

# Zeroplus Logic Analyzer Multi-LA Stack and LA-Oscilloscope Stack



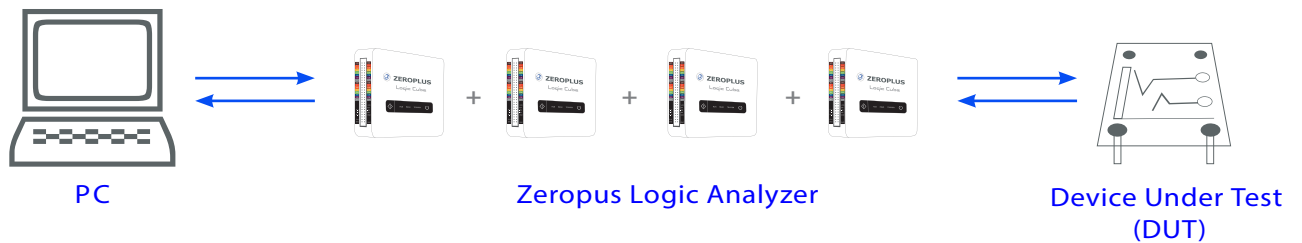
## Preface

As digital technology develops, new 3C products continuously come into the market. To help engineers to release their products earlier, Zeroplus Technology provides more than a hundred bus protocols along with powerful hardware and software, engineers could use them to develop and debug much quickly and accurately. Zeroplus LA is a must tool for debugging or signal analyzing.



## Enough Channel Quantity and RAM Size

RAM size is an important key to purchase Logic Analyzer. It concerns time length of captured signal and data amount. During product developing, developers always want to capture complete signal at one time to help their analyzing and debugging. Based on that, Zeroplus LA provides multi-LA stack function. If users want to do long-time measuring, they could connect two or more LAs with the computer to expand RAM size and channel quantity, so as to make the best use of LA.

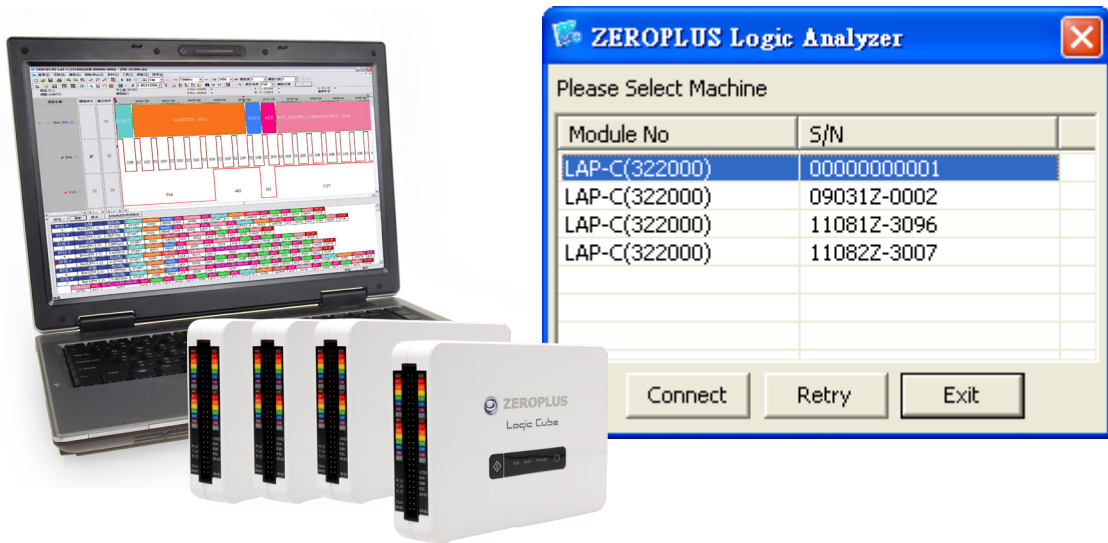


▲ Fig. 1 : Multi-LA Stack

See Fig. 1, connect one LA with PC, after PC identify it, connect OUT with it and connect synchronism channels between LAs.

# Zeroplus Logic Analyzer ~ Multi-LA Stack

Examples in this article are made by LAP-C(322000)



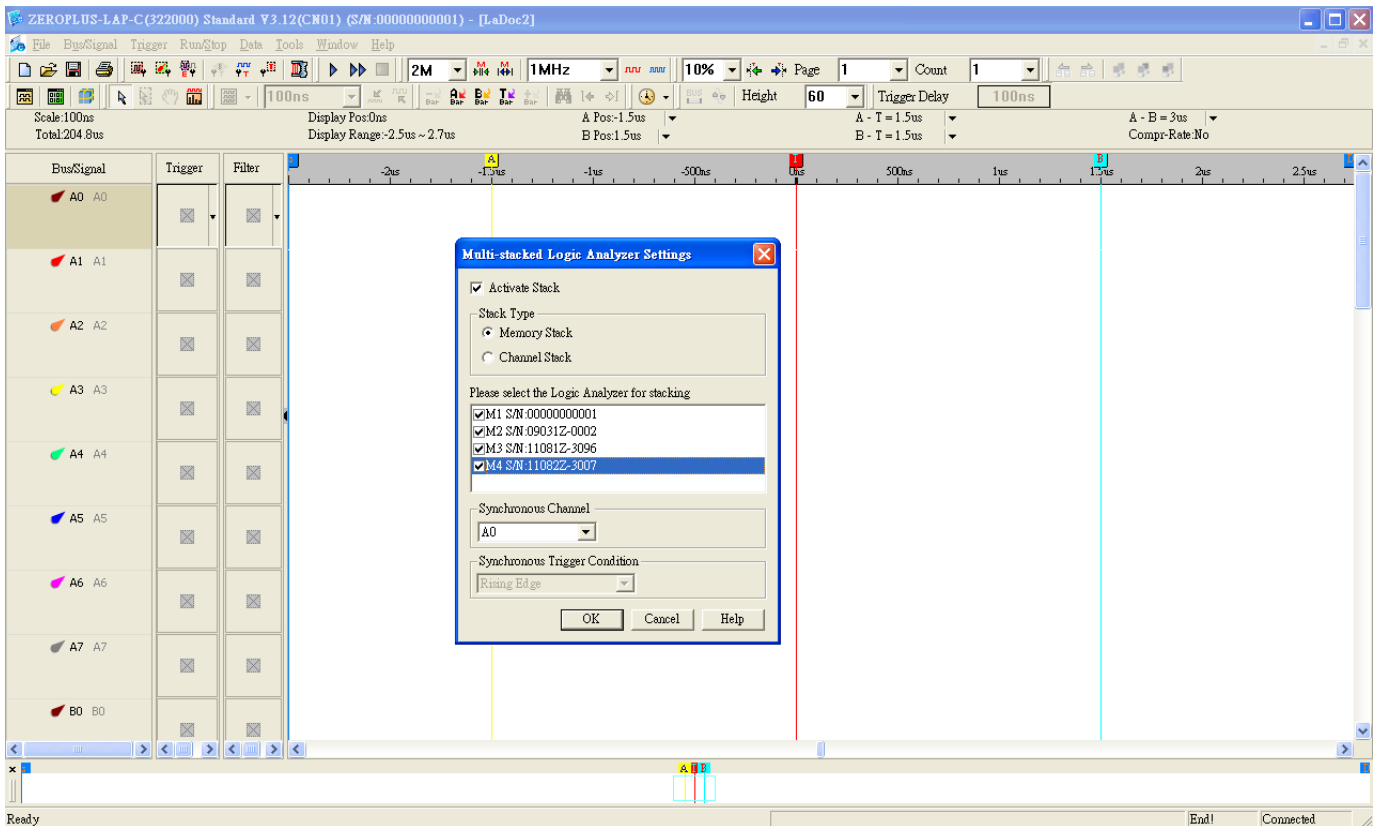
▲ Fig. 2 : 4 LAs are stacked

When PC connecting with many LAs, a dialog box will appear after software opened, users shall select one LA as master, the software would consider the other three as slaves automatically.

**Note:**

4 LAs could be stacked at most for Zeroplus LAP-C Series, and only models with 32 channels support this function.

**Zeroplus Logic Analyzer ~ Multi-LA Stack**

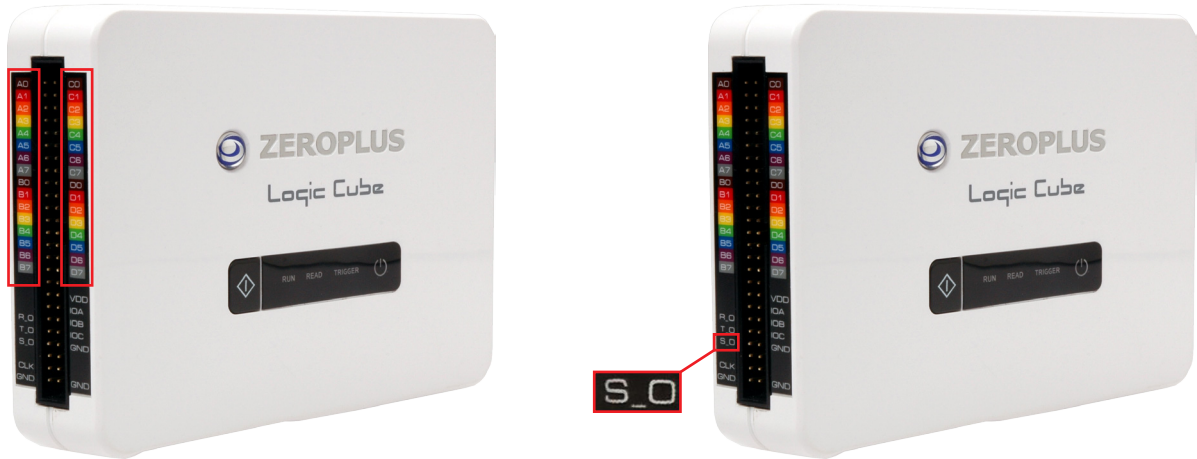


▲ Fig. 3 : Multi-LA Stack Settings

Select 'Multi-stacked Logic Analyzer Settings' from Tool menu to open the setting dialog box, see Fig. 3; in it, select stack mode (memory stack or channel stack) and select one channel as synchronism channel to transmit synchronism signal.

Take LAP-C(322000) as an example, if 4 LAs are memory stacked, then 31 channels are left but RAM size expands to 8M per channel. Fig. 4 shows the synchronism channel used to memory stack and channel stack.

Zeroplus Logic Analyzer ~ Multi-LA Stack



▲ Fig. 4 : synchronism channel: any input channel (channel stack), S\_O channel (memory stack)

For channel stack, the synchronism channel can be any one channel. If use A2, that means A2 channels of all LAs are parallel connected and receive one pin signal of object under test synchro, so every LA could trigger synchronously.

For memory stack, S\_O of each LA shall be connected with the synchronism channel, such as A2, and connect S\_O of the first LA with A2 of the second LA, S\_O of the second LA with A2 of the third LA, and the like.

Zeroplus Logic Analyzer ~ Multi-LA Stack

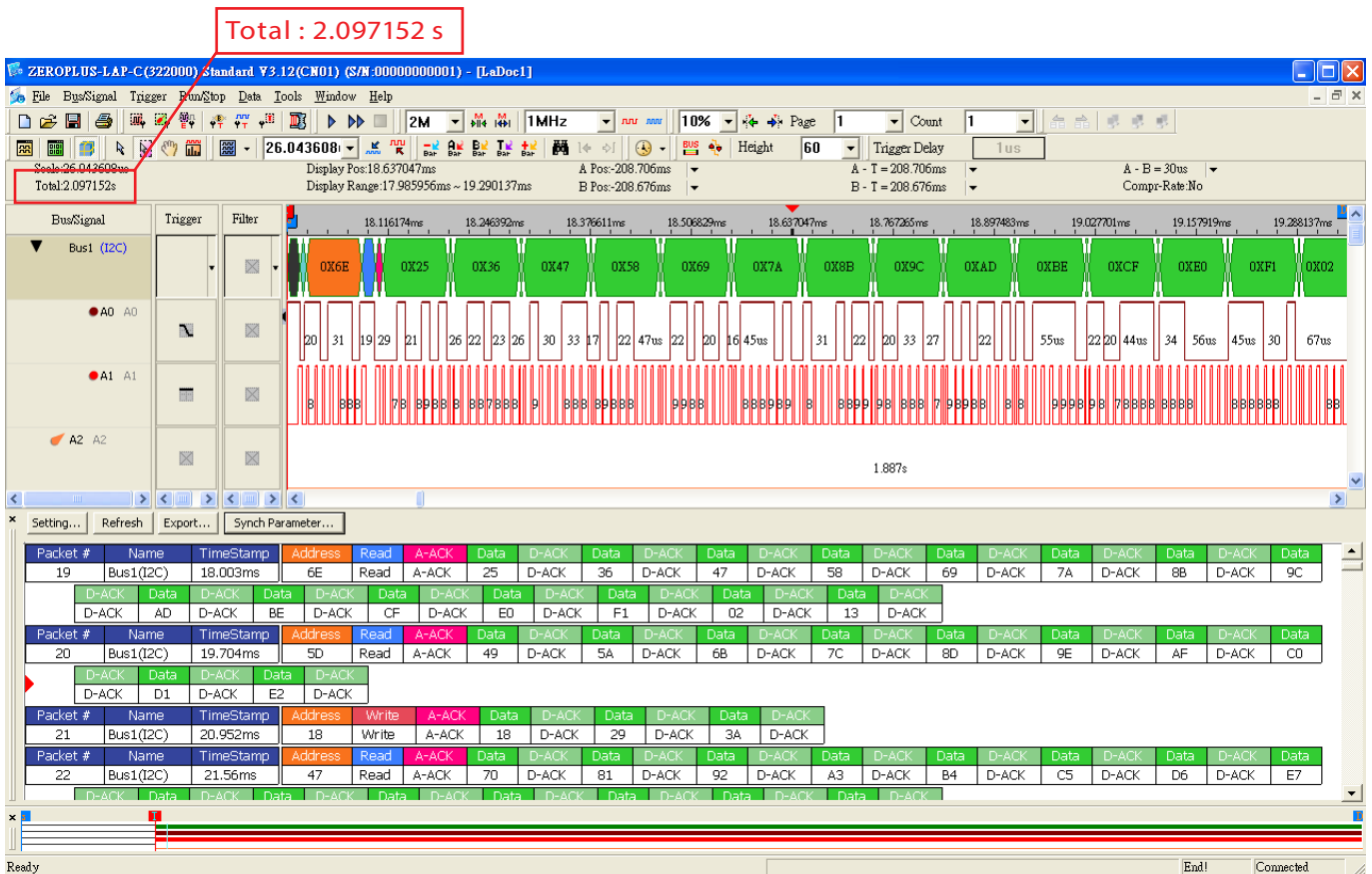
**Memory Stack**

Bus I2C is widely used in electronic products. Take EEPROM read/write data for an example, sometimes users need to analyze statuses of many MCUs and those written into the register, but because of limited memory depth, the problem signal data can't be captured. Now is time to use memory stack to increase memory depth. Below are the cases of testing of continuous signal of I2C standard mode (100 Kbit/s) with/without memory stack.

**One LA is used to measure**

Fig. 5 : (without memory stack)

With 1 MHz and 2M RAM, the time length of captured I2C signal is 2.097152s.



▲ Fig. 5 : the time of signal captured by one LA

Note : the time of signal captured calculating by the way below :

Total RAM size : 2M = 2 \* 1024 \* 1024 = 2,097,152bits

Sampling frequency : 1MHz = 1/1 ≙ 1us

Result : 2,097,152bits \* 1us ≙ 2.097152s

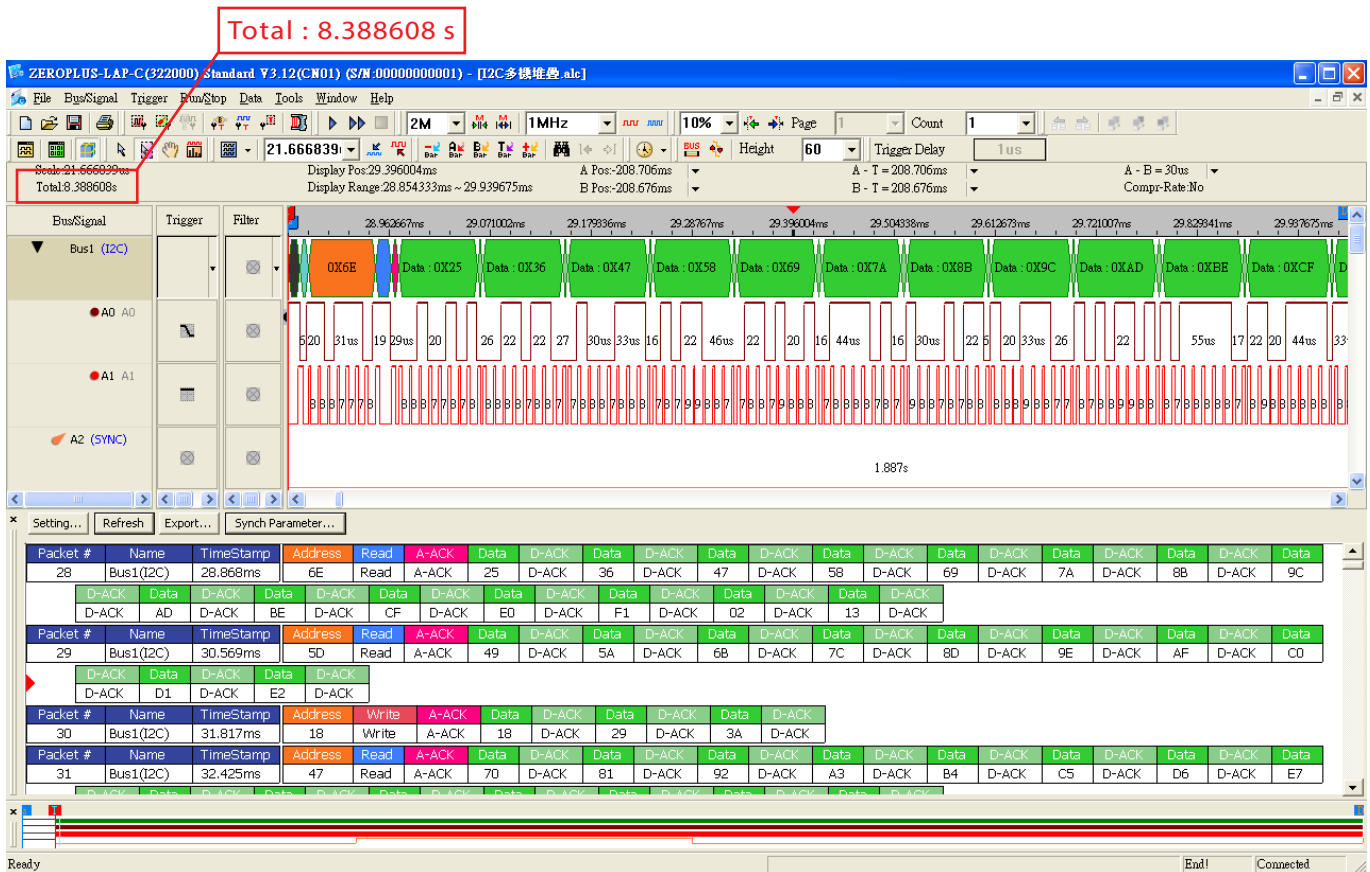
Zeroplus Logic Analyzer ~ Multi-LA Stack

**Memory Stack**

..... 4 LAs are used to measure (memory stack) .....

Fig. 6 : (with memory stack)

With 1 Mhz and 2M RAM, the time length of captured I2C signal is 8.388608s.



▲ Fig. 6 : the time of signal captured by four LAs

With memory stack, the time increased by 4 times [ 2.097152 (s) \* 4 (LA) = 8.388608 (s) ]. In this way users could capture much more signal.

Zeroplus Logic Analyzer ~ Multi-LA Stack

**Memory Stack**

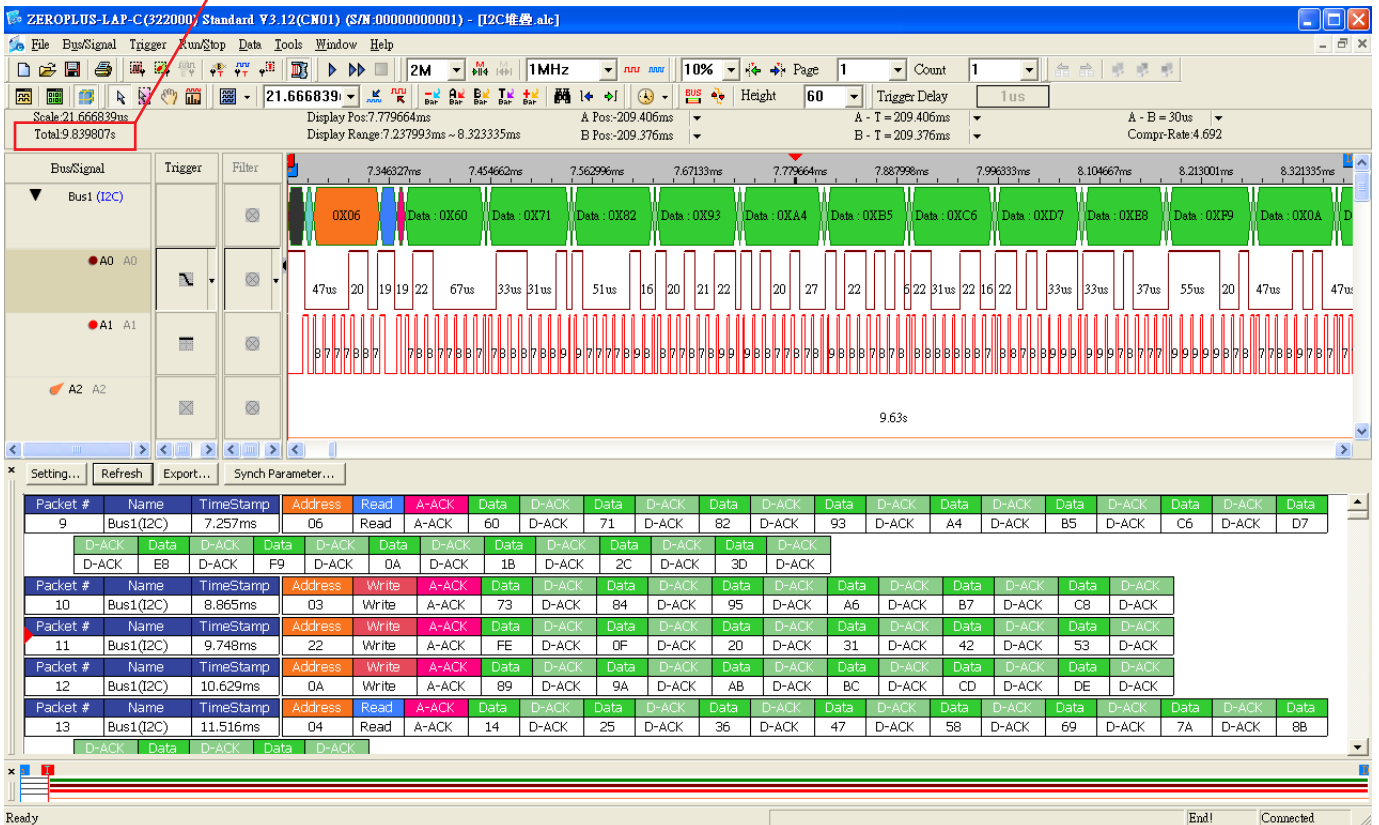
How to let LA capture more signal ?

There are 4 status of digital signal - High, Low, Rising Edge and Falling Edge. With the technology of hardware compression and software decompression, Zeroplus LA could process the signal through input port, judge its status and only keep the signal of edge status, so as to optimize the memory storage. Use "stack" and "compression" at same time, much more signal could be captured. (Below is a simple comparison.)

**Compression of one LA**

With compression activated, the time of captured signal is 9.839807 s.

Total: 9.839807 s



▲ Fig. 7 : Compression is activated in one LA.

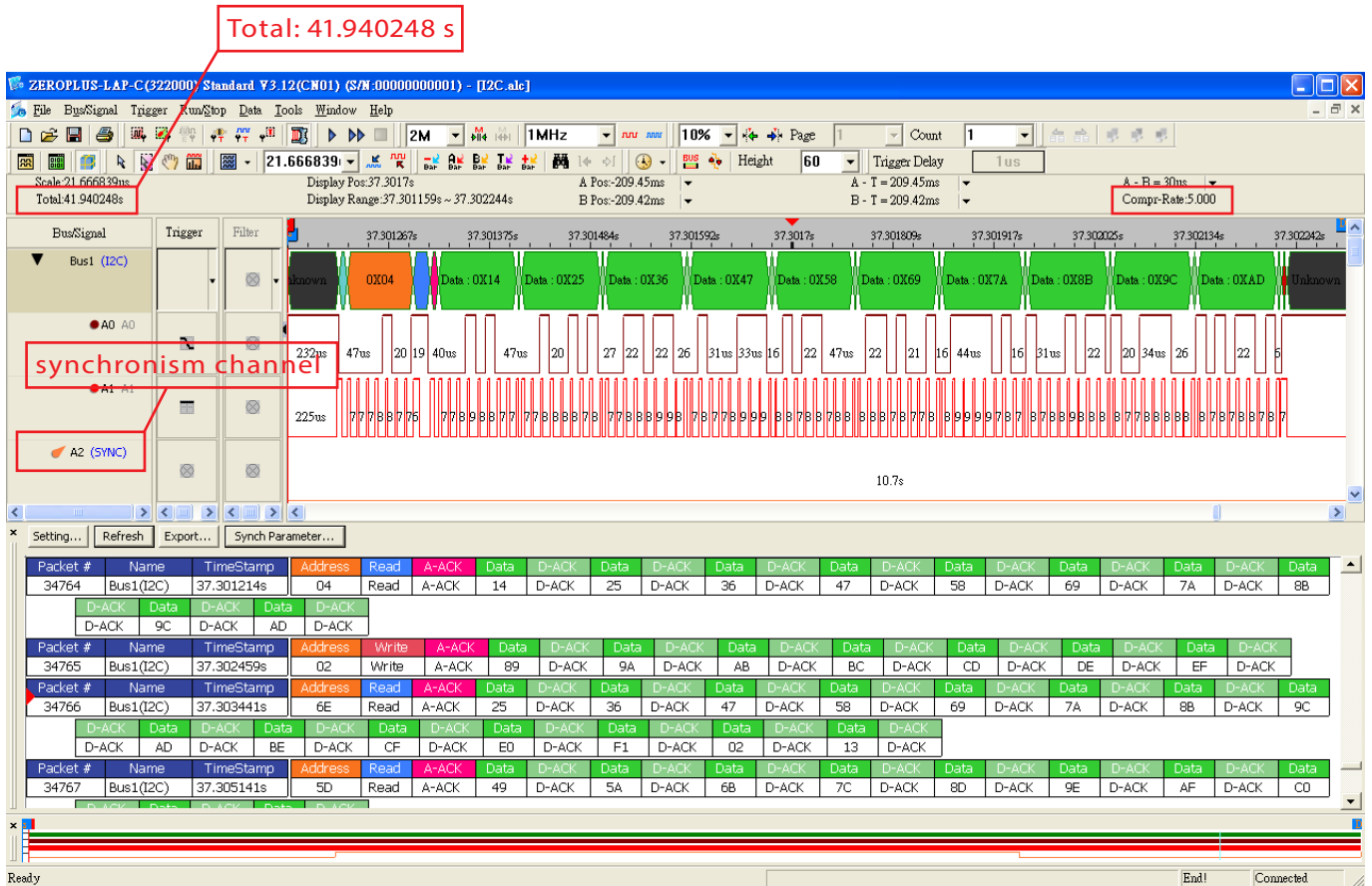


Zeroplus Logic Analyzer ~ Multi-LA Stack

**Memory Stack**

**Compression of 4 stacked LAs**

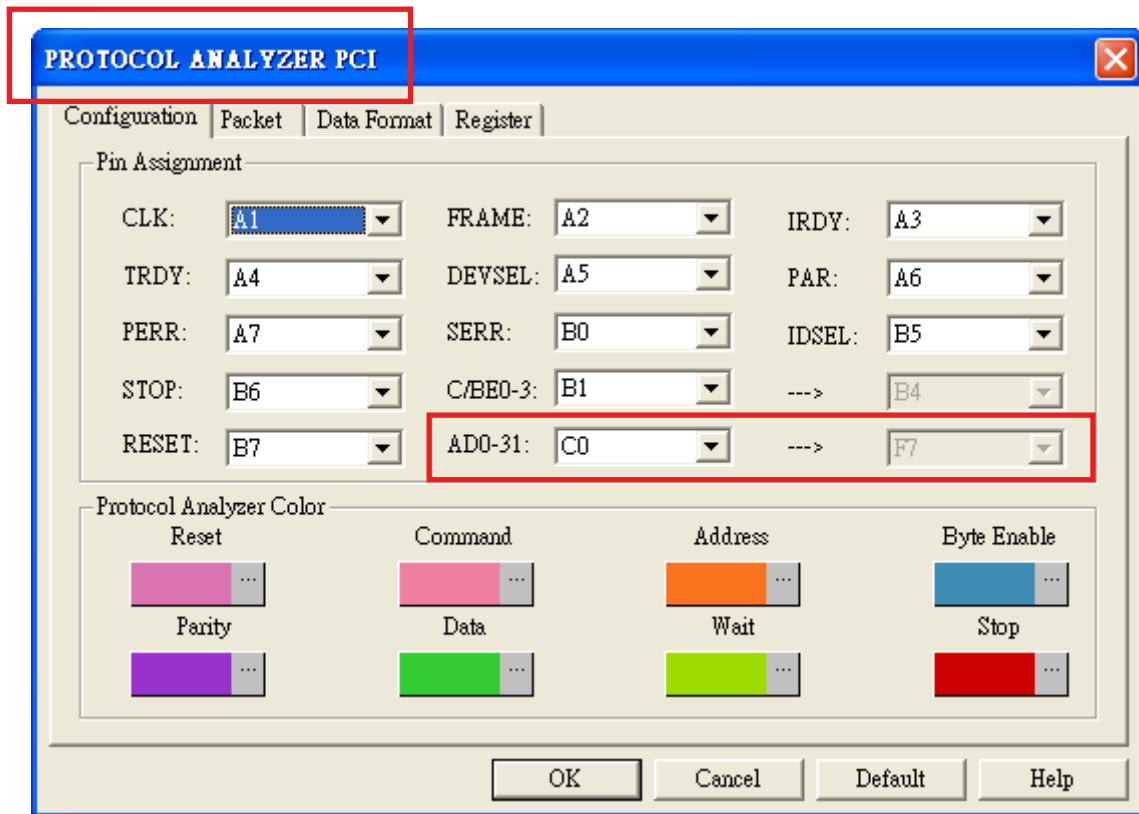
For example as fig. 8 shows, the time of captured signal is 41.940248 s by compression of 4 stacked LA, and you can see the capture time from the fig 8 is not integer multiples add to the fig. 7 (9.839614s). The reason is because of compression technology is only saves signal of edge status from user DUT on logic analyzer, so if the DUT is very high frequency to change signal of logic status, then also on behalf of the RAM have been occupied by more edge signals from the DUT.



▲ Fig. 8 : Compression is activated after stack

When measuring some bus protocols that needing lots of channels, such as PCI, or measuring multi-device at the same time, engineers often feel frustrated about insufficient channels. Our channel stack function provide the great solution to them!

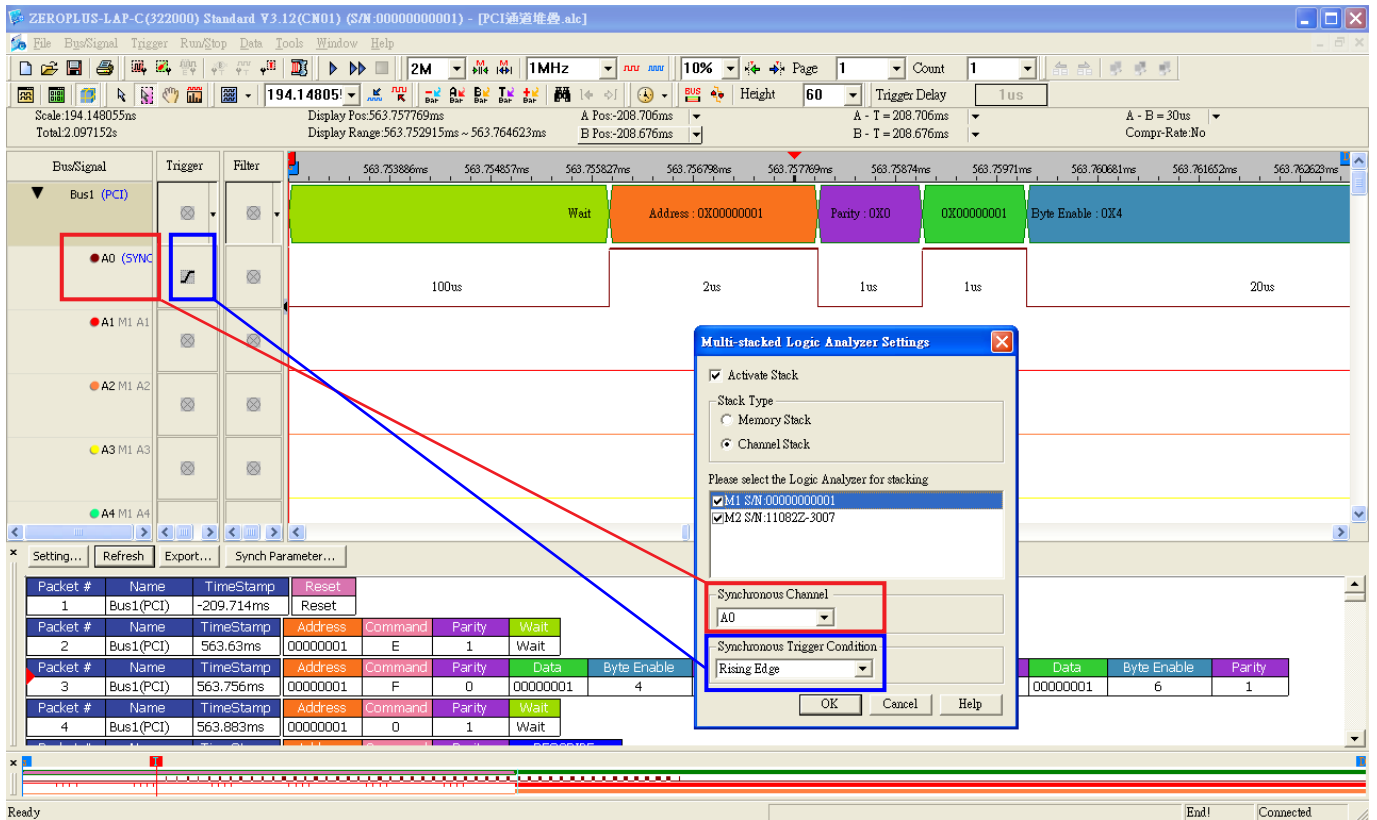
Take PCI protocol as an example, the parameter AD0-31 alone needs 32 channels. Users could take two Zeroplus LAP-C(322000) LAs to do channel stack, so as to meet multi-channel measure need!



▲ Fig. 9 : PCI Parameter Settings

## Zeroplus Logic Analyzer ~ Multi-LA Stack

## Channel Stack



▲ Fig. 10 : Channel stack is activated

As Fig. 10 shows, users shall set one synchronism channel also, and besides one synchronism trigger condition. When the signal received by the synchronism channel fits the trigger condition, the signal captured by all LAs would do data aligning.

Below table shows the difference between these two stack modes of Zeroplus LAP-C(322000).

LA Quantity Mode	One LA	Two LAs (stack)	Three LAs (stack)	Four LAs (stack)
Memory Stack	2 M	4 M	6 M	8 M
Channel Stack	32	62	93	124

▲ Tab. 1 Comparison of Two Stack Modes

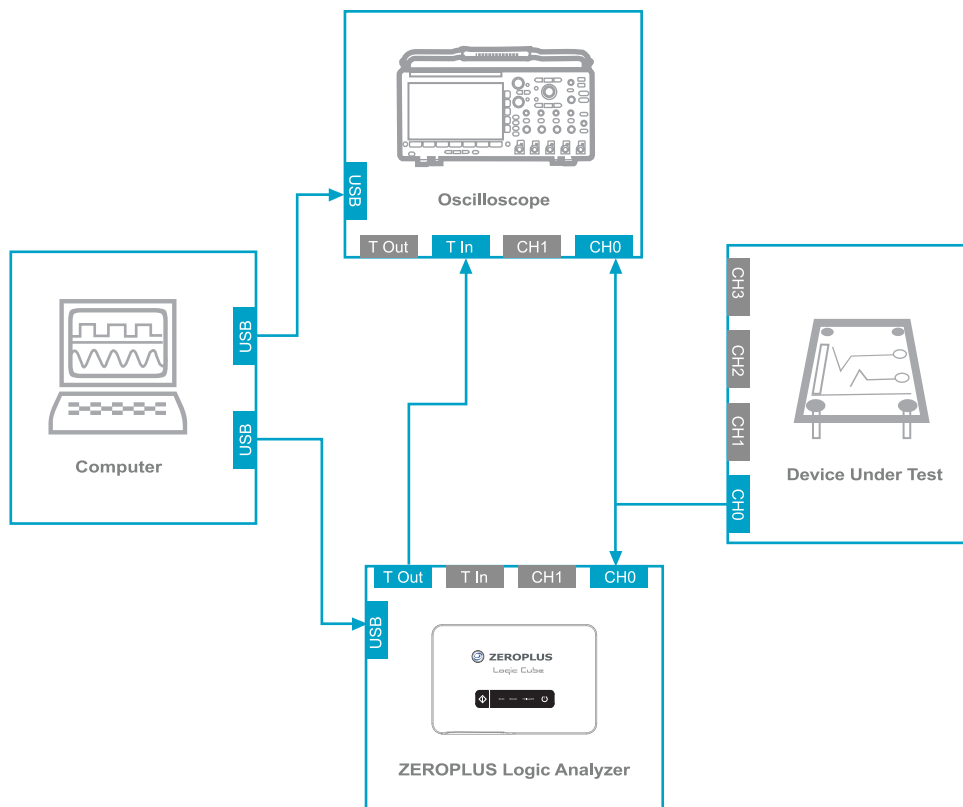
Using instruments flexibly is the good way to meet the communication specification of different kinds within all projects when debugging. That helps products come into the market earlier !

## Analog and Digital Signals Could Be Displayed Together

How to win in the fierce-competition digital area ? As the saying goes, ' Good tools are prerequisite to the successful execution of a job. ' Zeroplus LA supports stacking with Oscilloscope, and that could allow analog and digital signals be displayed together when developing DAC and ADC projects.

### Zeroplus Logic Analyzer ~ LA-Oscilloscope Stack

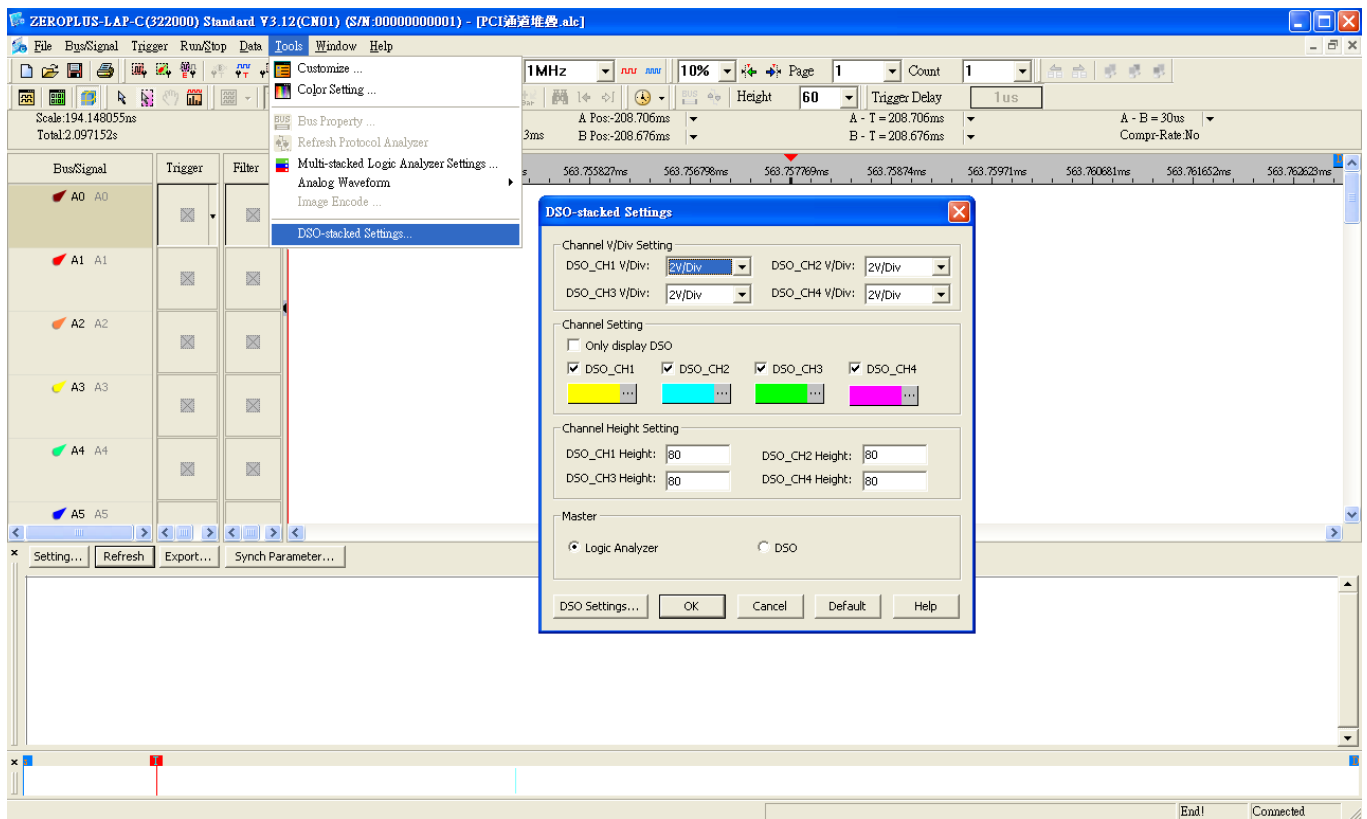
LA - Oscilloscope stack is often used in DAC and ADC developing if digital and analog signals need to be analyzed together. Users could set the Oscilloscope and display its waveform in LA software.



▲ Fig. 11 : Structure of LA-Oscilloscope Stack

**Zeroplus Logic Analyzer ~ LA-Oscilloscope Stack**

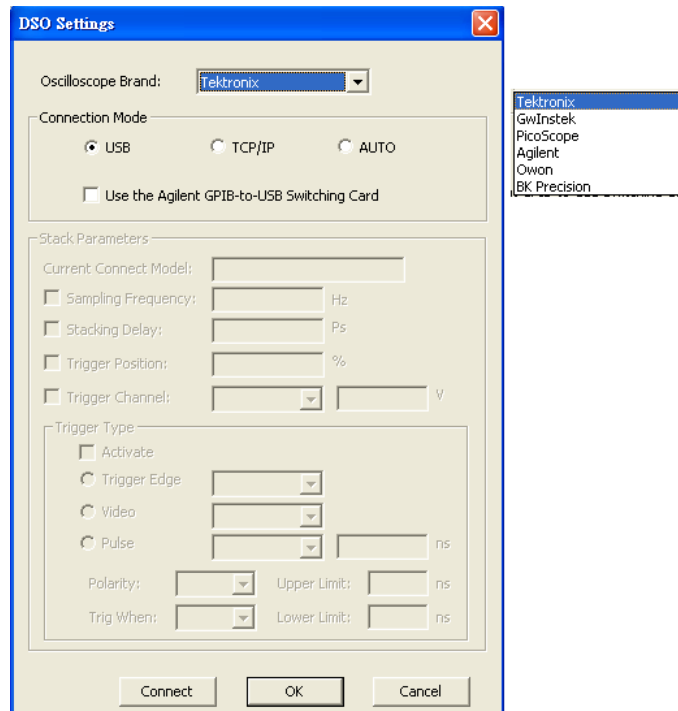
For example as fig. 11 shows, the connect Oscilloscope and LA with PC through USB port, then can use the LA channel hook and Oscilloscope probe together with the device under test (DUT), at last connect T\_O of LA with T\_I of Oscilloscope, that's done for the stack. When if trigger of the conditions are satisfied in LA, will the LA at the same time, it would inform Oscilloscope by sending synchronism signal through T\_O, and then PC would display 2 type signals (Digital and Analog) of both instrument in the software.



▲ Fig. 12 : LA-Oscilloscope Stack Setting Interface

**Zeroplus Logic Analyzer ~ LA-Oscilloscope Stack**

Select 'DSO-stacked Settings' from Tool menu, in the opened dialog box set the mode of the software to display the data transmitted by Oscilloscope (supporting only 4 channels). Click the button 'DSO Settings' to set the Oscilloscope. See Fig. 13.



▲ Fig. 13 : Select Oscilloscope model.

So far Zeroplus LA could stack with Oscilloscope of Tektronix, Gwinstek, Picoscope, Agilent, Owon and BK Precision, see Tab. 2.

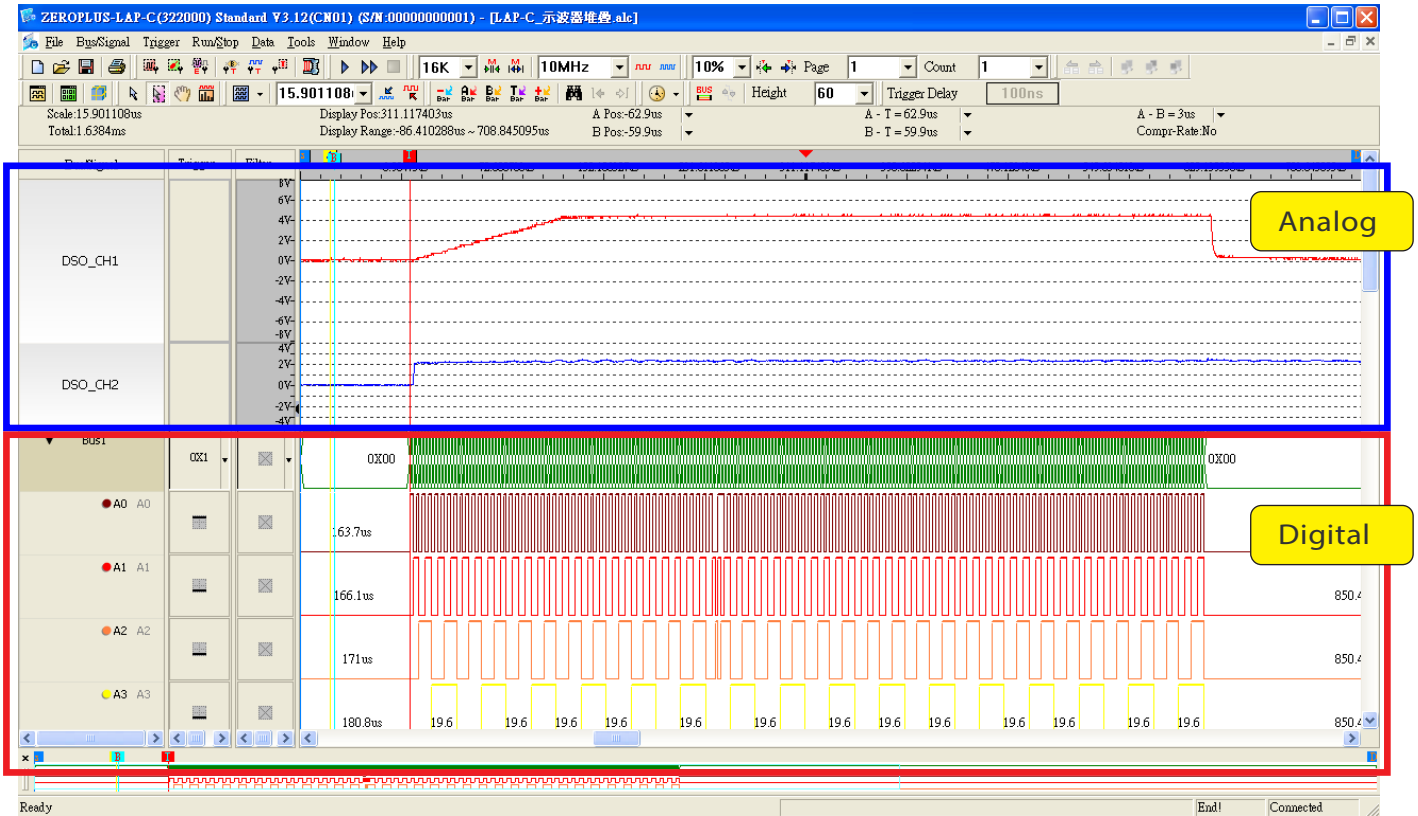
Oscilloscope Manufacture	Models	On-line Mode
Tektronix	TDS1000 Series	USB
	TDS2000 Series	USB
	TDS3000 Series	USB, TC/IP, GPIB
	TDS5000 Series	GPIB
	TDS6000 Series	In-built GPIB
OWON	SDS7102 Model	USB
PicoScope	3206B Series	USB
GwInstek	GDS-1000A Series	USB
	GDS-3000 Series	USB
Agilent	DSO 5000 Series	USB
BK Precision	2540B, 2542B, 2540B-GEN, 2542B-GEN	USB

▲ Tab. 2 : Oscilloscope models and on-line modes supported by Zeroplus LA

**Zeroplus Logic Analyzer ~ LA-Oscilloscope Stack**

Example: LA-Oscilloscope Stack

Input a signal of 8 bits Up Counter (0~255) to DAC IC, then which DAC would convert it to 0 - 5V Voltage signal (Analog) and output it, see Fig. 14.



▲ Fig. 14 : Image of analog and digital signals displayed together.

In Fig. 14, we could see the parallel value (0x00 ~ 0xFF) transmitted by Up Counter in the digital signal. In the above analog signal, DSO\_CH1 is 0-5V voltage converted by DAC IC, and DSO\_CH2 is the synchronism signal of LA calling Oscilloscope. Comparing these two signals, we could understand the analog waveform change generated by inputting parallel value into DAC. When the trigger condition establishes, LA would call Oscilloscope by synchronism signal and display the captured signal in the software.

 **Summary**

Zeroplus LA is always a great helper for engineers. It not only provides more than one hundred protocol analyzers, which could help engineers solve various problems in circuit developing, but also has a powerful software, which could meet various requirements of signal measurement. Hope we can enter into the digital measurement era with our counterparts and work together to improve the capability of signal analyzing.

Instrument Division / FAE  
Sam