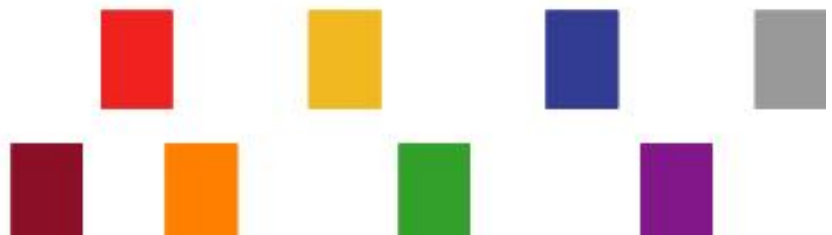




I2C-SPI Control Center

# 使用手册 User Manual





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# 1 Introduction

## 1.1 Preface

Welcome you to use the products, which are manufactured by the ZEROPLUS TECHNOLOGY CO., LTD. The ZeroPlus Technology has dedicated itself to developing the new technology, applying the patent and pursuing the high quality since its establishment, so the ZEROPLUS products have gotten the rather better evaluation ! We believe your choice is the best !

The ZEROPLUS Logic Analyzer has three series presently, namely, LAP-A Series, LAP-B Series, and LAP-C Series. The three Logic Analyzer Series not only have the latest technology, but also can help you do the fastest detection and analysis and measure the most information. So the ZEROPLUS Logic Analyzer is the essential tool for the electronic R & D persons, electronic testers, electrical and electronics students and personal research studio.

The lately issued product, I2C-SPI Control Center, is developed based on the Protocol Analyzer I2C and Protocol Analyzer SPI. It can be used to access to the Bus Data of the I2C/SPI Interface and send the Trigger Signal when the Data meets the corresponding Condition, or it can use the GPIO to transmit the signal. At the same time, the users can write the Command in the Batch Mode to transmit the corresponding signal. The I2C-SPI Control Center can be divided into three Modes, namely, I2C Mode, SPI Mode and GPIO Mode. With the help of the ZEROPLUS Logic Analyzer, the I2C-SPI Control Center can be used to do the R&D work more effectively.

Notice:

This document is subject to changes without notice. If there is some unconformity caused by the software version upgrade, users should take the software as the standard.



## 1.2 Package Contents

As soon as you get the package of the ZEROPLUS I2C-SPI Control Center Hardware, please verify the package contents. The following components should be included with your product.

No.	Product Name	Quantity
1	I2C-SPI Control Center	1 PCS
2	10-Pin Cable	1 PCS
3	12-Pin Cable	1 PCS
4	USB Cable	1 PCS
5	Driver CD	1 PCS
6	User Manual	1 PCS

\*If any component doesn't conform to the above specification, please contact our nearest distributor.

## 1.3 System Requirements

### 1.3.1 Operating System Requirements

	Support	Non-support
Operating System Name	<ul style="list-style-type: none"> <li>● Windows XP (Home, 32-Bit and 64-Bit Professional Editions )</li> <li>● Windows7 (32-Bit and 64-Bit Editions)</li> <li>● Windows VISTA (32-Bit and 64-Bit Editions)</li> </ul>	<ul style="list-style-type: none"> <li>● Windows NT 4.0 (Workstation &amp; Server, Service Pack 6)</li> <li>● Windows Server 2003</li> <li>● Windows 2000 (Professional, Server Series)</li> </ul>

### 1.3.2 Hardware System Requirements

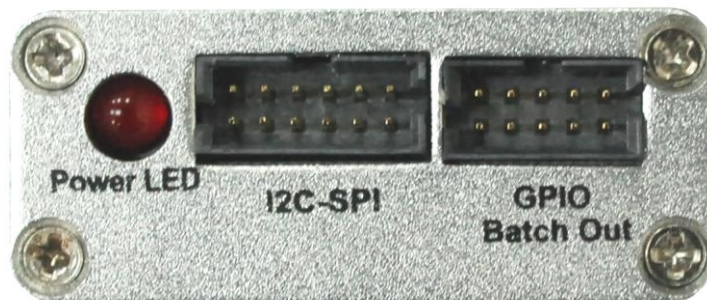
Hardware Name	Lowest Configuration	Recommended Configuration
CPU	166 MHz	900 MHz
Memory	64MB	256MB
Display Device	VGA Display Capability with 1024x768 resolution or higher	VGA Display Capability with 1024x768 resolution or higher
Hard Drive	At least 100MB available space	At least 100MB available space
USB	USB1.1 supported	USB2.0 recommended



## 1.4 Hardware Introduction



Front View



Right View

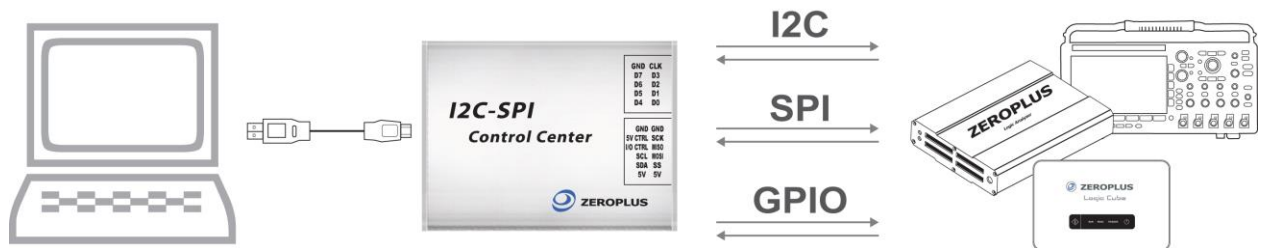


Left View



## 2 Hardware Installation and Software Installation

### 2.1 Hardware Installation



#### Installation Steps:

1. Install the Software according to the 2.2 Software Installation of the Specification in the Software Installation Disk.
2. Connet the I2C-SPI Control Center Hardware to the PC via a USB Cable after the Software Installation has been finished.
3. Connect the 10-Pin Cable and 12-Pin Cable to the I2C-SPI Control Center Hardware and Board to be tested or other Test Instruments (Oscilloscope or Logic Analyzer ), see the below Pin Description Table.
4. After the Connection Environment is finished, the Software can be activated. Please refer to the Chapter 3, User Interface, and Chapter 4, Operating Instructions to learn the detailed Operating Mode and Interface Introduction.



Pin Description Table:

5V	Power Supply, 5V
SS	It is used as the Slave Select in the SPI Mode. It is used as the Bit0 I/O in the GPTO Mode.
MOSI	It is used as the Master Out Slave In in the SPI Mode. It is used as the Bit1 I/O in the GPIO Mode.
MISO	It is used as the Master In Slave Out in the SPI Mode. It is used as the Bit2 I/O in the SPI Mode.
SCLK	It is used as the Serial Clock in the SPI Mode. It is used as the Bit3 I/O in the GPIO Mode.
SDA	It is used as the Serial Data in the I2C Mode. It is used as the Bit4 I/O in the GPIO Mode.
SCL	It is used as the Serial Clock in the I2C Mode. It is used as the Bit5 I/O in the GPIO Mode.
I/O CTRL	It is used as I/O SW in the 6 Pin Mode of GPIO. It is used as Bit6 I/O in the 8 Pin Mode of GPIO. It is used as the Trigger Output Pin in I2C Trigger Mode (Notice: The Mode Switch should be switched into the 8 Pin Mode.).
Target Power	It is used as the 5V Ctrl in the 6 Pin Mode. It is used as the Bit7 I/O in the 8 Pin Mode. It is used as the Trigger Output Pin in SPI Trigger Mode (Notice: The Mode Switch should be switched into the 8 Pin Mode.).
CLK	It is used as the Clock Output in the Batch of GPIO.
GND	It is connected to the Ground.

I/O Status Table:

Mode	Status	Mode Switch
6 Pin	In the Initial Status, the I/O Ctrl and the Target Power can be selected to perform the corresponding operations.	6 Pin
8 Pin	1. In 8 Pin Mode, the I/O Ctrl and the Target Power are selected, but they are forbidden to perform any operation. 2. When the Mode is switched into the 6 Pin Mode, the I/O Ctrl and the Target Power can be selected to perform the corresponding operations.	8 Pin
I2C Trigger	1. When the Mode is switched into the 8 Pin Mode automatically, the I/O Ctrl and the Target Power are selected, but they are forbidden to perform any operation. 2. When the Mode is exited in the I2C Trigger Mode, the Mode will keep in the 8 Pin Mode.	8 Pin
SPI Trigger	1. When the Mode is switched into the 8 Pin Mode automatically, the I/O Ctrl and the Target Power are selected, but they are forbidden to perform any operation. 2. When the Mode is exited in the SPI Trigger Mode, the Mode will keep in the 8 Pin Mode.	8 Pin
I2C Batch	1. When the Mode is switched into the 8 Pin Mode automatically, the I/O Ctrl and the Target Power are selected, but they are forbidden to perform any operation. 2. At this moment, the 6 Pin Mode can not be selected in the GPIO of I2C Mode. 3. When the Mode is exited in the I2C Batch Mode, the Mode	8 Pin



	will keep in the 8 Pin Mode.	
SPI Batch	<ol style="list-style-type: none"><li>1. When the Mode is switched into the 8 Pin Mode automatically, the I/O Ctrl and the Target Power are selected, but they are forbidden to perform any operation.</li><li>2. At this moment, the 6 Pin Mode can not be selected in the GPIO of SPI Mode.</li><li>3. When the Mode is exited in the I2C Batch Mode, the Mode will keep in the 8 Pin Mode.</li></ol>	8 Pin
GPIO Batch	It is the same with the 8 Pin Mode. That is to say, in the GPIO Batch Mode, the I/O Ctrl and the Target Power are selected, but they are forbidden to perform any operation.	Batch

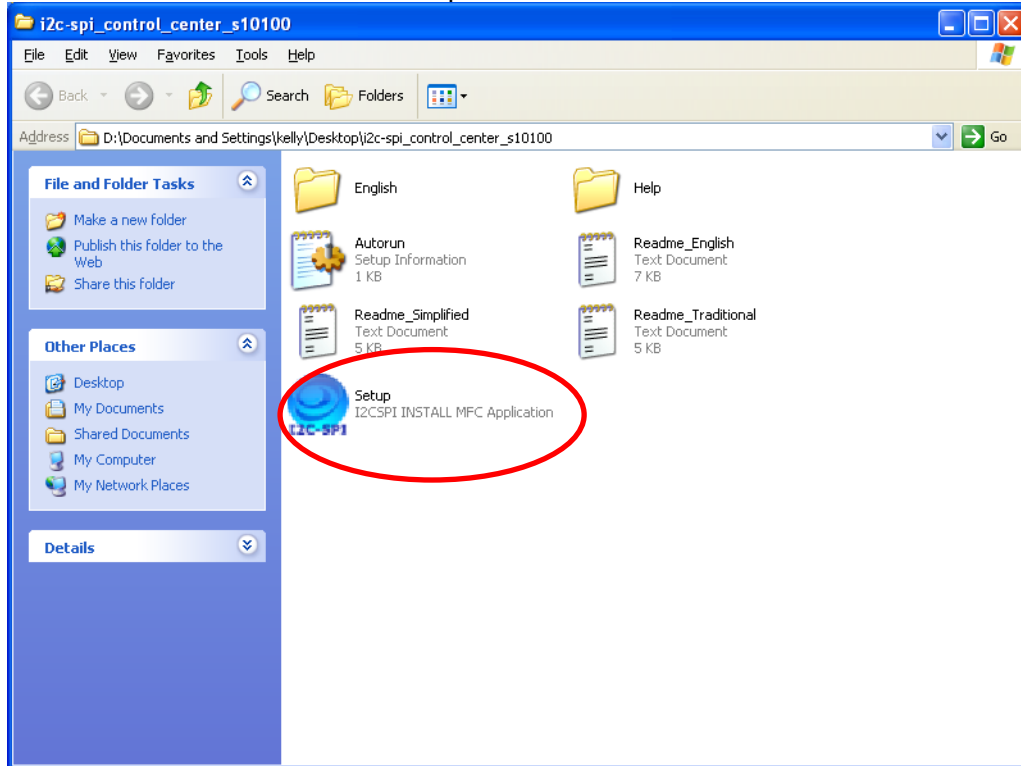




## 2.2 Software Installation

Please install the software as the following steps:

**STEP 1.** Double-click on the Setup.exe icon.

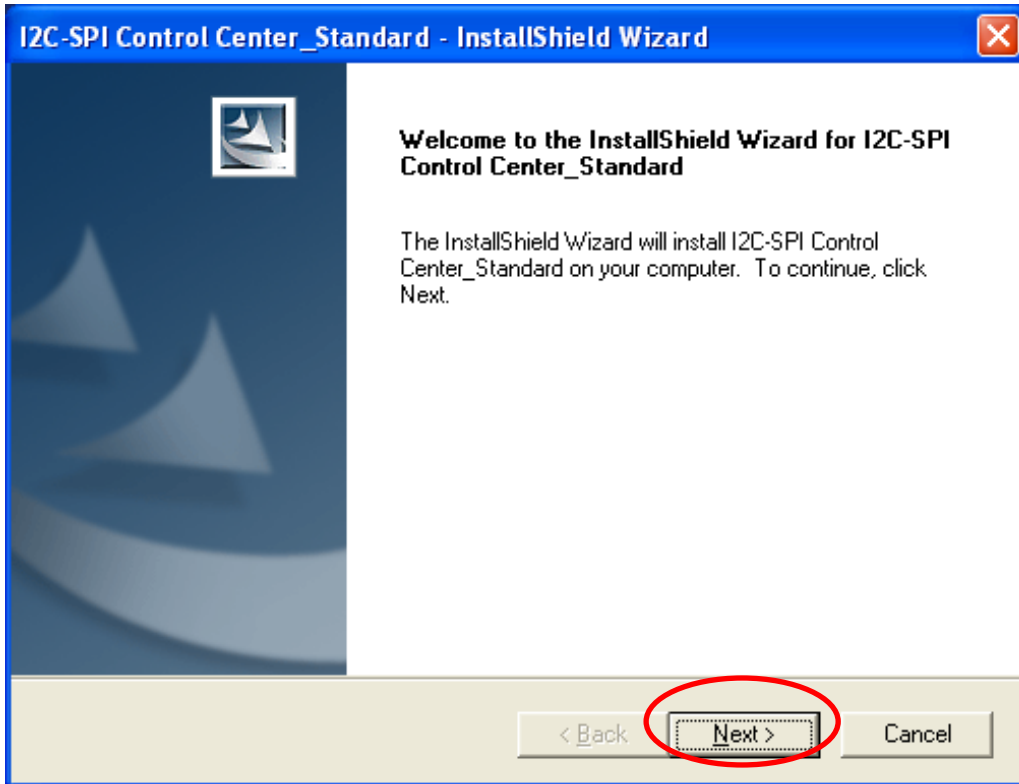


**STEP 2.** Click the English to install the English System.

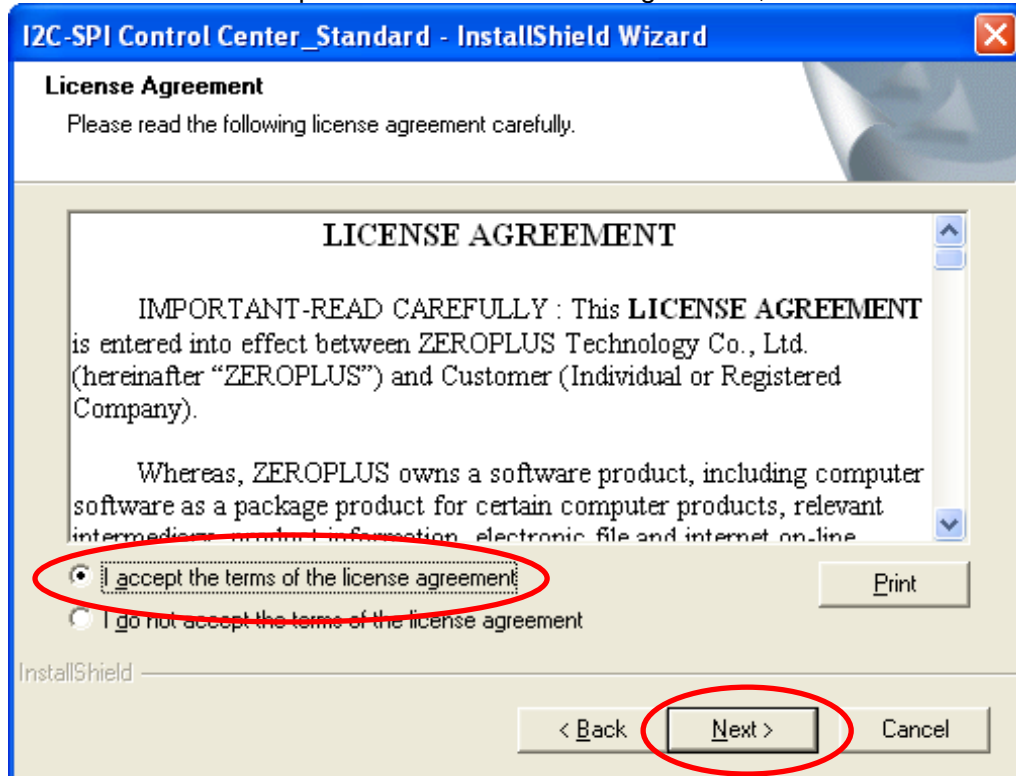




STEP 3. Click Next.



STEP 4. Select I accept the terms in the license agreement, and then click Next.





**STEP 5.** Fill in users' information in the below dialog box and click Next.

**I2C-SPI Control Center\_Standard - InstallShield Wizard**

**Customer Information**  
Please enter your information.

User Name:  
User

Company Name:  
ZeroPlus

Install this application for:

Anyone who uses this computer (all users)

Only for me (ioury6)

InstallShield

< Back   **Next >**   Cancel

**STEP 6.** Select the Complete or Custom as users' requirements, and then click Next.

**I2C-SPI Control Center\_Standard - InstallShield Wizard**

**Setup Type**  
Select the setup type to install.

Please select a setup type.

**Complete**  
All program features will be installed. (Requires the most disk space.)

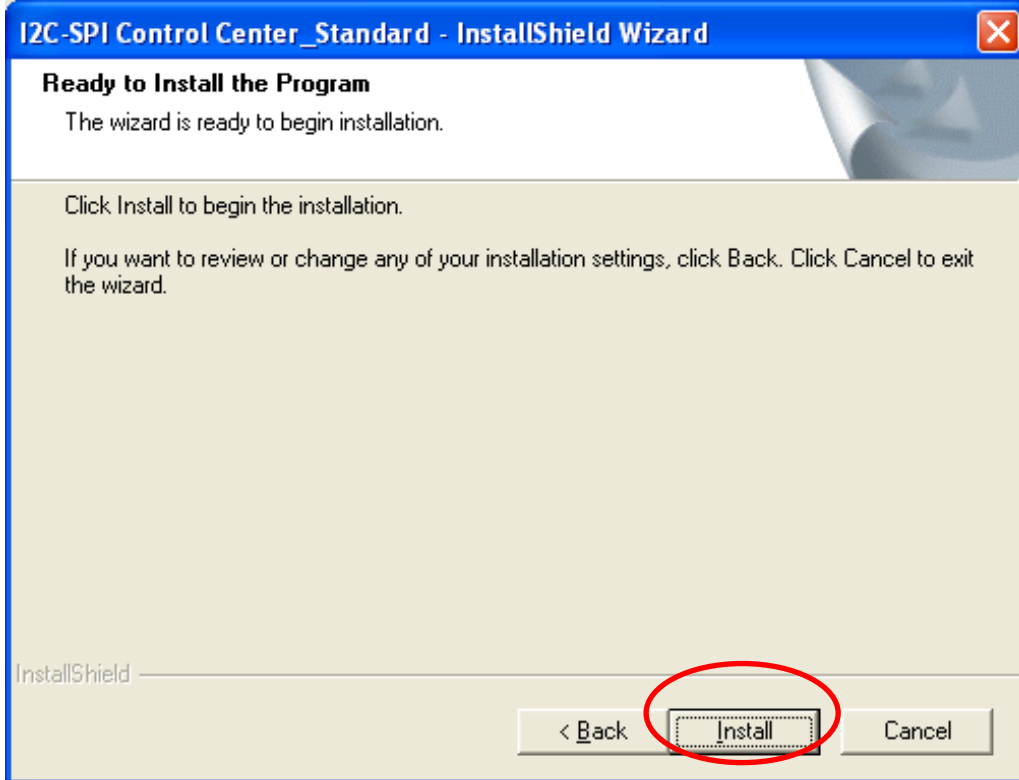
Custom  
Select which program features you want installed. Recommended for advanced users.

InstallShield

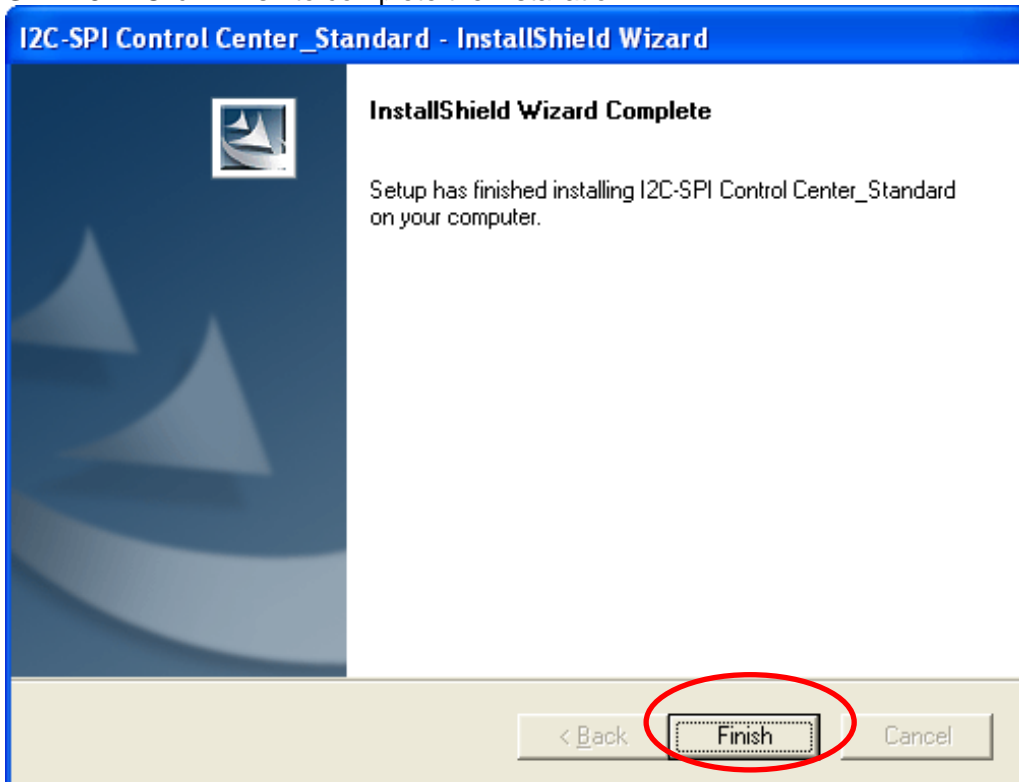
< Back   **Next >**   Cancel



**STEP 7.** Click Install to begin the installation.



**STEP 8.** Click Finish to complete the installation.





### 3 User Interface

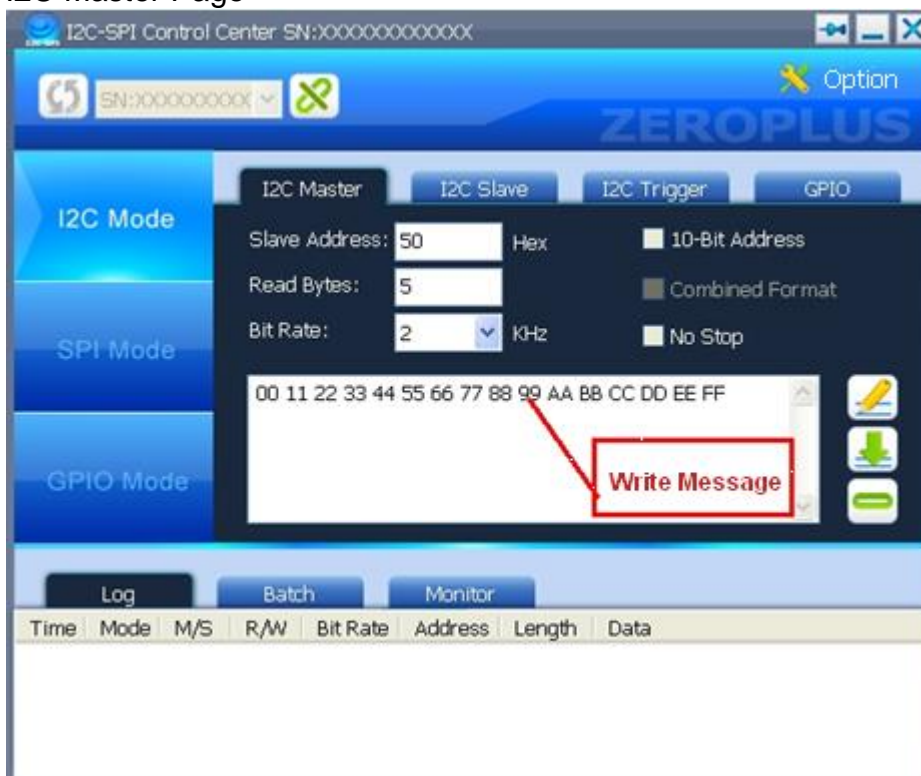
The Software can be divided into nine parts in general, namely, Title Column, Hardware Connect Button, Option Menu, I2C Mode, SPI Mode, GPIO Mode, Log Window, Batch and I2C Monitor.

#### 3.1 I2C Mode

- Notice: 1. When the I2C Mode is used, the external I2C Pull Hi SW should be set to ON.  
2. When the resistance of the I2C Bus Pull Hi is too low, it will cause to delay the time of outputting the Low; if the rather high frequency ( for example, 833KHz) appears in this condition, it can avoid the state on the condition that the I2C Bus Pull Hi is set to OFF.

All devices are controlled by two lines, Serial Data (SDA) and Serial Clock (SCL). And two devices are required to perform the corresponding operations, which are the Master and the Slave.

#### I2C Master Page



Slave Address: It is used to set the Address of the Data Transmission (in Hexadecimal notation) . Specifically, when the 10-Bit Address is not selected, the Slave Address is entered in 7-Bit Addressing Mode automatically, the maximum value is 7F; when the 10-Bit Address is selected, the Slave Address is entered in 10-Bit Addressing Mode, the maximum value is 3FF; when the entered value exceeds the range from 0 to 3FF, the entered value will be changed into "0".

Read Bytes: It is used to set how many Bytes are read from the Slave for one time, the range is from 1 to 65535 Bytes.

Bit Rate: It is used to set the communication speed between the Master and the Slave, and it can only be selected from the eleven options on the pull-down menu, namely, 2, 10, 20, 40, 80, 100, 200, 400,



500, 625 and 833 KHz. Otherwise, users can input the other values, if the input value is invalid, the software will return to a valid value automatically.

10-Bit Address: When the 10-Bit Address is selected, the Slave Address will be treated as a 10-Bit Address; or it will be treated as a 7-Bit Address.

Combined Format: When the Combined Format is selected, it will be used for the Master Read Command. However, the feature is only enabled when the 10-Bit Address is selected, because the Combined Format is only available when it is used in conjunction with the 10-Bit Address mode.

No Stop: When the option, No Stop, is selected, the Master Device won't explicitly transmit the "Stop" command at the final Byte of the Master Read or Write; and it will keep the statuses of current Read or Write continuously. At the same time, the Master Device will transmit the "Start" command following Master Read or Write to the Bus repetitively.

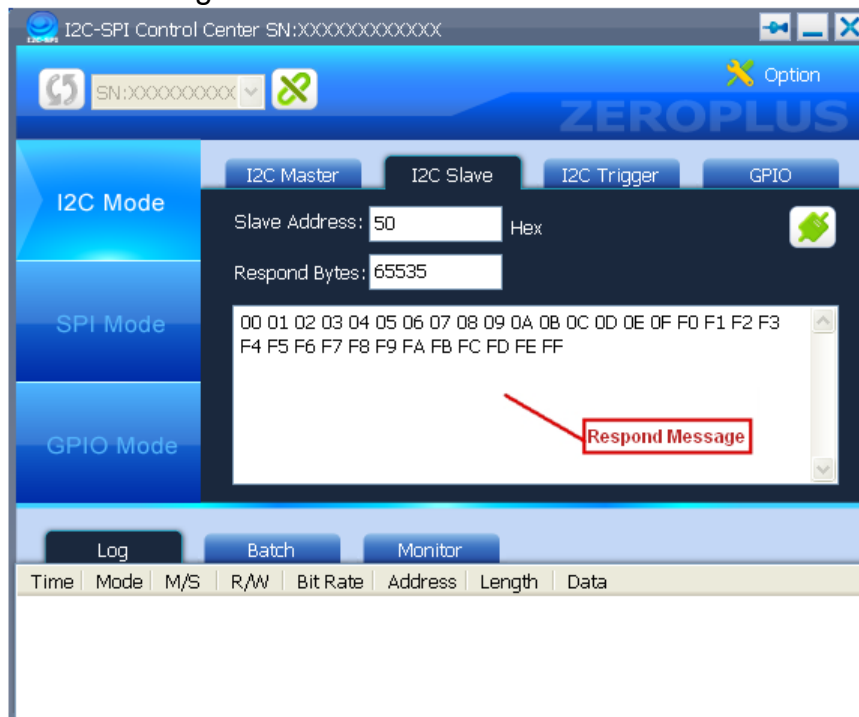
Write: Press the Write button to write the data into Slave, the maximum is 10240 Bytes.

Read: Press the Read button to read the data from the slave.

Free Bus: When the Free Bus button is pressed, the Master Device will transmit the "Stop" command to the Bus, which is used to make the Bus free.

Write Message: It is used to write the 16-Byte data, for example, 00 11 22 ... CC DD EE FF. In addition, the space between two data will be automatically added for better legibility but these spaces will not be sent as part of the message. When the data to be transmitted is confirmed in the Write Message area, the data will be written into the Slave Device after pressing the Write button, and the maximum data is 10240 Bytes.

## I2C Slave Page



Slave Address: It is used to set the Address of the Data Transmission, which is entered in Hexadecimal



notation. At the same time, the Address on the Slave End must be the same with that of the Master End, the range of the entered value is from 0 to 7F.

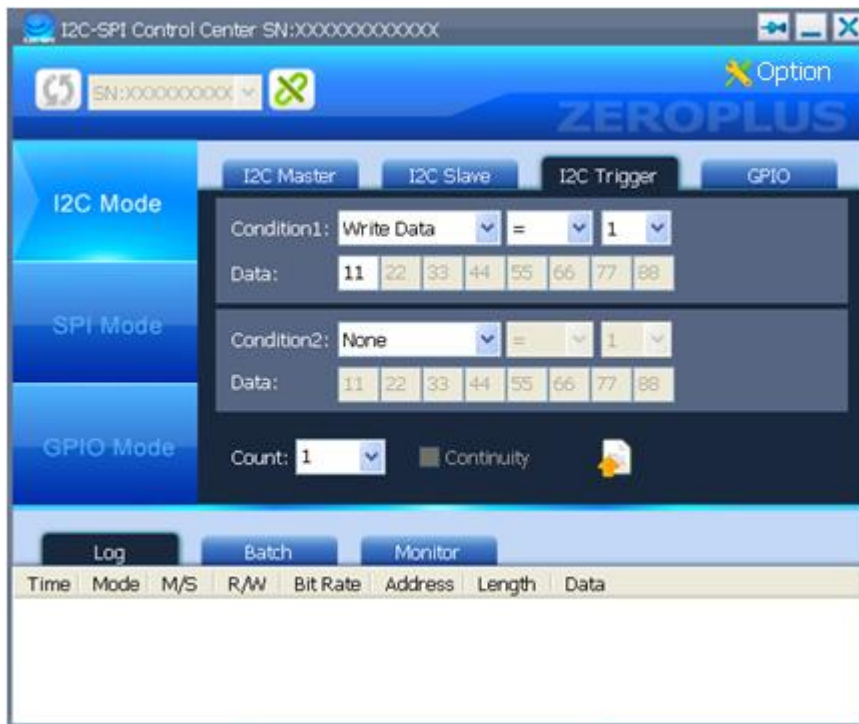
Respond Bytes: It is used to set the maximum Transmission Byte of the Slave Device, which is 65535. When the Respond Bytes are set to 0, the number of Byte is unlimited (When the Respond Bytes exceed the number of the Respond Message, the Respond Message will be transmitted repetitively.). When the number of the Read Bytes is more than that of the Respond Bytes, the number which is more than that of the Respond Bytes will be denoted by FF.

Respond Message: It is used to write the 16-Byte data. The data will be responded to the Master after pressing the Enable button, and the maximum data is 64 Bytes.

Enable/Disable: When the Button is in Enable status, it is used to respond the data to the Master; when the Button is in Disable status, the Slave Address, the number of the Respond Bytes and the Respond Message can be set.

## I2C Trigger Page

- Notice: 1. When the I2C Trigger is used, the external GPIO Mode Switch should be set to 8 Pin .  
2. When the Trigger Conditions are satisfied, the transferred time from the end of the last Clock to the I/O CTRL is  $14\mu\text{S} \pm 0.3\mu\text{S}$ .  
3. When the Trigger function is used in the I2C Slave Mode, the interval time between two Bytes should be longer than  $14\mu\text{S}$ .



I2C Trigger Condition Settings: Two groups of the Conditions (Condition1 and Condition2) for the I2C Trigger can be set at most for one time.

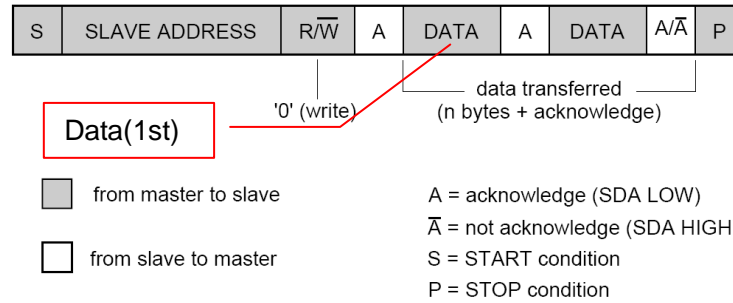
Condition1: It can be used to set the Write Data, Write Data (1st), Read Data and the Read Data (1st).

Condition2: It can be used to set the Write Data, Write Data (1st), Read Data, Read Data (1st) and the



None. When the Condition2 is set to None, only the Condition1 can be set.

※ When the Condition is set to Write Data (1st) or Read Data (1st), it denotes that as long as the Condition is set for the first data of the Packet, the Trigger Condition will be satisfied.



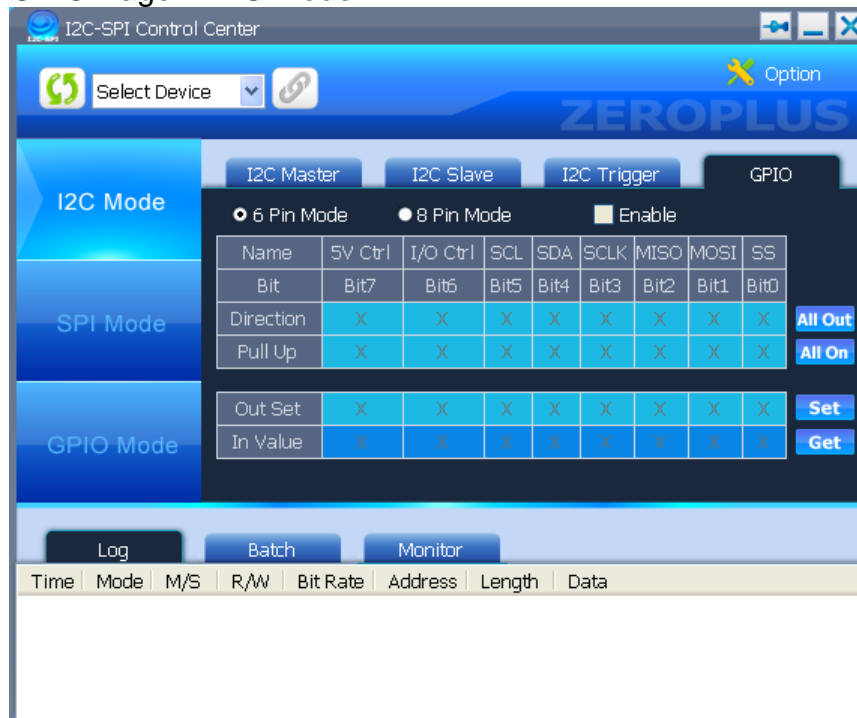
Operation Condition: Only when the Condition is set to Write Data or Read Data, the Operation Condition can be set to “=”; when the Condition is set to Write Data (1st) or Read Data (1st), the Operation Condition can be set to “=”, “>” or “<”.

Data: When the length of Data is changed, the Data Column will also be changed; when the Condition is set to Write Data (1st) or Read Data (1st), the length of Data only can be set to “1”.

Count: It is used to set whether the Condition conforms to the Trigger Count.

Continuity: It is used to set whether the two Conditions are continuous.

### GPIO Page in I2C Mode



GPIO Page in I2C Mode: When the option, Enable, is selected, the corresponding Pins can be set. And the Settings and the Functions of the Pins are the same with that of the GPIO Mode, but the only difference is that the SDA and SCL Pins are disabled in the GPIO Page under the I2C Mode.



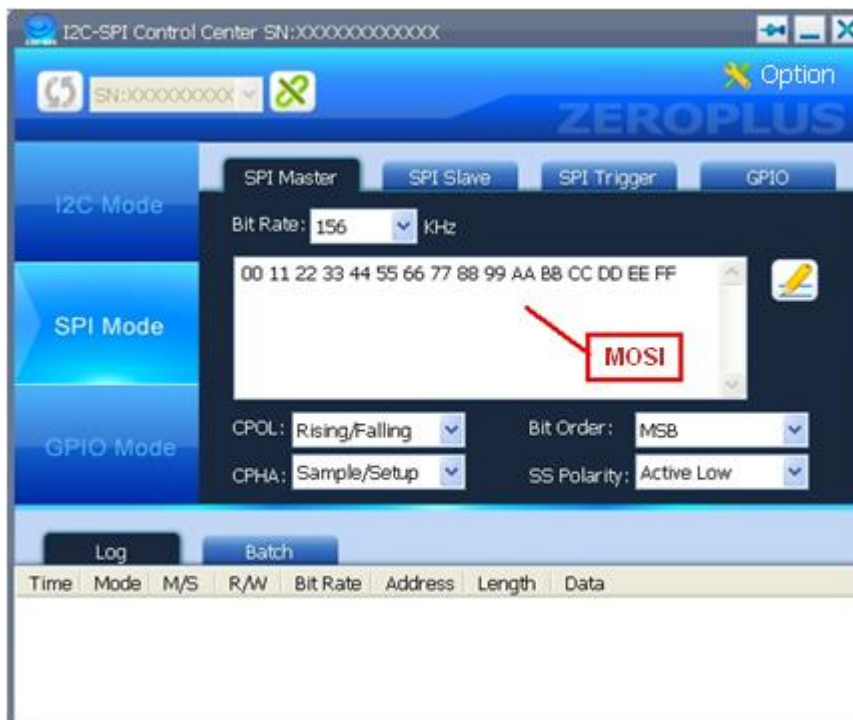


### 3.2 SPI Mode

- Notice:**
1. The highest CLK Bit Rate to transmit data is 8MHz in the SPI Slave Mode. When the CLK Bit Rate exceeds 8MHz, it can not be ensured that the transmitted data is correct.
  2. The highest CLK Bit Rate to receive data is 4MHz in the SPI Master/Slave Mode. When the CLK Bit Rate exceeds 4MHz, it can not be ensured that the received data is correct.

All devices are controlled by four lines, namely, Clock (SCLK), Master Output/Slave Input (MOSI), Master Input/Slave Output (MISO) and Slave Select (SS). And two devices are required to perform the corresponding operations, which are the Master and the Slave.

#### SPI Master Page



**Bit Rate:** It is used to set the communication speed between the SPI Master and SPI Slave, there are seven options on the pull-down menu that are 156, 312, 625, 1250, 2500, 5000 and 10000 KHz from small to big (users also can input manually).

**MOSI (Master Output/Slave Input):** The MOSI Message is entered in the form of 16-Bit mode; In addition, the spaces are inserted for legibility automatically. At the same time, the maximum data is 10240 Bytes due to the limitation of the Buffer.

**Write:** When the Write button is pressed, the data in the MOSI Message will be written into the Device.

#### Data Trigger Conditions:

The Trigger Conditions of the Data Transmission between SPI Master and Slave consists of four kinds, namely, CPOL, CPHA, Bit Order and SS Polarity. The detailed descriptions are as below:



CPOL: Set the CPOL as either “Rising/Falling” or “Falling/Rising”.

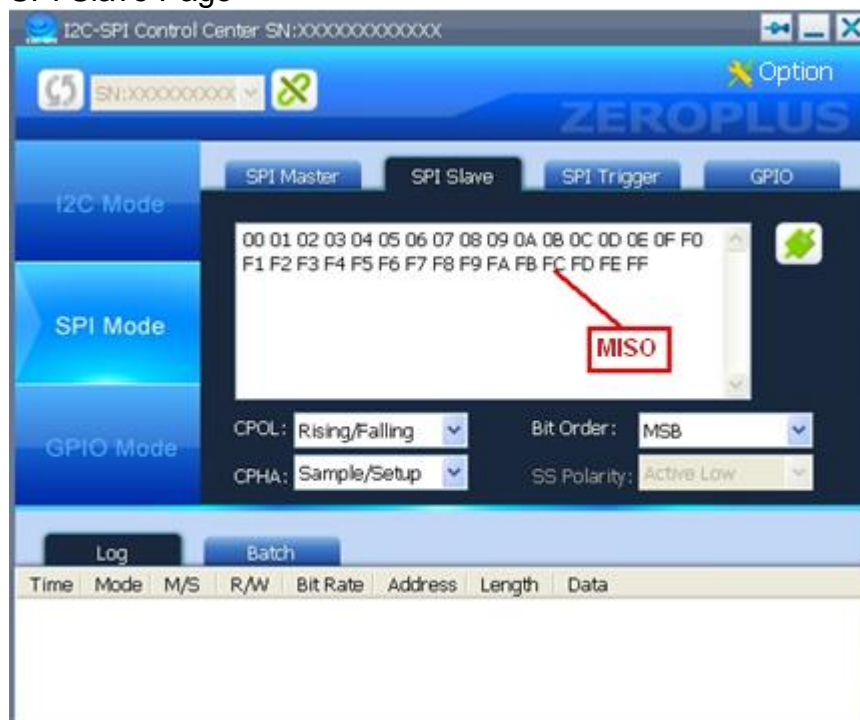
CPHA: Set the CPHA as either “Sample/Setup” or “Setup/Sample”.

Bit Order: Set the Bit Order as either “MSB” or “LSB”.

SS Polarity: It can be divided into two kinds, SS Active Low and SS Active High. However, it is only set in the SPI Master mode. In the case of SPI Slave, the SS Polarity can not be set, but the set result can be seen.

SPI utilizes the Full-duplex Transmission mode to transmit the signal. Specifically, when the MOSI transmits the message, the MISO will receive the message at once, and the length of the transmitted messages is the same with that of the received messages.

### SPI Slave Page



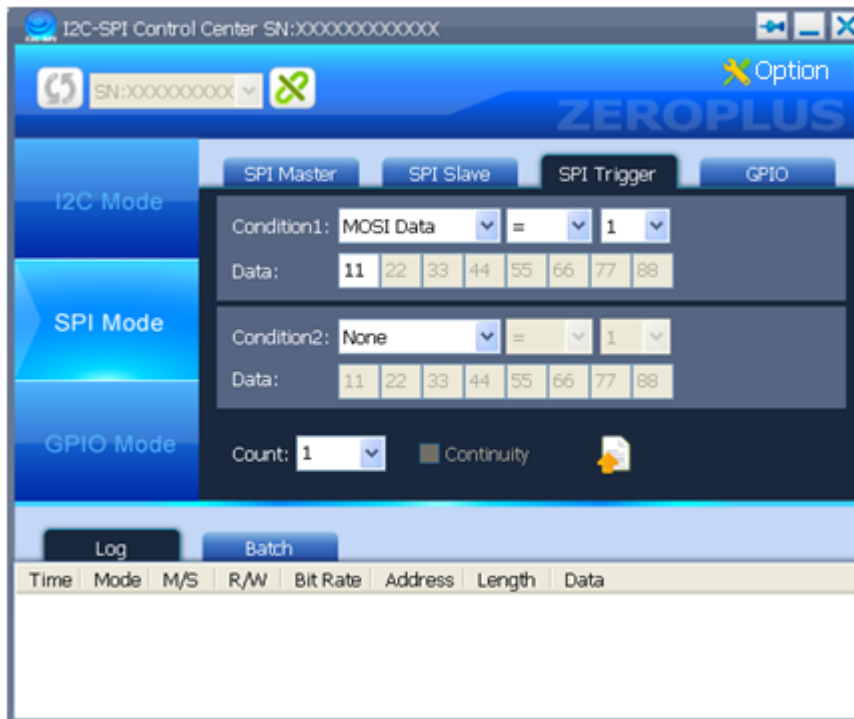
MISO(Master Input Slave Output): The MISO Message is entered in the form of 16-Bit mode; In addition, the spaces are inserted for legibility automatically. At the same time, the maximum data is 64 Bytes due to the limitation of the Buffer.

Enable/Disable: When the Button is in the Disable status, none of the Slave Message will be reported. When the Button is in the Enable status, the MISO data (CPOL, Bit Order and CPHA) and the Respond Message can be set at that time, and the data will be reported to the Master Device.



## SPI Trigger Page

- Notice: 1. When the SPI Trigger is used, the external GPIO Mode Switch should be set to 8 Pin at first.  
2. When the Trigger Conditions are satisfied, the transferred time from the end of the last Clock to the I/O CTRL is 10uS  $\pm$ 0.3uS.  
3. When the Trigger function is used in the SPI Slave Mode, the interval time between two Bytes should be longer than 10uS.

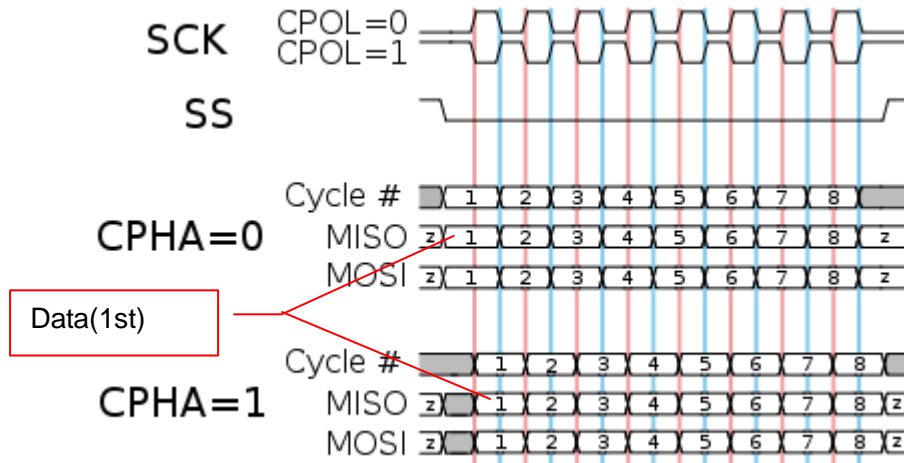


SPI Trigger Condition Settings: Two groups of the Conditions (Condition1 and Condition2) for the SPI Trigger can be set at most for one time.

Condition1: It can be used to set the MOSI Data, MOSI Data(1st), MISO Data and the MISO Data(1st)

Condition2: It can be used to set the MOSI Data, MOSI Data(1st), MISO Data, MISO Data(1st) and the None. When the Condition2 is set to None, only the Condition1 can be set.

※ When the Condition is set to MOSI Data (1st) or MISO Data (1st), it denotes that as long as the Condition is set for the first data of the Packet, the Trigger Condition will be satisfied.



Operation Condition: Only when the Condition is set to MOSI Data or MISO Data, the Operation Condition can be set to “=”; when the Condition is set to MOSI Data(1st) or MISO Data(1st ), the Operation Condition can be set to “=”, “>” or “<”.

Data: When the length of Data is changed, the Data Column will also be changed; when the Condition is set to MOSI Data(1st) or MISO Data(1st), the length of Data only can be set to “1”.

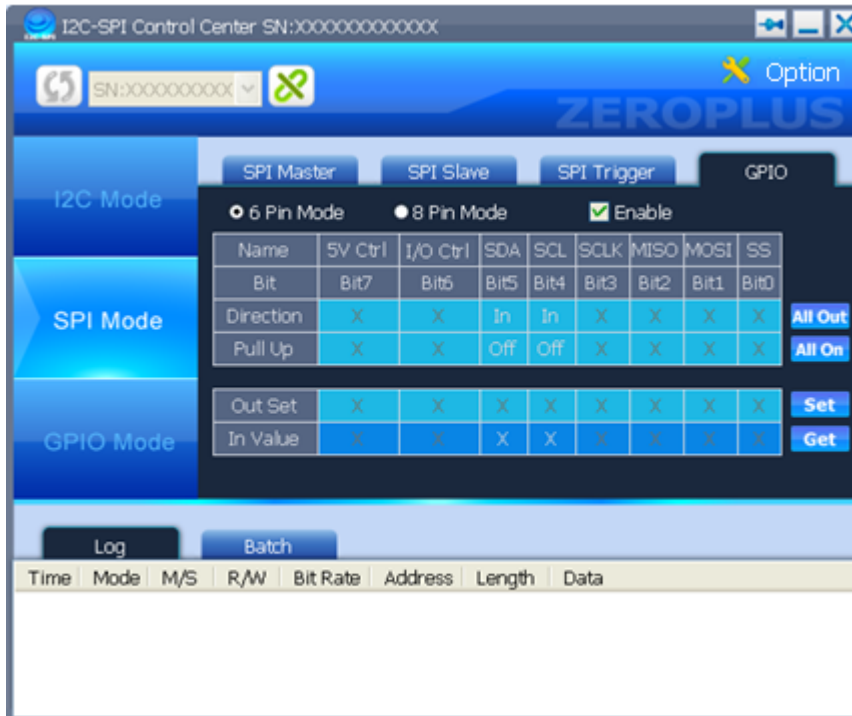
Count: It is used to set whether the Condition conforms to the Trigger Count.

Continuity: It is used to set whether the two Conditions are continuous.



GPIO Page in SPI Mode

Notice: When the SCL and SDA are used as the GPIO Pins, the external I2C Pull Hi SW should be set to OFF.



GPIO Page in SPI Mode: When the option, Enable, is selected, the corresponding Pins can be set. And the Settings and the Functions of the Pins are the same with that of the GPIO Mode, but the only difference is that the SS, MOSI, MISO and SCLK Pins are disabled in the GPIO Page under the SPI Mode.



### 3.3 GPIO Mode

- Notice: 1. When the 6 Pin Mode is used, the external GPIO Mode Switch should be set to the 6 Pin; the Bit6 I/O Ctrl and the Bit7 Target Power of the GPIO are respectively used to control the I/O SW and the Out 5V.
2. When the 8 Pin Mode is used, the external GPIO Mode Switch should be set to the 8 Pin Mode; the Bit6 I/O Ctrl and the Bit7 Target Power are used as GPIO Pins. At the same time, the I/O Ctrl and the Target Power in the Control Status are forced to set as Enable.
3. When the SCL and the SDA are used as the GPIO Pins, the external I2C Pull Hi SW should be set to OFF.



Direction: It is used to set the status of the Pin to In or Out.

Pull Up: Only when the status of the Pin is set to In, the Pull Up can be set to On or Off.

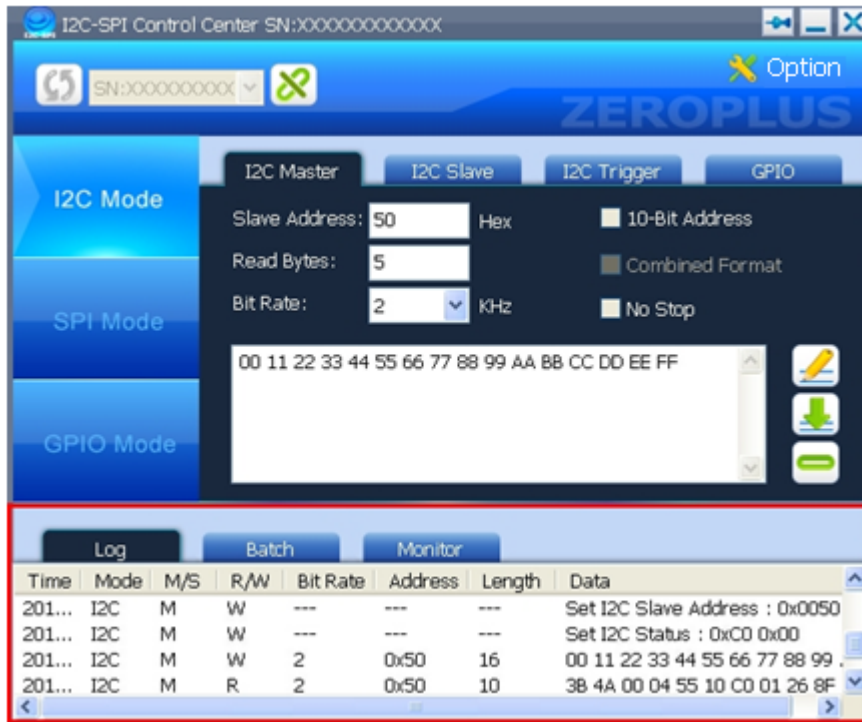
Out Set: Only when the status of the Pin is set to Out, the value of the Out Set can be set to "0" or "1". At the same time, when the values are set correctly, they can be outputted after pressing the Set button.

In Value: When the Get button is pressed, the statuses of the current Pins can be displayed as High (1) or Low (0).



### 3.4 Log Window

It is used to display the set information under different modes, which include Time, Mode, M/S, R/W, Bit Rate, Address, Length and Data.



**Time:** It is used to display the Time of the saved Data, which is displayed in the format of the Year-Month-Day, Hour: Minute: Second.

**Mode:** It is used to display what kind of modes the saved data is from, and the modes are divided into three kinds( I2C, SPI and GPIO).

**M/S:** It is used to display which device the Read/Write data is from Master<M> or Slave<S>. And it is only used by I2C or SPI.

**R/W:** It is used to display that the device is Read<R> or Write <W>. And it is only used by I2C or SPI.

**Bit Rate:** It is used to display the Transmission Speed, its Unit is KHz. And it is only used by I2C or SPI.

**Address:** It is used to display the Transmission Address. And it is only used by I2C or SPI.

**Length:** It is used to display the length of the Transmission Data. And it is only used by I2C or SPI.

**Data:** It is used to display the Transmission Data.

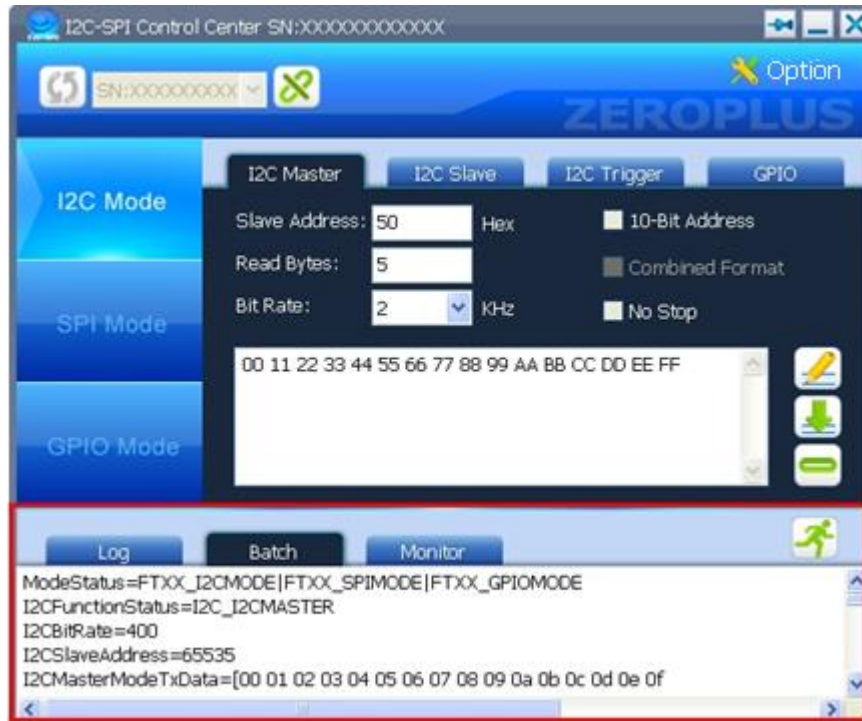


### 3.5 Batch

It is used to transmit the signal by performing the written commands.

- Notice:**
1. When the I2C Batch Mode or the SPI Batch Mode is used, the external GPIO Mode Switch should be set to 8 Pin.
  2. When the GPIO Batch Mode is used, the external GPIO Mode Switch must be set to Batch at first, and then the Software must be set to GPIO Batch Mode.

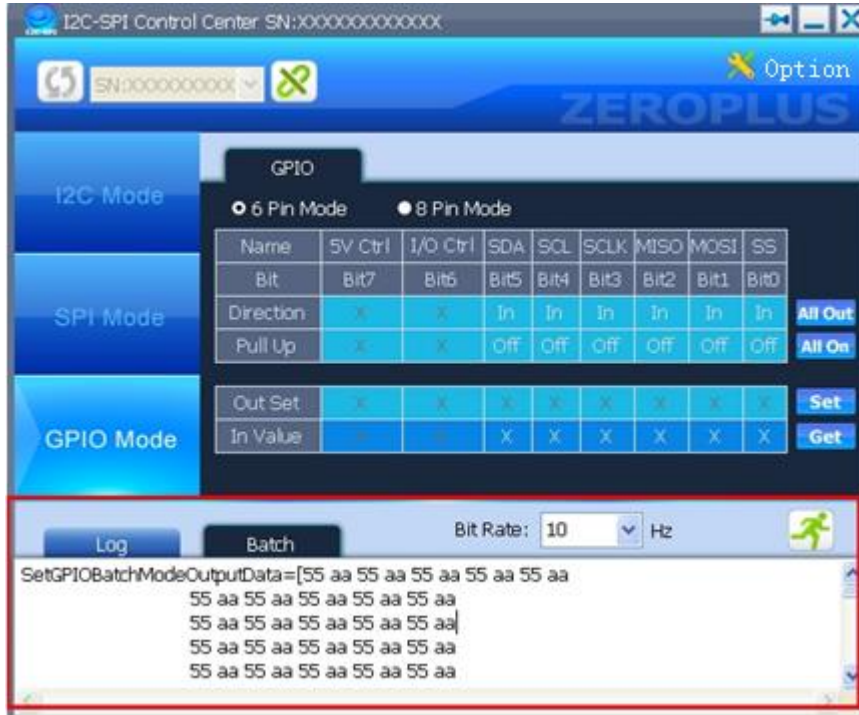
#### I2C/SPI Batch







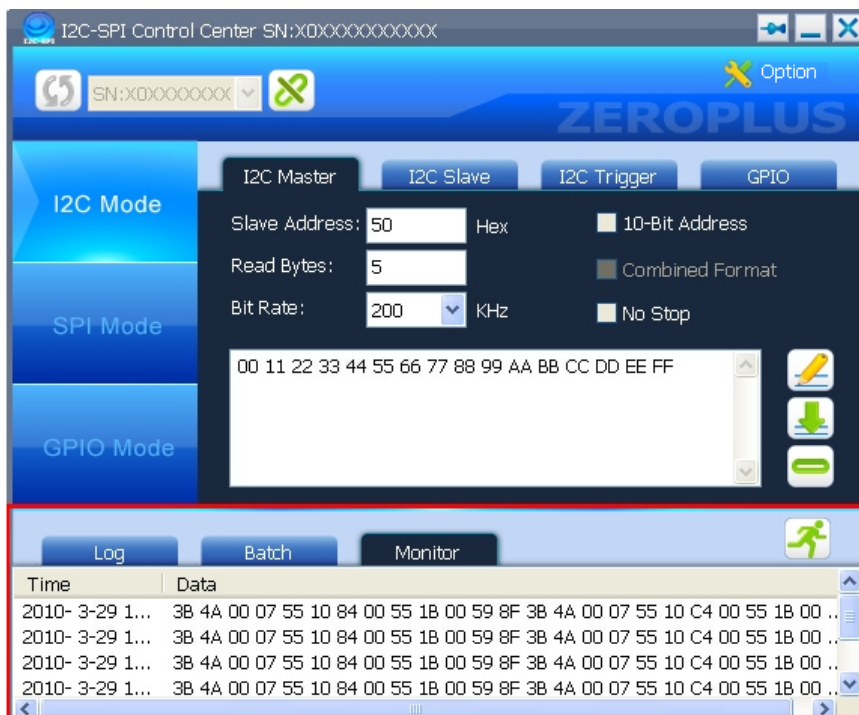
### GPIO Batch



Bit Rate: It is used to set the Transmission Speed for Data. The value of the Bit Rate can be selected from the pull-down menu or entered in the range between 10 and 25000, and the entered value can be changed into the optimum value automatically.

### 3.6 I2C Monitor

I2C Monitor can only be used in the I2C Mode, which is used to monitor the transmission status of the Data among the devices.

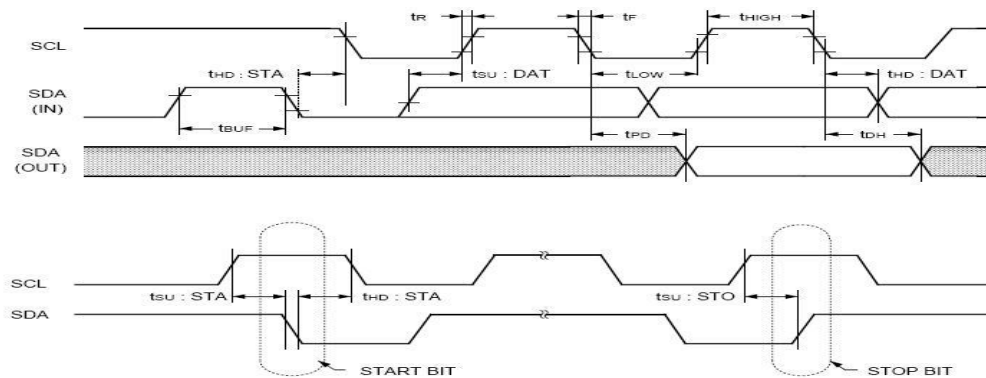




Time: It is used to display the time of writing/reading the data (This timestamp is based on when the I2C-SPI Control Center application monitored the data only and may differ from the actual time when the data was sent from the bus.).

Data: It is used to display all data in the process of Transmission.

### I2C Monitor Mode Timing:



Parameter	Timing
tUS:STA	> 3.3uS
tHD:STA	> 3.3uS
tSU:STO	> 3.3uS
tLOW	> 3.3uS
tHIGH	> 3.3uS
tSU:DAT	> 1.6uS
tHD:DAT	> 1.6uS

The highest SCL Bit Rate is 150KHz. When the SCL Bit Rate exceeds 150KHz, it can not be ensured that the received data is correct.



## 4 Operating Instructions

### 4.1 Steps for Hardware Connection

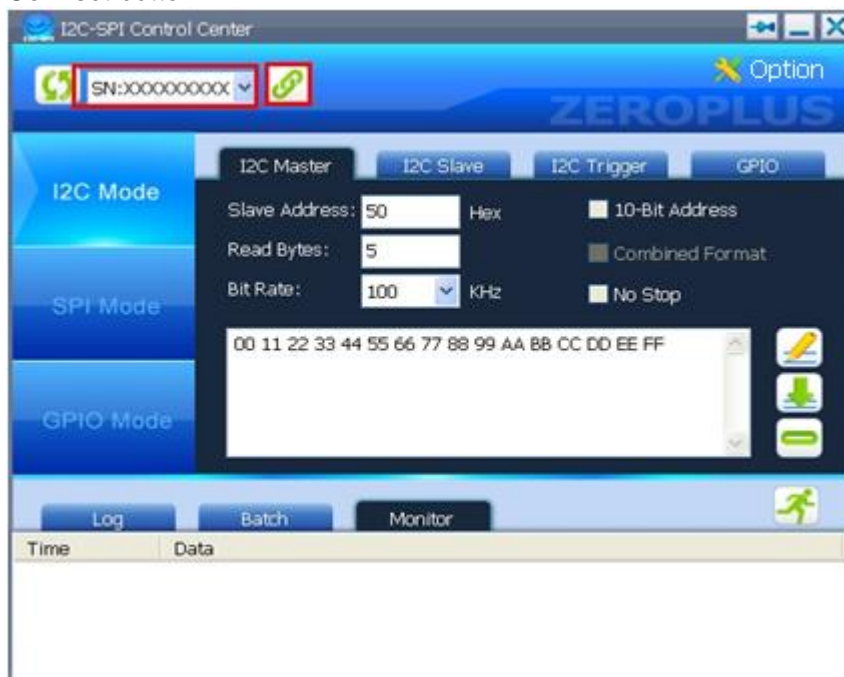
In the case of I2C and SPI Operations, it is necessary to connect two hardware devices synchronously to perform the corresponding operations; the I2C-SPI Control Center can be used as a Master or Slave.

STEP 1. Connect the device, and then plug the device into the USB Port on the PC.

STEP 2. Install the Driver automatically (the Driver needs to be installed when the devices are plugged into the PC for the first time).

STEP 3. Connect the corresponding pins; refer to the Chapter 2, Hardware Installation and Software Installation.

STEP 4. Open a Software Window, select a Device from the pull-down menu, and then press the Connect button.





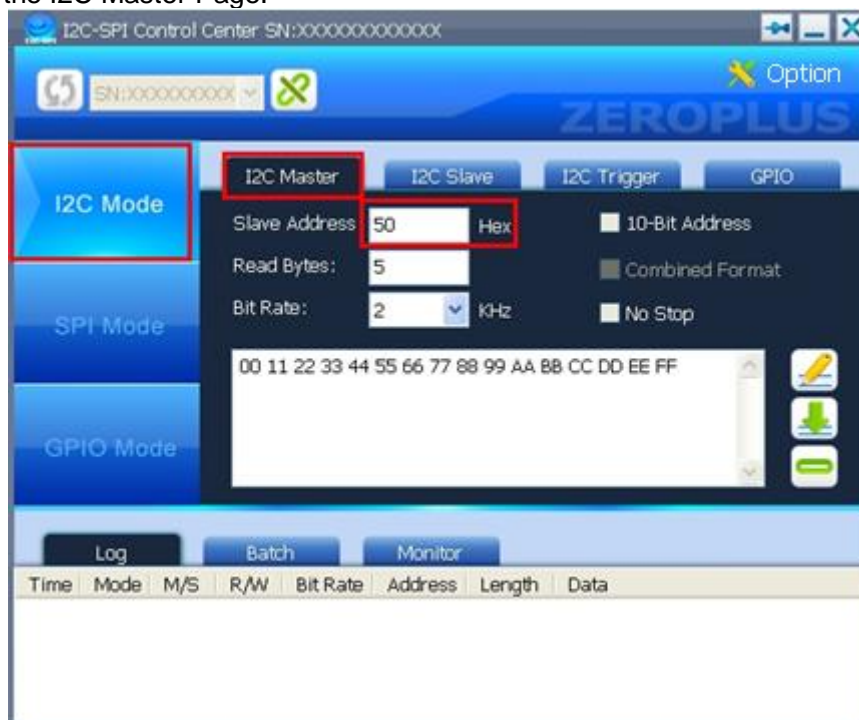
## 4.2 I2C Mode

Notice: 1. When the I2C Mode is used, the external I2C Pull Hi SW should be set to ON.

2. When the resistance of the I2C Bus Pull Hi is too low, it will cause to delay the time of outputting the Low; if the rather high frequency ( for example, 833KHz) appears in this condition, it can avoid the state on the condition that the I2C Bus Pull Hi SW is set to OFF.

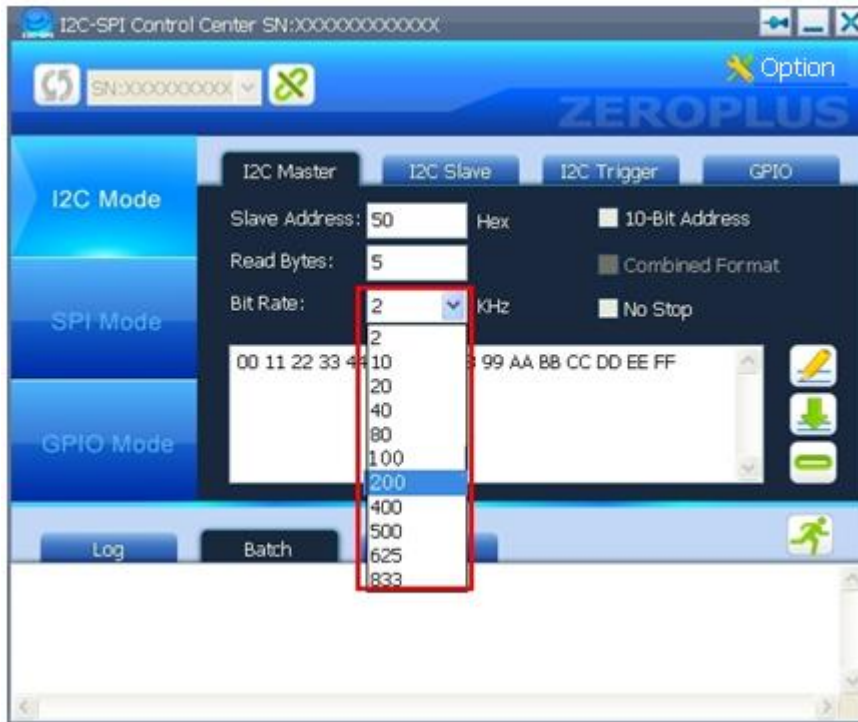
(1) The I2C-SPI Control Center is used as a Master to perform Read/Write Operations

**STEP 1.** Select the I2C Mode from the Software Window of Master, and then set the Slave Address on the I2C Master Page.



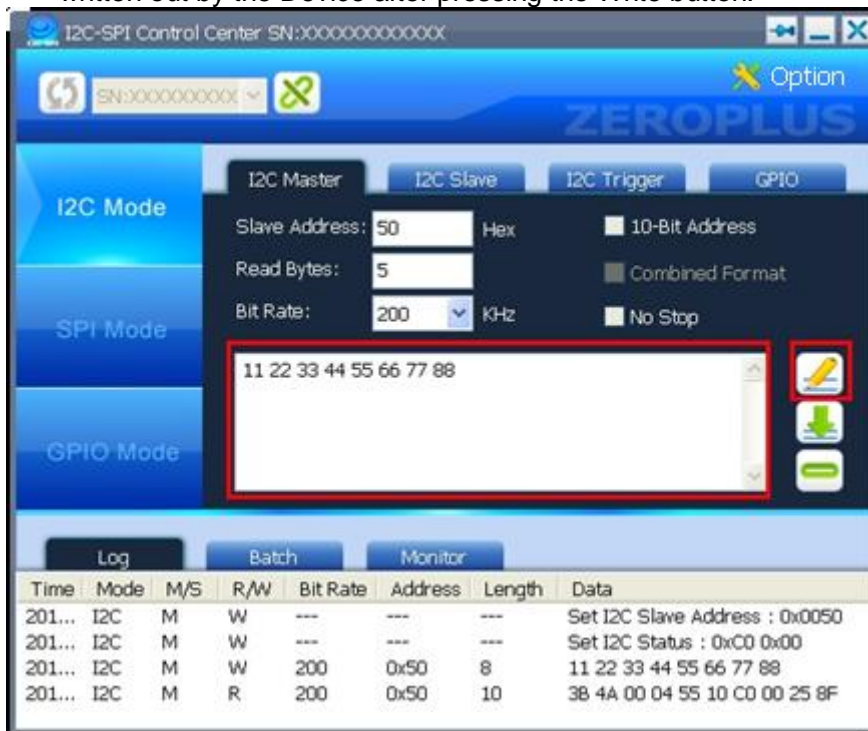


**STEP 2.** Set the Bit Rate (the value can be selected from the pull-down menu and input manually) on the I2C Master Page.



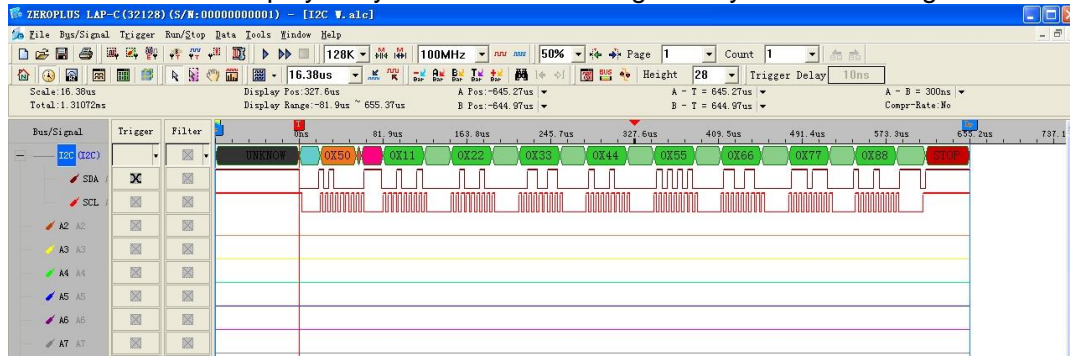
**STEP 3.** Read/Write Data.

(1) Write Data on the Master End: Write 16-Bit data in the Write Message area and the data will be written out by the Device after pressing the Write button.

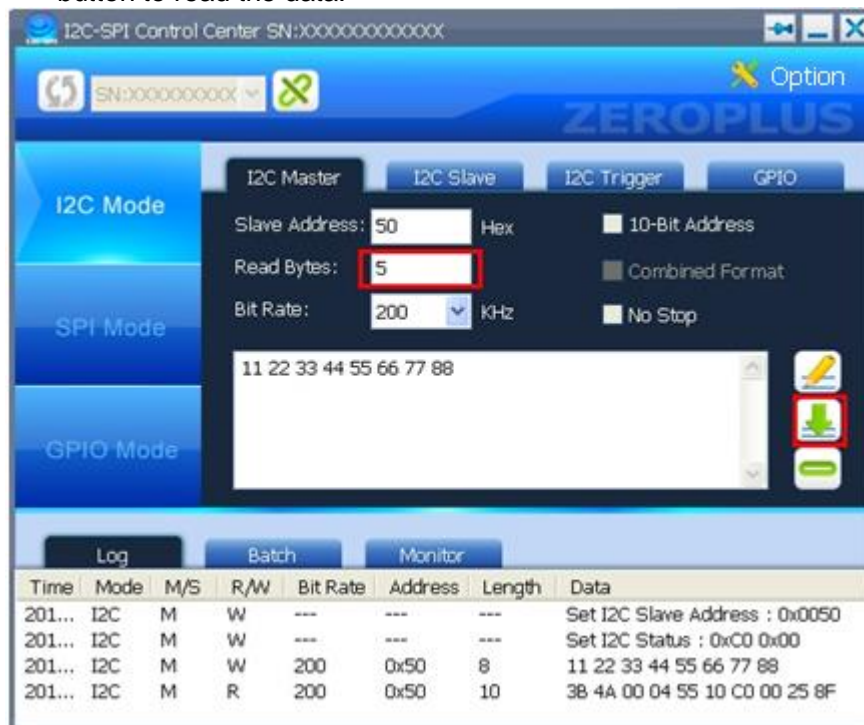




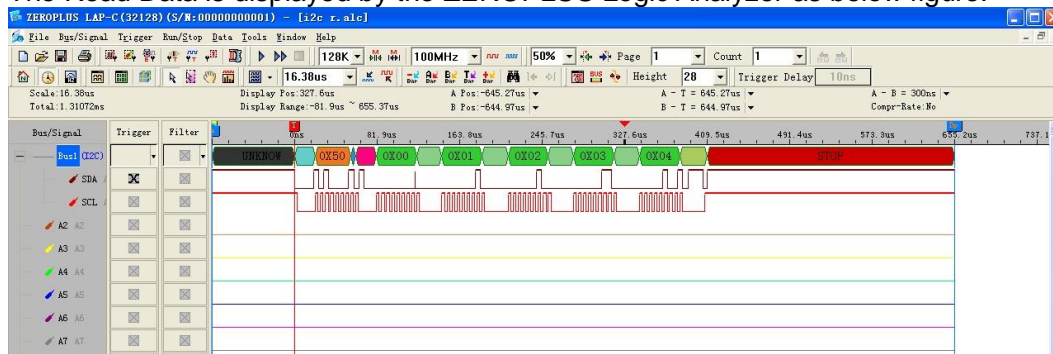
The Write Data is displayed by the ZEROPLUS Logic Analyzer as below figure:



(2) Read Data on the Master End: Set the Read Bytes of the data to be read, and then press the Read button to read the data.



The Read Data is displayed by the ZEROPLUS Logic Analyzer as below figure:



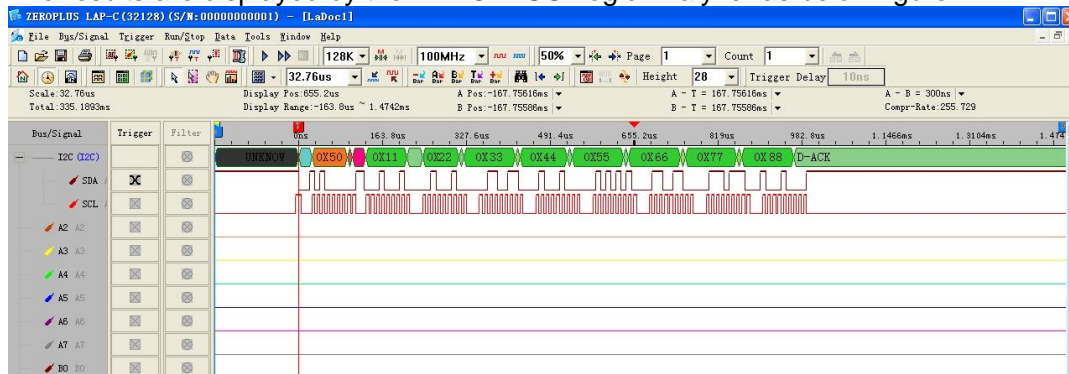
Remark: The data is read from the Slave.



**STEP 4.** When the option, No Stop, is selected, the Master Device won't transmit the Stop command at the final Byte of the Master Read or Write; and it will keep the current Read or Write status continuously. For example, press the Read button after selecting the No Stop.



The results are displayed by the ZEROPLUS Logic Analyzer as below figure:

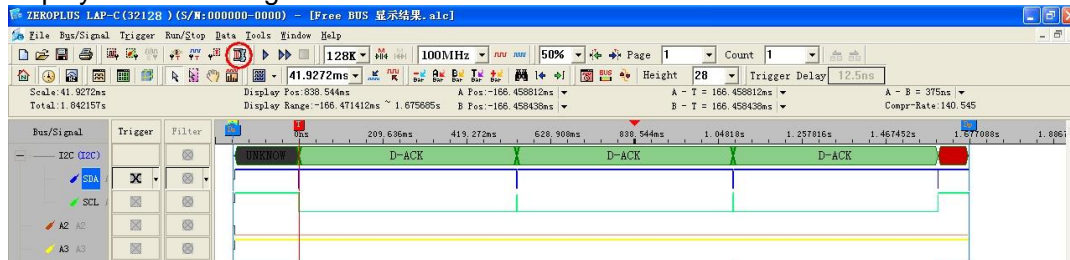




**STEP 5.** When the option, No Stop is selected, press the Write button or Read button continuously for several times, and then press the Free Bus button quickly; the Master Device will transmit a Stop command to the Bus, which will make the Bus free.



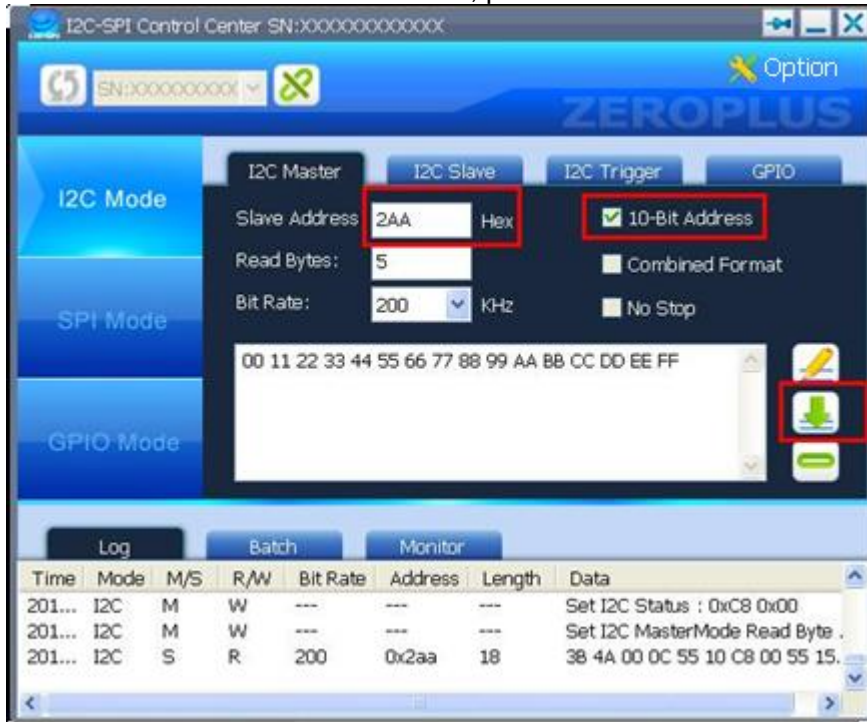
When the Compression function of the ZEROPLUS Logic Analyzer is activated, the results are displayed as below figure:





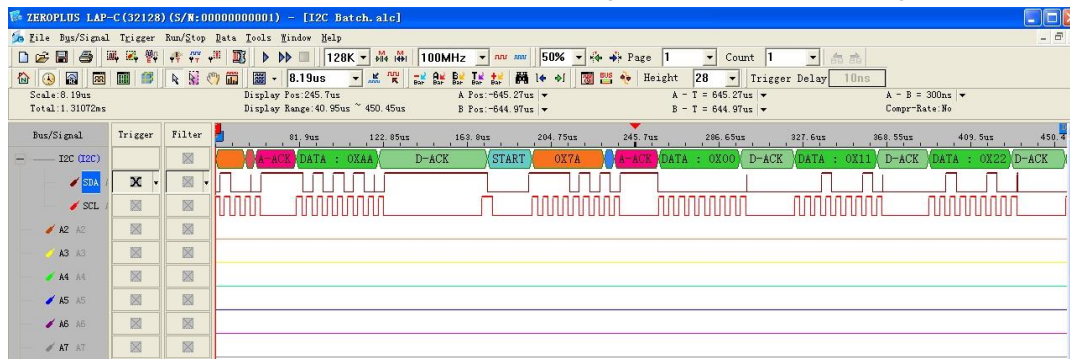


**STEP 6.** Select the 10-Bit Address, and change the Address according to the Device. For example, the Slave Address is set to 2AA. Next, press the Write or Read button.



Remark: The decoded Address Formats of the 10-Bit Address are 11110XX and XXXXXXXX. For example, when the Address, 0x2AA, is set for the I2C-SPI Control Center, the Hexadecimal Addresses which are decoded by the ZEROPLUS Logic Analyzer are 0X7A and 0XAA. When they are changed into the Binary Addresses, the two Addresses are 1111010 and 10101010 respectively.

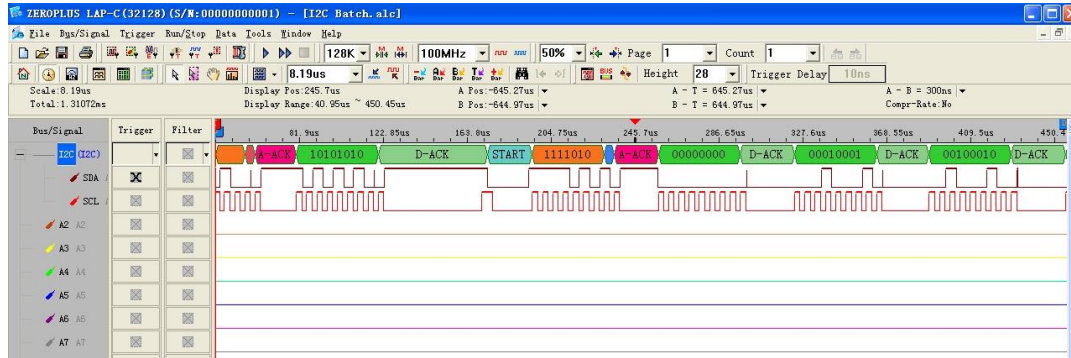
The results are displayed by the ZEROPLUS Logic Analyzer as below figure:



Data in Hexadecimal Notation

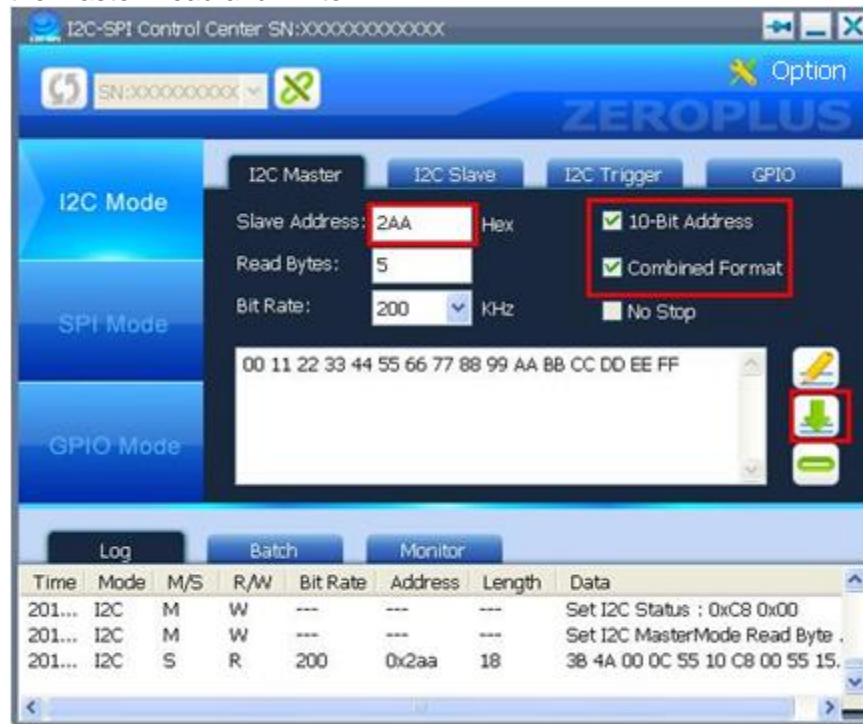


The results are displayed by ZEROPLUS Logic Analyzer as below figure:



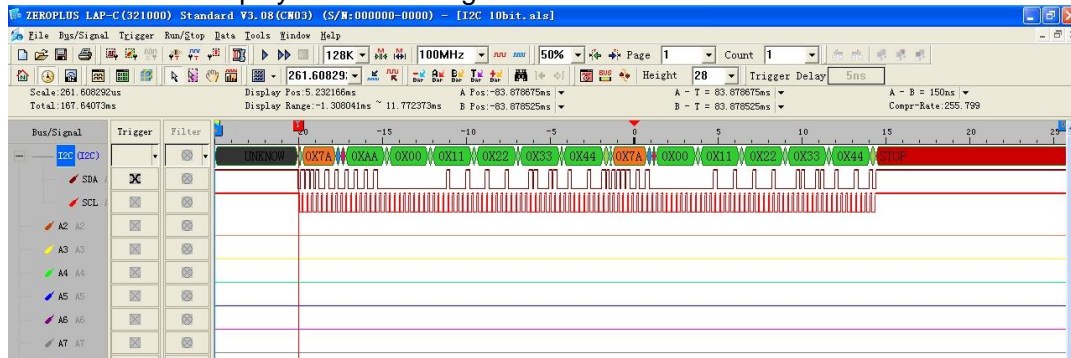
Data in Binary Notation

**STEP 7.** Select 10-Bit Address and the Combined Format, the Combined Format is only suitable for the Master Read and Write .



When the 10-Bit Address and Combined Format are selected synchronously, the Master will occupy the Bus, which is displayed as below figure.

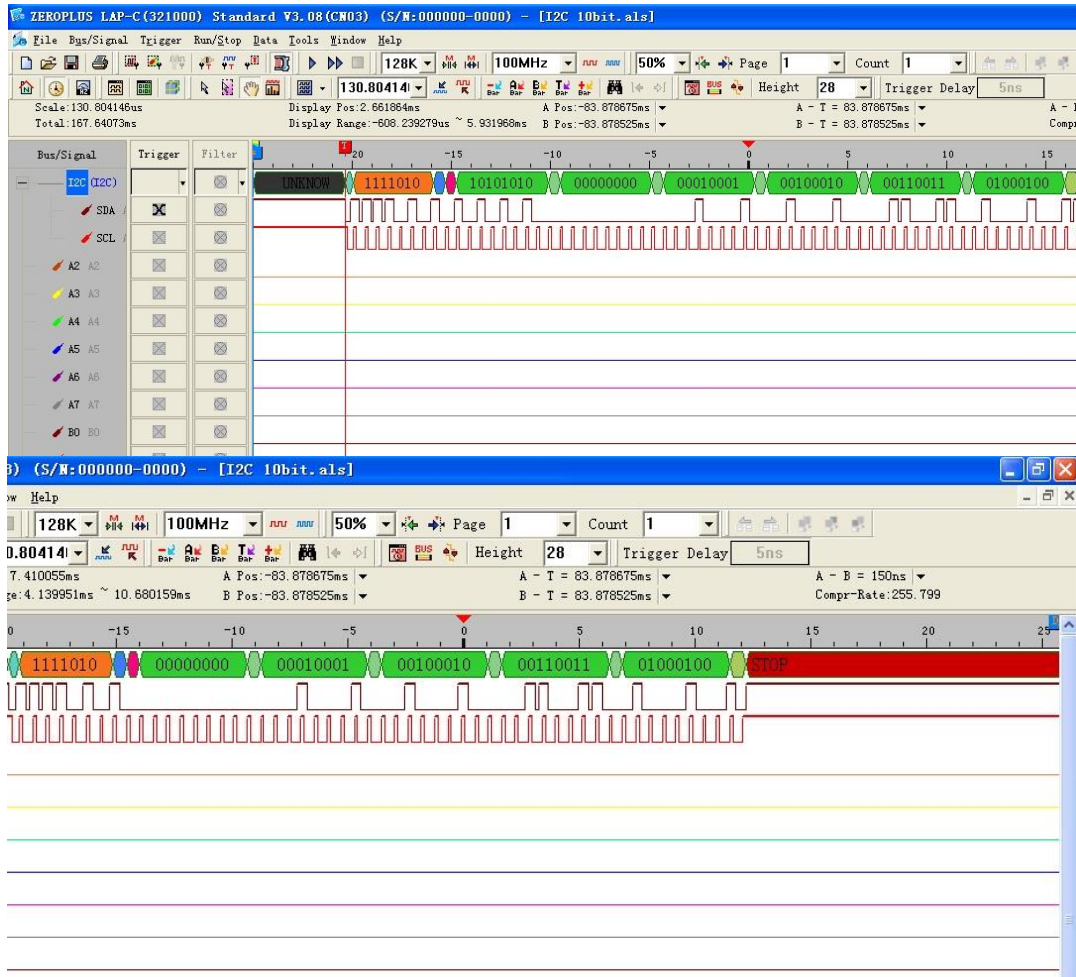
The results are displayed as below figure:



Data in Hexadecimal Notation



The results are displayed as below figure:

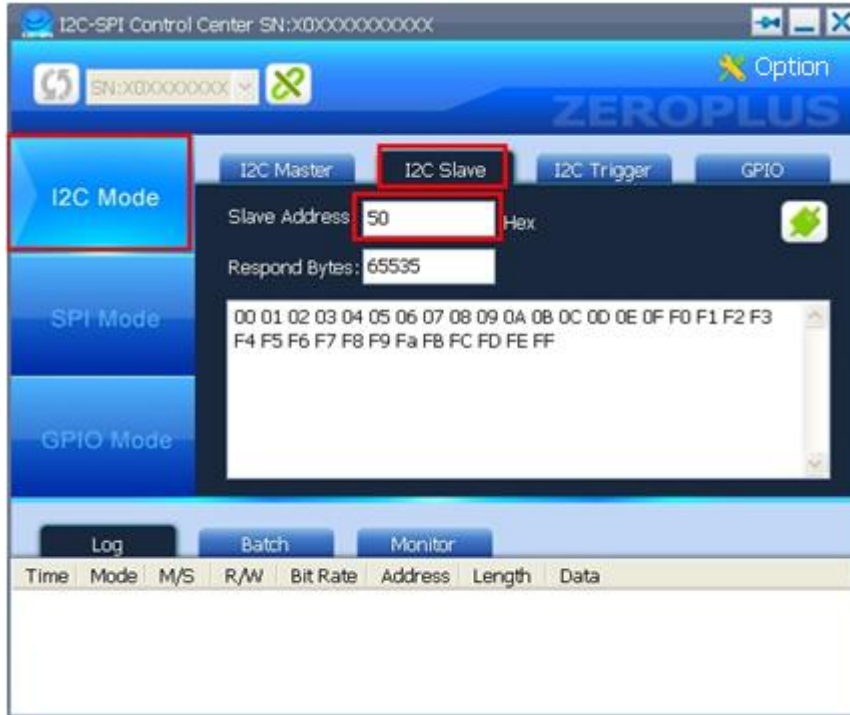


Data in Binary Notation

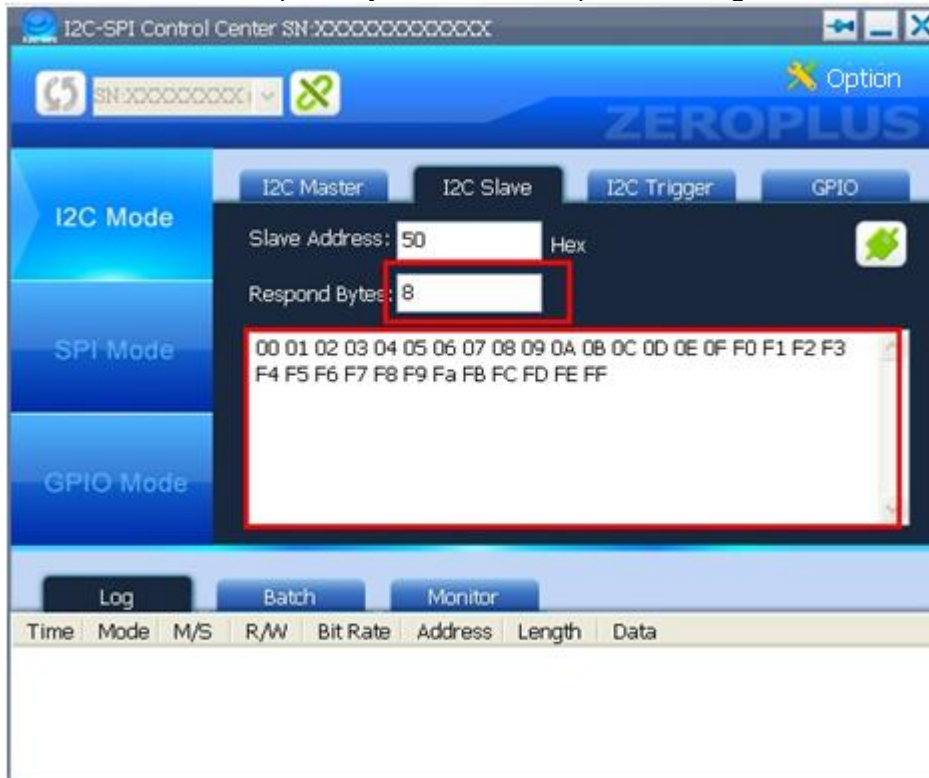


(2) The I2C-SPI Control Center is used as a Slave to perform Read/Write Operations

**STEP 1.** Select the I2C Slave tab from the Software Window of Slave, and then set the value of the Slave Address to coincide with that of the Master.

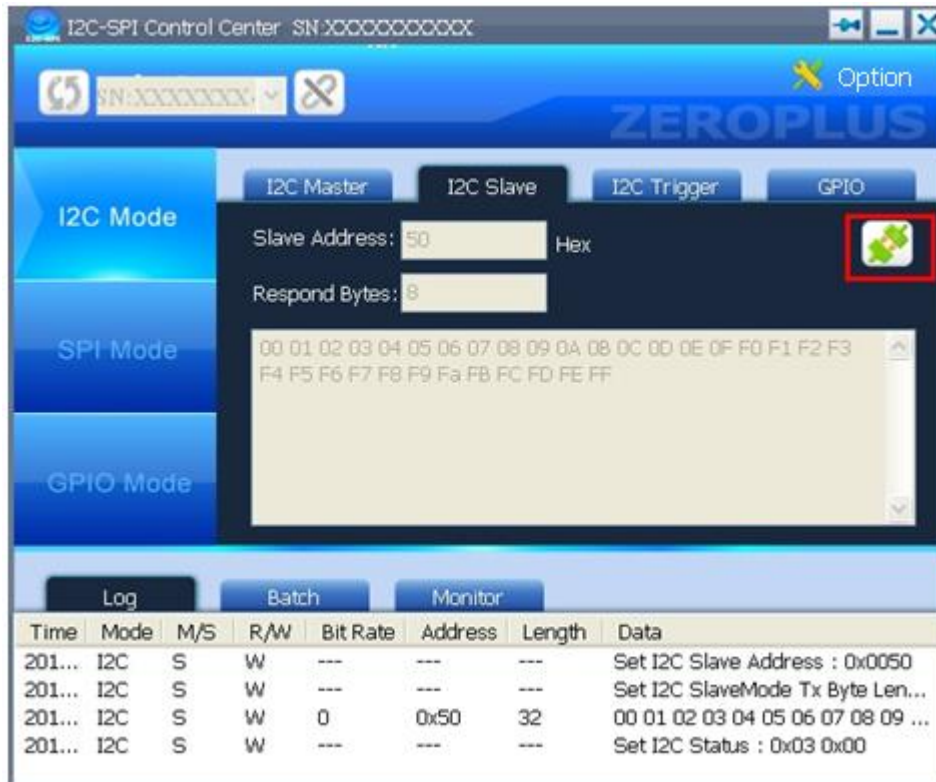


**STEP 2.** Set the Respond Bytes and the Respond Message.

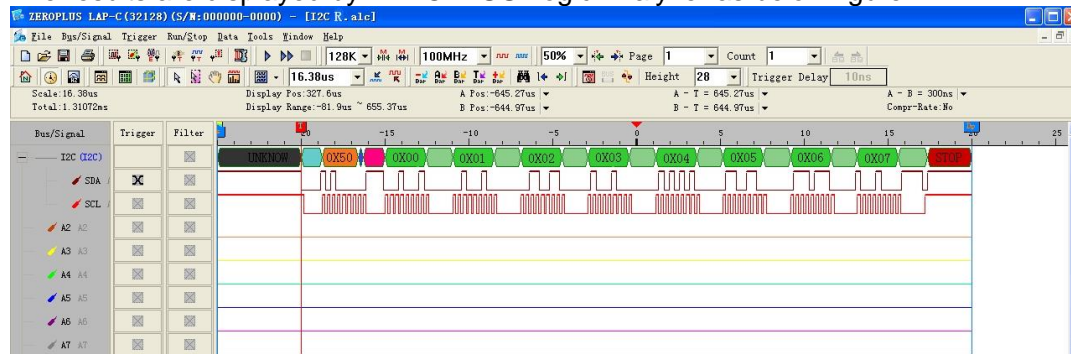




**STEP 3.** Press the Enable button to transmit the Respond Message, then the Page is in the disabled status.



The results are displayed by ZEROPLUS Logic Analyzer as below figure:



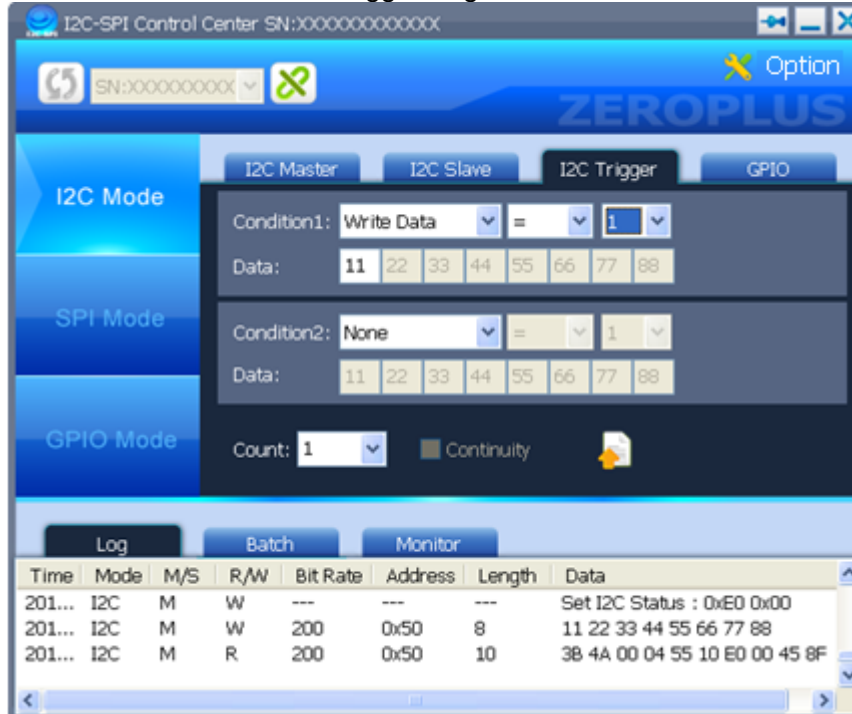
Remark: When the I2C-SPI Control Center is used as a Slave, the data, which is written in the the I2C Slave Page of the I2C-SPI Control Center Software, will be responded to the Master. When the Respond Bytes are set to “0”, all data will be responded; when the Respond Bytes are set to less than that of the data in the MISO, the number of the responded data will be equal to Respond Bytes; when the Respond Bytes are set to more than that of the data in the MISO, the data will be responded repetitively.



### (3) I2C Trigger

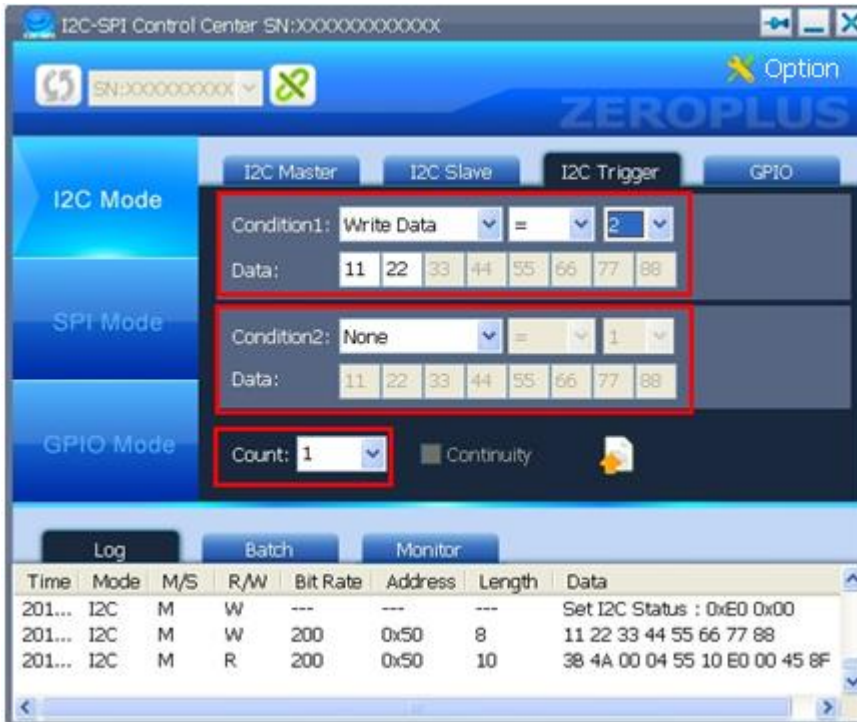
- Notice: 1. When the I2C Trigger is used, the external GPIO Mode Switch should be set to 8 Pin, and the I/O Ctrl is used as the Output Pin of the Trigger Signal at this moment.
2. When the Trigger Conditions are satisfied, the transferred time from the end of the last Clock to the I/O CTRL is 14uS  $\pm$ 0.3uS.
3. When the Trigger function is used in the I2C Slave Mode, the interval time between two Bytes should be longer than 14uS.

**STEP 1.** Select the I2C Trigger Page on the I2C Mode.





**STEP 2.** Set the Trigger Conditions (Condition1&2, Data, Count and Continuity). And one or two groups of the Trigger Conditions can be set for one time. For example, the Data of the Condition1 is set to 11 and 22.



Remark:

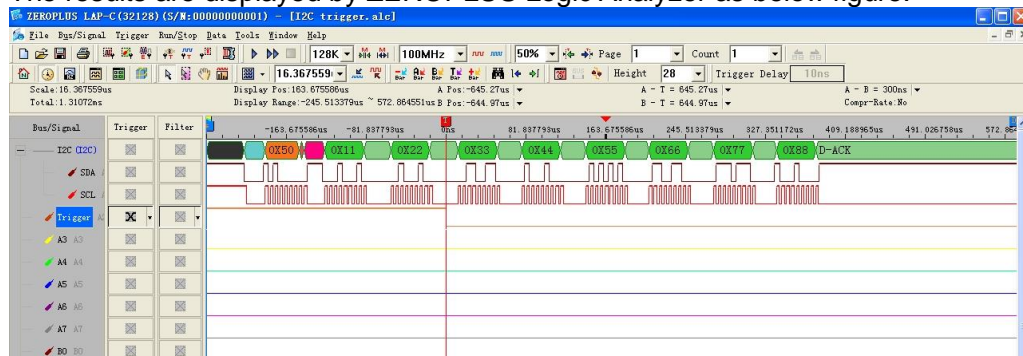
When the Continuity is selected, the definition for the I2C Continuity is as following: When the data meets the Condition1, the I2C-SPI Control Center will check whether the data between the next Start and the previous Start meets the Condition2; if the data meets the Condition2, the two groups of data are continuous.

**STEP 3.** Press the Enable button to use the set Trigger Conditions.





The results are displayed by ZEROPLUS Logic Analyzer as below figure:



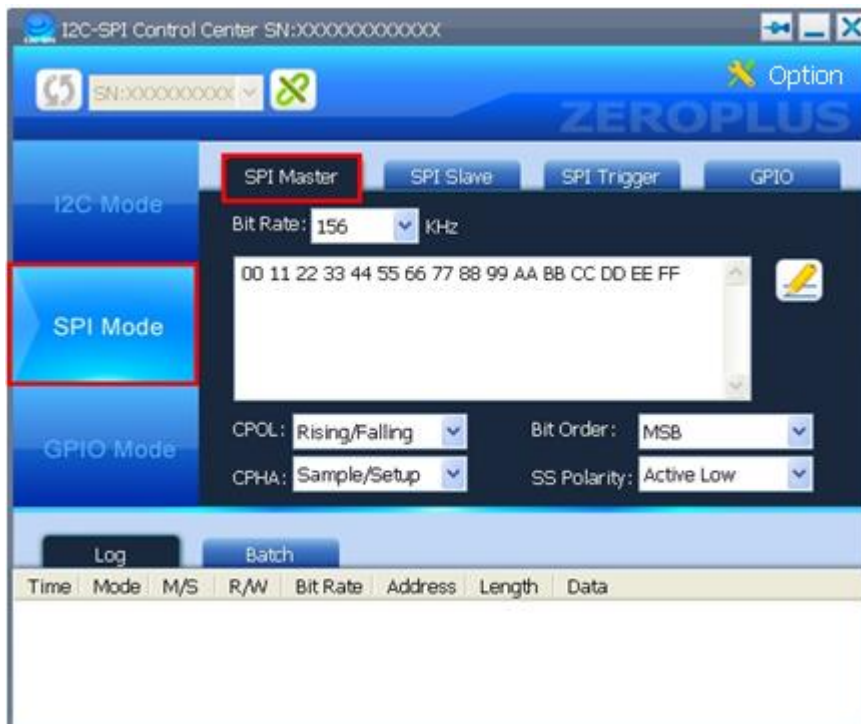
When the data meets the abovementioned set Trigger Conditions, the IO Ctrl Pin (the Pin is connected with the Trigger Signal of the Logic Analyzer) will transmit a Change Edge (Rising Edge or Falling Edge). For example, when the Trigger transmits a Falling Edge and the Conditions meet the Data 11 and Data 22 synchronously, the T Bar will stop at the position, see the above figure.

### 4.3 SPI Mode

- Notice:
1. The highest CLK Bit Rate to transmit data is 8MHz in the SPI Slave Mode. When the CLK Bit Rate exceeds 8MHz, it can not be ensured that the transmitted data is correct.
  2. The highest CLK Bit Rate to receive data is 4MHz in the SPI Master/Slave Mode. When the CLK Bit Rate exceeds 4MHz, it can not be ensured that the received data is correct.

(1) The I2C-SPI Control Center is used as a Master to perform Read/Write Operations

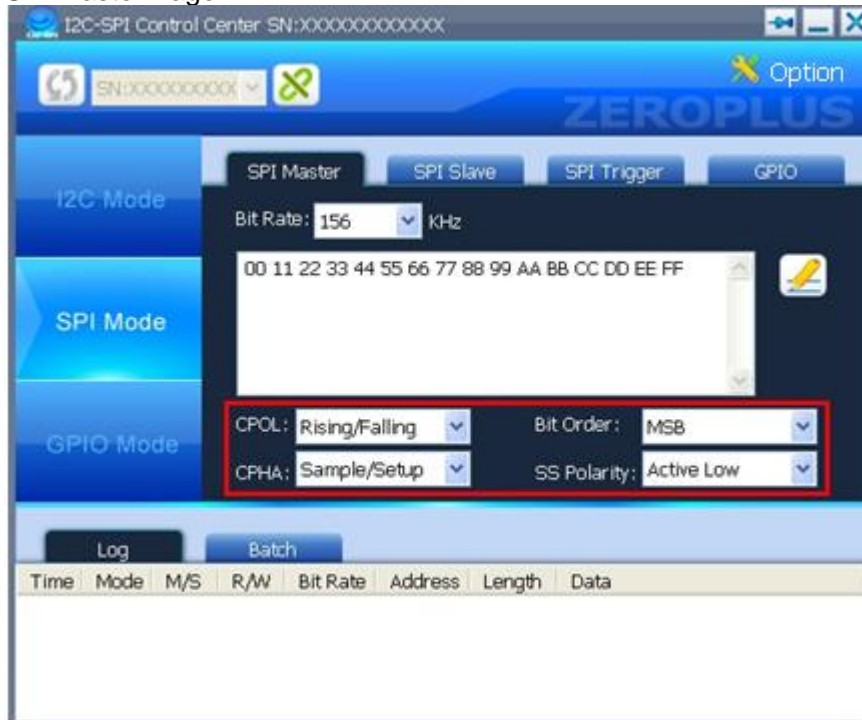
**STEP 1.** Select the SPI Master tab on the SPI Mode.



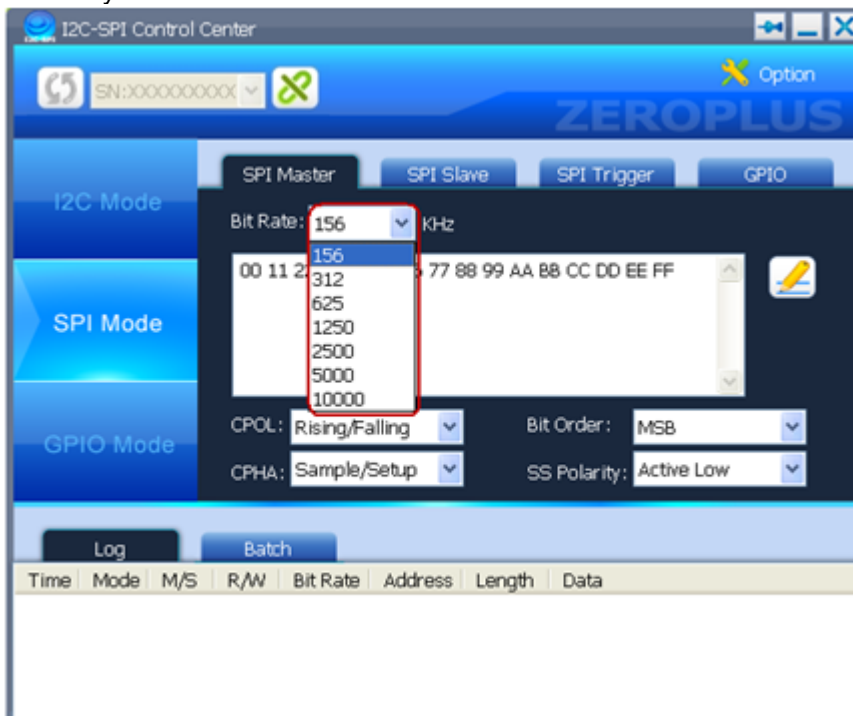




**STEP 2.** Set the corresponding Trigger Conditions (CPOL, CPHA, Bit Order and SS Polarity) on the SPI Master Page.

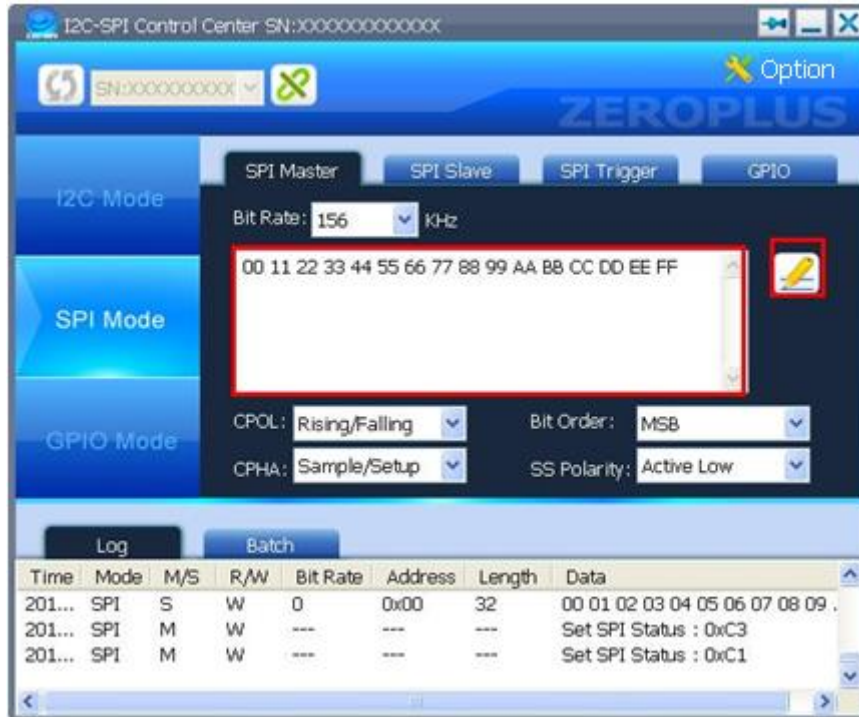


**STEP 3.** Set the Bit Rate from the pull-down menu on the SPI Master Page, and also users can input manually.

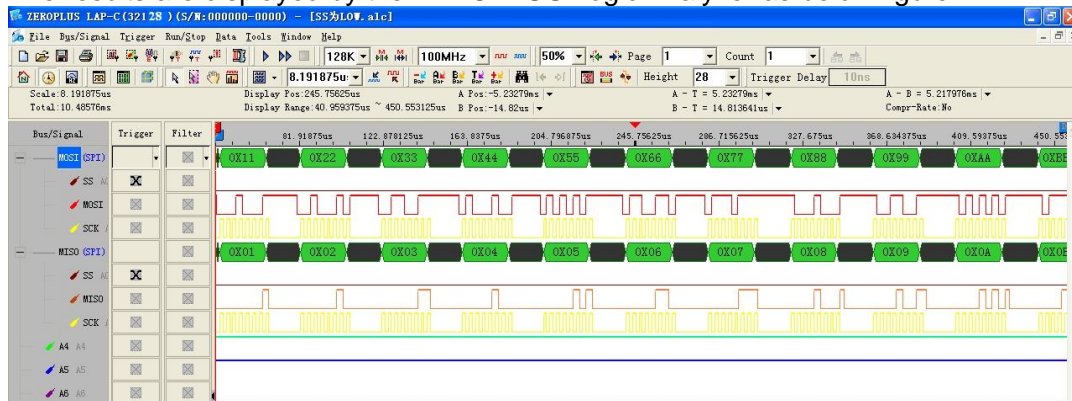




**STEP 4.** Write the data in the MOSI Message area, and then press the Write button.



The results are displayed by the ZEROPLUS Logic Analyzer as below figure:



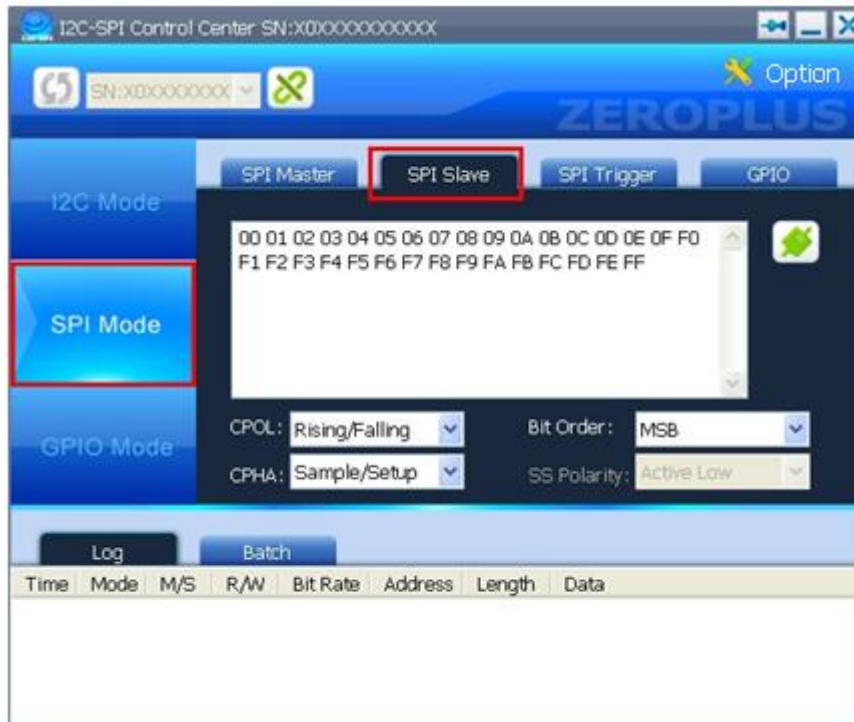
**Notice:**

SPI utilizes the Full-duplex Transmission mode to transmit the signal. Specifically, when the message is transmitted from the MOSI, it will be received in the MISO Message area at once; and the length of the transmitted message is the same with that of the received message.

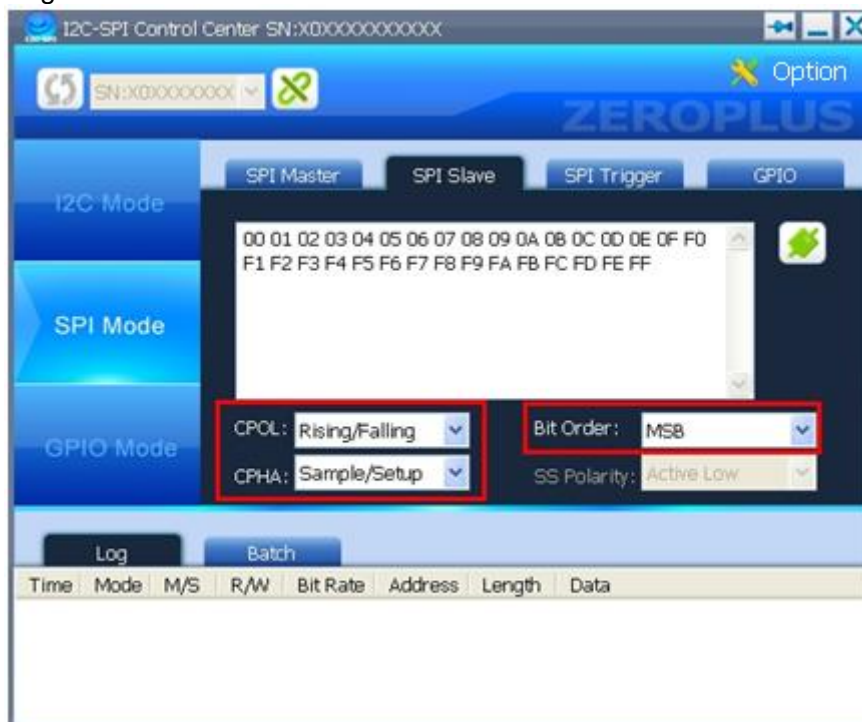


(2) The I2C-SPI Control Center is used as a Slave to perform Read/Write Operations

**STEP 1.** Select the SPI Slave tab on the SPI Mode from the Software Window of the Slave.

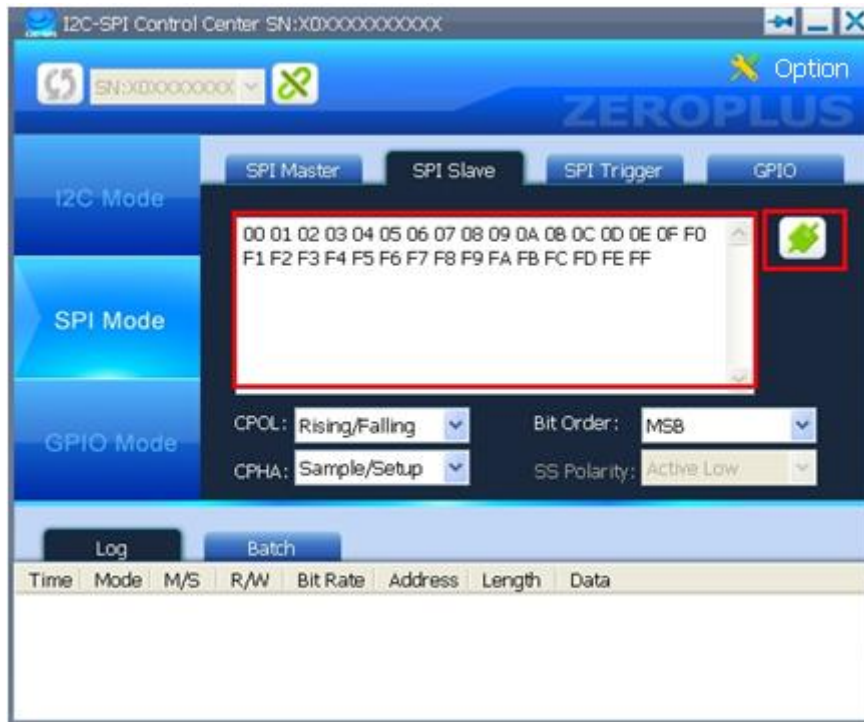


**STEP 2.** Set the corresponding Trigger Conditions (CPOL, CPHA and Bit Order) on the SPI Slave Page.

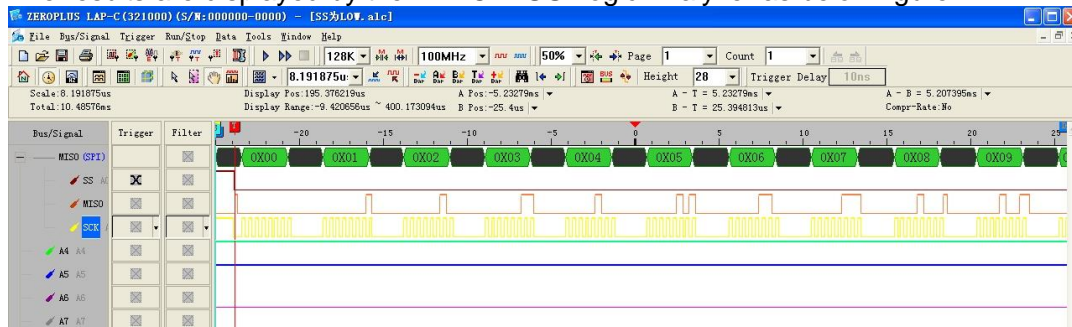




**STEP 3.** Write the data to be transmitted in the MISO Message area, and then press the Enable button.



The results are displayed by the ZEROPLUS Logic Analyzer as below figure:



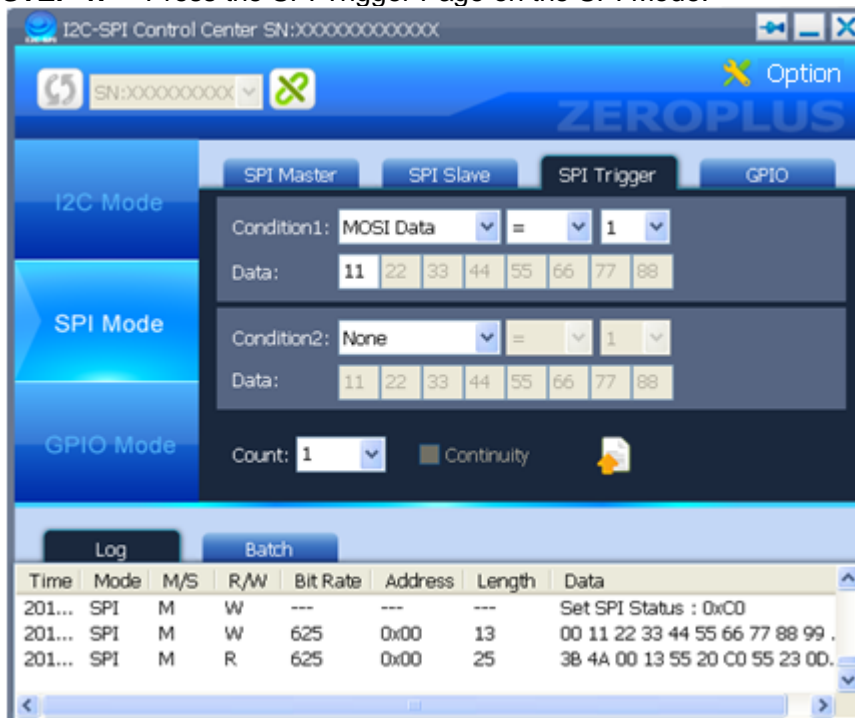
Remark: When the I2C-SPI Control Center is used as a Slave, all data, which is written in the SPI Slave Page of the I2C-SPI Control Center Software will be transmitted to the Master.



### (3) SPI Trigger

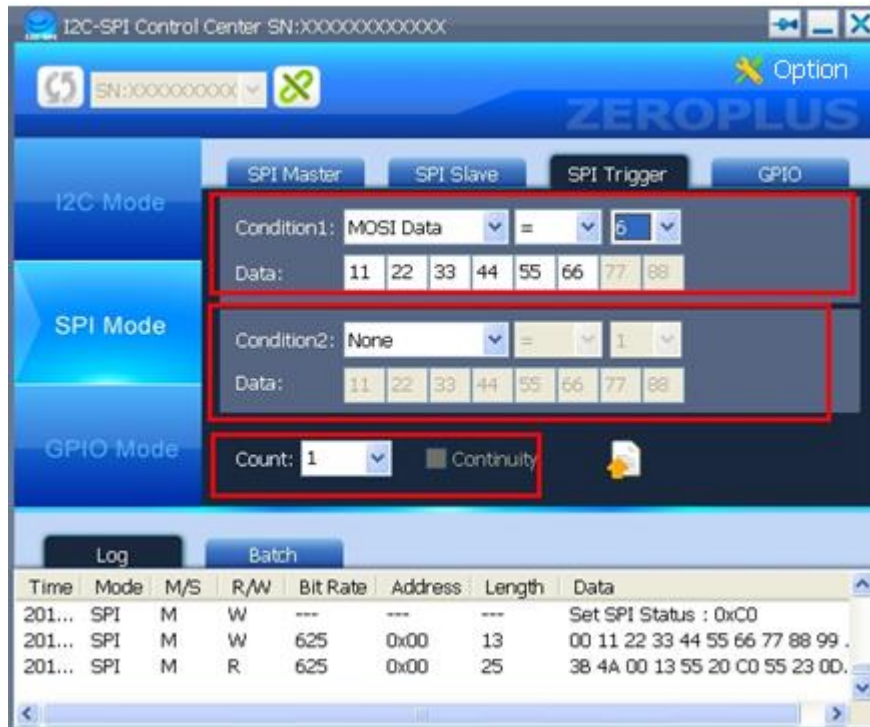
- Notice:
1. When the SPI Trigger is used, the external GPIO Mode Switch should be set to 8 Pin, and the Target Power is used as the Output Pin of the Trigger Signal at this moment.
  2. When the Trigger Conditions are satisfied, the transferred time from the end of the last Clock to the I/O CTRL is 10uS  $\pm$ 0.3uS.
  3. When the Trigger function is used in the SPI Slave Mode, the interval time between two Bytes should be longer than 10uS.

**STEP 1.** Press the SPI Trigger Page on the SPI Mode.





**STEP 2.** Set the Trigger Conditions (Condition1&2, Data, Count and Continuity), and one or two groups of the Trigger Conditions can be set for one time, for example, the MOSI Data for Condition1 is set to 11, 22, 33, 44, 55 and 66.



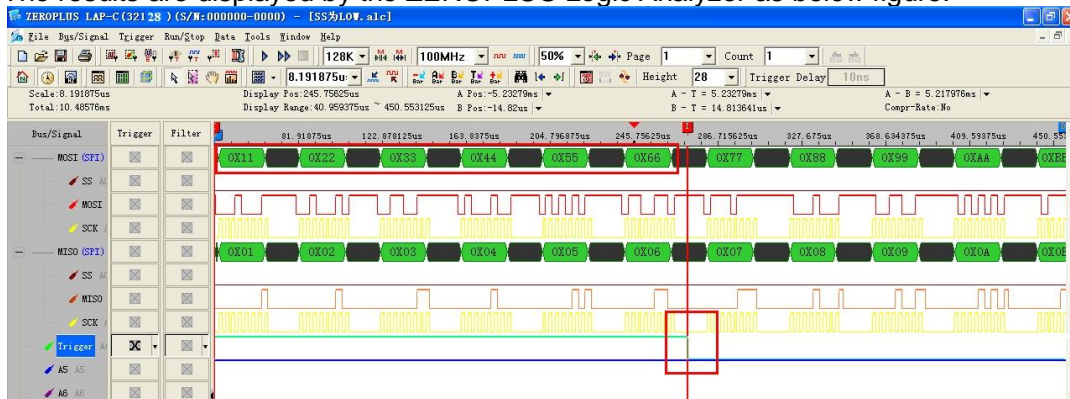
Remark: If the Continuity is selected, it denotes that two groups of data must conform to the two conditions continuously. The definition for the SPI Continuity is as following: When the data meets the Condition1, the I2C-SPI Control Center will check whether the data between the next SS Enable and the previous SS Enable meets the Condition2; if the data meets the Condition2, the two groups of data are continuous.



**STEP 3.** Press the Enable button to use the set Trigger Conditions.



The results are displayed by the ZEROPLUS Logic Analyzer as below figure:



Remark: When the data meets the abovementioned set Trigger Conditions, the Target Power (the Pin is connected with the Trigger Signal of the Logic Analyzer) will transmit a Change Edge (Rising Edge or Falling Edge). For example, when the Trigger transmits a Falling Edge and the Conditions meet the Data 11, 22, 33, 44, 55 and 66 synchronously, the T Bar will stop at the position, see the above figure.



## 4.4 GPIO Mode

- Notice: 1. When the 6 Pin Mode is used, the external GPIO Mode Switch should be set to the 6 Pin; and the Bit6 I/O Ctrl and the Bit7 Target Power of the GPIO are respectively used to control the I/O SW and the Out 5V.
2. When the 8 Pin Mode is used, the external GPIO Mode Switch should be set to the 8 Pin; and the Bit6 I/O Ctrl and the Bit7 Target Power are used as GPIO Pins. At the same time, the I/O Ctrl and the Target Power of the Control Status are forced to set as Enable.
3. When the SCL and the SDA are used as the GPIO Pins, the external I2C Pull Hi SW should be set to OFF.

GPIO uses eight Pins to transmit the general signals, which are SCL, SDA, SCLK, MISO, MOSI, SS, I/O Ctrl and Target Power.

**STEP 1.** Press the GPIO Mode on the Software Window.







**STEP 2.** Select the Mode as 6 Pin or 8 Pin. And the I/O Ctrl and Target Power are disabled in the 6 Pin Mode. (Take the 6 Pin Mode for an example)



**STEP 3.** Set the Direction to In or Out. When All Out or All In is pressed, all available Pins can be set to Out or In synchronously.

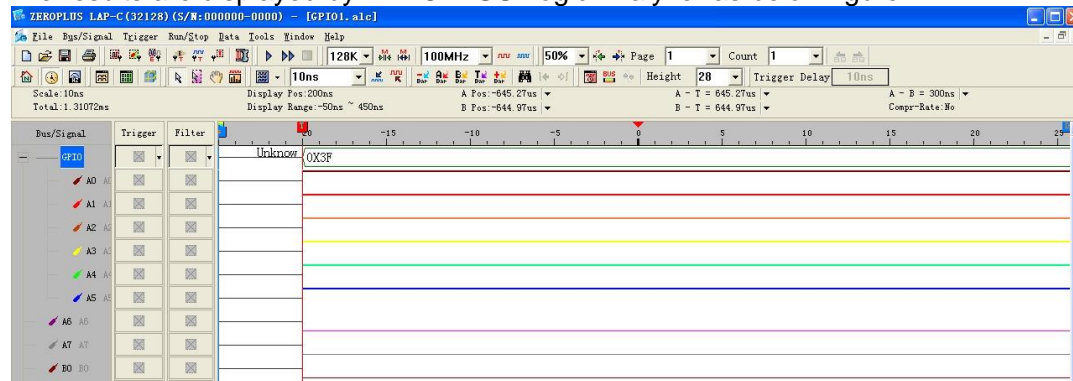




**STEP 4.** When the Direction is set to In, the Pull Up can be set to On or Off. When the All On or All Off is pressed, all available Pins can be set to On or Off. And then press the Get button to get the outputted data.



The results are displayed by ZEROPLUS Logic Analyzer as below figure.

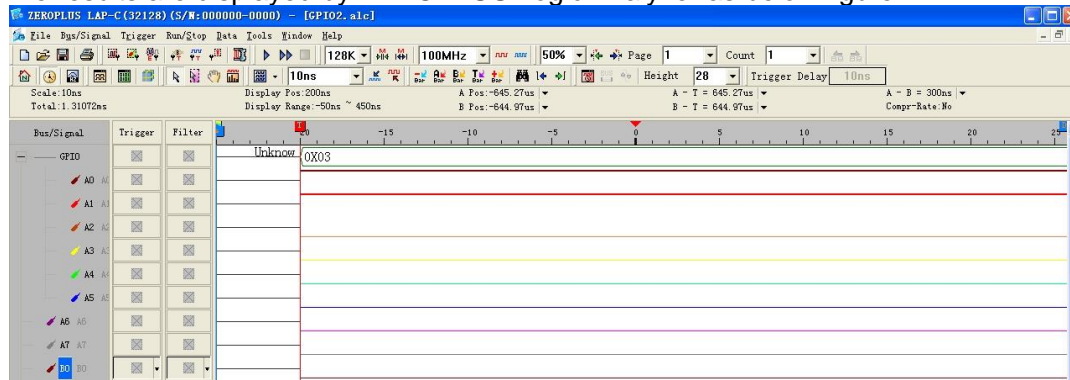




**STEP 5.** When the Direction is set to Out, the Out Set can be set. Press the Set button to write the set values into the Device.



The results are displayed by ZEROPLUS Logic Analyzer as below figure.



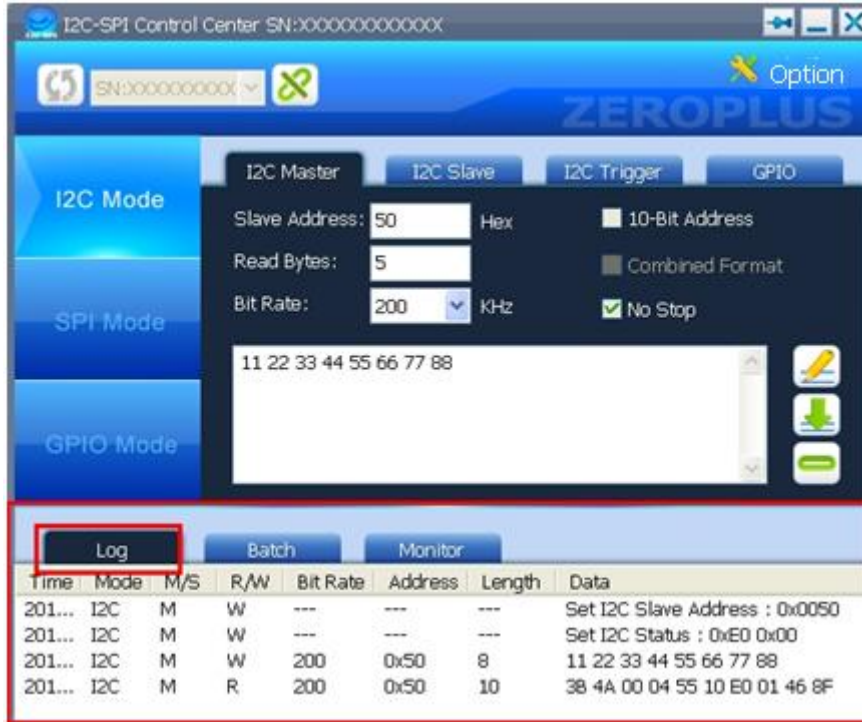
In addition, the Operating Steps of GPIO in I2C Mode and SPI Mode are the same with that of the GPIO Mode, and the only difference is that some pins cannot be used in different modes.



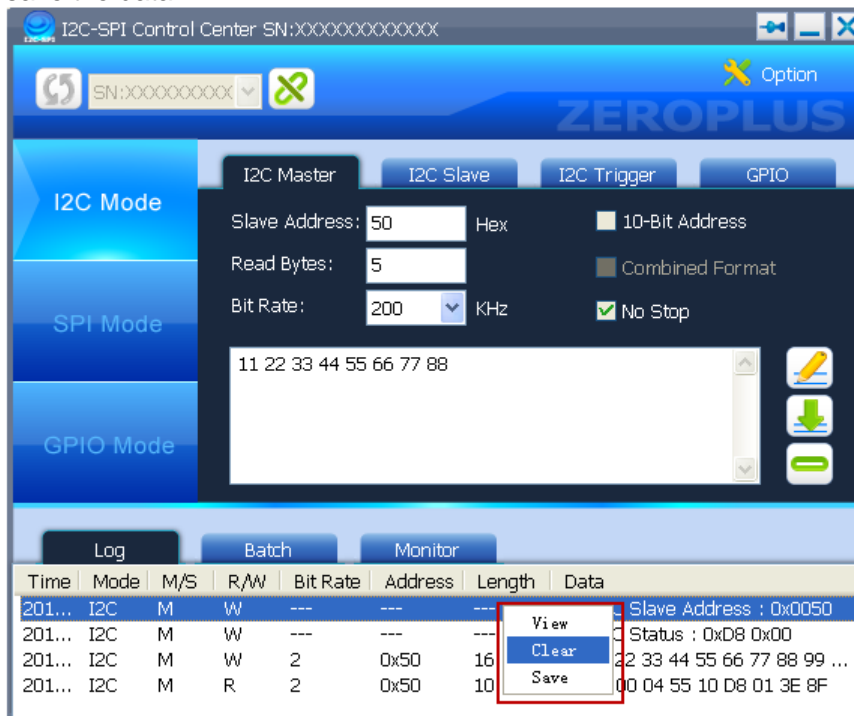
## 4.5 Log Window

When the Log Window is opened, it will display the set information for each mode automatically.

**STEP 1.** Press the Log tab, and move the Up/Down Scroll or pull the bottom of the Software Window to view the information.

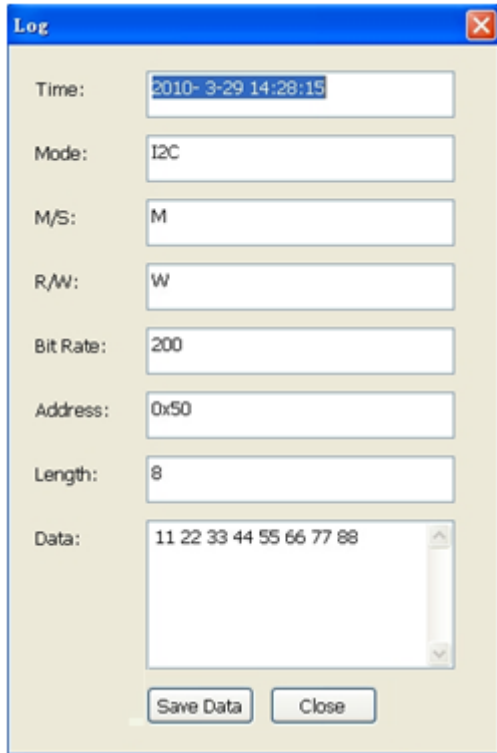


**STEP 2.** Move the Cursor to the information column, and double-click on the Right Key to view, clear or save the data.

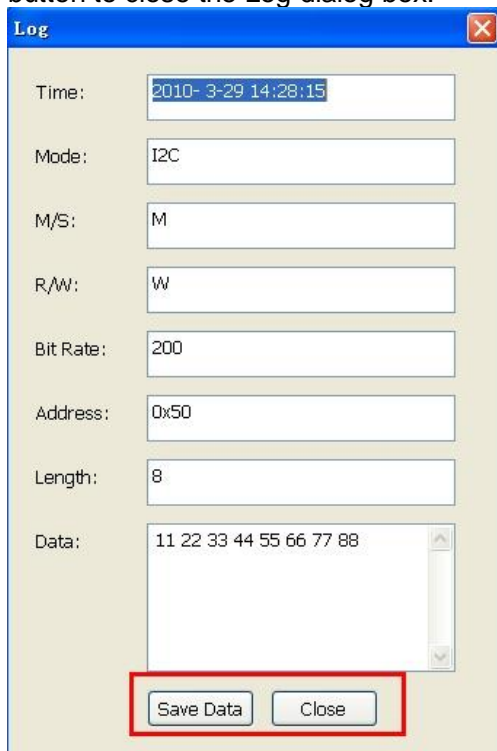




**STEP 3.** Move the Cursor to an entry in the information column, and double-click on the Right Key or select the View on the pull-down menu to view the information in the Log dialog box.



**STEP 4.** Press the Save Data button to save the information in the Data column, or press the Close button to close the Log dialog box.





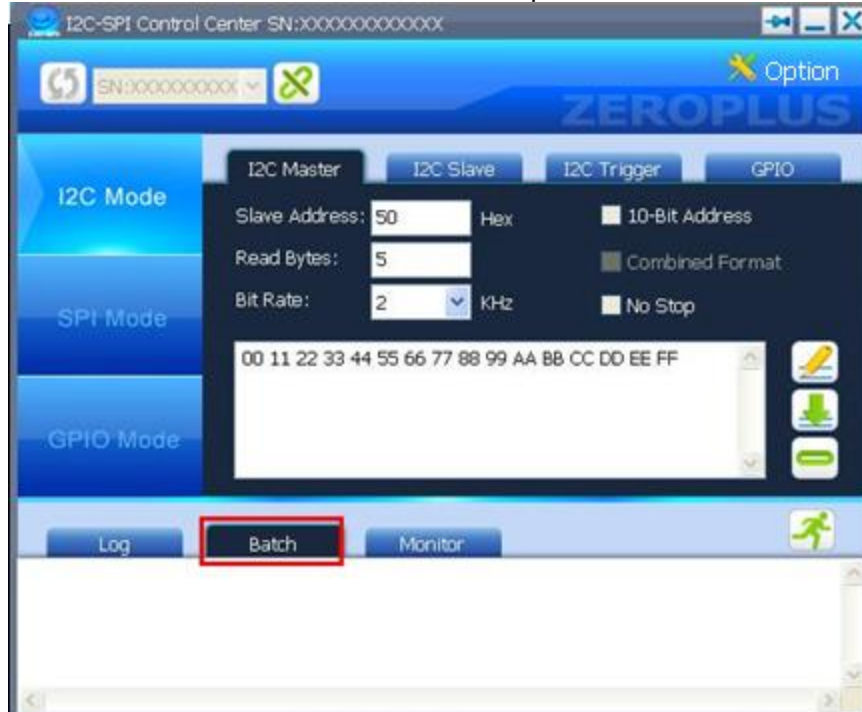
## 4.6 Batch

The operating steps of the I2C Batch are the same with that of the SPI Batch. The below takes the operating steps of I2C Batch for an example.

### (1) I2C Batch

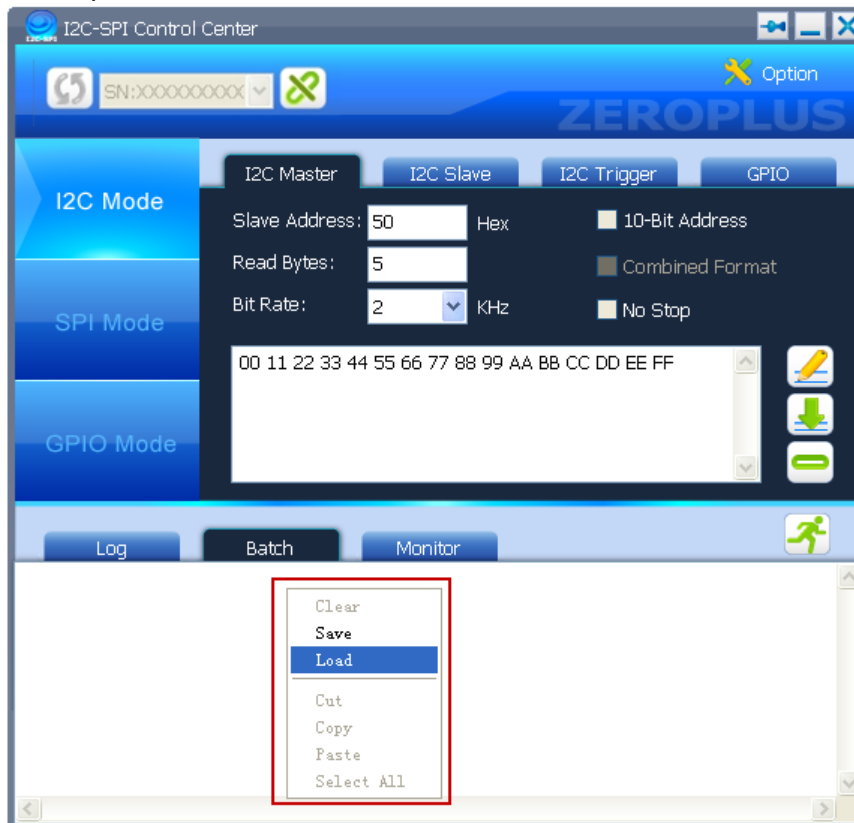
**Notice:** When the I2C or SPI Batch Mode is used, the external GPIO Mode Switch should be set to 8 Pin Mode.

**STEP 1.** Select the I2C Mode, and then press the Batch tab.

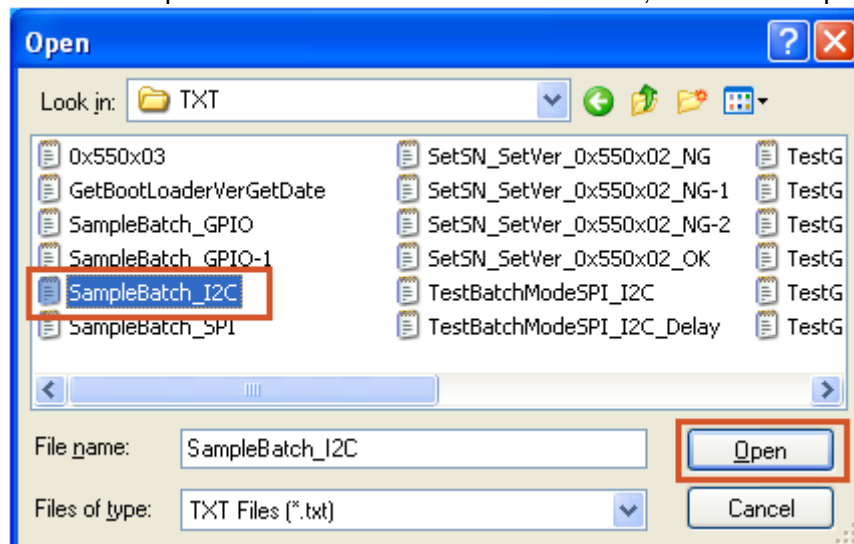




**STEP 2.** Move the cursor to the Batch window, and then click Right key on the mouse. Next, press the Load option.

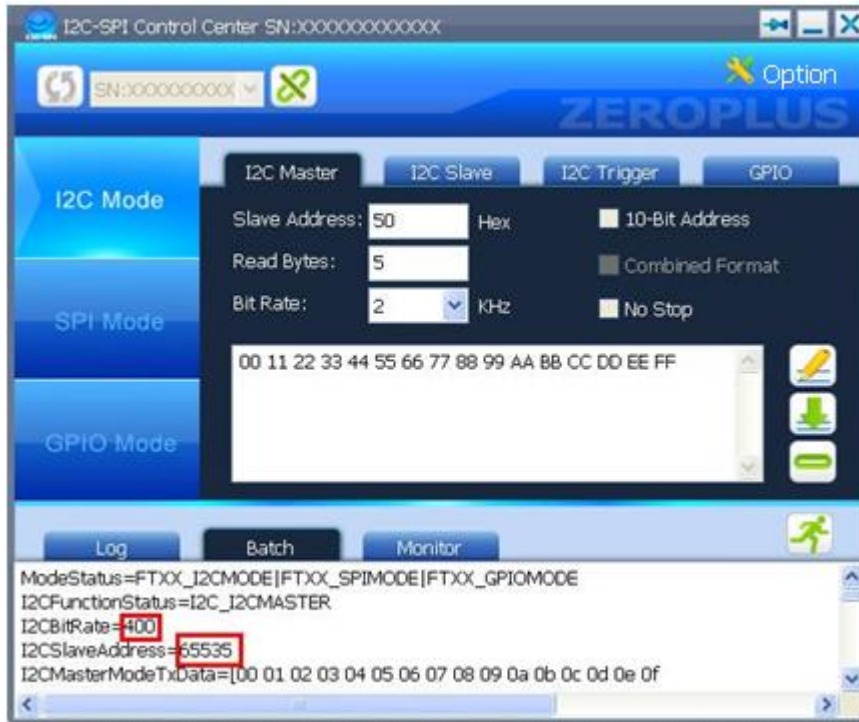


**STEP 3.** Open a Batch Mode from the saved files; take the SampleBatch\_I2C.txt for an example.

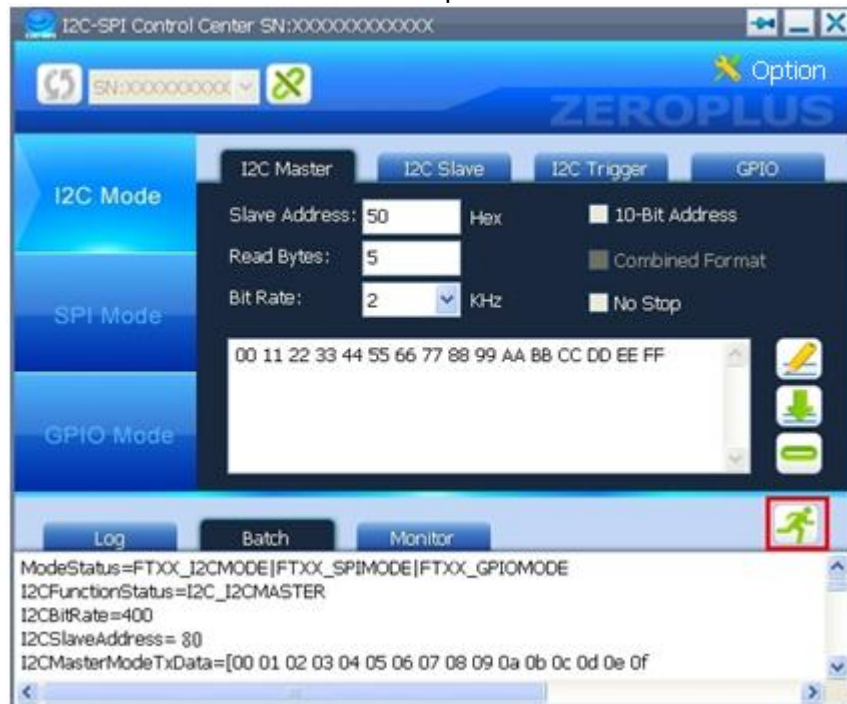




**STEP 4.** Modify the Bit Rate, Slave Address and Data of the loaded file, for example, the original Slave Address, 65535, is modified as 80.



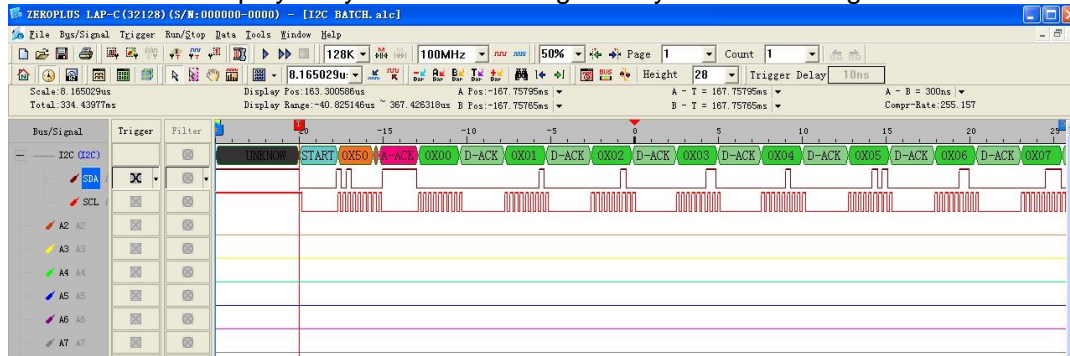
**STEP 5.** Press the Run button to perform the modified data.







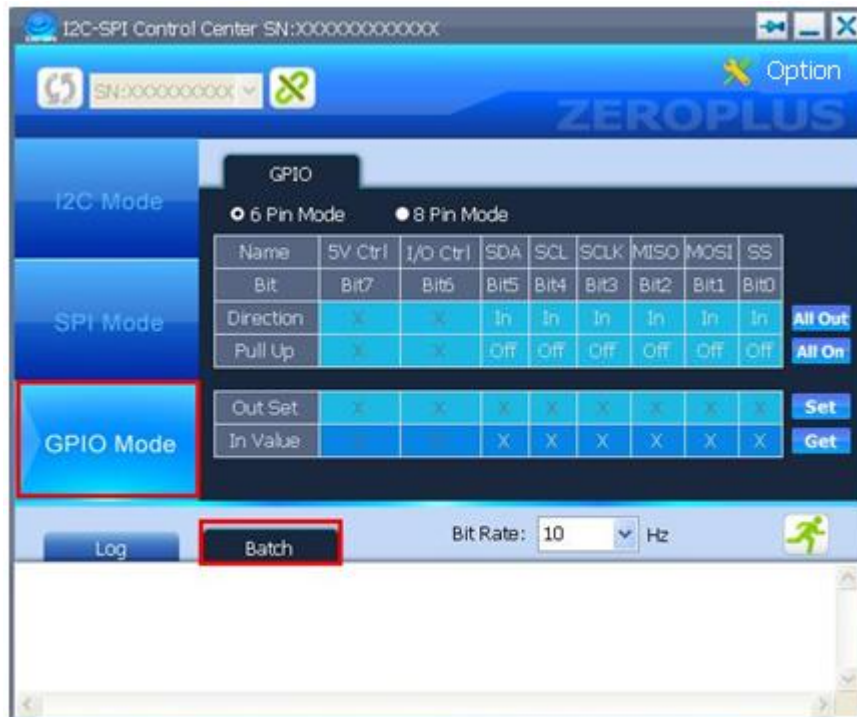
The results are displayed by ZEROPLUS Logic Analyzer as below figure.



## (2) GPIO Batch

- Notice: 1. When the GPIO Batch Mode is used, the external GPIO Mode Switch must be set to Batch at first, and then the Software must be set to GPIO Batch Mode.  
2. The signals of the GPIO Batch Mode will be outputted by the GPIO Batch Out (Data Pin \* 8, Clk \* 1).

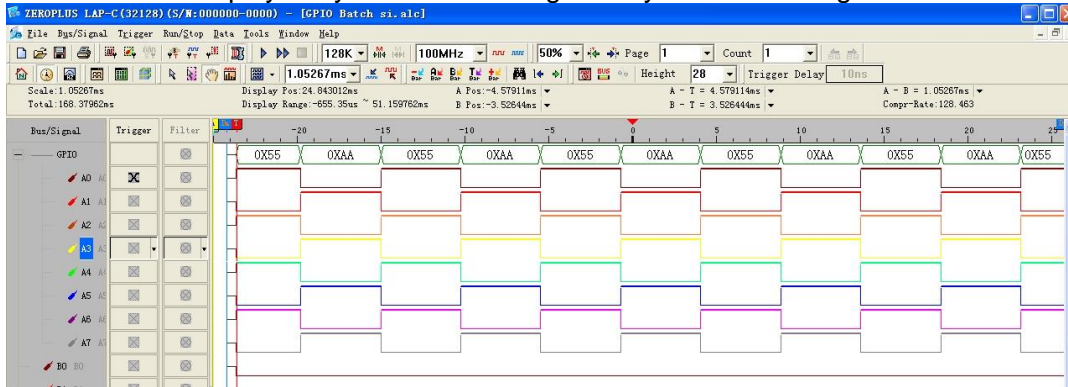
**STEP 1.** Press the Batch tab from the GPIO Mode on the Software Window.







The results are displayed by ZEROPLUS Logic Analyzer as below figure.



● Batch Mode Command

a. **ModeStatus**: Set the Control Mode of the Hardware

There are three kinds of Control Flag to be used, namely, FTXC\_I2CMODE, FTXC\_SPIMODE and FTXC\_GPIOMODE, see the below:

```
ModeStatus=FTXC_I2CMODE
ModeStatus=FTXC_SPIMODE
ModeStatus=FTXC_GPIOMODE
ModeStatus=FTXC_I2CMODE|FTXC_SPIMODE
ModeStatus=FTXC_I2CMODE|FTXC_GPIOMODE
ModeStatus=FTXC_SPIMODE|FTXC_GPIOMODE
```

b. **I2CfunctionStatus**: Set the Control Flag of the I2C Mode.

The I2CfunctionStatus consists of four flags, see the below;

```
I2CfunctionStatus=I2C_I2CMASTER|I2C_10BITADDR
|I2C_COMBINEDFORMAT|I2C_NOSTOP

I2CfunctionStatus= I2C_I2CSLAVE|I2C_10BITADDR
|I2C_COMBINEDFORMAT|I2C_NOSTOP
```

c. **I2CbitRate**: Set the Bit Rate in the I2C Mode, its Unit is KHz.

See the below:  
I2CbitRate=400

d. **I2CslaveAddress**: Set the Slave Address in the I2C Mode, which Support only Decimal number Address.

See the below:  
I2CSlaveAddress=65535

e. **I2CmasterModeTxData**: Set the TxData in I2C Master Mode, the Start and End of the Data is judged by “[” and “]” respectively.

The TxData can be displayed in the line folding mode, see the below:  
I2CmasterModeTxData=[00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f  
10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  
20 21]



- f. **I2CmasterModeReadByteLength**: Set the ReadByteLength in I2C Master Mode.  
I2CMasterModeReadByteLength=5
- g. **I2CfreeBus**: Set the FreeBus in I2C Mode.  
I2CFreeBus=true
- h. **I2CslaveModeTxByteLength**: Set the TxByteLength in I2C Slave Mode.  
I2CSlaveModeTxByteLength=10
- i. **I2CSlaveModeRxByteLength** Set the TxByteLength in I2C Slave Mode.  
I2CSlaveModeRxByteLength=10
- j. **I2CslaveRespondData**: Set the RespondData in I2C Slave Mode, the Start and End of the Data is judged by “[ “ and “]” respectively.

The RespondData can be displayed in the line folding mode, see the below:

```
I2CSlaveRespondData=[00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f
                      10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f
                      20 21]
```

- k. **I2CslaveModeEnabled**: Set the Enabled in the I2C Slave Mode.  
I2CSlaveModeEnabled=true
- l. **SPIFunctionStatus**: Set the Control Flag of SPI Mode.

The SPIFunctionStatus consists of five flags, see the below:

```
SPIFunctionStatus=SPI_MASTER
```

```
|SPI_POLARITY_FALLING_RISING
|SPI_PHASE_SETUP_SAMPLE
|SPI_BITORDER_MSB
|SPI_SS POLARITY_LOW
```

```
SPIFunctionStatus= SPI_SLAVE
```

```
|SPI_POLARITY_FALLING_RISING |SPI_PHASE_SETUP_SAMPLE
|SPI_BITORDER_LSB
|SPI_SS POLARITY_HI
```

- m. **SPIBitRate**: Set the Bit Rate in the SPI Mode, its Unit is KHz.  
SPIBitRate=400
- n. **SPIMasterModeMOSIData**: Set the MOSIData in SPI Master Mode, the Start and End of the Data is judged by “[ “ and “]” respectively

The MOSIData can be displayed in the line folding mode, see the below:

```
SPIMasterModeMOSIData=[00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f
                       10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f
                       20 21]
```

- o. **SPISlaveModeMISOData**: Set the MISOData in SPI Slave Mode, the Start and End of the Data is judged by “[ “ and “]” respectively .

The MISOData can be displayed in the line folding mode, see the below:

```
SPISlaveModeMISOData=[00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f
```



10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  
20 21]

- p. **SPISlaveModeEnabled**: Set the Enabled in the SPI Slave Mode.  
SPISlaveModeEnabled=true

- q. **GPIODirectionStatus**: Set the Status Flag of Direction in GPIO Mode.

The GPIODirectionStatus is controlled by the GPIO\_DIRECTION\_SPI\_SS, GPIO\_DIRECTION\_SPI\_MOSI, GPIO\_DIRECTION\_SPI\_MISO, GPIO\_DIRECTION\_SPI\_SCLK, GPIO\_DIRECTION\_I2C\_SDA, GPIO\_DIRECTION\_I2C\_SCL, GPIO\_DIRECTION\_IOCONTROL and GPIO\_DIRECTION\_5VCONTROL.  
GPIODirectionStatus=GPIO\_DIRECTION\_SPI\_SS|GPIO\_DIRECTION\_SPI\_MOSI|GPIO\_DIRECTION\_SPI\_MISO|GPIO\_DIRECTION\_SPI\_SCLK|GPIO\_DIRECTION\_I2C\_SDA|GPIO\_DIRECTION\_I2C\_SCL|GPIO\_DIRECTION\_IOCONTROL|GPIO\_DIRECTION\_5VCONTROL

- r. **GPiOPullUpsStatus**: Set the Status Flag of PullUps in CPIO Mode.

GPiOPullUpsStatus=GPIO\_PULLUPS\_SPI\_SS|GPIO\_PULLUPS\_SPI\_MOSI|GPIO\_PULLUPS\_SPI\_MISO|GPIO\_PULLUPS\_SPI\_SCLK|GPIO\_PULLUPS\_I2C\_SDA|GPIO\_PULLUPS\_I2C\_SCL|GPIO\_PULLUPS\_IOCONTROL|GPIO\_PULLUPS\_5VCONTROL

- s. **GPIOOutputStatus**: Set the Status Flag of IOOutput in CPIO Mode.

GPIOOutputStatus=GPIO\_OUTPUT\_SPI\_SS|GPIO\_OUTPUT\_SPI\_MOSI|GPIO\_OUTPUT\_SPI\_MISO|GPIO\_OUTPUT\_SPI\_SCLK|GPIO\_OUTPUT\_I2C\_SDA|GPIO\_OUTPUT\_I2C\_SCL|GPIO\_OUTPUT\_IOCONTROL|GPIO\_OUTPUT\_5VCONTROL

- t. **GetGPIOInputStatus**: Set the Status Flag of Input in CPIO Mode.  
GetGPIOInputStatus=true

- u. **SetDelayTime**: Set the shortest Delay Time to 10us, the longest Delay Time is 655350us (655.35ms).  
SetDelayTime=655

- v. **Loop...END LOOP**: Loop Command  
LOOP 10  
ModeStatus=FTXX\_I2CMODE|FTXX\_SPIMODE|FTXX\_GPIOMODE  
ModeStatus=FTXX\_GPIOMODE  
I2CFunctionStatus=I2C\_I2CMASTER  
I2CBitRate=400  
I2CSlaveAddress=80  
I2CMasterModeTxData=[00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f  
10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f  
20 21]  
END LOOP

- w. **DELAY Time(ms)**  
DELAY 20000

- GPIOBatchMode Command

**SetGPIOBatchModeOutputData**: Set the **OutputData** of Batch in GPIO Mode, the Start



and End of the Data is judged by “[ “ and ”]” respectively. The OutputData can be displayed in the line folding mode, see the below:

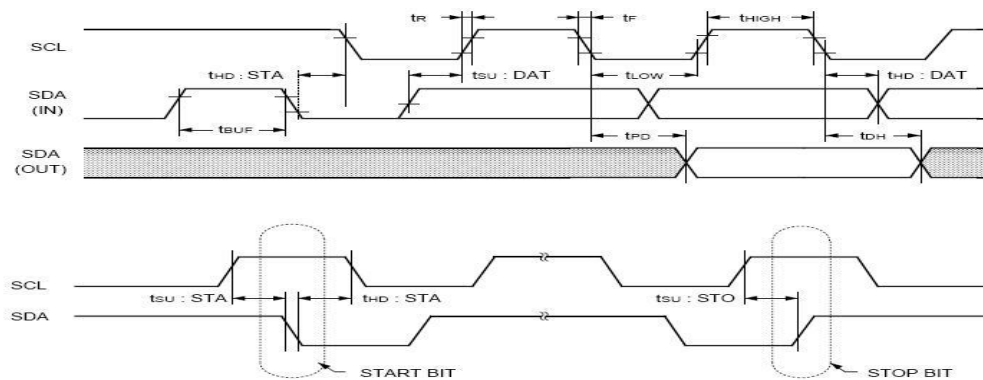
```
SetGPIOBatchModeOutputData=[00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f
10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f
20 21]
```

## 4.7 I2C Monitor

When the I2C-SPI Control Center is used for monitoring, it can monitor the Transmission status of the Data between I2C Master and Slave.

**Notice:** The highest SCL Bit Rate is 150KHz. When the SCL Bit Rate exceeds 150KHz, it can not be ensured that the received data is correct.

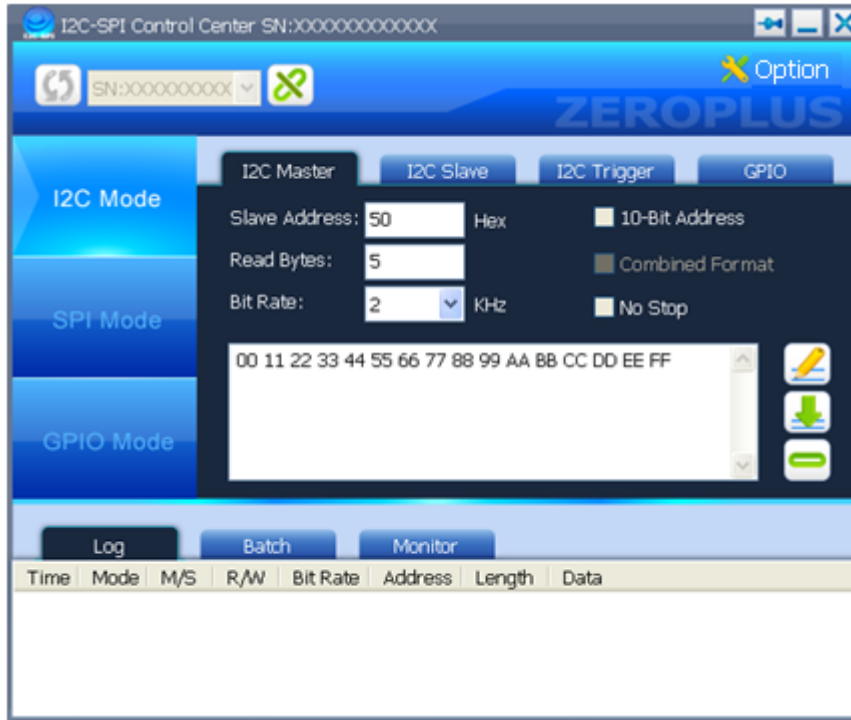
I2C Monitor Mode Timing:



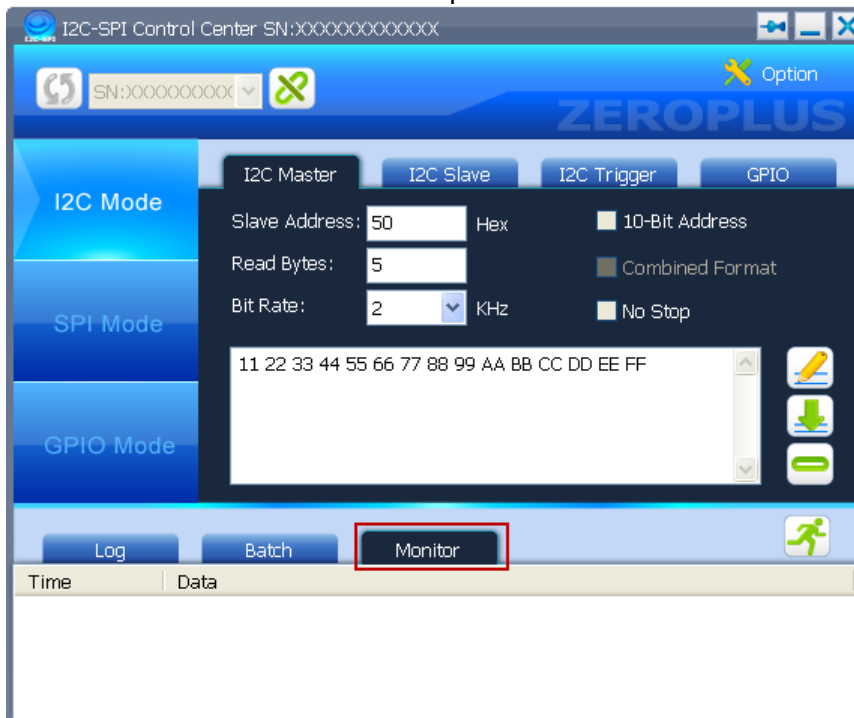
Parameter	Timing
tUS:STA	> 3.3uS
tHD:STA	> 3.3uS
tSU:STO	> 3.3uS
tLOW	> 3.3uS
tHIGH	> 3.3uS
tSU:DAT	> 1.6uS
tHD:DAT	> 1.6uS



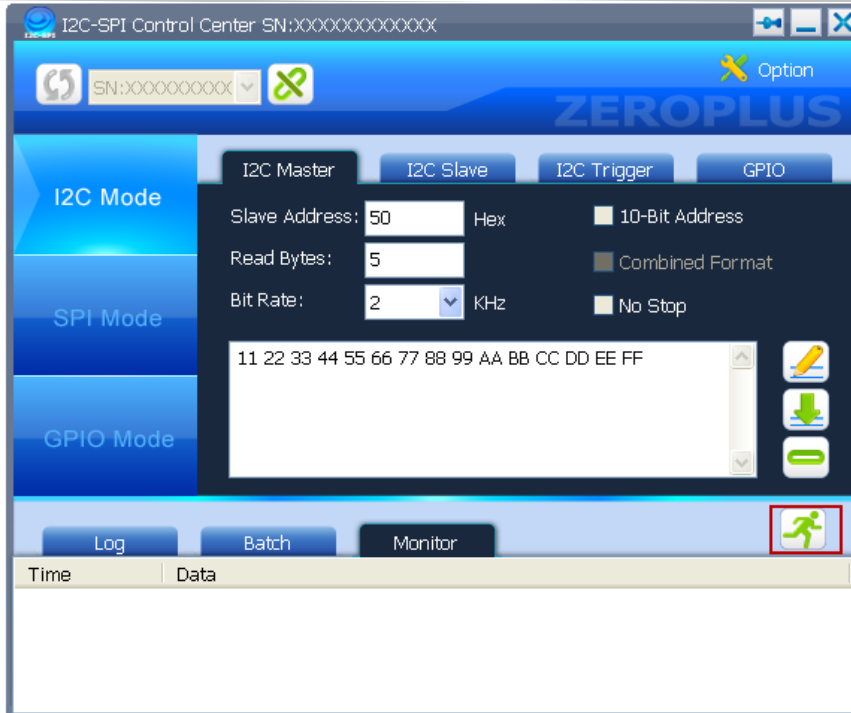
**STEP 1.** Activate the software to select a I2C-SPI Control Center Hardware, and then press the Connect button.



**STEP 2.** Select the I2C Mode and press the I2C Monitor tab.

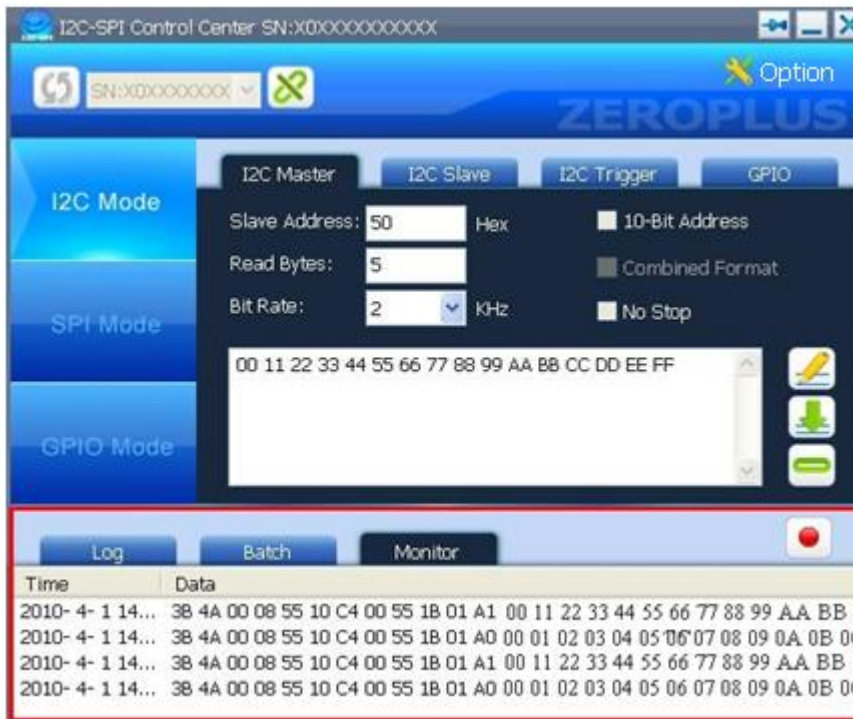


**STEP 3.** Press the Run button to perform the Monitor function.



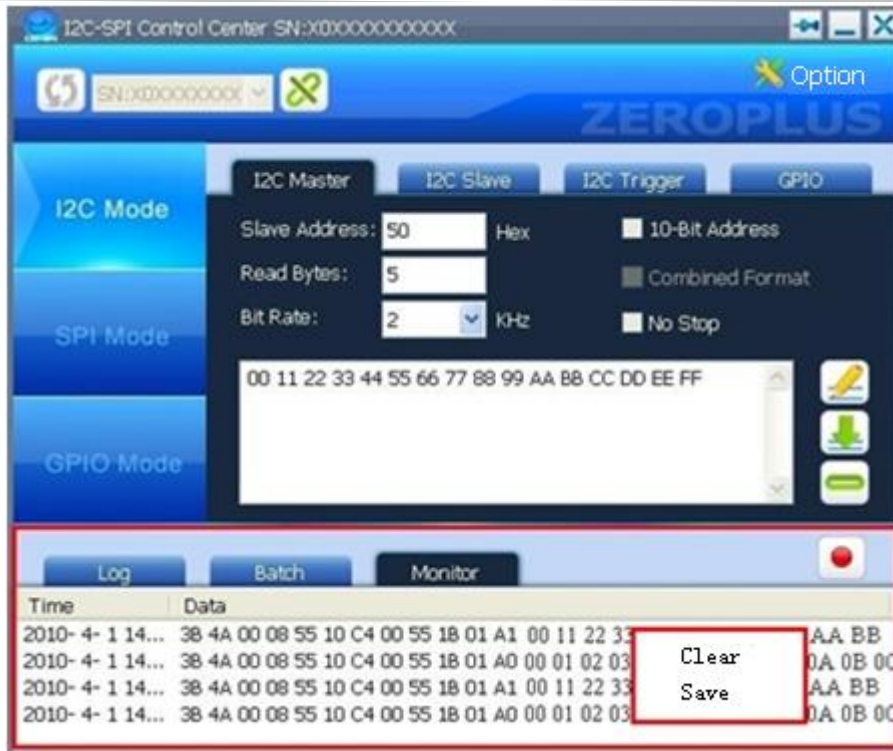
**STEP 4.** Read and write the Data between I2C Master and Slave.

**STEP 5.** When the data between I2C Master and Slave is read or written, the I2C Monitor will monitor the Read/Written data.



**STEP 6.** Select an entry, and then press the Right key on the mouse. Next, select Clear or Save to clear or save the current information on the Monitor window.





## 4.8 I2C Master sample

### How to read data from Slave Register

Take A (I2C-SPI) as Master, B (user device) as Slave.

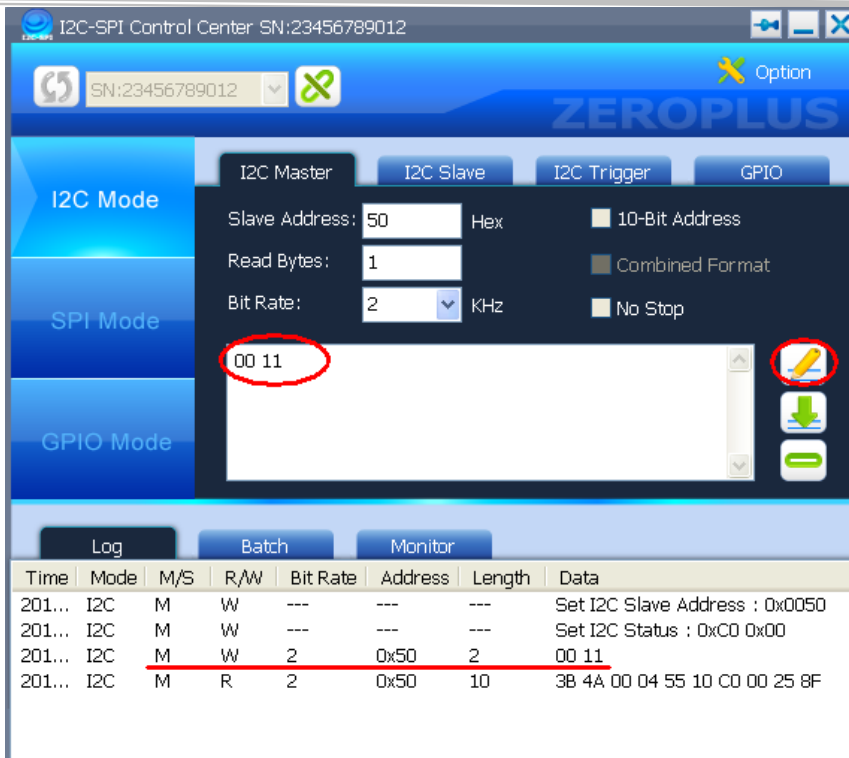
An example of communication between A and B is used as the description.

**Note** Only for example, not for practical using.

For an example, the “Write” data format as CMD, Para0, Para1 ..... defined between Master and Slave. CMD is 0x00, that represents Master want to read the data in Slave, and the Para0 represents the Register address where Master will read data start with. If wants to read the data of Slave register 0, Master needs to send CMD, Para0 to Slave according to the defined data format to inform Slave. Before reading, the Read Bytes of I2C-SPI Master needs to be set 1. The operation steps are as follow.

**STEP 1.** Connect the software and hardware properly.

**STEP 2.** Input 00 11 on Master as follow. 00 is CMD value, and 11 is the Register address of Slave. Then press “Write” button. The transmitted information is displayed in the Log window.

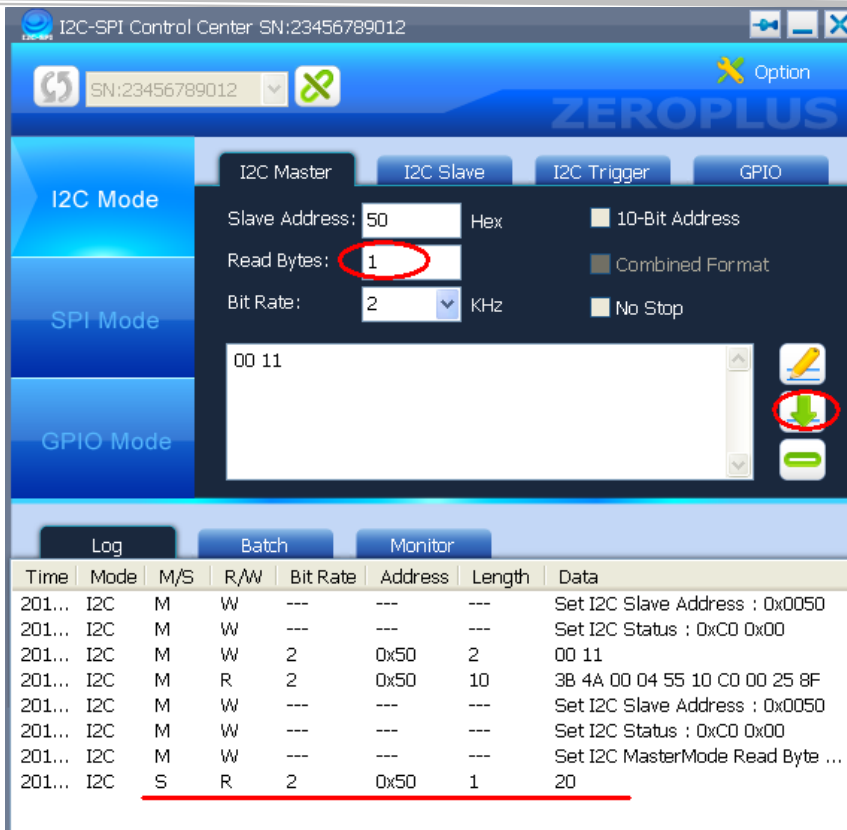


**Note** The 3B 4A 00 04.....are the status message from Master or Slave.

- Write command, and the connection between software and hardware is incorrect.  
The message is 3B 4A 00 04...01 26 8F.
- Write command, and the connection is correct.  
The message is 3B 4A 00 04...00 25 8F.
- Read command, and the connection is incorrect.  
The message is 3B 4A 00 04...02 27 8F.
- Read command, and the connection is correct.  
The message is the data from Slave register.

**STEP 3.** When receiving the data, Slave knows that Master want to read data from the 0x11 Register.

**STEP 4.** Before reading, set the Read Bytes to 1 in the Master. The read response on the Master is follow. The 0x20 is the data in the 0x11 Slave Register.



**STEP 5.** The communication is completed.