



## RIGOL DS4000 series oscilloscope features DEMO GUIDE



[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

Lindberghstr. 4  
82178 Puchheim, Germany  
info-europe@rigoltech.com  
Tel: 0049(0)89/8941895-0

<b>RIGOL DS4000 series oscilloscopes features and demos</b> .....	<b>2</b>
<b>FEATURES:</b> .....	<b>2</b>
Demo Board Applications .....	<b>3</b>
1. Memory depth demo.....	<b>3</b>
2. Capture rate demo. ....	<b>7</b>
3. Waveform Record Playback, Analyze.....	<b>9</b>
4.1 Serial Trigger and Decode-RS232.....	<b>11</b>
4.2 Serial Trigger and Decode-I <sup>2</sup> C.....	<b>13</b>
4.3 Serial Trigger and Decode-CAN .....	<b>15</b>
4.4 Record Function combined with Serial Bus Trigger .....	

**RIGOL** oscilloscopes have many features and this document will let you know how to show these features to customers.

**FEATURES:**

- **MEMORY DEPTH:** **RIGOL** DS4000 series oscilloscopes' memory depth is up to 140M, they can keep a high sample rate and get more samples at a longer time base.
- **CAPTURE RATE:** **RIGOL** DS4000 series oscilloscopes' capture rate is up to 110,000 waveforms/s, users can catch fortuitous abnormal signal easily.
- **Waveform Record, Playback, Analyze:** with the help of Waveform Record, users can analyze the signal conveniently.
- **Serial Trigger and Decode:** including RS232, SPI, I2C, CAN, FLEXRAY.

[www.rigoltech.eu](http://www.rigoltech.eu)

**Rigol Technologies EU GmbH**

**Lindberghstr. 4**

**82178 Puchheim, Germany**

**info-europe@rigoltech.com**

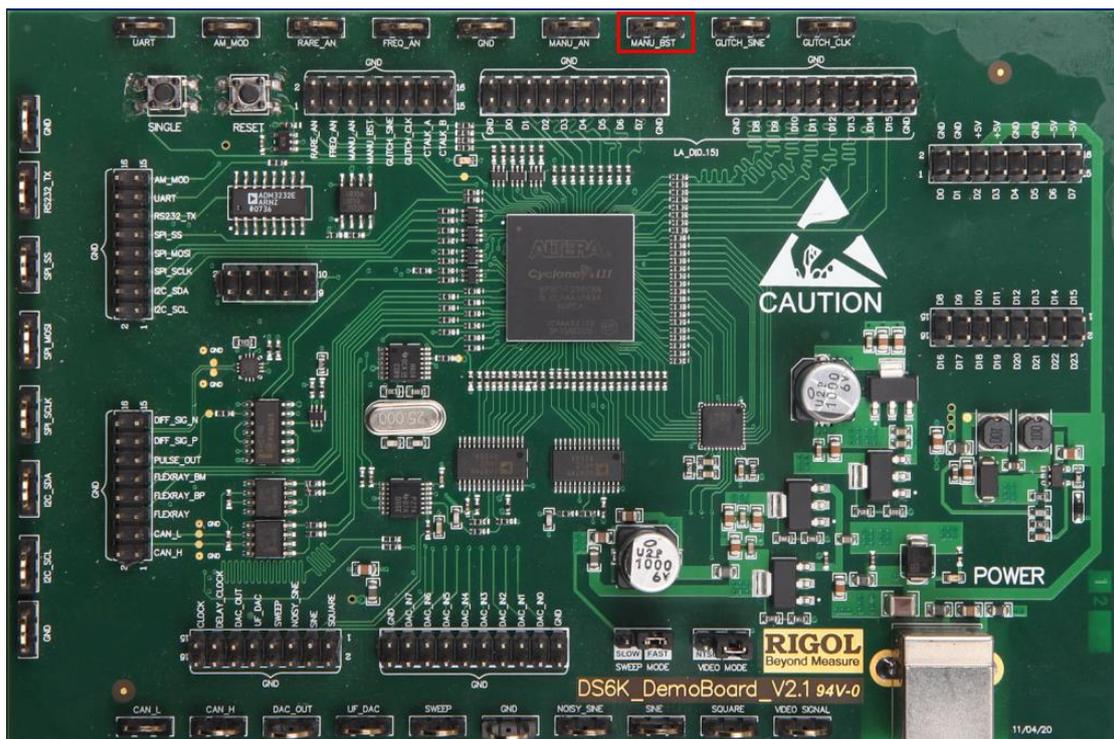
**Tel: 0049(0)89/8941895-0**

# Demo Board Applications

## 1. Memory depth demo.

### a) Signal Explanation

- Signal Output Pin: MANU\_BST (see red square)
- 25 bursts. Each burst contains high level and low level.



### b) Functions to be demonstrated throughout this demo

High sample rate, deep memory

[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

Lindberghstr. 4

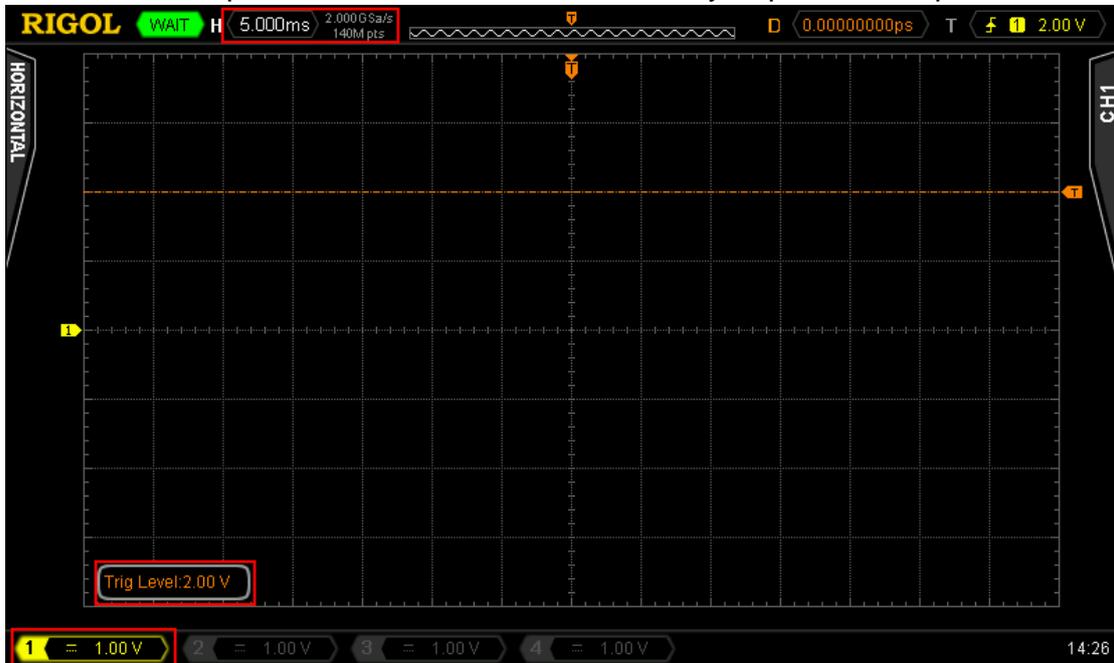
82178 Puchheim, Germany

info-europe@rigoltech.com

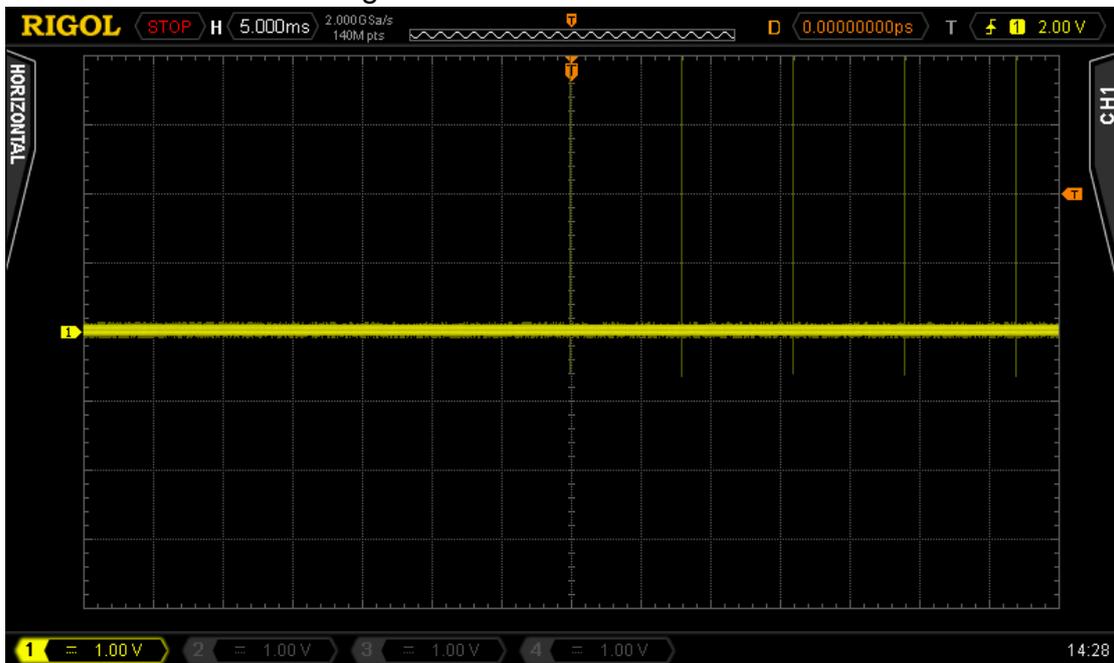
Tel: 0049(0)89/8941895-0

c) How to perform the demonstration

1. Connect the signal output pin MANU\_BST and GND to CH1 of the oscilloscope. Set the time base to 5ms, the vertical scale to 1V/div. Set the trigger level to about 2V, trigger mode to "SINGLE". At this point, the sample rate is 2GSa/s and the memory depth is 140Mpts.



2. Press "SINGLE" on the demo board, every burst can be captured as shown in the figure below.



[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

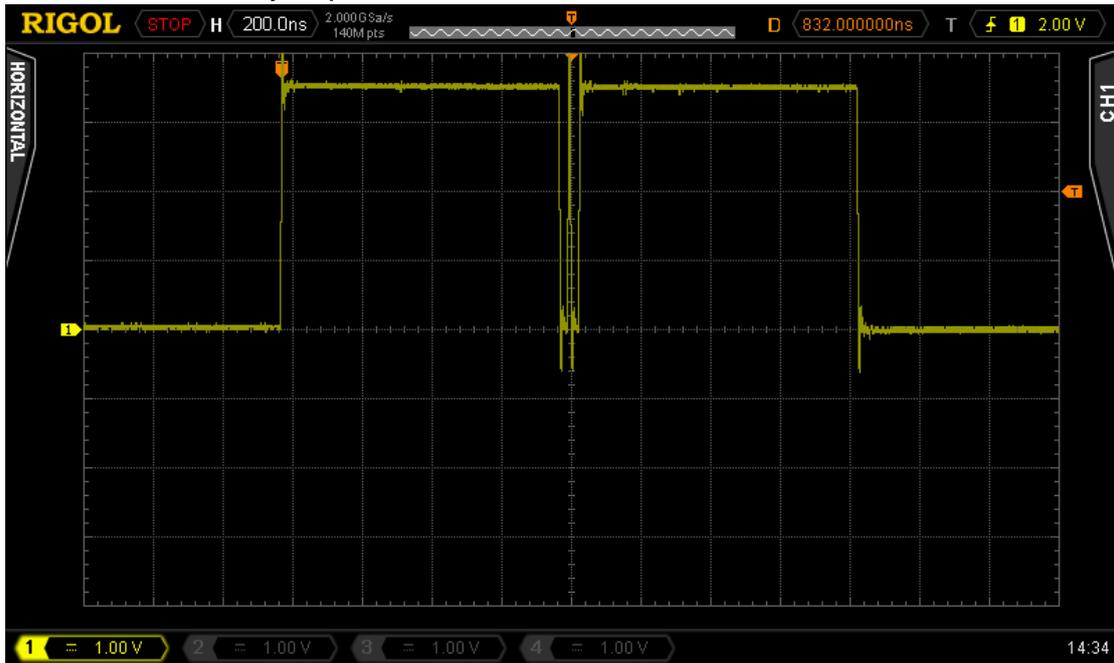
Lindberghstr. 4

82178 Puchheim, Germany

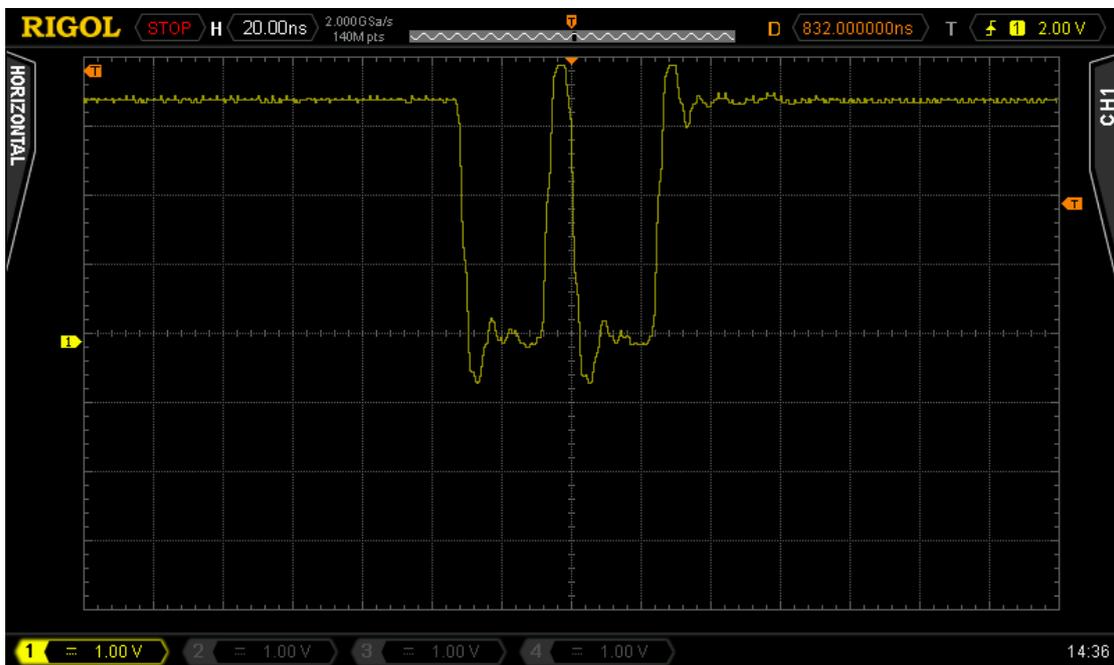
info-europe@rigoltech.com

Tel: 0049(0)89/8941895-0

3. Adjust the time base to 200ns/div, all the waveform details are successfully captured.



4. Go on and adjust the time base more the waveform, you can see more details.



[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

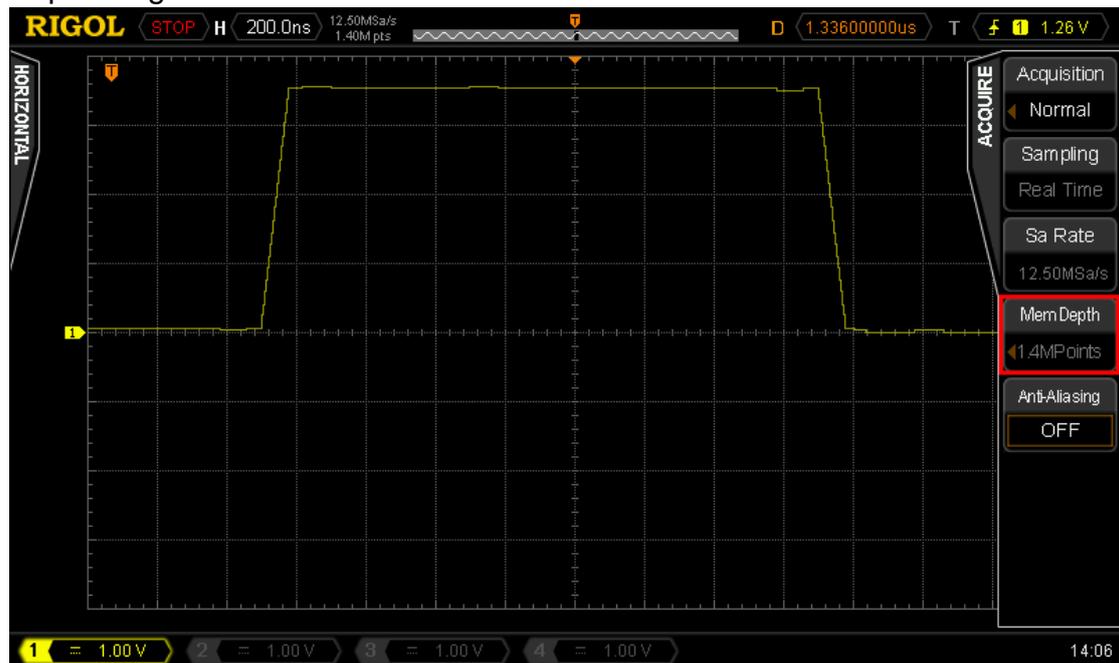
Lindberghstr. 4

82178 Puchheim, Germany

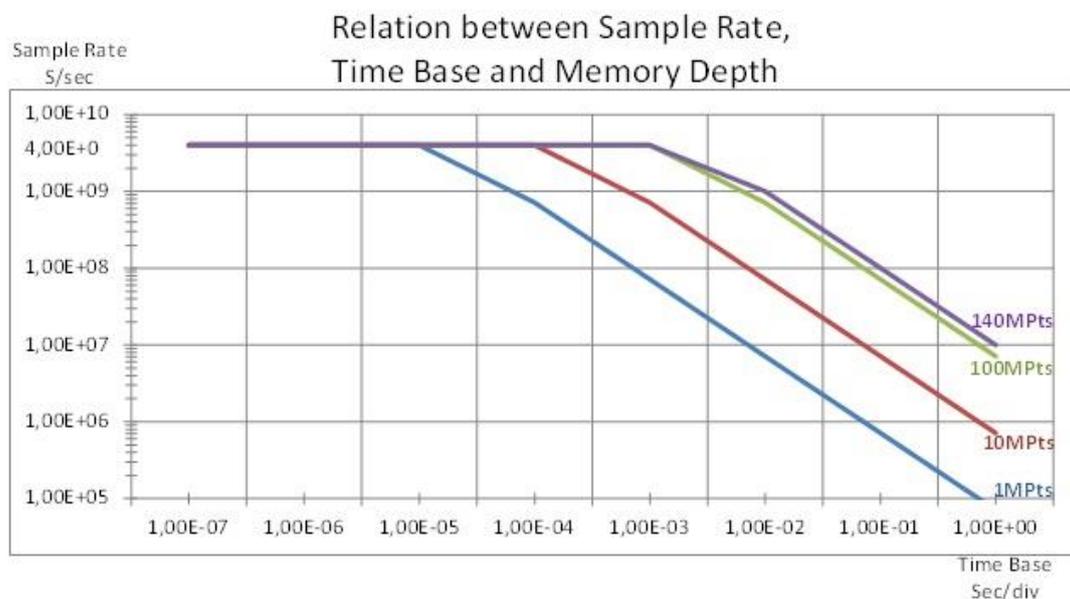
info-europe@rigoltech.com

Tel: 0049(0)89/8941895-0

5. Press **Acquire** → **Mem Depth**, adjust the memory depth to 1.4M Points, do step1~4 again. The result now looks like this.



We can't catch the details as before. It is because if the memory depth is not high enough, oscilloscope can't keep a high sample rate in large time base. The relationship between Memory Depth, Sample Rate and Time Base is as the figure below:



[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

Lindberghstr. 4

82178 Puchheim, Germany

info-europe@rigoltech.com

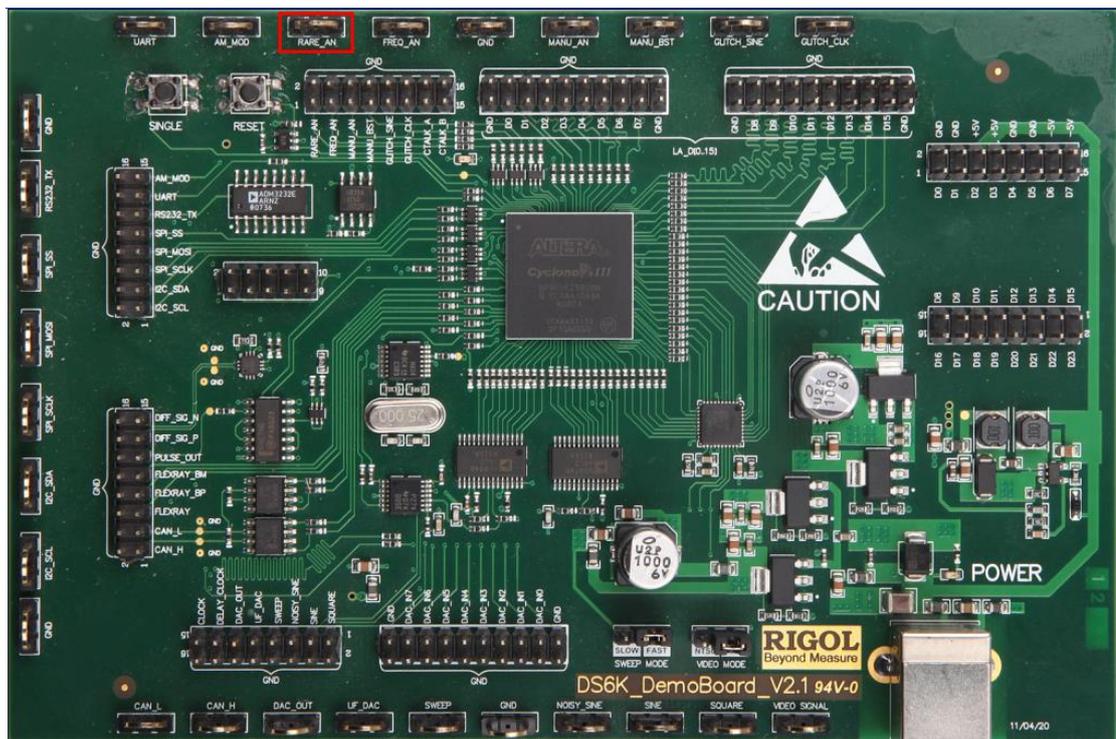
Tel: 0049(0)89/8941895-0

## 2. Capture rate demo.

### a) Signal Explanation

Signal Output Pin: RARE\_AN (red square)

Square waveform with 1MHz frequency. Narrow pulse occurs every 100ms and the pulse width cannot exceed 5ns.



### b) Functions to be demonstrated throughout this demo

Waveform capture rate

### c) How to perform the Demonstration

1. Connect the signal output pin RARE\_AN and GND to CH1 of the oscilloscope, then press "AUTO".
2. Adjust the time base to 5ns/div, set the persistence time to 20s and the capture result of abnormal signal is as shown in the figure below. If the capture rate of oscilloscope is not high enough, the rear abnormal signal can't be captured.

[www.rigoltech.eu](http://www.rigoltech.eu)

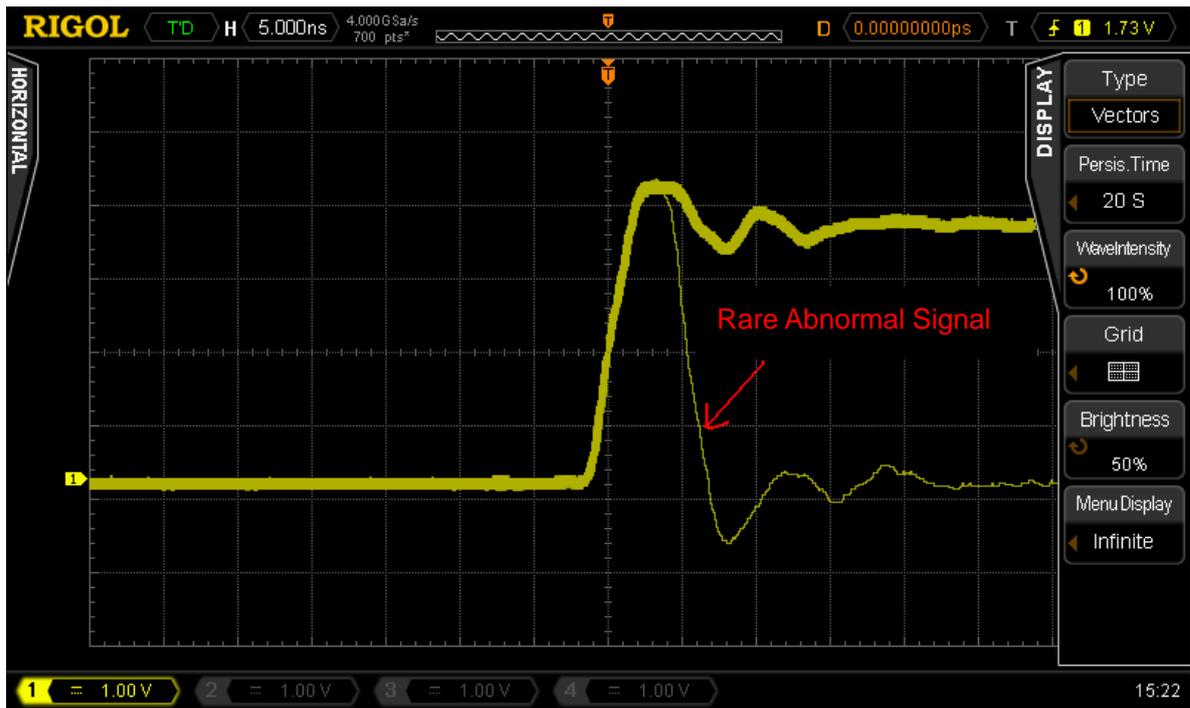
Rigol Technologies EU GmbH

Lindberghstr. 4

82178 Puchheim, Germany

info-europe@rigoltech.com

Tel: 0049(0)89/8941895-0



[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

Lindberghstr. 4

82178 Puchheim, Germany

[info-europe@rigoltech.com](mailto:info-europe@rigoltech.com)

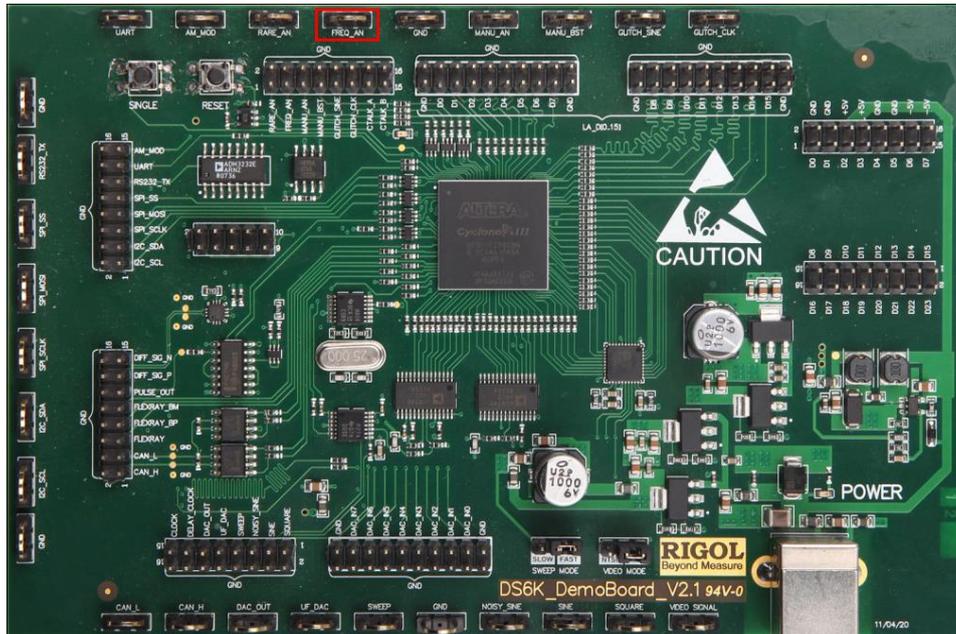
Tel: 0049(0)89/8941895-0

### 3. Waveform Record Playback, Analyze

#### a) Signal Explanation

Signal Output Pin: **FREQ\_AN** (red square)

Square waveform with 1MHz frequency. Narrow pulse occur every 1msec and the pulse width cannot exceed 5ns.

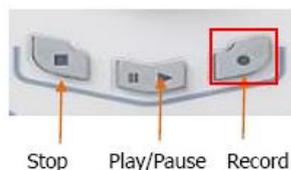


#### b) Functions to be demonstrated throughout the demo

Waveform Record Playback, Analyze

#### c) How to perform the demonstration:

1. Connect the signal output pin **FREQ\_AN** and **GND** to **CH1** of the oscilloscope, then press "AUTO".
2. Press **Record** → **Mode**, choose **Record**. Use the multi-function knob or the navigation knob to adjust the **End Frame** at about 3000.
3. Press shortcut key (red square) to start record.



[www.rigoltech.eu](http://www.rigoltech.eu)

**Rigol Technologies EU GmbH**

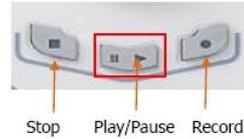
**Lindberghstr. 4**

**82178 Puchheim, Germany**

**info-europe@rigoltech.com**

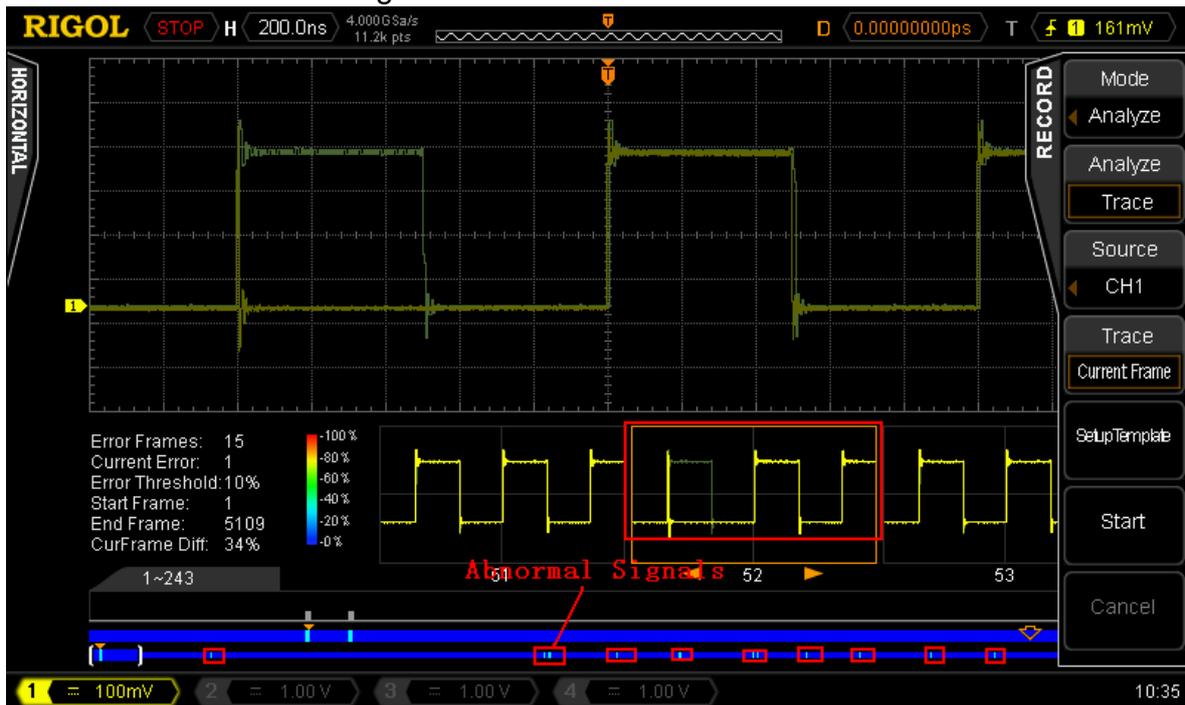
**Tel: 0049(0)89/8941895-0**

4. Press **Mode**, choose **Play back** to replay the recorded waveforms.



Press Button (red square) to play.

5. Press **Mode**, choose **Analyze**. Press **Setup Template** to set a normal waveform as the template. Press **Start** to analyze the recorded waveforms. The result is shown in the figure below. Press **RUN/STOP**, **SINGLE** to locate the previous and the next abnormal signal.



With the help of this feature, users can capture and analyze abnormal signals easier.

[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

Lindberghstr. 4

82178 Puchheim, Germany

[info-europe@rigoltech.com](mailto:info-europe@rigoltech.com)

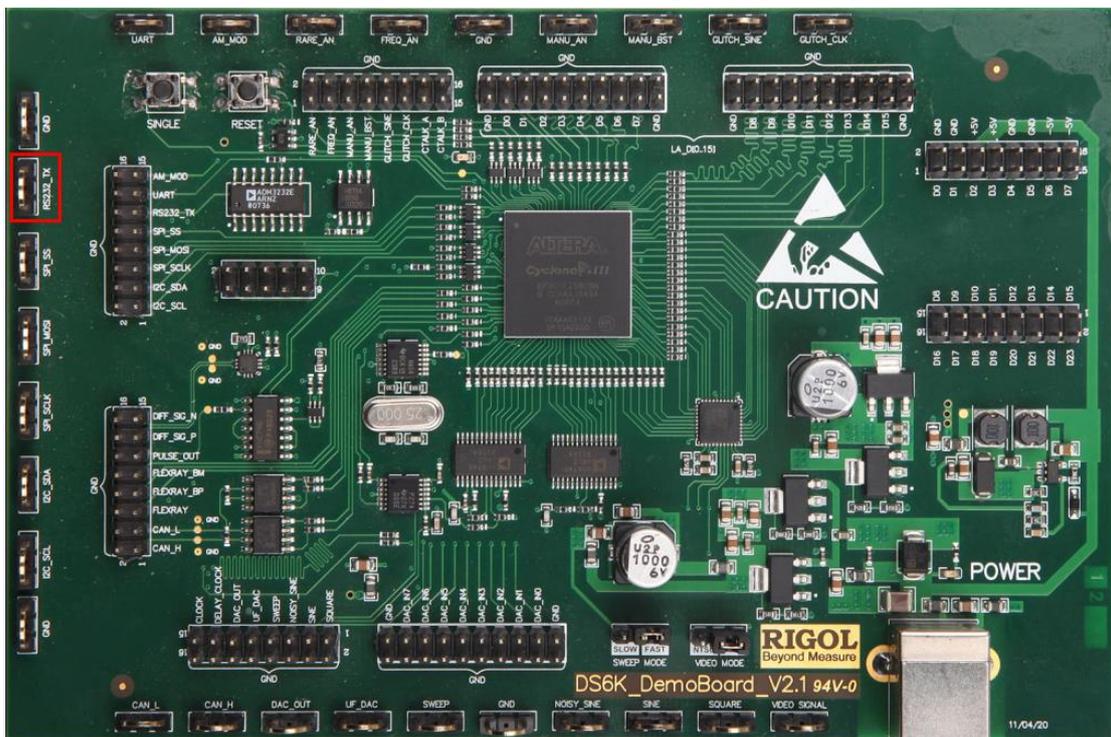
Tel: 0049(0)89/8941895-0

## 4.1 Serial Trigger and Decode-RS232

### a) Signal Explanation

Signal Output Pin: RS232\_TX (red square)

Rate: 9600bps; Data: RIGOL DS6000; Frame structure: 1bit start bit+ 8bits data bits+ 1bit stop bit; LSB output; negative polarity, none (check bit)



### b) Functions to be demonstrated throughout the demo

RS232 trigger, RS232 decoding

### c) How to perform the demonstration:

1. Connect the signal output pin RS232\_TX and GND to CH1 of the oscilloscope, then press "AUTO".
2. Adjust the time base to 2ms, set trigger type to "RS232".
3. Press Decode1, set the decode type to RS232, TX:"CH1", RX:"OFF", Format:"ASCII", turn on the Bus Status, the result is shown in the figure below:

[www.rigoltech.eu](http://www.rigoltech.eu)

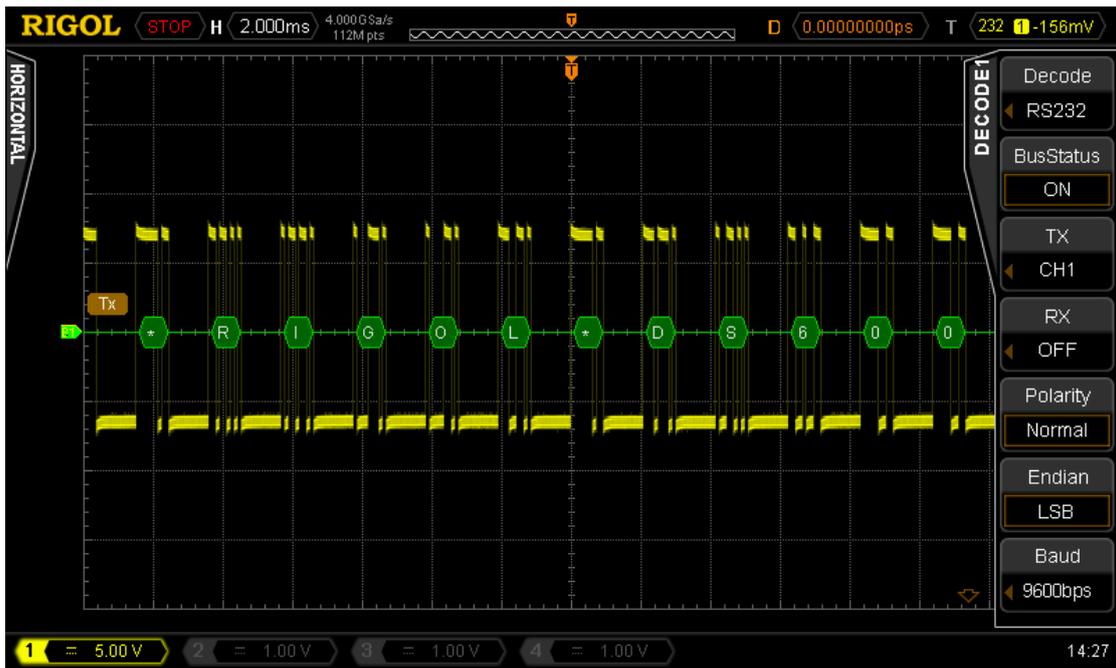
Rigol Technologies EU GmbH

Lindberghstr. 4

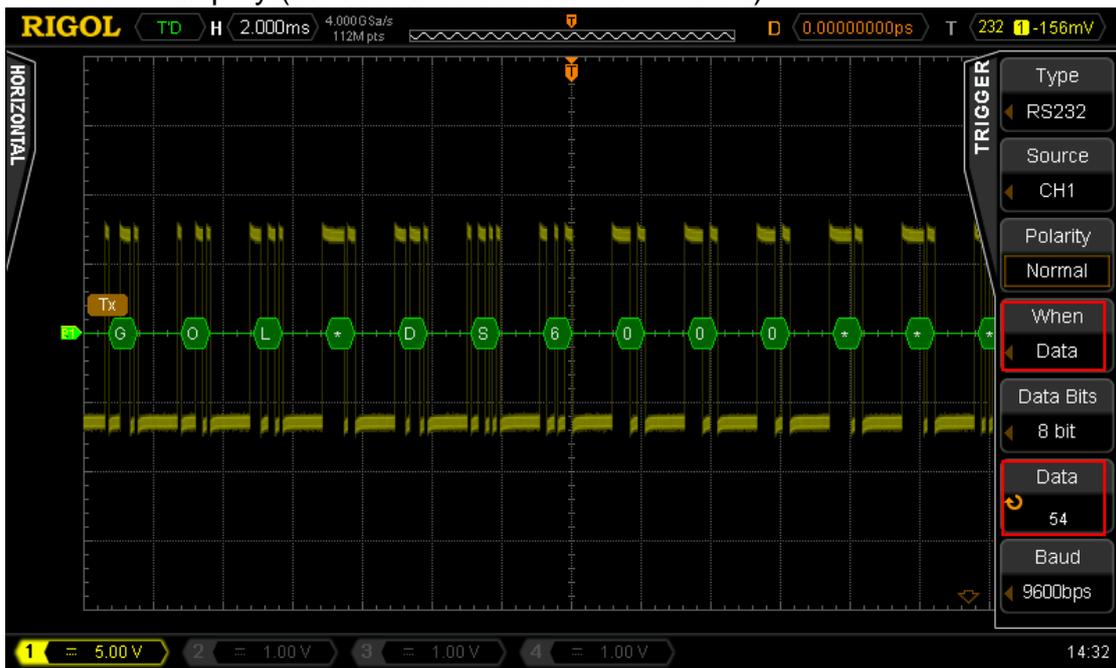
82178 Puchheim, Germany

info-europe@rigoltech.com

Tel: 0049(0)89/8941895-0



4. You can also set trigger “when data is 54” as below to get a steady display.(the ASCII code value of “6” is 54)



[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

Lindberghstr. 4

82178 Puchheim, Germany

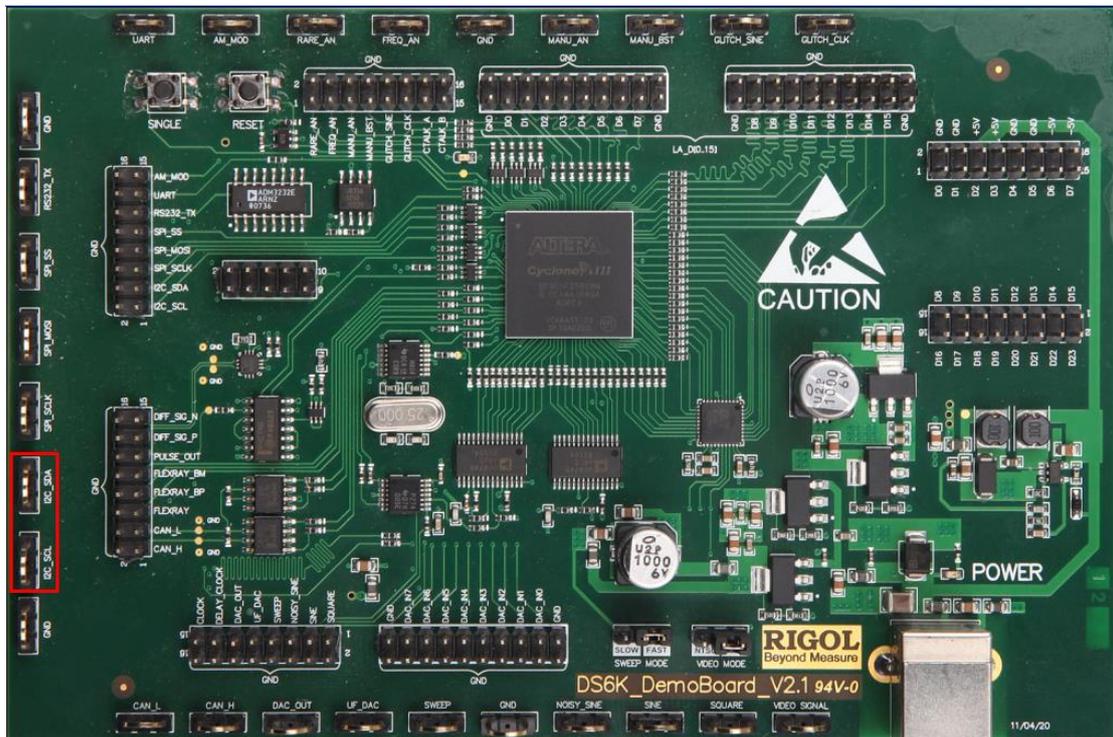
info-europe@rigoltech.com

Tel: 0049(0)89/8941895-0

## 4.2 Serial Trigger and Decode-I<sup>2</sup>C

### a) Signal Explanation

Signal Output Pin: I<sup>2</sup>C\_SCL, I<sup>2</sup>C\_SDA (red square)  
I<sup>2</sup>C signal with 125 kHz rate. The content is "RIGOL". The data frame read and the read/write bit would change.



### b) Functions to be demonstrated throughout the demo

I<sup>2</sup>C trigger, I<sup>2</sup>C decoding

### c) How to perform the Demonstration:

1. Connect the signal output pin I<sup>2</sup>C\_SCL and GND to CH1, pin I<sup>2</sup>C\_SDA and GND to CH2 of the oscilloscope, then press "AUTO". Set the time base to 100 $\mu$ s, trigger type to "I<sup>2</sup>C".
2. Press **When**, Choose **Data**, use "Current Bit" and "Data" under I<sup>2</sup>C trigger menu to set trigger "when data is LHLHLLHL" (namely the decimal number 82 and the ASCII code of the character "R")

[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

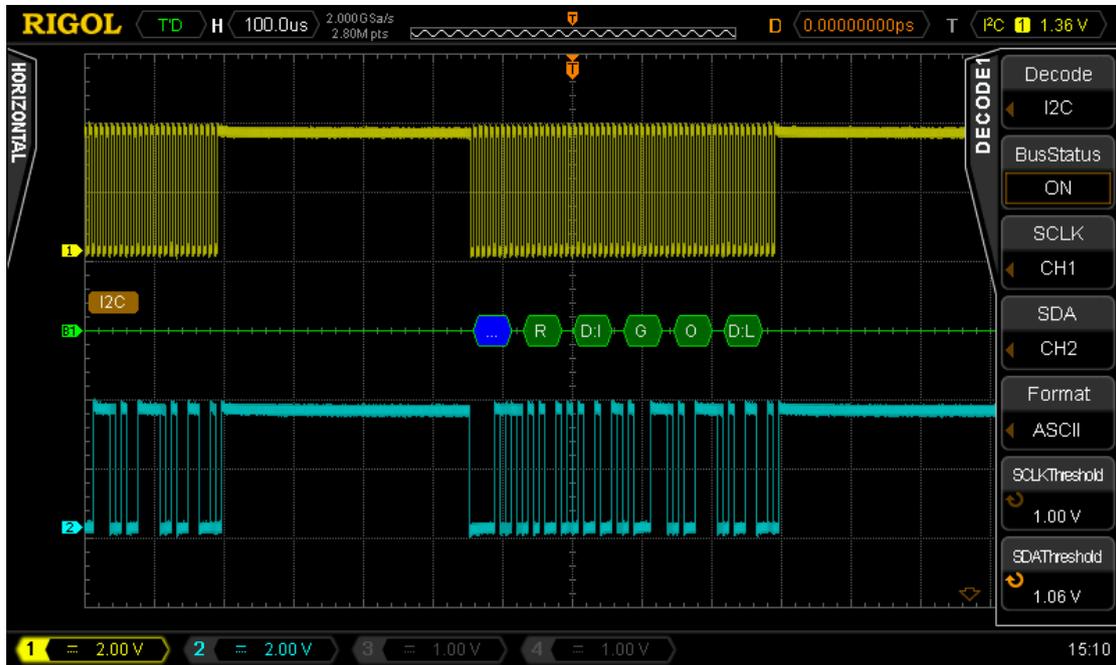
Lindberghstr. 4

82178 Puchheim, Germany

info-europe@rigoltech.com

Tel: 0049(0)89/8941895-0

3. Press Decode1, set the decode type to I<sup>2</sup>C, SCLK:"CH1", SDA:"CH2", Format:"ASCII". Use the multi-function knob to set the SCLK Threshold and SDA Threshold to about 1V, turn on the Bus Status, the result is shown in the figure below:



[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

Lindberghstr. 4

82178 Puchheim, Germany

info-europe@rigoltech.com

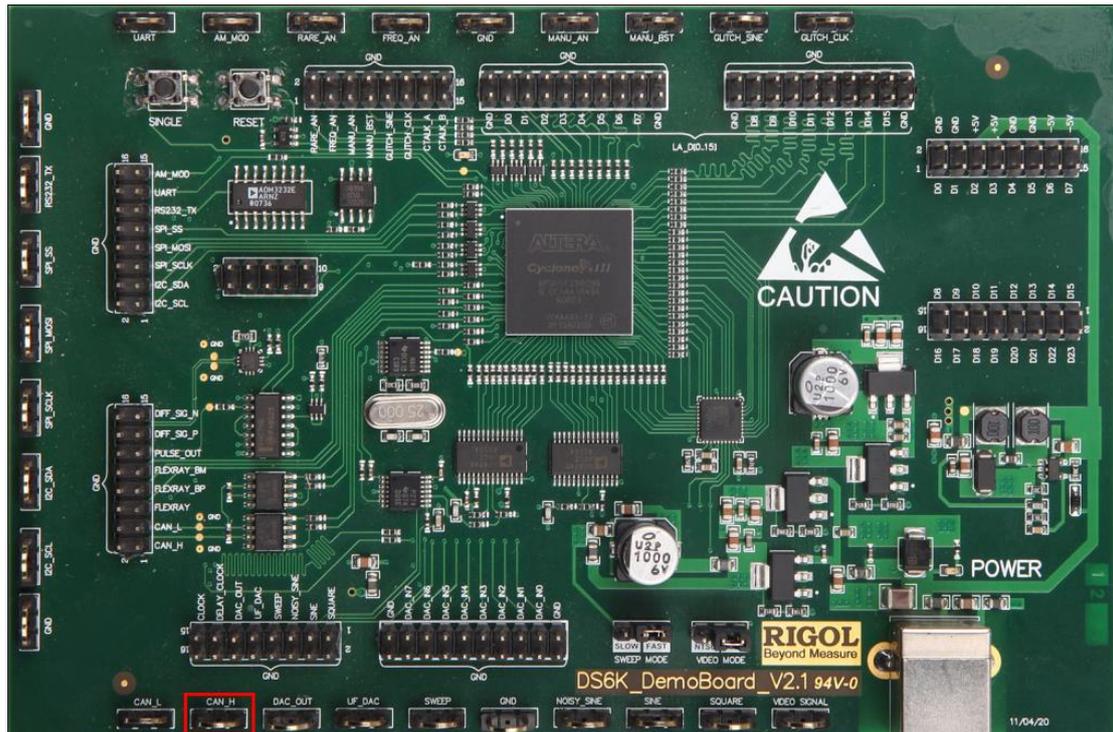
Tel: 0049(0)89/8941895-0

## 4.3 Serial Trigger and Decode-CAN

### a) Signal Explanation

Signal Output Pin: CAN\_H (red square)

CAN signal with 1MHz signal rate. The data is the character string "RIGOL"; the data length is 5; the signal uses CRC check and does not have ACK segment. Frame head and the read/write bit would change.



### b) Functions to be demonstrated throughout the demo

CAN trigger, CAN decoding

### c) How to perform the Demonstration:

1. Connect the signal output pin CAN\_H and GND to CH1 of the oscilloscope, then press "AUTO". Set the time base to 20 $\mu$ s, trigger type to "CAN", Signal Type to "CAN\_H", Baud to "1Mb/s".

[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

Lindberghstr. 4

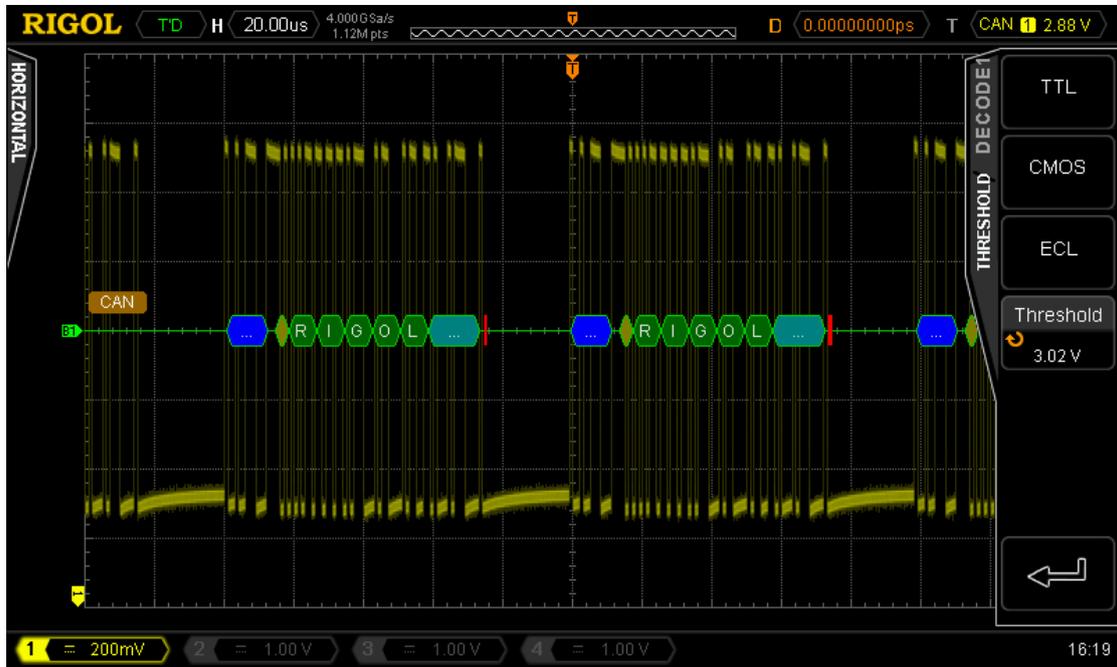
82178 Puchheim, Germany

info-europe@rigoltech.com

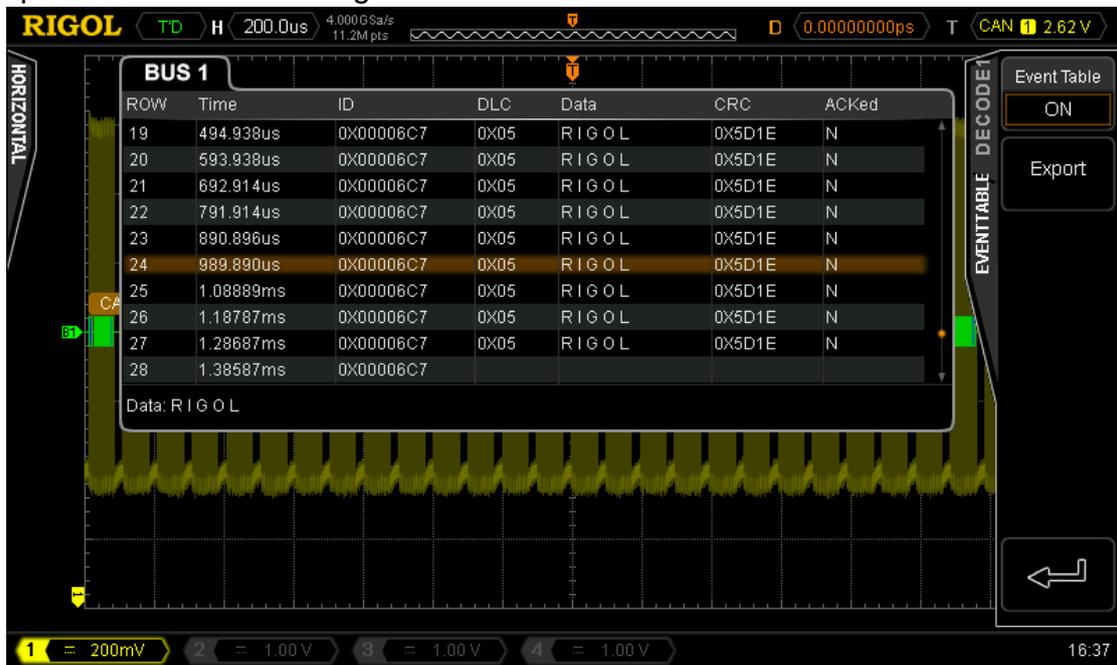
Tel: 0049(0)89/8941895-0

- Press Decode1, set the decode type to CAN, Signal Type:"CAN\_H", Baud:"1Mb/s", Format:"ASCII". Use the multi-function knob to set the Threshold to about 3V. Turn on the Bus Status, the result is shown in the figure below:

3.



When using Serial Trigger and Decode, you can turn up the time base and open the Event Table to gain more data.



[www.rigoltech.eu](http://www.rigoltech.eu)

Rigol Technologies EU GmbH

Lindberghstr. 4

82178 Puchheim, Germany

info-europe@rigoltech.com

Tel: 0049(0)89/8941895-0

## 4.4 Record function combined with serial bus trigger

### a) Signal Explanation

Signal Output Pin: I<sup>2</sup>C\_SCL, I<sup>2</sup>C\_SDA (red square)  
I2C signal with 125 kHz rate. The content is "RIGOL". The data frame read and the read/write bit would change.

### b) Functions to be demonstrated throughout the demo

I<sup>2</sup>C trigger, I<sup>2</sup>C decoding, Record function also on Serial Busses

### c) How to perform the Demonstration:

1. Press Default Button on the Scope
  2. Connect I2C Signals with Probes to the Scope  
I2C\_SDA -> Channel 1  
I2C\_SCL -> Channel 2
  3. Press Auto Set Button -> Signal on Ch1 and Ch2 should be visible
  4. Press Trigger Menu Button -> Set the Soft Menus as follow:  
Type-> I2C  
SCL -> Ch2  
SDA -> Ch1  
When -> Address  
Adress -> 16  
Sweep -> Normal
  5. Adjust Trigger Level -> middle of Signal
  6. Adjust Time Setting -> 100usec /div
  7. Press Decode1 Button -> Set the Soft Menus as follow:  
Decode -> I2C  
Status -> ON  
SClk -> Ch2  
SData -> Ch1  
Format-> Dec  
SCL Thresh. -> 1.6V  
SDA Thresh. -> 1.6V
  8. Change Time setting to 50usec/div. Shift Signal with Time Position Knob to the left so that a full Frame is visible on screen (Trigger Point @ around second/third division from the left)
- Up till here it is similar to Demonstration under 4.2.

[www.rigoltech.eu](http://www.rigoltech.eu)

**Rigol Technologies EU GmbH**

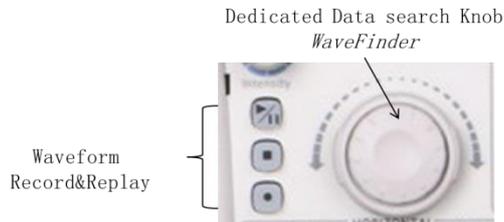
**Lindberghstr. 4**

**82178 Puchheim, Germany**

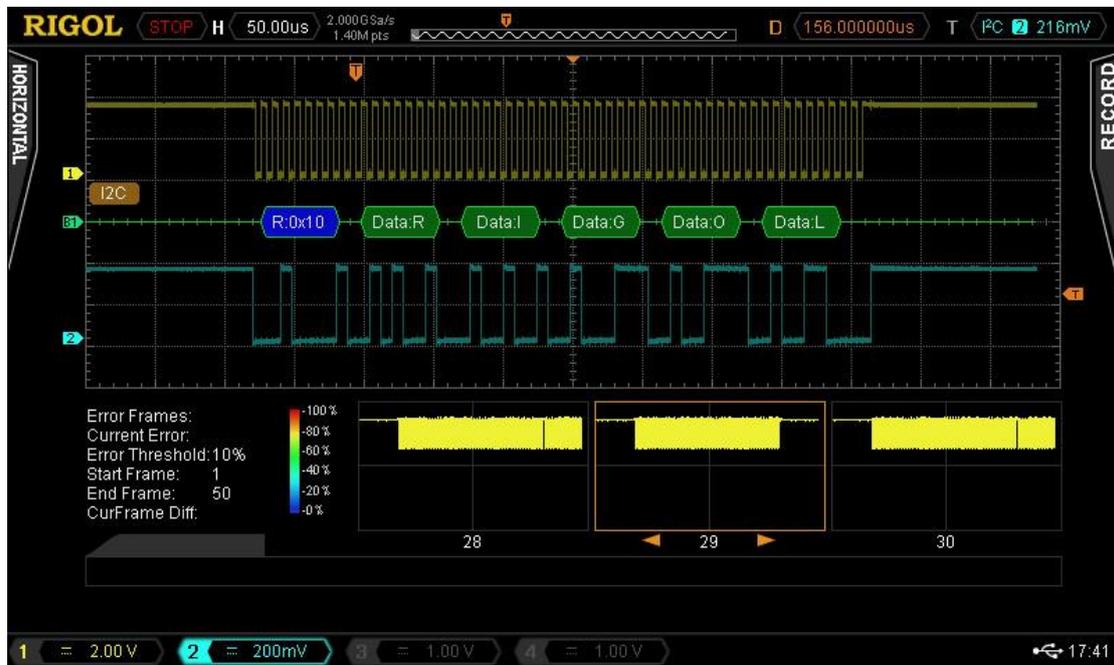
**info-europe@rigoltech.com**

**Tel: 0049(0)89/8941895-0**

9. Press Record Button-> Change Mode to RECORD
10. Press Softkey Operate -> Run/Stop and Rec Button starts blinking red and recording is running. You can see the record counter in the display. Wait until memory is full or if it takes too much time Press Stop Button.
11. Change Mode -> Analysis mode now you can step thru the recorded frames by using the big Data Search knob.



After setting up every all as above you should see the following picture:



[www.rigoltech.eu](http://www.rigoltech.eu)

**Rigol Technologies EU GmbH**

**Lindberghstr. 4**

**82178 Puchheim, Germany**

**info-europe@rigoltech.com**

**Tel: 0049(0)89/8941895-0**