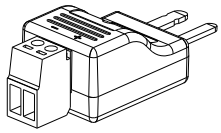
Standard Equipment



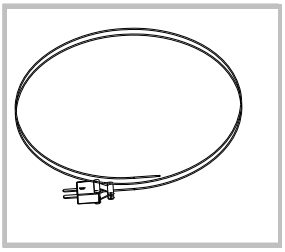
Main unit

User's Manual CD-ROM

Standard Equipment (Cable)



■ Voltage adapter
VA-480 x 1



■ Thermocouple wire
K type 1 m x 1

Note When additional item is required, just inform Chroma the item name.

Storage, Freight & Maintenance

Storage
When don't use the device, please pack it properly and store under a good environment. (The packing is no needed when the device under appropriate environment.)

Freight
Please use the original packing material when move the device. If the packing material is missing, please use the equivalent buffer material to pack and mark it fragile and waterproof etc to avoid the device damage during movement. The device belongs to precise equipment, please use-qualified transportation as possible. And avoid heavy hitting etc to damage the device.

Maintenance
The device is without any maintenance operation for the general user. (Except for the notice in the manual.) Please contact our company or agent when the device occurred the user judgment abnormal. Don't maintain by yourself to avoid occurred unnecessary danger and serious damage to the device.

Revision History

The following lists the additions, deletions and modifications in this manual at each revision.

Date	Version	Revised Sections
Jun. 2012	1.0	Complete this manual.

Table of Contents

1. Installation 1-1
1.1 Basic Structure 1-1
1.2 Temperature, Voltage and Current Measurement 1-3
1.3 LED Display 1-4
1.4 Initial Inspection 1-4
2. Program Operation 2-1
2.1 Installing Program 2-1
2.2 Executing Program 2-2
2.3 Communication Setup 2-2
2.4 Data Display 2-4
2.5 File Selection 2-7
2.6 Setting Selection 2-10
2.7 Unit Selection 2-11
2.8 About Selection 2-11
2.9 Graph Record 2-11
2.10 Measurement Selection 2-16
3. Communication Protocol 3-1
3.1 Sequence Communication Structure 3-1
3.2 Packet Format 3-1
3.3 Information Code & Definition 3-3
3.4 Example 3-4
3.5 Dynamic Link Library 3-5
3.6 TDL Recall Method 3-9
Appendix A A-1
A.1 Dimension A-1
A.2 Product Specification A-1
A.3 Measurement Range and Accuracy A-3

1. Installation

Chroma 51101-1 Thermal/Multi-function Data Logger (It is called eLogger for short. The manual adopts this name for instructing and reading conveniently.) is an efficient instrument for measuring temperature, DC voltage and DC current which equipped with compact size and carry convenience. By using USB communication port on the PC to operate it, the external power supply is no need. It is easy to use, measurement accuracy and powerful function. For getting correct operation, please peruse this manual and follow it to operate.

1.1 Basic Structure

Two sides of eLogger are USB communication port and thermal couple connector. The USB communication port is attached with dust cover when delivery, please remove it as operating and connected to PC or notebook. The thermal couple connector can accept thermocouple wire of mini-type connector as temperature detection input or accept other adapters for measuring voltage, current, etc physicals. The middle of eLogger has a LED for displaying operation status, its entire structure is shown as Figure 1-1.

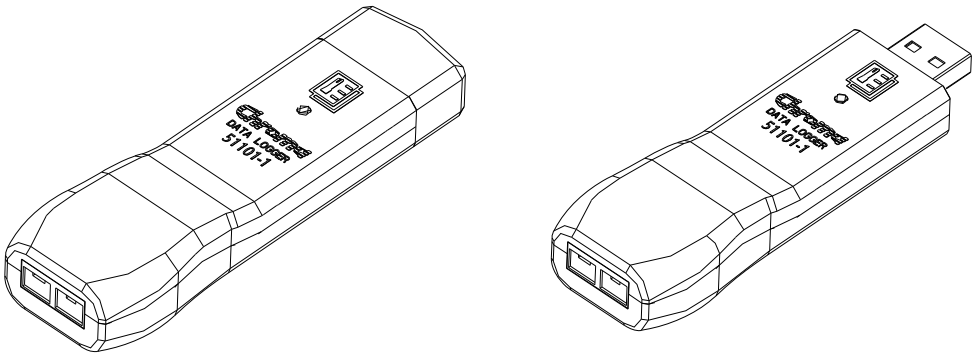


Figure 1-1 Outline and structure of eLogger (left: covered with dust cover, right: remove the dust cover)

When using eLogger and measuring temperature or physical of single point, plug eLogger into any USB port of PC directly as Figure 1-2 shown. If multiple point to be measured with simultaneous, a general USB hub (users purchased their own) can be used for adding the number of USB port to be connected and several eLoggers are plugged into it respectively as Figure 1-3 shown. eLogger subsidiary program Chroma_eLV (about the detail of the program installing and operating, please see chapter 2) can support four points measurement with simultaneous at most.

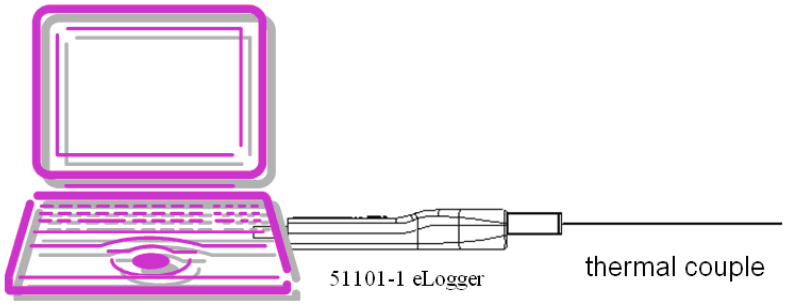


Figure 1-2 Use eLogger single point measurement structure

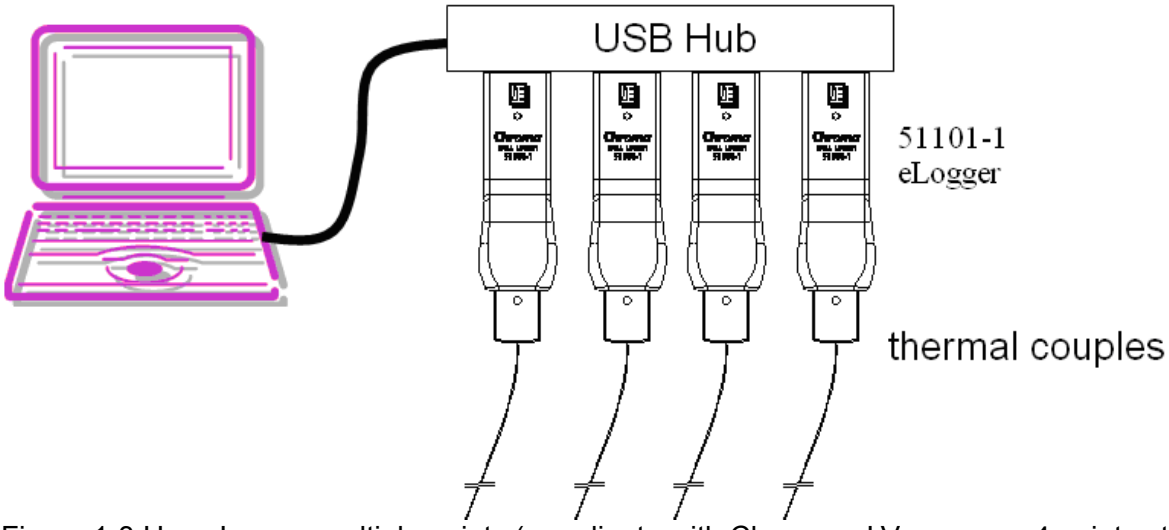
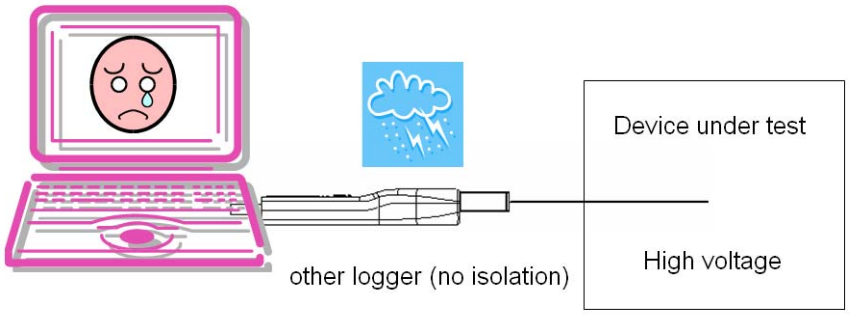


Figure 1-3 Use eLogger multiple points (coordinate with Chroma_eLV program, 4 points at most) measurement structure

CAUTION The similar products on the market, only Chroma eLogger product can contact the measured device with high voltage directly, still keep accurate and reliable measurement result due to high voltage isolation protection circuit inside it. For other brand products don't be operated by this way, otherwise it may be interfered by external voltage and cause measurement result error and high voltage may be inducted, logger and computer may be burned down.



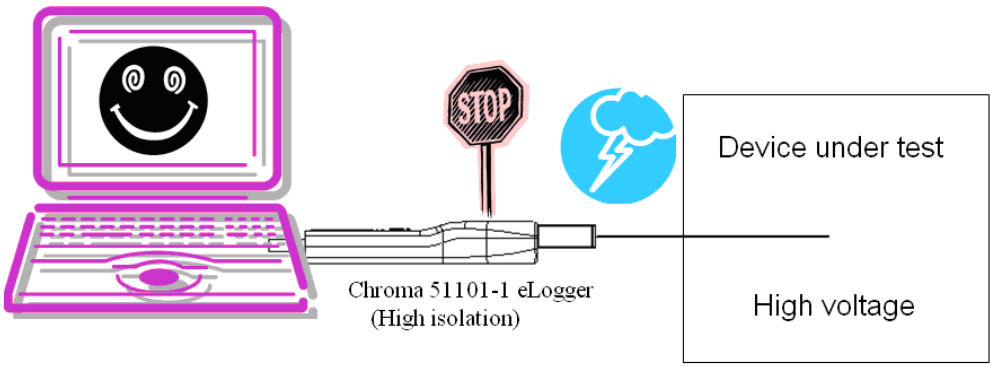


Figure 1-4 Only Chroma eLogger is with high voltage isolation protection circuit. It can get safety accuracy measured function under high external voltage environment.

1.2 Temperature, Voltage and Current Measurement

Chroma 51101-8 is for measuring temperature and DC voltage, among them temperature measurement use various thermocouples of mini type connector which includes ITS-90 standard defined thermocouple of B, E, J, K, N, R, S or T type as Figure 1-5 shown. When processing voltage measurement, it is necessary to use dedicated Chroma VA-480 voltage adapter. When measuring current, it is necessary to use dedicated Chroma IA-3 current adapter (optional accessory) and then voltage or current measurement line is connected as Figure 1-6 shown otherwise correct measurement result can't be gotten and even eLogger will be damaged.

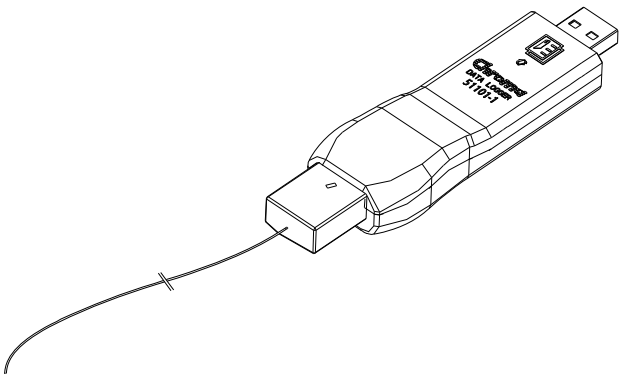


Figure 1-5 Use thermocouple wire of mini type connector to proceed temperature measurement

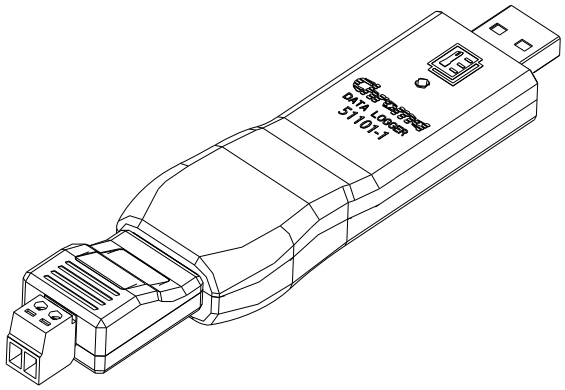


Figure 1-6 When measuring voltage/current, it is necessary to use dedicated Chroma VA-480/IA-3 voltage/current adapter

CAUTION When operating Chroma eLogger to process voltage and current measurements, please use dedicated voltage adapter VA-480 and current adapter IA-3. Other adapters which unapproved by Chroma or refitted thermocouple mini-type are prohibited to use, otherwise it may cause measurement result error and high voltage may be inducted, logger and computer may be burned down.

1.3 LED Display

LEDs in the middle of eLogger, its color and displayed method are with indication functions as Table 1-1 shown.

LED Color	LED Display Method	Indication
Green	Flash once each 10 seconds	eLogger operating normally
Green	Flash once each 1 second	eLogger identification and guide
Red	Flash once each 2 seconds	Error message. Its reasons include thermocouple disconnection open circuit, temperature over measurement range and other factors.

Table 1-1 LED Indication Definition

1.4 Initial Inspection

Before shipment, this instrument was inspected and found to be free of mechanical and electrical defects. As soon as the instrument is unpacked, inspect for any damage that may have occurred in transit. Save all packing materials in case that the instrument has to be returned. If damage is found, please file claim with carrier immediately. Do not return the instrument to Chroma without prior approval.

2. Program Operation

2.1 Installing Program

Chroma 51101-1 eLogger is a measurement instrument via computer connection operation and gets measurement result via computer operation interface. Therefore, one eLogger measurement program (Chroma eLogger Viewer program, **Chroma_eLV)** will be attached to eLogger. Please be sure the computer using Microsoft Windows operating system, insert CD with the good and CD content will be executed automatically as Figure 2-1 shown. If CD doesn't be executed automatically, please execute AutoRun.exe under CD root directory. Install driver firstly, press **Install USB Driver** and follow installation indication to complete it. And then press **Install Logger Viewer Program** to proceed application installation. After the program first-time installation is completed, it will be executed automatically. Next to click "Start" → "Programs" → "Chroma ATE INC." → "Chroma_eLV" to execute the program.

Figure 2-1 Chroma_eLV CD installation screen

Notice The following are minimum computer software and hardware requirements for installing and executing the program.

Hardware: IBM compatible PC or notebook, Pentium-II or above CPU minimum. 256 MB RAM, CD ROM drive readable, 20 MB hard drive space, one USB port at least. Resolution 1024x600, 256-color above graphic card and monitor.

Software: Microsoft window operating system includes Windows 2000, Windows Millennium, Windows XP, Windows Vista and Window 7. Other Microsoft window operating systems also can be used, but they don't be tested and can't be guaranteed. In these operating systems, Windows XP and Windows 7 are most stable and most recommended whereas Windows Vista may contain some unpredictable problems due to its stability and inner error. Although the software is developed by the up-to-date Microsoft Visual Basic, it still can't guarantee various conflicts between Microsoft software and hardware.

If Chroma_eLV measurement program to be removed, please enter "Control Panel" to select "Add or Remove Program" and then click Chroma_eLV.

2.2 Executing Program

Before executing the program, please connect eLogger to idle USB port of computer firstly and then start Chroma_eLV program. First of all, the program main screen will be appeared as Figure 2-2. The program can support 4 eLoggers' measurement at most and difference calculation of 2 among them. The immediate read data is shown on the left of main screen, graphic record is drawn at the right of main screen. The detail descriptions will be given in this chapter.

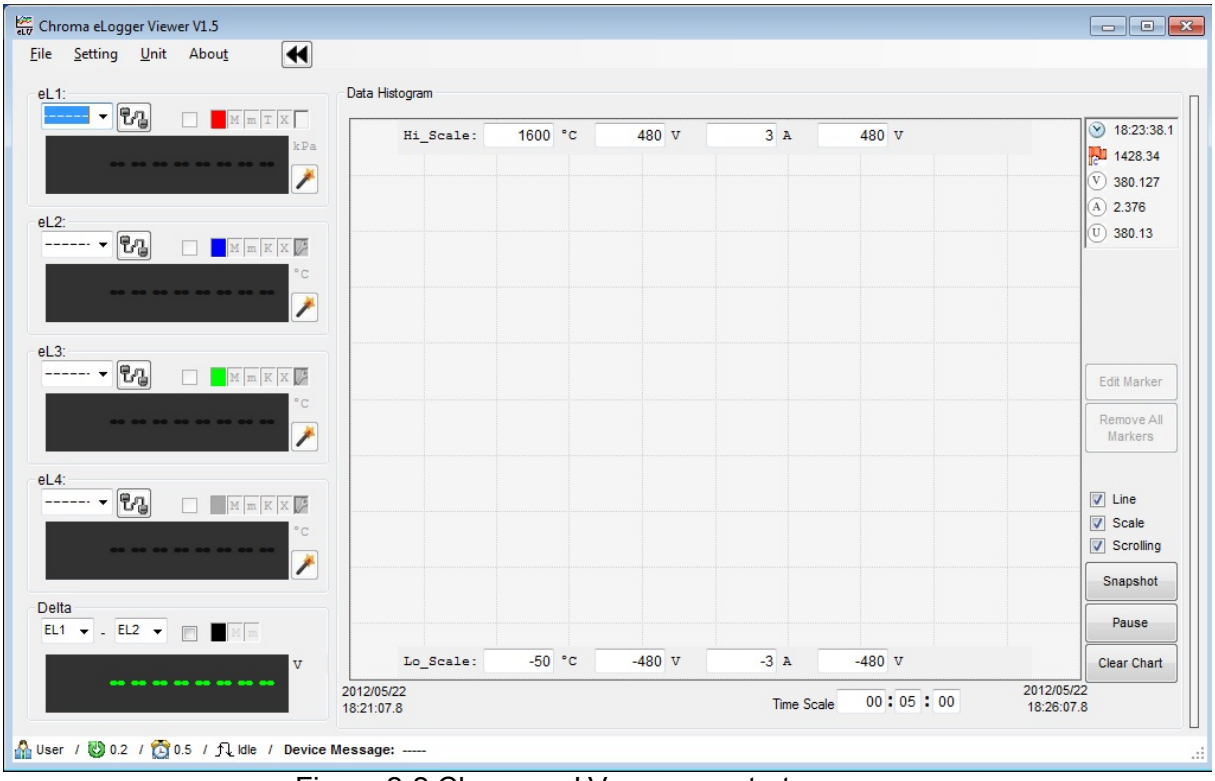


Figure 2-2 Chroma_eLV program startup screen

2.3 Communication Setup

First of all, the communication between eLogger and program need to be set up. There is COM port selection and "Communication" button at the upper side of data displayed area mapping to each eLogger as Figure 2-3 (a) shown. After selecting correct COM port, press "communication setup" button and the communication between eLogger and program will be set up. The value read from eLogger will be displayed at once, "Communication" button will turn to "Disconnection" button as Figure 2-3 (b) shown. If COM port selection is error thus the displayed area no response and it will be remained as Figure 2-3 (a) shown. If there is several eLoggers, please follow this procedure to select COM port for each eLogger and communication setup.

(a) (b)

Figure 2-3 Data display (a) before completing communication setup and (b) after completing communication setup

Notice

When using several eLoggers foe measuring, COM ports of each eLogger are different. There is no fixed location relationship between COM port and USB port, it is difficult to infer the program displayed eL1~eL4 to correspond to which location of actual USB port. For resolving the confusion that the value is measured by which eLogger, please use the “identification button” at the right side of displayed value as Figure 2-4 shown. When pressing this button, the corresponding eLogger LED will show green flash and press this button again for cancelling green flash. Check one by one to confirm physical locations of all eLoggers.

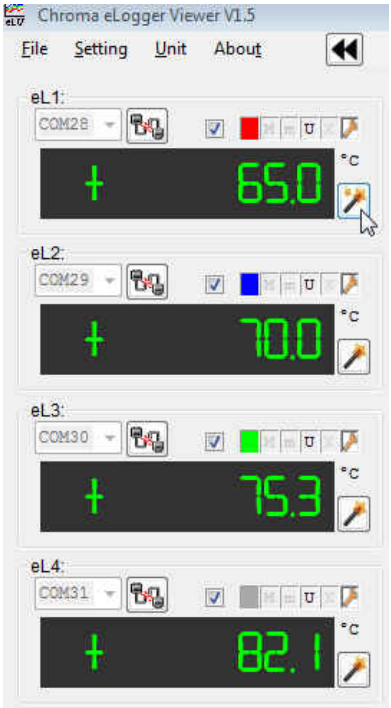


Figure 2-4 By using “Identification button” to confirm physical location of eL1~eL4

2.4 Data Display

In each data display area, there are various settings except for data display as Figure 2-5 shown.

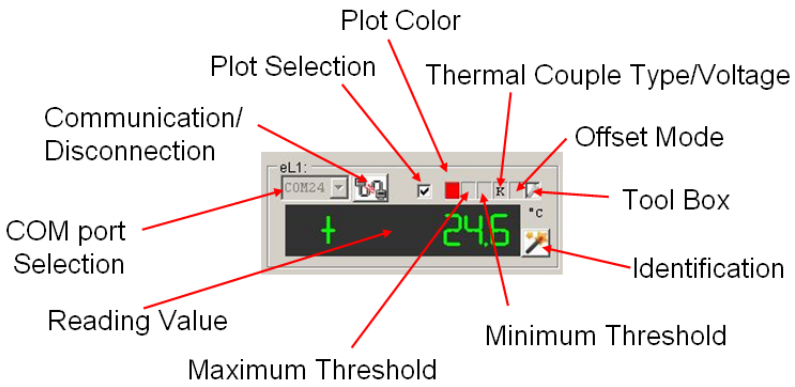


Figure 2-5 Various settings of data display area

COM Port Selection: The details of COM Port selection are described in 2.3.

Communication/Disconnection: The descriptions of these two buttons are described in 2.3.

Identification: The description of this button is described in 2.3.

Plot Selection: Check this item for eLogger data plotting on graphic area (see 2.9), otherwise it won't plot the eLogger data.

Plot Color: Each eLogger is set to separate plot color. If users desire to change it to other colors, please use the mouse to right click this selection. A color selection window will be popped up for selecting the color to be set. Since the program is without checking color applicability and conflict, please don't set the same color on different eLogger to avoid confusion.

Maximum Threshold and Minimum Threshold: It is for setting maximum or minimum threshold. When the value tested is higher than maximum threshold, background color in data display area will be changed to red, whereas the value tested is lower than minimum threshold, the background color will be changed to light blue as Figure 2-6 shown. The background color variation can be as warning signal to hint users that temperature and voltage abnormality. Right click the area by the mouse while setting threshold, thus the setting window will be popped up and then key in critical value.

After setting critical value, left click the selection by the mouse to start or end critical value detection. When maximum threshold/minimum threshold is activated, the selection box will show "M"/"m". If "M"/"m" isn't shown, thus indicating this function is inactivated.

(a) (b)

Figure 2-6 Background color in display area changed indicating (a) higher than maximum threshold (red) or (b) lower than minimum threshold (light blue)

Thermal Couple Type/Voltage/Current/User Define: It is necessary to select thermocouple type to be used correctly while measuring temperature thus correct temperature can be gotten. Other measurements are also the same thus please use the mouse right click this item, a selection list will be shown as Figure 2-7. Select correct thermocouple type or voltage, current or user defined physical, selected result will be shown on the selection box by its English letter.

Note The measurement of voltage/current need to use Chroma dedicated VA-480/IA-3 adapter. It is only for measuring DC voltage/current but can't measure AC voltage/current. The user defined physical (such as pressure, humidity, speed, optical power, etc), users need to prepare physical sensor to convert it to DC voltage via VA-480 to read the voltage. By using conversion ratio of user define in the program to get measurement purpose.

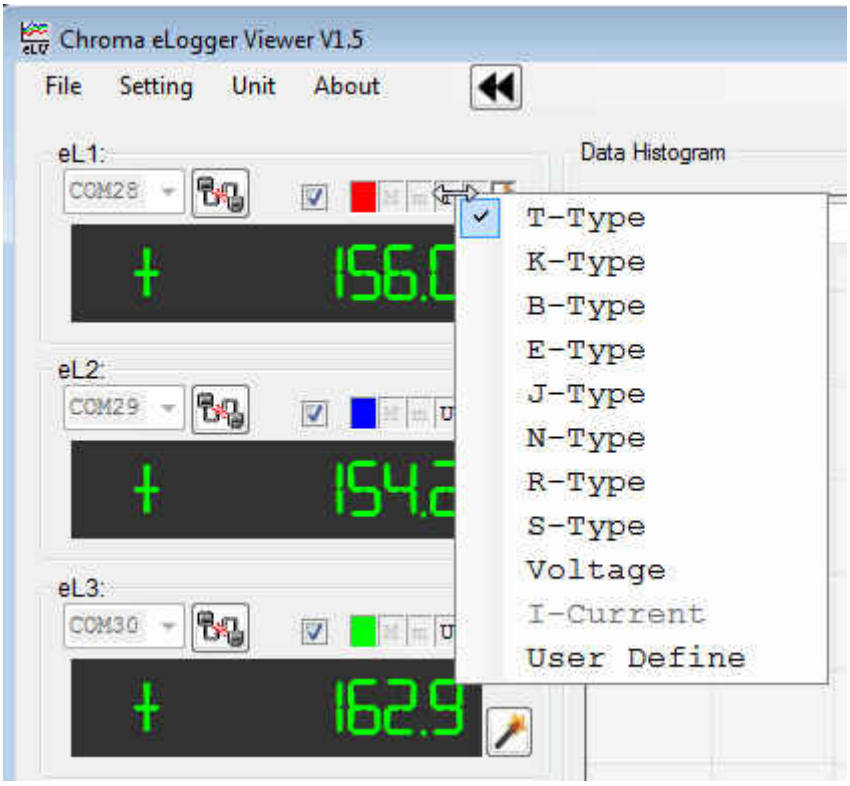
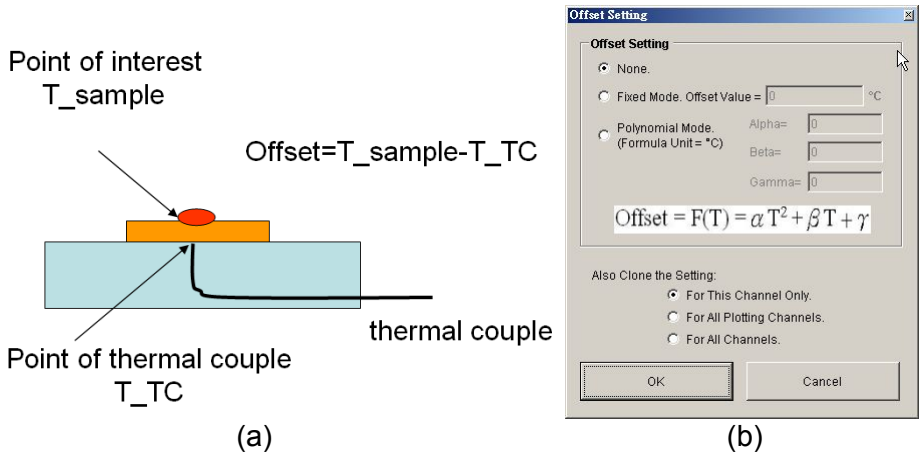


Figure 2-7 Thermal Couple Type/Voltage/Current/User Define

Offset Mode: In some occasions and limited by some spaces, thermocouple installation

location may be not the location that users desire to measure temperature point as Figure 2-8 (a) shown. Thus, thermocouple read temperature (T_TC) and measurement point temperature (T_sample) to be gotten will have difference. For reducing this difference as possible, users can test temperature difference between these two points (T_sample-T_TC=Offset) *i.e.* temperature Offset. Later, add offset to actual thermocouple position temperature (T_TC) then can modify it to the temperature (T_sample) of measurement point to be gotten. The selection provides this function, once it is set, the data reading display is T_TC+Offset=T_sample and it isn't thermocouple direct reading. The setting provides three modes: **None** is no using offset compensation. **Fixed Mode** is using constant compensation (Offset is a constant value for input). **Polynomial Mode** will follow temperature calculation value for compensation (Offset is temperature quadratic function) as Figure 2-8 (b) shown. For which one is appropriate and correct, please realize the function completely, calibration firstly and operate it reasonable. If "Offset" correction is activated, the box in this selection will show "X", otherwise this function will be inactivated.



(a) (b)

Figure 2-8 (a) Physical meaning and (b) setting mode of "Offset" compensation

Tool Box: It includes three significant settings in this selection as Figure 2-9 shown.

Set Alias: Give an easy to remember name for the measured data in the eLogger, for example "CPU" (measure temperature for CPU), "Ambient" (measure ambient temperature) or any name can stand for measurement point. This name is shown on data display area and also shown on plotting area and data record file.

Set Filter: It can set moving average range after processing data, the larger of value and the higher possibility of noise interference can be removed. The temperature reaction speed also will be slow down, the reaction is quick but high noise vice verse. How to set appropriately depending on actual applied environment and requirement.

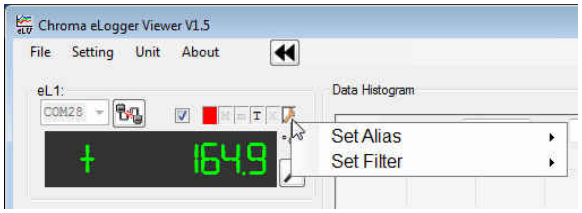


Figure 2-9 Tool box setting

2.5 File Selection

File selection is located at the upper left corner of main screen which includes User Name, Save Configuration, Load Configuration, Data Recording and File Identification as Figure 2-10 shown.

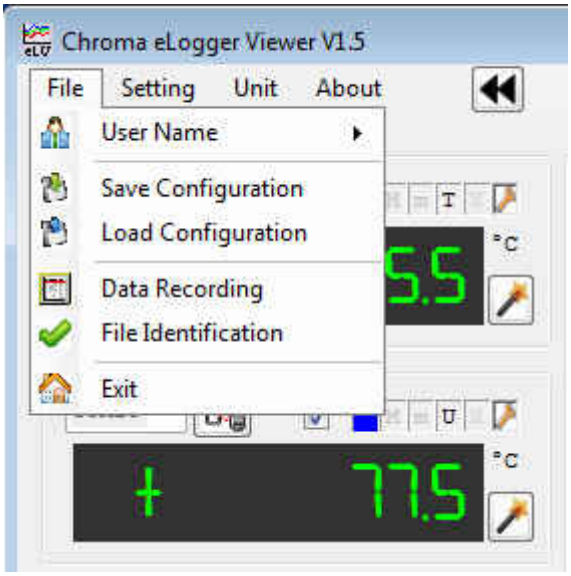


Figure 2-10 File selection detail

User Name
Users can input user name or code here. It hasn't any influence to measurement process and result but it will be written into data record file for users' identity confirmation.

Save Configuration
This selection can save plotting color of eLogger, upper/lower limit setting, thermocouple type, offset mode, toolbox, etc into the file as described in section 2.4. Recall the file for next time using the same operation status. It can restore to initial setting for various items and no need to choose reset one by one.

Load Configuration
Before opening this option, restore previous settings by saved files in "Save Configuration".

Data Recording
Its purpose is to write the measured data into computer hardware for preserving and analyzing afterward. This selection will bring out file name and saved directory window as Figure 2-11. After the file is set up, data recording related settings will be shown as Figure 2-12.

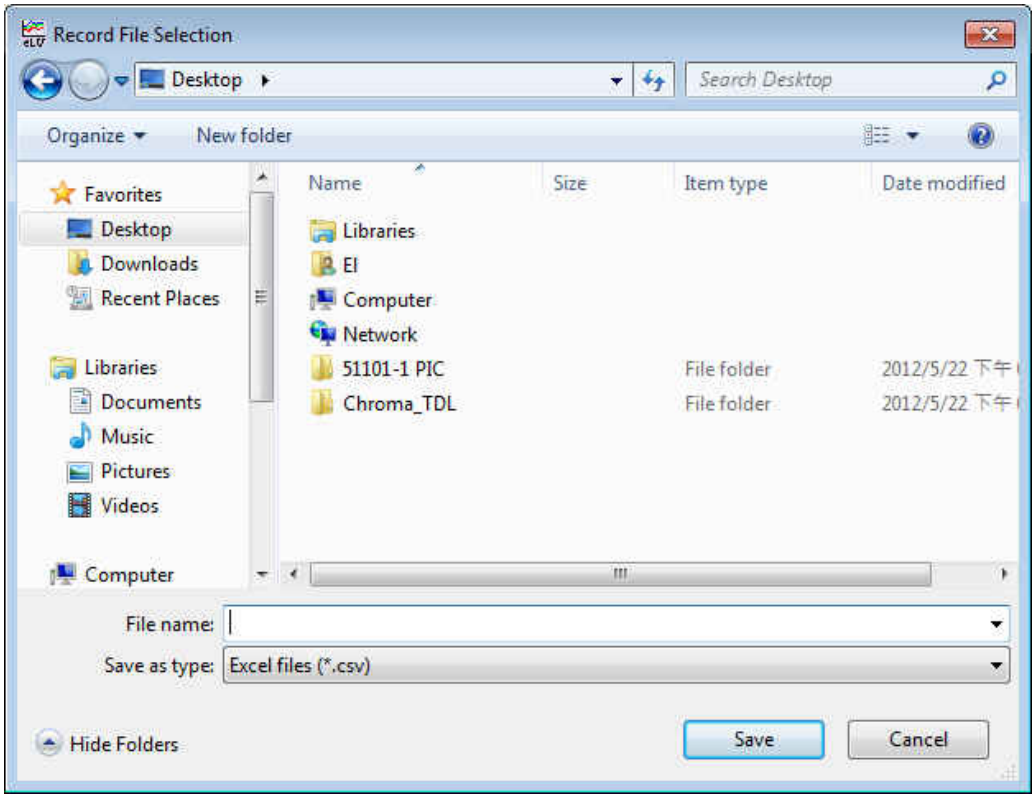


Figure 2-11 Save file name and directory window

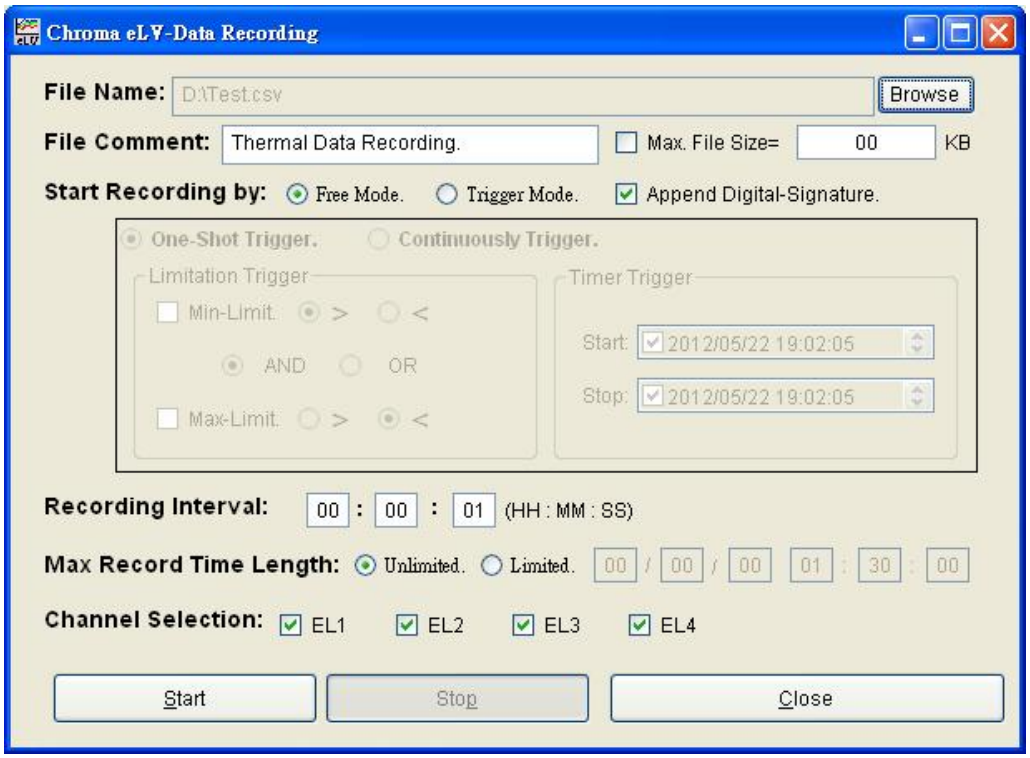


Figure 2-12 Data recording setting window

It is necessary to set save directory and file name firstly. The program provides two file formats of text file (.txt format) or Microsoft Excel file (.cvs format) for saving data. File Comment provides annotation for the file and inputted text will be saved in front of file.

Due to long time record file may be significant even over the general software, ex. Excel file size can be processed. To avoid file too large and can't be processed thus **Max. File Size** is for limiting file size. If this selection is checked thus add 000, 001, 002…….. serial number after setting file as actual file name. When the record file is up to setting size, the old file will end record and open next serial number as new file to record continuously. Use or not to use **Max. File Size** setting with advantages and disadvantages. When **Max. File Size** is not used thus all data are saved in a file for analyzing afterward. All records are in the file and unnecessary to search by section, it is recommended to be used under the condition of small amount of data and analysis software can be processed. If the data is with great amount thus this selection is recommended to use, each file size of serial number should be under 100MB thus analysis afterward can be proceeded. However, it may take the time to find certain time data saving in which serial number of file.

For avoiding record file to be modified afterwards and loss of public trust thus **Append Digital-Signature function** can be added. If this option is checked thus a signature code will be generated in saved file that utilizes original recording content via Chorma's specified algorithm and generated it. It is coordinated with option 5 **File Identification** function to confirm the file still remains the original content or has be modified.

Data recording mode includes Free Mode and Trigger Mode.

Free Mode
It starts recording when clicking **Start** at lower side of window. And it stops recording when clicking **Stop**.

Trigger Mode
It is based on trigger condition to start recoding. When this mode is selected, gray area beneath it will turn to normal display for setting various trigger conditions.

One-shot Trigger Mode
When any trigger condition is established then to start recording until record length up to **Max Record Length** or click **Stop** by manual to end recording.

Continuously Trigger Mode
When any trigger condition is established then to start recording and all trigger conditions are disabled to stop recording. If trigger condition is established again thus restore recording, trigger condition is disabled again thus stop recording again. Repeat these procedures until record length up to **Max Record Length** or click **Stop** by manual to end recording.

Limitation Trigger
It can set **Maximum** and **Minimum Threshold** as section 2.4. When any eLogger measurement and threshold are more conforming to logic relationship here set up then trigger will be generated. For example, **Maximum Threshold** and **Minimum Threshold** of eL1 are set to 100°C and 0°C separately, logic relationship is set to **"<" Min-Limit "OR" ">" Max-Limit** thus eL1 reading higher than 100°C or lower than 0°C trigger recording will be generated.

Timer Trigger
It can be set to generate trigger start record in specified time and stop trigger disable stop record in specified time. Please be aware that **Start** and **Stop** time setting should be earlier than set time of **Max Record Length**, otherwise setting in here will be invalid and meaningless.

Recording Interval
Here we set how much time to save a record, the shortest time is 0.2 second. Please key decimal in second place directly such as 0.2 if setting is less than 1.

Maximum Record Length
For avoiding unlimited record, here can set record end time. If this limit doesn't be enabled, it may be recorded until PC hardware is full. When this selection is enabled and the time is over the setting, any trigger is invalid and doesn't be recorded.

Channel Selection
The channel value checked will be saved in the file.

File Identification
It can identify whether the file with Append Digital-Signature remains original content, or is altered for obtaining credibility.

2.6 Setting Selection

Setting selection includes eLogger Enumeration, Timeout Setting, Polling Speed Setting, Data Buffer, Display Alias and Audio Alarm as Figure 2-13 shown.

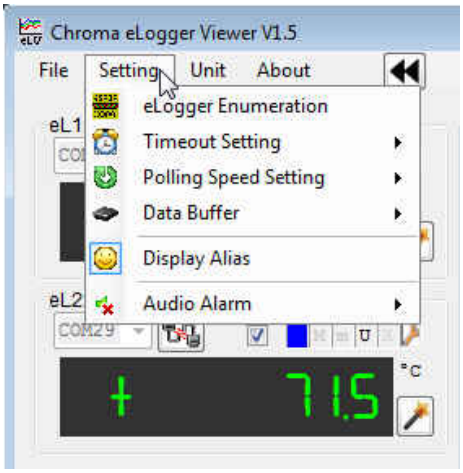


Figure 2-13 Setting selection

eLogger Enumeration
When using eLogger, users should plug eLogger into USB port of computer firstly and then activate Chroma_eLV program. The operation procedure may be reversed sometimes, Chroma_eLV program is activated firstly and then eLogger is plugged. The Chroma_eLV program can't detect the COM Port and can't set up communication. If such problem is encountered, this selection can be applied for Chroma_eLV program searching COM Port again and establish number. Thus it can set up communication and proceed measurement smoothly.

Timeout Setting
The selection sets how long the communication failure to be regarded as communication timeout. The setting unit is in second. When the communication timeout, please check hardware and connection.

Polling Speed Setting
The selection sets how much time the computer read a value from eLogger, the fastest can be set to 0.2 second. However, the difference of computer process capability, some older, poor performance computer may be unable handle data process so quickly. If the computer process capability is unsure, this selection can be set to “Auto” so that Chroma_eLV program will adjust polling speed setting automatically.

Data Buffer
The Chroma_eLV program sets a part of RAM as data buffer thus it can plot quickly and analyze records for several hours and days. The selection can check data buffer space, usage condition or clear this area for re-use. About the utility of data buffer will be described as **Cropped Histogram** in 2.9.

Display Alias
It can decide whether to show defined name which in Tool Box.

Audio Alarm
If there is high/low temperature (or voltage, current, etc physical) threshold setting and detection is activated. When temperature is over threshold, system audio effect of computer will be started and sound generated to attract users’ attention. About the generated audio quality and volume, please utilize PC operating system and audio control.

2.7 Unit Selection

It can select temperature displayed unit °C, °F or °K as Figure 2-14 shown.

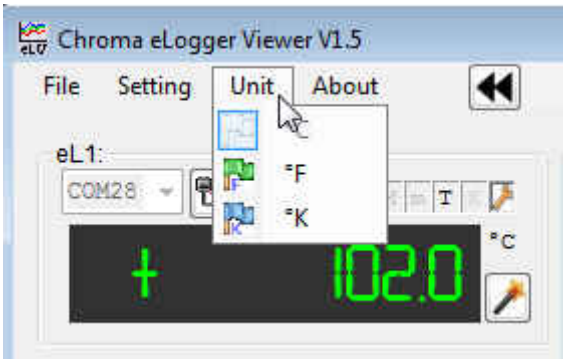


Figure 2-14 Temperature unit selection

2.8 About Selection

It checks eLogger firmware version, program version and Chroma information.

2.9 Graph Record

Draw the record value to graph which is helpful to analysis as Figure 2-15 shown. In the right graphic area of main window, horizontal axis stands for time, vertical axis has four

selections of temperature, voltage, current or user define. There are four corresponding input boxes at upper and lower side of window, key in range value of vertical axis directly. When displayed time, temperature or other range values are changed, click **Clear Chart** to plot again and changed range value will be valid. Except for graph display, the program provides a lot of analysis functions as the following.

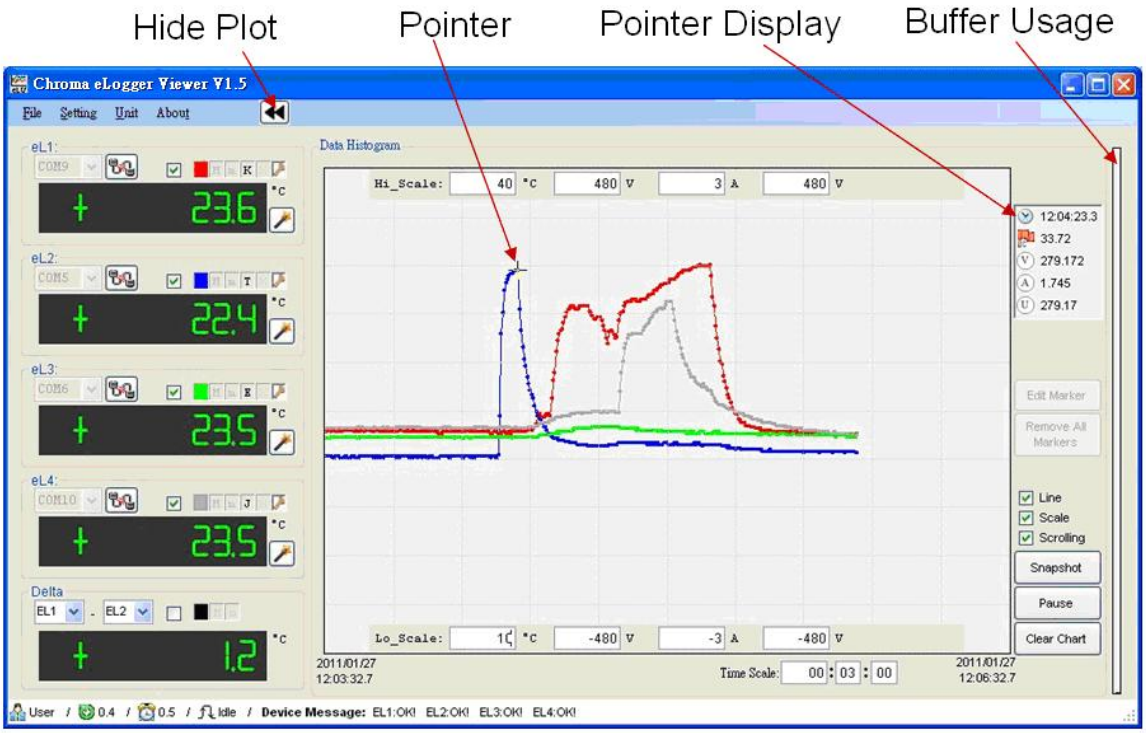


Figure 2-15 Graph area display temperature, voltage, current or self defined physical variation by time

Pause/Continue
Click this button to stop graph and pause plotting, it is for users checking graph detail. Click it again to restore plotting and continue recording graph.

Clear Chart
Clear the existed graph, new horizontal/vertical axis values become effective and plotted again.

Snapshot
The entire screen of main window is saved in the format of jpeg or bmp.

Line
Use straight line to connect measured data point and point. If this selection isn't checked, thus it will be only displayed in various data points.

Scale
When this selection is checked, show four horizontal axis high and low limit values at upper and lower of window. If it isn't checked, the high and low limit values on horizontal axis will be hidden and doesn't be shown for the plot space larger.

Scrolling
When the curve gets to the right side by the time, the plotting next will check the method can

be scrolled to move the left side from plotting window piecewise and the right side adds plotting window. If it isn't checked thus clear entire window and plotting from the left side.

Hide Plot
Click here for hiding plot window and just display the value at the left side. Click again then can restore plot window.

Pointer Display
The mouse pointer moves to plot window and shown in cross pointer. The pointer located corresponding time, temperature, voltage, current and user define are shown on this box. Therefore, users only need to move the mouse pointer to record curve for obtaining the data of the curve point.

Buffer Usage
A certain proportion of PC RAM in the program is reserved as data buffer. Thus, it can record millions of temporary data for recalling from "Cropped Histogram" mode to view analysis. The histogram shows buffer memory usage ratio, the longer of use time and the more of eLogger connection number. The larger of temporary data quantity and the higher of histogram usage percentage can be viewed. When the histogram is full, it indicates data quantity already over buffer memory can be saved. Next to remove the earliest data and save the latest one for using buffer memory.

Cropped Histogram
By pressing the left key of mouse to generate a dotted line square in main window, meanwhile right click the mouse **Crop** selection will be shown as Figure 2-16. Click the left key of mouse to select Crop, a cropping enlarged histogram will be shown as Figure 2-17. This cropping enlarged histogram is for processing detail analysis. There is only one cropping enlarged histogram, new cropping histogram will replace the old one when re-cropping in the main window.

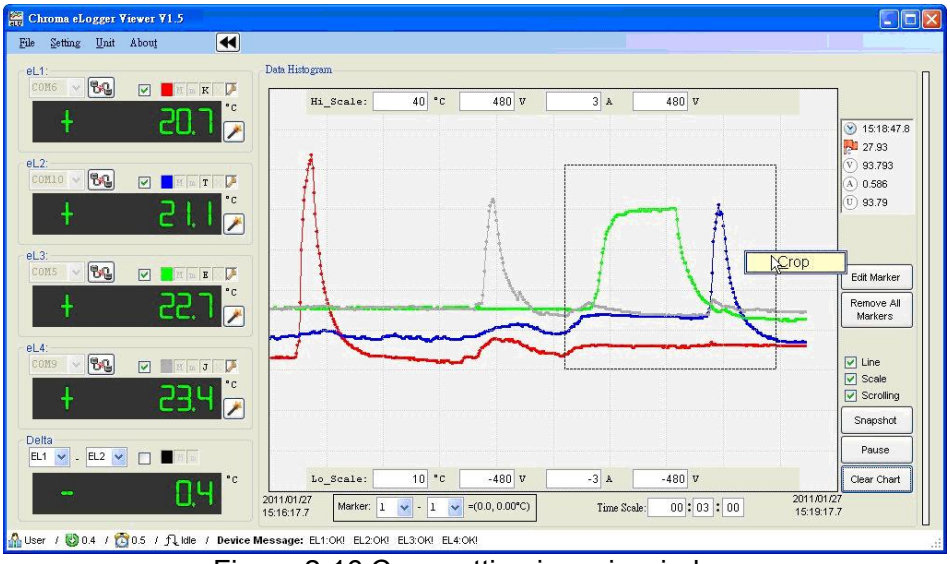


Figure 2-16 Crop setting in main window

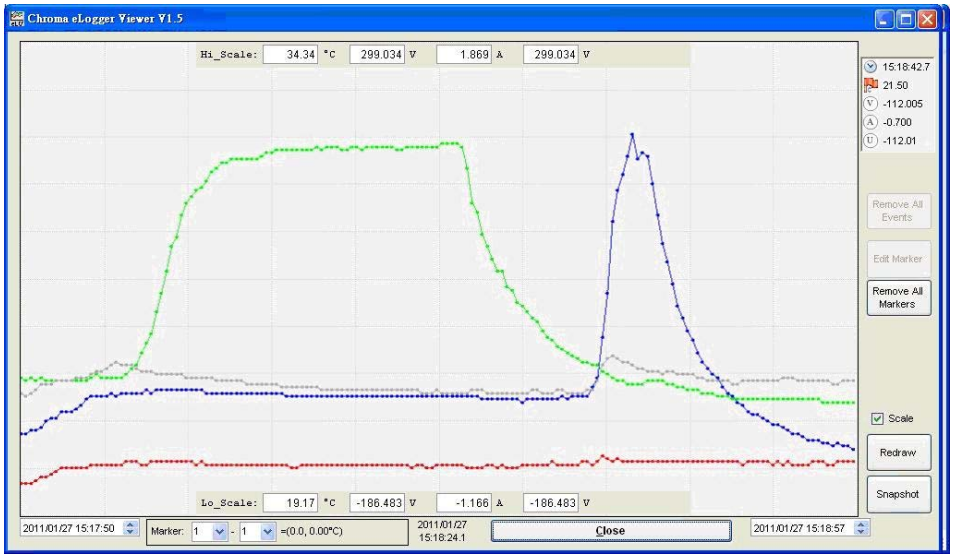
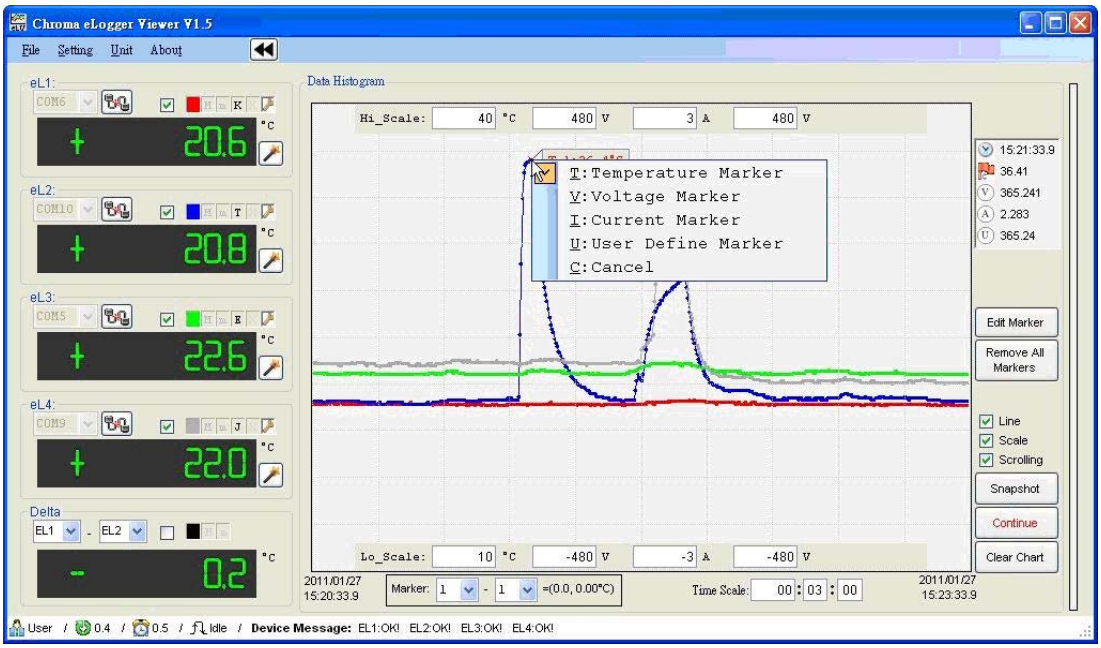
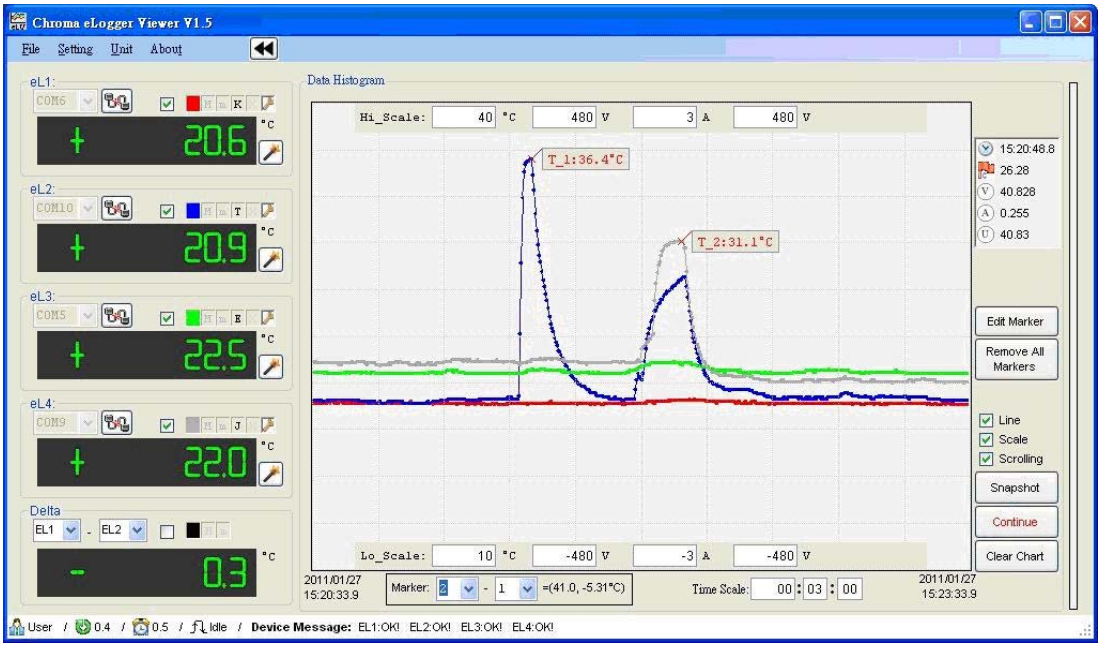


Figure 2-17 Cropping enlarged histogram according to Figure 2-16

Double left click, a marker will be generated. The marker attribute will be produced firstly to define the marker as Temperature Marker (expressed by Tn, n indicates integer), Voltage Marker (expressed by Vn), Current Marker (expressed by In) or User Define Marker (expressed by Un). Add marker to the place which to be produced, the marker quantity is without any limitation. It can be proceeded in plotting area of main window and also can be proceeded in cropping enlarged figure. The marker produced in any figure, it will be also appeared on corresponding position of another figure. If certain marker information to be read, please click **Edit Marker** a small window will be popped up. Select the number of marker, its time, temperature, voltage, etc information can be seen. It also can be written in comment and the difference between markers can be calculated below plot area. The displayed result is the difference of selected two markers' time interval, temperature or voltage as Figure 2-18 shown.



(a)



(b)

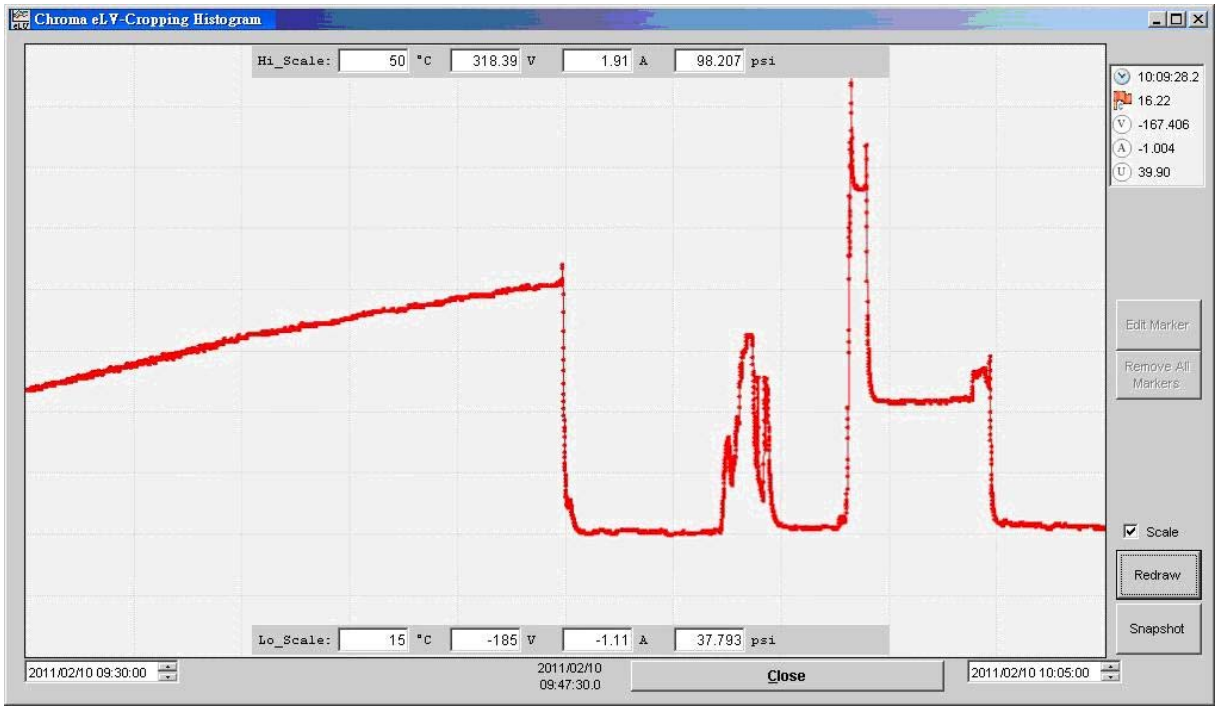
Figure 2-18 Marker(a) produced and marker(b) differential calculation

CAUTION The produced marker in plotting area of main window or cropping enlarged figure will be appeared automatically on corresponding position. Even the corresponding position isn't in plotting time or vertical axis range that can't be displayed on plot area, its marker value still can be memorized and be computed. Click **Remove All Markers** to remove markers, all generated markers will be removed and can be re-defined.

Cropping Enlarged Histogram Range Modified

It is not only providing enlarged view function but also tracing passed record. After changing time/temperature/voltage range, click **Redraw**. For example, Figure 2-19 original cropping histogram (a) time range is from 09:53:25 to 09:54:17, temperature range is from 19.45 to 34.55 °C. Time range after redefined is from 09:30:00 to 10:05:00 and temperature range is from 15 to 50 °C. After redrawing it is shown as Figure 2-19 (b). This method is for users viewing the record of a few hours ago even a few days ago. The sections unseen in the main window all can be called to view by the method of define time/temperature/ voltage range redrawing in cropping enlarged histogram. The only limitation is if data buffer (section 2.6) full or not, after memory is full, new data still be saved and the oldest data will be removed and plot can't be recalled. Besides, the defined time is earlier than Chroma_**eLV** program enabled or later than present time thus the plot won't be shown.

(a)



(b)

Figure 2-19 (a) Original produced cropping histogram and (b) Re-plot cropping histogram of changed time/temperature/voltage/current/physical range

2.10 Measurement Selection

Except for measuring/recording temperature, eLogger also can measure/record DC voltage, current and user define as Figure 2-6 shown. The details are described as follows.

A. Temperature: The thermocouple wire used in measurement selection which is one kind among 8 thermocouples of T, K, B, E, J, N, R and S. The displayed numerals are measured temperature.
B. Voltage: Select Voltage in measurement selection and use VA-480 voltage measurement adapter. The displayed numerals are measured DC voltage, its range is from -480 V to +480 V.
C. Current: Select I-Current in measurement selection and use IA-3 current measurement adapter. The displayed numerals are measured DC current, its range is from -3A to +3A.
D. User define: First of all, users need to prepare the sensor for converting user defined physical into analogy voltage output. For example, some manometers can convert pressure into voltage output, voltage level and pressure intensity are in direct proportion. The optical detector can convert light intensity into photocurrent output and then convert it into voltage through resistor. In short, the final output type of user define should be DC voltage and then select User Define in measurement selection thus Figure 2-20 will be brought out. Here define the relationship between the physical and output voltage. When measuring user defined physical, it still needs VA-480 voltage measurement adapter for connecting voltage output of the sensor. Be aware that voltage output of the sensor can't lower than -480VDC or higher than +480VDC.

   To define the relationship between physical and output voltage, please write character and number in each field of the window. Take an example by Figure 2-20, the user defined physical is atmospheric pressure and its unit is in KPa. If the pressure is -100KPa, voltage output is 1V whereas if the pressure is +1000KPa, voltage output is 5V. The number is shown one place under decimal point, after the definition is completed and OK is clicked, the program will interpret measured voltage by linearity relationship. For instance, the pressure sensor output is 3V, the program will show the pressure as 450.0 KPa.

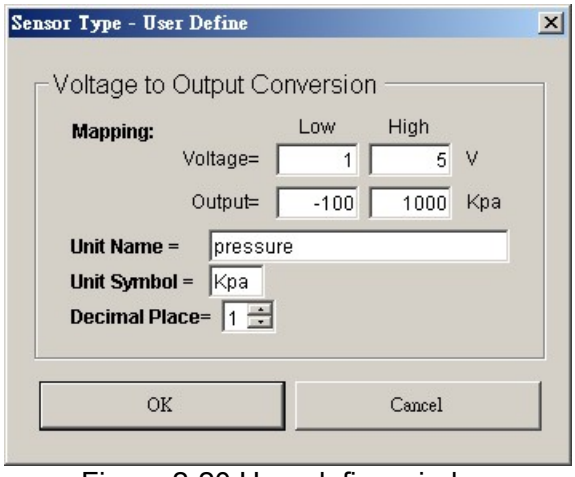


Figure 2-20 User define window

Note If the relationship between output voltage and physical of user defined sensor is non-linearity thus the program can't provide correct calculation. Please don't utilize the program to measure the physical.

3. Communication Protocol

For eLogger, we provide communication protocol between personal computers to let users developing their own program or integrate eLogger into complicated test system. Please contact Chroma if further assistance and service of program development or system integration is required.

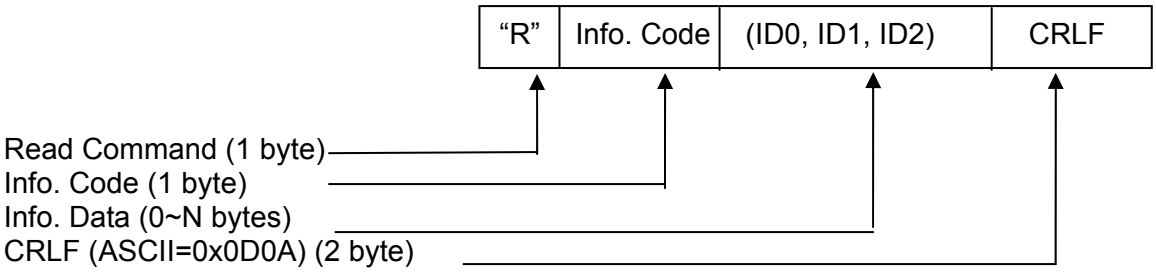
Chroma eLogger communication protocol formats are as the following.

3.1 Sequence Communication Structure

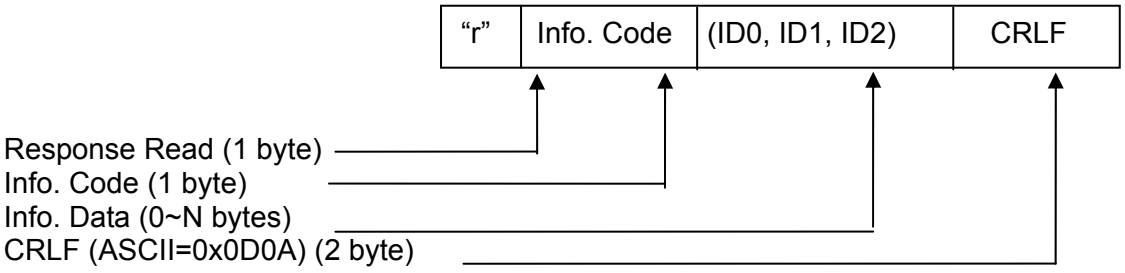
The sequence communication rate used is 9,600 bps, byte format is 8, n, 1.

3.2 Packet Format

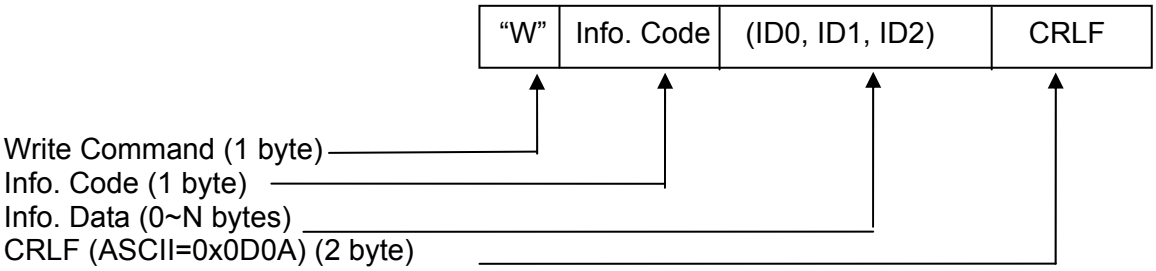
The read eLogger information packet format is sent by computer.



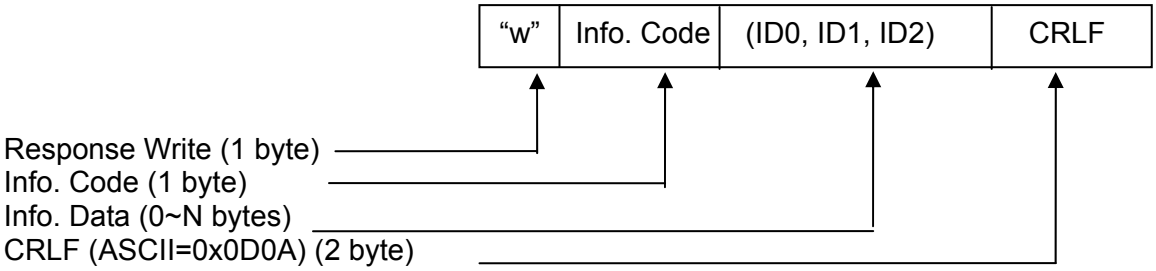
Response read packet format, send it out from eLogger.



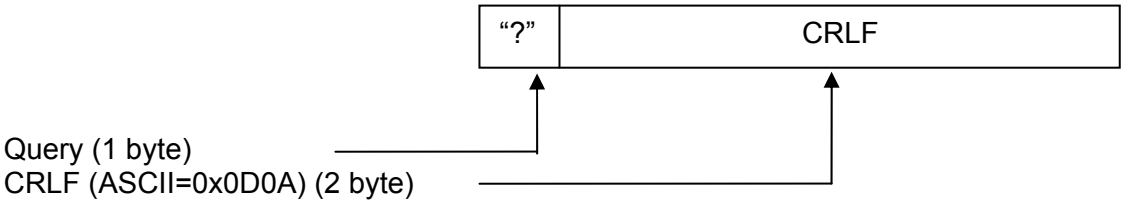
Write packet format, send it out from computer.



Response write packet format, send it out from eLogger.



List all information code definitions, send them out from computer.



When eLogger receives the query command, respond a series of string to explain packet format, command definition, etc.

Communication mode between computer and eLogger is very simple and direct. The computer is initiative and eLogger is passive which take Q (computer asked) & A (eLogger answered) method. For read command, eLogger will respond the data value to be read. For write command, eLogger will respond the same packet for confirmation. If packet error and can't be identified thus eLogger responds "Command Error" code. If signal data includes multiple bytes, transmit it by high byte in advance and low byte afterward as the following.

MSB → LSB
2-Byte Info. Data: ID0, ID1.
3-Byte Info. Data: ID0, ID1, ID2.
4-Byte Info. Data: ID0, ID1, ID2, ID3.

3.3 Information Code & Definition

Info. Code	Info. Code Description	Read	Write	Info. Data (1) ID0, ID1~IDn	Data Byte	Definition
"G"	**G**et Current Sensor Data	Yes	No	PC->Device: ID0: Data Format Selection "0": Number String. "1": 4-Byte floating number. (32-bit IEEE-754 standard).	1	Number String Example: "+12.345", "+1000.5" and "-42.1". "TC Open", "+O.R.", "-O.R." 4-Byte floating number definition: 0x80000000: TC open-circuit 0x80000001: Sensor negative-overload. 0x80000002: Over display negative-range. 0x7FFFFFFE: Sensor positive-overload 0x7FFFFFFD: Over display positive-range. Others: 32-bit IEEE-754 standard format float number.
				Device->PC: ID0~9: Number String. ID0~3: 4-Byte floating number. (32-bit IEEE-754 standard).	4 or 7~10	
"P"	Actively **P**ush Sensor Data	Yes	No	PC->Device: ID0: Push Interval "0": 200mS. "1": 400mS. "2": 600mS. "3": 800mS. "4": 1S.# "5": 2S. "6": 5S. "7": 10S. "8": 30S. "9": 1min.	1	Once user chooses this operation, the most updated sensor data will be actively pushed to PC by dongle every "Push Interval". While in data pushing, sending a specified STOP byte 0x1B(ESC key) will terminate it. Number String Example: "+12.345", "+1000.5" and "-42.1". "TC Open", "+O.R.", "-O.R."
				Device->PC: ID0~9: Number String.	7~10	
"T"	Sensor **T**ype Setting*	Yes	Yes	PC->Device: ID0: Sensor type(write only) "T", "K", "B", "E", "J", "N", "R", "S", "V" , "I"	0 or 1	Sensor Type: "T": T-type "K": K-type "B": B-type "E": E-type "J": J-type "N": N-type "R": R-type "S": S-type "V": Voltage "I": Current Others: It will cause a "Command Error Response" error and the original value will not be changed.
				Device->PC: ID0:Sensor type "T", "K", "B", "E", "J", "N", "R", "S", "V" , "I"	1	
"F"	**F**ilter Selection*	Yes	Yes	PC->Device: ID0:Filter Selection(write only) "0"~"3"	0 or 1	Filter Selection: "0": No filter "1": Moving Average by 2 "2": Moving Average by 4 "3": Moving Average by 8 It will cause a "Command Error Response" if ID0's value is undefined. The original value will not be changed.
				Device->PC: ID0:Filter Selection "0"~"3"	1	
"E"	Device **E**rror Code	Yes	No	PC->Device: ""	0	
				Device->PC: ID0= Code Number "0"= Normal "0"= Normal Others: Reserved for future	1	Error Indicating Priority: "2" > "1" > "0"
"N"	Device Model **N**ame	Yes	No	PC->Device: ""	0	
				Device<->PC: ID0~15= Model Name String	16	"Chroma 51101-1"
"M"	Device Model Number	Yes	No	PC->Device: ""	0	
				Device<->PC: ID0~15= Model Number String	16	"51101-1"

"V"	MCU Firmware **V**ersion Number	Yes	No	PC->Device: "" Device->PC: ID0~6=FW Version String "0.0.0.0" ~ "9.9.9.9"	0 7	 Ex: "V1.0.0.0"
"L"	**L**ED Flashing	No	Yes	PC->Device: ID0: Enable/Disable "0": Disable. "1": Enable.. Device->PC: ID0: Result "0": Disable. "1": Enable.	1	LED flashing action follows Table 1-1 LED indication. .
"err:"	Command Error **R**esponse	No	No	Device->PC: ID0: Error Response "1": Wrong info. code/data or format.	1	This information is generated automatically by device if device got incorrect info code/data.

CAUTION

1. The data byte length is varied by different info. code.
2. The item is marked by symbol " * " will be saved in eLogger non-volatile memory.

3.4 Example

CAUTION

In communication protocol, capital or lowercase definition of English letters are different. Therefore, please obey capital and lowercase to use correctly and don't make them confused.

Read eLogger measurement value:

Command	***Meaning***
"RG0"+CRLF	Read/GetSensorData/NumberString (PC→eLogger)
"rG-12.3"+CRLF	ReadResponse/GetSensorData/NumberString (eLogger→PC)
"RG0"+CRLF	Read/GetSensorData/NumberString (PC→ eLogger)
"rG+105.2"+CRLF	ReadResponse/GetSensorData/NumberString (eLogger→ PC)

Enable eLogger active return measurement value (for setting read rate).

Command	***Meaning***
"RP0"+CRLF	Read/ActivePushData/NumberString (PC→eLogger)
"rP+12.3"+CRLF	ReadResponse/ActivePushData/NumberString (eLogger→ PC)
"rP+12.4"+CRLF	ReadResponse/ActivePushData/NumberString (200 mS later, eLogger→ PC)
"rP+12.3"+CRLF	ReadResponse/ActivePushData/NumberString
.....	(200 mS later, eLogger→ PC)

Define thermocouple type or voltage:

Command	***Meaning***
"RT"+CRLF	Read/SensorType (PC→eLogger)
"rTT"+CRLF	ReadResponse/SensorType/T-Type (eLogger→ PC)
"WTK"+CRLF	Write/SensorType/K-Type (PC→eLogger)

"wTK"+CRLF	WriteResponse /SensorType/K-Type (eLogger→ PC)
"WTV"+CRLF	Write/SensorType/Voltage (PC→eLogger)
"wTV"+CRLF	WriteResponse/SensorType/Voltage (eLogger→ PC)

Set average:

Command	***Meaning***
"RF"+CRLF	Read/FilterSelection (PC→eLogger)
"rF1"+CRLF	ReadResponse/FilterSelection/MV_02 (eLogger→ PC)
"WF3"+CRLF	Write/FilterSelection/MV_08 (PC→eLogger)
"wF3"+CRLF	WriteResponse/FilterSelection/MV_08 (eLogger→ PC)

Set line frequency filter:

Command	***Meaning***
"RL"+CRLF	Read/LineFreqRej (PC→eLogger)
"rL1"+CRLF	ReadResponse/LineFreqRej/60Hz (eLogger→ PC)
"WL0"+CRLF	Write/LineFreqRej/50Hz (PC→eLogger)
"wL0"+CRLF	WriteResponse/LineFreqRej/50Hz (eLogger→ PC)

Read equipment error/fault code:

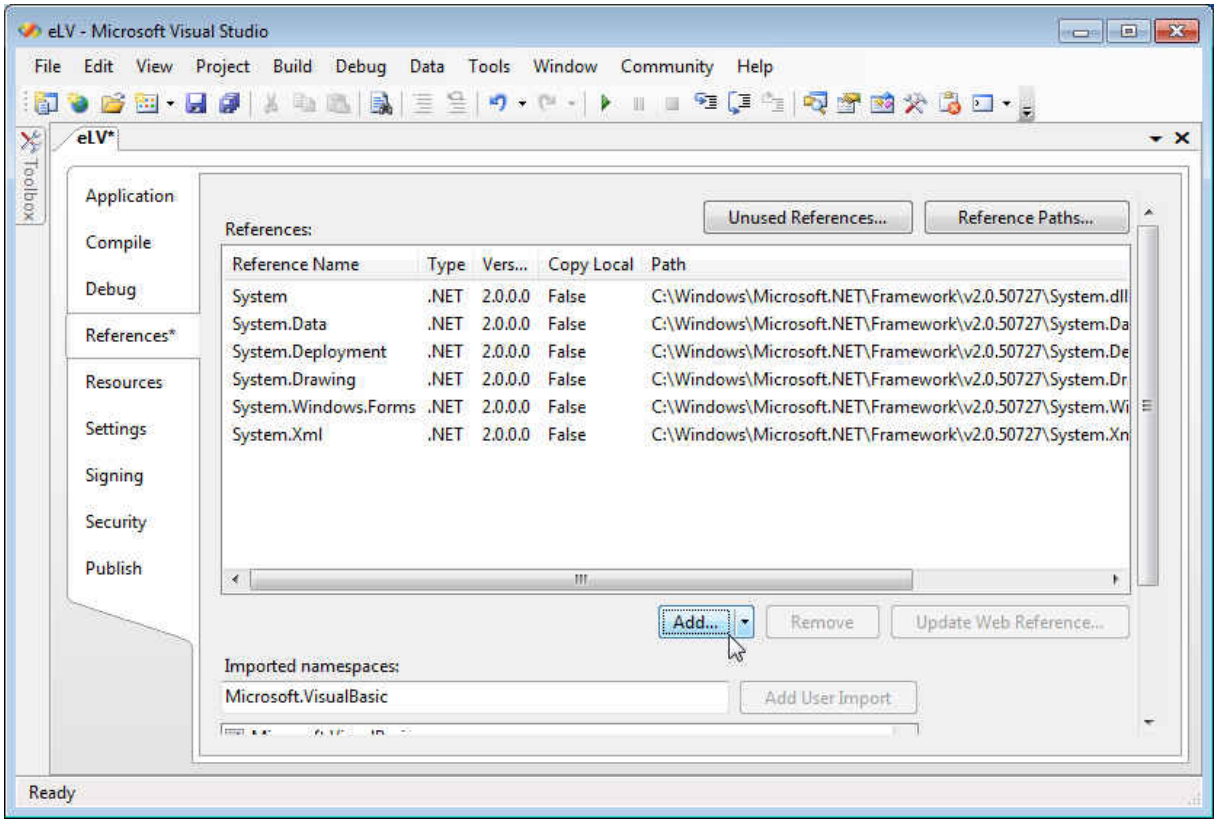
Command	***Meaning***
"RE"+CRLF	Read/DeviceErrorCode (PC→eLogger)
"rE1"+CRLF	ReadResponse/DeviceErrorCode/TempOutOfSpec (eLogger→ PC)

3.5 Dynamic Link Library

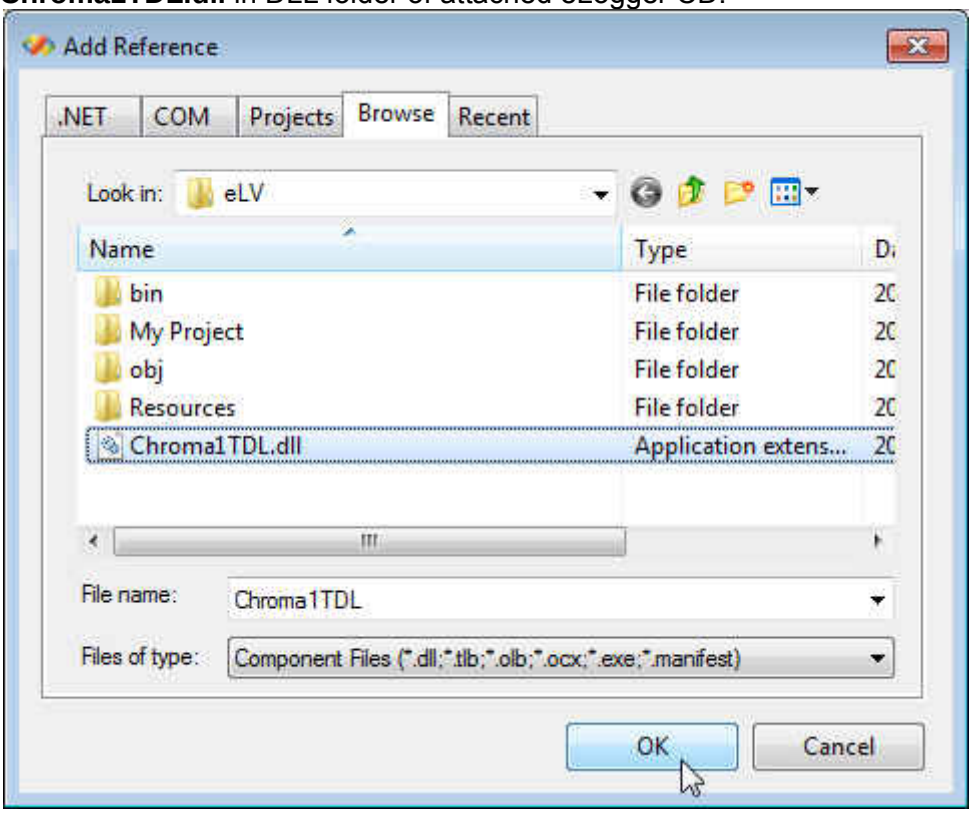
Proceed program edit by communication protocol directly needs considerable experience in low-level program code, it may be not easy to adapt for engineer usual used high-level program language. Thus, we also provide DLL (dynamic link library) to proceed program edit, operation methods are as the following.

Take an example by Microsoft Visual Basic 2005 program development.

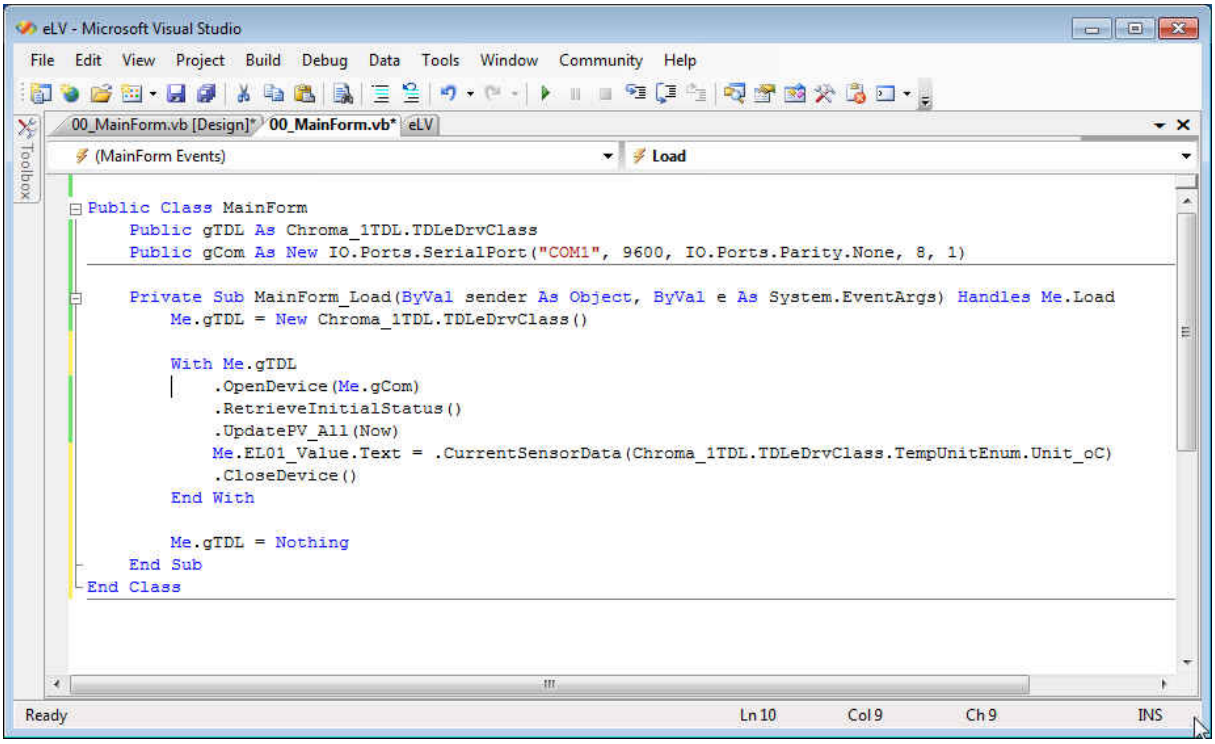
1. Open new plan, enter page “Reference”.



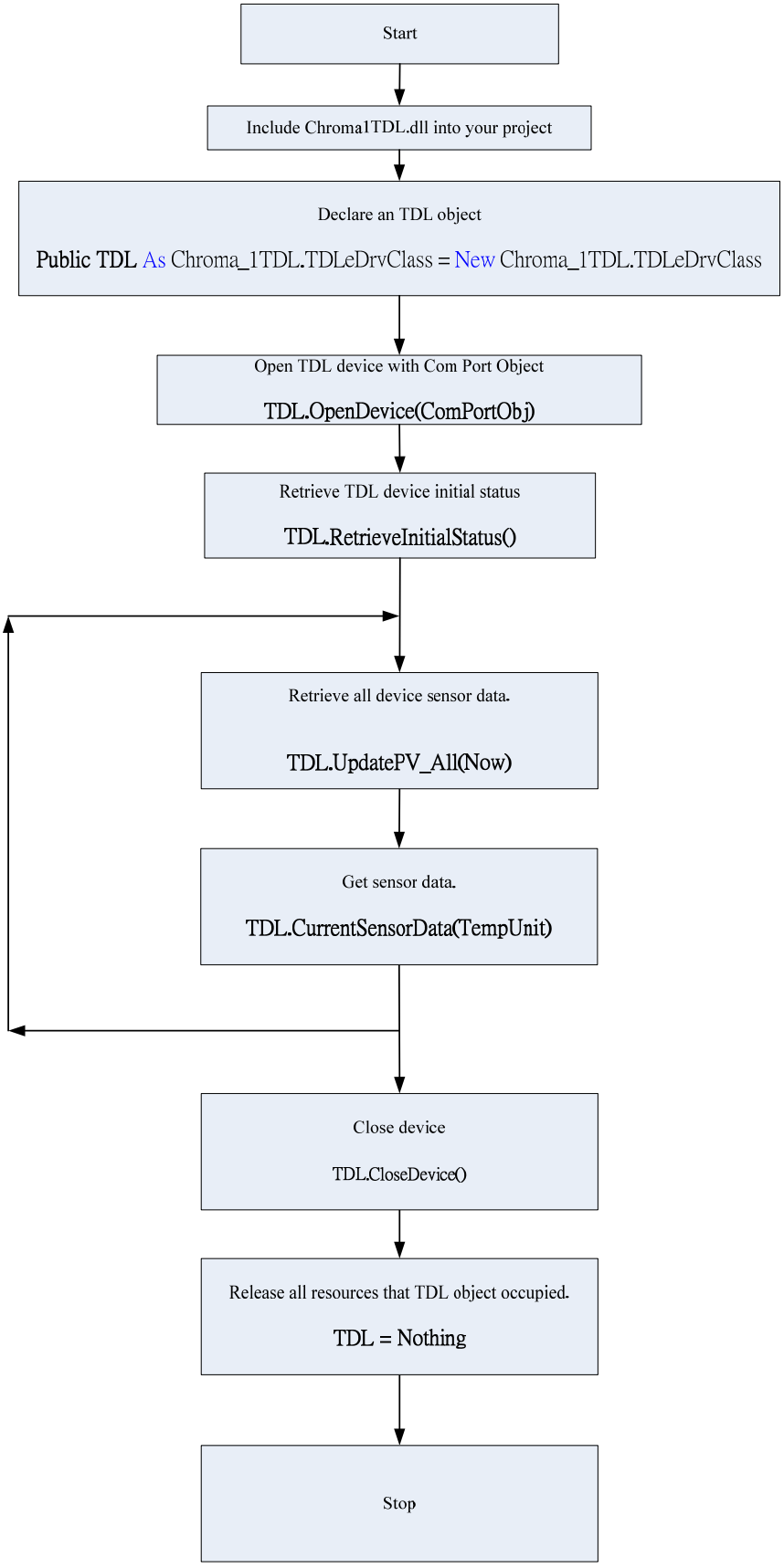
2. Find **Chroma1TDL.dll** in DLL folder of attached eLogger CD.



3. When **Chroma1TDL.dll** to be added to Reference, the related sub-program can be recalled in Visual Basic program afterward.


eLV - Microsoft Visual Studio
File Edit View Project Build Debug Data Tools Window Community Help
00_MainForm.vb [Design]* 00_MainForm.vb* eLV
Toolbox
(MainForm Events)
Load
Public Class MainForm
Public gTDL As Chroma_1TDL.TDLeDrvClass
Public gCom As New IO.Ports.SerialPort("COM1", 9600, IO.Ports.Parity.None, 8, 1)
Private Sub MainForm_Load(ByVal sender As Object, ByVal e As System.EventArgs) Handles Me.Load
Me.gTDL = New Chroma_1TDL.TDLeDrvClass()
With Me.gTDL
.OpenDevice(Me.gCom)
.RetrieveInitialStatus()
.UpdatePV_All(Now)
Me.EL01_Value.Text = .CurrentSensorData(Chroma_1TDL.TDLeDrvClass.TempUnitEnum.Unit_oC)
.CloseDevice()
End With
Me.gTDL = Nothing
End Sub
End Class
Ready
Ln 10
Col 9
Ch 9
INS

4. Program flow example:



3.6 TDL Recall Method

TDL(Thermal Data Logger) DLL driver is developed by Microsoft Visual Basic 2005, recall method in the following is also based on the program language. If users edit program by other program language, please follow the language used to do related modification.

CloseDevice()

It closes logger and corresponding COM Port, before ending the program please recall this item.

OpenDevice(ByRef COMPortObj As System.IO.Ports.SerialPort, Optional ByVal CommunicationTimeout As Integer = 500) As CommunicationResultEnum

According to specified COM Port object to set up connection and set communication timeout. The response definitions of gotten set up communication are as the following.

```
Enum CommunicationResultEnum As Integer
    ComPortOpenOK = 1
    CommunicationOK = 0
    Busy = -1
    CommunicationTimeout = -2
    DataError = -10
    ComPortOpenFail = -100
    ComPortFailure = -101
    ComPortClosed = -102
    ComPortObjNA = -200
End Enum
```

SetDigitalFilterType(ByVal Setting As DigitalFilterTypeEnum) As Boolean

It sets data average time, Setting definitions are as the following.

```
Enum DigitalFilterTypeEnum As Byte
    MV_02 = Asc("1")
    MV_04 = Asc("2")
    MV_08 = Asc("3")
End Enum
```

SetSensorType(ByVal SensorType As SensorTypeEnum) As Boolean

It sets input thermocouple type or voltage, setting pass or fail will be returned by Boolean value. Its setting definitions are as the following.

```
Enum SensorTypeEnum As Byte
    T_Type = Asc("T")
    K_Type = Asc("K")
    B_Type = Asc("B")
    E_Type = Asc("E")
    J_Type = Asc("J")
    N_Type = Asc("N")
    R_Type = Asc("R")
    S_Type = Asc("S")
    Volt_Type = Asc("V")
    Current_Type = Asc("I")
End Enum
```

UpdatePV_All(ByVal CurrDT As Date) As CommunicationResultEnum

Proceed one status update for the device which includes read back various readings and device inner status. Users should get readings of various channels (ex:CurrentSensorData()) after the sub-program is recalled. Parameter CurrDT transmits the current date and time for polling speed control. Chroma temperature recorder fastest sampling rate is 0.2 second/all channels thus users recall the sub-program speed shouldn't faster than this rate, otherwise it may affect recorder operation efficiency and result in reading update abnormal even system failure. To enforce recorder proceeding status update with the rate lower than 0.2 second which can't guarantee its normal operation.

ChannelSatus() As CHStatusEnum
It reads sensor status, the definitions are as the following.

```
Enum CHStatusEnum As Integer
    Channel_Not_Available = -5
    TC_Open = -4
    Minus_Overlaod = -3
    Over_Neg_DisplayRange = -2
    Over_MinLimit = -1
    Normal = 0
    Over_MaxLimit = 1
    Over_Pos_DisplayRange = 2
    Plus_Overlaod = 3
End Enum
```

CommunicationTimeoutSetting() As Integer
It sets communication timeout, the time unit is in mS (1/1000 second).

CurrentSensorData(ByVal TempUnit As TempUnitEnum) As Double
It reads the current temperature value, temperature unit definitions are as the following.

```
Enum TempUnitEnum As Byte
    Unit_oC = 1
    Unit_oF = 2
    Unit_oK = 3
End Enum
```

Please be aware that temperature reading is 4-byte original data and includes the next four decimal. Due to noise and equipment stability, not every digit is accurate. When the average setting is MV_2~4, its accuracy is up to the next one decimal. When the average setting is above MV_8 thus the accuracy will reach to the next two decimal. The last significant digit little rolling is the normal condition.

DeviceDriverVersionNumber() As VersionDescClass
It reads driver version number.

DeviceFWVersionNumber() As VersionDescClass
It reads logger firmware version number.

DigitalFilterType() As DigitalFilterTypeEnum
It reads average filter setting.

ModelName() As String
It reads logger model name.

ModelNumber() As ModelNumberEnum
It reads logger model number.

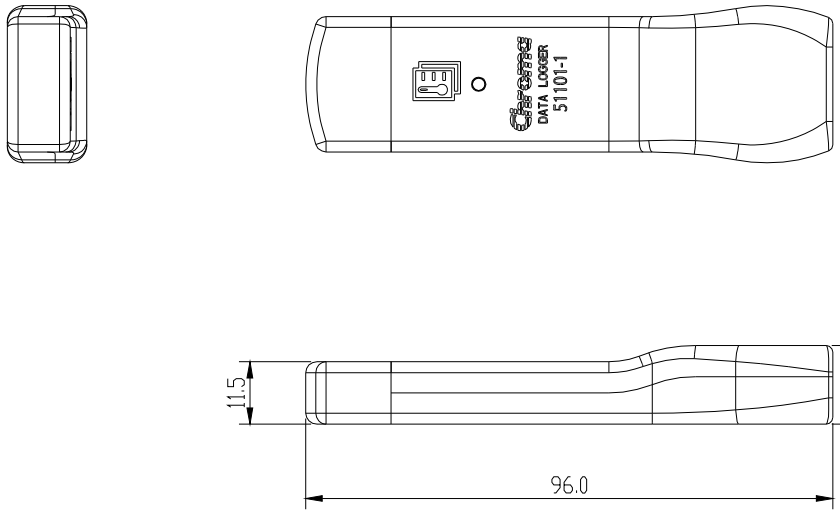
PollingSpeed() As ULong
It reads or sets data polling speed, we don't recommend to change it arbitrarily.

SensorType() As SensorTypeEnum
It reads input thermocouple type, voltage or current file, the definitions are as the following.

```
Enum SensorTypeEnum As Byte
    T_Type = Asc("T")
    K_Type = Asc("K")
    B_Type = Asc("B")
    E_Type = Asc("E")
    J_Type = Asc("J")
    N_Type = Asc("N")
    R_Type = Asc("R")
    S_Type = Asc("S")
    Volt_Type = Asc("V")
    Current_Type = Asc("I")
End Enum
```

Appendix A

A.1 Dimension



unit: mm

A.2 Product Specification

Absolute Maximum

Specification Item	Symbol	Value	Unit
Dongle Power Supply Voltage	Vdc	6	V
Dongle Power Supply Current	Idc	0.08	A
Thermocouple Differential Input Voltage	Vtc	±2.5	V
Operating Temperature	Top	0~50	°C
Storage Temperature	Tst	-20~60	°C
Storage Humidity		80	%RH

Specifications

Specification Item	Symbol	Value	Unit
Thermocouple Connector Specifications			
Thermocouple connector		B, E, J, K, N, R, S, or T mini-type	
Thermocouple jacks		B, E, J, K, N, R, S, or T mini-type	
Temperature Reading Specifications			
Temperature Sensor Type		Thermocouple B, E, J, K, N, R, S, T	
Temperature Scale		ITS-90 defined	
Temperature Accuracy[(1) (2)]		±[0.01% of reading +0.3]	°C
Temperature Resolution		±0.01 [(3)]	°C
CJC Error[(2)]	e_{cjc}	±0.3	°C

Maximum Sample Rate	SR	5	Sample /Sec
Galvanic Isolation	Viso	1000	Vdc
Input Resistance	Rin	5M	Ω
Thermocouple break detection current	Itc_open	100	nA
Voltage Reading Specifications			
Voltage Input Type		Chroma VA-480 Voltage Adapter	
Voltage Resolution		1	mV
Voltage Input Range		+/- 480	Vdc
Voltage Reading Accuracy		±[0.1% of reading +1mV]	
Input Resistance	Rin	1M	Ω
Current Reading Specifications			
Current Input Type		Chroma IA-3 Current Adapter	
Current Resolution		1	mA
Current Input Range		+/- 3	Adc
Current Reading Accuracy		±[1% of reading +1mA]	
Communication Specifications			
USB Communication		USB2.0(full speed device), USB A-type Connector	
Power Specifications			
Power Requirement (Dongle)	Vdc	4.5~5.5	V
Maximum Power Consumption	Pmax	0.33	W
Physical Specifications			
Dimensions (WidthxDepthxHeight)		96x29x14.5	mm^3
Weight		30	g
Environmental Specifications			
Operating Temperature	Top	0~50	°C
Humidity		< 80	%RH

(1) Accuracy is based on operating temperature 20°C ~ 30°C and up to thermal balance. Meanwhile USB supplied voltage should be regulated within the condition of 5V± 0.1V and exclude temperature error of thermocouple.
(2) If operating temperature is over the range of 20°C ~ 30°C, it needs to add (0.01% of reading + 0.03°C)/ °C and multiplied by error which over temperature range value.
(3) Under MV_8 filtering mode.

A.3 Measurement Range and Accuracy

Measurement Mode	Measurement Range	Accuracy
DC Voltage(1)	- 480 to 480 V	± [0.1% of reading +1mV]
DC Current(2)	-3 A to 3 A	± [1% of reading +1mA]
Thermocouple T-type	-200 to 400°C	± [0.01% of reading +0.3] °C (3)
Thermocouple K-type	-200 to 1372°C	
Thermocouple B-type	250 to 1820°C	
Thermocouple E-type	-200 to 1000°C	
Thermocouple J-type	-210 to 1200°C	
Thermocouple N-type	-200 to 1300°C	
Thermocouple S-type	-50 to 1760°C	
Thermocouple R-type	-50 to 1760°C	

(1) It needs to be coordinated with Chroma VA-480 voltage adapter.
(2) It needs to be coordinated with Chroma IA-3 current adapter (optional accessory).
(3) Accuracy definition is based on operating temperature is 20°C ~ 30°C and up to thermal balance. Meanwhile USB supplied voltage should be regulated within the condition of 5V± 0.1V and exclude temperature error of thermocouple. If operating temperature is over this range, thus accuracy needs to add the value which over temperature and multiplied by (0.01% of reading + 0.03°C) / °C.

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