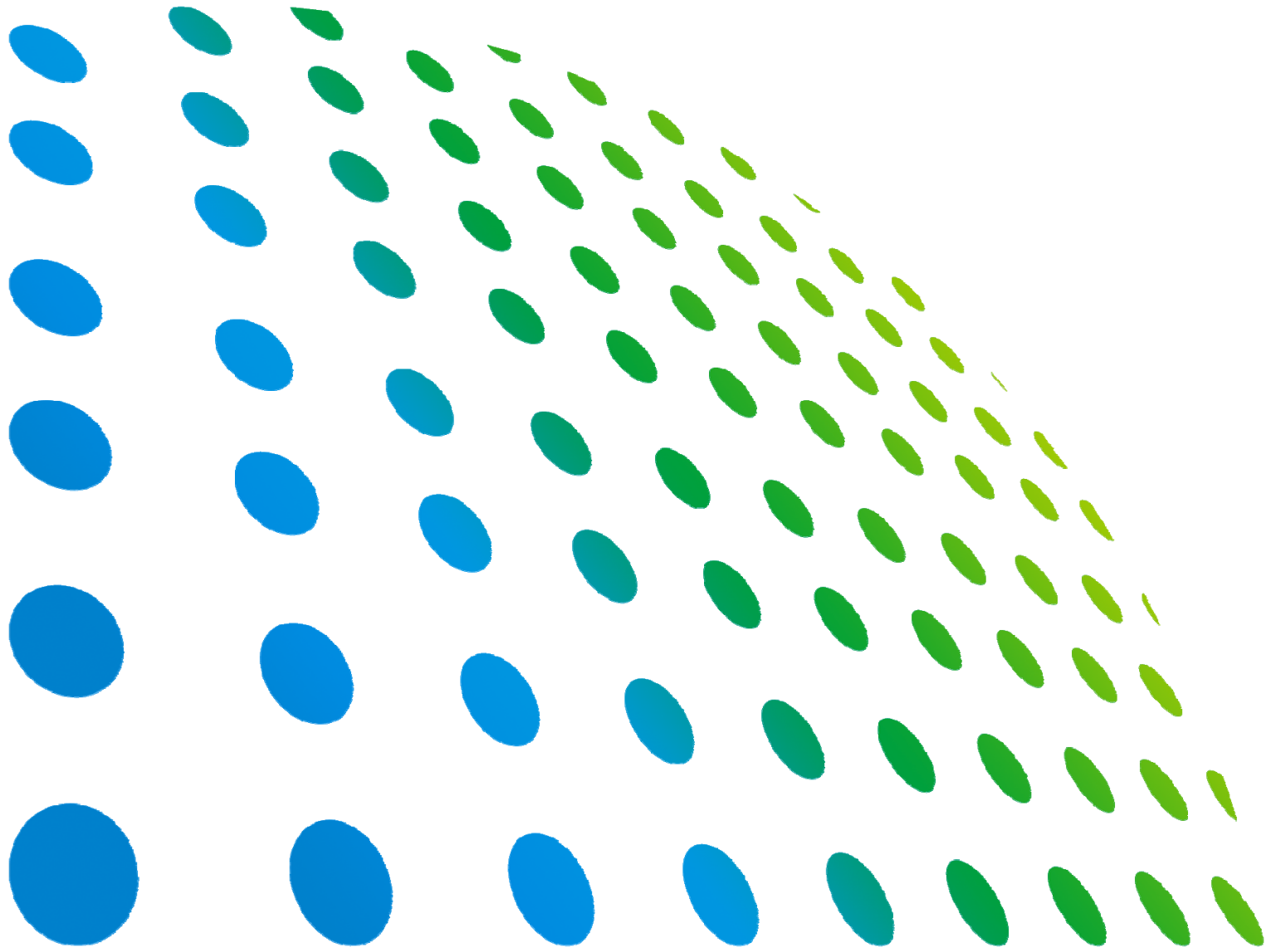




Thermal/Multi-function Data Logger

51101-8

User's Manual



Thermal/Multi-function Data Logger 51101-8 User's Manual



Version 1.0
June 2012

Legal Notices

The information in this document is subject to change without notice.

Chroma ATE INC. makes no warranty of any kind with regard to this manual, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Chroma ATE INC. shall not be held liable for errors contained herein or direct, indirect, special, incidental or consequential damages in connection with the furnishing, performance, or use of this material.

CHROMA ATE INC.

66 Hwaya 1st Rd., Kueishan Hwaya Technology Park, Taoyuan County 33383, Taiwan

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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 | ○ | ○ | ○ | ○ | ○ | ○ |
| CHASSIS | ○ | ○ | ○ | ○ | ○ | ○ |
| ACCESSORY | ○ | ○ | ○ | ○ | ○ | ○ |
| PACKAGE | ○ | ○ | ○ | ○ | ○ | ○ |

“○” 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 | × | ○ | ○ | ○ | ○ | ○ |
| CHASSIS | × | ○ | ○ | ○ | ○ | ○ |
| ACCESSORY | × | ○ | ○ | ○ | ○ | ○ |
| PACKAGE | ○ | ○ | ○ | ○ | ○ | ○ |

“○” 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.





SPORTON LAB.

Certificate No: CB10104039

Report No.: EC232611

CERTIFICATE

● **EQUIPMENT:** 8-channel data logger
MODEL NO. : 51101-8
APPLICANT : CHROMA ATE INC.
 66 Hwaya 1st Rd., Kueishan Hwaya Technology Park,
 Taoyuan County 33383, Taiwan



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 55011:1998/A1:1999/A2:2002 Class A, EN 61000-3-2:2006, EN 61000-3-3:1995/A1:2001/A2:2005, IEC 61000-4-2:1995/A1:1998/A2:2000, IEC 61000-4-3:2002, IEC 61000-4-4:2004, IEC 61000-4-5:1995/A1:2000, IEC 61000-4-6:2003, IEC 61000-4-8:1993/A1:2000, IEC 61000-4-11:2004).
 THE TEST WAS CARRIED OUT ON Mar. 30, 2012 ~ Apr. 08, 2012 AT SPORTON INTERNATIONAL INC. LAB.

Jordan Hsiao

 Jordan Hsiao

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.



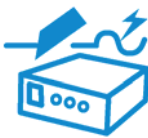
BEFORE APPLYING POWER

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.



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.



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.



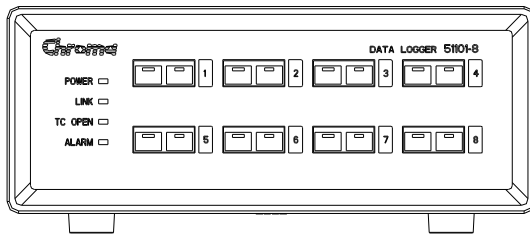
This indicates important information or tips for the procedures and applications, etc. The contents should be read carefully.

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

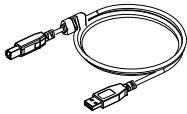


Main unit



User's Manual CD-ROM

Standard Equipment (Cable)



- USB Cable
1.8m 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 | 2-3 |
| 2.5 | File Selection..... | 2-7 |
| 2.6 | Communication Selection | 2-10 |
| 2.7 | Setting Selection | 2-10 |
| 2.8 | Temperature Unit Selection..... | 2-11 |
| 2.9 | About Selection | 2-12 |
| 2.10 | Graph Record..... | 2-12 |
| 3. | Communication Protocol..... | 3-1 |
| 3.1 | Sequence Communication Structure..... | 3-1 |
| 3.2 | Packet Format..... | 3-1 |
| 3.3 | Signal Code & Definition | 3-3 |
| 3.4 | Checksum | 3-4 |
| 3.5 | Example | 3-5 |
| 3.6 | Dynamic Link Library..... | 3-5 |
| 3.7 | 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 51101-8 Thermal/Multi-function Data Logger (is called 8-Logger for short) is an efficient instrument with powerful function for measuring temperature and DC voltage which equipped with compact size and carry convenience. It is capable of monitoring temperature, voltage or current for 8 points simultaneously, by using USB communication port on the PC to supply power and operation. If USB communication port on the PC meets regulation of supplied 100mA, thus external power supply is no need. It is easy to use, measurement accuracy and powerful function which is much better than other similar products. For getting correct operation, please peruse this manual and follow it to operate.

1.1 Basic Structure

Chroma 51101-8 Thermal/Multi-function Data Logger (is called 8-Logger for short) panel consists of 8 mini-type thermocouple connectors and 4 status display LED. The rear panel includes USB port and standby power port as Figure 1-1 shown.

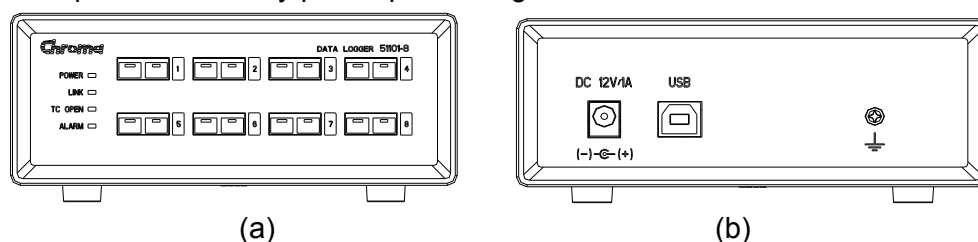


Figure 1-1 Outline of 8-Logger (a) front panel and (b) rear panel

When using 8-Logger, connect 8-Logger to any USB port of the PC by USB connection cable as Figure 1-2 shown. If the USB port meets regulation of supplied 100mA, thus external power supply is no need. For some older computers or USB can't supply enough when through certain HUB, thus they can be supplied by optional Chroma dedicated external power supply.

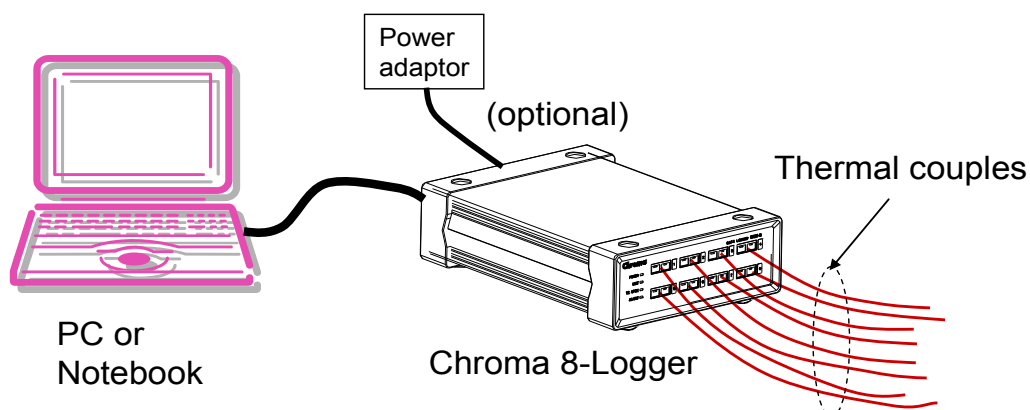


Figure 1-2 Use 8-Logger measurement structure

CAUTION The similar products on the market, only Chroma Thermal/Multi-function Data Logger series 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.

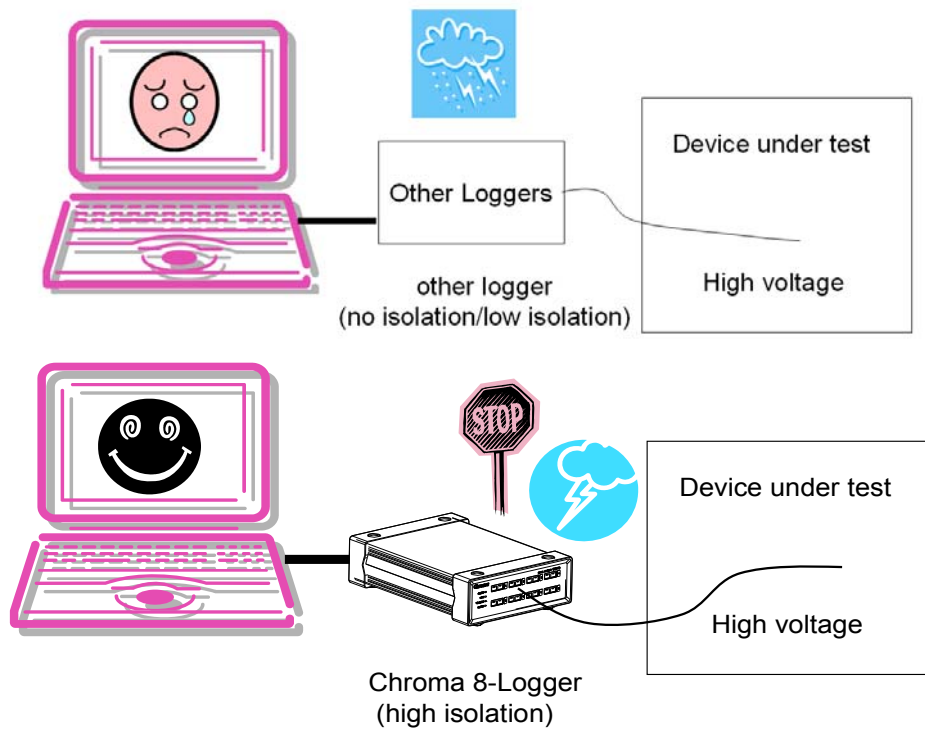


Figure 1-3 Only Chroma Thermal/Multi-function Data Logger series product is with high voltage isolation protection circuit. It can get safety accuracy measured function under high external voltage environment.

Note There is a grounding hole on rear panel as Figure 1-4 shown. When operating, use lead to lock the terminal and ground connection. The thermocouple wire also needs to be grounded at measurement end simultaneously, it avoids electrostatic interference even may cause equipment failure.

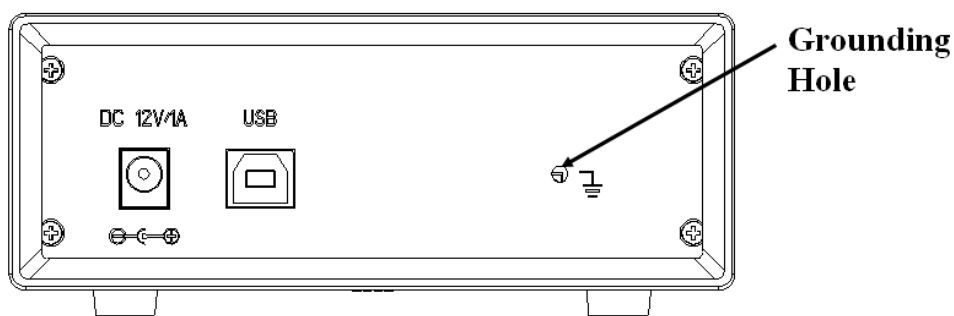


Figure 1-4 Grounding hole on rear panel

1.2 Temperature, Voltage and Current Measurement

Chroma 51101-8 (51101 series is the model number for the product of Chroma Thermal/Multi-function Data Logger. 51101-8 is a model for 8-channel thus is called 8-Logger for short. The manual adopts the same name for short that users can read it conveniently) 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 measuring voltage, it is necessary to use dedicated Chroma VA-480 voltage adapter (optional accessory). When measuring current, it is necessary to use dedicated Chroma IA-3 current adapter (optional accessory) and then current measurement line is connected as Figure 1-6 shown, otherwise correct measurement result can't be gotten and even 8-Logger will be damaged.

⚡ CAUTION : When operating Chroma 8-Logger 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.

8 inputs of 8-Logger can be utilized separately, for example, 1st input is K type thermocouple, 2nd input is T type thermocouple and 3rd input is VA-480 measurement voltage. Each input has individual input type, only the software according to individual input to set correctly (see chapter 2) and operating simultaneously without limit.

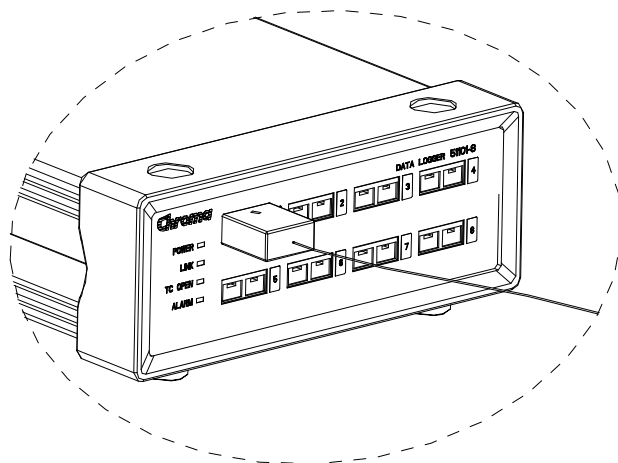


Figure 1-5 Use thermocouple wire of mini type connector to proceed temperature measurement

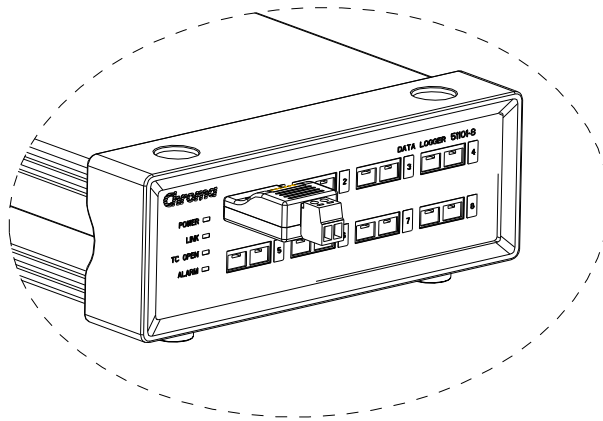


Figure 1-6 When measuring voltage or current, it is necessary to use dedicated Chroma VA-480 voltage adapter or IA-3 current adapter.

Note Current and custom physical measurement function need to be PC program version 1.1 and 8-Logger firmware version 1.0 or newer version that is equipped with this function. Otherwise, only temperature and voltage measurement functions are provided.

1.3 LED Display

LEDs on 8-Logger panel, its displayed meanings are shown as Table 1-1.

| Name | LED Color | LED Display Method | Indication |
|---------|-----------|--------------------|-----------------------------------------------------------------------|
| Power | Green | Always ON | 8-Logger supplies power normally |
| Link | Green | Quick blinking | Connect to the computer under normal operation |
| | | OFF | It doesn't connect to the computer. |
| TC Open | Red | Blinking | It has certain channel thermocouple break open or input disconnected. |
| Alarm | Red | | Temperature over measurement range and other error reasons |

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 8-Logger is a measurement instrument for computer operation and gets measurement result via computer operation interface. Therefore, one 8-Logger measurement program (Chroma 8-Logger Viewer program, **Chroma_8LV**) will be attached to 8-Logger. Please be sure the computer using Microsoft Windows operating system, insert CD with the good and installation program will be executed automatically as Figure 2-1 shown. Install USB driver firstly and then install Viewer Program, its procedure follows installation indication to complete it. After CHROMA_8V program first-time installation is completed, it will be executed automatically. Next to click “Start” → “Programs” → “Chroma ATE INC.” → “Chroma 8LV” to execute the program.



Figure 2-1 Chroma 8LV program 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 is 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 8LV** measurement program to be removed, please enter “Control Panel” to select “Add or Remove Program” and then click **Chroma 8LV**.

Note : The instrument needs to install USB driver in advance, please install Chroma_8LV program and driver also need to be installed.

2.2 Executing Program

Before executing the program, please connect 8-Logger to USB port firstly and then start **Chroma_8LV** program. First of all, the program main screen will be appeared as Figure 2-2. 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.

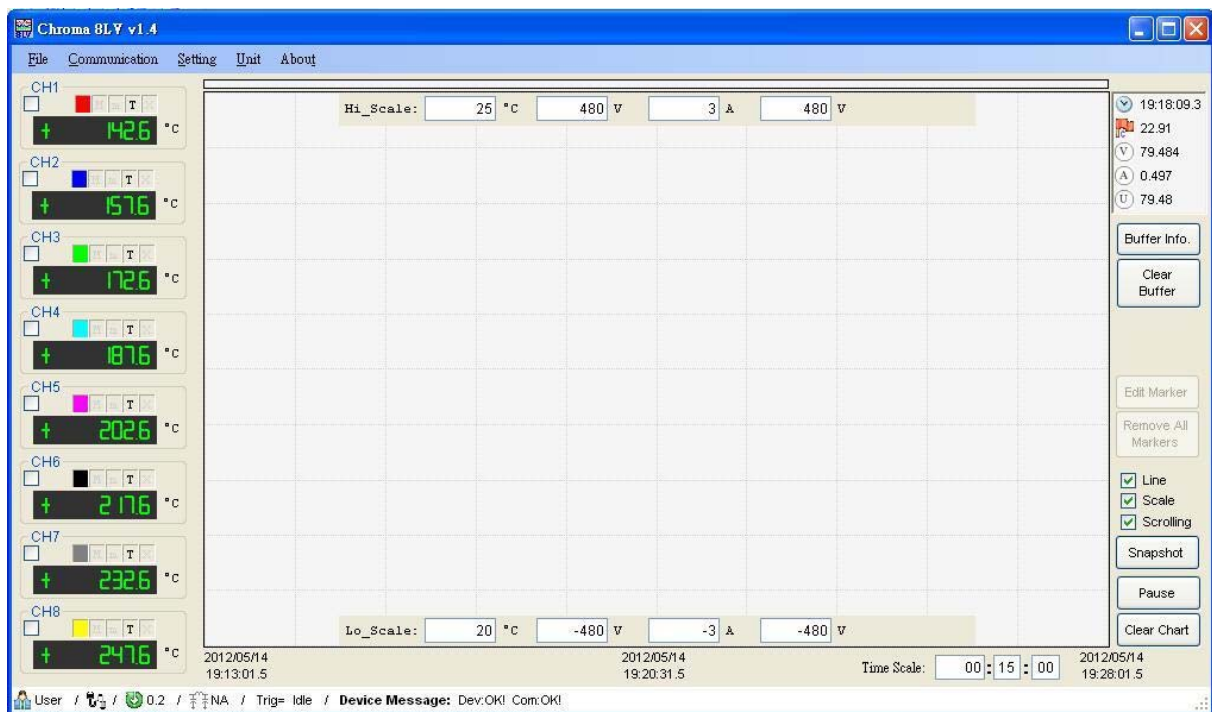


Figure 2-2 Chroma 8LV program startup screen

2.3 Communication Setup

First of all, the communication between 8-Logger and program need to be set up, please click **Communication** at upper left side of window and select **COM Port** which connects to 8-Logger as Figure 2-3 shown. Click **Connect** on pull-down menu to set up communication, the communication between 8-Logger and program can be set up and the value from 8-Logger will be displayed immediately as Figure 2-4 shown. If COM port selection is error thus the value displayed area is without reaction, choose other COM port until it is correct. If correct COM port location is unknown, Auto Search function also can be selected. To search 8-Logger located COM port from the program and connection automatically.

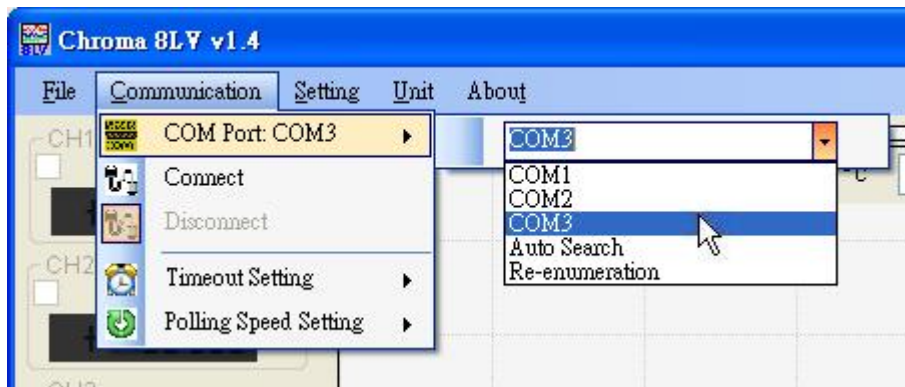


Figure 2-3 Select COM Port for communication setup

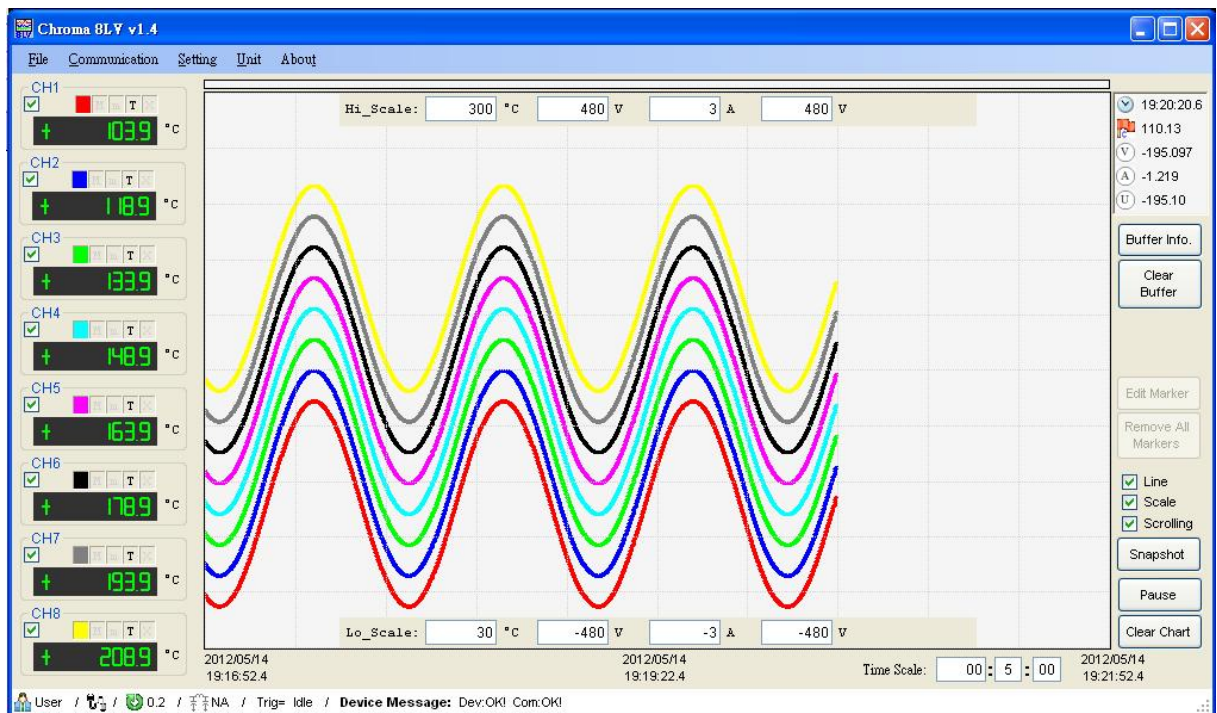


Figure 2-4 After completing communication setup, various channels values will be shown immediately

2.4 Data Display

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

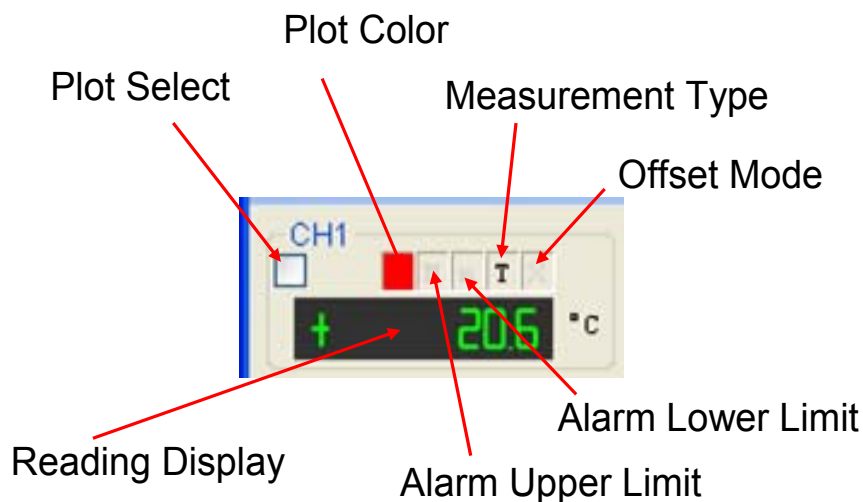


Figure 2-5 Various settings of data display area

Plot Select, check this item for 8-Logger data plotting on graphic area (see 2.9), otherwise it won't plot the 8-Logger data.

Plot Color, each channel of 8-Logger 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 channels of 8-Logger to avoid confusion.

Alarm Upper Limit and Alarm Lower Limit, it is for setting upper or lower threshold. When the value tested is higher than upper threshold, background in data display area will be changed to red, whereas background in data display area will be changed to light blue as Figure 2-6 shown. The background 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 threshold.

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

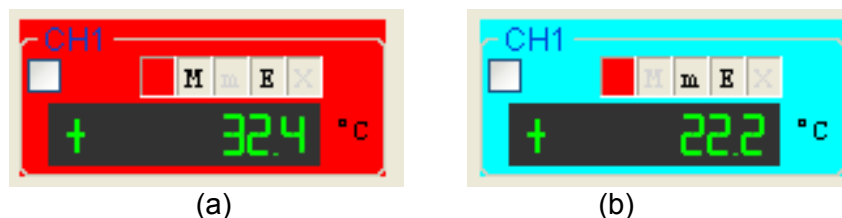


Figure 2-6 Background in display area changed indicating (a) higher than maximum high limit (red) or (b) lower than minimum low limit (light blue)

Measurement Type, it is necessary to select thermocouple type to be used correctly while measuring temperature thus correct temperature can be gotten. Voltage, current and user defined physical 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 and other measurement types, selected result will be shown on the selection box by its English letter.

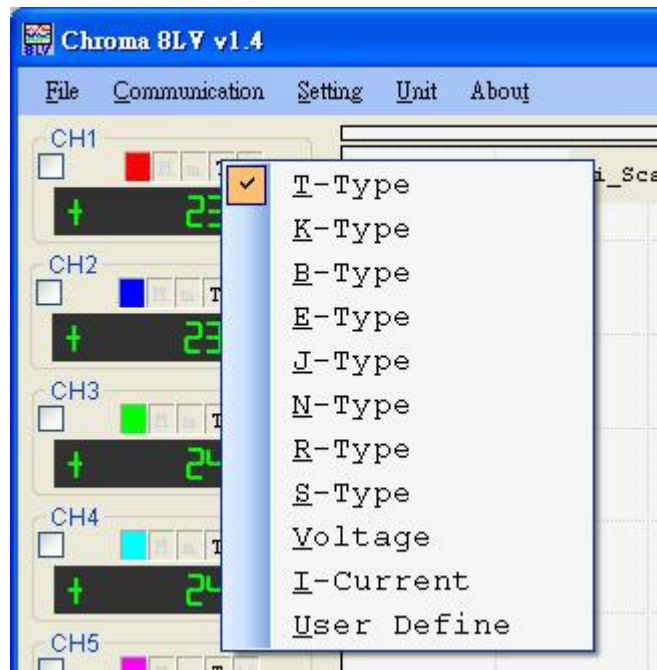


Figure 2-7 Measurement type selection

Note

- User defined physical measurement needs two conditions as the following.
1. Users prepared physical detector, the detector can transform physical quantity under test to DC voltage. For example, light intensity measurement can use photodiode to coordinate with bias voltage resistance for transforming light intensity into voltage. Some commercially available electronic barometers can transform atmospheric pressure into voltage.
 2. The physical quantity transformed into voltage should be in linearity within measurement range. For example, light intensity 0W generated 0V voltage, 1mW generated 0.2V voltage, 10mW generated 2V voltage thus 8-Logger detected 1V voltage will be interpreted into 5mW light intensity. If the generated voltage is non-linearity thus 8-Logger can't interpret the physical quantity correctly.

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) Physical meaning and (b) setting mode of "Offset" compensation 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 ($T_{sample} - T_{TC} = \text{Offset}$) *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 $T_{TC} + \text{Offset} = T_{sample}$ and it isn't thermocouple direct reading. The setting provides three modes: **Not used** is no using offset compensation. **Fix offset compensation** is using constant compensation (Offset is a constant value for input). **Multiple offset compensation** will follow temperature calculation value for compensation (Offset is temperature quadratic function) as Figure 2-8 (a) Physical meaning and (b) setting mode of "Offset" compensation 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.

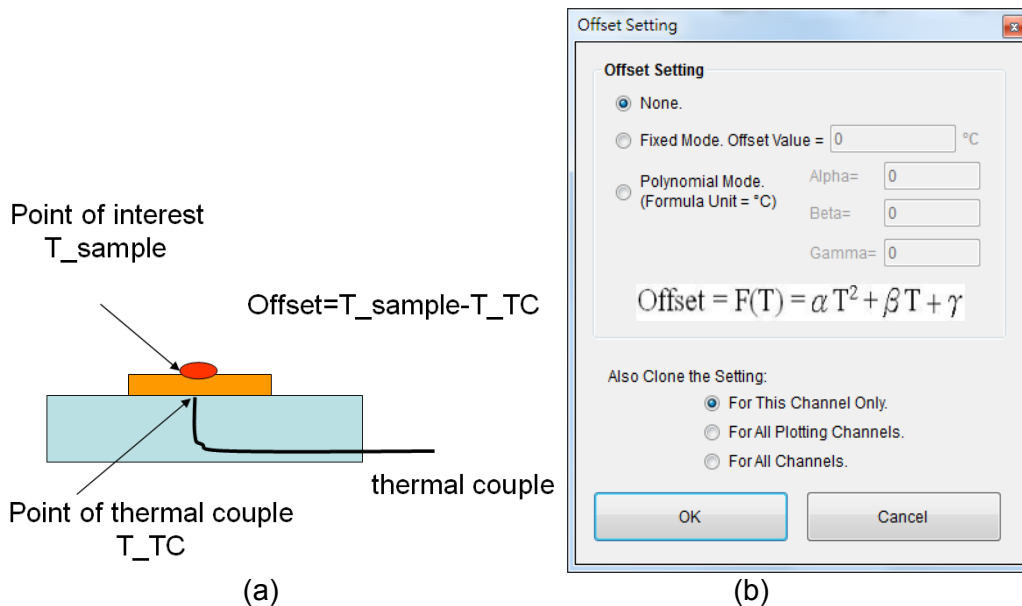


Figure 2-8 (a) Physical meaning and (b) setting mode of "Offset" compensation

Except for above options, right click the mouse on the value displayed area (black block) and selection list will be popped up as Figure 2-9 shown. The definition and operation from "Set Plotting Color" to "Set Offset" are the same as the items above described.

Enable/Disable Sampling, set if the channel read data is transmitted to PC.

Set Alias, give an easy to remember name for the measured data in the channel, 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 plotting area and data record file.

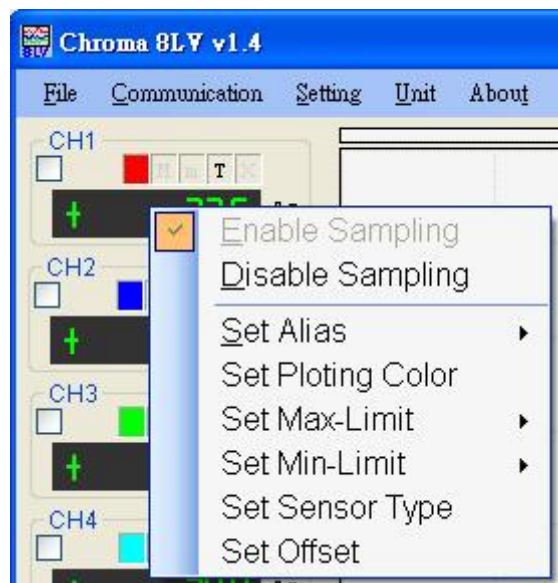


Figure 2-9 Selection list of data area

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 in 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 8-Logger, 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

This selection will bring out the window as Figure 2-11, its purpose is to write the measured data into computer hardware for preserving and analyzing afterward. The program provides a lot of data recording related settings are given as the following.

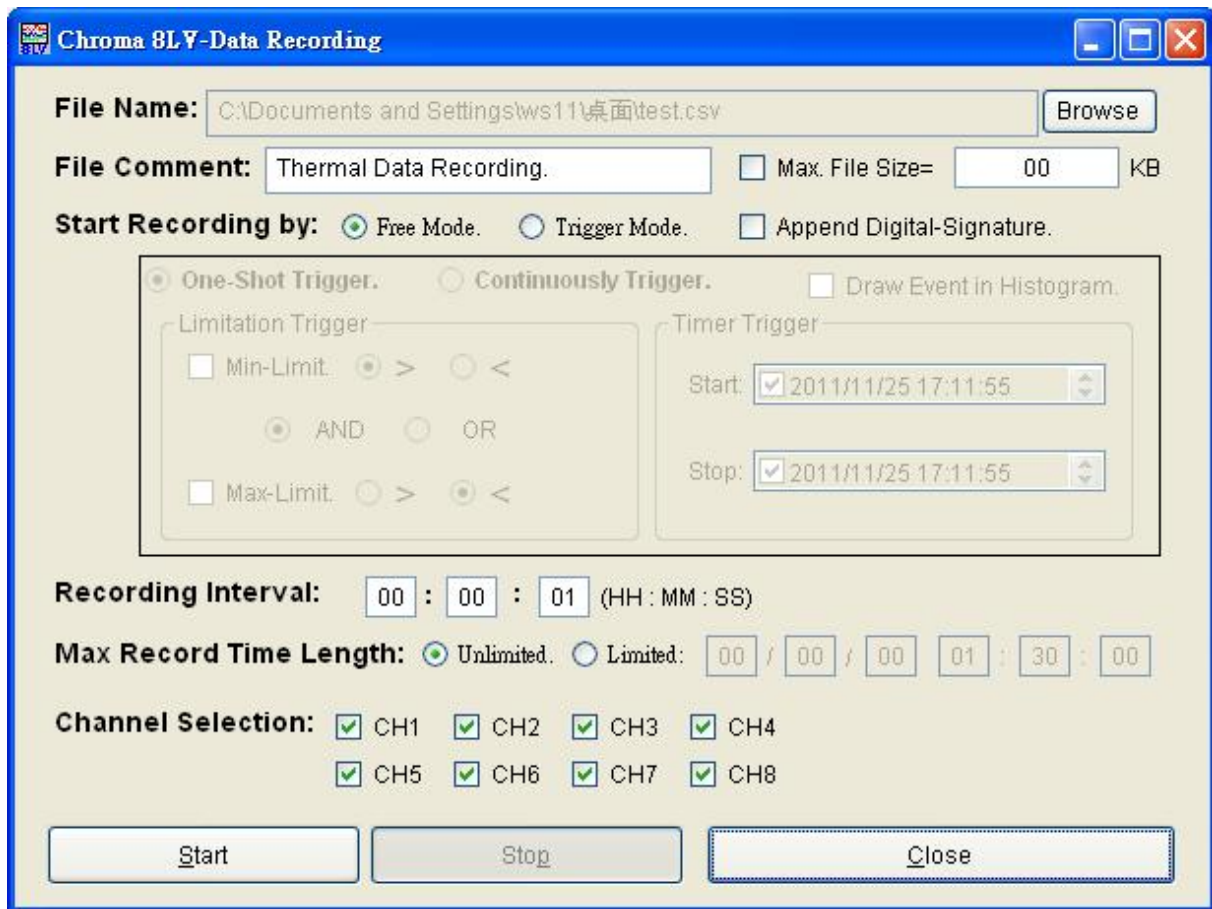


Figure 2-11 Data recording setting window

It is necessary to click **Browse** to set save directory and file name firstly. The program provides two file formats of text file (.txt format) or Microsoft Excel file (.csv 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.

Data recording mode includes Free Mode and Trigger Mode.

Free Mode recording 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 recording. When this mode is selected, gray area beneath it will turn to normal display for setting various trigger conditions.

Append Digital Signature

It adds digital signature in recording file, the signature is based on recording data via specified coding rule to compute and generated. Its purpose is to ensure primitive of record file, it won't be matched to the signature if recording file changed by manual. This situation can be inspected while identifying signature.

One-shot Trigger mode

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

Limitation Trigger

It can set upper and lower threshold as section 2.4. When any 8-Logger measurement and threshold are more conforming to logic relationship here set up then trigger will be generated. For example, upper limit and lower limit of CH1 are set to 100°C and 0°C separately, logic relationship is set to "<" Min-Limit "OR" ">" Max-Limit thus CH1 reading higher than 100°C or lower than 0°C trigger recording will be generated.

Time Trigger

It can be set to start generating 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 Time 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.

Max Record Time 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 selects the file open to be identified, the selection will be calculated by its digital signature and file content. Confirm the file data to be original record, or it is altered by manual. Please be aware that **Append Digital Signature** should be checked while recording setting, thus digital signature will be generated for the selection identification. Otherwise, the selection can't judge its primitive.

2.6 Communication Selection

The Communication Selection includes except for COM Port and Connect in section 2.3, it also includes **Disconnect**, **Timeout Setting** and **Polling Speed Setting** as Figure 2-12 shown.

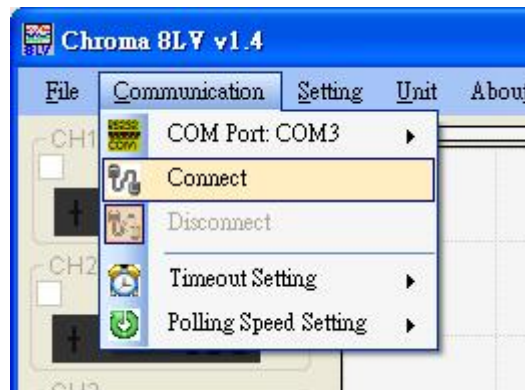


Figure 2-12 Communication selection

Disconnect

It stops all data and status reading of 8-Logger.

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 8-Logger, 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_8LV** program will adjust polling speed setting automatically.

2.7 Setting Selection

Setting selection includes **Differential Channel**, **Filter Selection**, **Display Alias**, **Audio Alarm** and **Language** as Figure 2-13 shown.



Figure 2-13 Setting selection

Differential Channel

After clicking this item, 4 virtual channels data window will be popped up. It can be set to differential calculation of any two real channels, for example, set dCH1 as differential of real channel CH2 and CH1, and set dCH2 as differential of real channel CH6 and CH5 as Figure 2-14 shown. Each differential channel displays the value, it also can set upper limit, lower limit and graphic display as well.



Figure 2-14 Differential channel window

Filter Selection

It can set data processed moving average range, the larger of value and the noise is less. However, the temperature reaction speed also will be slow down. On the contrary, reaction is quickly but more noise. How to set is most appropriate depending on actual application and requirement. Please notice that average setting is 8 (MV_8), temperature reading resolution can be increased from 0.1 to 0.01 thus temperature variation can be analyzed delicately.

Display Alias

It can decide if shows defined name of **Set Alias** in data list.

Audio Alarm

When the reading of any channel is higher than high limit or lower than low limit and it results in warning and enables computer audio. It is for users getting warning happened by hearing the sound instead of viewing computer monitor. The sound generated can be decided by selected audio file.

Language

The program interface provides two selections of Traditional Chinese and English. The selected language interface will be displayed when restarting the program next time.

2.8 Temperature Unit Selection

It can select temperature displayed unit °C, °F or °K as Figure 2-15 shown.



Figure 2-15 Temperature unit selection

2.9 About Selection

It checks program version, firmware version and Chroma information.

2.10 Graph Record

Draw the record value to graph which is helpful to analysis as Figure 2-16 shown. In the right graphic area of main screen, horizontal axis stands for time, vertical axis has four selections of temperature, voltage, current and self defined physical quantity. There are four numeral boxes at upper and lower side of window, key in range value of these four measurements directly. When displayed time, temperature, voltage, current and self defined physical quantity range 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.

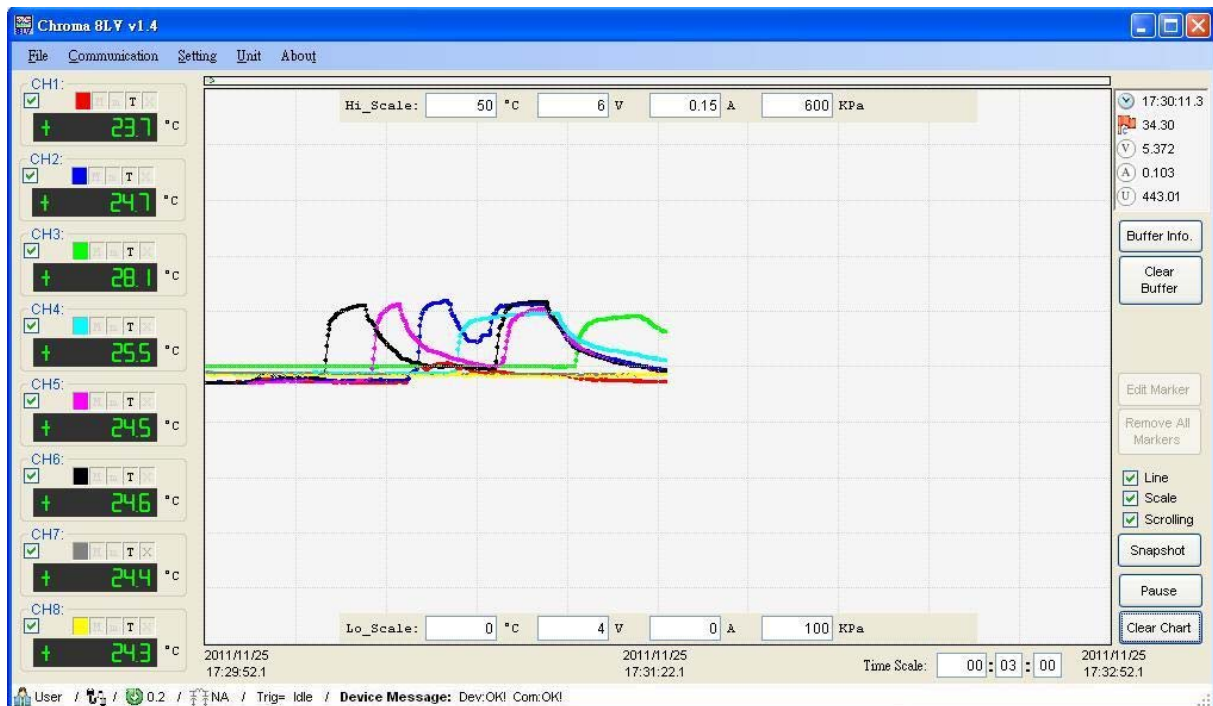


Figure 2-16 Graph area display temperature or voltage variation by time

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 to plot again.

Snapshot

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

Buffer Info.

The program saves captured temperature/voltage/current/self defined physical quantity by a part of PC dynamic memory. The capacity of memory, using condition, estimated data time length to be saved, etc can be realized in this selection. The buffer memory application let users no need to save file to query all data within hours and days quickly, even to 0.2 second each data. This function can be reached by general recorders.

Clear Buffer

Clear all data in buffer memory and zeroing it as well for restart using buffer memory. There is a value display area at the upper right corner of window, the display value indicates the mouse cursor located position which corresponds to time/temperature/voltage/current/self defined physical quantity. By using this function, move the cursor to certain position of measurement curve that can get the time and measurement value. It is very convenient easy to use.

Crop

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 2-17. Click the left key of mouse to select Crop, a cropping enlarged histogram will be shown as Figure 2-18. This cropping enlarged histogram is for processing detail analysis.

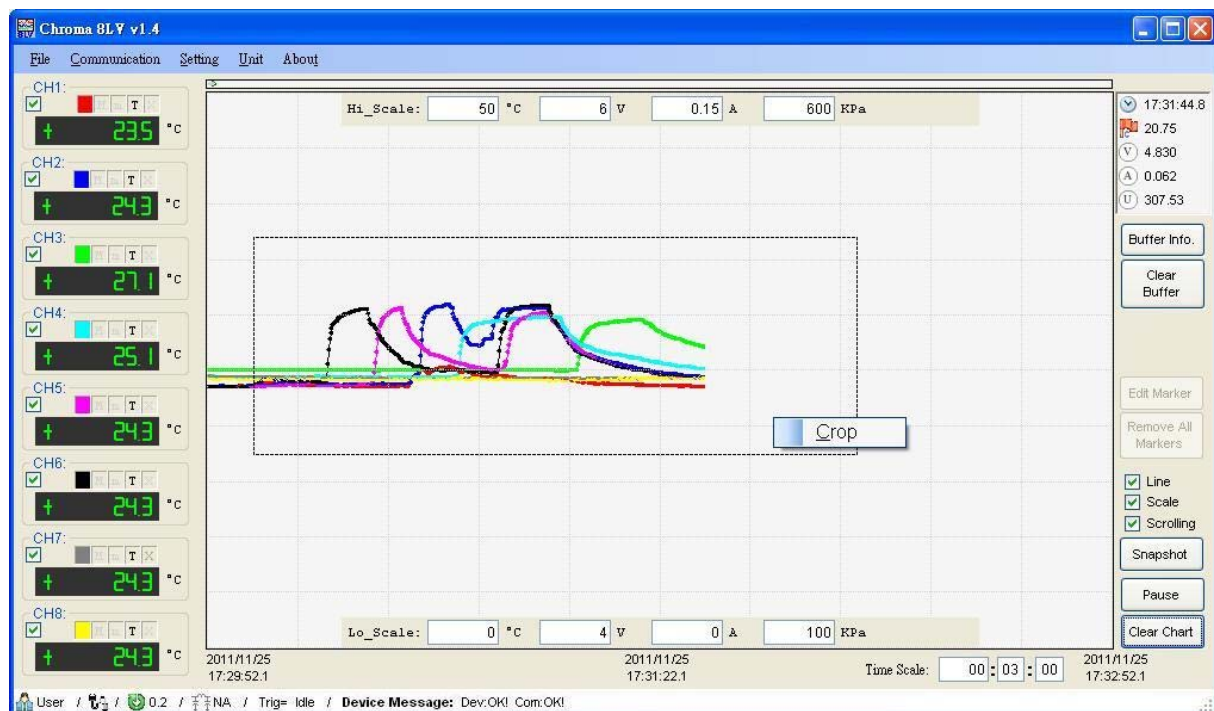


Figure 2-17 Crop setting in main window

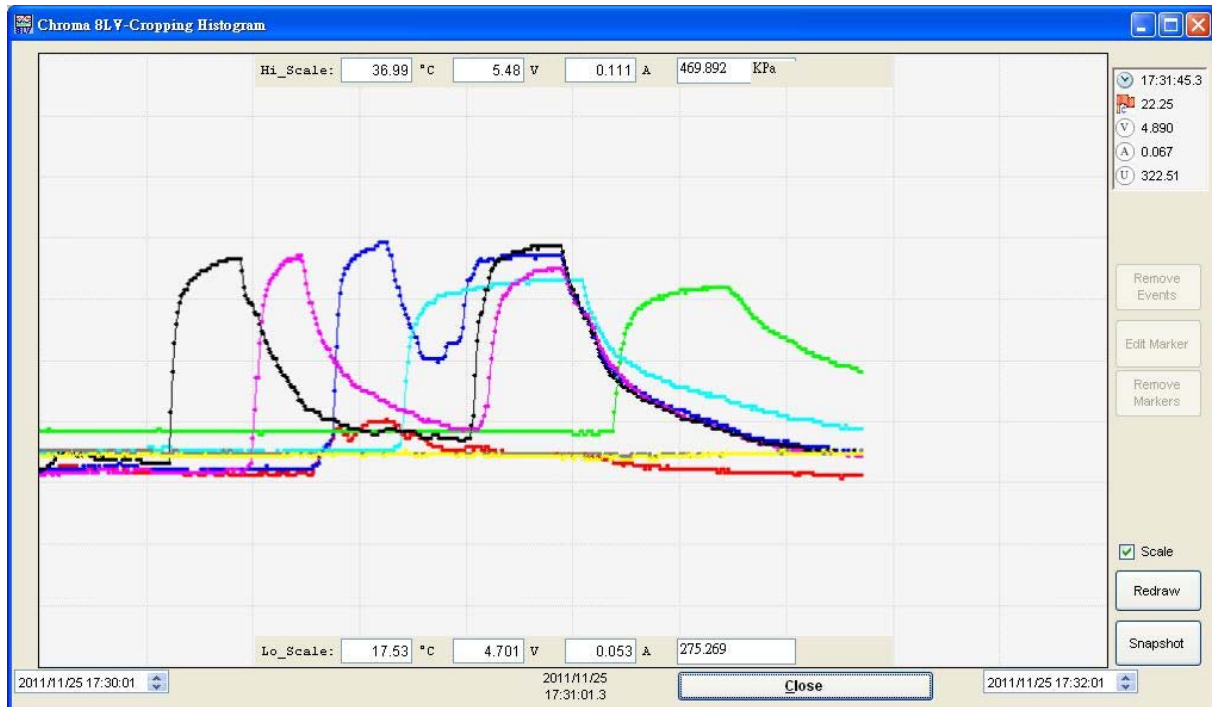
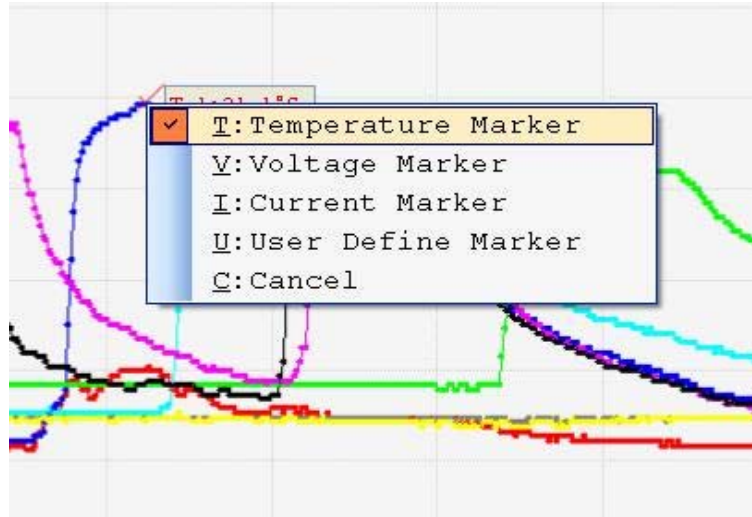


Figure 2-18 Cropping enlarged histogram according to Figure 2-17

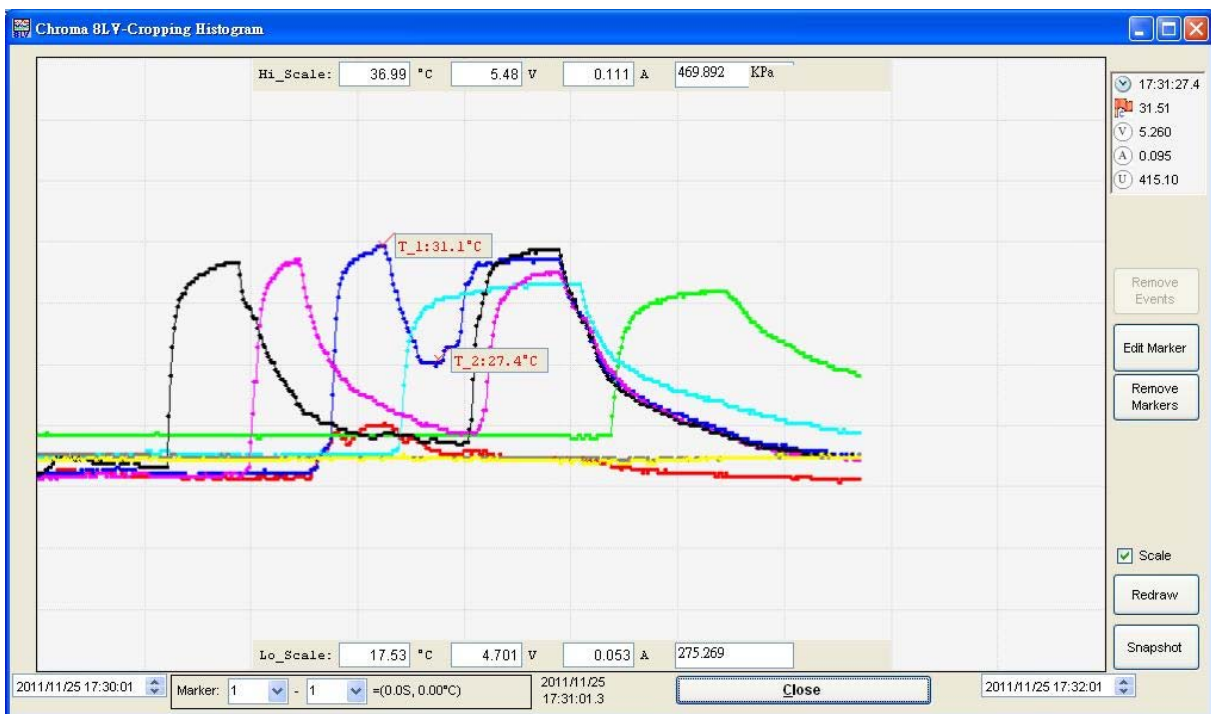
There is only one cropping enlarged figure, new cropping figure will replace the old one when re-cropping in the main window.

Marker

Double click the left key of mouse, a marker will be generated. The marker attribute will be produced firstly to define the marker is Temperature Marker (expressed by T_n, n indicates integer), Voltage Marker (expressed by V_n, n indicates integer), Current Marker (expressed by I_n, n indicates integer) or User Define Marker (expressed by U_n, n indicates integer). 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 also appear 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, current or self define physical quantity information can be seen. It also can be written in comment and the difference between markers can be calculated below graph area. The displayed result is the difference of selected two markers' time interval, temperature, voltage, current or self define physical quantity as Figure 2-19 shown. The marker difference calculation needs to select the same category, its calculation result will be meaningful. The program won't judge if users' selected differential calculations between markers are reasonable, users needs to judge their own and select the same category marker to proceed differential calculation.



(a)



(b)

Figure 2-19 Marker(a) produced and marker(b) differential calculation

⚡ CAUTION The produced marker in plotting area of main window or cropping enlarged figure will appear automatically on corresponding position. Even the corresponding position isn't in plotting time or vertical axis range that can't be displayed in graph area, its marker value still can be memorized and be computed

Edit Marker

A text window can be produced, checking date, time, temperature or voltage of marker. A text comment also can be written for the marker.

Remove Markers

After generating the markers, they can't be removed by individually. But the markers can be removed through this button and they will be generated again. All marker numbers are

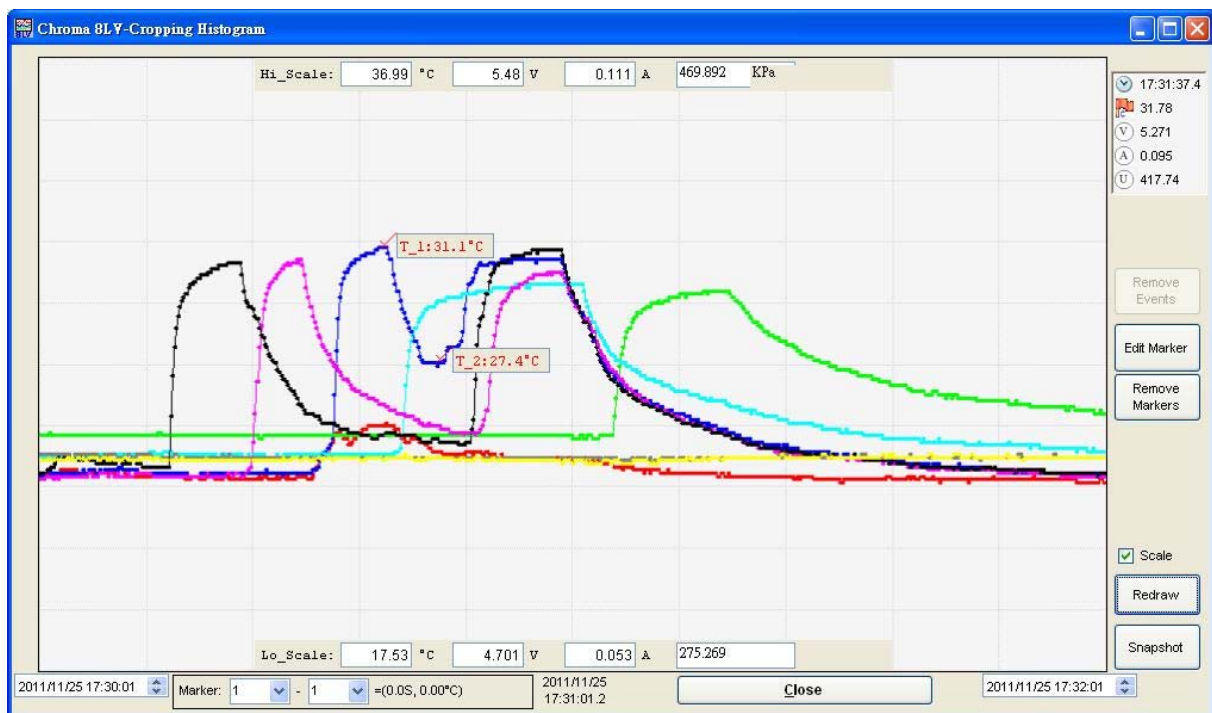
starting from 1.

Remove Triggers

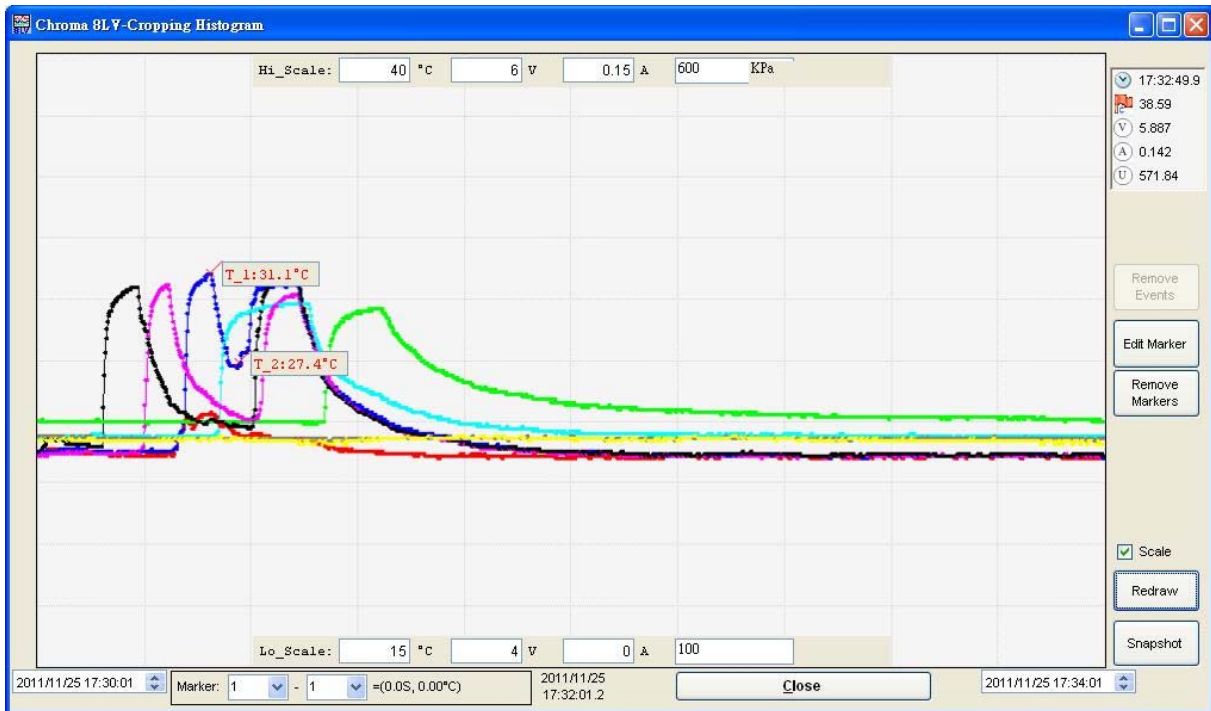
“Trigger Event” we called is that setting trigger condition can be satisfied in saved data. The time point will generate a vertical line on graph, whereas this button can clear these vertical line markers.

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 2-20 original cropping histogram (a) time range is from 11:52:36 to 11:54:08, temperature range is from 7.42 to 37.31 °C. Other vertical axis range is also deviated from brief numeral, time range after redefined is from 11:52:00 to 12:00:00 and temperature range is from 20 to 40°C. Other vertical axis ranges are also taken brief numeral, after redrawing it is shown as Figure 2-20 (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 memory full or not, after memory is full, new data still be saved and the oldest data will be removed and plotting can't be recalled. Besides, the defined time is earlier than 8LV program enabled or later than present time thus the graph won't be shown.



(a)



(b)

Figure 2-20 (a) Original produced cropping histogram and (b) Time/temperature/voltage/self define physical quantity changed cropping histogram

3. Communication Protocol

For 8-Logger, we provide communication protocol between personal computers to let users developing their own program or integrate 8-Logger into complicated test system. Please contact Chroma if further assistance and service of program development or system integration is required.

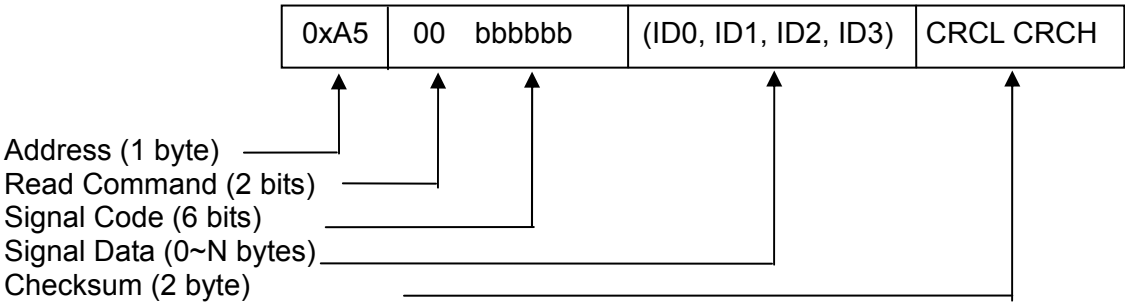
Chroma 8-Logger communication protocol formats are as the following.

3.1 Sequence Communication Structure

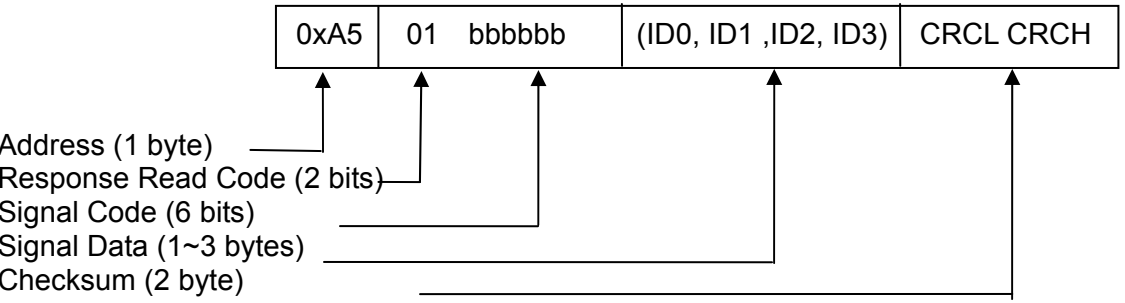
The sequence communication rate used is 115,200 bps, byte format is 8, n, 1.

3.2 Packet Format

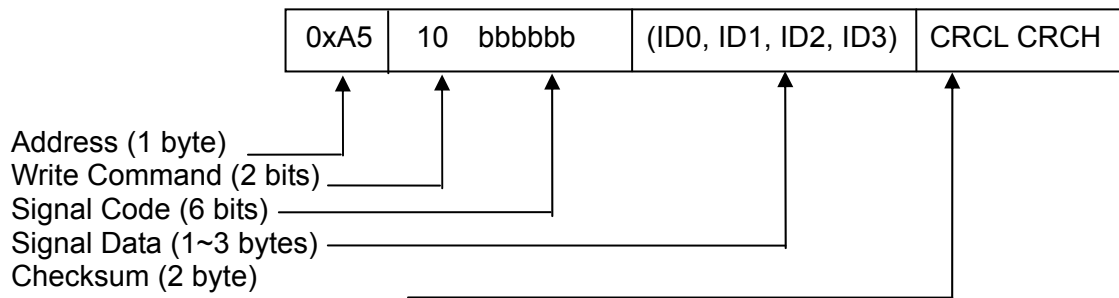
The read 8-Logger information packet format is sent by computer.



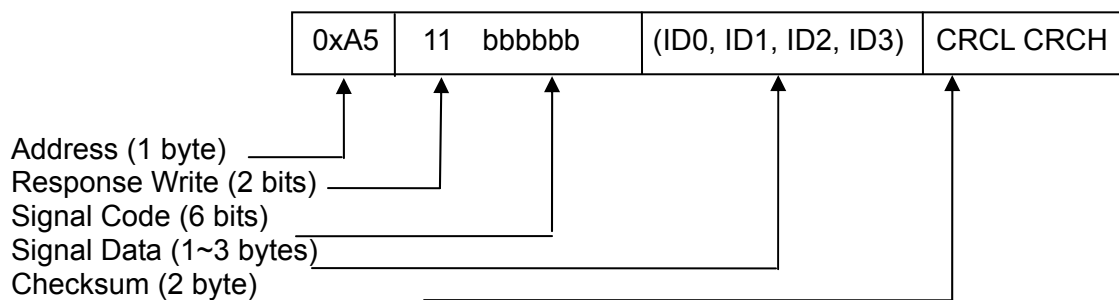
Response read packet format, send it out from 8-Logger.



Write packet format, send it out from computer.



Response write packet format, send it out from 8-Logger.



Communication mode between computer and 8-Logger is very simple and direct. The computer is initiative and 8-Logger is passive which take Q (computer asked) & A (8-Logger answered) method. For read command, 8-Logger will respond the data value to be read. For write command, 8-Logger will respond the same packet for confirmation. If packet error and can be identified thus 8-Logger 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.

- ⚡ CAUTION**
1. 8-Logger addresses are all set to 0xA5 of hexadecimal (HEX) at present.
 2. For the packet with error content such as address isn't 0xA5 and checksum operation is unsuited thus 8-Logger will ignore it and without any response.

3.3 Signal Code & Definition

| Info. Code | Info. Code Description | Read | Write | Info. Data ⁽²⁾ ID0, ID1~IDn | I.D. Size | Definition |
|------------|------------------------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0x00 | Get Sensor Data | Yes | No | PC->Device: ID0: Slot/Channel Number Bit0~2: Channel Number Bit3~5: Reserved. Bit6,7: By-Channel/Device | 1 | Channel number range: 0~7 Please note physical device channel number is 1~8, which is the number here plus 1. By-Channel/Device selection: Bit6,7=00b: by channel. Channel number should be specified. Bit6,7=10b: by device. The data of all existing channels will be retrieved. It will cause a "Command Error Response" error if the slot/channel number is out of range or set bit6=1 on Entry-Level model. |
| | | | | Device->PC: By channel mode: ID0~3 = Sensor temperature data of selected CH. By device mode: ID0~8 = All channel sensor data of the group. (EX: CH1,CH2,CH3...CH8) 0x00000000~0xFFFFFFFF N = Total Grouping Channel Number. | 4/ 32/ 4xN | Value range (+10000) is from -214,748.3645 to +214,748.3644 ⁽¹⁾ except the following numbers bear some special meanings: -214,748.3648 (0x80000000): TC open-circuit -214,748.3647 (0x80000001): Signal strength overloaded (negative polarity). -214,748.3646 (0x80000002): Display over range (negative polarity). +214,748.3647 (0x7FFFFFFF): channel not available. +214,748.3646 (0x7FFFFFFE): Signal strength overloaded (positive polarity). +214,748.3645 (0x7FFFFFFD): Display over range (positive polarity). |
| 0x02 | Sensor Type Setting* | Yes | Yes | PC->Device: ID0: Channel Number Bit0~2: Channel Number Bit3~5: Reserved. Bit6~7: Reserved. ID1=Sensor type(write only) 0x00~0x09 | 1 or 2 | Channel number range: 0~7 It will cause an "Command Error Response" error if the channel number is out of range. The original value will not be changed. Sensor Type: 0x00: T-type(default) 0x01: K-type 0x02: B-type 0x03: E-type 0x04: J-type 0x05: N-type 0x06: R-type 0x07: S-type 0x08: Voltage. 0x09: Current. Others: n/a. Will cause an "Command Error Response" error and the original value will not be changed. |
| | | | | Device->PC: ID0=Sensor type 0x00~0x09 | 1 | |
| 0x04 | Filter Selection* | Yes | Yes | PC->Device: ID0=Filter Selection(write only) 0x00:No Filter 0x01:Moving average by 2 0x02:Moving average by 4 0x03:Moving average by 8 | 0 or 1 | It will cause an "Command Error Response" if ID0's value > 0x05. The original value will not be changed. |
| | | | | Device->PC: ID0=Filter Selection 0x00:No Filter 0x01:Moving average by 2 0x02:Moving average by 4 0x03:Moving average by 8 | 1 | |
| 0x10 | Device Address | Yes | No | PC->Device: n/a | 0 | |

| | | | | | | |
|------|-----------------------------|-----|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | | | Device->PC: ID0=Address (0xA5) | 1 | |
| 0x12 | Initialization Status | Yes | No | PC->Device: n/a | 0 | |
| | | | | Device->PC: ID0= Status 0x00= Warming Up 0x01= Ready 0x02= System Reset Others: Reserved. | 1 | |
| 0x13 | Device Fatal Error Code | Yes | No | PC->Device: n/a | 0 | |
| | | | | Device->PC: ID0= Code Number 0x00: Normal. Bit1 is always set to 0. Others reserved for future use | 1 | |
| 0x14 | Device Model Number | Yes | No | Device<->PC: ID0= Model Number 0x07 | 1 | ID0: Bit0~5=Total channel number – 1 Bit6=0. Bit7=reserved. |
| 0x15 | MCU Firmware Version Number | Yes | No | PC->Device: n/a | 0 | |
| | | | | Device->PC: ID0~1=FW Version 0x0000~FFFF | 2 | 0.0.0.0 ~ 15.15.15.15 |
| 0xFF | Command Error Response | No | No | Device->PC: ID0:Response Bit0&1=00: Wrong info. code/data. Bit0&1=01: packet timeout (>100mS) Bit0&1=10: Previous info. code is read-only. Bit0&1=11: Previous info. code is write-only. Bit2=1: CRC error. Bit3~7: Reserved. | 1 | This information is generated automatically from device if device got incorrect packet, wrong info code or packet timeout. The prefix of info-code, that is, 0x00, 0x40, 0x80 and 0xc0, is ignored here. |
| | | | | | | |

(1) The value is calculated by binary complement: (a) Hexadecimal value with positive/negative sign turns into decimal value (result should be within the range of -214,748.3648 ~ +214,748.3647), (b) divided the integer by 10000 and then (c) compare it with limit value. For example, read the voltage to get 0xFFFFFB2E, it is -1234 in decimal and divided by 10000 will get -0.1234 thus this voltage is -0.1234V.

- ⚡ CAUTION**
1. The data length is related with signal code, it isn't the fixed length.
 2. It is marked by symbol “*” and once be written in, it will be saved in 8-Logger non-volatile memory. The value will be saved permanently even though the power is disconnected, it will be changed unless write again.

3.4 Checksum

The checksum is generated by CRC-16 algorithm, *i.e.* packet content is divided by remainder of 0xA001. It can be calculation/generated by sub-program of C program language which attached as the following.

```
#define POLYNOMIAL          0xA001
```

```

unsigned int Calc_CRC(unsigned char *start_of_packet, unsigned char *end_of_packet)
{
    unsigned int crc;
    unsigned char bit_count;
    unsigned char *char_ptr;
    char_ptr = start_of_packet;
    crc=0xffff;
    do {
        crc ^= (unsigned int)*char_ptr;
        bit_count = 0;
        do {
            if (crc & 0x0001) { crc>>= 1;  crc^= POLYNOMIAL; }
            else
                crc>>= 1;
        }while (bit_count++ <7);
    }while (char_ptr++ <end_of_packet);
    return(crc);
}

```

3.5 Example

The following are communication examples of PC and 8-Logger.

Example 1: Check if 8-Logger is existence.

| | |
|-----------------------------------|-----------------|
| PC transmission | A5 10 7B 2C |
| If 8-Logger is inexistence | No response |
| If 8-Logger is existence, respond | A5 50 A5 9D 98. |

Example 2: Read Channel 1 data

| | |
|-------------------|--------------------------------------------------------------------------|
| PC transmission: | A5 00 00 61 E3 |
| 8-Logger response | A5 40 80 00 00 00 30 E1 (TC open, thermocouple wire open or inexistence) |

Example 3: Read input type

| | |
|-------------------|---------------------------------------------------------|
| PC transmission | A5 02 00 60 83 (query Channel 1 input type) |
| 8-Logger response | A5 42 00 51 43 (Channel 1 is T type thermocouple input) |

Example 4: Set input type

| | |
|-------------------|----------------------------------------------------------------|
| PC transmission | A5 82 00 01 43 00 (Set Channel 1 to K type thermocouple input) |
| 8-Logger response | A5 C2 01 F1 43 |

Example 5: Set average value MV_8

| | |
|-------------------|----------------|
| PC transmission | A5 84 03 42 E2 |
| 8-Logger response | A5 C4 03 73 22 |

If there is any need for assistance, please contact Chroma.

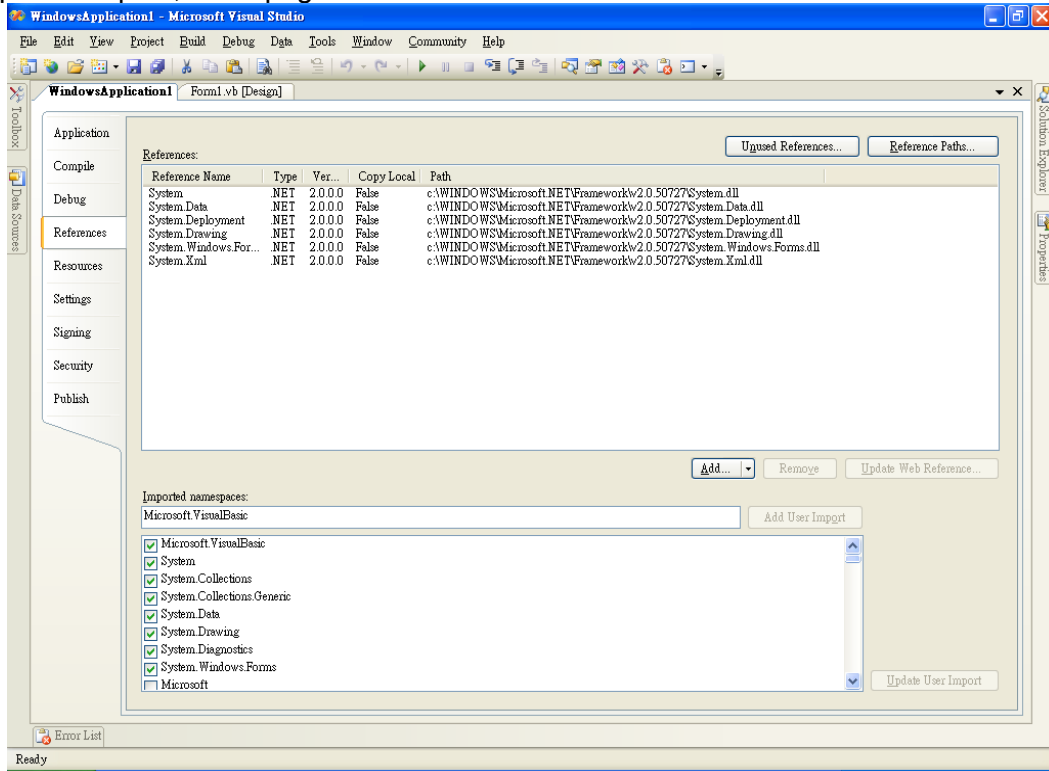
3.6 Dynamic Link Library

Proceed program edit by communication protocol directly needs considerable experience in

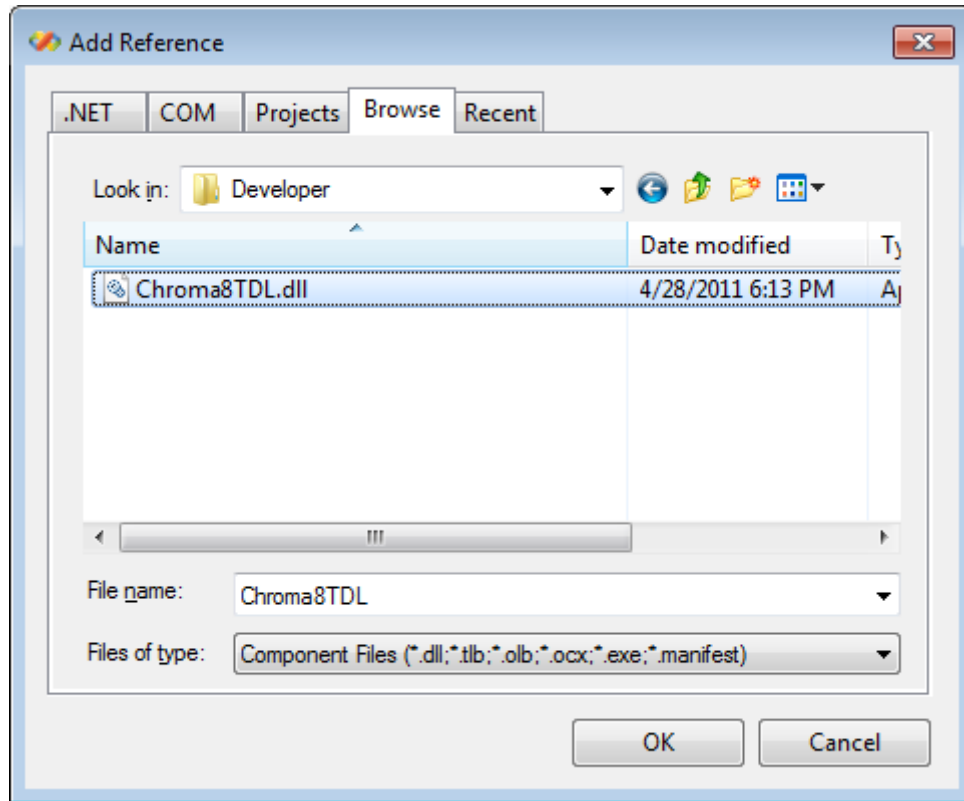
low-level program code, it may be not easy to adapt for engineer usual used high-level program language. Thus, we also provides dynamic link library to proceed program edit, operation methods are as the following.

Take an example by Microsoft Visual Basic 2005 program development.

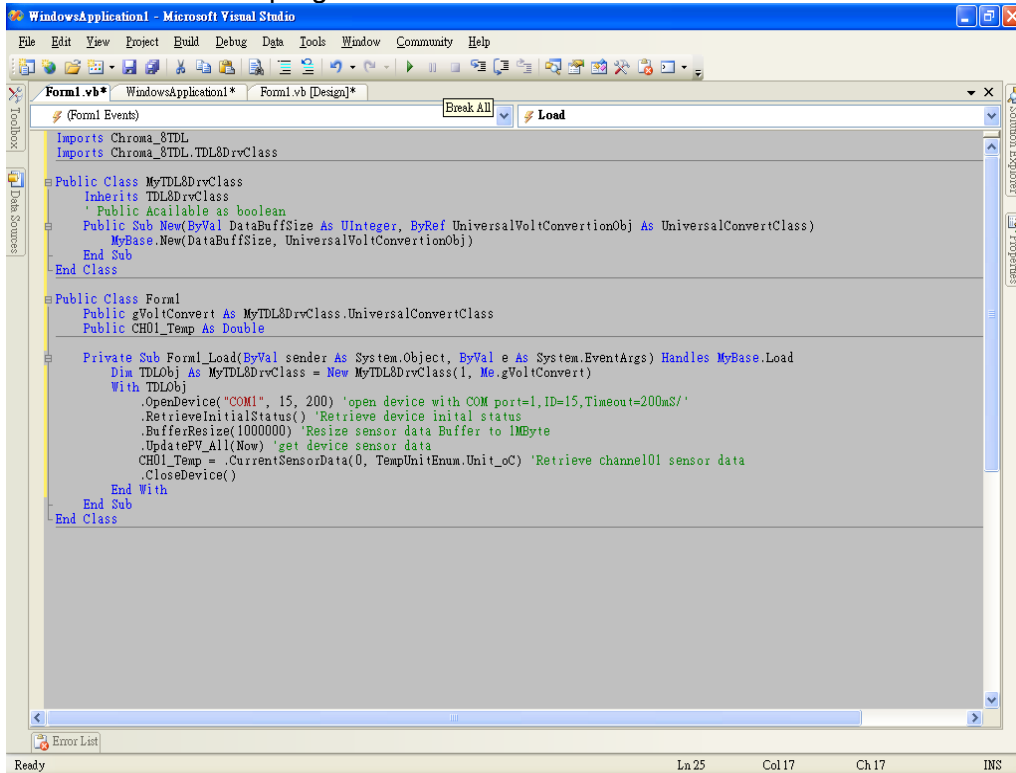
1. Open new plan, enter page "Reference".



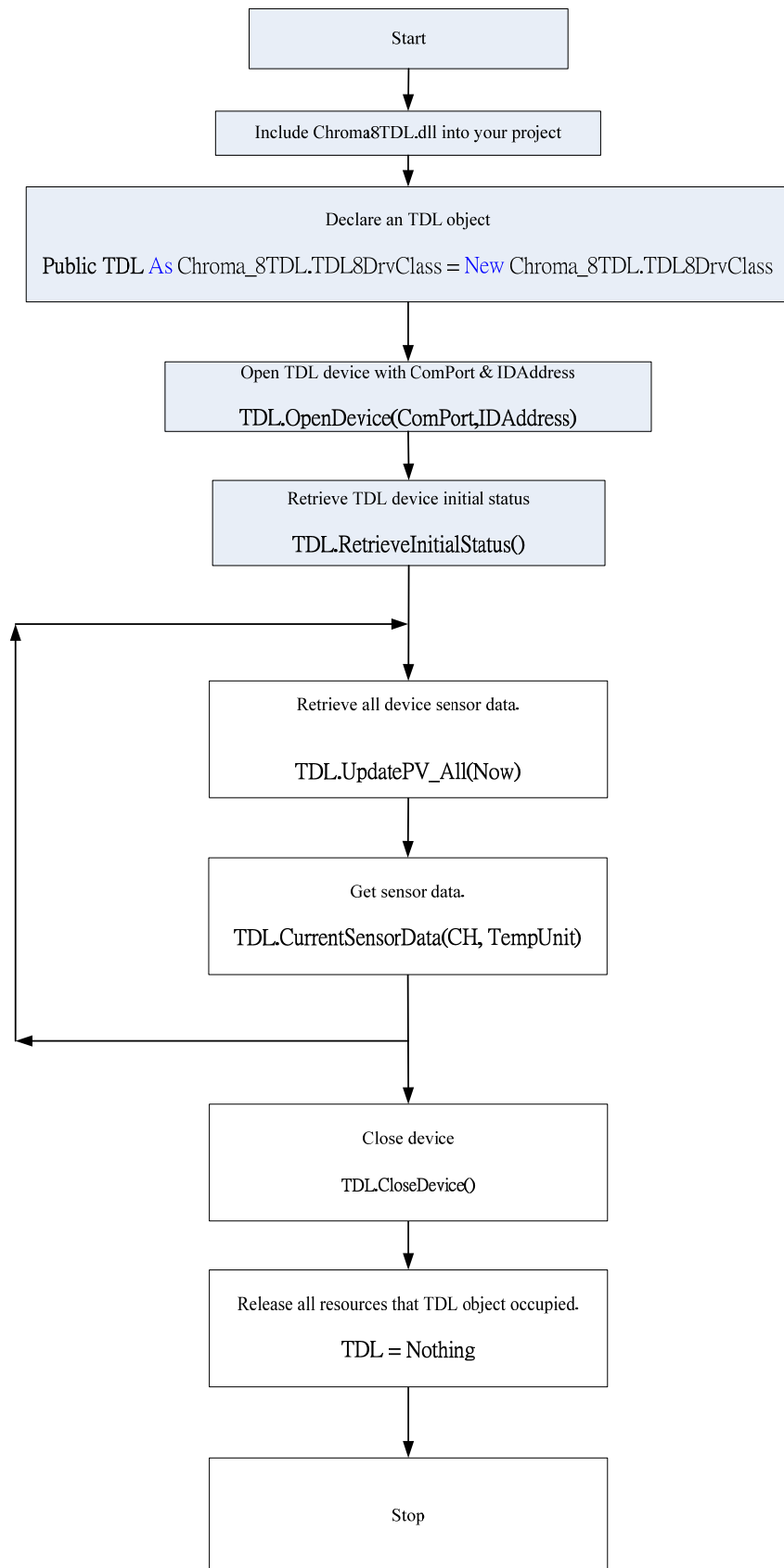
2. Find **Chroma8TDL.dll** in DLL folder of attached 8-Logger CD.



3. When **Chroma8TDL.dll** to be added to Reference, the related sub-program can be recalled in Visual Basic program afterward.



4. Program flow recommended is:



3.7 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. (About LabView/LabWindow developer, IVI driver in attached CD can be used and the path of IVI folder is under CD-ROM drive root directory.

`CloseDevice()`

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

`OpenDevice(ByVal PortName As String, Optional ByVal IDAddress As Integer = -1, Optional ByVal CommunicationTimeout As Integer = 200) As CommunicationResultEnum`

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

CommunicationResultEnum is defined as:

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

`RetrieveInitialStatus() As CommunicationResultEnum`

It retrieves initial status, the return value is the same as OpenDevice().

`SetDigitalFilterType(ByVal Setting As DigitalFilterTypeEnum) As Boolean`

It sets data average time, setting pass or fail will be returned by Boolean value. Its setting definitions are as the following.

DigitalFilterTypeEnum is defined as:

```
Enum DigitalFilterTypeEnum As Byte
    MV_02 = 1
    MV_04 = 2
    MV_08 = 3
End Enum
```

`SetSensorType(ByVal CH As Integer, 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.

SensorTypeEnum is defined as:

```
Enum SensorTypeEnum As Byte
    T_Type = 0
```

```
K_Type = 1
B_Type = 2
E_Type = 3
J_Type = 4
N_Type = 5
R_Type = 6
S_Type = 7
Volt_Type = 8
Current_Type=9
```

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(ByVal CH As Byte) As CHStatusEnum

It reads specified channel status, the status definitions are as the following.

CHStatusEnum is defined as:

```
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

CommunicationCRCError() As Boolean

It checks if communication is with CRC checksum error at last time.

CommunicationTimeout() As Integer

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

CurrentSensorData(ByVal CH As Byte, ByVal TempUnit As TempUnitEnum) As Double

It reads measurement value of specified channel, follow different input types it can be temperature value (based on specified temperature unit), voltage value or current value. The temperature unit definitions are as the following.

TempUnitEnum is defined as:

```
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.

`DevideIDAddress()` As Byte

It reads logger ID (address).

`DigitalFilterType()` As DigitalFilterTypeEnum

It reads average filter setting.

`InitStatus()` As InitialStatusEnum

It reads initiation status of logger, the definitions are as the following.

InitialStatusEnum is defined as:

```
Enum InitialStatusEnum As Byte
```

```
    WarmingUp = 0
```

```
    Ready = 1
```

```
    SystemReset = 2
```

```
End Enum
```

`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(ByVal ChannelNum As Integer) As SensorTypeEnum`

It reads input thermocouple type or voltage of specified channel, the definitions are as the following.

SensorTypeEnum is defined as:

```
Enum SensorTypeEnum As Byte
```

```
    T_Type = 0
```

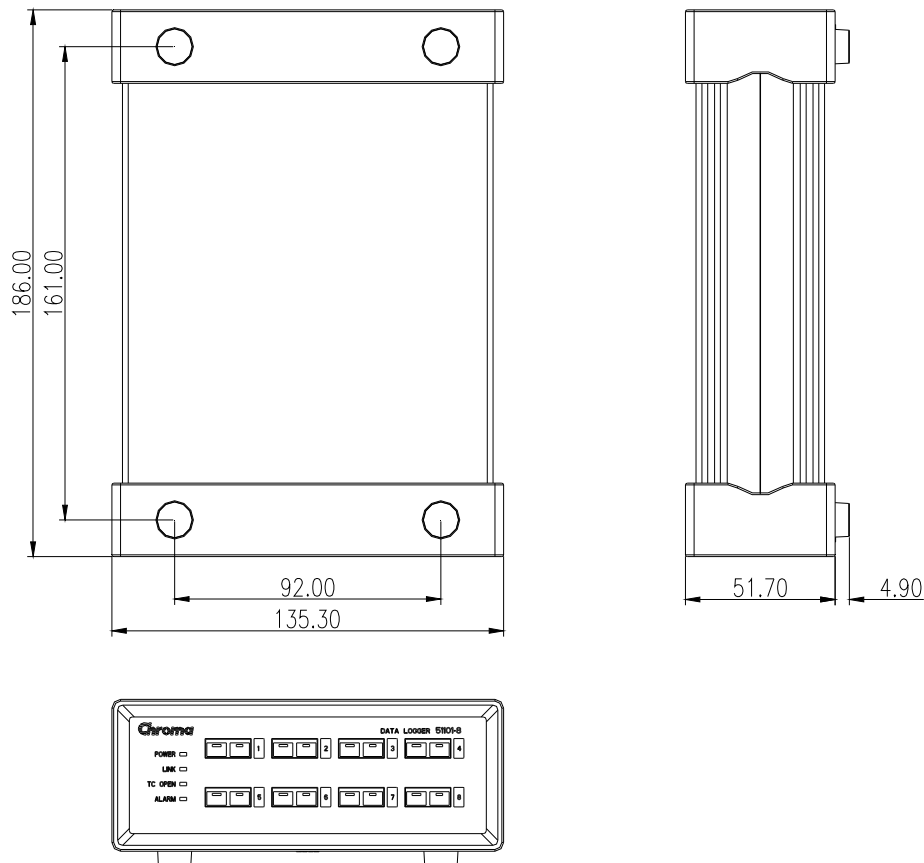
```
    K_Type = 1
```

```
    B_Type = 2
```

```
E_Type = 3  
J_Type = 4  
N_Type = 5  
R_Type = 6  
S_Type = 7  
Volt_Type = 8  
Current_Type=9  
End Enum
```

Appendix A

A.1 Dimension



Length unit: mm

A.2 Product Specification

Absolute Maximum

| Specification Item | Symbol | Value | Unit |
|-----------------------------------------|--------|--------|------|
| Power Supply Voltage | Vdc | 6 | V |
| Power Supply Current | Idc | 0.25 | 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)} | | $\pm[0.01\% \text{ of reading} + 0.3]$ | °C |
| Temperature Resolution | | $\pm 0.01^{(3)}$ | °C |
| CJC Error | ecjc | ± 0.3 | °C |
| Maximum Sample Rate | SR | 5 | Sample/ Sec |
| Galvanic Isolation ⁽⁴⁾ | Viso | 1000 | Vdc |
| Input Resistance | Rin | 5M | Ω |
| Thermocouple break detection current | ltc_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 | | $\pm[0.1\% \text{ of reading} + 1\text{mV}]^1$ | |
| 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 | | $\pm[1\% \text{ of reading} + 1\text{mA}]$ | |
| Current Path Shunt Resistance | Rin | 0.01 | Ω |
| User Define Reading Specifications | | | |
| Signal Type to Logger | | DC Voltage to VA-480 Voltage Adapter | |
| Signal Input Range | | +/- 480 | Vdc |
| Signal Interpolation | | 2-point linear interpolation | |
| Communication Specifications | | | |
| USB Communication | | USB2.0(full speed device), USB B-type Connector | |
| Power Specifications | | | |
| Power Requirement | Vdc | 4.5~5.5 | V |
| Maximum Power Consumption | Pmax | 1.2 | W |
| Physical Specifications | | | |
| Dimensions (Width x Depthx Height) | | 135.3x186x51.7 | mm ³ |
| Weight | | 1200 | 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 $5V \pm 0.1V$

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.
- (4) Channel to channel, channel to case.

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 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.
- (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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