

**RIGOL** 唯有创新  
Innovation or nothing

# DS8000R Product Training

# Agenda

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- Product Introduction
- Product Operation
- Integrated Application
- Communication Mechanism
- Options & Accessories
- PC Software

# 科技之小黑 集成之大器



# Product Introduction

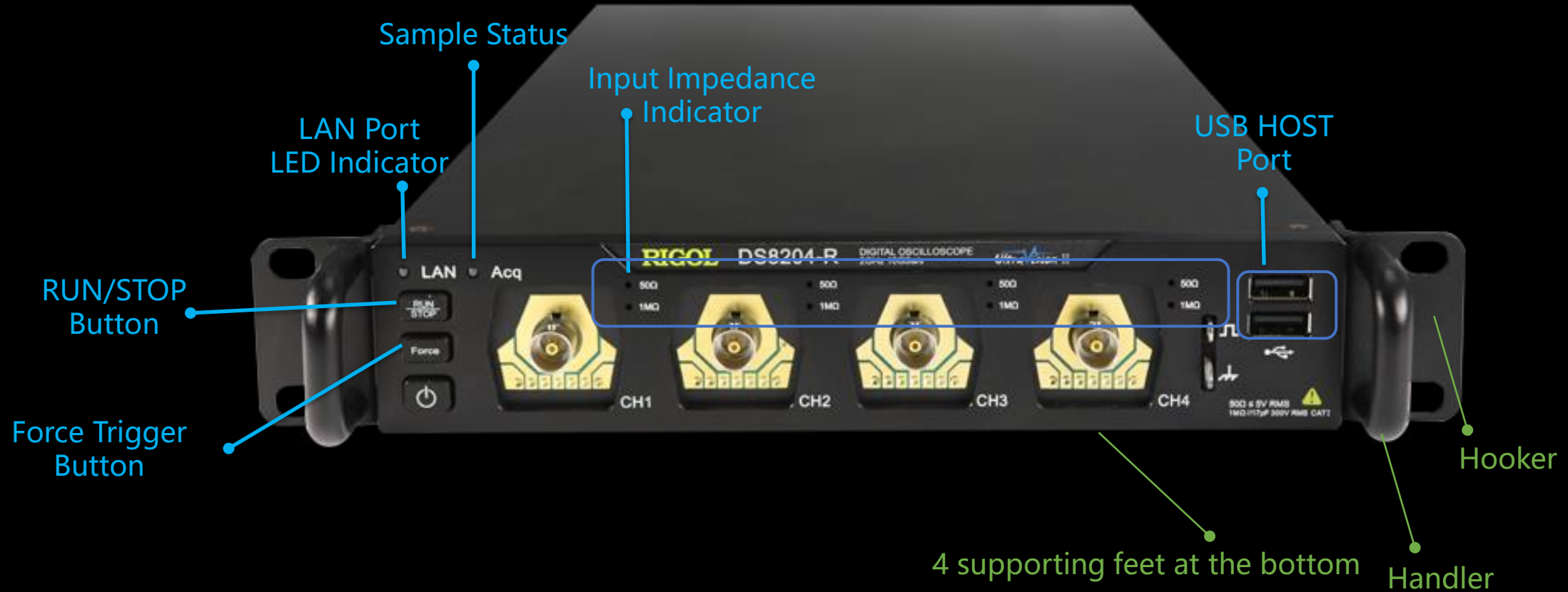


## DS8000-R Series:

- Analog channel bandwidth: 2GHz ,1GHz , 350MHz
- Ultra-thin design, small size, (1U height, half rack width)
- Low jitter, support multi-machine synchronization
- Support 10GbE SFP+ optical port high-speed data communication
- Can be expanded to 512 channels at most, supporting synchronous acquisition
- The lowest working temperature can reach -40°C
- As powerful analysis function as MSO8000

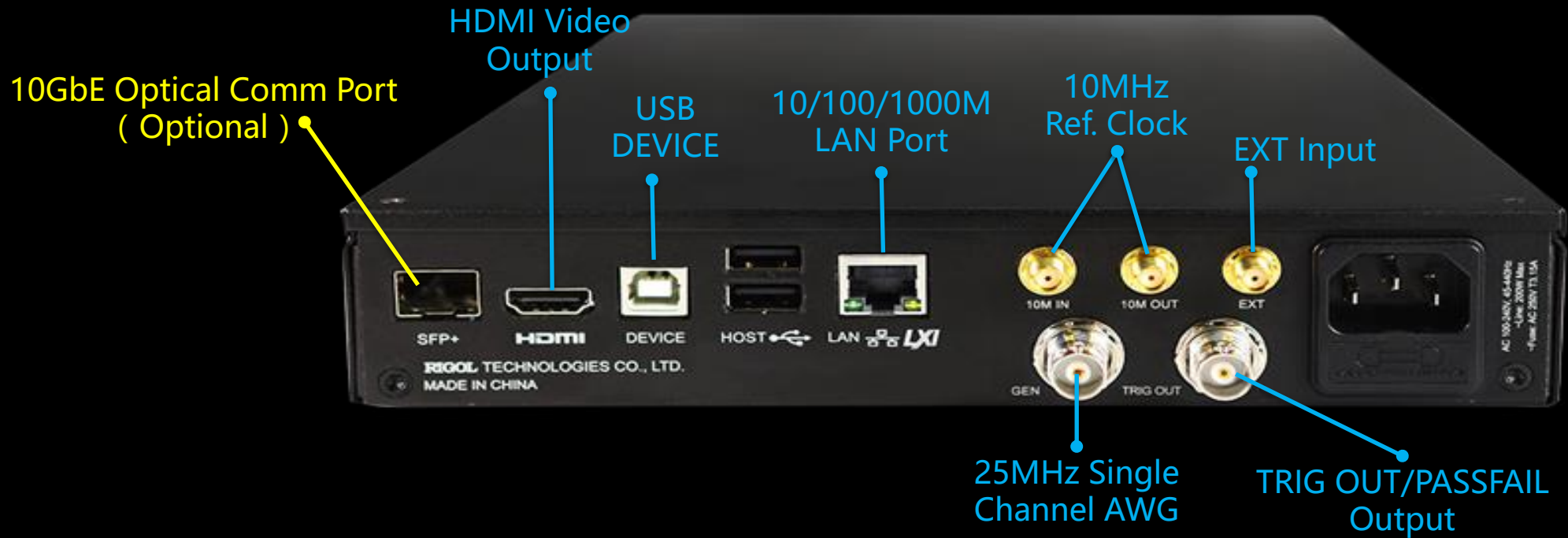
# Product Introduction

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# Product Introduction

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# Product Introduction—**BW & Sample Rate**

	50Ω	1MΩ
DS8204-R	2 GHz	500MHz
DS8104-R	1 GHz	500MHz

	Single-Channel	Dual-Channel	4-Channel
DS8204-R	10 GSa/s	5 GSa/s	2.5 GSa/s
DS8104-R	10 GSa/s	5 GSa/s	2.5 GSa/s

DS8000-R can reach 2GHz bandwidth only in single channel mode and half channel mode. Because in the four-channel mode, the maximum sampling rate can only reach 2.5GSa/s, which does not meet the Nyquist law, and can only collect signals up to 1GHz.



# Product Operation

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- HDMI high-definition interface to connect the display
- Mouse operation (click, double click, drag)
- Keyboard operation (number or character input)
- PC or mobile terminal remote control



# Integrated Application

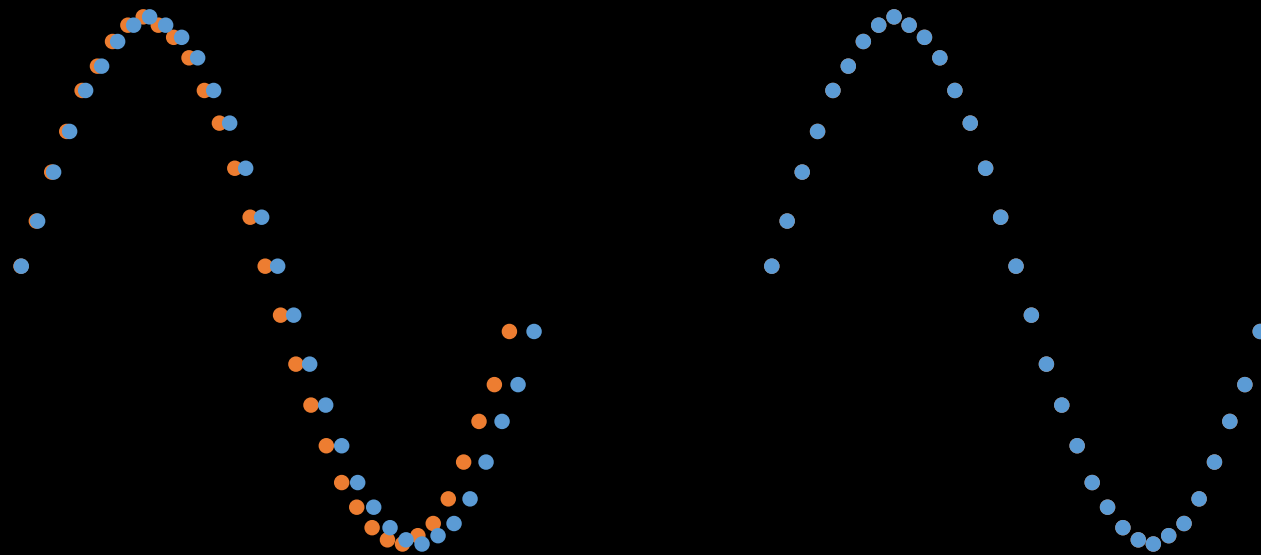
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- Can provide solutions for multi-channel high-speed data acquisition related applications,
- Applicable fields:
  - High energy physics (collect transient events, harsh working environment)
  - Automated test system (programming performance, compact space requirements)
- Support 128 oscilloscopes cascaded to use, expandable to 512 channels
  - Sampling clock synchronization
  - Trigger synchronization

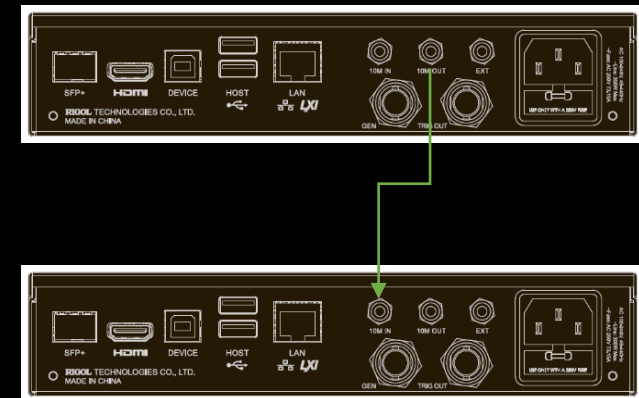
# Integrated Application

- Sampling clock synchronization



Clock is not synchronized

Clock synchronization



# Integrated Application

- External trigger synchronization (stand-alone)



EXT trigger jitter (stand-alone):  
Typical value: <200psRMS  
(extreme value <250ps)  
Normal sampling mode, edge  
trigger, the trigger level is near  
50% of the EXT input signal.

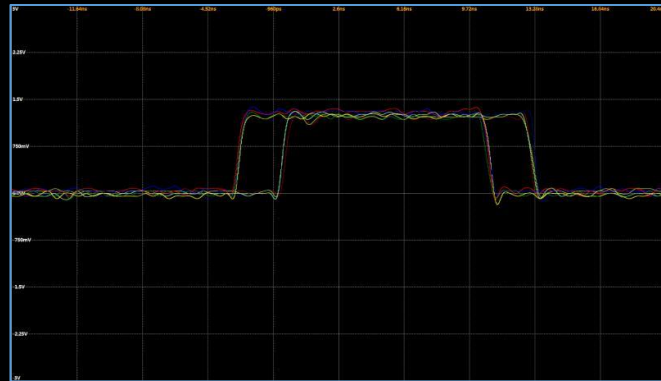
Support user manual calibration

Factory calibration of delay between channels

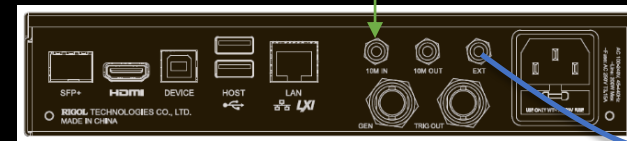
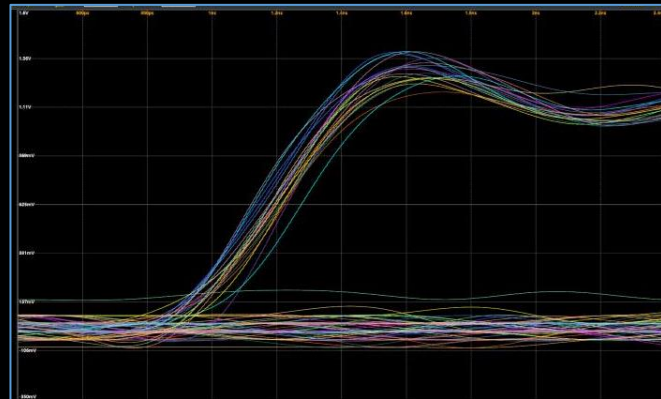
# Integrated Application

- External trigger synchronization (system)

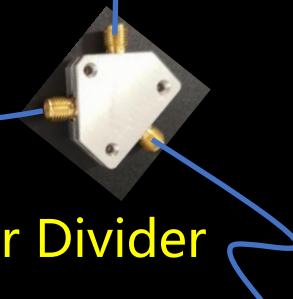
Not calibrated



After calibration

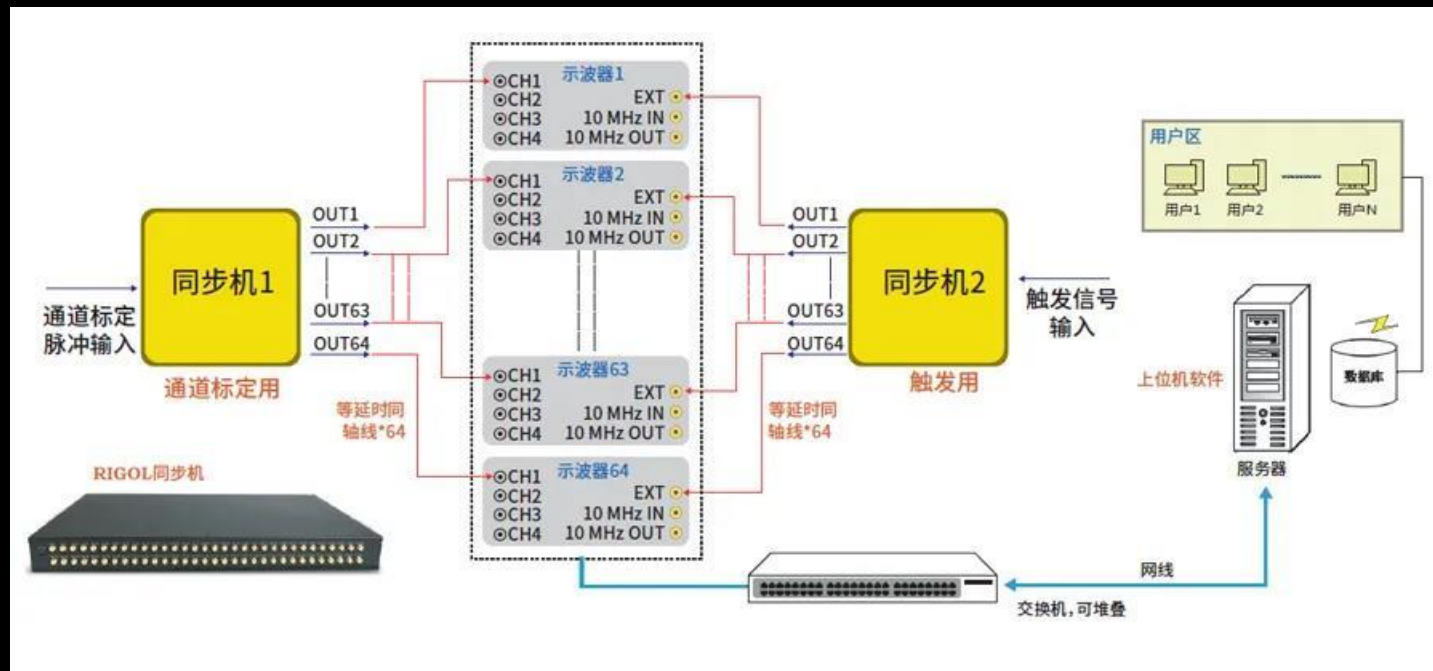


Power Divider  
PRSC42



# Integrated Application

- System calibration scheme



Synchronous machine DS SYNC64

EXT synchronous trigger (integrated system):

Typical value:  $\pm 100\text{ps}$  RMS jitter on each instrument, 150ps delay  
 $\leq 350\text{ps}$  RMS (extreme value  $\leq 500\text{ps}$ ) total time delay between instruments  
For sinusoidal input voltage  $\geq 500\text{mV}$ , it can be further improved by calibration

# Integrated Application

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- **Data transfer scheme (memory point)**

## 1. Passively read data

Through SCPI instruction, it is actively controlled by the PC program to read the waveform data of each channel sequentially.

The command set is the same as MSO8000.

**Advantage:** The user has the initiative.  
**Disadvantages:** Control commands and data can only be transmitted serially, with frequent interactions.

## 2. Proactively report data

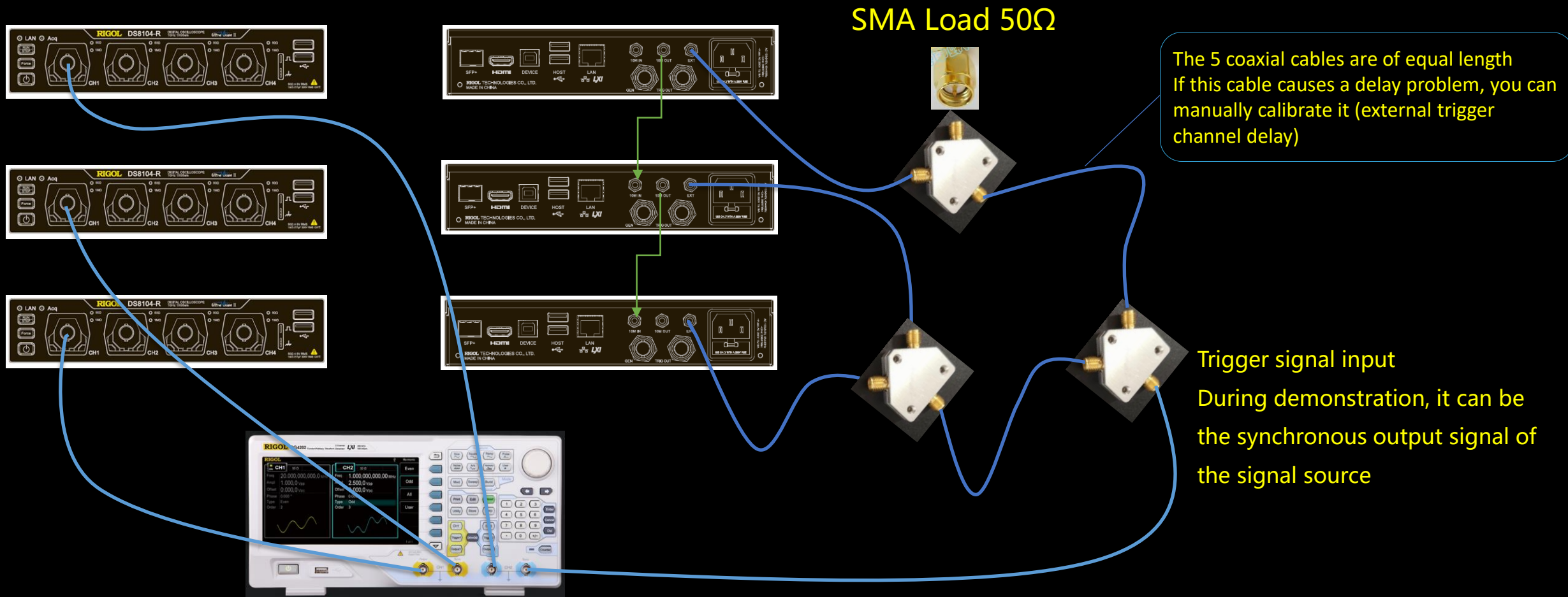
DS8000-R dedicated communication mode, the oscilloscope actively reports the instrument status and waveform data to the PC program according to the agreed rules.

Open source software toolkits and UltraDAQ use this data transfer method.

**Advantages:** parallel transmission, improving efficiency, mainly control commands;  
Synchronous data acquisition between multiple instruments (synchronous trigger);  
Support multi-channel waveform delay calibration (report calibration information).

# Integrated Application——Case Study

- 3 oscilloscopes, extended to 12 channels



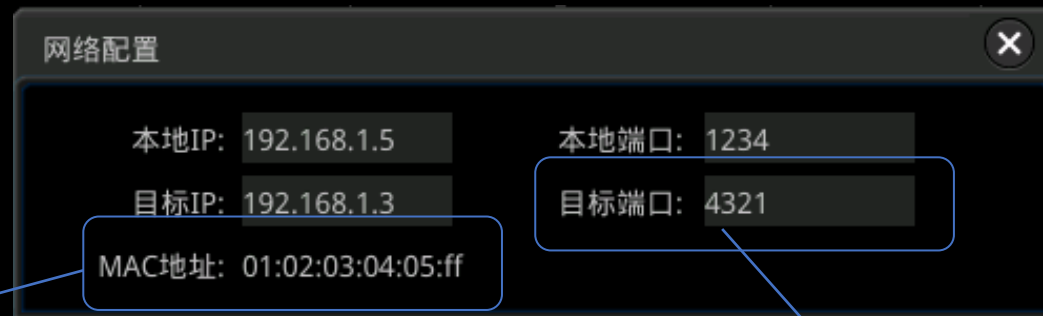


# Integrated Application——Optical Comm

- **Support 10GE SFP+ optical fiber communication (standard hardware, optional function)**

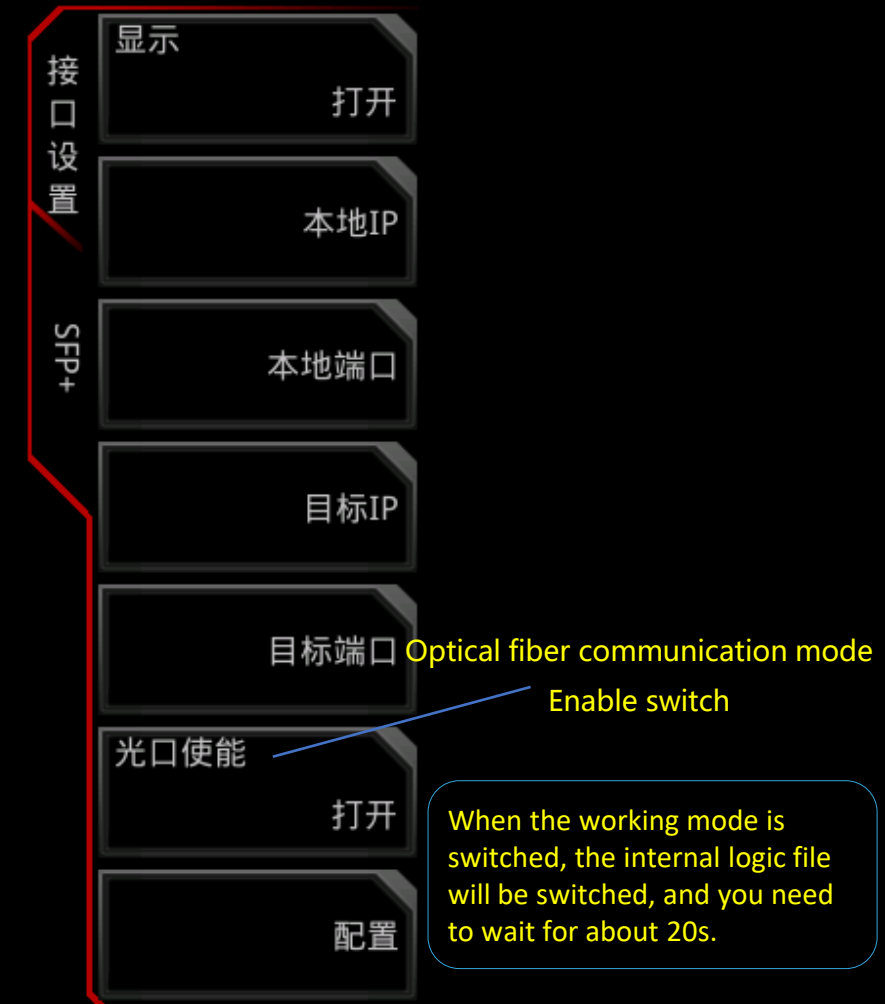
- Interface rate > 5Gbit/s

Actual measurement: 500Mpts memory data, all reported to the PC through the optical port, it takes 0.5s. (Does not include the time when the host computer receives data)



Default  
Setup

Only used in automatic data  
reporting mode



Optical fiber communication mode  
Enable switch

When the working mode is  
switched, the internal logic file  
will be switched, and you need  
to wait for about 20s.

# Integrated Application——Optical Comm

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- **Optical fiber communication example**

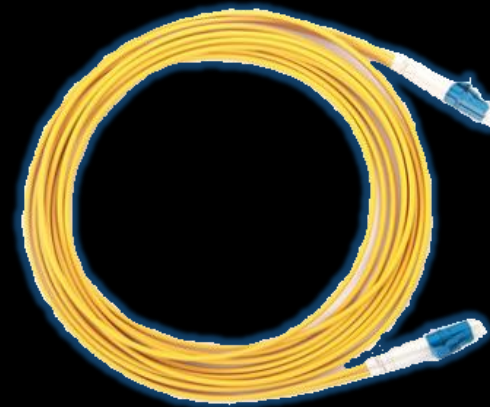
- **Device List**

- Optical network card (including driver)

- Optical module

- Optical fiber

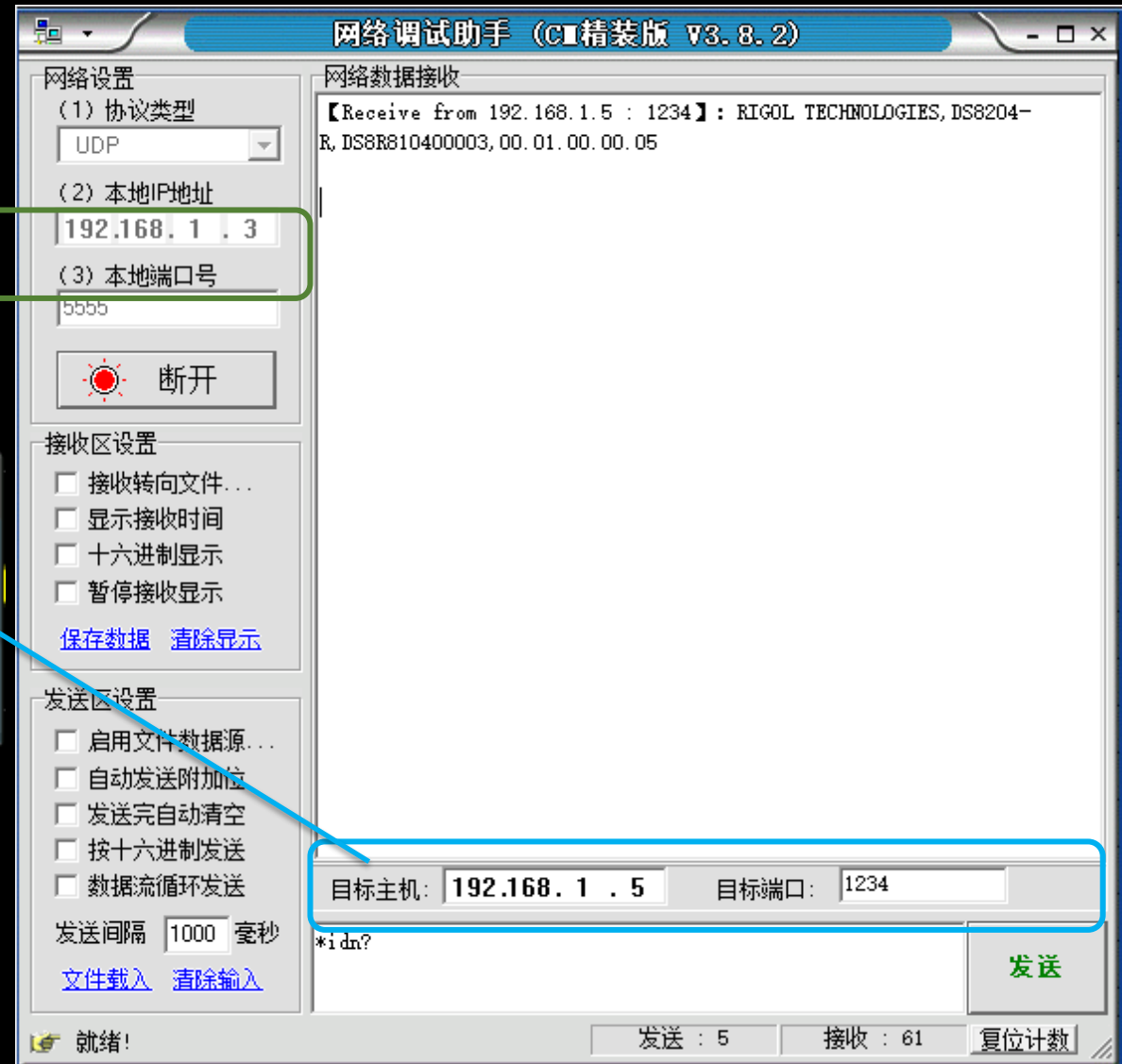
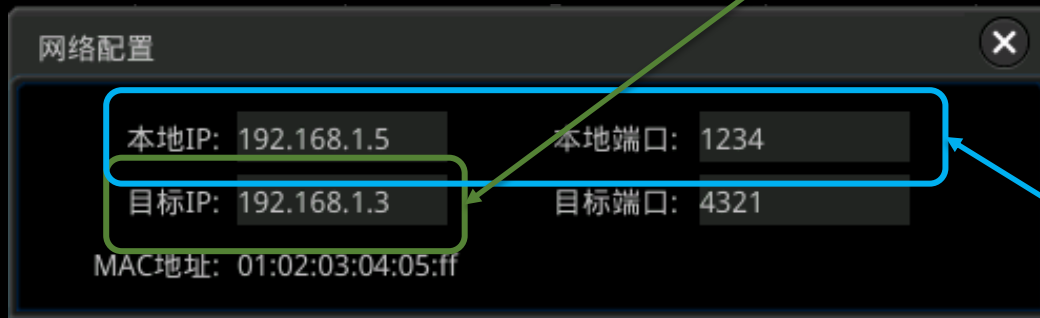
- Optical switch (used for multiple devices)



# Integrated Application——Optical Comm

- **Optical fiber communication example (direct connection between machine and PC)**

1. Install the optical network card and driver
2. Configure IP and port number

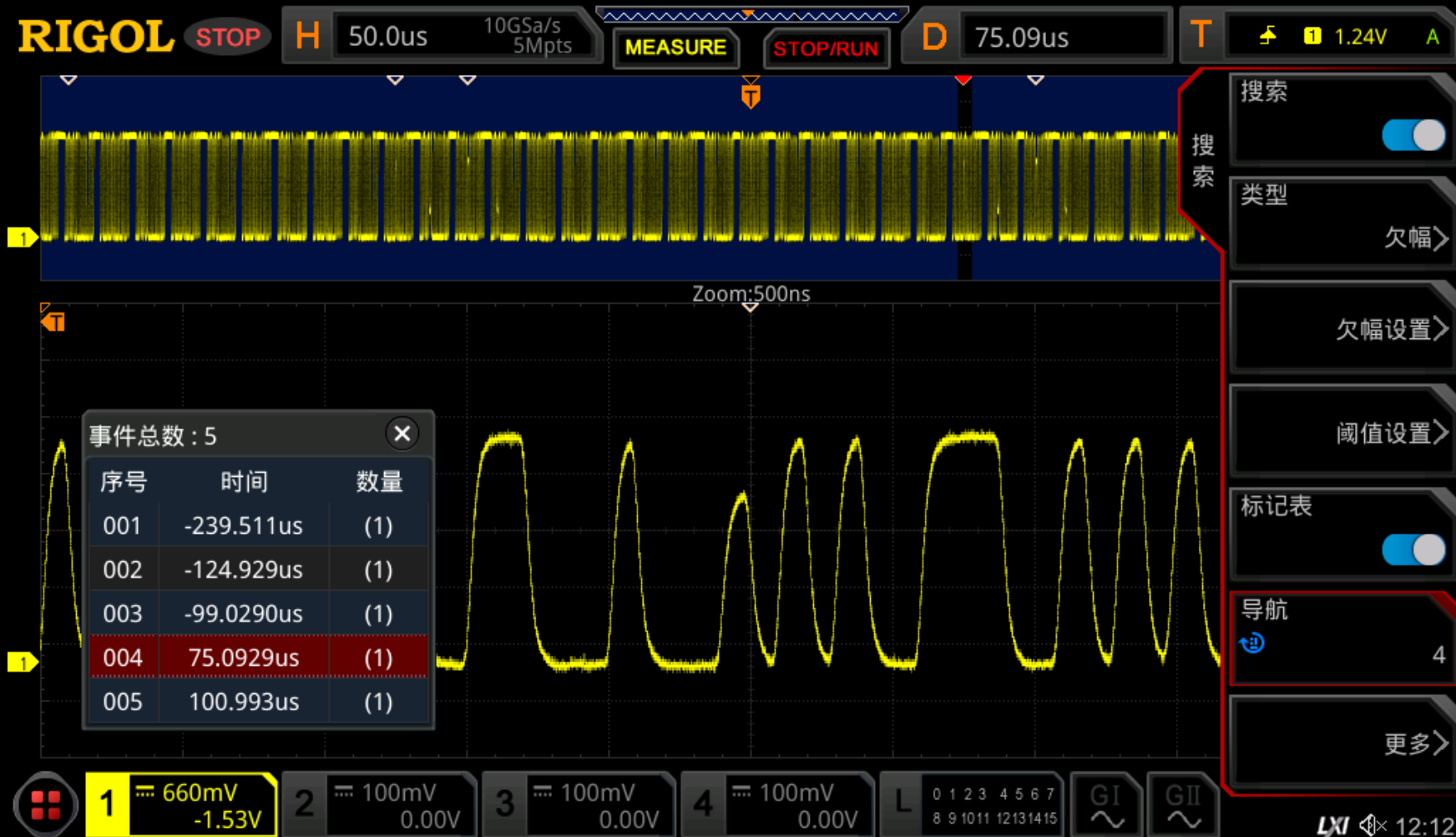


# Precise Measurement



In optical fiber communication mode, The precise measurement function is disabled!!!

# Search & Navigation



In optical fiber communication mode, The waveform search function is disabled!!!

# Options & Accessories

## Standard accessories

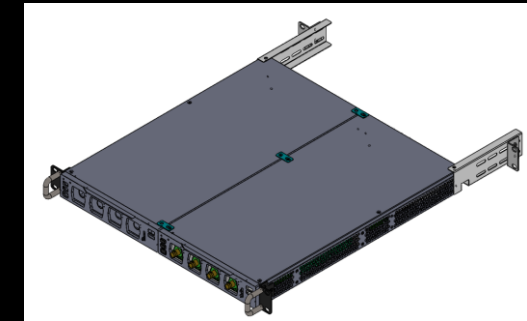
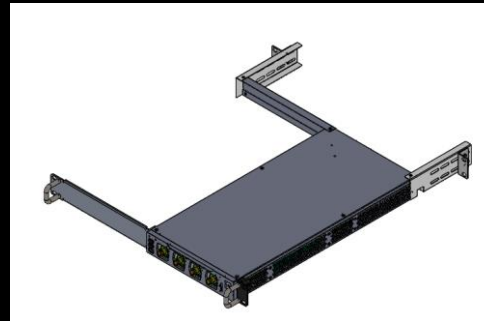


Power Core 1

USB Cable 1

Quick Guide 1

Rack installation kit (2 kinds of installation accessories are equipped)



# Options & Accessories

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- 10GbE Comm Option (Software Upgrade)

HSDC      10GE SFP+ High-speed data communication function option

SFP+ optical communication interface hardware is standard, and functional options need to be purchased separately.

**Note:**

After activating the HSDC option and turning on the optical communication function, the precise measurement and search functions will be disabled.



# Options & Accessories

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## ▣ Measurement App Options ( Software Upgrade )

BND	App Bundle Kit ( Contains all the following standalone packages )
COMP	Computer Serial Bus Trigger and Decode(S232/UART)
EMBD	Embedded Serial Bus Trigger and Decode(I2C, SPI)
AUTO	Automobile Serial Bus Trigger & Decode(CAN, LIN)
FLEX	FlexRay Serial Bus Trigger & Decode
AUDIO	Audio Serial Bus Trigger & Decode (I2S)
AERO	MIL-STD 1553 Serial Bus Trigger & Decode
AWG	Dual Channel 25 MHz AWG
PWR	Build-In Power Analysis
JITTER	Real Time Eye & Jitter Analysis

# PC Software

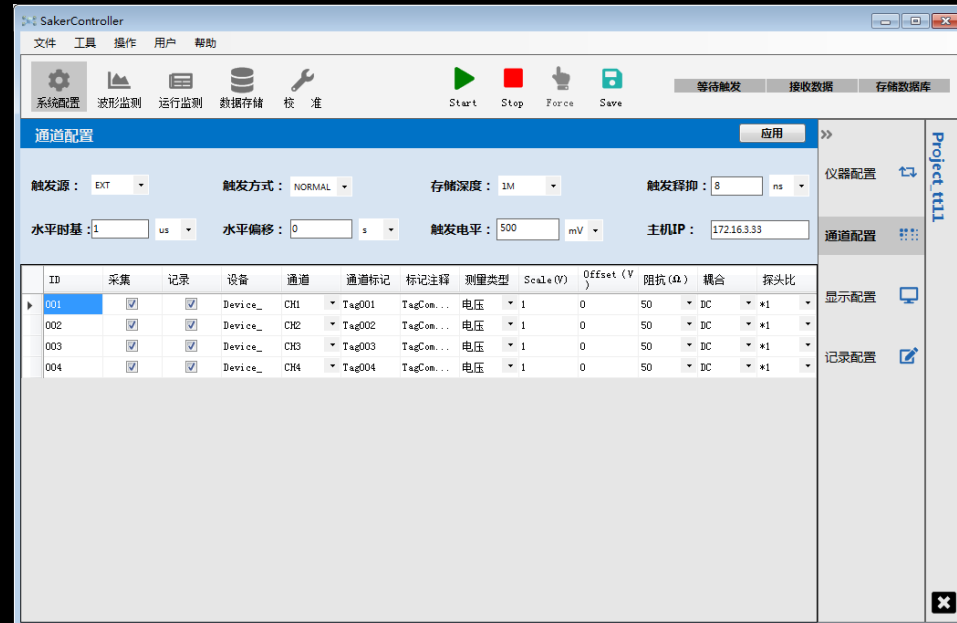
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- **Ultra Sigma – doesn't support Optical Comm**



# PC Software

- **Software toolkit (free download executable program from official website, contact technical support for open source code)**
- Instrument configuration (up to 4 units)
- Channel configuration
- Display configuration
- Record configuration (local)
- Waveform monitoring



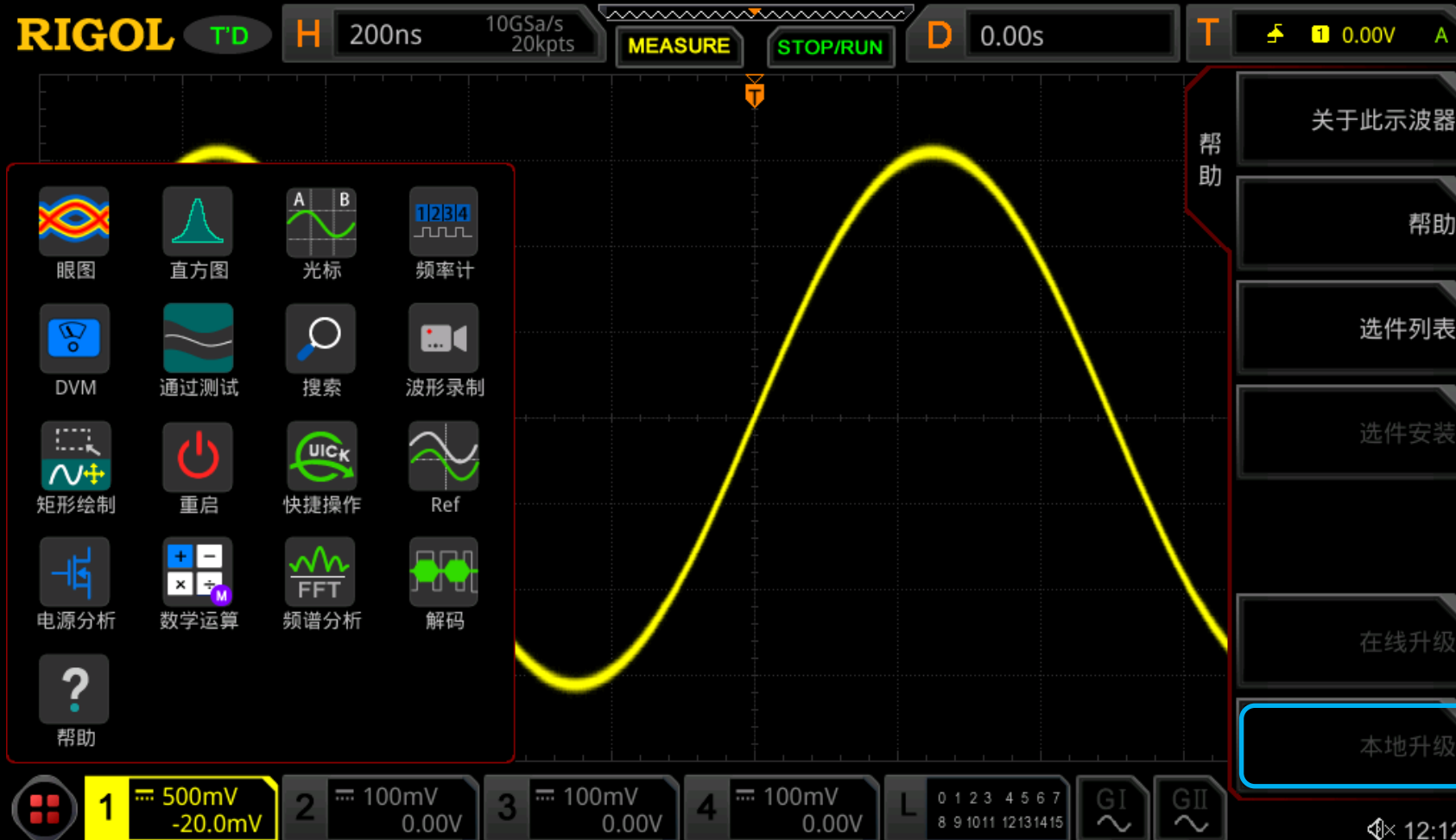
# PC Software

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- **UltraDAQ ( Toll )**
  - Instrument configuration (up to 128 units)
  - Channel configuration
  - Display configuration
  - Record configuration (local + database)
  - Waveform monitoring
  - ...Function to be determined...



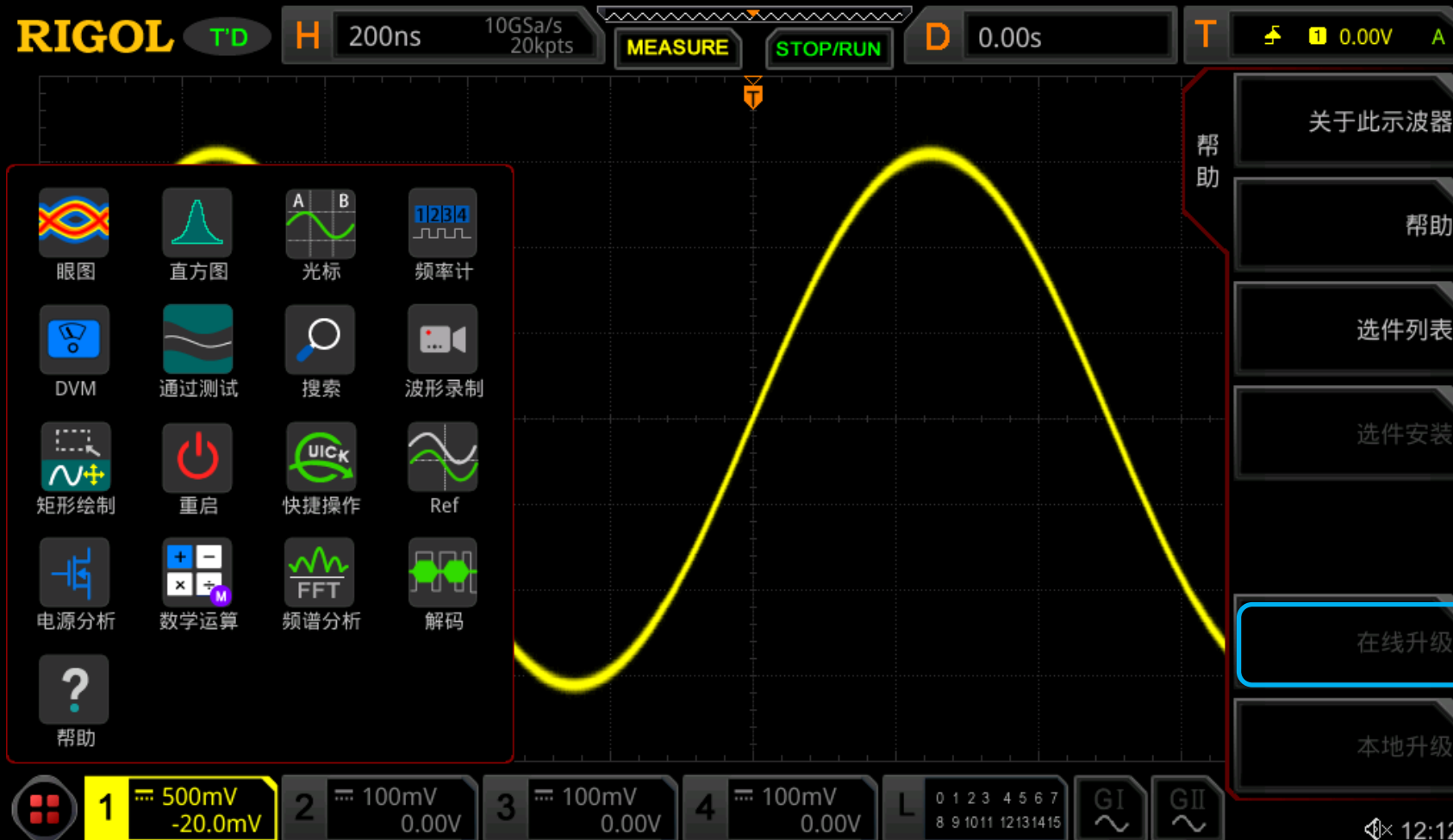
# Local Upgrade



1. Upgrade to a higher version
2. Upgrade to the same version
3. Temporary version upgrade
4. This method supports downgrade

Local Upgrade

# Remote online upgrade



Only support upgrading to higher version.  
method:  
Insert the network cable,  
access the Internet network,  
and click online upgrade.

在线升级 ← On-Line Upgrade

# Comparison Table

	<b>RIGOL DS8000-R</b>	<b>Tektronix MSO58LP</b>	<b>Lecroy Wave Runner 8000-R</b>
<b>Channels</b>	4	8 + 32	4
<b>Size</b>	1U height, half rack width, 3.6kg	2U height, full rack width, 12.7kg	2U height, full rack width, 7.4kg
<b>Analog BW</b>	1, 2 GHz	1 GHz	1, 2.5, 4GHz
<b>Max sample rate</b>	10GSa/s	6.25 GSa/s	40 GSa/s
<b>Max memory depth</b>	500Mpts	125 Mpts	128Mpts
<b>Waveform update rate</b>	> 600,000wfms/s	>500,000 wfm/s	> 1,000,000wfms/s (Sequence mode)
<b>Resolution</b>	8 bit	12 bit	8 bit
<b>EXT Trigger</b>	Trigger jitter <200psRMS (extreme value <250ps) ±100psRMS jitter on each instrument, 150ps delay; ≤350psRMS (extreme value≤500ps) total delay between instruments	Trigger jitter ≤ 200 psRMS ±100ps jitter and 150ps delay on each instrument; ≤350ps total between instruments.	





Thanks