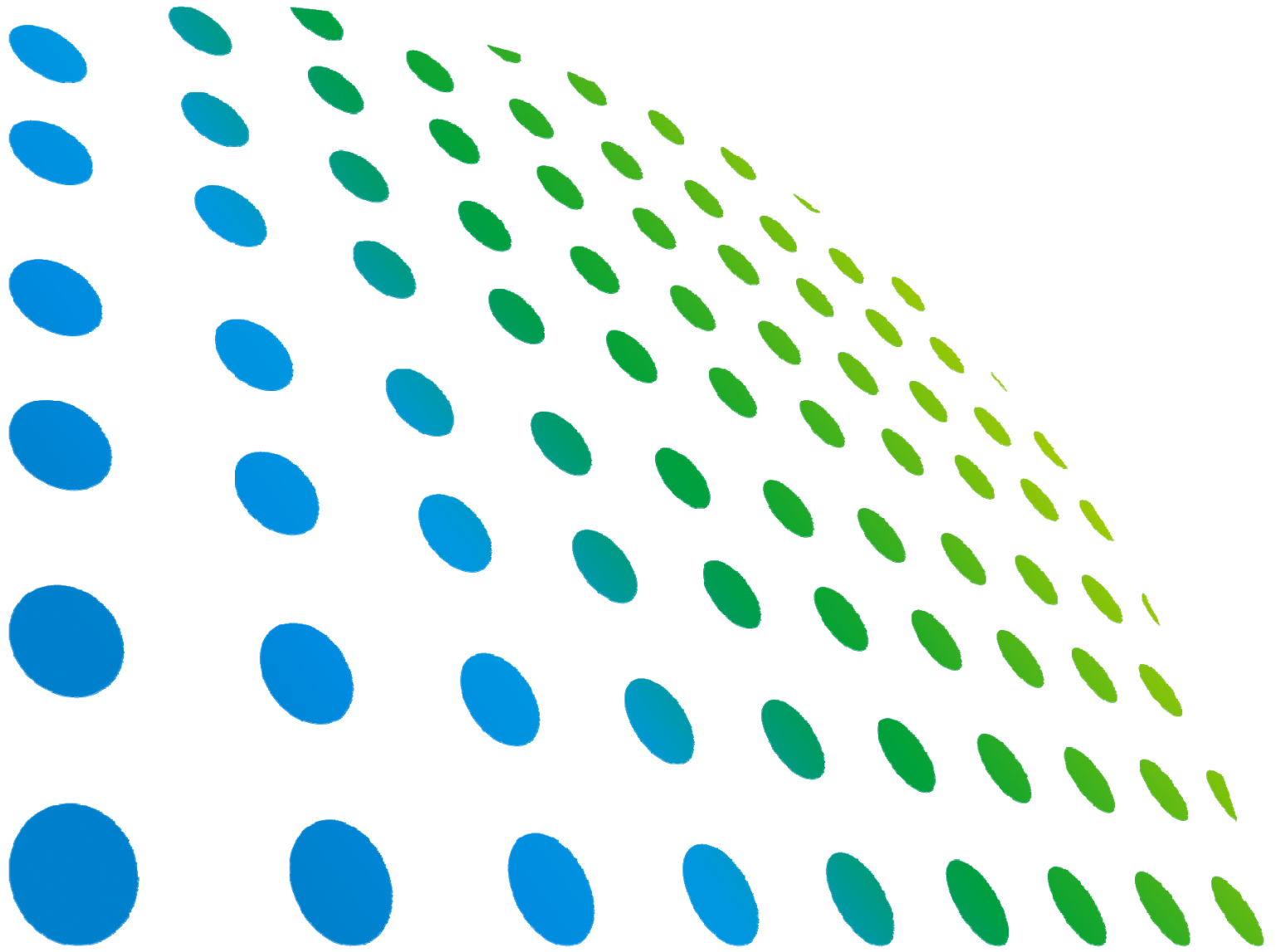
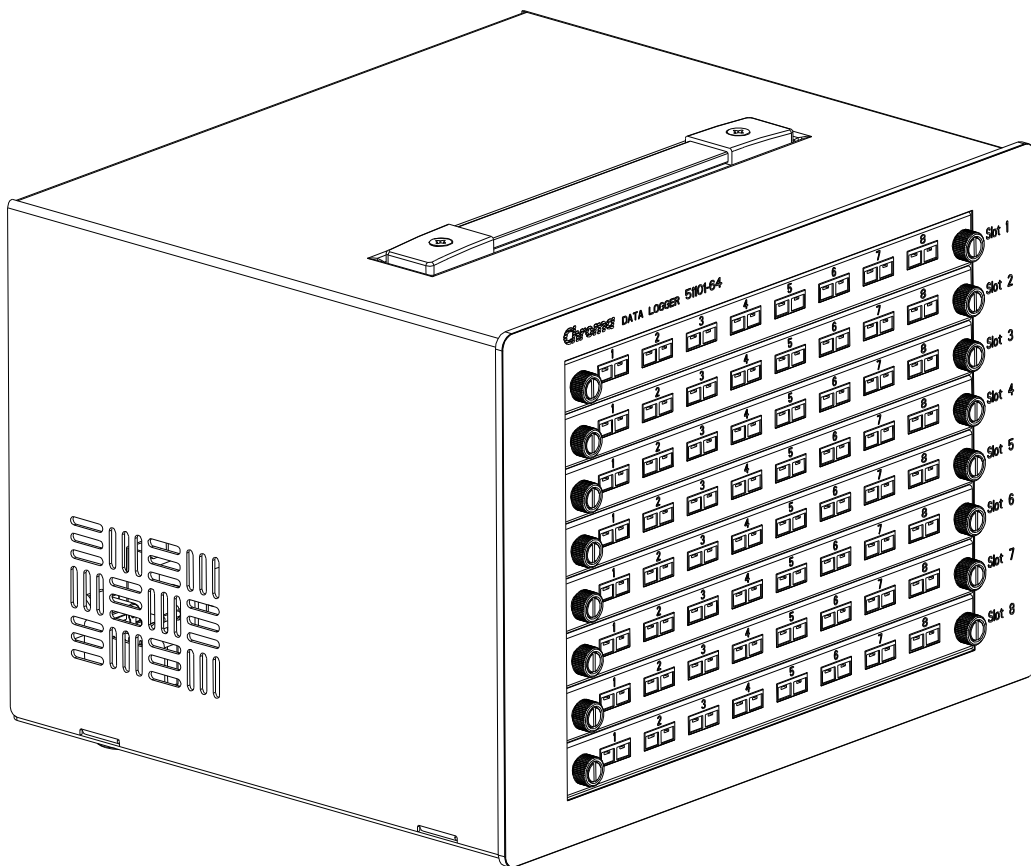




Thermal/Multi-function Data Logger
51101-64
User's Manual



Thermal/Multi-function Data Logger 51101-64 User's Manual



Version 1.0
June 2012

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CHROMA ATE INC.

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

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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: CB10104041

Report No.: EC232612


CERTIFICATE

- **EQUIPMENT: 64-channel data logger**
MODEL NO. : 51101-64
APPLICANT : CHROMA ATE INC.
66 Hwaya 1st Rd., Kueishan Hwaya Technology Park,
Taoyuan County 33383, Taiwan



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. 26, 2012 ~ Apr. 08, 2012 AT SPORTON INTERNATIONAL INC. LAB.


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.



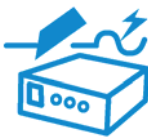
BEFORE APPLYING POWER

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.



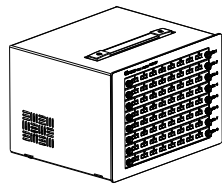
This indicates important information or tips for the procedures and applications, etc. The contents should be read carefully.

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

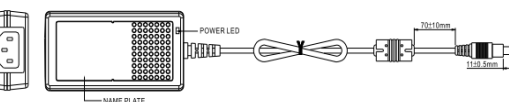
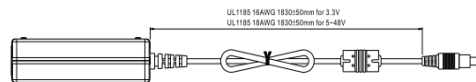


User's Manual CD-ROM

Standard Equipment (Cable)



- Power cord
1.8m x 1
(Note: Plug type is varied by different countries.)



- Power supply
AC100-240V, 50/60Hz to DC12V x 1



- I/O terminal block
8PIN x 2



- 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.

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1. Installation


Thanks for choosing Chroma 51101-64 Data Logger with plug-in units for your temperature measurement applications. Depending on the options of your purchase, each data logger can log channel number including 8, 16, 24, 32, 40, 48, 56 and 64. The channel number is up to 64 that is called as 64-Logger for short. The manual adopts the same name for short that users can read it conveniently. If the required log channel number is larger than 64, several 64-Loggers can be connected to the same PC for monitoring hundreds of log channels. Chroma 64-Logger not only provides accurate measurement and record of temperature, voltage or current but also each channel is with the feature of resistance high-voltage isolation. Thermocouple contacts charged object directly and can be measured accurately, it won't affect the accuracy of other channel. Research development & production in electronic product, power equipment, battery & photoelectric and automobile industry are users' best utilities. About the usage of product will be described detail in this manual.

1.1 Basic Configuration

The main structure of 51101-64 is main unit frame, each sensing unit is the combination of sensing module and main unit frame by plug-in method. Each module consists of 8 input channels, each main frame can plug in 1~8 pcs of sensing module. Therefore, each 51101-64 main unit includes 64 input channels at most, measure 64 points temperature, DC voltage or DC current simultaneously.

Multi-channel temperature, voltage or current measurement is with a lot of important applications such as developing electronic and electrical equipment. Detect operating temperature and voltage current in various important parts of product to ensure product life and quality. Check each point temperature when using oven to ensure uniform temperature and safety. Except for immediate measurement temperature, many applications need record for long time that observes temperature or voltage variation for finding occurred process and analyzing it.

Chroma 51101-64 Data Logger is powerful and substantial selection, only need a desktop PC or notebook via USB, RS232 or LAN connection as Figure 1-1 shown. Each channel input can be ITS-90 defined thermocouples of B, E, J, K, N, R, S or T type, it also can coordinate Chroma VA-480 voltage adapter to proceed DC voltage measurement or Chroma IA-3 current adapter to proceed DC current measurement as Figure 1-2 shown. Each channel can be set measurement input category independently, some channels won't be used for temporary that can keep it open circuit and no need to input.

 **CAUTION** When operating Chroma 51101-64 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.

For channel requirement over 64, multiple 51101-64 Data Loggers connect to a PC as Figure 1-3 shown. Thus it can meet hundreds of channels measurement with simultaneous, please be aware whether processing capacity of the PC enough or not. If processing capacity of

the PC is insufficient, it may cause data acquisition speed reduced or part of data loss, even computer lag that is unable to record.

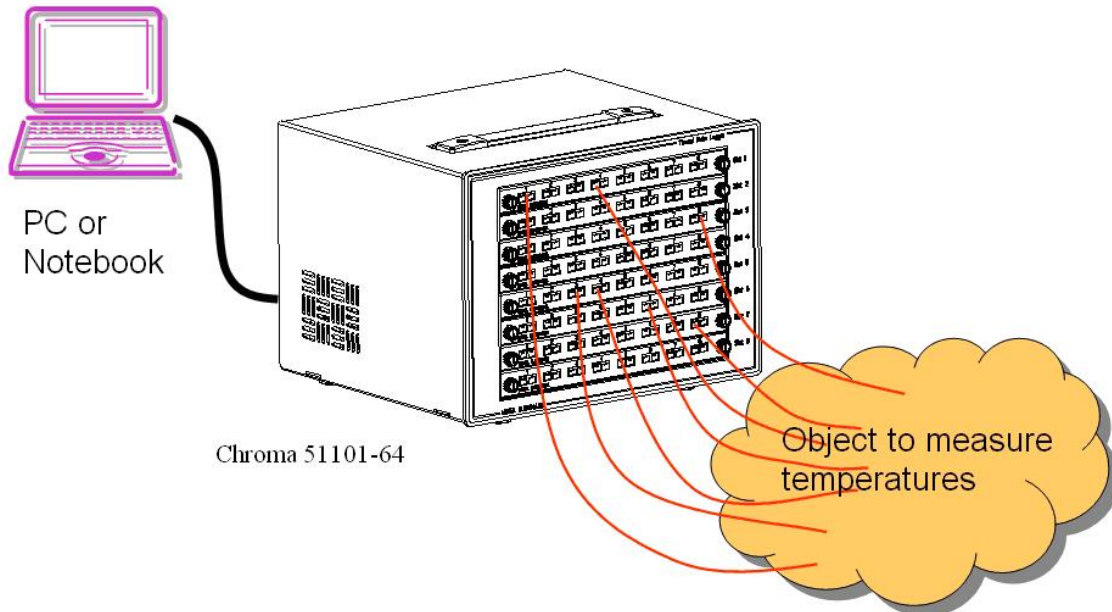


Figure 1-1 51101-64 Data Logger Basic Configuration

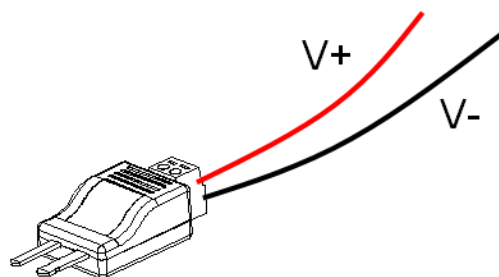


Figure 1-2 VA-480 voltage adapter or IA-3 current adapter (Optional accessory for measuring DC voltage/current)

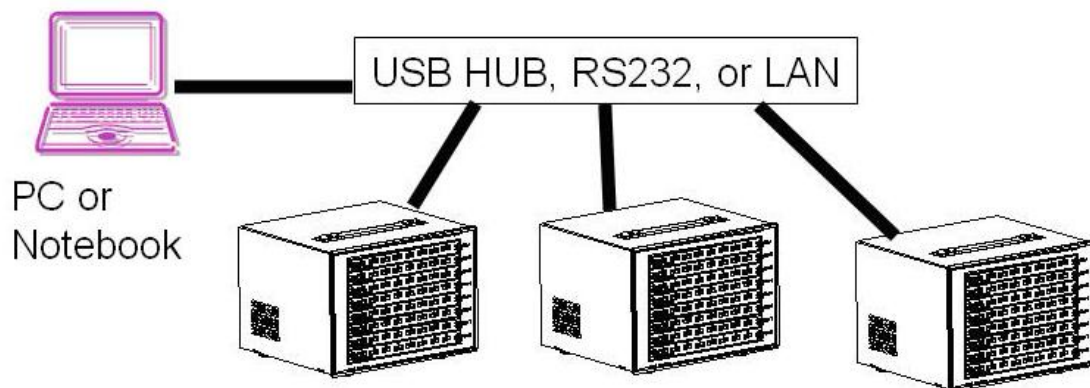


Figure 1-3 Structure of multiple 51101-64 Data Loggers connect to a PC

1.2 Front Panel

The front panel includes 1 ~ 8 pcs of sensing module as Figure 1-4 shown. Each sensing module is with inserted card board design and includes 8 channel inputs as Figure 1-5 shown. If inserted sensing module is less than 8 pcs, the empty area will be covered with aluminum cover.

Please be aware the items as below when operating.

1. **Use thermocouple with mini-type plug.** This plug is one of thermocouple standard plug and easy to be obtained. Don't use other plug with incompatible mechanical structure and don't pull out forcibly to avoid causing the damage of plug and jack as well as affecting measurement accuracy.
2. Each channel is calibrated accurately while installing every sensing module, thus **don't pull out sensing module arbitrarily or change plug in location** to avoid calibration parameter variation affecting the accuracy of equipment.
3. **In case sensing module needs to be changed or added, please ask Chroma for service.** We not only follow your need to change or add hardware but also calibrate it again to ensure the accuracy of data logger.

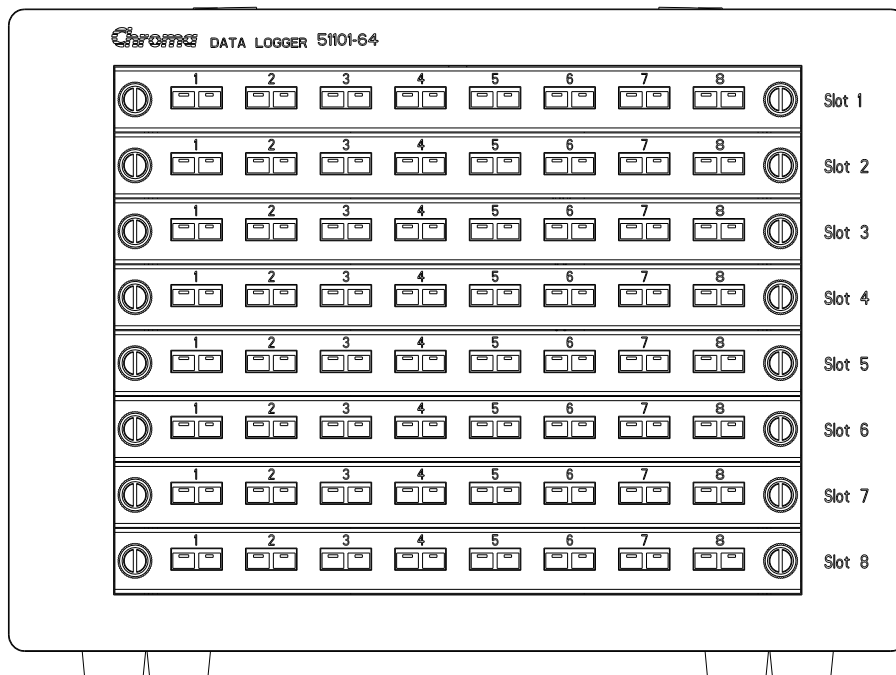


Figure 1-4 51101-64 Front Panel Configuration of Data Logger

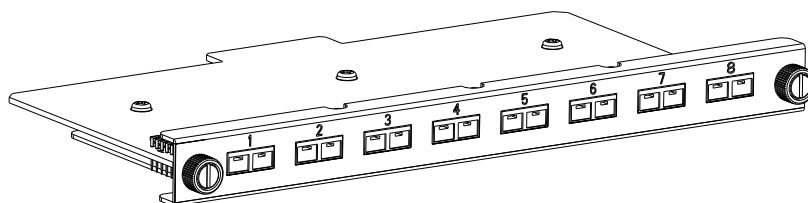


Figure 1-5 Sensing Module, Card Board Unit of Inserted 51101-64 Main Unit Frame

1.3 Rear Panel

The rear panel contains DC power input, power switch, PC connection port, address setting, LEDs and digital I/O as Figure 1-6 shown. The descriptions are given as the following.

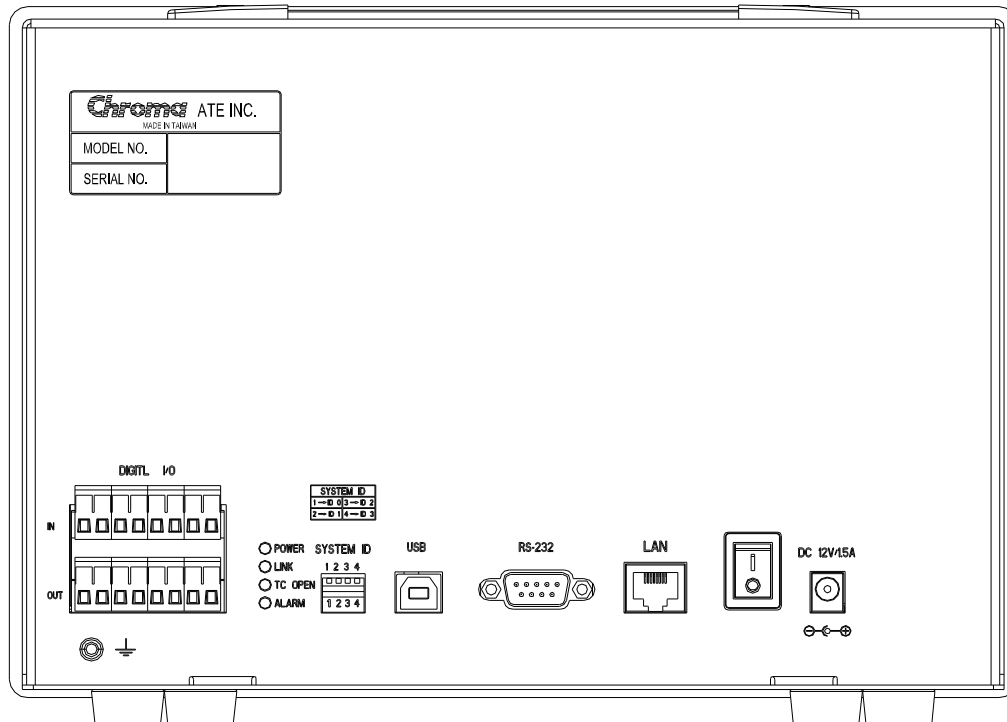


Figure 1-6 Rear Panel Configuration of 51101-64 Data Logger

DC Power Input: 51101-64 Data Logger is energy saving extremely, current consumption is less than 12VDC/1.5A even under 64 channel full load status. Please use the power supply attached to the Data Logger, the accuracy of equipment can't be guaranteed if power supplies from other sources are used. After connecting the power, please use power switch to control power state of logger.

PC Connection Port: 51101-64 Data Logger provides three kinds of PC connection ports, they are RS232, USB and LAN. RS232 and USB ports are standard accessories and LAN is optional accessory which needs to be specified when purchasing. No matter which port is used, the port will be mapped to a serial COM port of PC for proceeding communication connection. A PC is composed of many serial COM ports thus it can control more than one 51101-64 Data Loggers simultaneously. However, a set of 51101-64 Data Logger can't connect more than one PC to avoid occurring conflict of communication.

System ID: Some serial communication interfaces such as RS485 allow many devices connected in series with the same communication cable. Therefore, each device needs specified address for identification that avoids the conflict of communication. 51101-64 Data Logger also allows a lot of devices connected in series thus it is with address setting function. The address settings can be set from binary 0000 to 1111 by 4 bits DIP switch. Please set it properly to ensure connected cables in series with different addresses. The address setting table of DIP switch is provided as below, please refer this table for setting. After completing the setting, it is need to do power reset for once thus new setting become effective.

System ID	Switch Position	System ID	Switch Position	System ID	Switch Position	System ID	Switch Position
0		1		2		3	
4		5		6		7	
8		9		10		11	
12		13		14		15	

LEDs: 4 LEDs are marked as Power, Link, TC Open and Alarm. When 12 VDC power is connected, the Power LED will be always lit in green. The Link LED will be always lit in green when it establishes communication connecting with the PC successfully. The TC Open LED is for detecting if thermocouple is abnormal. When any channel is without input or thermocouple open circuit, the LED will be always lit in red. The Alarm LED is for inspecting temperature over high or low. When the temperature is over threshold setting, the LED will be always be lit in red. About the threshold setting, please see section 2.4.

Digital I/O: There are 4 groups of digital differential inputs (8 pins) and 4 groups of digital differential outputs (8 pins) for various applications. Digital input status detection and digital output setting should be performed by the program, for more detail please see chapter 3 Communication Protocol and Program Library. Please be aware that the 1st group of digital input reserved is for recording trigger, others are without limitation. Users can define it in users' own programs, about pins and their descriptions please see Figure 1-7 and Table 1-1.

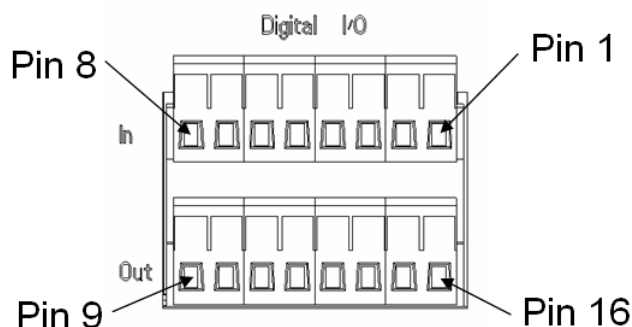


Figure 1-7 Pin Number of Digital I/O

Pin No.	Name	Type	Description
1	DI0+	In	Digital differential input pin 0+. DI0+ is defined as external trigger signal Input+.
2	DI0-	In	Digital differential input pin 0-. DI0- is defined as external trigger signal Input-.
3	DI1+	In	Digital differential input pin 1+. DI1+ is defined as generic Input+.
4	DI1-	In	Digital differential input pin 1-. DI1- is defined as generic Input-.
5	DI2+	In	Digital differential input pin 2+. DI2+ is defined as generic Input+.
6	DI2-	In	Digital differential input pin 2-. DI2- is defined as generic Input-.
7	DI3+	In	Digital differential input pin 3+. DI3+ is defined as generic Input+.

8	DI3-	In	Digital differential input pin 3-. DI3- is defined as generic Input-.
9	DO3-	Out	Digital differential output pin 3-. DO3- is defined as generic Output-.
10	DO3+	Out	Digital differential output pin 3+. DO3+ is defined as generic Output+.
11	DO2-	Out	Digital differential output pin 2-. DO2- is defined as generic Output-.
12	DO2+	Out	Digital differential output pin 2+. DO2+ is defined as generic Output+.
13	DO1-	Out	Digital differential output pin 1-. DO1- is defined as generic Output-.
14	DO1+	Out	Digital differential output pin 1+. DO1+ is defined as generic Output+.
15	DO0-	Out	Digital differential output pin 0-. DO0- is defined as generic Output-.
16	DO0+	Out	Digital differential output pin 0+. DO0+ is defined as generic Output+.

Table 1-1 Pin Description of Digital I/O

Grounding hole: There is a grounding hole at lower left corner of rear panel, the lead should be used to lock the terminal and grounding. The thermocouple wire also needs to be grounded at measurement side simultaneously, it avoids electrostatic interference that even causes equipment failure.

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

The data logger isn't equipped button and monitor thus it needs to be coordinated with the PC, the driver and Chroma 64-Logger measurement program (Chroma 64-Logger Viewer program, **Chroma_64LV**) will be attached to the Data Logger. Before installing, please be sure it is IBM compatible PC or notebook which uses Microsoft Windows operating system. Next to confirm the required communication interface, RS-232, USB or LAN for installing. Please insert program CD to CD-ROM drive. If the USB interface is selected, the driver 51101-64USB.exe in USB-232 folder should be installed firstly for completing USB driver installation. If the LAN interface is selected, please skip to Appendix A to peruse and complete network driver which relates to installation. If the RS-232 interface is selected thus the operating system driver is already provided, it is no need to be installed additionally.

Next to install measurement program for executing setup.exe in Chroma_64LV folder. Follow the installation guide and the program will be installed easily.

After the installation is completed, the program will be executed automatically. Otherwise, when executing in the future, click "Start" → "Programs" → "Chroma ATE inc." → "Chroma 64LV" to start the program.

Please be aware that the following are minimum computer software and hardware requirements for executing the program.

Hardware requirement: IBM compatible personal desktop computer, notebook or netbook, CPU is Pentium-II or above. The memory capacity should be 256 MB RAM at least, one CD ROM or DVD ROM drive available, 20 MB hard drive space, RS-232 serial communication or USB port. If network communication control is selected, thus the PC should be equipped with 10M/100M Ethernet port. RS232/USB/Ethernet ports can be selected one for using and monitor displayed resolution 1024x600 and 256-color.

Software requirement: Microsoft window operating system includes Windows 2000, Windows Millennium, Windows XP, Windows Vista and Window 7. Other Microsoft Windows operating systems also can be used, but they don't be verified. In these operating systems, Windows XP is most stable and most recommended whereas Windows Vista contains some compatible and stable problems thus using problem is easy to be occurred.

If the program needs to be removed, please enter "Control Panel" to activate "Add or Remove Program" and then click "Chroma 64LV".

2.2 Executing Program

Connecting communication line firstly is recommended, 51101-64 series Data Logger power on and then execute Chroma 64LV program. When the program is activated, main program screen in Figure 2-1 will be shown. The upper of the screen is main option for establishing communication, logger setup, data log and analysis, etc. Each channel contains a small area for showing its setting, status and reading. The detail descriptions will be given in the following paragraphs.

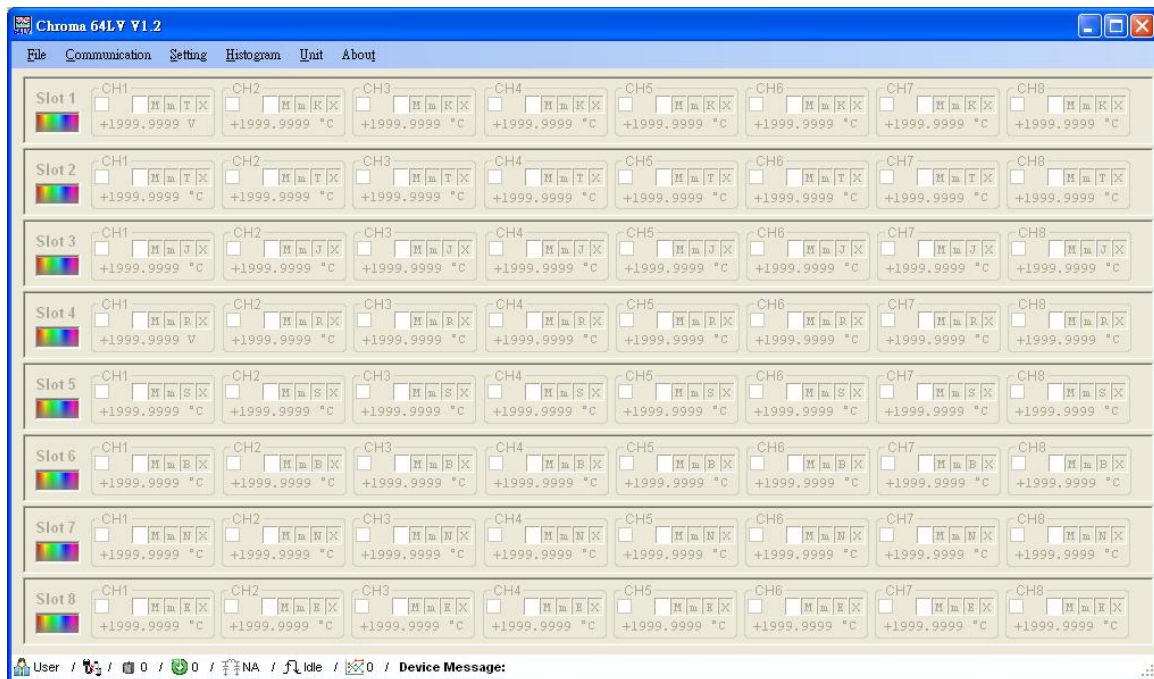


Figure 2-1 Chroma 64LV Program Main Screen

2.3 Communication Setup

After starting the program, communication between logger and PC should be established firstly. Click **“Communication”** at the upper of the screen and then select **“Connect”** as Figure 2-2 shown.

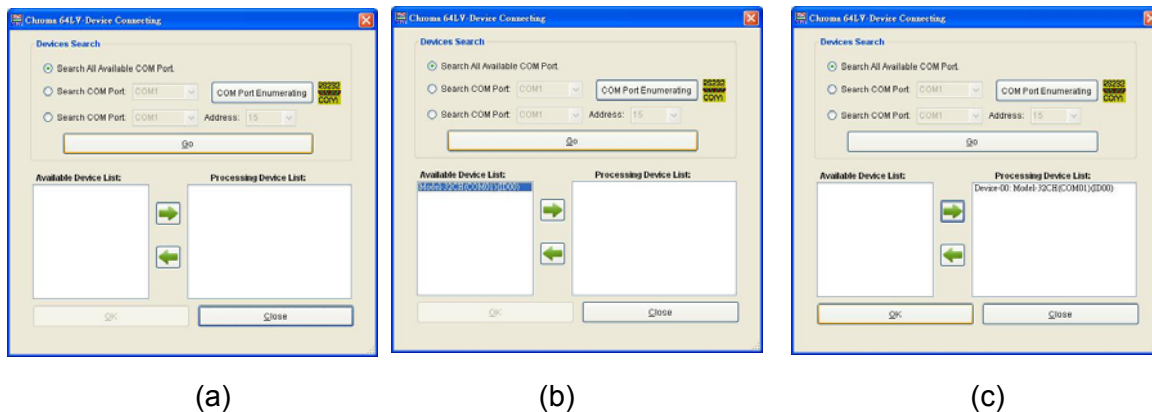


Figure 2-2 Use **“Communication”** to establish communication

Once **“Connect”** is selected, the screen as Figure 2-3 will be shown. No matter physical connection is via USB, RS232 or network, they will map to serial COM port. The address setting on rear panel of each logger (section 1.3, System ID), communication setup is by serial communication port number and address to identify logger. If these two parameters above described are known, the 3rd line can be selected and input it directly. If serial communication port number is known but address unknown, search the address via the 2nd

line. Otherwise, select the 1st line to let the PC searching all possible serial communication port numbers and addresses. No matter which selection, please click **Go** to process search.

After searching, the logger found will be appeared at lower left side “**Available Device List**” area. In Figure 2-3 (b), only one logger is found. Several loggers may be connected to the same PC in system application thus search results of several loggers will be appeared. Next step is to select the logger communication to be established and add it to the lower right side “**Processing Device List**” as Figure 2-3 (b), (c) and click **OK** to complete logger communication procedure.



(a) (b) (c)
Figure 2-3 Logger Search and Select Connection Procedure

Notice:

If communication port is RS232, it is no need to install driver. If USB port is used, the USB driver must be installed first. If network port is used, please follow installation network driver described in A.5 LAN Port Setting of Appendix A.

- (1) If there is two or above logger on the same serial communication port, the address settings of these loggers should be different. The address setting can be 0 to 15 via DIP switch on rear panel. When communicating, it is need to use address to identify communication device. For mostly application, there is only one logger, the program will search the address of this logger automatically.
- (2) Once the communication is established successfully, the grey area in a lot of screens will turn into black or other colors. It stands for the status with no information and no modification is already changed, data will be shown and operation will be allowed.

The normal operation should power logger on firstly and then activate Chroma 64LV program. If Chroma 64LV program is activated firstly, then power logger on. Thus the logger can't be found and can't be connected while activating the program and the serial port doesn't be established yet. Meanwhile, click **COM Port Enumerating** to update communication port information then search again for resolving the problem which can't find the logger.

2.4 Data Display

Once communication is established successfully, the read temperature or voltage will be displayed immediately as Figure 2-4 shown. The existed channel, its mapping location will have a reading, ex. the reading of Slot 1 CH1 is 142.6°C in Figure 2-4. If the channel is existed but no thermocouple input (or thermocouple damaged open-circuited), the screen will show “**TC Open**”. However, inexistent slot and channel are still the area in grey.

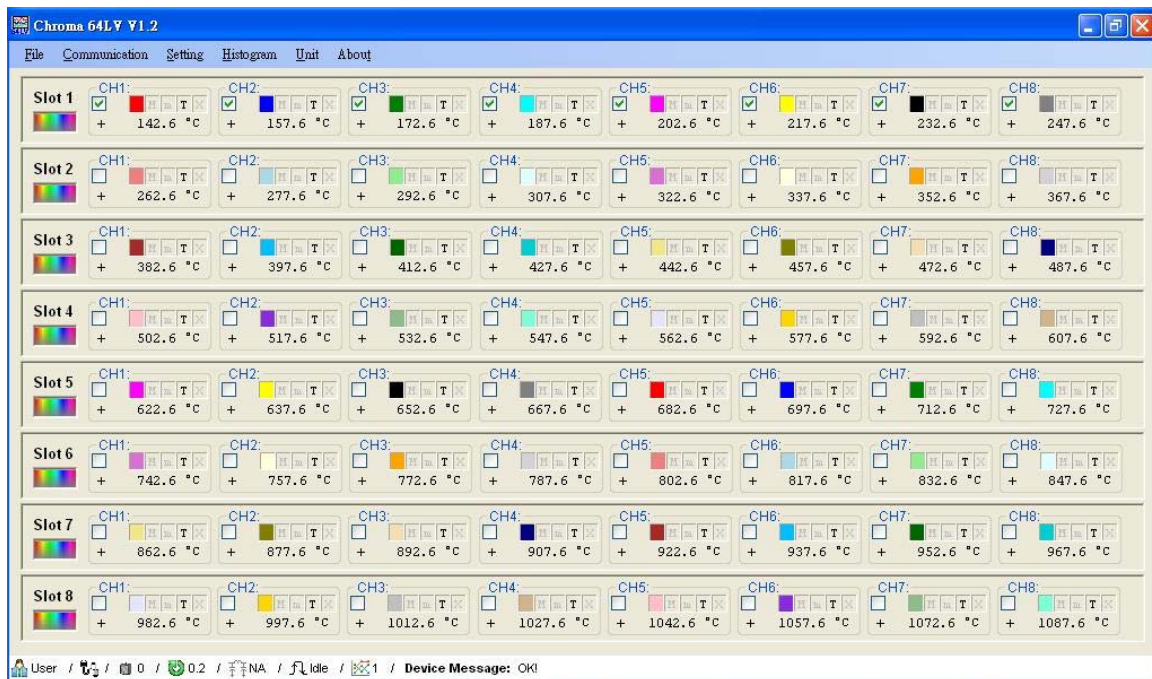


Figure 2-4 Reading Display Screen after Connection Setup Successfully

Due to input type isn't set initially, the reading may be incorrect. Therefore, it is need to follow thermocouple type of each channel inputted (it can be B, E, J, K, N, R, S or T) or measured voltage/current settings properly thus correct readings can be displayed. Figure 2-5 shows each channel area, there are various settings except for read values. The detail descriptions will be given as follows.

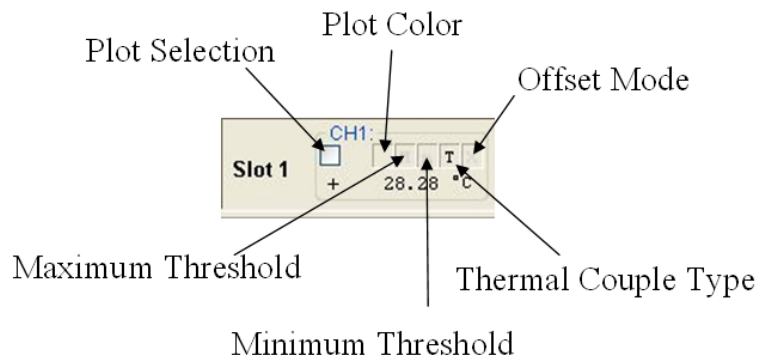


Figure 2-5 Readings and Various Settings in Channel Display Area

Plot Selection: The temperature or voltage is varied by time and represented by the figure, these will be described in section 2.8. If the channel data needs to add plot display, please click this place to create check symbol. If the channel data needs to be removed from plot display thus click this place again to uncheck.

Plot Color: Click the right key of mouse here will show color selection window as Figure 2-6. The curve color of temperature or voltage is varied by time variation which can be set while displaying the channel graph via the color selection. Since the color can be set arbitrarily, please don't set the same color on different channels or it may cause confusion.

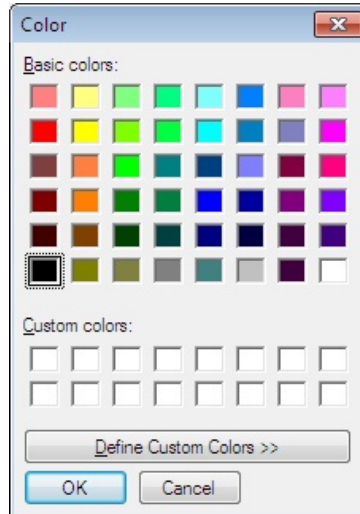


Figure 2-6 Plot Color Selection Screen

Maximum Threshold & Minimum Threshold: Some threshold temperatures in applications will be regarded as warning or trigger limit, thus maximum threshold and minimum threshold will be provided. Right-click on the 2nd and 3rd square of Figure 2-5 and setting screen will be brought out. Except for threshold input, the value also can be selected For This Channel Only, For All Plotting Channels or For All Channels.

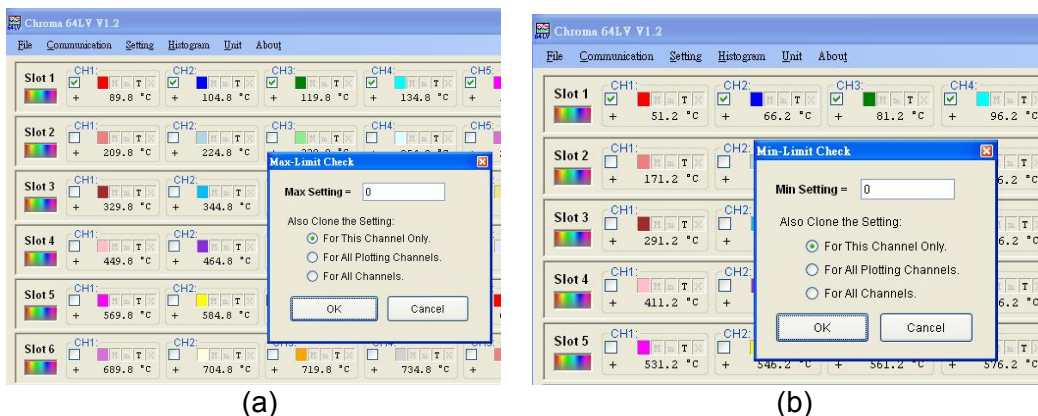


Figure 2-7 (a) Maximum Threshold & (b) Minimum Threshold

Although maximum threshold/minimum threshold are already set, users can select whether activate the detection of critical value. Left-click the 2nd square, it will show “M” letter in black thus maximum threshold detection is activated. Click the square again “M” letter will turn into light gray to deactivate detection function. Click the 3rd square with the same way, “m” letter in black occurred indicating minimum threshold detection is activated otherwise this function is disabled. When the threshold is detected and to be activated, the read temperature, voltage or current value over this threshold, the background color of channel display area will be changed. For example, in Figure 2-8 CH2 temperature of Slot 1 is higher than maximum threshold, the background color will turn into red. Whereas, CH3 temperature of Slot 1 is lower than minimum threshold, the background color will turn into azure.

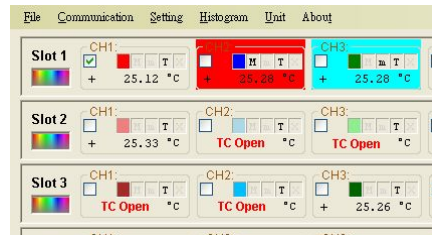


Figure 2-8 Background color changed indicating the channel reading higher than maximum high limit (red) and lower than minimum low limit (azure)

Thermal Couple 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 right click this item, a selection list will be shown as Figure 2-9. Select correct thermocouple type and other measurement types, selected result will be shown on the selection box by its English letter.

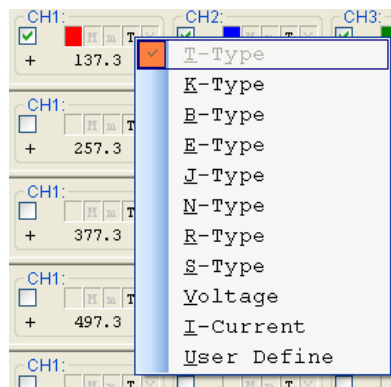


Figure 2-9 Thermocouple, voltage or current input selection

Note

- User defined physical measurement needs two conditions as the following.
- 1. Users prepared physical detector, the detector can transform physical 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 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 64-Logger detected 1V voltage will be interpreted into 5mW light intensity. If the generated voltage is non-linearity thus 64-Logger can't interpret the physical quantity correctly.

Offset Mode: In some occasions, thermocouple can't attach temperature point to be measured directly. There is a temperature Offset on the place fit to attach thermocouple (T_TC) and temperature point (T_sample) to be measured as Figure 2-10(a) shown. If offset can be calibrated in advance (Offset= T_sample- T_TC), add offset to measurement value (T_TC) afterwards. In theory, users can get temperature value (T_TC+Offset= T_sample) to be measured indirectly. The offset may be related to temperature, three modes are provided - None Mode, Fixed Mode and Polynomial Mode. **None mode** won't do any offset compensation, temperature displayed value is reading. **Fixed Mode** is for a constant value as offset compensation. **Polynomial Mode** needs to do multi-point temperature calibration to find the relation of offset and temperature. Use quadratic

polynomial to close measured value, according to this quadratic polynomial and measurement temperature to calculate offset afterwards as well as add measured value as compensation.

Right-click the last square can bring out offset setting window as Figure 2-10 (b). Follow the description above to select applicable offset mode and parameter. After setting is completed, can left-click the last square. When “X” letter in black is occurred indicating offset mode is activated whereas it is inactivated if the letter in gray.

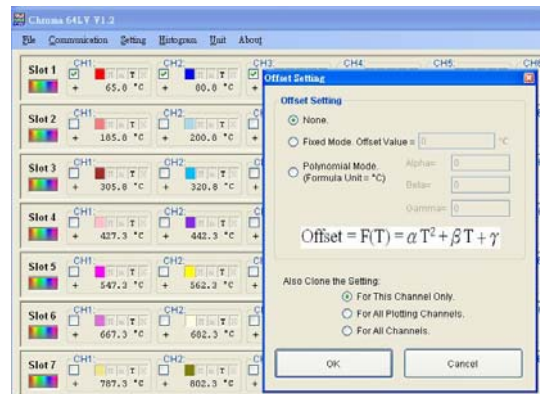
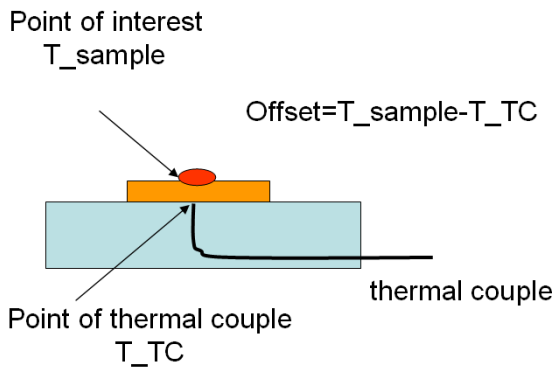


Figure 2-10 (a) Phenomenon and (b) setting window of “Offset” compensation

The settings above except for clicking the square sequentially, users also can right-click on channel display background area thus integral setting option as Figure 2-11 (a) will be brought out. The bottom 5 items in Figure 2-11 (a) already are explained previously, there is **Disable Sampling** for stopping read data from the channel and the area is displayed as Figure 2-11 (b). Until the setting is changed to **Enable Sampling** thus read data from the channel will be restored. **Set Alias** gives an easy to remember and meaningful name for the measured data in the channel, for example Slot 1 CH1 is for measuring CPU surface temperature thus its name can be defined as CPU. After setting, the name will be shown on upper side of square as Figure 2-11 (c).

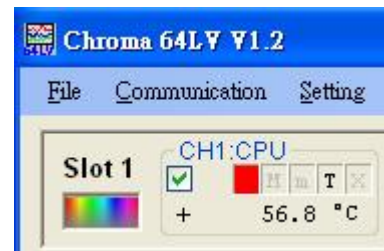
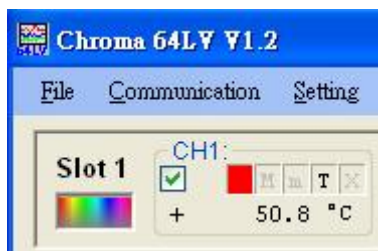
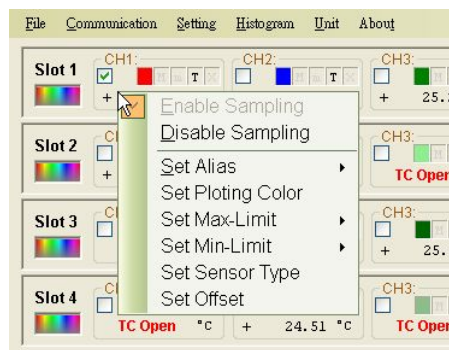


Figure 2-11 Other channel settings

2.5 File Selection

After clicking "File" on program main screen, it includes User Name, Save Configuration, Load Configuration, Data Recording and File Identification as Figure 2-12 shown.

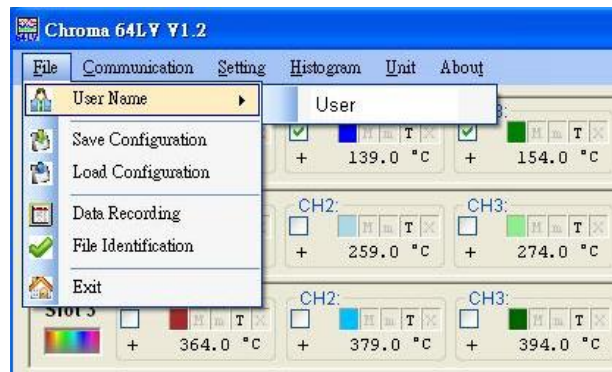


Figure 2-12 File selection detail

User Name: The input hasn't any influence to program operation but it will be written into record file for users' identity confirmation.

Save Configuration: Each time to execute the program should do setting for each channel will be complicated and time-consuming as section 2.2 described. Thus, the program provides save configuration function, only measurement structure unchanged to click "Save Configuration" for saving. Click "Load Configuration" and select the configuration for restoring while executing program next time. There are various configurations for different settings, use file name to distinguish these files while saving.

Load Configuration: Load Configuration can recall saved configuration to restore complicated setting which includes plot selection, plot color, input thermal couple type or voltage, maximum/minimum threshold, offset mode and name definition.

Data Recording: Click the selection will bring out a data setting window as Figure 2-13 shown. The data display and plot of program screen are all temporary data which won't be existed when program ends or computer shuts down. This data record function is for saving the data in hard drive for long-term preservation. However, the program provides powerful data record function, it is not only start or end record simply but also is based on reserved time, temperature to reach threshold setting or external trigger signal to open or end record. Therefore, please peruse the descriptions below for the data recording to get best performance.

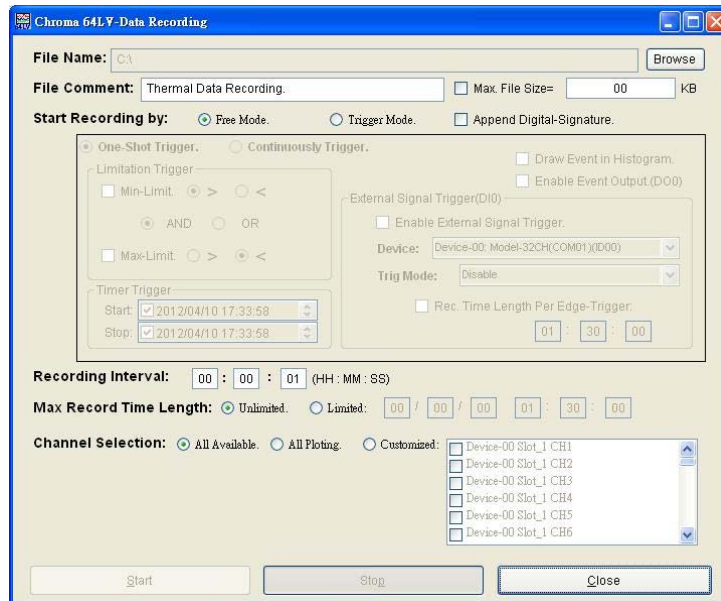


Figure 2-13 Data recording window

It is necessary to click **Browse** at upper right side to set data file, give file name and file type on file saving screen. The file types are text file (.txt format) or Microsoft Excel file (.csv format). Moreover, users can input description and annotation of the file to “File Comment” field.

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 10MB 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

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 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 Threshold and Minimum 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, Maximum Threshold and Minimum Threshold 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.

Timer Trigger

It can be set to generate trigger start record in specified time and 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.

External Signal Trigger

Digital difference input 1st group on rear panel (see section 1.3) provides this external trigger function. Trigger mode includes rising edge, falling edge, high level and low level as Figure 2-14 shown. If several 64-Loggers connect to a PC, each 64-logger can set its trigger mode. It is unnecessary to set them to the same trigger mode. Once trigger start recording, a certain period of time length record can be selected and ended automatically (Rec. Time Per Edge-Trigger). If this item is unselected, the record continues until **Stop** is pressed.

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 hard drive 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

It is selected for recording all channels, recording plot channel or recording channel checked individually.

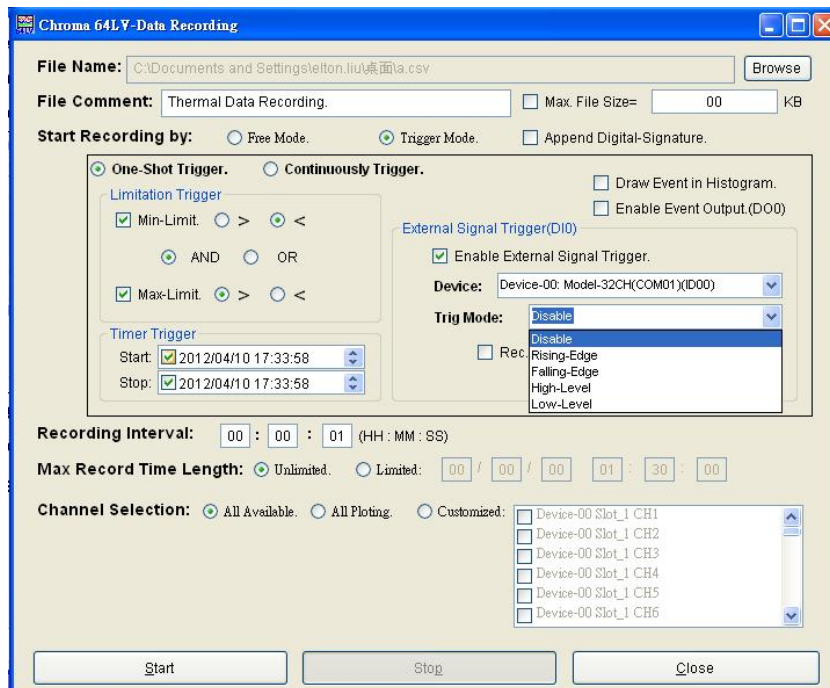


Figure 2-14 Recording trigger condition setting

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 communication setup in section 2.3, it also includes the contents as follows.

Device Selection:

There are multiple 64-Loggers (that is 51101-64 data logger) connect to a PC. Due to the limitation of screen, it shows one of 64-Logger channel read value for once. Thus, users can select to display which one is 64-Logger channel as Figure 2-15 shown.

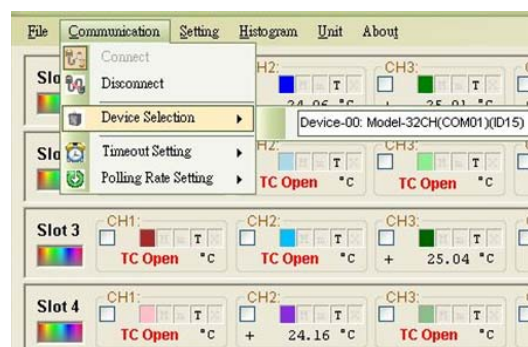


Figure 2-15 Multiple 64-Logger channel display switch

Notice:

1. 64-Logger names are listed as below method:
Device-aa: Model-bbCH(COMcc)(IDdd), aa is sequential number, bb is 64-Logger channel number which can be supported at most, cc is serial port number for connecting and dd is address ID setting.
2. Although data value only can choose one for display, but data record (described in section 2.5) can select multiple 64-Loggers to process at the same time and don't be affected by display switch.
3. In theory, the program can connect and monitor up to 99 sets of 64-Loggers. But actually, due to computer limitation of communication bandwidth and data processing capability, it is difficult to be processed if the quantity is too large. If multiple 64-Loggers are connected, quick speed and high processing capability computer is recommended.

Timeout Setting

The selection sets how long the communication time of 64-Logger to be exceeded that it will be regarded as communication timeout. The setting unit is in second. When the communication is timeout, please check hardware and connection as well as connection setup again.

Polling Speed

The selection sets how much time the computer read a value from 64-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 to handle data process so quickly. If the computer process capability is unsure, this selection can be set to "Auto" so that the program will adjust polling speed setting automatically.

Re-try Times

The selection sets the program sending communication command next time automatically for re-trying connection time when 64-Logger doesn't respond in communication timeout setting.

2.7 Setting Selection

The selection includes a lot of settings as below figure shown.

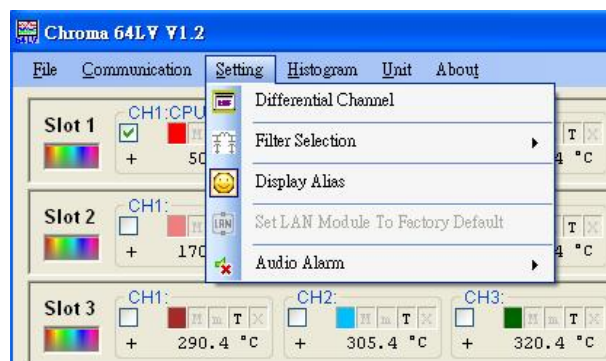


Figure 2-16 Setting selection

Differential Channel

After clicking this item, 8 virtual channels data window will be popped up as Figure 2-17 shown. Each differential channel can be set to differential calculation of any two real channels, for example, set dCH1 as differential of real channel Device-00 Slot_1 CH2 and Device-00 Slot_1 CH1. The channel added differential calculation can be set to any

64-Logger, any Slot or any channel connected to the PC. Due to temperature can't do differential calculation with voltage, please select temperature or voltage measurement with the same attribute. Each differential channel displays the value, it also can set Maximum Threshold, Minimum Threshold and graphic display as well.



Figure 2-17 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.

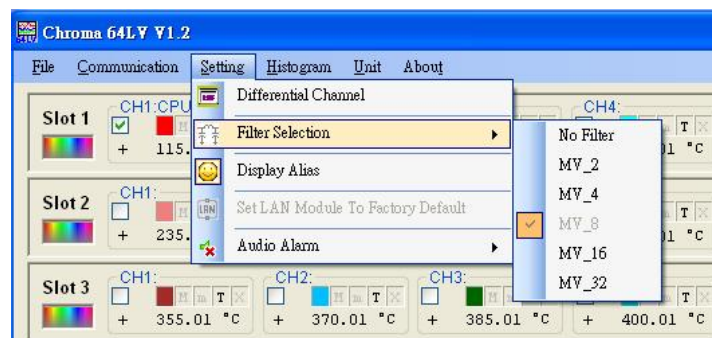


Figure 2-18 Filter Selection

Set LAN Module to Factory Default

This function is enabled only when the purchased 64-Logger already installed LAN module. When users forgot LAN relate settings, such as IP address, reset LAN module to factory default via USB or RS232 connection.

2.8 Histogram Selection

Draw the record value to histogram which is helpful to analysis via histogram group setting and selection as Group selection in Figure 2-19 and "Show Histogram" at upper side of screen thus histogram screen as Figure 2-20 will be shown. The horizontal axis stands for time, vertical axis has four selections of temperature, voltage, current and self defined physical quantity from left to right. 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 histogram display, the program provides a lot of analysis functions as the following.

Sometimes, too many channels to plot with simultaneous may cause visual confusion that hard to see which channel belongs which curve. Thus, the program provides grouping function as Figure 2-19 shown. Select a group firstly, for example **Group01** and check histogram channel to be added under this status, their histogram groups are all belong to **Group01**. Next to select other groups such as **Group02** and check the channel that belongs to **Group02** and so on. There are 8 groups at most. The upper right of Figure 2-20 can select group display as plotting, the checked group will be displayed thus the displayed group can be switched at any time for analysis convenience. When applying practically, according to measurement position, attribute and physical meaning to divide group is helpful to analysis.

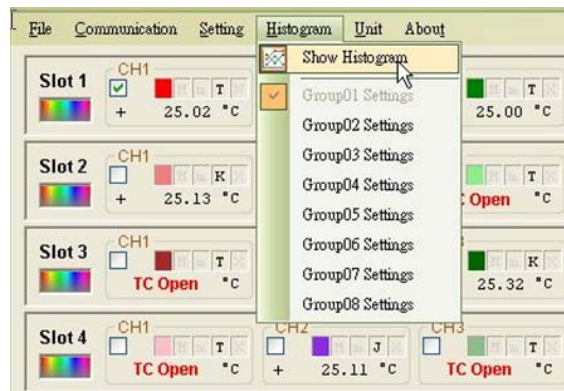


Figure 2-19 Histogram group setting

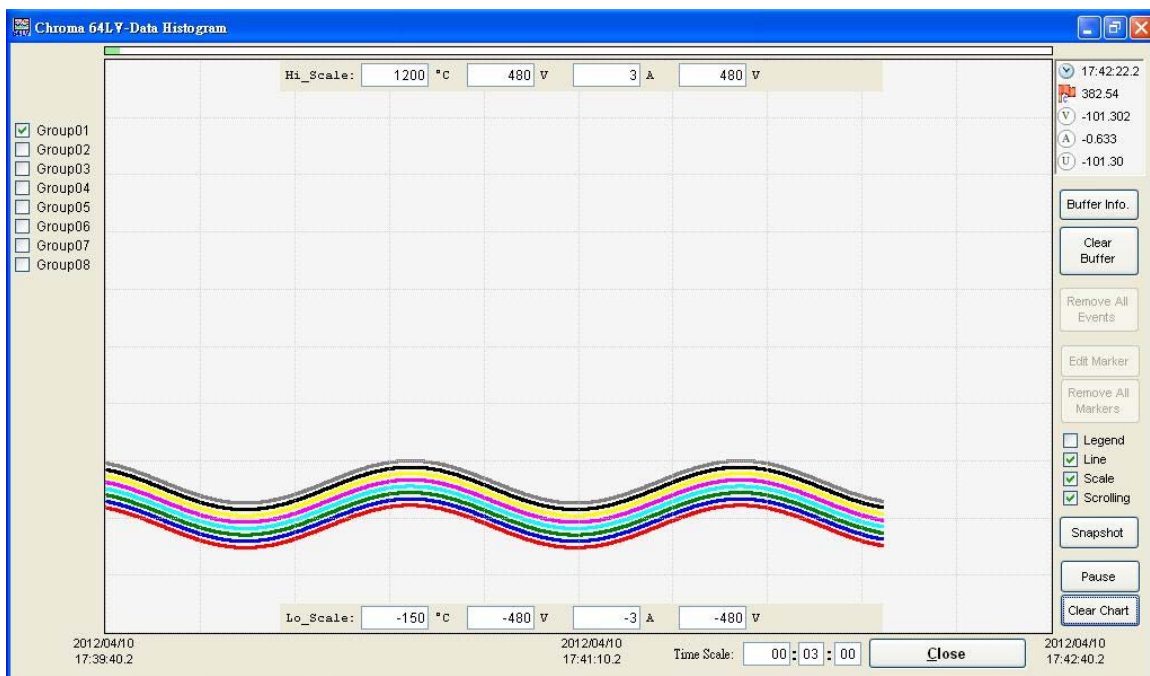


Figure 2-20 Histogram screen of temperature/voltage variation to time

There are a lot of functions selections at the surrounding of histogram area, the descriptions are as follows.

Buffer Info.

The program saves captured temperature, voltage or current data 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't be reached by general recorders.

Clear Buffer

Clear all data in buffer memory and zeroing it as well for restart using buffer memory.

Legend

It selects to enable or disable Legend.

Line

It selects whether connect adjacent plot points in the same channel with straight line.

Scale

It selects to enable or disable Scale.

Scrolling

It selects to enable or disable scrolling function.

Snapshot

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

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.

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 2-21. Click the left key of mouse to select Crop, a cropping enlarged histogram will be shown as Figure 2-22. This cropping enlarged histogram is for processing detail analysis. There is only one cropping enlarged figure, new cropping figure will replace the old one when re-cropping in the main window.

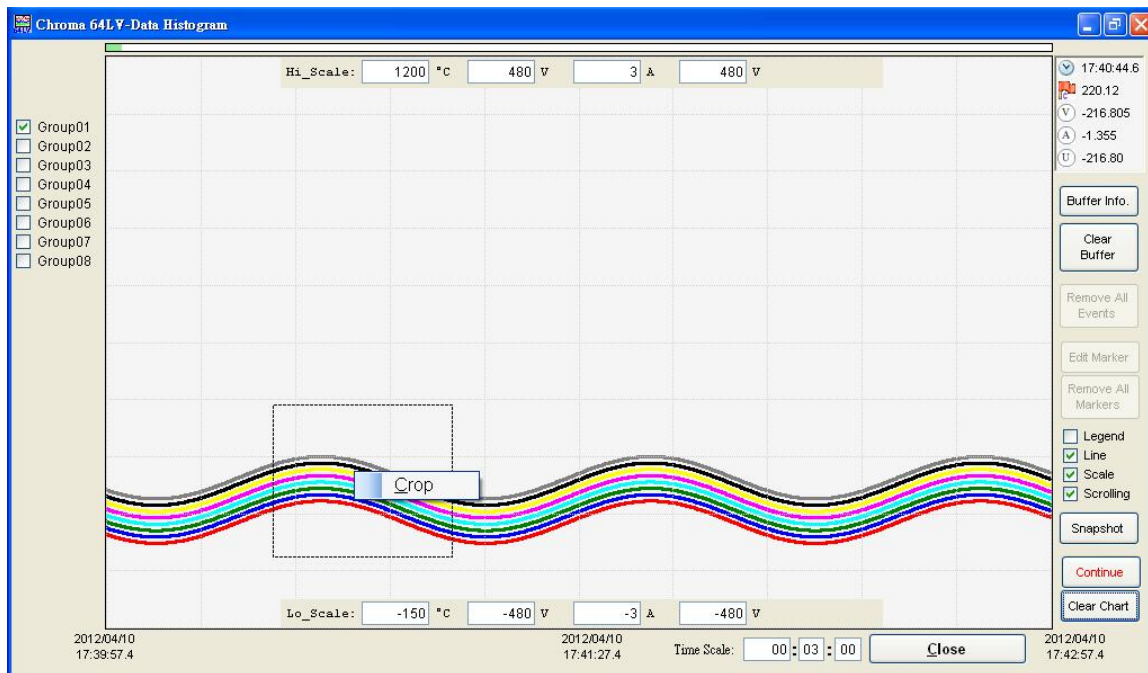


Figure 2-21 Crop in displayed histogram

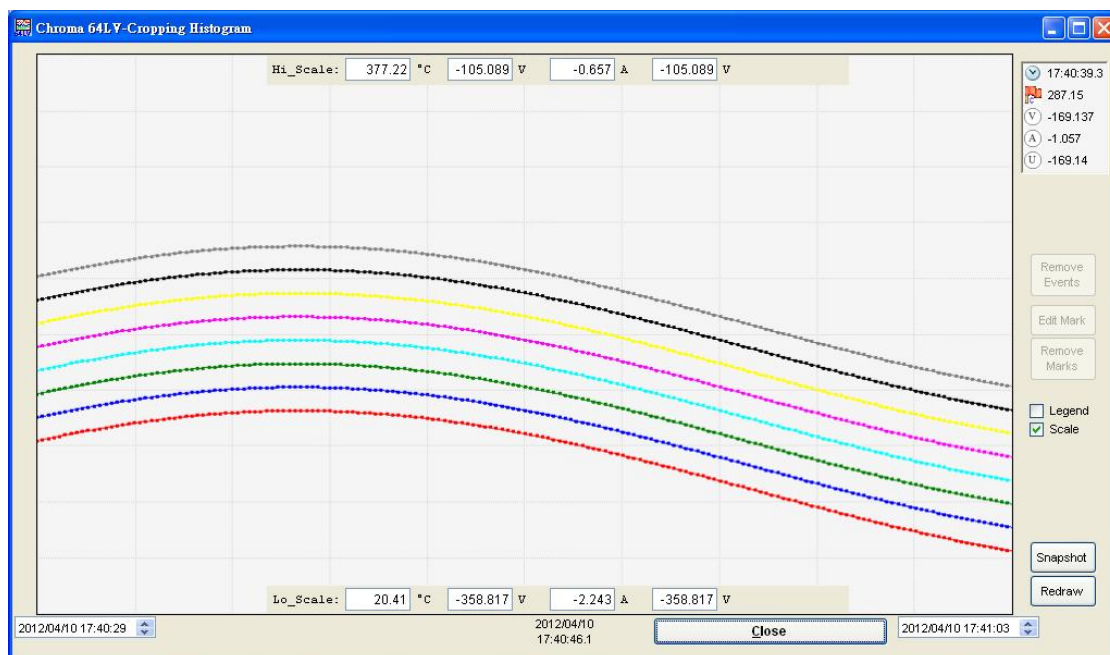


Figure 2-22 Cropping enlarged histogram according to Figure 2-21

Marker

Double left-click continuously, 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 user define physical quantity information can be seen. It also can be

written in comment and the difference between markers can be calculated in below graph area. The displayed result is the differences of selected two markers' time interval, temperature, voltage, current or user define physical quantity as Figure 2-23 shown.

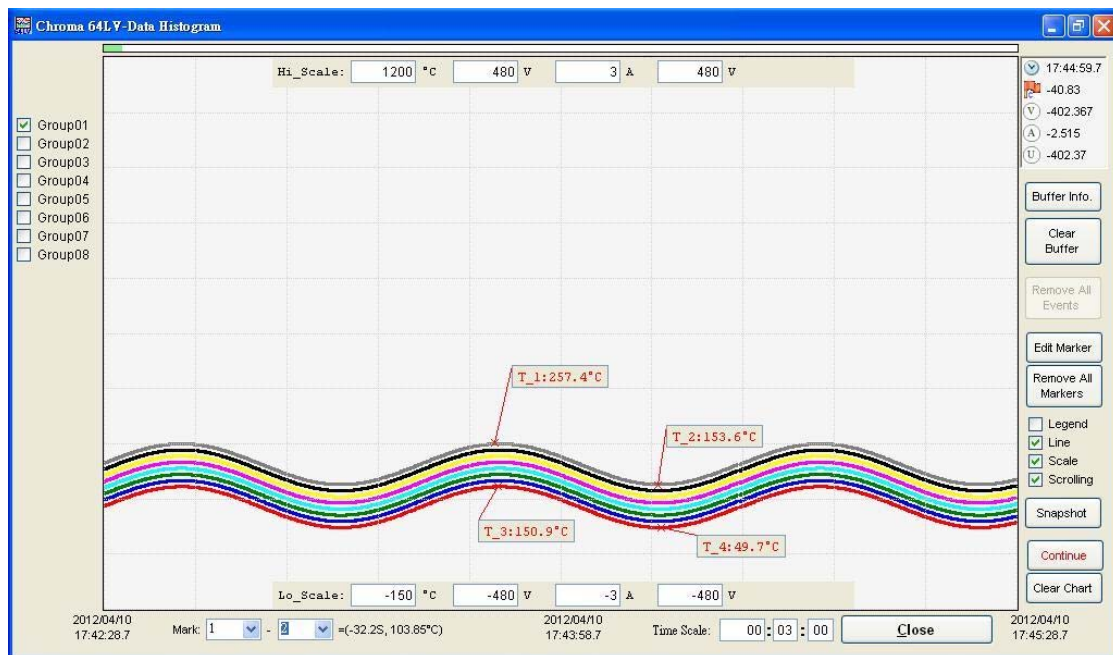


Figure 2-23 Marker produced and between markers differential calculation

⚡ 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 temperature/voltage 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, voltage, current or user define physical of marker. A text comment also can be written for the marker.

Remove All 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.

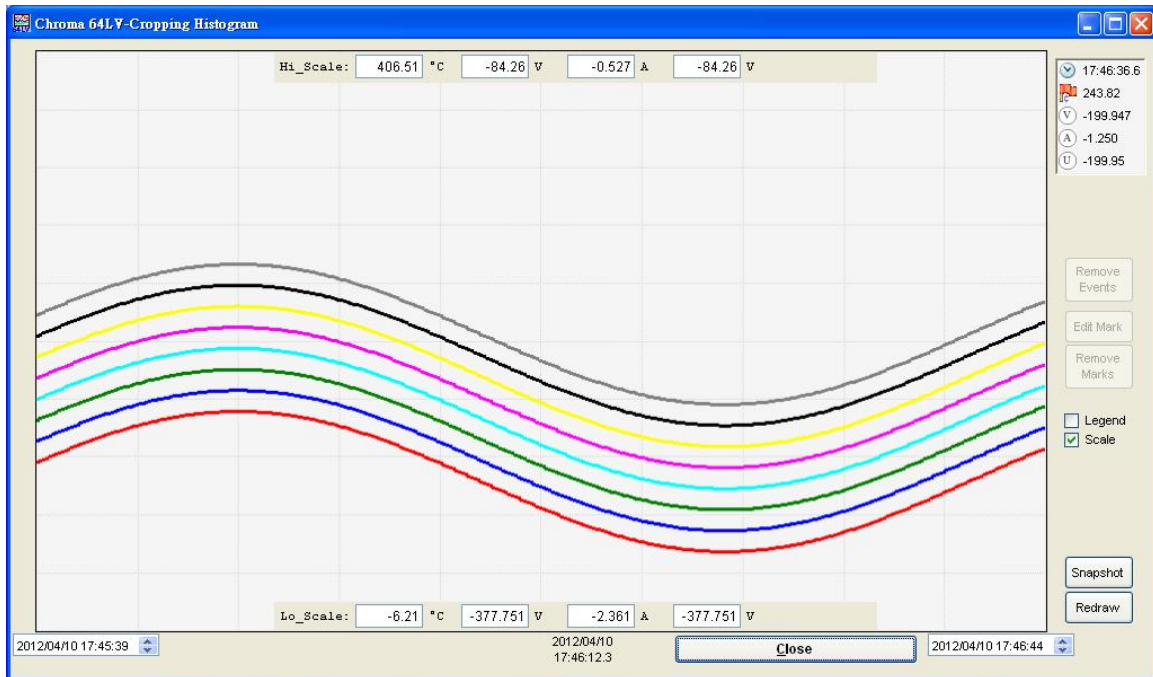
Remove All Events

"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.

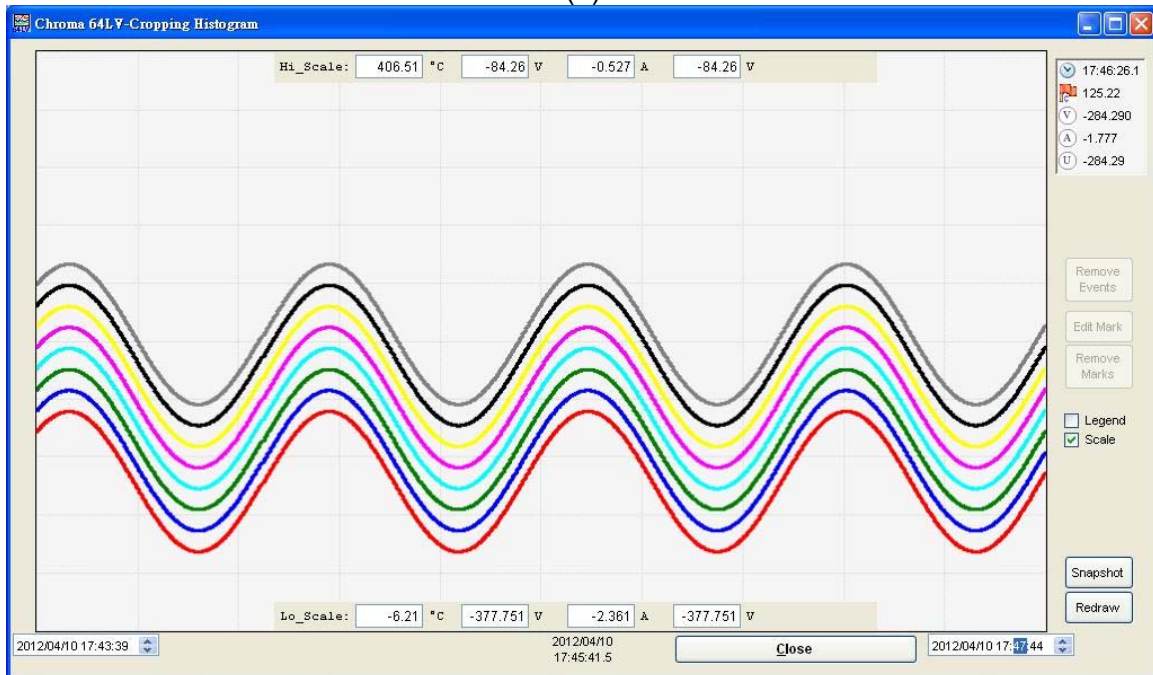
Cropping Enlarged Histogram Range Modified

It is not only providing enlarged view function but also tracing passed record. After changing time/temperature/voltage/current/user define physical range, click **Redraw**. For example, Figure 2-24 original cropping enlarged histogram (a) time range is from 17:45:39 to 17:46:44, time range after redefined is from 17:43:39 to 17:47:44 and after redrawing it is shown as Figure 2-24 (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/current/user define physical 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 the program enabled or later than present time thus the graph won't be shown.



(a)



(b)

Figure 2-24 (a) Original cropping enlarged histogram and (b) Time changed cropping enlarged histogram

2.9 Unit Selection

It can select temperature displayed unit °C, °F or °K as Figure 2-25 shown.

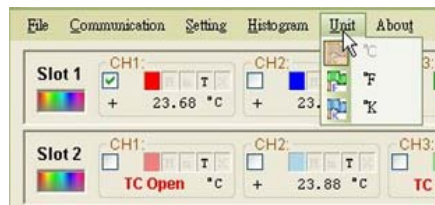
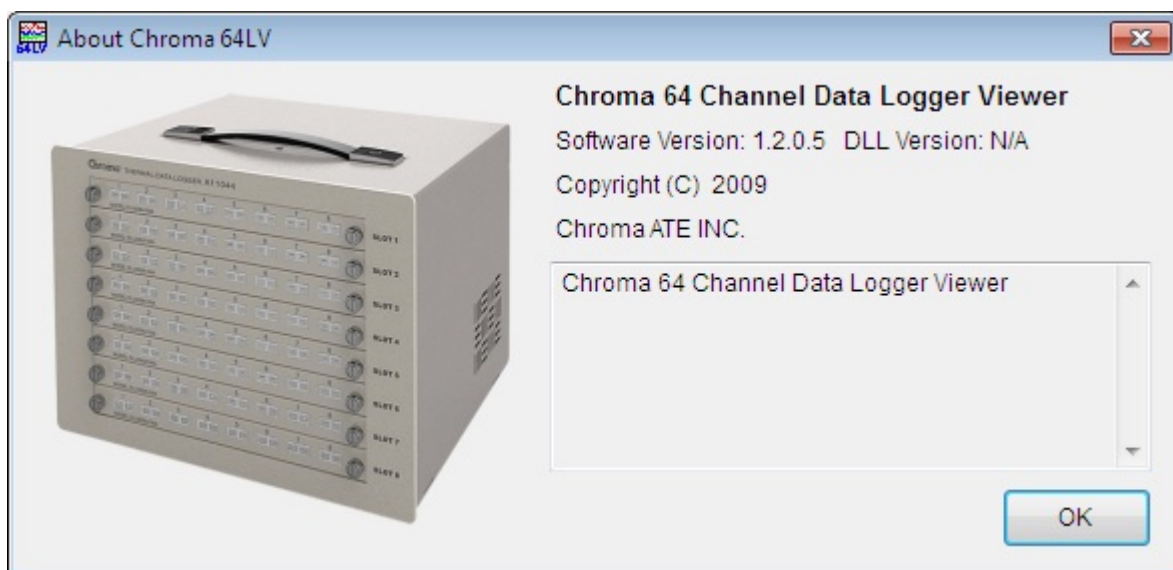


Figure 2-25 Temperature unit selection

2.10 About Selection

It checks program version and Chroma information.



3. Communication Protocol

For 64-Logger, we provide communication protocol between personal computers to let users developing their own program or integrate 64-Logger into complicated test system. Please contact Chroma if further assistance and service of program development or system integration is required.

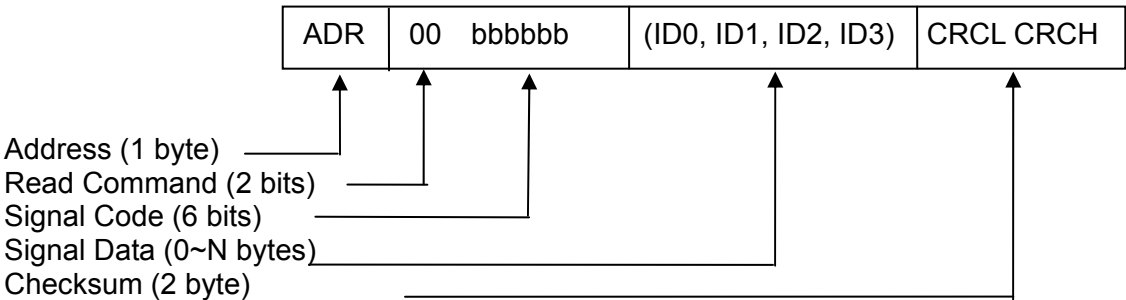
Chroma 64-Logger communication protocol formats are as the following.

3.1 Sequence Communication Structure

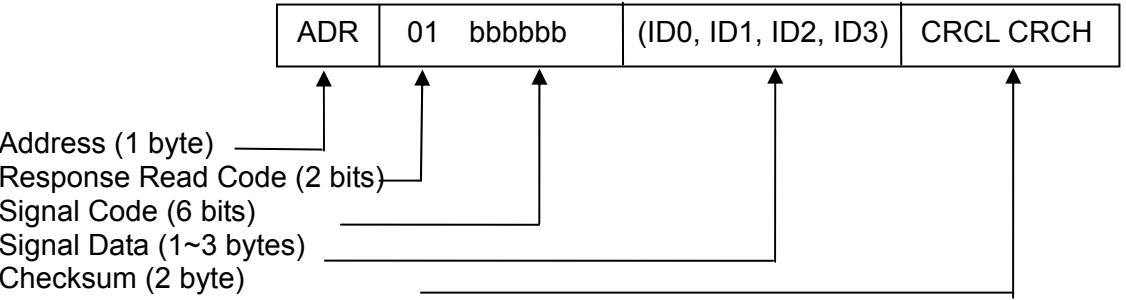
The sequence communication rate used is 115,200 bps, byte format is 8, n, 1.

3.2 Packet Format

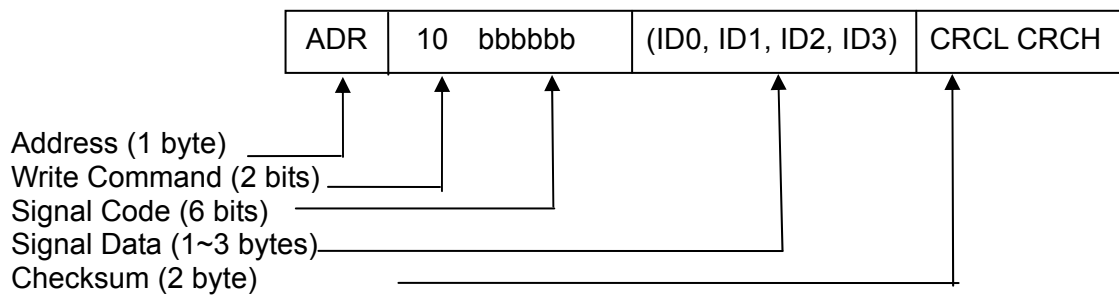
The read 64-Logger information packet format is sent by computer.



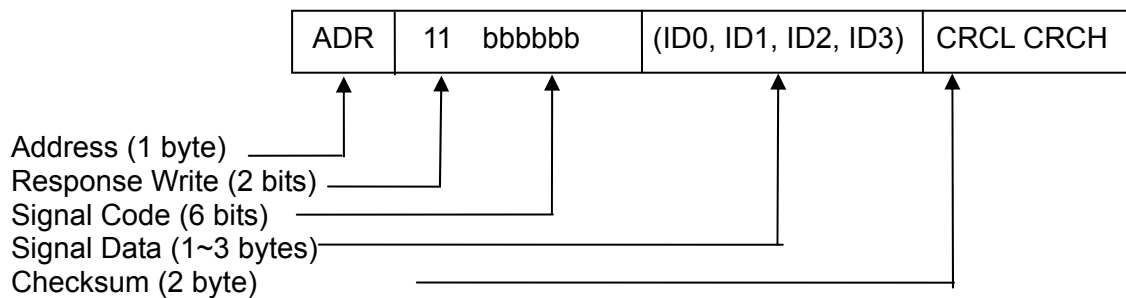
Response read packet format, send it out from 64-Logger.



Write packet format, send it out from computer.



Response write packet format, send it out from 64-Logger.



Communication mode between computer and 64-Logger is very simple and direct. The computer is initiative and 64-Logger is passive which take Q (computer asked) & A (64-Logger answered) method. For read command, 64-Logger will respond the data value to be read. For write command, 64-Logger will respond the same packet for confirmation. If packet error and can't be identified thus 64-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. Address setting is based on ID DIP switch on rear panel, its range is 0~15 *i.e.* 0x00 to 0x0F of hexadecimal. About the description of address setting, please refer section 1.3.
 2. For the packet with error content such as address different and checksum operation is unsuited thus 64-Logger will ignore it and without any response.

3.3 Information 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: Slot Number Bit6,7: By-Channel/Slot /Group Selection.	1	Channel number range: Single-channel: 0 Dual-channel: 0~1 Quad-channel: 0~3 Multi-channel: 0~7 Slot number range: Single-channel: 0 Dual-channel: 0 Quad-channel: 0 Oct- or Multi-channel: 0~7 By-Channel/Slot/Group selection: Bit6,7=00b: by channel. Slot and channel number should be specified. Bit6,7=01b: by slot. All sensor data of the selected slot is requested implicitly. Bit6,7=10b: by group. Slot 0~3 are grouped as Group One; Slot 4~7 are grouped as Group Two. Using this operation, all sensor data of same group is requested implicitly except those channel number is greater than total channel number specified in Device Model Number Bit 0~5. That is, 32CH model will response 32CH data totally, even if there is any grouped slot is empty; 16CH model will response 16 channel data only, even if there are more than 16 channels available visibly. To specify Slot number 0~3 is to indicate Group One, 4~7 is Group Two. Besides, channel number is ignored in this operation. It will cause an "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 slot mode: ID0~31 = All channel sensor data of selected slot. (CH1,CH2,CH3...CH8) 0x000000~0xFFFFFFFF By group mode: ID0~N = All channel sensor data of the group. (EX: CH1,CH2,CH3...CHN) 0x00000000 ~ 0xFFFFFFFF		4/ 32/ 4xN

0x02	Sensor Type Setting*	Yes	Yes	PC->Device: ID0: Slot/Channel Number Bit0~2: Channel Number Bit3~5: Slot Number Bit6~7: Reserved. ID1=Sensor type(write only) 0x00~0x09	1 or 2	Channel number range: Single-channel: 0 Dual-channel: 0~1 Quad-channel: 0~3 Multi-channel: 0~7 Slot number range: Single-channel: 0 Dual-channel: 0 Quad-channel: 0 Multi-channel: 0~7 It will cause an "Command Error Response" error if the slot/channel number is out of range. The original value will not be changed. Sensor Type: 0x00: T-type# 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	
0x03	Trigger Setting*	Yes	Yes	PC->Device: ID0=Ext. HW Signal Trigger Setting(write only) Bit 0: Ext. Trigger enabler. Bit 1~2: Trigger mode. Bit 3~7: Reserved.	0 or 1	Trigger Setting: Bit0=1: Enable ext. trigger. Bit 1~2: 0x00: Rising edge trigger 0x01: Falling edge trigger 0x02: Level trigger - HIGH 0x03: Level trigger - LOW Trigger Setting/Status: Bit0: 0=Disable;1=Enable Bit 1~2: 0x00: Rising edge trigger 0x01: Falling edge trigger 0x02: Level trigger - HIGH 0x03: Level trigger - LOW Bit3: 0=Idle; 1=Triggering. (In Edge-trigger mode, this bit will be automatically cleared by firmware after it is read by software.)
				Device->PC: ID0=Trigger Setting/Status Bit 0: Ext. Trigger enabler. Bit 1~2: Trigger mode. Bit 3: Idle/Triggering. Bit 4~7: Reserved.	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 0x04:Moving average by 16 0x05:Moving average by 32	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 0x04:Moving average by 16 0x05:Moving average by 32	1	

0x0A	GPIO Configuration*	Yes	Yes	PC->Device: ID0=Reserved. ID1=Polarity(Write only) Bit N=0: retained Bit N=1: inverted	0 or 2	Default : ID1 : all retained
				Device->PC: ID0= Reserved ID1=Polarity Bit N=0: retained Bit N=1: inverted	2	
0x0B	Get/Set GPIO Status	Yes	Yes / No(for Input Pin)	PC->Device: ID0=Status(Write only) Bit0~7=GPIO0~7	0 or 1	ID0: Read: Bit 0~7=Port Status Write: Bit 0~3=Reserved. Bit 4~7= DO0~DO3 output value
				Device->PC: ID0=Status Bit0~7=GPIO0~7	1	
0x10	Device Address	Yes	No	PC->Device: n/a	0	Address: 0~15, the others is ignored. The Device Address will not be modified if the device has its own physical-ID-address instead(ex: DIP switch).
				Device->PC: ID0=Address 0x00~0F	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	Operation Temp. Out of Spec.
				Device->PC: ID0= Code Number 0x00= Normal Bit0: Reserved. Bit1=1: Int. fan fail Bit2=1: Temp. Out of Spec. Bit3 ~7: Reserved.	1	
0x14	Device Model Number	Yes	No	Device->PC: ID0= Model Number 0x00~FF	1	ID0: Bit0~5=Total channel number – 1 Bit6=1: LAN module equipped. Bit7: Reserved.
0x15	MCU Firmware Version Number	Yes	No	PC->Device: n/a	0	0.0.0.0 ~ 15.15.15.15
				Device->PC: ID0~1=FW Version 0x0000~FFFF	2	
0x16	Reset LAN Module	Yes	Yes	PC->Device: n/a	0	ID0: 0x00: The write command is accepted and is going to execute. 0xFF: LAN module has NOT been equipped. ID1: 0x00: LAN module has been reset to default successfully. 0x01: Fail to reset LAN module. 0x02: No write command has been accepted by device. 0xFF: LAN module has NOT been equipped.
				ID0=Write Result(for Write) 0x00: Command accepted. 0xFF: No LAN module. ID0=Read Result(for Read) 0x00: Success. 0x01: Fail. 0x02: Idle. 0xFF: No LAN module.	1	

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 64-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 calculated/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 64-Logger. (To assume address ID of 64-Logger below is 0x0F.)

Example 1: Check if 64-Logger is existence.

PC transmission 0F 10 05 8C
 If 64-Logger is inexistence No response
 If 64-Logger is existence, respond 0F 50 0F 3D C7.

Example 2: Read Slot 1 Channel 1 value.

PC transmission 0F 00 00 41 C3
 64-Logger response 0F 40 80 00 00 00 28 EB (TC open, no thermocouple)

Example 3: Query Slot 1 Channel 1 input mode

PC transmission 0F 02 00 40 A3
 64-Logger response 0F 42 00 71 63 (Slot 1 Channel 1 is T type thermocouple input)

Example 4: Set Slot 1 Channel 1 input mode

PC transmission 0F 82 00 01 62 D8 (it is set to K type thermocouple input)
 64-Logger response 0F C2 01 D1 63

Example 5: Set average value 16, *i.e.* filter MV_16

PC transmission 0F 84 04 23 00
 64-Logger response 0F C4 04 12 C0

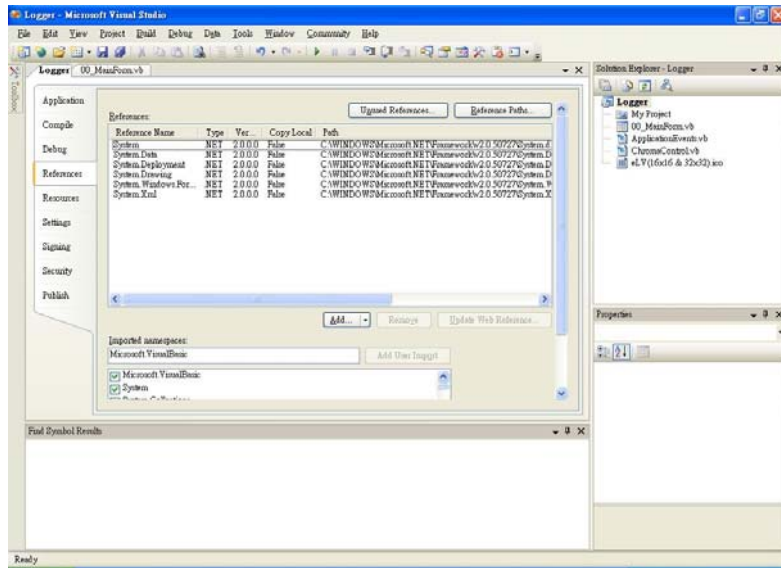
If there is any need for assistance, please contact Chroma.

3.6 Dynamic Link Library

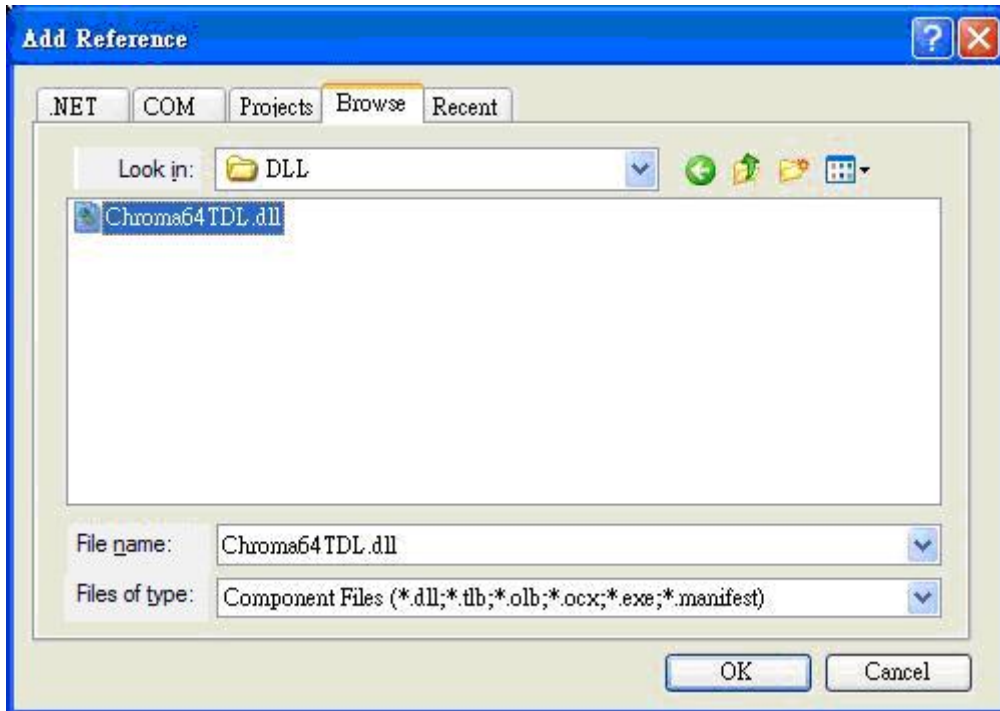
Proceed program edit by communication protocol directly needs considerable experience in low-level program code, it may be not easy to adapt for engineer usual used high-level program language. Thus, we also provides dynamic link library to proceed program edit, operation methods are as the following.

Take an example by Microsoft Visual Basic 2005 program development.

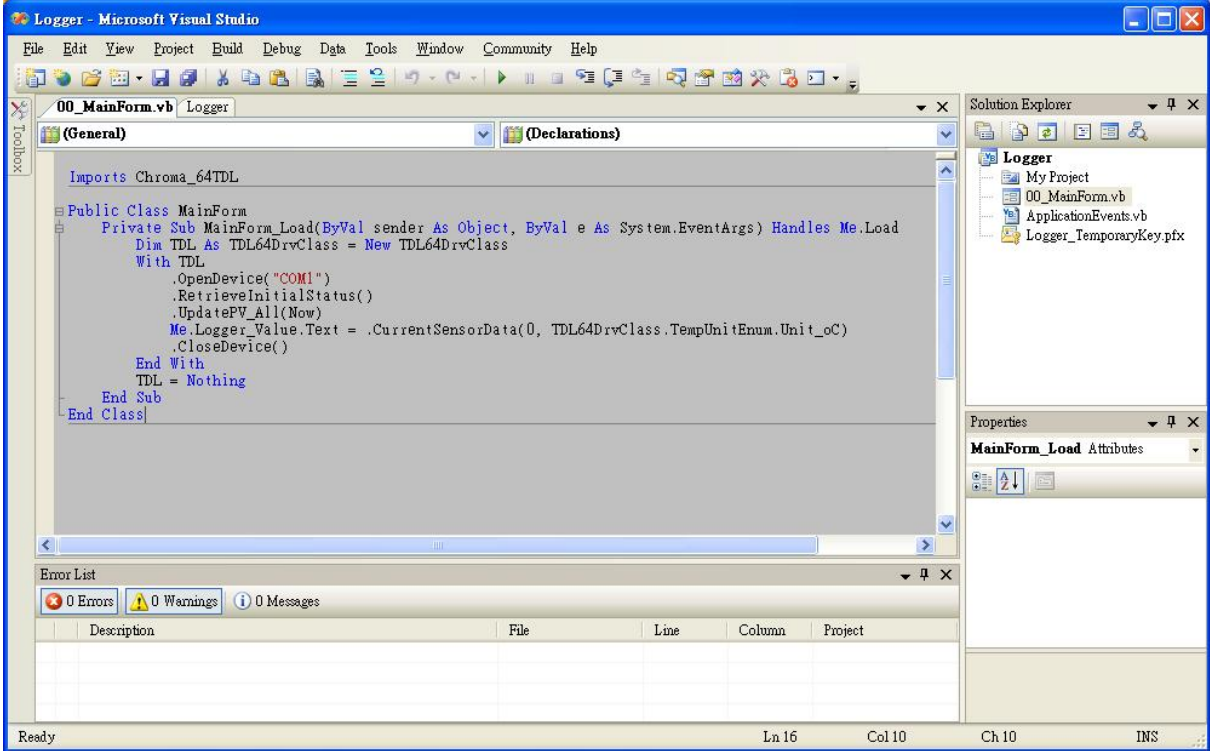
1. Open new plan, enter page "Reference".



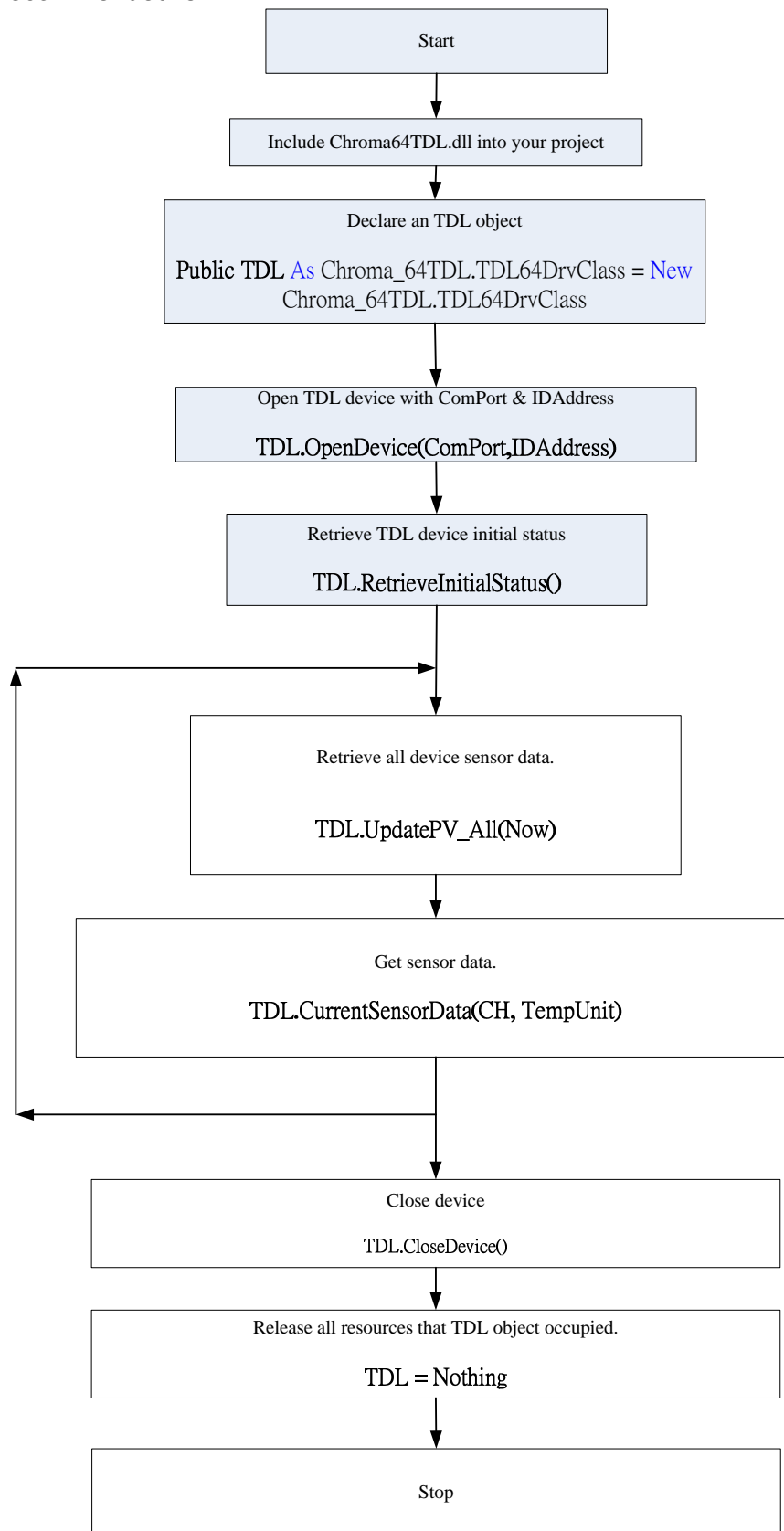
2. Find **Chroma64TDL.dll** in DLL folder of attached CD.



- 3. When **Chroma64TDL.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 using 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 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 device initial status, 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
    MV_16 = 4
    MV_32 = 5
End Enum
```

`SetGPIOConfiguration(ByVal IOPolarity As Byte) As Boolean`

It sets digital output/input level polarity by IOPolarity.

IO Polarity:

Bit N=0: GPIO port N= positive logic level

Bit N=1: GPIO N= negative logic level

It will return a truth/false value whether executes successful or not.

SetGPIOStatus(ByVal Setting As Byte) As Boolean

It sets digital output/input level status by Setting.

Setting:

Bit N=1: GPIO port N=High

Bit N=0: GPIO port N=Low

It will return a truth/false value whether executes successful or not.

SetSensorType(ByVal CH As Integer, ByVal SensorType As SensorTypeEnum) As Boolean

It sets input thermocouple type, voltage or current, 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

SetTriggerMode(ByVal Mode As TriggerModeEnum) As Boolean

It sets external trigger condition to following one, please be aware that the external trigger adopts the 1st group of digital input (DI0) status. It will return a truth/false value whether executes successful or not.

Enum TriggerModeEnum As Byte

Disable = &H0

EdgeRising = &H1

EdgeFalling = &H2

LevelHigh = &H3

LevelLow = &H4

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_Overload = -3
    Over_Neg_DisplayRange = -2
    Over_MinLimit = -1
    Normal = 0
    Over_MaxLimit = 1
    Over_Pos_DisplayRange = 2
    Plus_Overload = 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. According to various input types, it can be temperature value (base on specified temperature unit), voltage value or current value. About 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 64-Logger firmware version number.

DeviceIDAddress() As Byte

It reads logger ID (address).

DigitalFilterType() As DigitalFilterTypeEnum

It reads average filter setting.

GPiOPolarity() As Byte

It reads digital output/input level polarity setting.

Bit N=0: GPIO N= Normal level
Bit N=1: GPIO N= Reverse level

GPIOStatus() As Byte

It reads digital output/input status, please be aware that the status is logic 1 or 0 affected by IOPolarity definition.

InitStatus() As InitialStatusEnum

It reads initiation status of 64-Logger.

InitialStatusEnum is defined as:

Enum InitialStatusEnum As Byte

WarmingUp = 0

Ready = 1

SystemReset = 2

End Enum

MaxChannelNum() As UInteger

It reads maximum channel number which is based on 64-Logger inserted sensing module number. The value should be 8, 16, 24, 32, 40, 48, 56 or 64.

MaxSlotNum() As UInteger

It reads maximum slot number which is based on 64-Logger inserted sensing module number. The value should be 1, 2, 3, 4, 5, 6, 7 or 8.

ModelName() As String

It reads 64-Logger model name.

ModelNumber() As ModelNumberEnum

It reads 64-Logger model number.

OperationTempFailure() As Boolean

It checks if operation temperature is over specification range.

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
```

`TriggerMode()` As TriggerModeEnum
It reads external trigger mode setting.

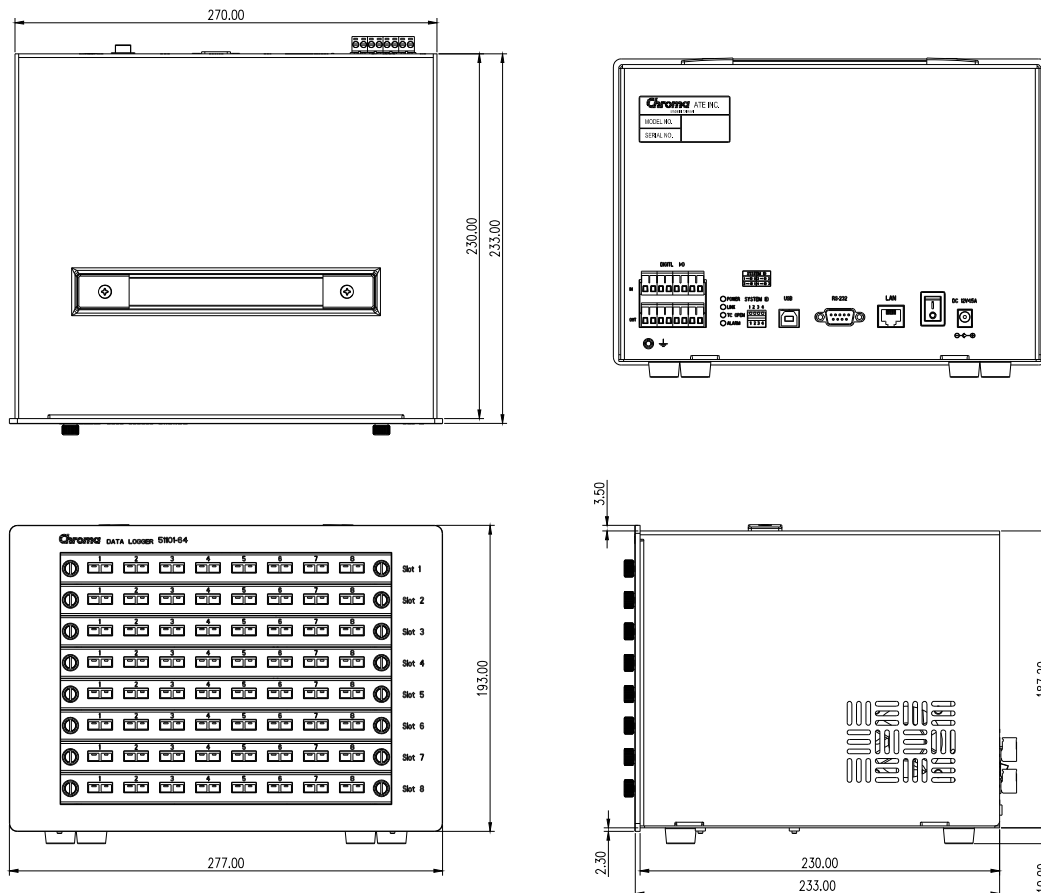
TriggerModeEnum is defined as:

```
Enum TriggerModeEnum As Byte  
    Disable = &H0  
    EdgeRising = &H1  
    EdgeFalling = &H2  
    LevelHigh = &H3  
    LevelLow = &H4  
End Enum
```

`TriggerStatus()` As Boolean
It reads external trigger status.

Appendix A

A.1 Dimension



Length unit:mm

A.2 Product Specification

Absolute Maximum

Specification Item	Symbol	Value	Unit
Power Adaptor Input Voltage	V _{sa}	90 to 260	VAC
Power Adaptor Input Frequency	F _{sa}	47 to 63	Hz
Main Frame DC Input Voltage	V _{dc}	12.6	V
Main Frame DC Input Current	I _{dc}	1.5	A
Thermocouple Differential Input Voltage	V _{tc}	±5	V
External Digital Input/Output Voltage	V _{io}	30	V
External Digital Output Current	I _{o_ext}	400	mA
Operating Temperature	T _{op}	0~50	°C

Storage Temperature	Tst	-20~60	°C
Storage Humidity		80	%RH

Specifications

Specification Item	Symbol	Value	Unit
Thermocouple Connector Specifications			
Thermocouple Connector		PCC-SMP-U-100-R-CE-ROHS (Omega)	
Thermocouple Jacks		SMPW-U-M (Cu-Cu, White, Omega)	
Temperature Reading Specifications			
Number of Inputs		8, 16, 24, 32, 40, 48, 56, 64	Channel
Temperature Sensor Type		Thermocouple B, E, J, K, N, R, S, T	
Temperature Scale		ITS-90	
Temperature Accuracy ⁽¹⁾⁽²⁾		±[0.01% of reading +0.3]	°C
Temperature Resolution		±0.01 ⁽³⁾	°C
CJC Error	e _{cjc}	±0.3	°C
Sample Rate	SR	200	ms
Galvanic Isolation	Viso	1000	Vdc
Input Resistance	Rin	5M	Ω
Thermocouple break detection current	ltc_open	100	nA
Voltage Reading Specifications			
Number of Inputs		8, 16, 24, 32, 40, 48, 56, 64	Channel
Voltage Input Type		Chroma VA-480 adapter	
Voltage Resolution		1	mV
Voltage Input Range		+/-480	Vdc
Voltage Input 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]	
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	
Digital I/O Specifications			
Number of Digital I/O		4 differential digital inputs, 4 differential digital outputs	
Digital Input		1 trigger input(DI0) and 3 general inputs	
Digital Input- High Input Voltage	VIH	3 ~ 30	V
Digital Input- Low Input Voltage	VIL	<0.8	V
Digital Input- High Input Current	IIH	0.8 ~ 13.1	mA
Digital Input- Low Input Current	IIL	<10	μA

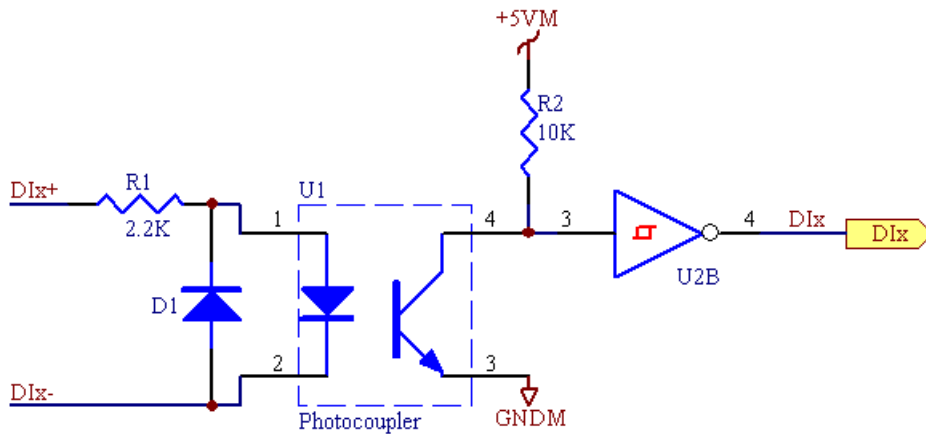
Digital Input- Terminal Resistor	RT	2.2K	Ω
Digital Output Configuration		transistor switch	
Digital Output- External Supply Voltage	Vext+	<30	V
Digital Output- ON-state Voltage	Von	<1.5	V
Digital Output- ON-state Current	Ion	<400	mA
Digital Output- OFF-state Current	Ioff	<2.1	μ A
Digital Output- Power Dissipation per Output	Pd	<0.6	W
Isolation Voltage	Viso_io	\pm 250	V
Communication Specifications			
RS-232		Half Duplex, DB-9 female connector	
USB		USB2.0 (full speed device), USB B-type connector	
LAN (Option)		Ethernet (10BASE-T/100BASE-TX), RJ-45 connector	
Power Specifications			
Power Requirement	Vdc	11.4~12.6	V
Maximum Power Consumption	Pmax	18	W
Physical Specifications			
Dimensions (Main Frame WxDxH)		277x200.7x233	mm ³
Weight for Main Frame		2.4	Kg
Weight per Sensor Card		0.15	Kg
Weight (Main Frame + 8 Sensor Card)		3.6	Kg
Environmental specifications			
Operating Temperature	Top	0~50	$^{\circ}$ C
Humidity		< 80	%RH

- (1) Accuracy is based on operating temperature 20 $^{\circ}$ C ~ 30 $^{\circ}$ C, thermal balance and excludes temperature error of thermocouple.
- (2) If operating temperature is over the range of 20 $^{\circ}$ C ~ 30 $^{\circ}$ C, it needs to add (0.01% of reading + 0.03 $^{\circ}$ C)/ $^{\circ}$ 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 Digital Output/Input Circuit Configuration

The following provides digital output and input ports, 64-Logger inner circuit configuration and coordinating with outer circuit is recommended. If digital output or input function is applied, please peruse this section to avoid coordinating with error circuit that can't reach expected function and may damage equipment.

Inner circuit configuration of digital input:



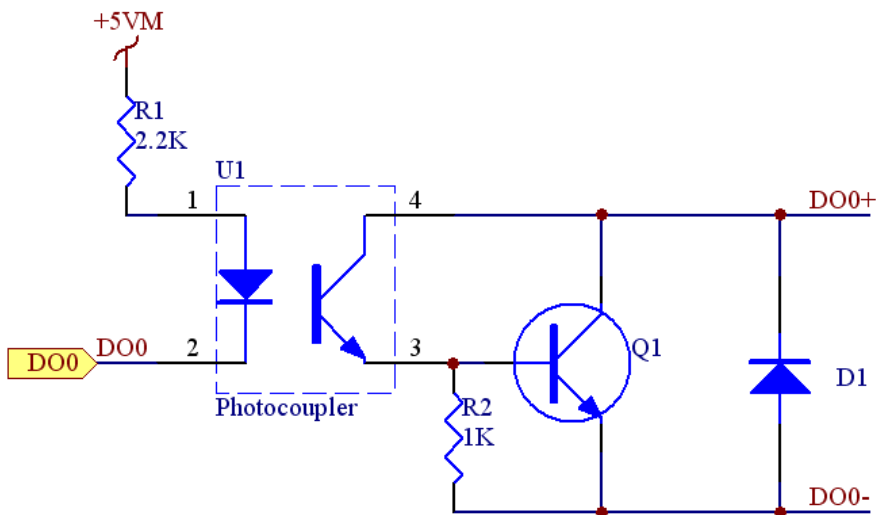
Digital input status DIx ($x=0, 1, 2, 3$) is the differential of input terminal of $DIx+$ and $DIx-$.

$V_I = V(DIx+) - V(DIx-) > 3V$, $\rightarrow DIx =$ logic level high

$V_I = V(DIx+) - V(DIx-) < 0.8V$, $\rightarrow DIx =$ logic level low

V_I must $> 3V$ or $< 0.8V$, otherwise DIx logic level can't be judged accurately.

Inner circuit configuration of digital output:



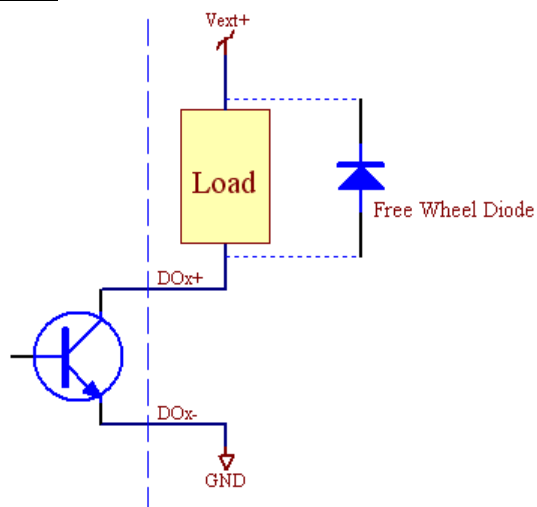
Digital output status DOx ($x=0, 1, 2, 3$) is the differential of $DOx+$ and $DOx-$.

$DOx =$ logic level low, $\rightarrow Q1$ on, $V(DOx+) - V(DOx-) = V_{CE,Q1 Sat} < 2V$.

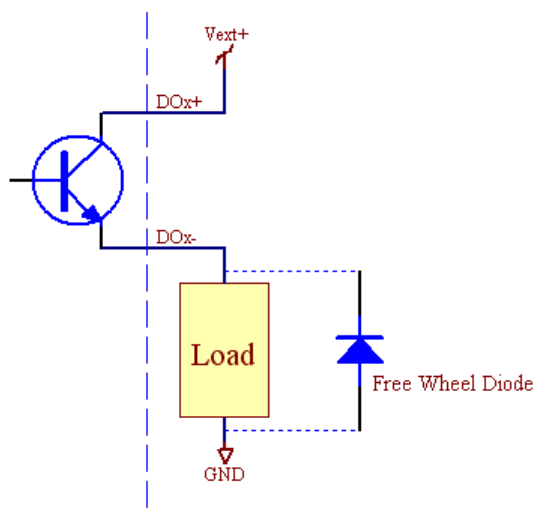
$DOx =$ logic level high, $\rightarrow Q1$ off, $V(DOx+) - V(DOx-) = \text{external } V + R_{load} / (R_L + R_{load})$
(Please see the example in the following.)

Configure example of digital output circuit

Low voltage terminal switch



High voltage terminal switch



When digital output setting is enabled, thus $V_{on} = V(DOx+) - V(DOx-) = V_{CE,Sat}$.

When digital output setting is disabled, thus $V_{off} = V(DOx+) - V(DOx-) = V_{ext+}$.

If load current $< 400mA$, thus $V_{CE,Sat} < 1.5V$.

Whatever switch circuit configuration of low voltage or high voltage terminal, if it is inductive load such as relay and Free Wheel Diode all need to add the switch as protection.

A.4 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 ⁽²⁾
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 is defined in operating temperature 20°C ~ 30°C, thermal balance and excludes 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.

A.5 LAN Port Setting

The communication ports of USB and RS232 are standard equipments of 64-Logger which meets mostly controls and operations. If users desire to do remote control via LAN, thus LAN COM port needs to be purchased for adding LAN COM port. Therefore, any LAN reached computers are all likely to become 64-Logger controller.

Chroma 64LV program is regarded as communicating with 64-Logger via a certain serial Com port for connection which using on any Com port. For LAN port users, it is need to map LAN IP address of 64-Logger to a Com port firstly and select the Com port in Chroma 64LV program to establish communication connection. It explains how to correspond IP address to Com port setting in the following.

1. First of all, confirm IP address of 64-Logger LAN port to be installed. The IP address can't be used with other LAN device.
2. Connect 64-Logger LAN port to PC LAN port by cross-over CAT.5 cable and turn on the power.
3. Execute Microsoft Internet Explore or any web browser at PC, input website: **192.168.127.254** (the address is factory setting of 64-Logger NIC). A setting screen will be appeared, please select **Operating Setting** as Figure A-1 shown. Select "**Real Com Mode**" in **Operation Mode** and click **Submit** at the lower of screen, then click **Save/Restart** on next page. When the screen doesn't be appeared, thus confirm whether 64-Logger LAN module is installed and LAN cable connection condition. If these conditions are confirmed, please reset LAN module (refer **Set LAN Module to Factory Default** in section 2.7 of this manual) and then retry this procedure.
4. Select **Network Setting** as Figure A-2 shown, change address **192.168.127.254** to address 192.168.6.202 which gotten from step 1 at **IP address** selection. Click **Submit** at the lower of screen and **Save/Restart** on next page to close web browser.
5. Execute **Network Enabler Administrator.exe** under the directory of program CD

Network. After executing, a **Network Enabler Administrator** program will be generated and will be used for network IP address mapping serial Com port.

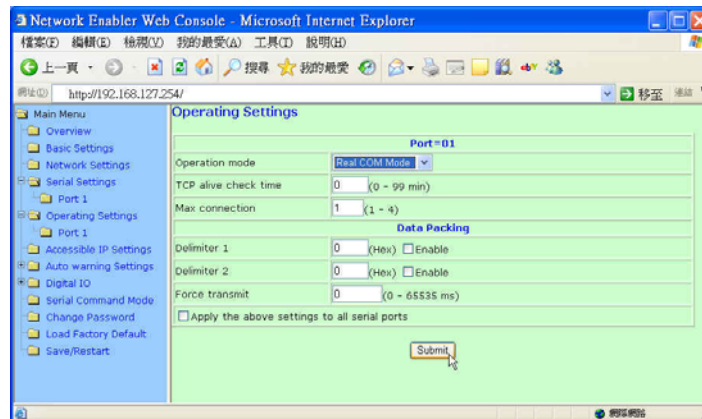


Figure A-1 After connecting 64-Logger via 192.168.127.254 website, select **Real COM Mode** in **Operating Settings**

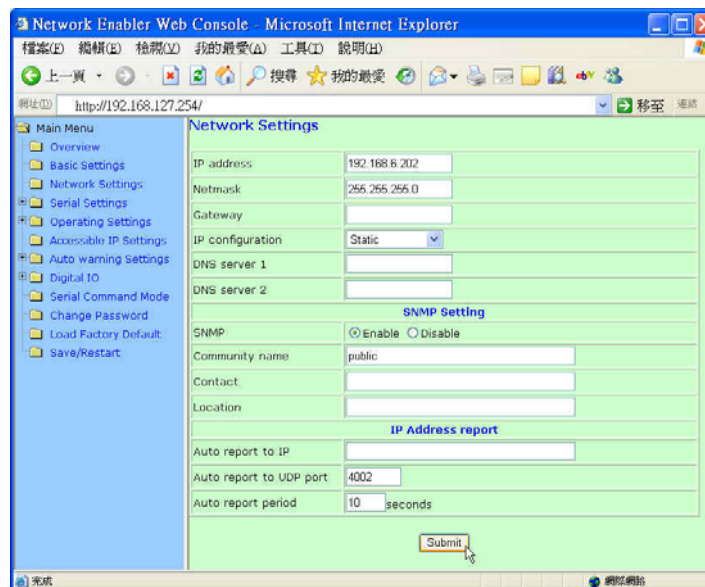


Figure A-2 Change IP to the address to be installed

- Execute **Network Enabler Administrator** program as Figure A-3 shown. Click **COM Mapping** → **Add Target**.

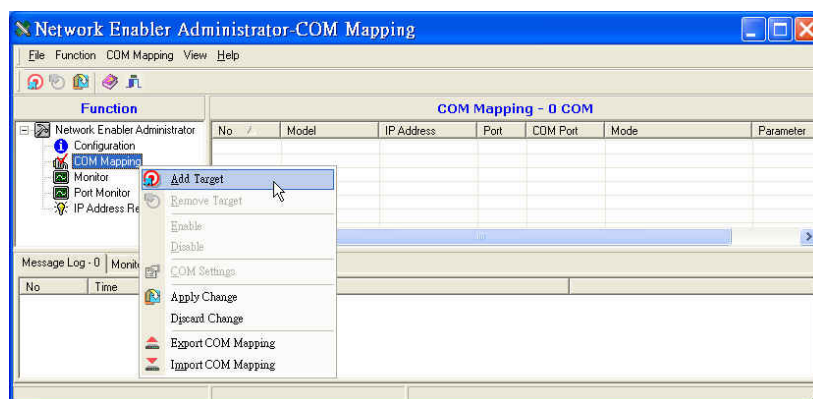


Figure A-3 Execute **Network Enabler Administrator** program for mapping network IP

address to Com port

- Click **Rescan** on Add Target window to search available 64-Logger network interface. Please be aware that the founded one will be appeared in NE-4100T and its IP address will be attached as Figure A-4 shown, click **OK** to quit from the window.

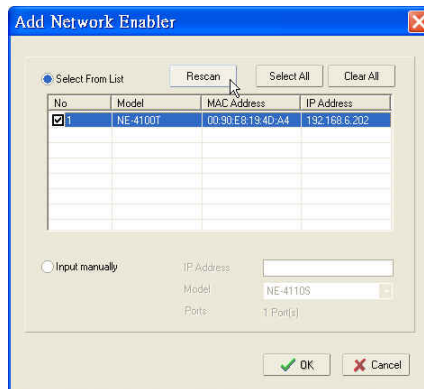


Figure A-4 Search available 64-Logger network interface

- Return to program main screen, network interface new added will be appeared. Select this part then right-click, a lot of selection will be popped up as Figure A-5 shown and then click **COM Setting**.

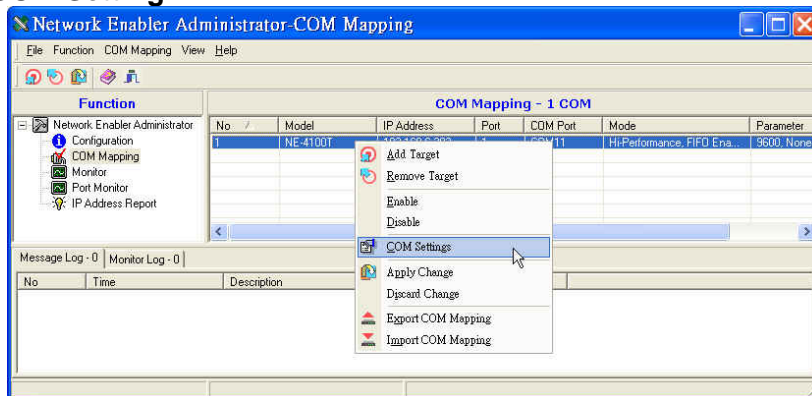


Figure A-5 Com port setting on selected network interface

- As Figure A-6 shown, select a COM Number in **Basic Settings** page and check **Fast Flush** in **Advanced Settings** page, then click **OK** for confirmation and quit from the program. For this case, IP address of 64-Logger is already mapped to COM 12. By using COM 12 to establish communication connection in Chroma 64LV program afterward.

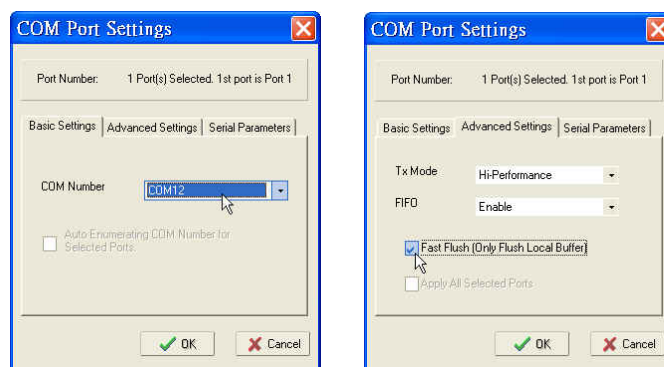


Figure A-6 Com port setting



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