10.1 Waveform Settings

Open the display menu, tap Waveform button to open the waveform display menu. This menu is used to set the display mode and brightness of waveform. The waveform display mode is divided into two types: dots and vectors. The waveform brightness percentage is adjustable, and the waveform display setting is shown in Figure 10-2.

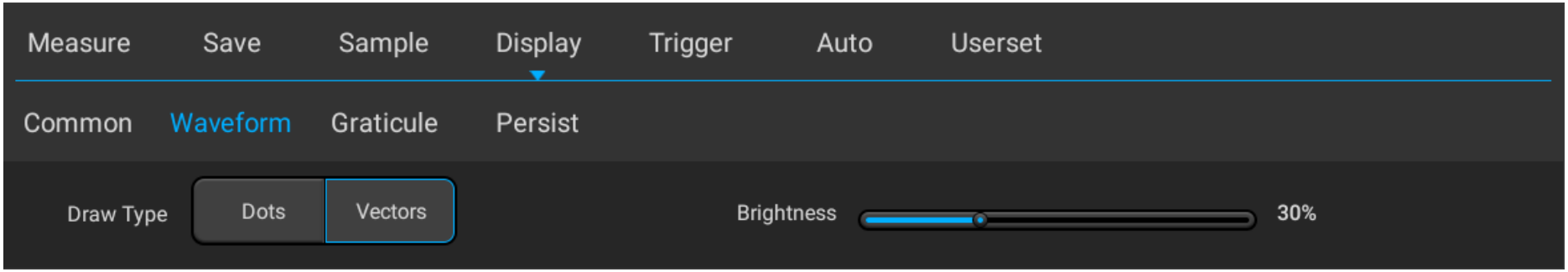

Figure 10-2 Waveform Display Menu

10.2 Graticule Setting

Open the display menu and tap Graticule button to open the graticule setting menu (Figure 10-3). Graticule display mode includes: “Full”, “Grid”, “Crosshair” and “Frame”, and the brightness percentage is adjustable.

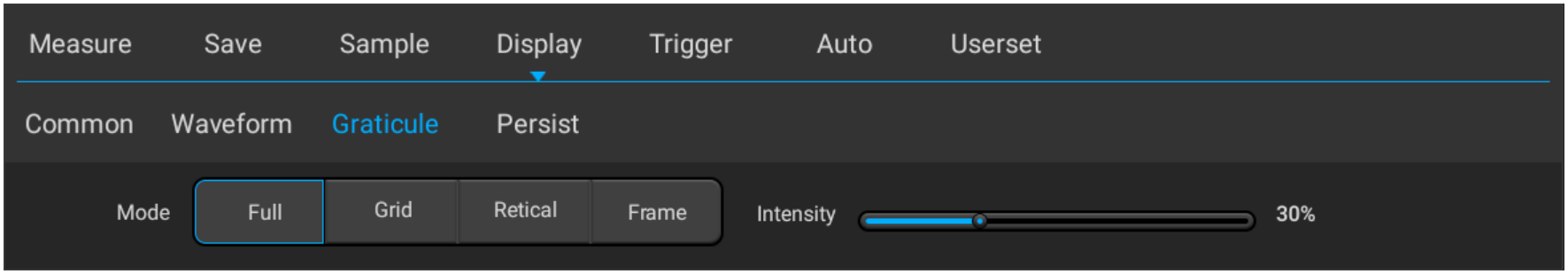

Figure 10-3 Graticule Menu Display

10.3 Persistence Setting

Open the display menu and tap Persist key to open the persistence settings menu.

1) Persistence setting

In the persistence setting menu, select:

- **None:** None - no persistence.
- **Auto:** Auto — automatic persistence.

- **Normal:** Normal - set the persistence time — After selecting the variable persistence, tap the box on the right of "Adjust" to pop up the persistence time selection box (Figure 10-4) and set the persistence time. It can be set between 10ms and 10s.

- ∞**:** Infinite persistence - never erase the results of previous acquisitions

  Infinite persistence can be used to measure noise and jitter, display the worst-case extremes of varying waveforms, find time violations, capture events that occur infrequently.

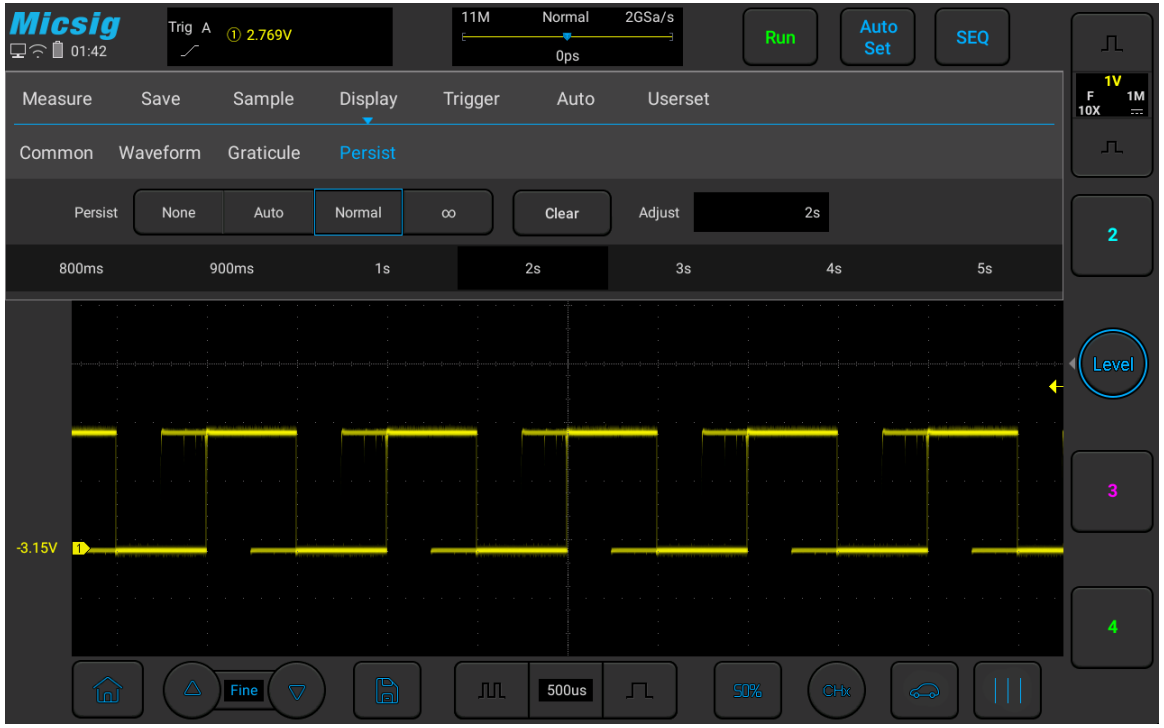

Figure 10-4 Persist time adjust

2) Erase persistence

To erase the previously acquired results from the display, tap Clear key or adjust the horizontal time base and vertical sensitivity. The oscilloscope will erase the persistence display and start the cumulative acquisition again.

10.4 Horizontal Expansion Center

Horizontal expansion is divided into two types: screen center and trigger position:

1) Screen center

   Select "Center" to adjust the time base waveform to expand or contract toward both sides with the screen center as the base point, and the delay time does not change.

2) Trigger position

   Select "TrigPos" to adjust the time base waveform to expand or contract toward both sides with the trigger position as the base point. The delay time varies with the horizontal time base.

10.5 Color Temperature Setting

Turn on the color temperature mode, and the waveform display is shown in Figure 10-5;

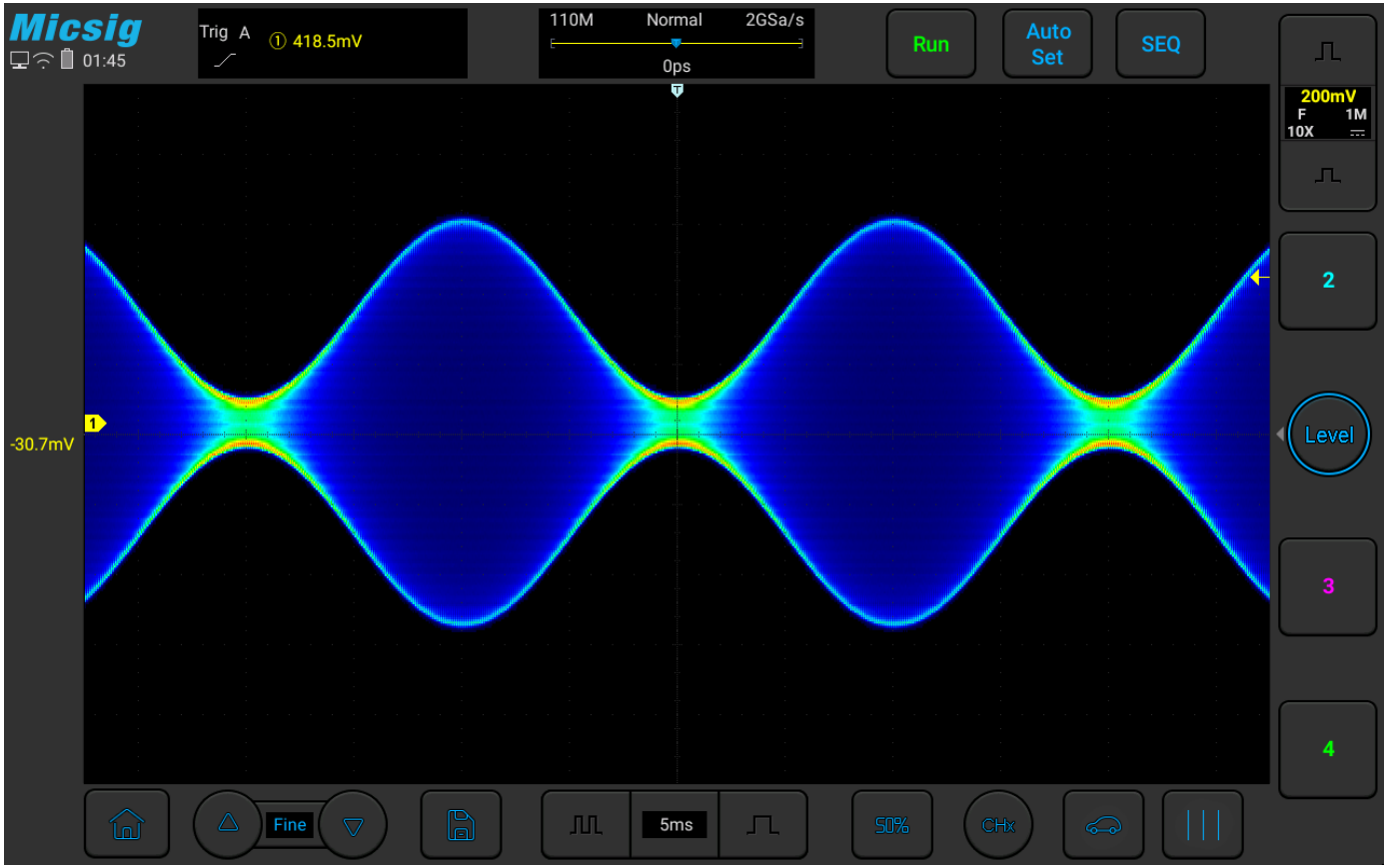

Figure 10-5 Color Temperature Open Mode

10.6 Time Base Mode Selection

For details, please refer to “4.4 ROLL, XY“ in Chapter 4.

Chapter 11 Sampling System

This chapter contains the detailed information of the sampling system of the oscilloscope. You are recommended to read this chapter carefully to understand the setting and operation of the sampling system of the ATO series oscilloscope.

- Sampling overview
- Run, stop and single sequence acquisition (running control)
- Select sampling mode
- Record length and sampling rate

11.1 Sampling Overview

To understand the sampling and sampling modes of the oscilloscope, you need to understand the sampling principle, aliasing, oscilloscope bandwidth and sampling rate, oscilloscope rise time, required oscilloscope bandwidth, and the influence of memory depth on the sampling rate.

Sampling principle

According to the Nyquist sampling principle, for a bandwidth-limited signal with the maximum frequency f_{MAX}, the equidistant sampling frequency f_S must be twice as large as the maximum frequency f_{MAX}, so that a unique signal can be reconstructed without aliasing.

$$f_{MAX} = \frac{f_S}{2} = \text{Nyquist frequency } (f_N) = \text{alias frequency}$$

Aliasing

Aliasing occurs when the signal is under sampled ($f_S<2f_{MAX}$). Aliasing is signal distortion caused by incorrectly reconstructing low frequencies from a small number of sampling points.

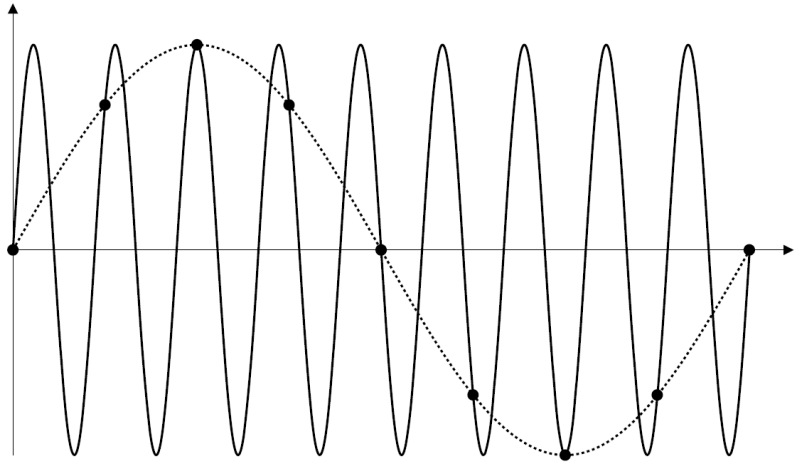

Figure 11-1 Aliasing

Oscilloscope bandwidth and sampling rate

The oscilloscope bandwidth usually refers to the lowest frequency at which the input signal sine wave is attenuated by 3dB (-30% amplitude error).

For oscilloscope bandwidth, according to the sampling principle, the required sampling rate is $f_S=2f_{BW}$. However, this principle assumes that there is no frequency component exceeding f_{MAX} (f_{BW} in this case) and requires a system with ideal brick-wall frequency response.

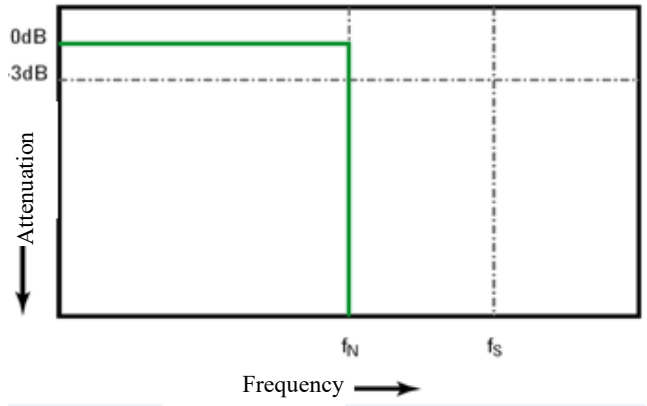

Figure 11-2 Theoretical Brick-Wall Frequency Response

However, digital signals have frequency components that exceed the fundamental frequency (the square wave consists of sine waves at fundamental frequency and an infinite number of odd harmonics), and for bandwidths of 500MHz and below, the oscilloscope typically has Gaussian frequency response.

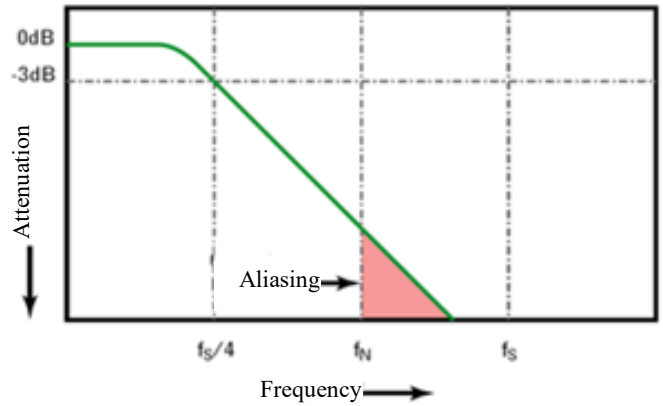

Figure 11-3 Sampling Rate and Oscilloscope Bandwidth

The oscilloscope bandwidth is limited to 1/4 sampling frequency and reduces the frequency response above the Nyquist frequency.

Therefore, in fact, the oscilloscope sampling rate should be 4 times or more of its bandwidth: $f_S \geq 4f_{BW}$. This can reduce aliasing and cause greater attenuation in the aliased frequency components.

Oscilloscope rise time

The oscilloscope rise time is closely related to its bandwidth. The rise time of an oscilloscope with Gaussian type frequency response is approximately $0.35/f_{BW}$ (based on the standard from 10% to 90%).

The oscilloscope rise time is not the fastest edge speed that an oscilloscope can accurately measure. It is the fastest edge speed that the oscilloscope can produce.

Desired oscilloscope bandwidth

The oscilloscope bandwidth required to accurately measure signal is primarily determined by the rise time of the signal rather than the frequency of the signal.

The following steps can be used to calculate the required oscilloscope bandwidth:

1) Determine the fastest edge speed.

   Rise time information is typically obtained from the published device specifications used in the design.

2) Calculate the maximum “actual” frequency component.

According to Dr. Howard W. Johnson's book "*High-Speed Digital Design–A Handbook of Black Magic"*, all fast edges have wirelessly continuous frequency components. However, there is a turning point (or "inflection point") in the fast edge spectrum at which frequency components above f_{knee} are negligible in determining the signal shape.

f_{knee}=0.5/signal rise time (based on 10% - 90% threshold)

f_{knee}=0.4/signal rise time (based on 20% - 80% threshold)

3) The multiplication factor for the desired accuracy is used to determine the required oscilloscope bandwidth.

Desired Accuracy	Desired Oscilloscope Bandwidth
20%	$f_{BW}=1.0xf_{knee}$
10%	$f_{BW}=1.3xf_{knee}$

3%	$f_{BW}=1.9xf_{knee}$

Figure 11-4 Bandwidth Corresponding to Oscilloscope Measurement Accuracy

11.2 Run/Stop Key and Single SEQ Key

Use softkeys in the button area to start and stop the oscilloscope acquisition system: Run/Stop button 

and Single Sequence Acquisition 

button.

- When the Run/Stop button 

is displayed in green, it indicates that the oscilloscope is running, that is, it meets the trigger condition and data acquisition is being performed. The green "RUN" or "WAIT" is displayed in the upper left corner of the screen.

  To stop data collection, tap the Run/Stop button. After stopping, the screen displays the last acquired waveform.

- When the Run/Stop button 

is displayed in red, it indicates that data acquisition has stopped. The red "STOP" is displayed in the upper left corner of the screen.

To resume data acquisition, press the Run/Stop button again.

- To capture and display single acquisition (whether the oscilloscope is running or stopped), tap the single sequence key 

for a single acquisition.

11.3 Select Sampling Mode

Open the main menu, tap the sampling mode option under “Sampling”, and choose among the four sampling modes: normal, average, peak and envelope in the pop-up box.

The sampling modes of all channels are same. That is, if the sampling mode of any channel is changed, the sampling mode of all channels is changed at the same time.

Normal sampling mode

Oscilloscope samples signal through equivalent time intervals to build waveform. When the time base of 20 ns or faster is chosen, the oscilloscope automatically performs an interpolation algorithm that inserts difference point between sampling points.

This mode produces the best display effects for most waveforms.

Peak sampling mode

In peak sampling mode, when the horizontal time base setting is low, the minimum and maximum sample values are retained to capture rare events and narrow events (with any noise expanded). This mode will display all pulses that are at least as wide as the sampling period.

When the time base is set to 200ms and above, the oscilloscope will automatically exit the peak sampling mode and switch to the normal sampling mode.

Burr or narrow pulse capture

Burr is the rapid change in waveform that is usually narrower than waveform. Peak sampling mode can be used to view burr or narrow pulses more easily. In the peak sampling mode, narrow burr and transition edges are brighter than in those in the “normal” sampling mode, making them easier to see.

Applying the peak sampling mode can avoid signal aliasing but show more real noises.

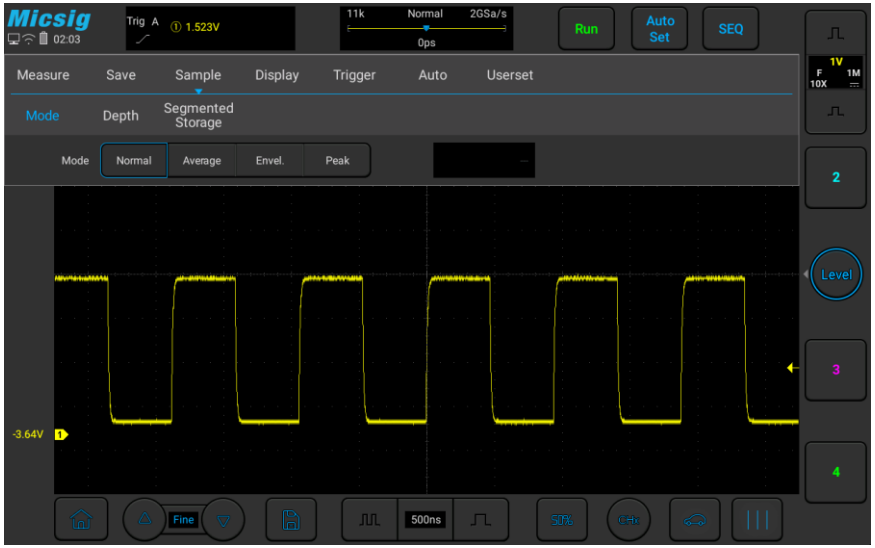

Figure 11-5 Sine Wave with Burr

Normal Sampling Mode

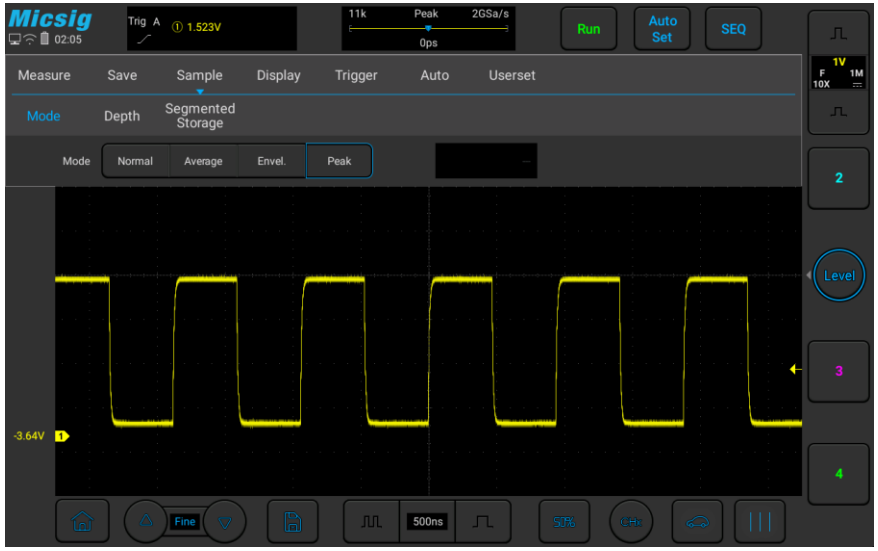

Figure 11-6 Sine Wave with Burr

Peak Sampling Mode

Use peak detection mode to find burrs

1) Connect signal to the oscilloscope to be stably displayed.

2) To find burr, select the peak sampling mode in Sampling Mode option in the Channel menu.

3) In the menu, tap “Display” → “Persistence”, then tap “∞” (infinite persistence). The oscilloscope will restart sampling data and display them on the screen.

4) Use the zoom mode to represent the characteristics of burr:

   a. Tap the “Zoom” button in the main menu to open the zoom window.

   b. To get a better resolution of burr, expand the time base to set the expanded portion of the normal window view around burr.

Average sampling mode

The average sampling mode averages multiple acquisition results to reduce random or unrelated noises in the displayed signal. The average of multiple sampling results requires stable trigger.

The average number can be set in the selection box after the average sampling mode, and can be set to eight order of magnitudes: 2, 4, 8, 16, 32, 64, 128 and 256.

The higher the average number is, the slower the response of the displayed waveform-to-waveform changes. A compromise must be made between the response speed of waveform versus the changes and the degree of noise reduction shown on the signal.

Use average sampling mode

1) Open the channel menu and select the average sampling mode in the sampling mode option.

2) Press the number box on the right of the average sampling mode box to pop up the average number and then tap it to set the average number that can best eliminate displayed waveform noises.

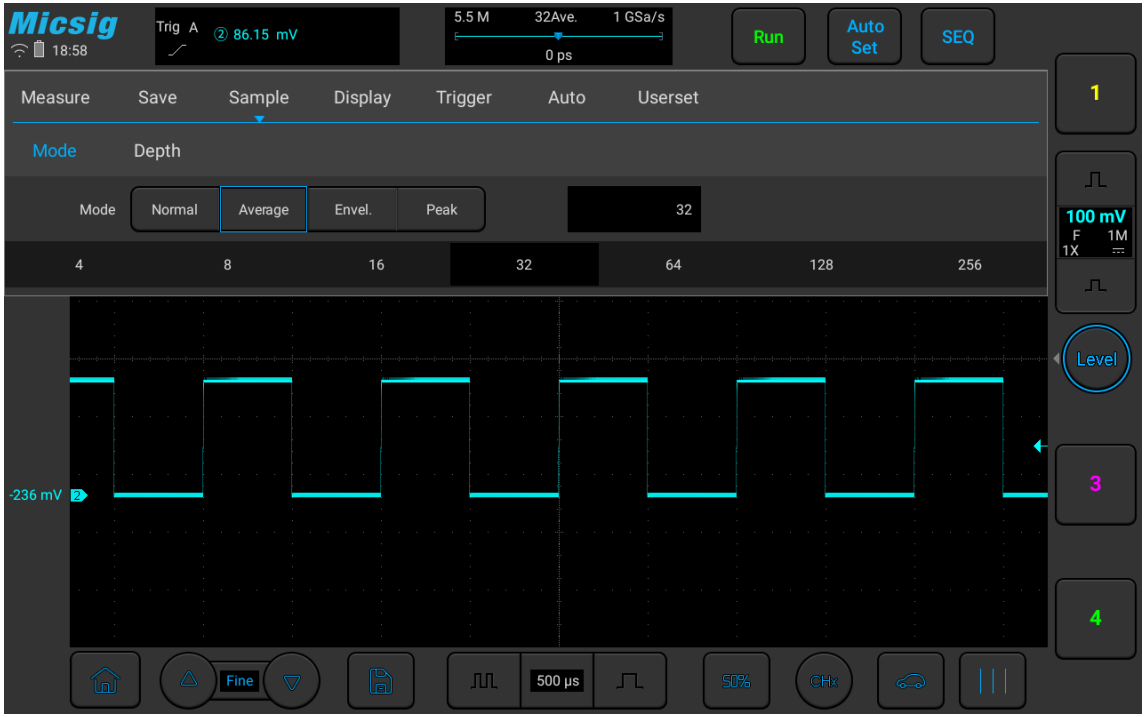

Figure 11-7 Waveform after choosing the average sampling mode, with average number 32

Envelope sampling mode

In the envelope sampling mode, the superposition effect of several sampled waveforms can be observed. The maximum and minimum values of one signal can be captured in the specified N sample data, and the number of waveform superpositions can be set to 2, 4 , 8, 16, 32, 64, 128, 256 or ∞.

Figure 11-8 AM Signal in Envelope Sampling Mode (32)

11.4 Record Length and Sampling Rate

The record length is the data volume for each captured waveform. For example, if the record length is 700K, it means that 700K sample points are captured by one trigger.

In the main menu, tap "Sample" to enter the record length setting menu, which can be set by tapping the corresponding record length.

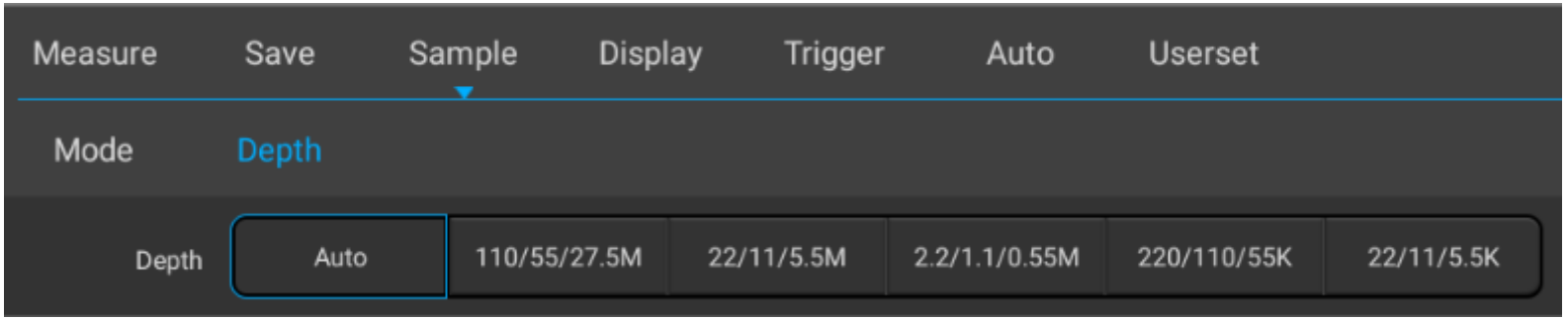

Figure 11-9 Record Length

In normal refresh mode, if it is a single channel, the record length can be set to 22k, 220k, 2.2M, 22M, 110M, Auto; if it is dual channel, the record length can be set to 11k, 110k, 1.1M, 11M, 55M, Auto; if it is three or four channels, the record length can be set to 5.5k, 55k, 0.55M, 5.5M, 27.5M, Auto.

Record length and sampling rate

The record length is data volume collected per waveform capture. For example, if the record length is 0.7M, it means that 700K sample points are captured by one trigger.

The oscilloscope record length and sampling rate have the following relationship:

Sampling rate = record length/acquisition time

Generally, the oscilloscope acquisition time is exactly the display time on the current entire screen (current horizontal time base ×14).

For example, if the oscilloscope has the memory depth of 700K, the sampling rate of 1GSa/s, and the horizontal time base of 50us/div, the acquisition time is 700us, which is 50us/div ×14div.

However, when the fast time base (below 20 ns) or the record length is set to a fixed value, the oscilloscope acquisition time does not necessarily represent the display time on the current entire screen.

For example, if the oscilloscope has the memory depth of 700K, the sampling rate of 1GSa/s, and the horizontal time base of 20ns, the acquisition time is 700ns, which is 2.5 times of the current display time on the entire screen.

Or, if the memory depth is 140K (fixed value), the sampling rate is 1GSa/s, and the horizontal time base is 1us, the acquisition time is 140us, which is 10 times of the current display time on the entire screen.

For a single channel in a channel pair, the maximum sampling rate of the ATO series oscilloscope is 1GSa/s.

If any two channels are opened, the sampling rate of the two channels will halved. For example, when CH1 and CH3 are opened, the sampling rates of CH1 and CH3 are both 500 MSa/s.

If any three channels or all four channels are opened, the sampling rate per channel will become 1/4 of the maximum sampling rate. For example, when CH1, CH2 and CH3 are opened, the sampling rates of CH1, CH2 and CH3 are 250 MSa/s for each of them.

Chapter 12 Serial Bus Trigger and Decode (Optional)

This chapter contains the detailed information of serial bus decoding. You are recommended to read this chapter carefully to understand the setting and operation of Smart bus trigger and decode.

This chapter mainly include the below contents:

- UART (RS232/RS422/RS485) bus trigger and decode
- LIN bus trigger and decode
- CAN(FD) bus trigger and decode
- SPI bus trigger and decode
- I2C bus trigger and decode
- ARINC429 bus trigger and decode (Optional)
- 1553B bus trigger and decode (Optional)

Swipe up or down at the channel selection area to enter the second channel selection area, tap 

or 

to enable decoding, open bus configuration menu, select bus type, there are seven bus types: UART (RS232/RS422/RS485), LIN, CAN(FD), SPI, I2C, ARINC429, 1553B, where channels S1 and S2 can be used for decoding simultaneously. Open the trigger setting menu, choose an appropriate trigger type, the corresponding bus trigger type and trigger mode can be set when the bus trigger is selected, and the serial bus is displayed in graphic form.

In the serial bus decode mode, if it is screen rolling in other modes, the time base is automatically adjusted to 1ms when switching to serial decode (the maximum time base supported by the serial decode mode is 100ms); in Zoom mode, the enlarged signal can be decoded and displayed. The normal display window supports a maximum time base of 100ms. When decoding is enabled, clicking “AUTO” will set the trigger type to be the same as the decode channel bus type. The bus type selection menu is shown in Figure 12-1:

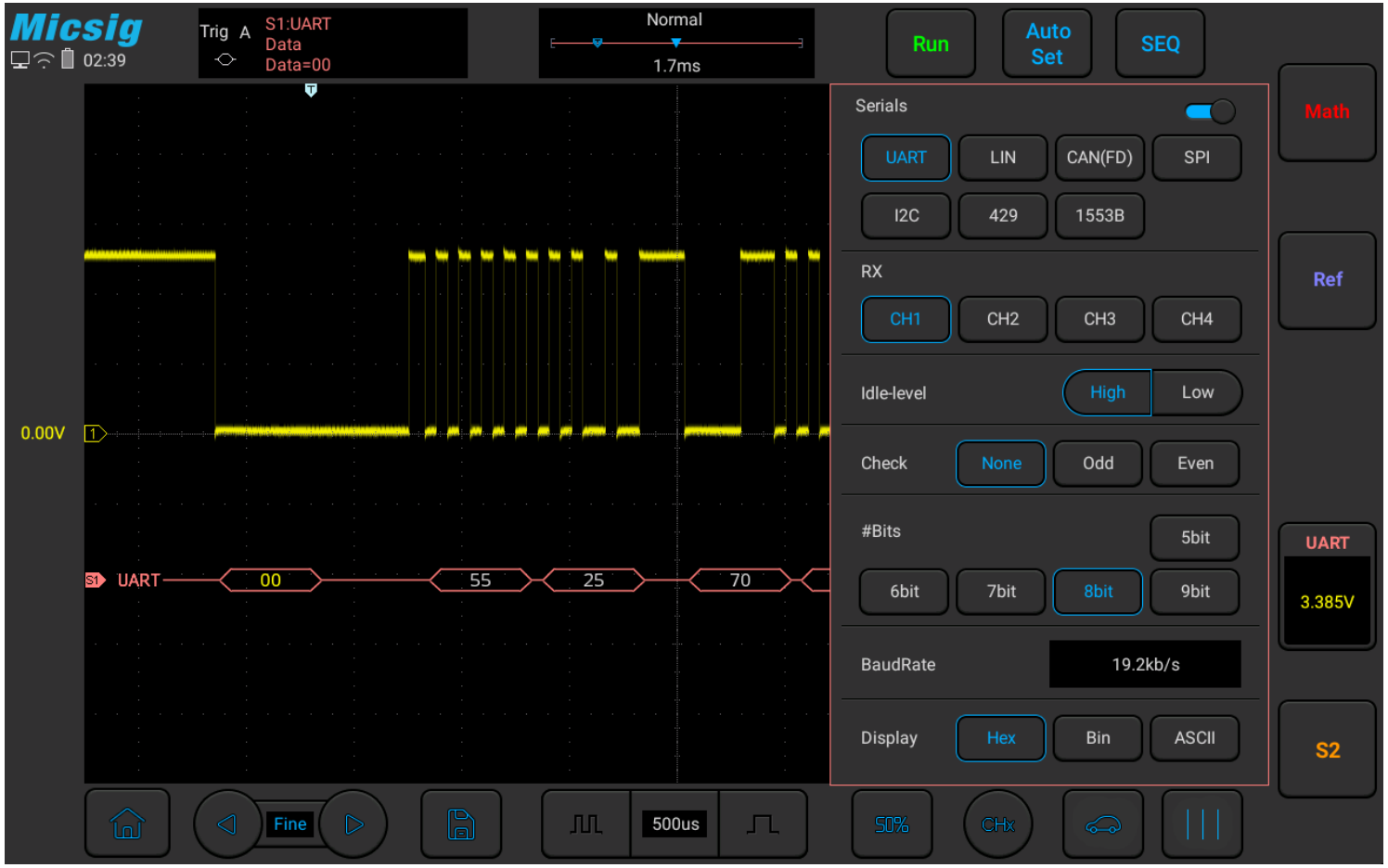

Figure 12-1 Bus Type Selection Menu

Open the pull-up menu and tap 

key to open or close the text mode, as shown in Figure 12-2.

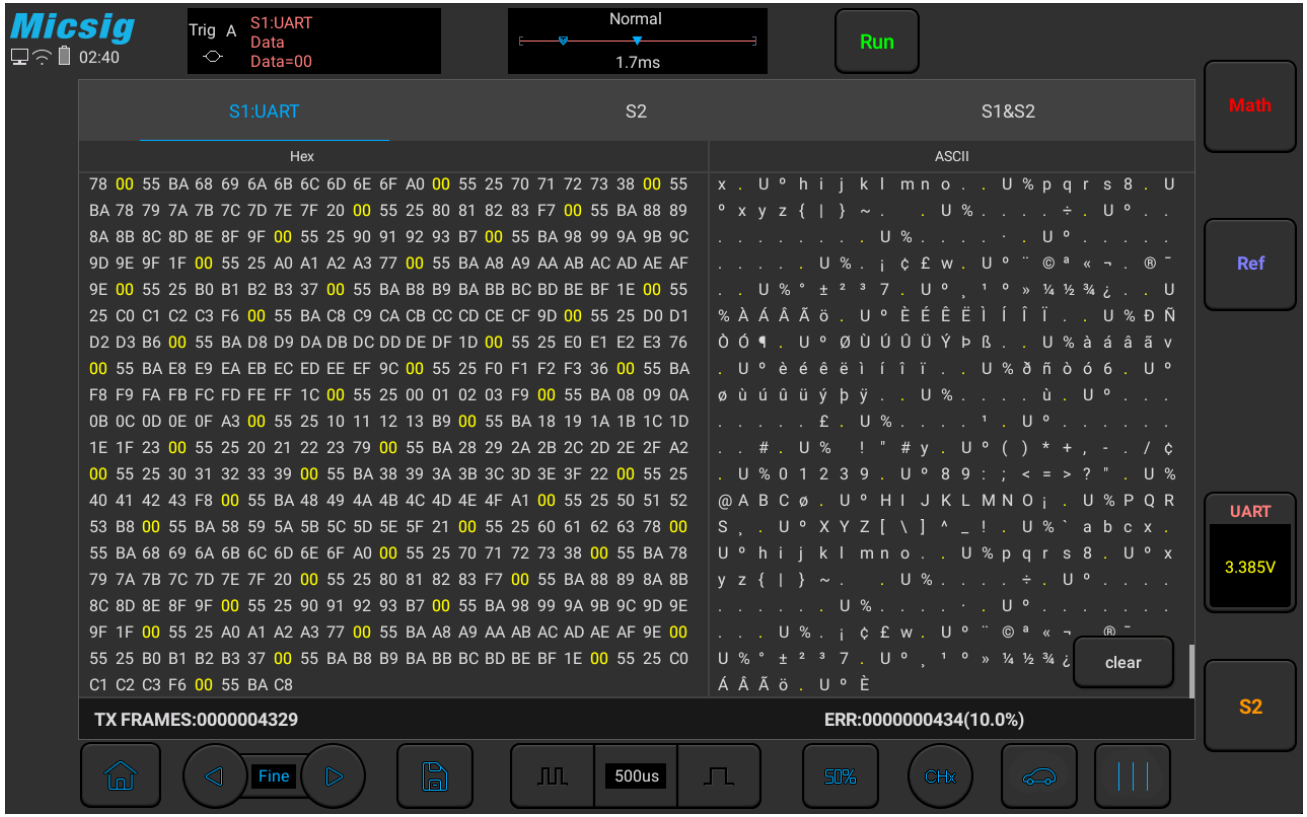

Figure 12-2 Bus Decode Text Mode

Description:

Two decode channels S1&S2 in the text interface must be configured identically to be opened, and each channel is displayed in chronological order with different colors;

S1/S2/S1&S2 are the channel configuration bus information, and X knob is rotated or the label is switched to change the bus channel;

Clicking save during the text acquisition process can save all currently acquired data. If the date volume is too large, “wait” will be displayed, and the save success prompt will be displayed.

Oscilloscope can be used as a USB storage device to view saved files on a computer, as shown in Figure 12-3:

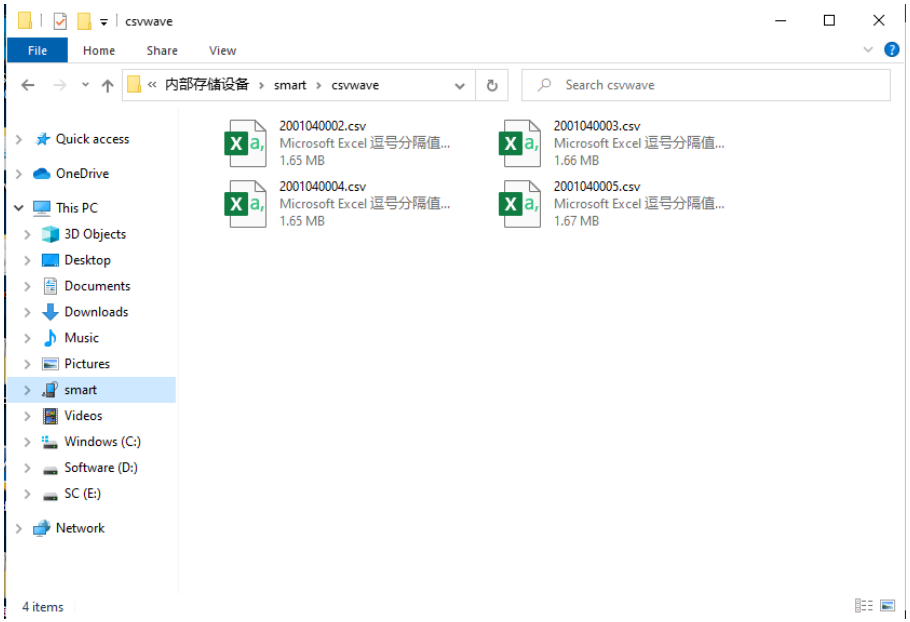

Figure 12-3 Bus Text Storage Files

12.1 UART (RS232/RS422/RS485) Bus Trigger and Decode

For correctly decoding UART(RS232/RS422/RS485) bus data and making trigger stable, the bus configuration, trigger mode setting and trigger level need to be adjusted.

- **Bus configuration**

  Left swipe 

 or 

 to open the bus configuration menu, as shown in Figure 12-4. The RX channel must be chosen and the following parameters must be set according to measured signals:

  Idle Level — Choose Idle Low or Idle High to match the idle state of measured equipment. For RS232, Idle Low may be chosen.

  Note: RS232 industry standard uses "negative logic", namely high level is logic "0" and low level is logic "1".

  Parity Bit — Choose odd, even or none depending on measured equipment.

  Word Length — Set the number of bits in UART word to match measured equipment (5-9 bits available).

Baud Rate — Choose the baud rate that matches signal in measured equipment.

The baud rate can be set within the range from 1.2Kb/S to 8.000Mb/S.

Bus Display — Choose hexadecimal, binary or ASCII code display.

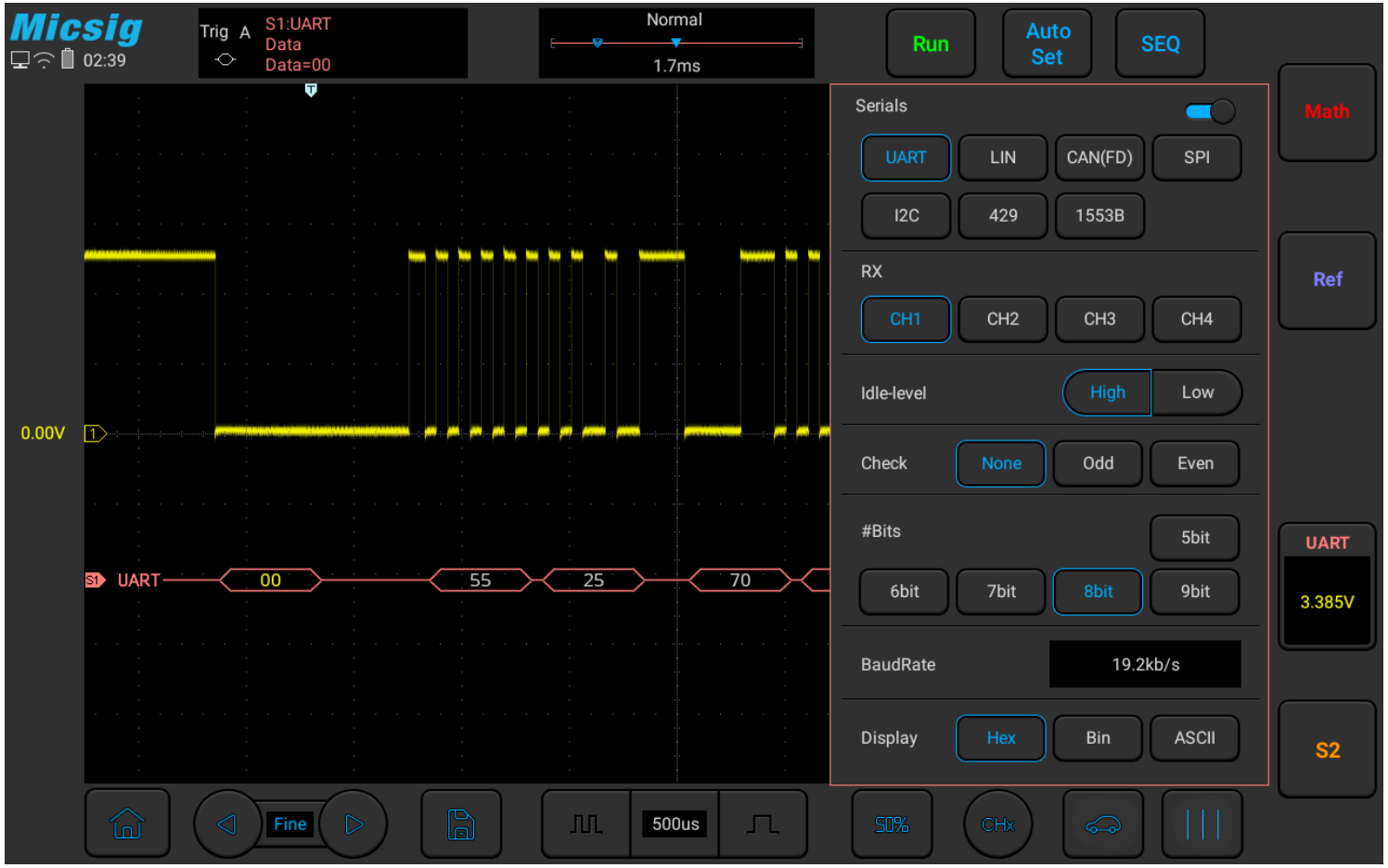

Figure 12-4 UART Bus Configuration Menu

When word is displayed in ASCII, 7-bit ASCII format is used. Valid ASCII characters are between 0x00 and 0x7F. To display in ASCII, at least 7 bits in the “Bus Configuration” must be chosen. If ASCII is chosen and the data exceeds 0x7F, the data will be displayed in hexadecimal.

Click the baud rate setting box to open the baud rate selection column. If Custom is chosen, click to pop up the virtual soft keyboard, select the bit to be modified, enter value, and click “Enter” on the virtual soft keyboard to complete setting. The baud rate can be set from 1.2Kb/S to 8.000Mb/S. The virtual soft keyboard is shown in Figure 12-5:

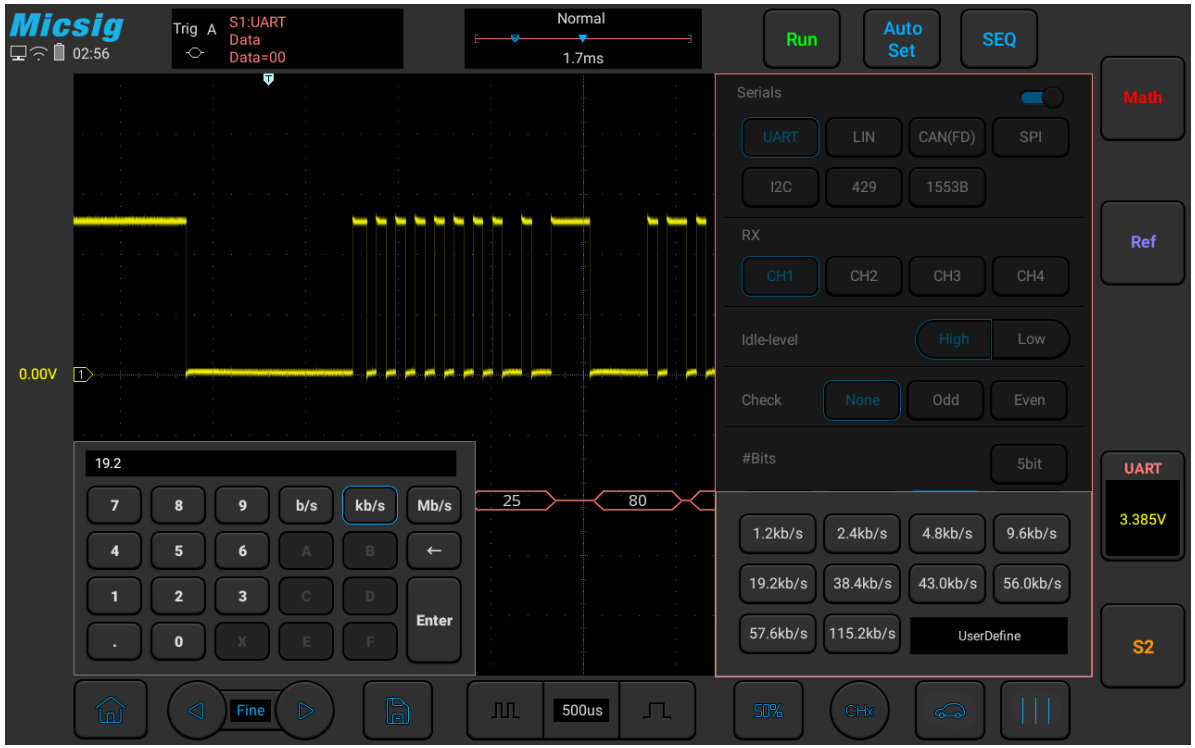

Figure 12-5 Baud Rate Default Setting

Note: When there is parity bit, the data word length indicates the total length of data bit plus parity bit. When there is no parity bit, the data word length is considered to be the length of data bit. For example, if the data word length is 8bit, when there is no parity bit, it means that the total length of data bits is 8bit; when there is parity bit, it means that the total length of data bits is 7bit, and there is parity bit of 1 bit.

- **Trigger mode**

Open the trigger configuration menu and select the appropriate trigger type; when choosing UART bus trigger, the trigger type, trigger relationship and trigger data need to be set, as shown in Figure 12-6:

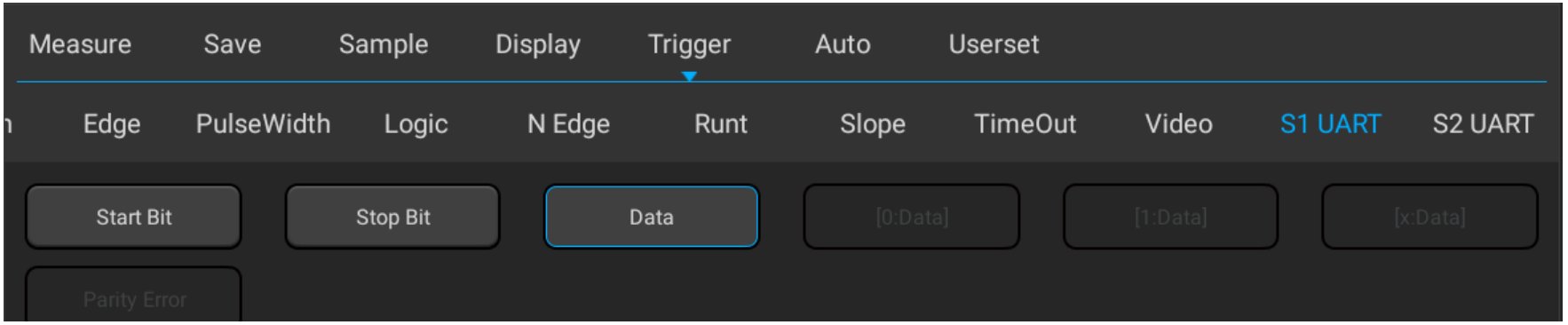

Figure 12-6 Trigger Setting Menu

After selecting the trigger data, use the pop-up virtual keyboard to modify it, enter the value, and click “Enter” on the virtual soft keyboard to complete the setting.

UART trigger configuration menu description:

a) Start bit — trigger at the start bit of the measured signal;

b) Stop bit — trigger at the stop bit of the measured signal, no matter the measured signal uses 1, 1.5, or 2 stop bits or not, the trigger will occur at the first stop bit.

c) [data] — Trigger at the specified data bit, when measured signal data bits are effective as 5 to 8bits, select [data], and select the trigger relationship as "=", ">" , " <", "≠", then select "Trigger Data", press data on the touch screen, and use the pop-up virtual keyboard to modify;

d) [0:data] — the measured signal data bits is 9bits (the 9th bit is parity bit). Only when the 9th bit is 0, then trigger. The trigger relationship, trigger data configuration are the same as those of [data] trigger;

e) [1:data] — the measured signal data bits is 9bits (the 9th bit is parity bit). Only when the 9th bit is 1, then trigger. The trigger relationship, trigger data configuration are the same as those of [data] trigger;

f) [x:data] — the measured signal data bits is 9bits (the 9th bit is parity bit). No matter what the value of the 9th bit is, trigger at the designated data bit. The trigger relationship, trigger data configuration are the same as those of [data] trigger;

g) Parity error — valid when there is parity check at parity bit, trigger while parity error.

- **UART serial decode**

The measured signal word length is 8bit; parity bit, none; baud rate, 19.2kb/s, hexadecimal; trigger mode as data bit:55; follow the steps as below:

(1) Tap S1 to open the decode channel, and click S1 again to open the bus configuration menu;

(2) Select the bus type as “UART”, click “Ch1”, “Idle High”, “Parity None”, “8bit”, “19.20kb/s”, display “hexadecimal”, then close menu;

(3) Open the trigger mode setting menu, click “Data”, enter 55 manually, and press “enter” to confirm;

(4) Adjusting the threshold level according to the amplitude level of signal may make the signal to be stably triggered. The UART trigger graphic interface is shown in Figure 12-8:

Method 1: Click 

configuration information to open the decode channel threshold level adjustment box, and drag the adjustment box upward and downward to adjust the threshold level.

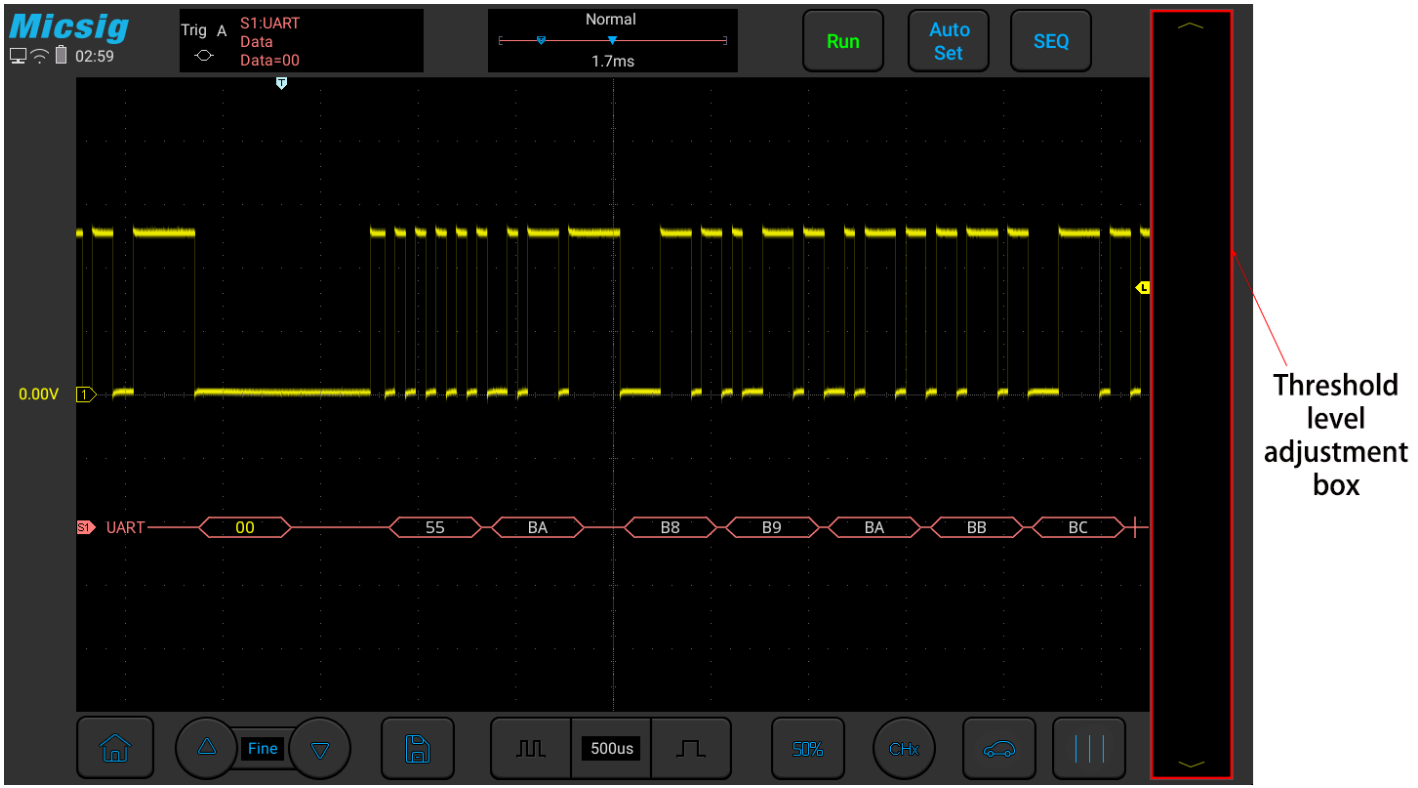

Figure 12-7 UART Decode Level Adjustment

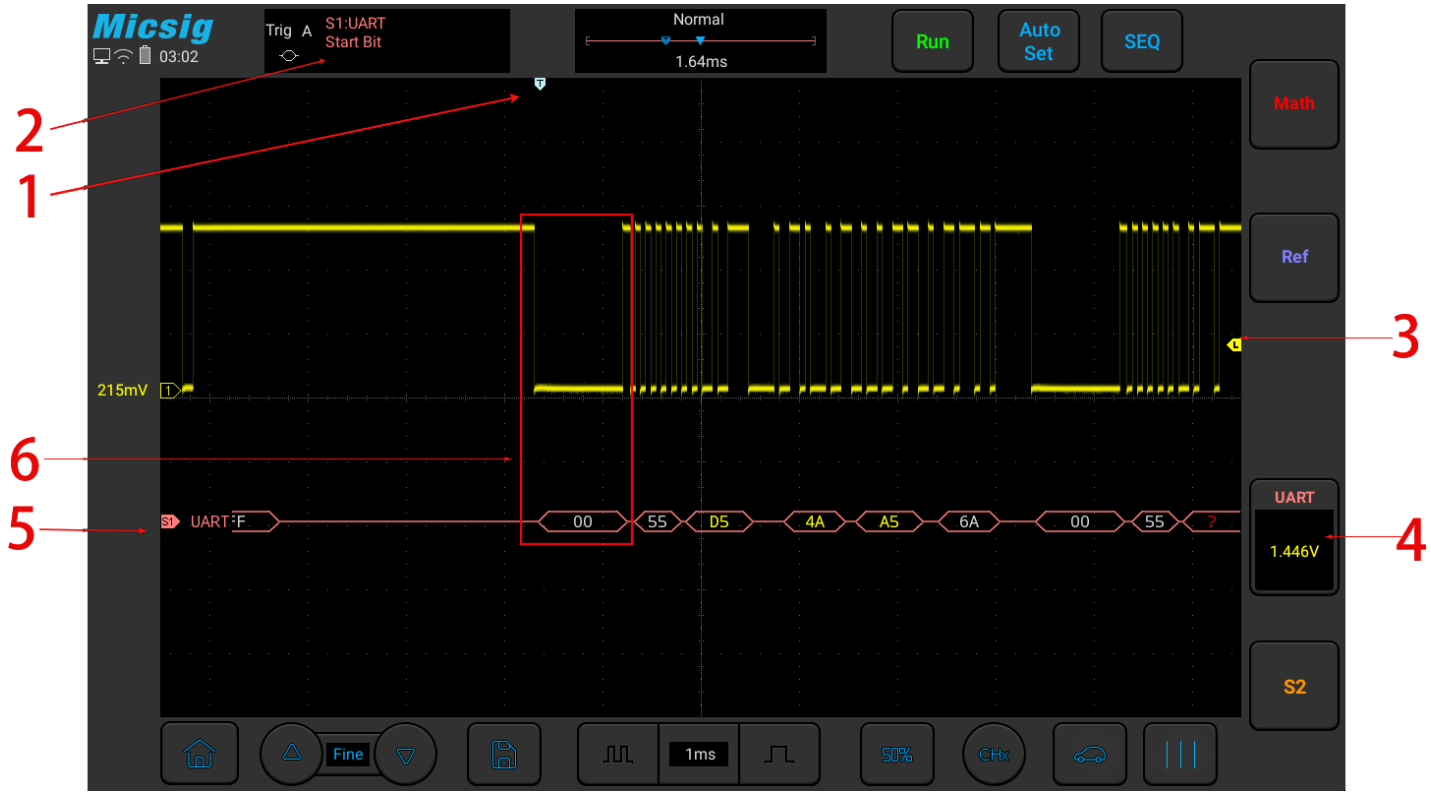

Figure 12-8 UART Graphic Interface

UART graphic interface description:

(1) Trigger position

(2) Trigger type

(3) Threshold level

(4) Configuration information

(5) Decode the data packet, detailed as follows

(6) Decode data and the corresponding waveform area

UART decode data packet description:

(1) Decode data packet displays real-time data about the bus activities;

(2) Decode data displays as hexadecimal system in white;

(3) When the word length is 5-8 bits, the decode data displays as two bits of hexadecimal; when the word length is 9 bits, the decode data displays as 3 bits of hexadecimal, and the 9th bit displays at the left side;

(4) When there is error in decode data, if the error is at stop bit, the data displays in yellow, if it is parity error, data displays in red;

(5) When "?" appears, the time base needs to be adjusted to view decode results.

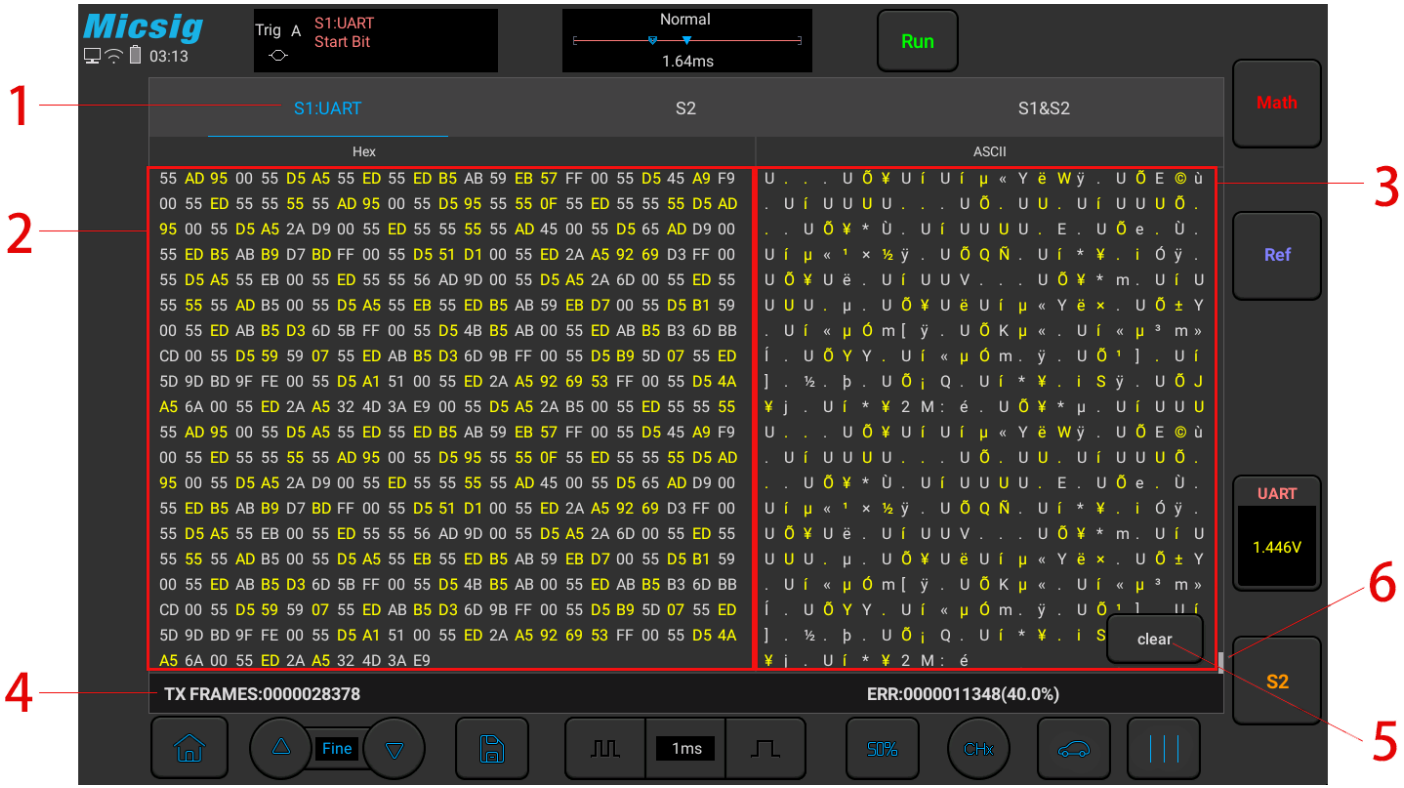

Figure 12-9 UART Text Interface

UART text interface description, see Figure12-9:

(1) S1/S2/S1&S2 is channel configuration bus information.

(2) Area for decode data.

(3) ASCII code corresponding to the text data (when the data format is 9 bits and there is no parity bit, ASCII code corresponds to lower 8 bits of data on the left side).

(4) Counter: Calculates the total number of frames and the percentage of ERR (parity error and stop bit error) frames.

(5) Clear: Clear the counter data.

(6) Roller bar.

In the decode data area, the stop bit error data is displayed in yellow, and the decode error data is displayed in red;

12.2 LIN Bus Trigger and Decode

For correctly decoding LIN bus data and making trigger stable, the bus configuration, trigger mode set and trigger level need to be adjusted.

- **Bus configuration**

Left swipe 

or 

to open the bus configuration menu, and the following need to be set according to measured signal:

Source — Select the signal source of decode.

Idle Level - high and low. Select whether to display high active or low active after the signal start bit of measured equipment.

Baud Rate — Select the baud rate that matches the signal being measured, and it can be customized.

The setting method is the same as that of UART, and will not be repeated here. As shown in Figure 12-10:

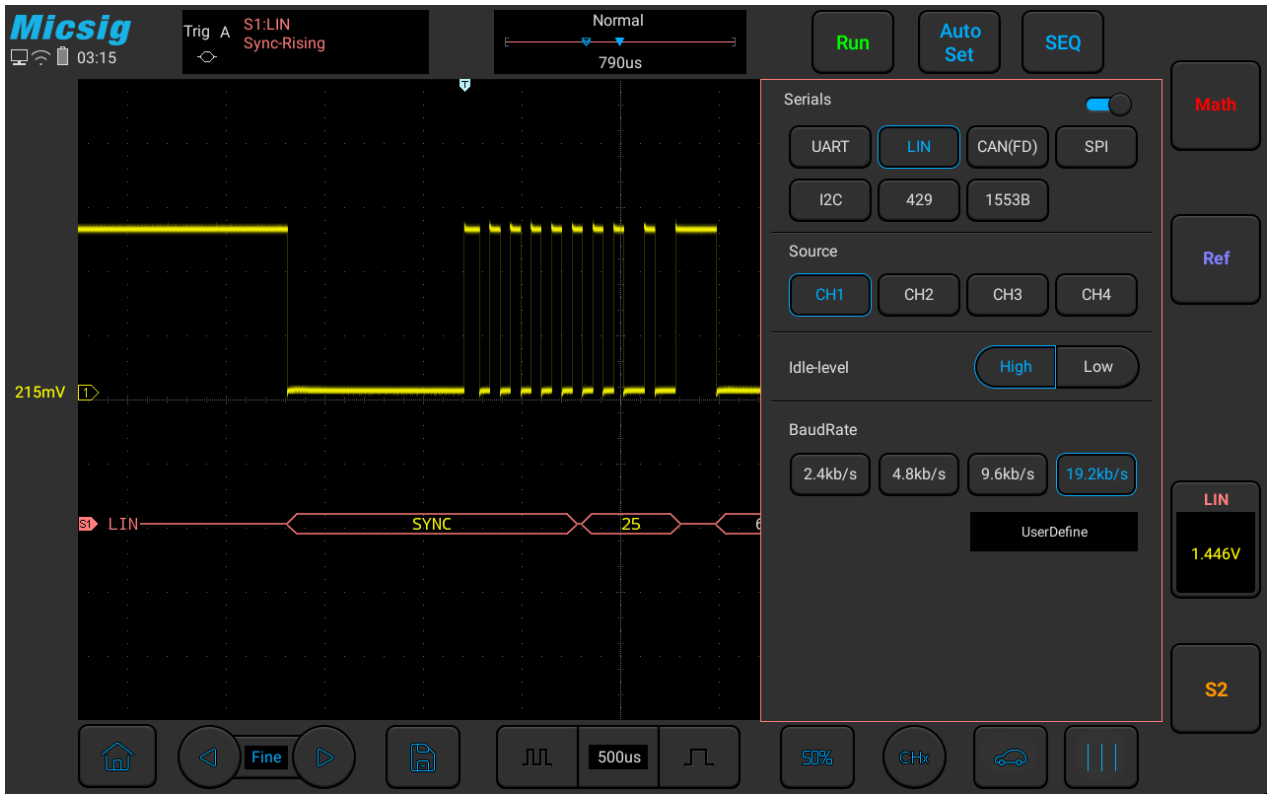

Figure 12-10 LIN Bus Configuration Menu

- **Trigger mode**

Open the trigger configuration menu and select the appropriate trigger type. When the LIN bus trigger is selected, the trigger mode includes: synchronous rising edge, frame ID, frame ID and data. See Figure 12-11:

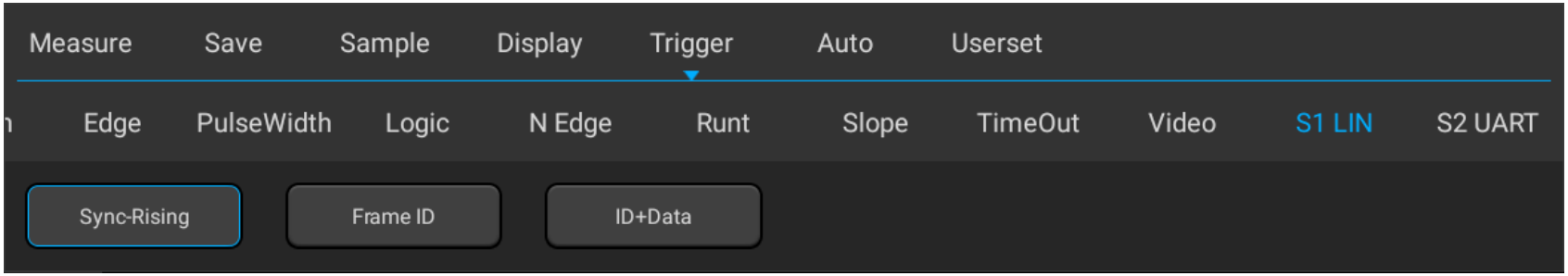

Figure 12-11 LIN Trigger Mode Configuration Menu

a) Synchronous rising edge – When the "Sync Interval" of LIN bus ends, the rising edge triggers.

b) Frame ID — Triggered when a frame with an ID equal to the set value is detected. Select "Frame ID", click data on the touch screen, and use the pop-up virtual keyboard to modify it.

c) Frame ID and data—triggered when a frame with ID and data equal to the set value is detected. After selecting "Frame ID and Data", click ID or data, and set them.

- **LIN serial decode**

Ch1 is connected to measured signal. The idle level is high and the baud rate is 19.2 kb/s. The trigger mode is synchronous rising edge. Please follow these steps:

(1) Tap S1 to open the decode channel, and click again to open the bus configuration menu;

(2) Select the bus type as “LIN”, click “Ch1”, “Idle High”, “19.20kb/s”, and then close the menu;

(3) Open the trigger mode configuration menu and click “Synchronous Rising Edge”;

(4) Click 

configuration information to open the decode channel threshold level adjustment box, and drag the adjustment box upward and downward to adjust the threshold level; adjust the threshold level according to the signal amplitude level to make the signal stably triggered. The LIN trigger graphic interface is shown in Figure 12-12:

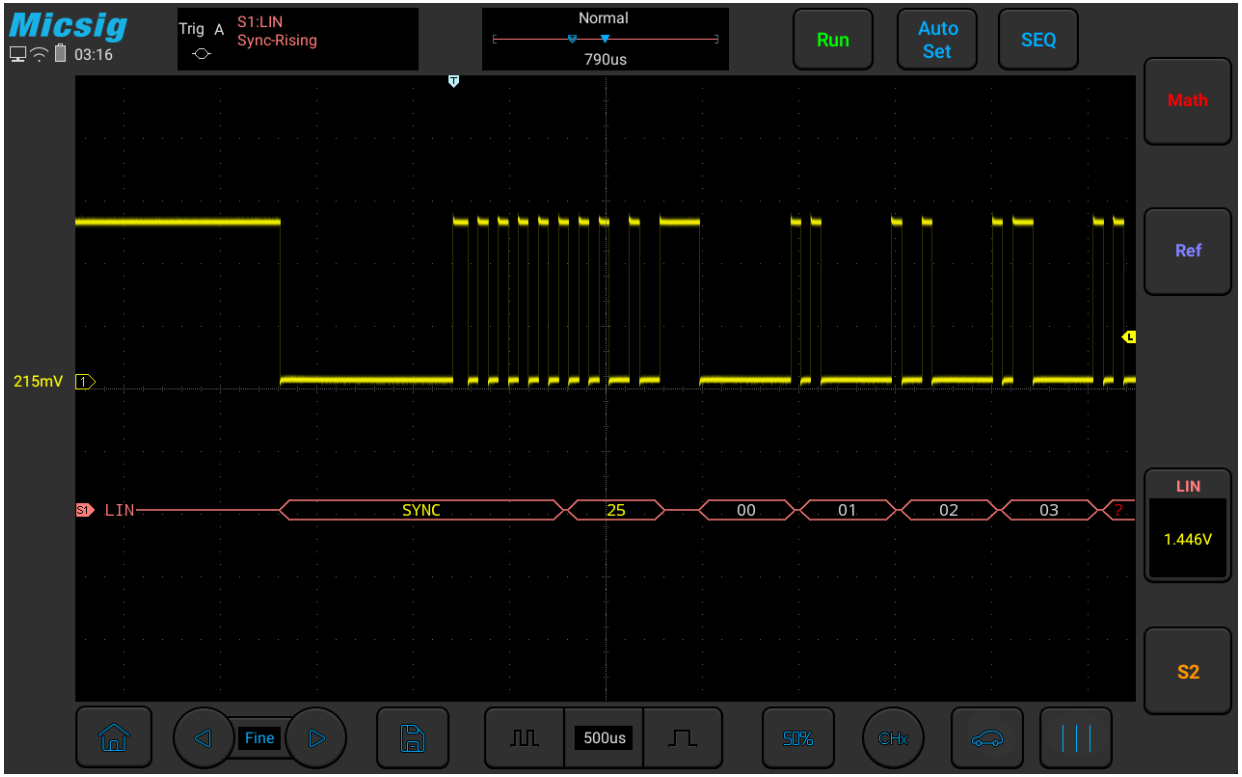

Figure 12-12 LIN Graphic Interface

LIN decode data packet description:

(1) Decode data packet displays real-time data about the bus activities.

(2) Decode data displays as hexadecimal system.

(3) “Frame ID” displays in yellow, “Data” displays in white, and “Parity sum” displays in green. If the parity sum has error, it is displayed in red “E”.

(4) When “?” appears, the time base needs to be adjusted to view decode results.

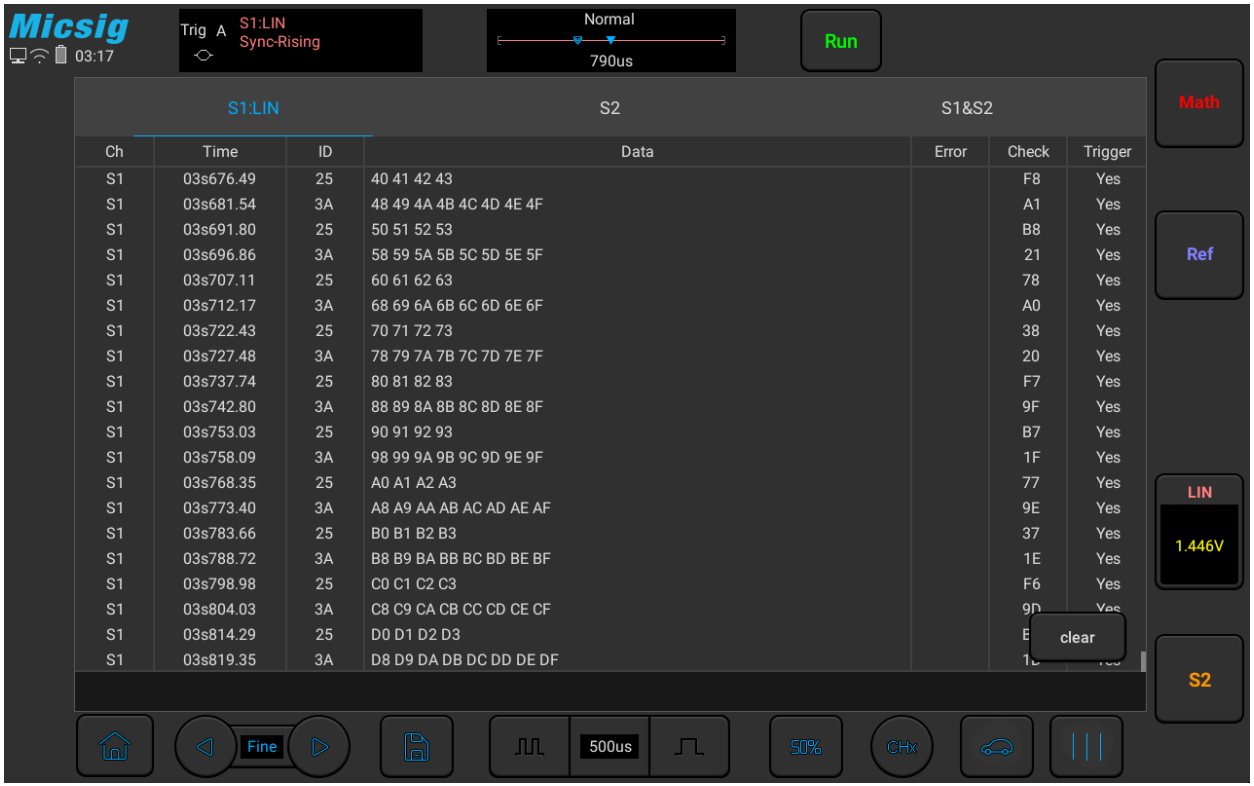

Figure 12-13 LIN Text Interface

LIN text interface description, as shown in Figure 12-13:

(1) “Ch”: bus channel.

(2) “Time”: Time intervals between the last frames to current frames.

(3) “ID”: Frame ID value.

(4) “Data”: Frame data.

(5) “Parity sum”: Frame parity sum, the sum of parity error displays in red.

(6) “Trigger”: “Yes” means the frame reaches trigger condition.

(7) “Clear”: Clear counter data.

12.3 CAN Bus Trigger and Decode

For correctly decoding CAN and CAN FD(optional) bus data and making trigger stable, the bus configuration, trigger mode set and trigger level need to be adjusted.

- **Bus configuration**

  Left swipe 

 or 

 to open the bus configuration menu, the signal source needs to be set, and the signal type and baud rate are set according to measured signal; the setting method is the same as that of UART and will not be repeated here. See Figure 12-14:

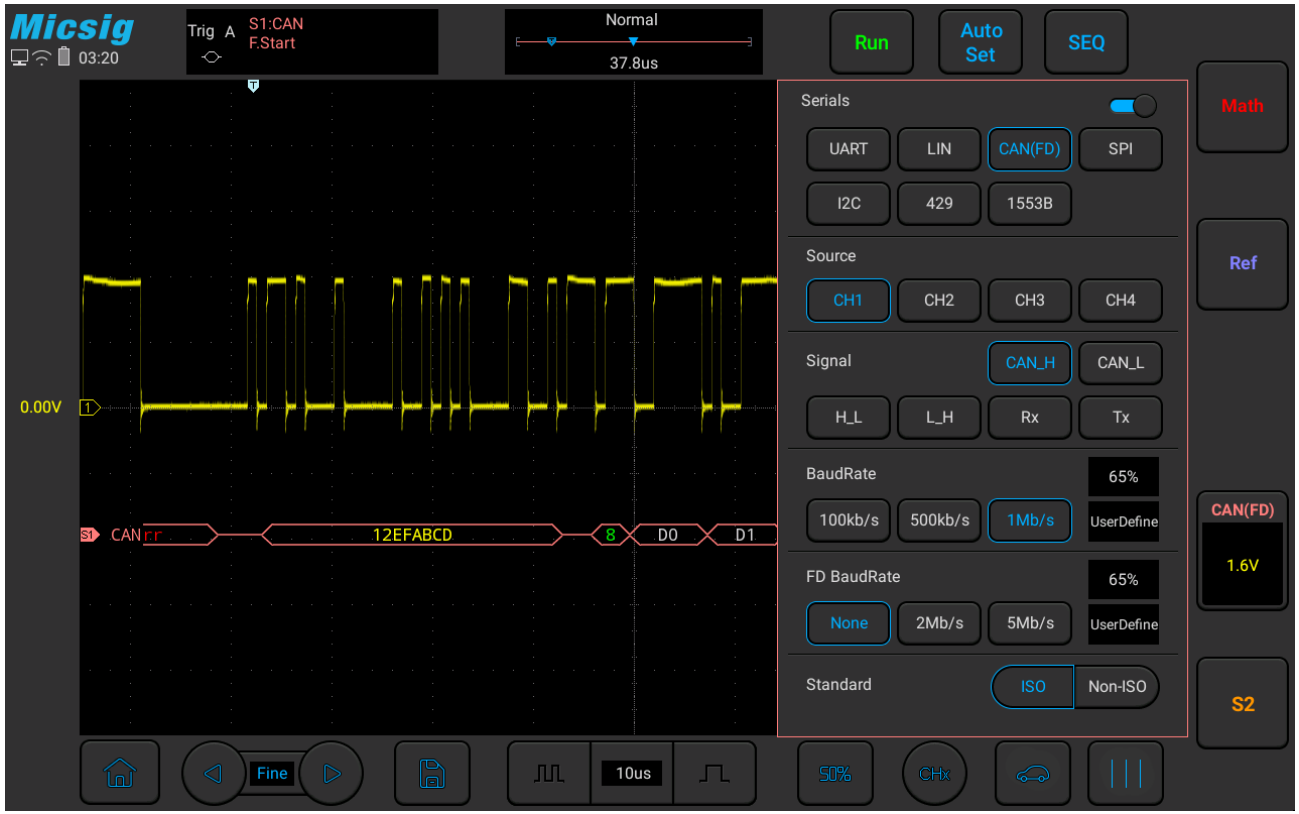

Figure 12-14 CAN Bus Configuration Menu

- **Trigger mode**

Open the trigger configuration menu and select the appropriate trigger type; when S1 CAN bus trigger is selected, as shown in Figure 12-15:

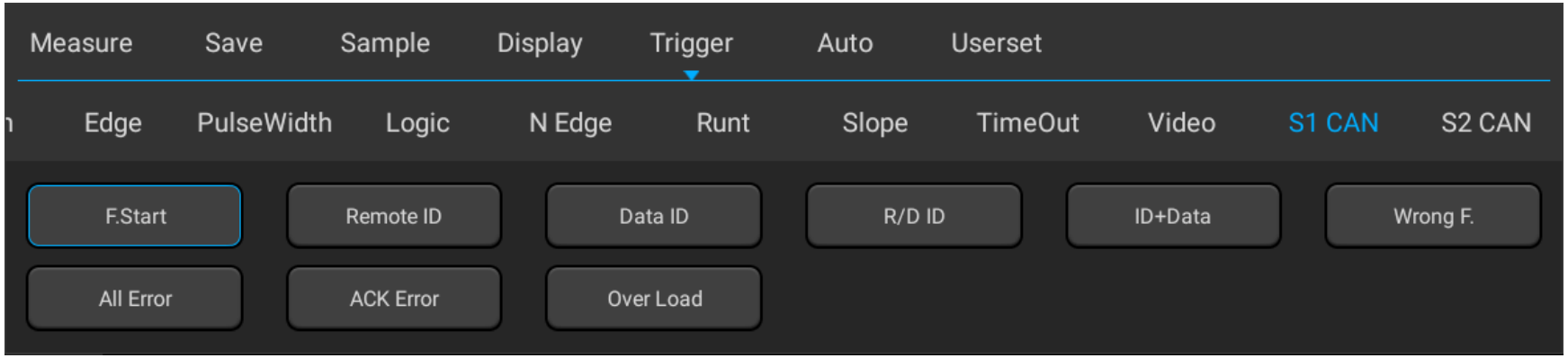

Figure 12-15 CAN Trigger Mode Configuration Menu

Trigger mode selection menu description:

a) Frame start — trigger at the start of the frame;

b) Remote frame ID — setting the ID matches the remote frame trigger. After selecting the “Remote Frame ID”, and then set the ID value at the bottom of the trigger data area

Operation description: Press the numbers on the touch screen and use the virtual keyboard to set;

c) Data framed ID — trigger on data frame that matches set ID. Data frame ID configuration mode is the same as the remote data frame ID configuration;

d) Remote frame/data frame ID — trigger on remote frame or data frame that matches set ID. Remote frame/data frame ID configuration is the same as the remote data frame ID configuration;

e) Data frame ID and data ID — trigger on data frame that matches set ID and data. The configuration method is the same as the remote frame ID configuration;

f) Error frame — trigger on CAN error frame;

g) All errors — trigger when there is any error in format or activity;

h) Ack error — trigger on recessive (high) Ack position;

i) Overload frame — trigger on CAN overload frame.

- **CAN serial decode**

Ch1 is connected to measured signal. The idle level is high and the baud rate is 1Mb/s; the Trigger mode is the frame start. Please follow these steps:

(1) Tap S1 to open the decode channel, and click S1 again to open the bus configuration menu;

(2) Select the bus type as “CAN”, and then click “Ch1”, “Idle High” and “1Mb/s”. After setting, click the blank area to close the menu;

(3) Open the trigger mode configuration menu and click “Frame Start”;

(4) Adjust the threshold level according to the signal amplitude; the CAN trigger graphic interface is shown in Figure 12-16:

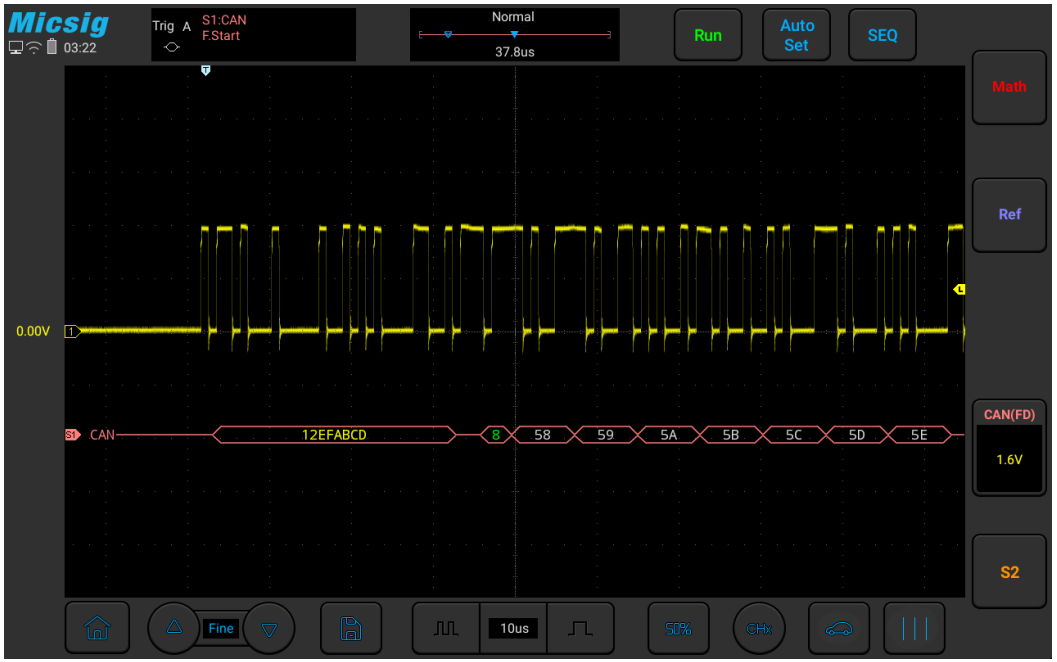

Figure 12-16 CAN Graphic Interface

CAN decode data packet description:

(1) Decode data packet displays real-time data about the bus activities.

(2) Decode data displays as hexadecimal system.

(3) “Frame ID” displays in yellow, “Data” displays in white, and “DLC” and “CRC” codes display in green. If there is frame error, it is displayed in red “E”.

(4) When “?” appears, the time base needs to be adjusted to view decode results, and “!” indicates that the bus waveform corresponding to the decode data packet is incomplete and the data cannot be displayed correctly.

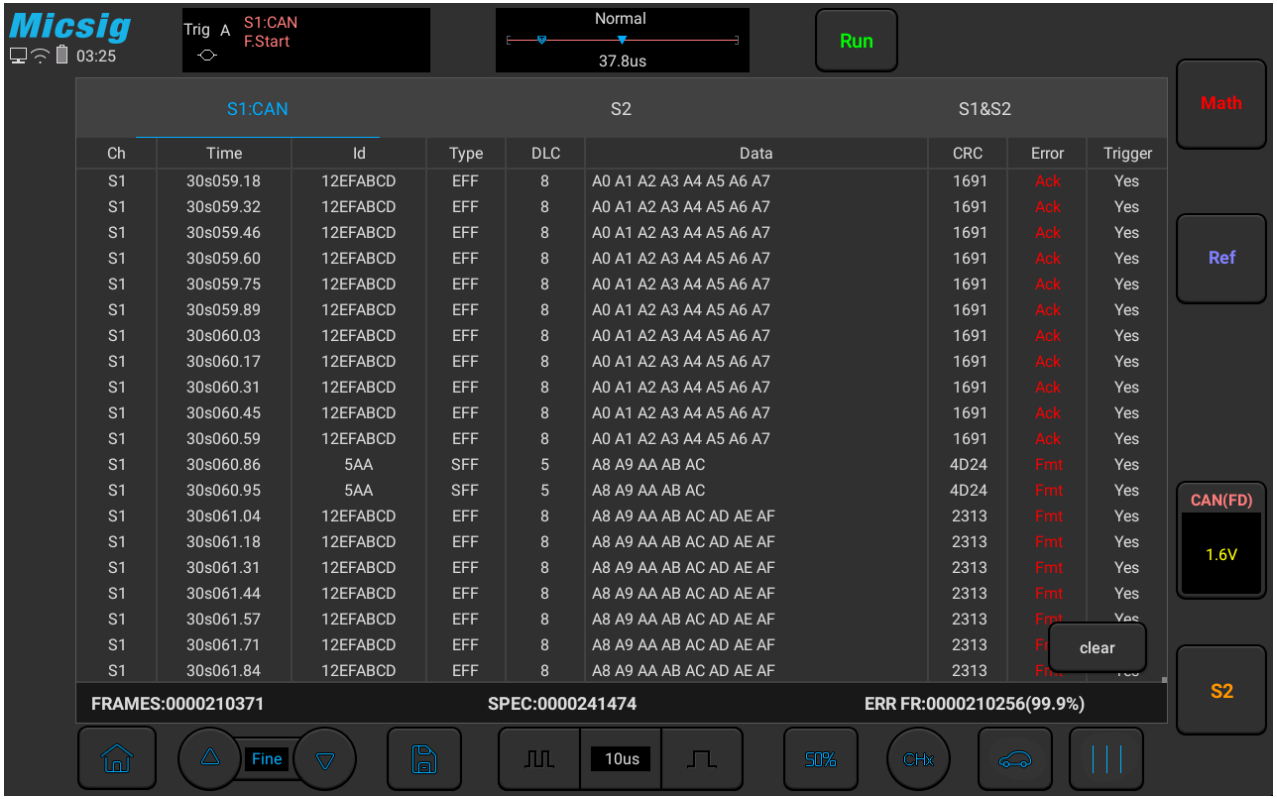

Figure 12-17 CAN Text Interface

CAN text interface description, as shown in Figure 12-17:

(1) “Ch”: bus channel.

(2) “Time”: Time intervals between the last frames to current frames.

(3) “ID”: CAN frame ID value displayed in hexadecimal, maximum 29 bits.

(4) “Type”: Frame type, “SFF” standard data frame, “SRF” standard remote frame, “EFF” extended data frame, “ERF” extended remote frame.

(5) “DLC”: Number of data bytes sent by this frame. This value can be ignored for remote frames.

(6) “Data”: Frame data.

(7) “CRC”: Frame CRC check code.

(8) “Error”: Response error, bit stuffing error, format error, CRC error.

(9) “Trigger”: “Yes” means the frame reaches trigger condition.

(10) “Statistics”: counts the number of occurrences of frame type, data length, status, etc., and the percentage.

12.4 SPI Bus Trigger and Decode

For correctly decoding SPI bus data and making trigger stable, the bus configuration, trigger mode set and trigger level need to be adjusted.

- **Bus configuration**

Left swipe 

or 

to open the bus configuration menu, the following need to be set:

Clock source, data source, chip select signal, and data word length, as shown in Figure 12-18:

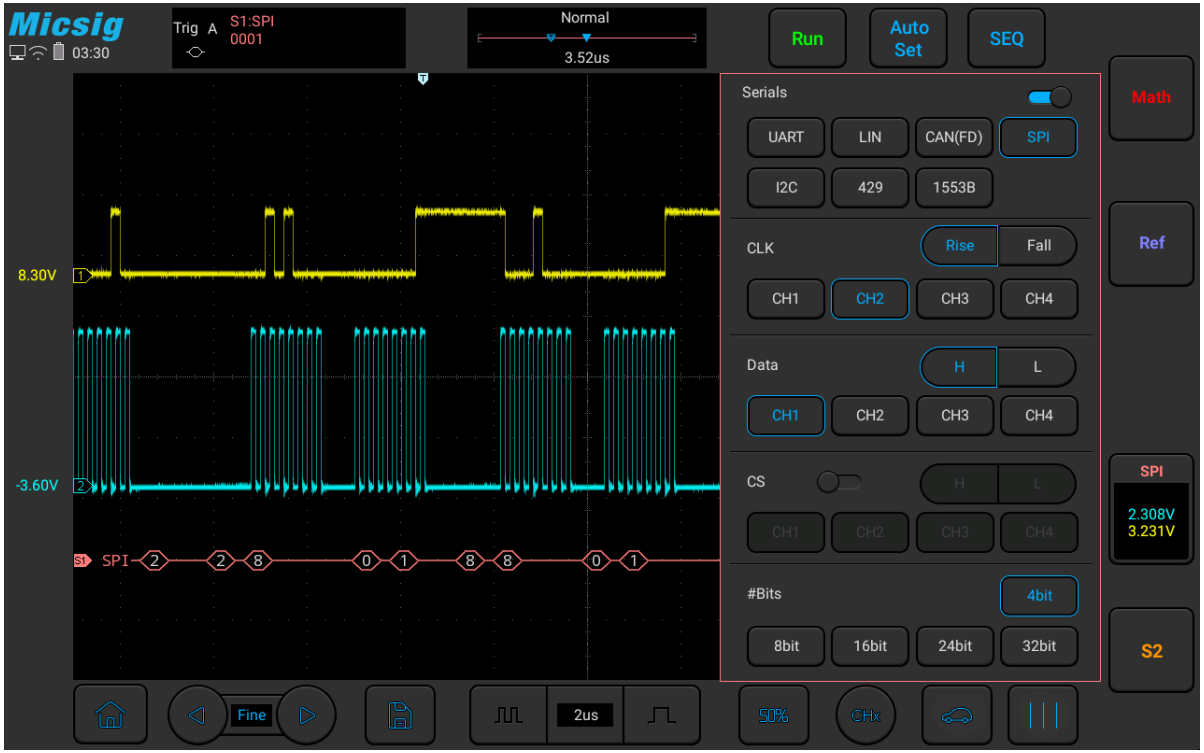

Figure 12-18 SPI Bus Configuration Menu

- **Trigger mode**

Open the trigger configuration menu and select the appropriate trigger type; when selecting the SPI bus trigger, as shown in Figure 12-19:

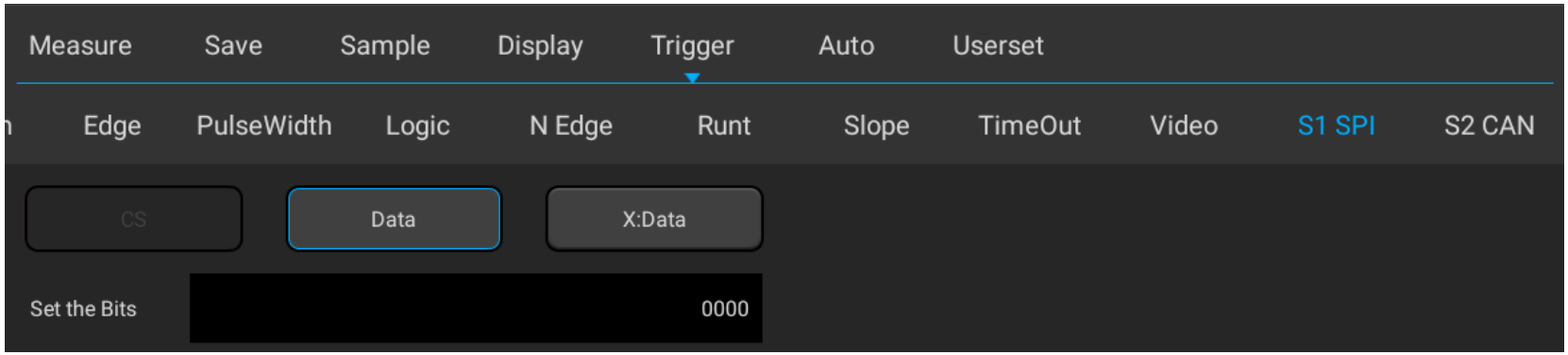

Figure 12-19 SPI Trigger Mode Configuration Menu

The operation method is the same as CAN frame ID to be matched in the configuration, and will not be repeated here.

Note: According to the data byte length set by bus decode, the value of the relevant bit within the byte length is set. Trigger when the corresponding bit on data bus matches the set value.

- **SPI serial bus**

The measured signal channel Ch1 is connected to CLK, Ch2 channel is connected to DATA, the bus idle state is high, the clock rising edge is sampled; the data word length is 4 bits; the CS chip select is off; the trigger mode matches the “Data” at 0001, please follow the steps below:

(1) Tap S1 to open the decode channel, and click S1 again to open the bus configuration menu;

(2) Select the bus type as “SPI”, click clock as “Ch1” rising edge, the data is “Ch2” high level, and the data word length is “4bit”;

(3) Open the trigger setting menu, click data on the touch screen, and use the virtual soft keyboard to set the data to be matched as “0001”;

(4) Adjust the threshold levels of two channels according to signal amplitude; the SPI trigger graphic interface is shown in Figure 12-20:

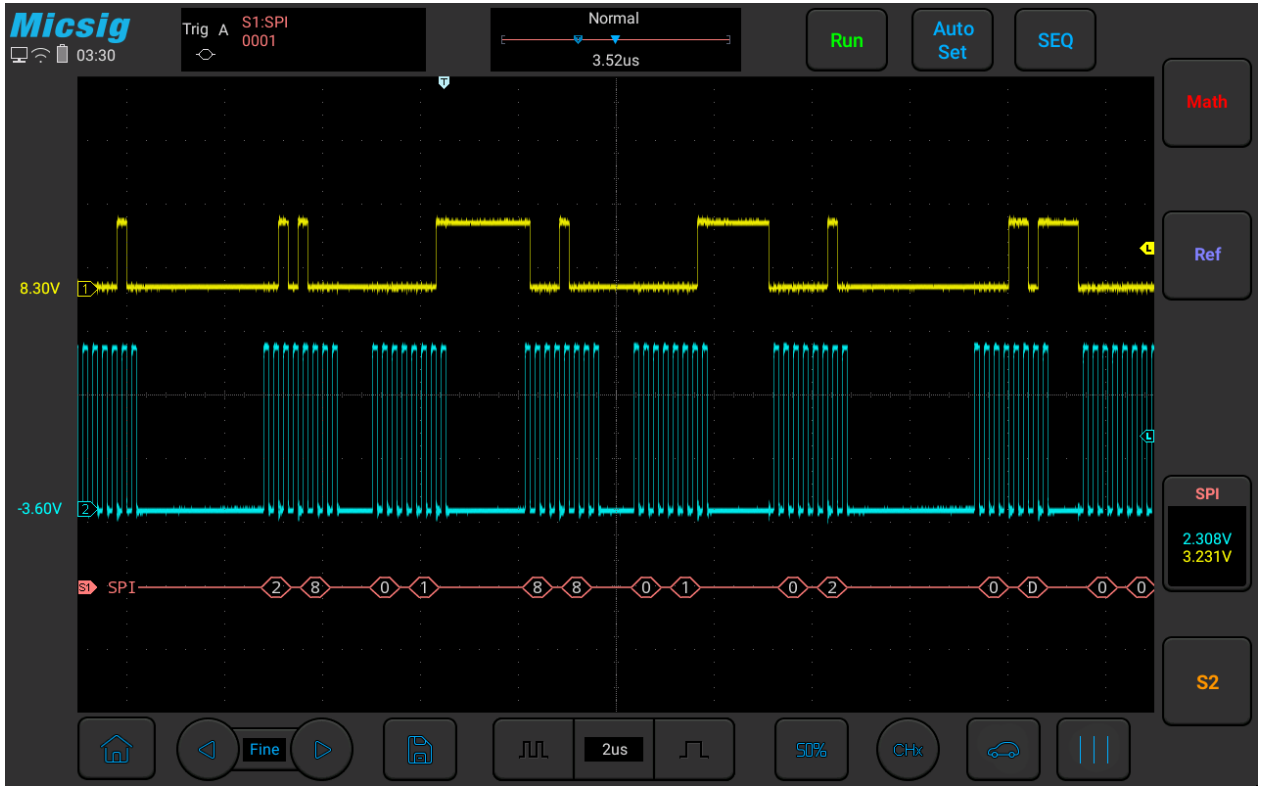

Figure 12-20 SPI Graphic Interface

SPI decode data packet description:

(1) Decode data packet displays real-time data about the bus activities.

(2) Decode data displays as hexadecimal system.

(3) Data displays in white.

(4) When “?” appears, the time base needs to be adjusted to view decode results.

Figure 12-21 SPI Text Interface

SPI text interface description, as shown in Figure 12-21:

(1) "Ch": bus channel.

(2) "Time": Time intervals between the last frames to current frames.

(3) "Data": According to the data word length setting, the decode data is displayed. For example, if the data word length is 8bit, only one byte displays in the data column; if the data word length is 16bit, 2 bytes display in the data column; if the data word length is 24bit, 3 bytes display; and if the data word length is 32bit, 4 bytes display.

(4) "Trigger": "Yes" means the frame reaches trigger condition.

Note: "One frame" is measured by the set "data word length" and can meet 1 data bit code stream.

12.5 I2C Bus Trigger and Decode

For correctly decoding I2C bus data and making trigger stable, the bus configuration, trigger mode set and trigger level need to be adjusted.

- **Bus configuration**

  Left swipe 

 or 

 to open the bus configuration menu, Bus configuration includes the serial clock (SCL) and the serial data (SDA) corresponding to the channel settings. See Figure 12-22:

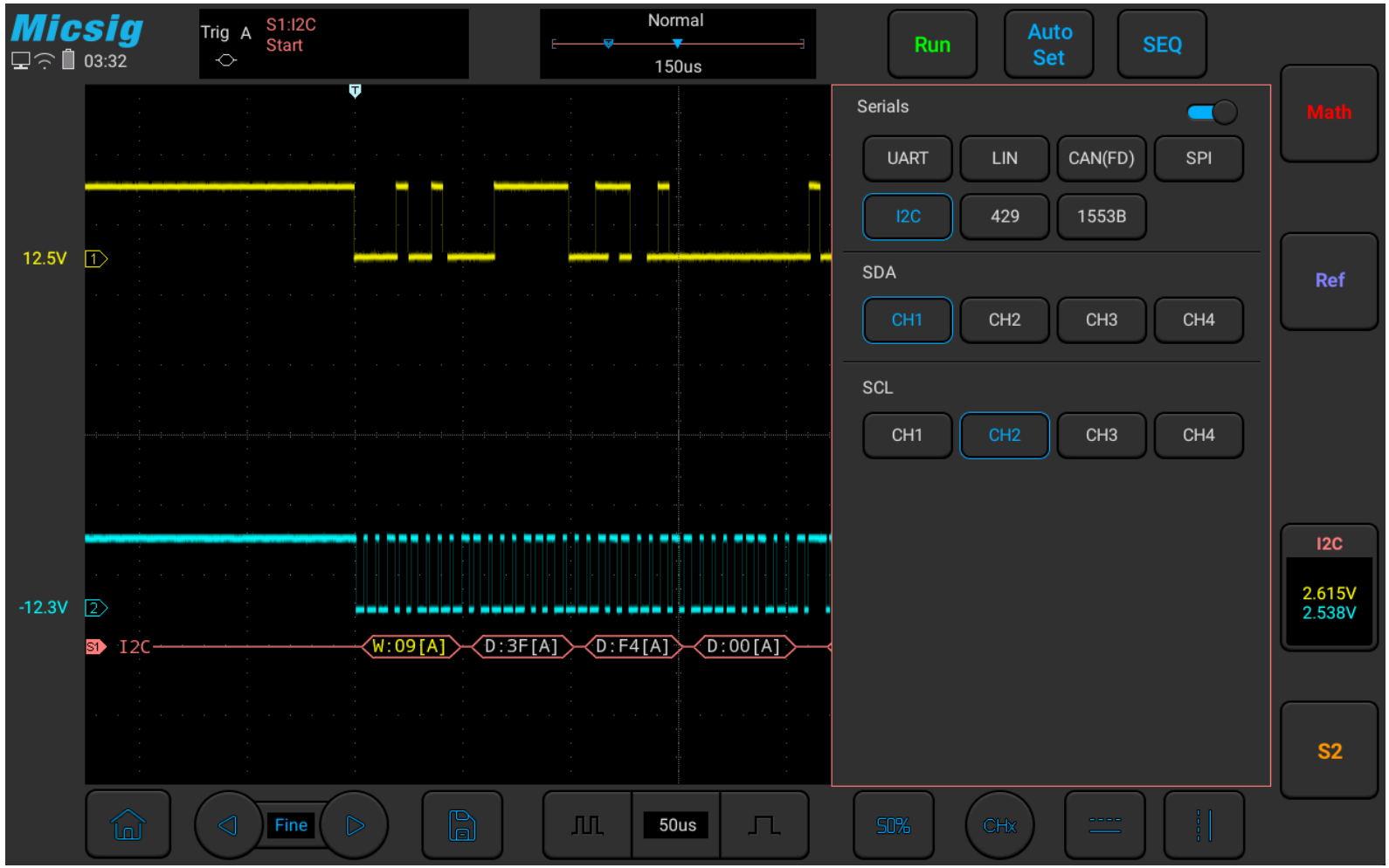

Figure 12-22 I2C Bus Configuration Menu

Notes: When SCL or SDA channel is set, the system will automatically set other channels.

- **Trigger mode**

Open the trigger configuration menu and select the appropriate trigger type. When the I2C bus trigger is selected, click the trigger type and relationship on the screen, as shown in Figure 12-23:

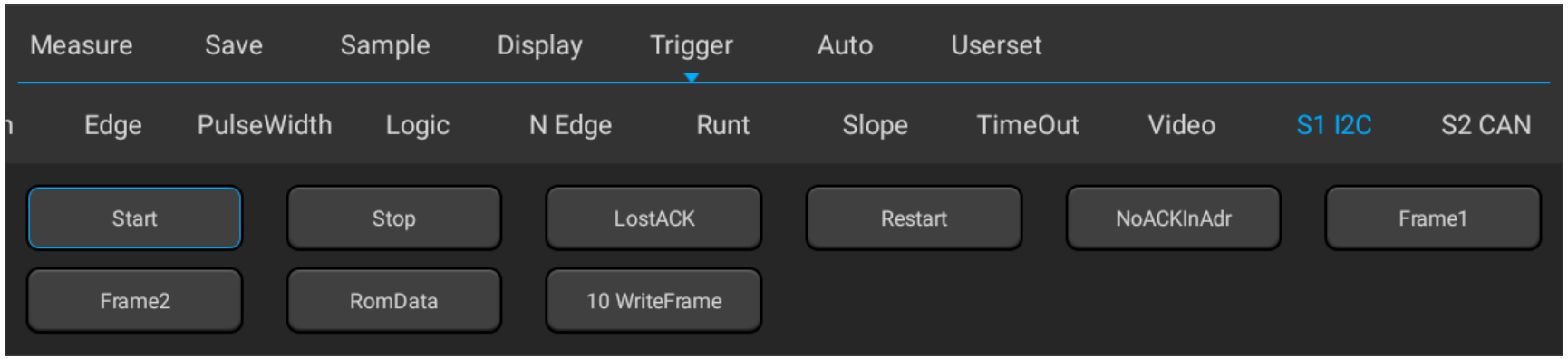

Figure 12-23 I2C Trigger Mode Configuration Menu

Trigger mode menu description:

a) Start condition — trigger when SCL is high and SDA has a falling edge (includes restart).

b) Stop condition — trigger when SCL is high and SDA has a rising edge.

c) Ack Loss — Trigger when the bus Ack bit is high.

d) Restart — triggered when a new start condition occurs before the stop condition.

e) Address no ack — trigger when the ack bit in the set address field is invalid (ignoring W/R bit), select "Address" in the trigger data, and use the pop-up virtual soft keyboard to modify it.

f) Frame Type 1 - Start + Address 7 + Read/Write + Acknowledge + Data; if all bits in the frame type match, trigger on read/write frames in 7-bit addressing mode on the 17th clock edge.

Frame type 1 operation method: Select values after the address/data, click values after the address/data on the touch screen, and modify them on the pop-up virtual soft keyboard.

g) Frame type 2 — Start + Address 7 + Read/Write + Acknowledge + Data 1 + Acknowledge + Data 2; trigger on read/write frames in 7-bit addressing mode on the 26th clock edge if all bits in the frame type match. The operation method of configuring frame type 2 is the same as frame type 1, and will not be repeated here.

h) EEPROM data read - When the read operation which contains 1010xxx control byte of the EEPROM appears on the bus and the Ack bit is correct, then the read data can be captured. If the captured data and

the set data match the set relationship condition, trigger on the clock edge of Ack bit after the data byte. After selecting “EEPROM Data Read”, click the relationship by “=” “ >” “<” “ ≠”, and the setting method is the same as the address field.

i) 10-bit write frame - Trigger on 10-bit write frame on the 26th clock edge if all bits in the pattern match.

Trigger mode is start condition, SCL connect to Ch2, SDA connect to Ch1, follow these steps as below:

(1) Tap S1 to open the decode channel, and click S1 again to open the bus configuration menu;

(2) Select the bus type as “I2C”, open the bus setting menu, and select the clock SCL as Ch2 channel;

(3) Open the trigger mode configuration menu and click “Start Condition” on the touch screen.

(4) Set the threshold level of two channels according to signal amplitude; I2C trigger graphic interface is shown in Figure 12-24:

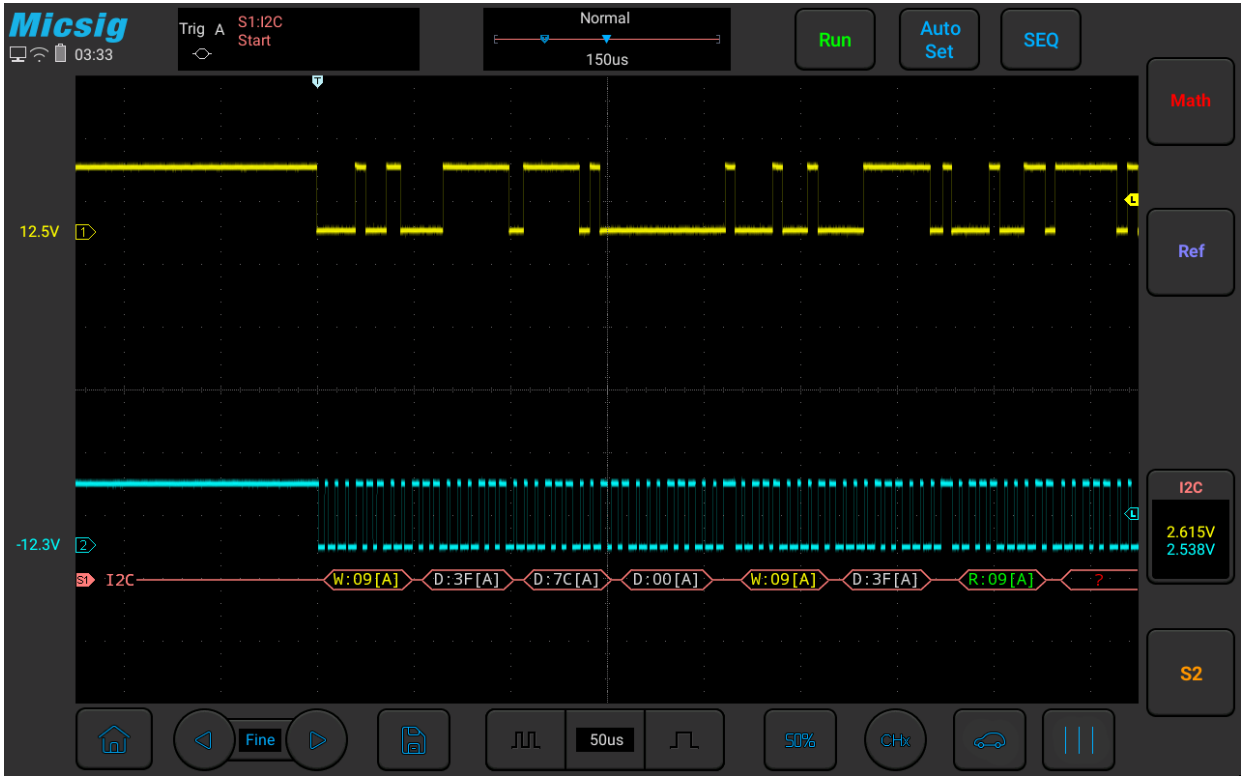

Figure 12-24 I2C Graphic Interface

I2C decode data packet description:

(1) Decode data packet displays real-time data about the bus activities.

(2) Decode data displays as hexadecimal system.

(3) Address content display: Read address displays in green, write address displays in yellow, and data displays in white. “W” denotes write operation, “R” denotes read operation, “D” denotes decode data, and “~A” denotes no Ack bit.

(4) When “?” appears, the time base needs to be adjusted to view decode results.

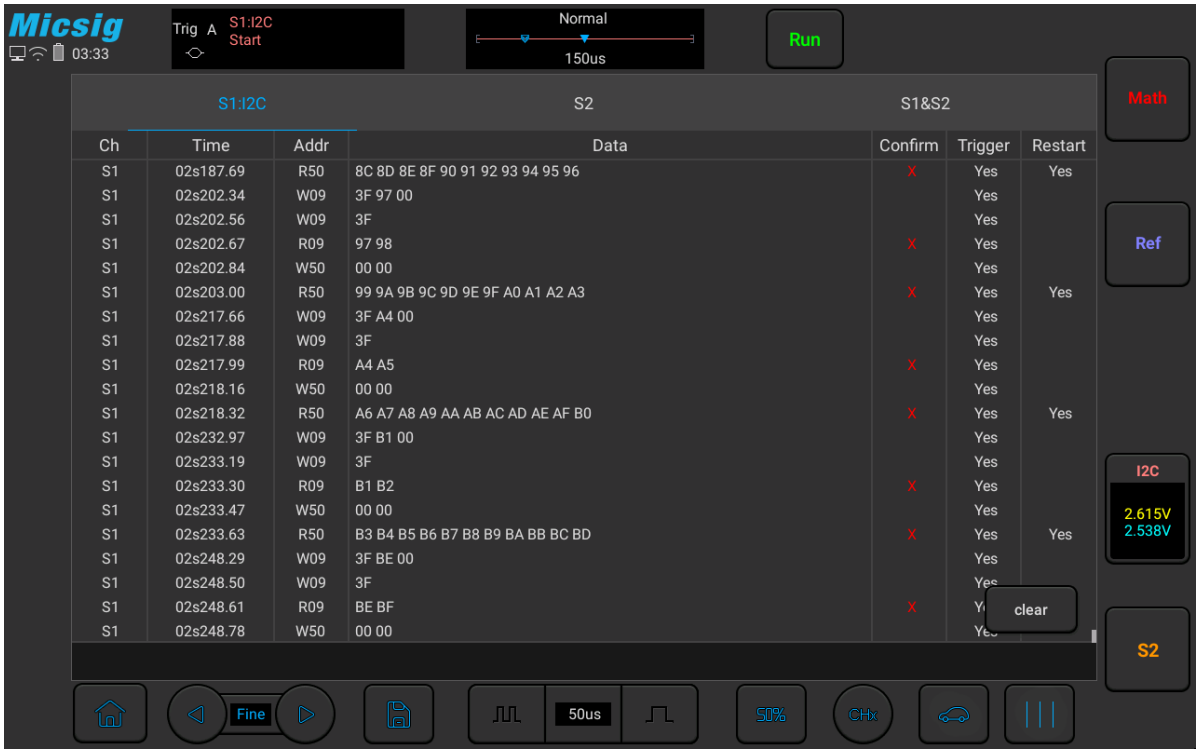

Figure 12-25 I2C Text Interface

I2C text interface description, as shown in Figure 12-25:

(1) “Ch”: bus channel.

(2) “Time”: intervals between the last read/write operations to current read/write operations

(3) “Address”: in address bar, “R” means the read operation, and “W” means write operation

(4) “Data”: data sent by one read and write operation is in the data bar.

(5) “Ack”: in Ack bar, “X” means Ack bit lost.

(6) “Trigger”: “Yes” means reach trigger condition.

(7) “Restart”: “Yes” means reach restart condition.

12.6 ARINC429 Bus Trigger and Decode

For correctly decoding ARINC429 bus data and making trigger stable, the bus configuration, trigger mode set and trigger level need to be adjusted.

- **Bus configuration**

  Left swipe 

 or 

 to open the bus configuration menu, the following needs to be set:

  Data Source — Select channel for ARINC 429 signal.

  Word format — Select ARINC 429 decode mode.

  Bus Display — Set the format for ARINC 429 decode data.

  Baud Rate — Set the speed of ARINC 429 signal.

  As shown in Figure 12-26:

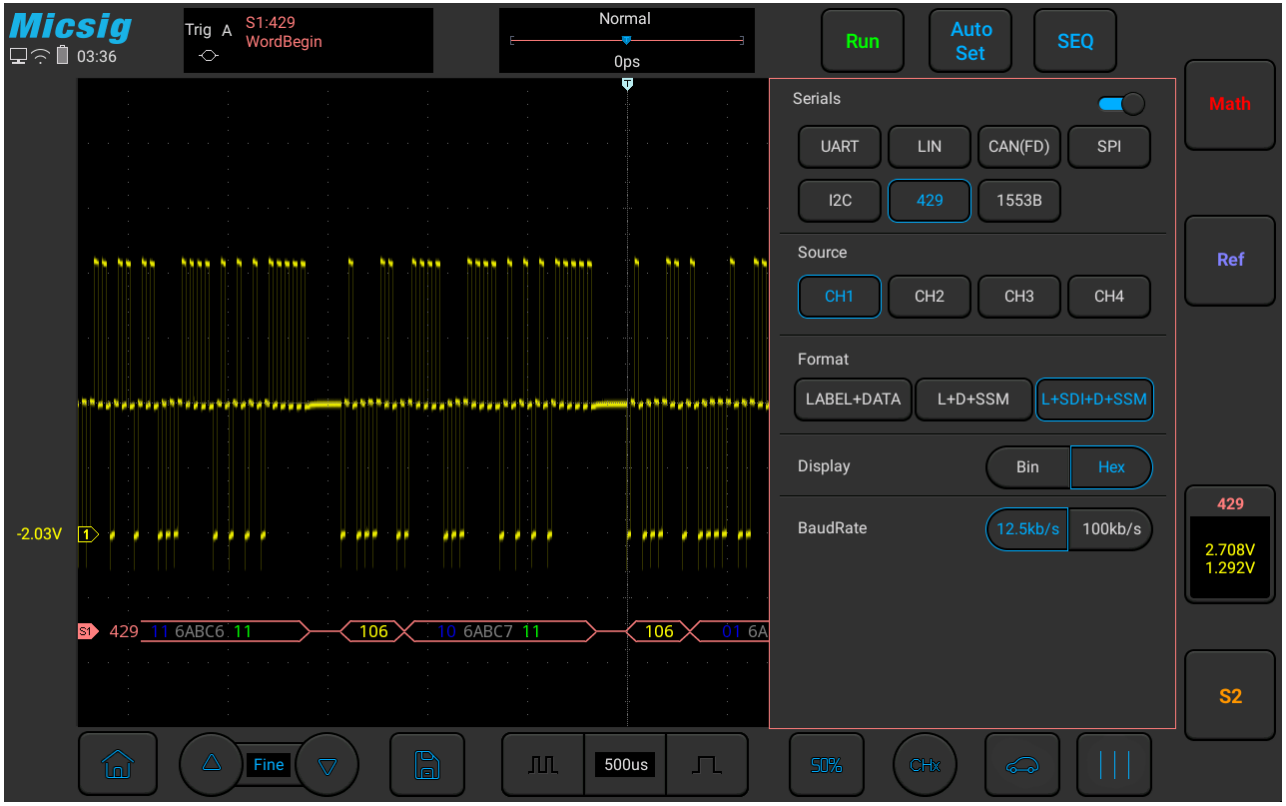

Figure 12-26 ARINC429 Bus Configuration Menu

- **Trigger mode**

Open the trigger configuration menu and select the appropriate trigger type; when the ARINC429 bus trigger is selected, click the trigger type and relationship on the screen, as shown in Figure 12-27:

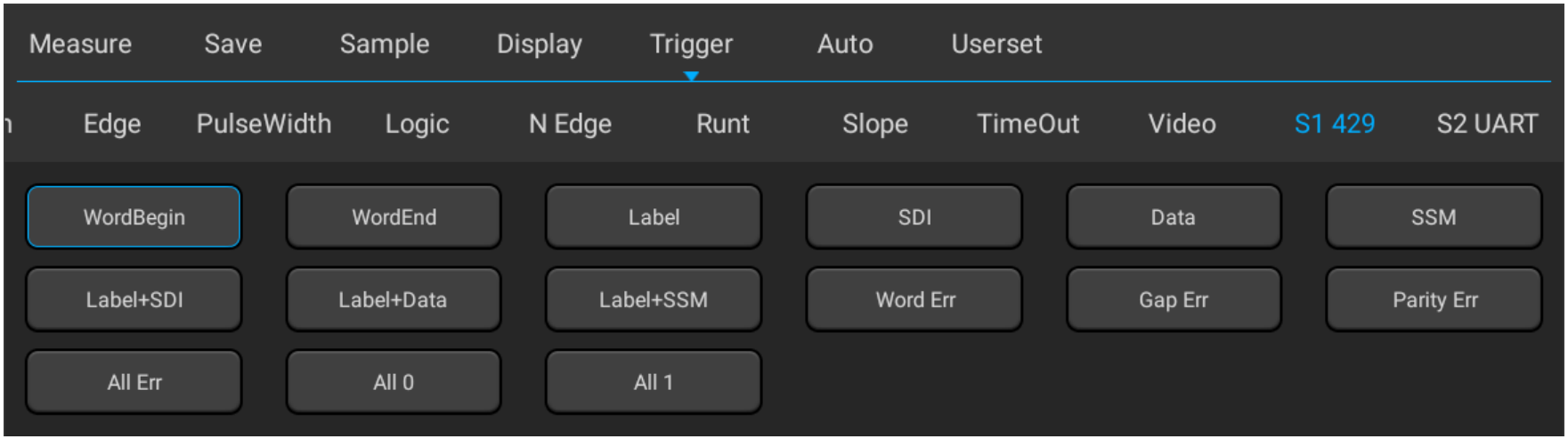

Figure 12-27 ARINC429 Trigger Mode Configuration Menu

If LABEL, SDI (source identifier), DATA or SSM (symbol/status mark) trigger are used, after selecting trigger mode, use the pop-up virtual keyboard to modify it, enter the value, and click “Enter” on the virtual soft keyboard to complete the setting.

Trigger configuration menu description:

a) Word start: Trigger at the word start.

b) Word stop: Trigger at the word stop.

c) LABEL: Label, triggered when the specified tag value occurs.

d) SDI: Source identifier, triggered on the specified source terminal.

e) DATA: Trigger on the specified data.

f) SSM: Symbol/status mark, triggered on the specified symbol status matrix.

g) LABEL+SDI: Trigger on the specified label and the specified source terminal.

h) LABEL+DATA: Trigger on the specified label and the specified data.

i) LABEL+SSM: Trigger on the specified label and the specified symbol status matrix.

j) Word Error - Triggered when a word error occurs.

k) Word gap error: Triggered when a gap error occurs.

l) Verification error: Triggered when a verification error occurs.

m) All errors: Triggered when any of the above errors occur.

n) All 0 bits: Triggered when any bit with the value of zero occurs.

o) All 1 bit -: Triggered when any bit with the value of 1 appears.

- **ARINC 429 serial decode**

The measured signal source is CH1, the decode format is LABEL+DATA, the display is in hexadecimal, the baud rate is 12.5kb/s, and the trigger mode is LABEL, operate as follows:

(1) Tap S1 to open the decode channel, and click S1 again to open the bus configuration menu;

Select bus type “429”, source as “CH1”, decode format as “LABEL+DATA”, display in “hexadecimal”, baud rate as 12.5kb/s.

(2) Open the trigger setting menu, select the trigger type as bus trigger, S1-ARINC429, the trigger mode is LABEL, and enter LABEL as “106” on virtual keyboard.

Adjust **High trigger threshold level** and **Low trigger threshold level** according to signal amplitude; and ARINC429 trigger graphic interface is shown in Figure 12-28:

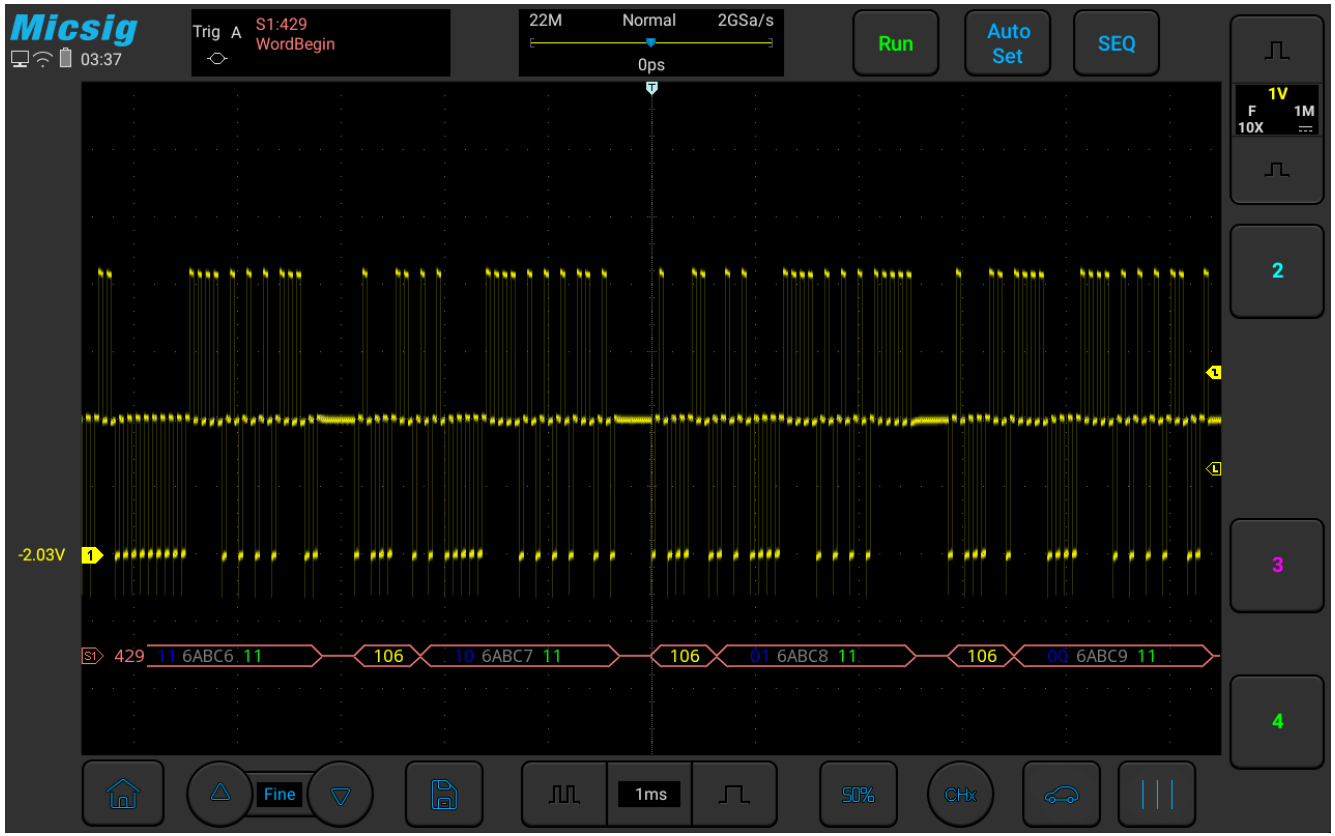

Figure 12-28 ARINC429 Graphic Interface

ARINC429 decode data packet description:

(1) Data packet, a total of 32bits, the data format is 8~1 (label bit, high bit first) +9~10(SD) +11~29 (data bit, low bit first) +30~31 (symbol status bit) +32 (parity bit)

(2) Label (8bits) - Displayed in octal: yellow

(3) SDI (2bits) - Displayed in binary: blue

(4) Data (19bits) - Displayed in selected numeration system: white, or red if there is parity error

(5) SSM (2bits) - Displayed in binary: green

Figure 12-29 ARINC429 Text Interface

ARINC429 text interface description, as shown in Figure 12-29:

(1) “Ch”: bus channel.

(2) “Time”: intervals between the last read/write operations to current read/write operations

(3) “LABLE”: label, information identifier, displayed in octal.

(4) “SDI”: source/target identifier, displayed in binary (displays XX if not identified separately).

(5) “Data”: content of the transmitted information, displayed in the selected numeration system.

(6) “SSM”: symbol/status matrix, displayed in binary (displays XX if not identified separately).

(7) “Error”: displays the frame error type (parity error Par, frame error Frm).

(8) “Trigger”: “Yes” means reach trigger condition.

12.7 1553B Bus Trigger and Decode

For correctly decoding 1553B bus data and making trigger stable, the bus configuration, trigger mode set and trigger level need to be adjusted.

- **Bus configuration**

  Left swipe 

 or 

 to open the bus configuration menu, the data source and display hexadecimal need to be set, as shown in Figure 12-30:

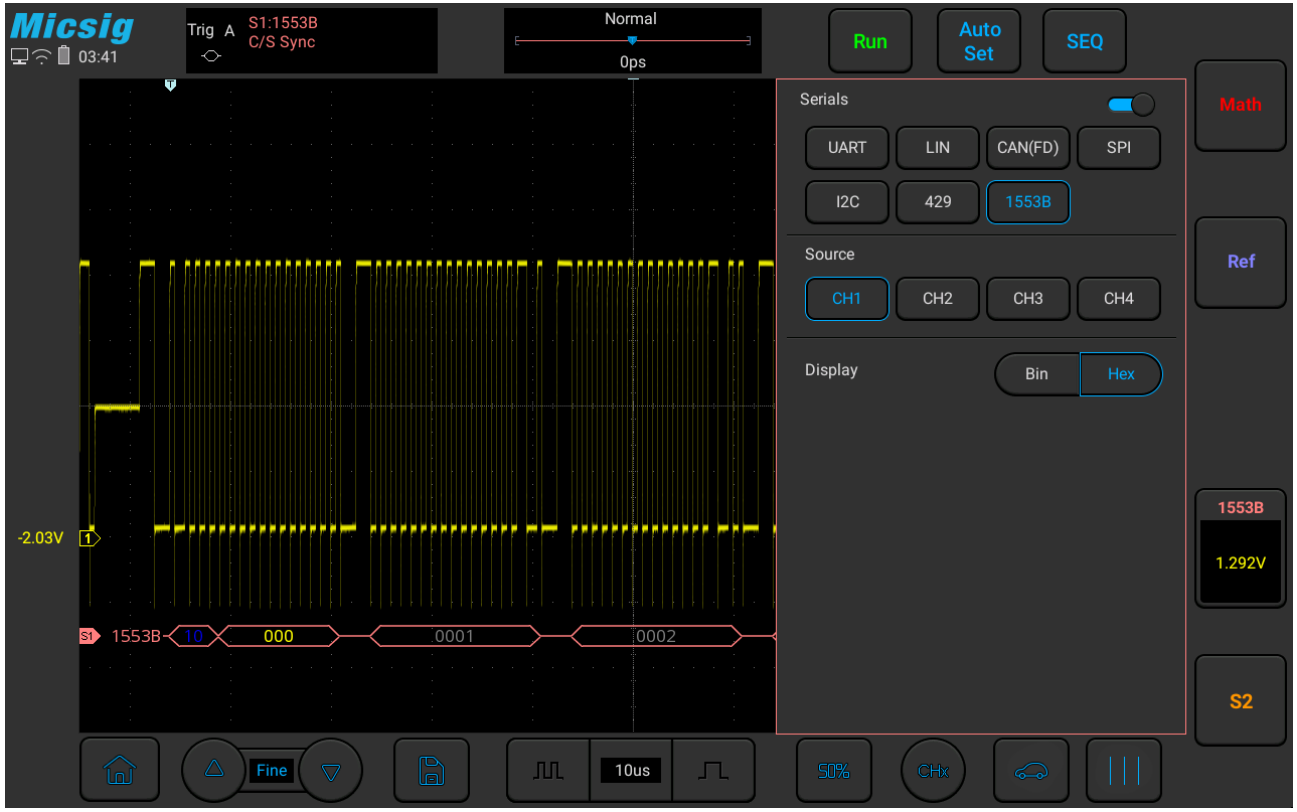

Figure 12-30 1553B Bus Configuration Menu

- **Trigger mode**

Open the trigger configuration menu and select the appropriate trigger type. When the trigger type is 1553B bus trigger, click the trigger type on the screen, as shown in Figure 12-31:

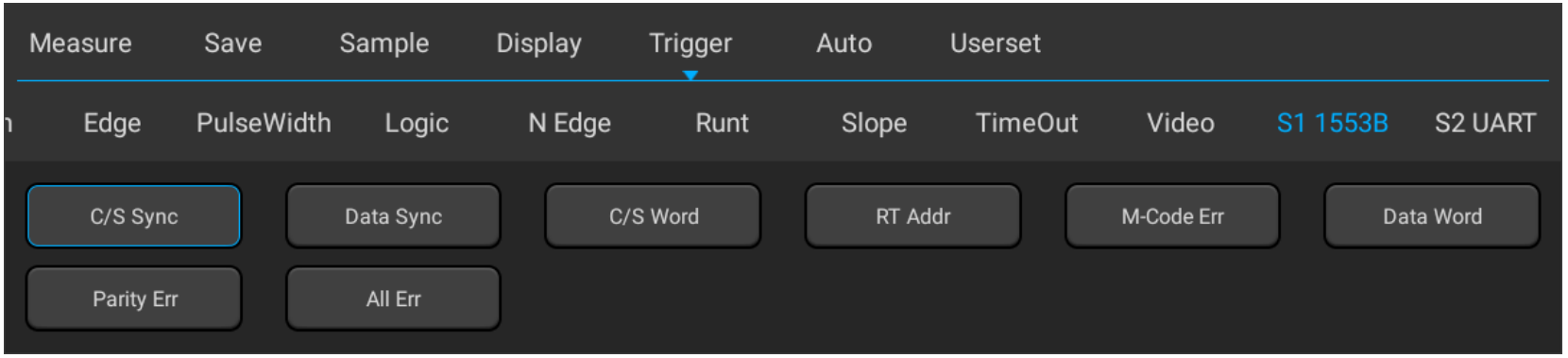

Figure 12-31 1553B Trigger Mode Configuration Menu

Trigger configuration menu description:

a) Command/status word sync header: Triggered at the beginning of the command/status word (at the end of valid C/S sync pulse).

b) Data word sync header: Triggered at the beginning of data word (at the end of valid data sync pulse).

c) Command/status word: Triggered when the specified command/status word is detected.

d) Remote terminal address: Triggered when RTA of command/status word matches the specified value.

e) If you select this option, RTA softkey will be available, allowing you to select the hexadecimal remote terminal address value to be triggered on it. If you select 0xXX (irrelevant), oscilloscope will trigger on any RTA.

f) Manchester coding error: Triggered when a Manchester coding error is detected.

g) Data word: Triggered when the specified data word is detected.

h) Odd parity error: Triggered when the odd parity bit is incorrect for data in the word.

i) All errors: Triggered when an error is detected.

- **1553B serial decode**

The measured signal source is CH1, the bus display is hexadecimal, the baud rate is 12.5kb/s, and the trigger mode is the command/status word sync header, and operate as follows:

(1) Tap S1 to open the decode channel, and click S1 again to open the bus configuration menu;

(2) Select the bus type as “1553B”, source as “CH1’, and display in “hexadecimal”.

(3) Open the trigger setting menu, select the trigger type as bus trigger, 1553B, and trigger mode as "command/status word sync header".

Channel **threshold level** is adjusted according to signal amplitude. 1553B trigger graphic interface is shown in Figure 12-32:

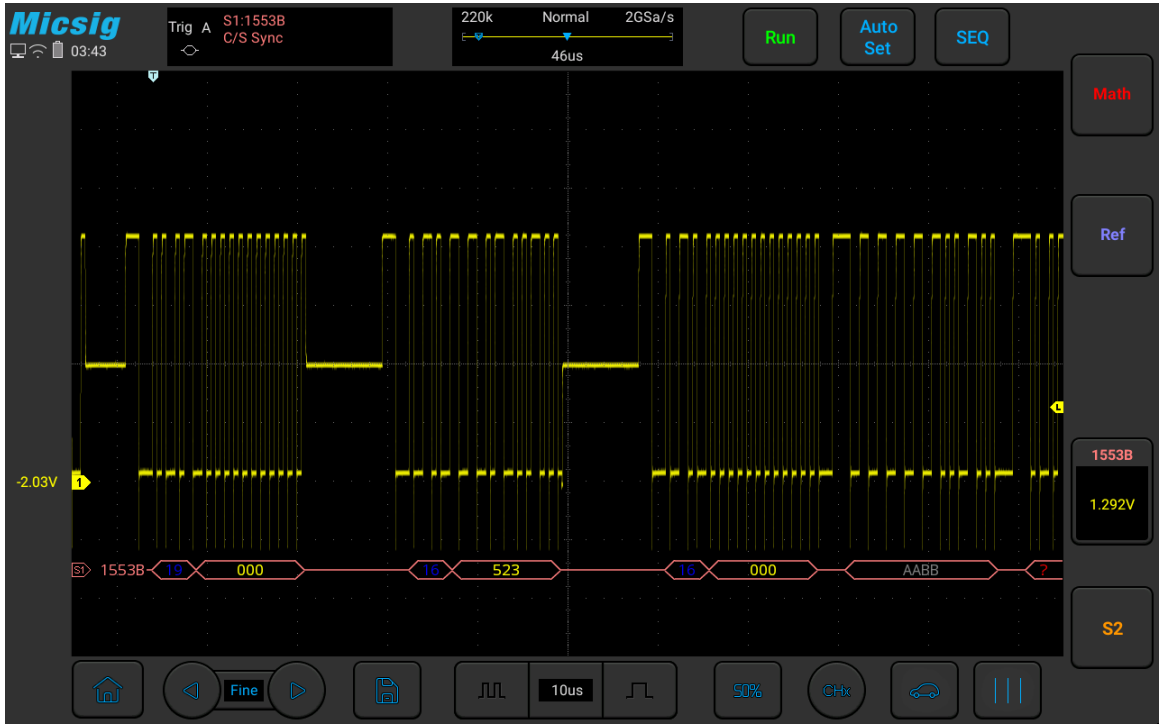

Figure 12-32 1553B Graphic Interface

1553B decode data packet description:

(1) Remote terminal address (5-bit data): blue

(2) The value of remaining 11 bits of the command/status word: yellow

(3) Decoded data: white

(4) If the command/status or data word has a parity error, its decoded text is displayed in red instead of green or white.

(5) The sync error is displayed together with the word “SYNC”.

Figure 12-33 1553B Text Interface

1553B text interface description, as shown in Figure 12-33:

(1) “Ch”: bus channel.

(2) “Time”: intervals between the last read/write operations to current read/write operations.

(3) "Type": frame type (data frame DATA, command/status frame C/S, others N/A).

(4) "RAdr": remote terminal address, displayed in the selected numeration system (N/A for no content display).

(5) "Data": content of the transmitted information, displayed in the selected numeration system.

(6) "Trigger": "Yes" means reach trigger condition.

(7) "Error": displays the frame error type (parity error Par, Manchester coding error M-ch).

Chapter 13 Homepage Functions

This chapter contains the functions of the oscilloscope homepage and describes the functions of all icons on the homepage and settings. You are recommended to read this chapter carefully to understand the homepage functions of the ATO series oscilloscope.

- Oscilloscope
- App Store
- Settings
- File manager
- Calculator
- Browser
- Gallery
- Calendar
- Electronic Tools
- Clock
- Power Off

The following figure shows the contents of the oscilloscope home page. Slide left or right to display the remaining applications. See Figure 13-1.

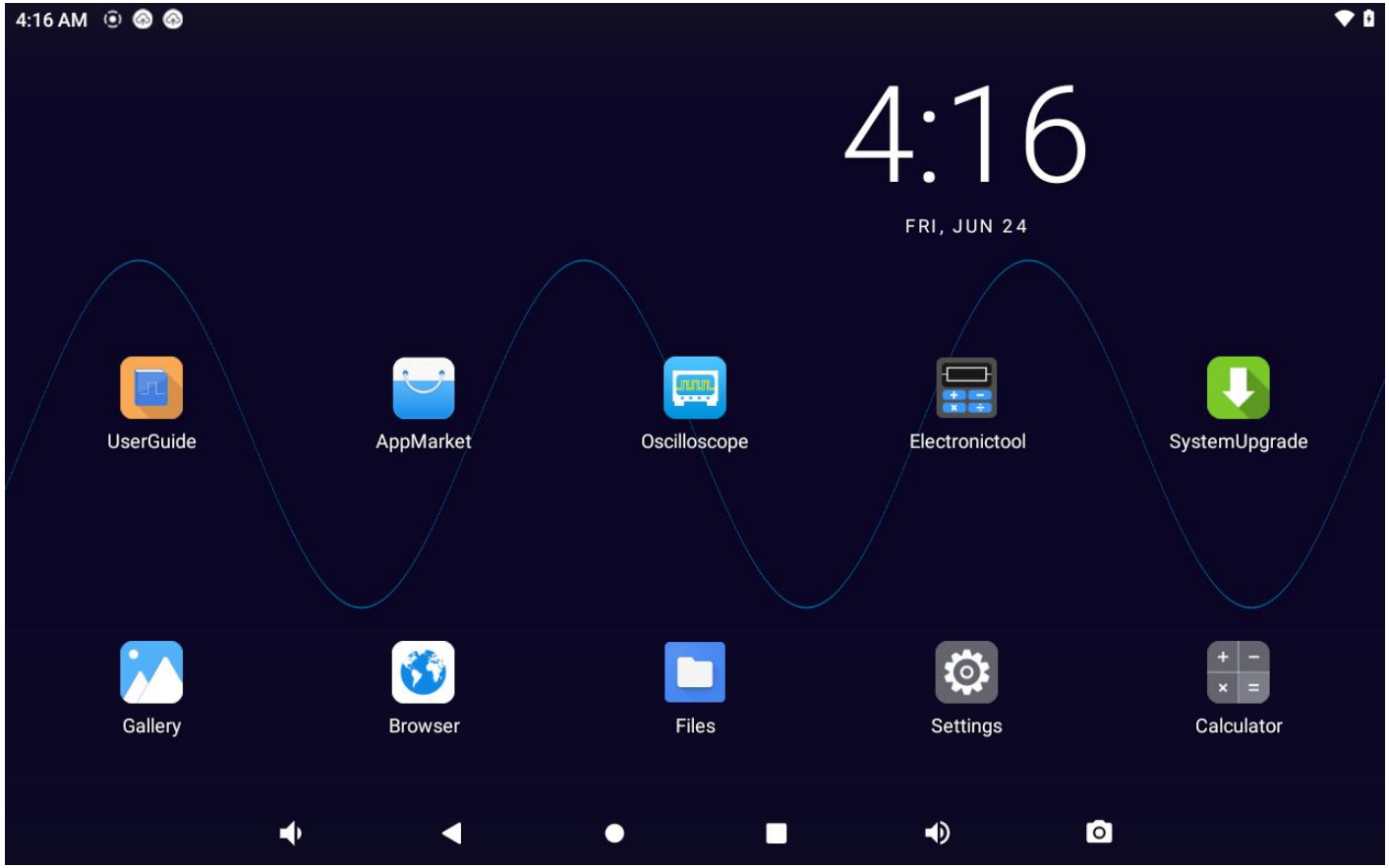

Figure 13-1 Homepage Interface

13.1 Oscilloscope (see Chapters 2~12)

13.2 App Store

Tap the app store icon on the homepage to go to the app store interface, as shown in Figure 13-2. App store content includes Network, Local, U-disk, and About.

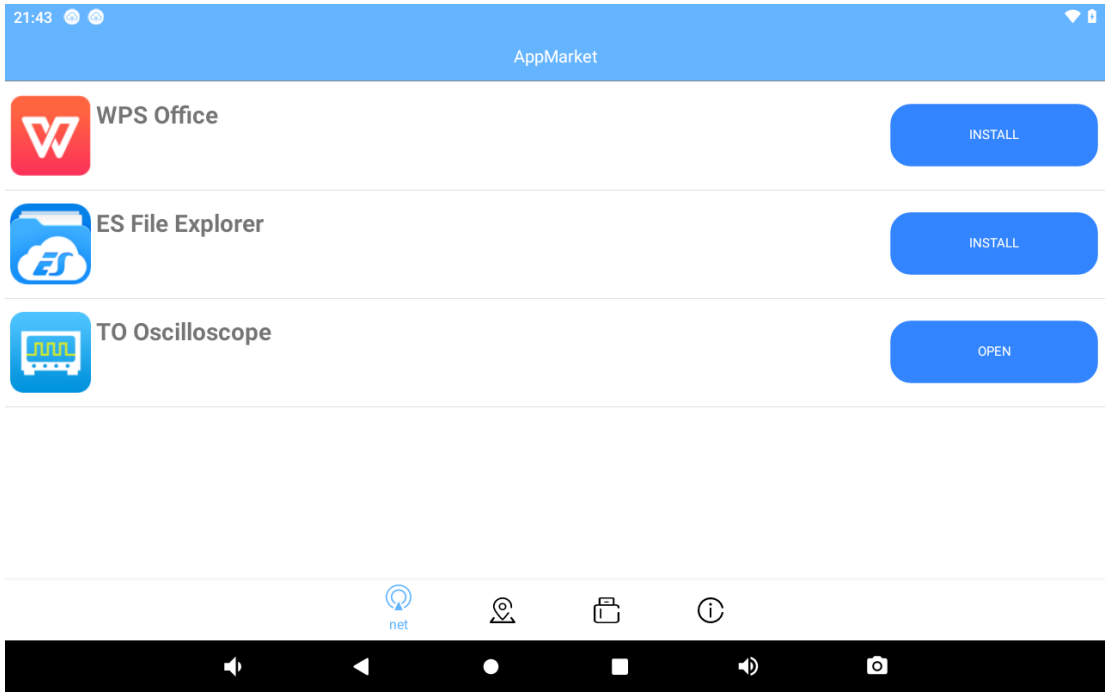

Figure 13-2 App Store

Network

Tap “Network” to open the application list.

Tap app icon to view details such as version number of the current app and app description, and tap the green open option below to open or install the current app.

Tap the green option on the right of the app list to open and install the app.

Local

Apps that have been downloaded and installed are displayed locally. When there is no downloaded application installation package file locally, the interface will display “There are no available apk files in the local directory”.

U-disk

The U disk interface will display applications that can be opened in the USB disk.

If the USB disk is not plugged, the interface displays “U-disk not inserted”.

After USB disk has been plugged, if there are no apk files in the USB device for installation, the interface displays "There is no available apk file in the U disk directory".

About

In "About" interface, the equipment model, bandwidth, serial number, version information, shipment date and information about installed options can be viewed. Open the virtual keyboard and enter the license to install the corresponding options.

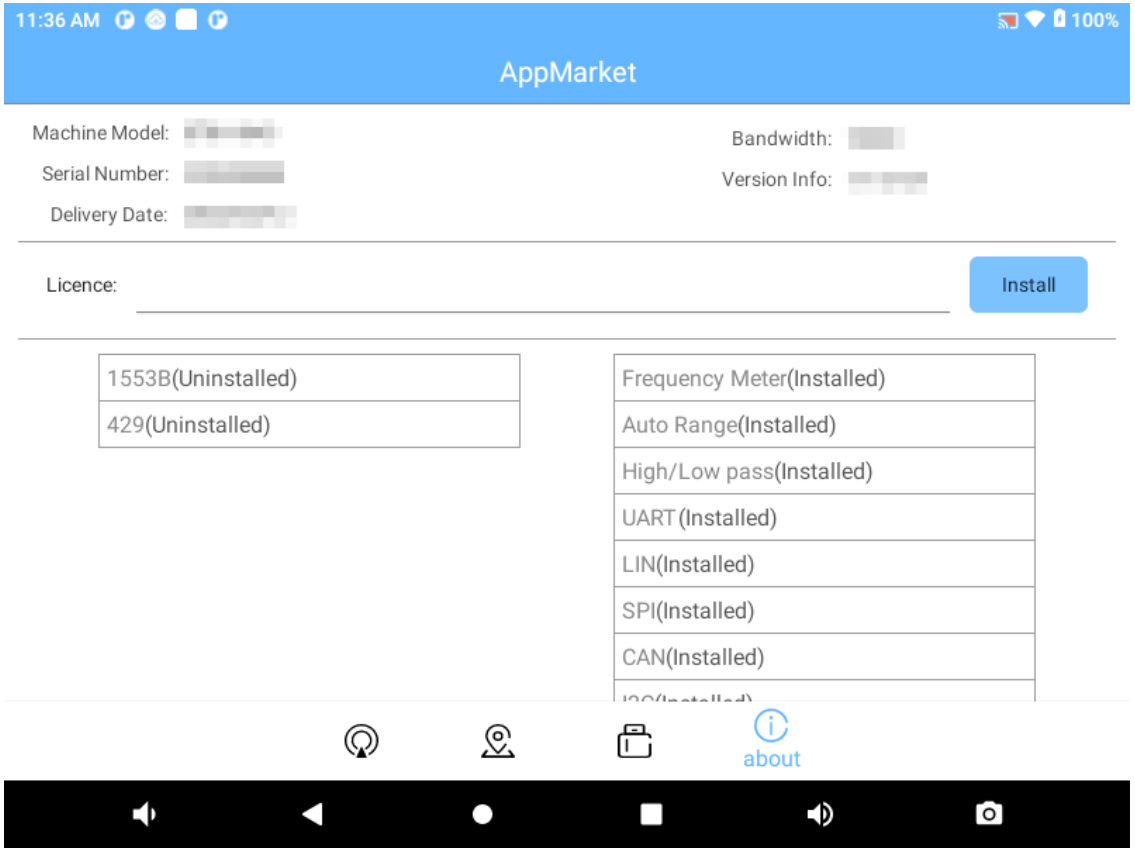

Figure 13-3 About Interface

The options that can be installed include: UART, LIN, SPI, CAN, CAN FD, I2C, 1553B, 429 and other serial decode (refer to Chapter 12 Serial Bus Trigger and Decode).

13.3 Settings

Tap settings on Homepage to enter the System Settings interface. Settings on the settings interface include Network & internet, display, sound, storage, system and About Oscilloscope, as shown in Figure 13-4.

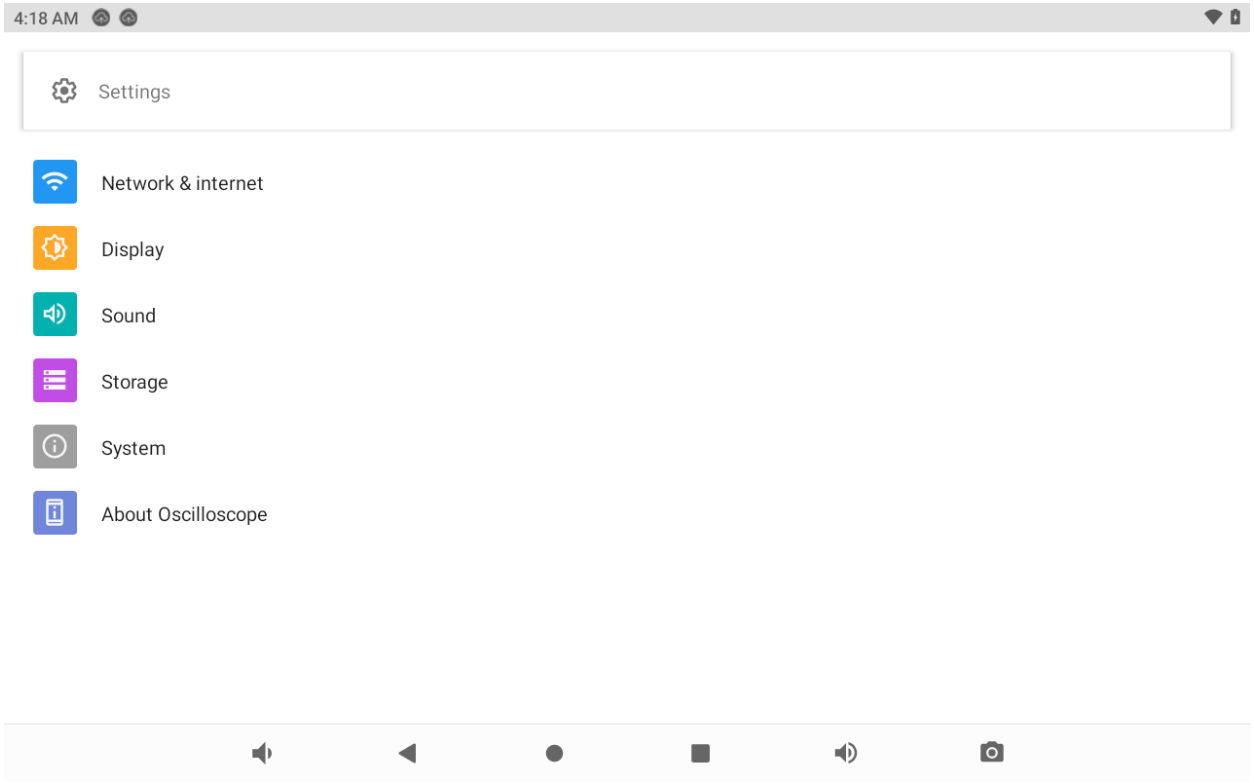

Figure 13-4 System Setting Interface

WLAN connection

Tap WIFI icon to enter the WLAN settings interface, as shown in Figure 13-5.

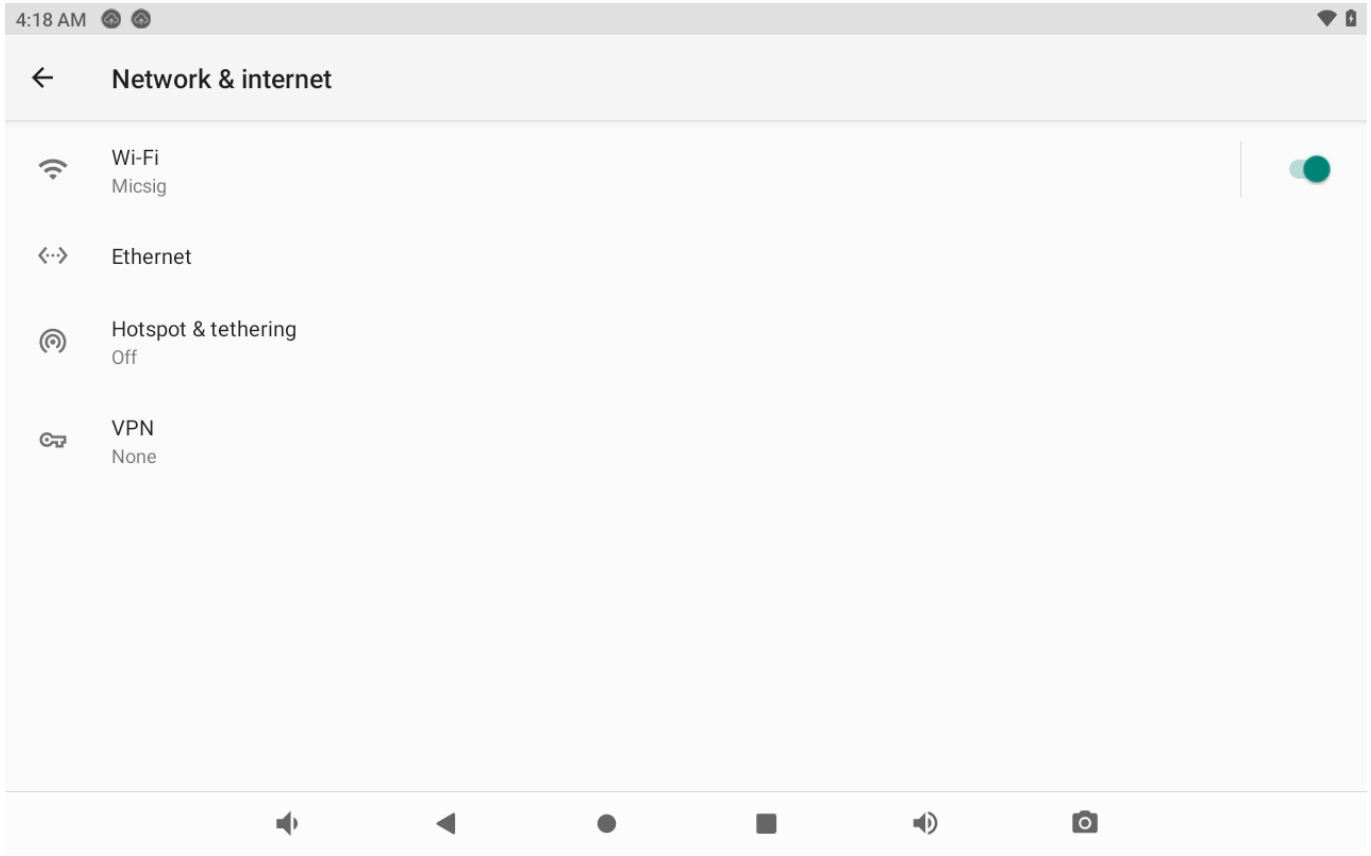

Figure 13-5 WLAN Connection Setting

Tap on/off bar to turn the WLAN function on. Oscilloscope can automatically scan the surrounding wireless networks and display their names by list.

Tap the wireless network to be connected and the password input box will pop up. After entering password using the virtual keyboard, tap Enter to connect oscilloscope to the wireless network.

Click the current network can advanced settings for WIFI.

Portable WLAN hotspot

Tap **Hotspot** to enter the portable hotspot settings interface.

Tap the off icon to open the hotspot. Click “hotsopt name” to enter the network name and password using the virtual keyboard, as shown in Figure 13-6. Other equipment can share oscilloscope files by linking oscilloscope hotspots (portable hotspot default IP is: 192.168.243.155).

Figure 13-6 Portable WLAN Hotspot Setting

Display

Tap display icons to set the oscilloscope Brightness level, Dark theme, Wallpaper, Font size and Display size.

Brightness level: The progress bar can be dragged to set the brightness of the screen display.

Dark theme: Set Dark theme uses a black background to help keep battery alive longer on some screens.

Wallpaper: Set the screen wallpaper.

Font size: Change the system display font size.

Display size: Make the items on your screen smaller or larger. Some apps on your screen may change position.

Sound

Tap the “sound” icon and drag the progress bar in the sound section to change the media volume, alarm volume and notification volume. After clicking the default notification ring tone, drag up and down to select the ring tone, then click OK.

Storage

Tap storage to enter the storage space view interface, then view the total storage capacity, size of available space, as well as memory size of applications (application data and media content), pictures, videos, audio (music, ringtones, podcasts, etc.), download content, cache data, and others.

If USB device is plugged, it will display the total storage capacity and available memory size, and can also uninstall and format SD card.

Language and input method

Tap System →language & input icons to set your system language and input method.

Language: add a language and drag it to the first position of language list to make it as system language.

Spell Checker: When this function is turned on, it will automatically check for correctness as you type.

On-screen keyboard includes Android keyboard and Gboard, tap +manage on-screen keyboards to turn off one of them.

Advanced setting include Spell checker, Autofill service, Personal dictionary, Pointer speed.

Date and time

Tap System →Date & time icons to set your system date and time

Use network-provided time: When turned on, the time provided by the network will be used as the system time. Date and time cannot be set manually after turning this on.

Set date: Set the system date manually.

Set time: Set the system time manually.

Select time zone: Set the time zone manually.

Use 24-hour system: If on, the system time will be 24-hours, and off for 12 hours.

About Oscilloscope

In the “About” interface, view legal information, Android version, IP address, build number and other information.

Accept online updates: turn off/on System update, app update, boot interface update, userguide update ...

13.4 File Manager

File manager app can enable quick access to and management of various files stored on the equipment.

Tap the Files app icon on the homepage screen to enter the file manager interface.

Recent: shows files that have been opened recently

Classification: views files by types, including images, videos, Audio, Documents, Downloads, STO etc.

Local: views the content stored in the oscilloscope by the traditional folder list mode. When USB device is plugged, the content in the USB device can also be accessed through external storage.

To operate files, simply press and hold a single file to select it. The selected file will show blue √. Then, click the remaining files to select them. If all files must be selected, tap the□icon at the right top of the screen and click Select all, which also includes copy, cut, compress, rename and more operations. Tap the trash icon to delete files.

13.5 Calculator

Tap calculator icon on the homepage to open the calculator app.

Calculator can perform simple addition, subtraction, multiplication and division calculations as well as scientific calculations.

13.6 Browser

Tap the browser icon on homepage interface to enter the browser interface, and then it can access to the internet if the network condition is good, as shown in Figure 13-7.

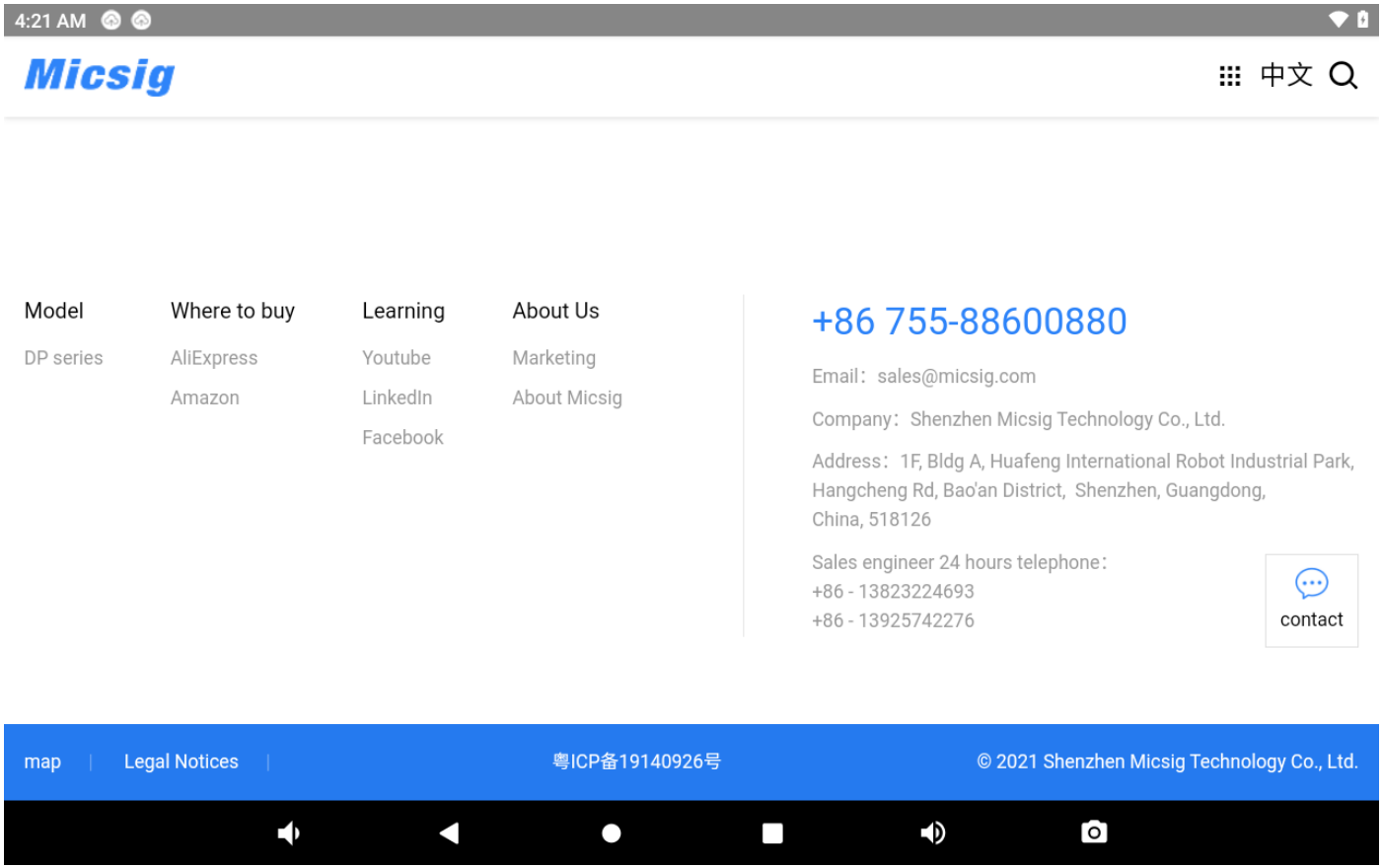

Figure 13-7 Browser Interface

13.7 Gallery

Tap gallery application on the homepage interface to enter the picture viewing interface, as shown in Figure 13-8.

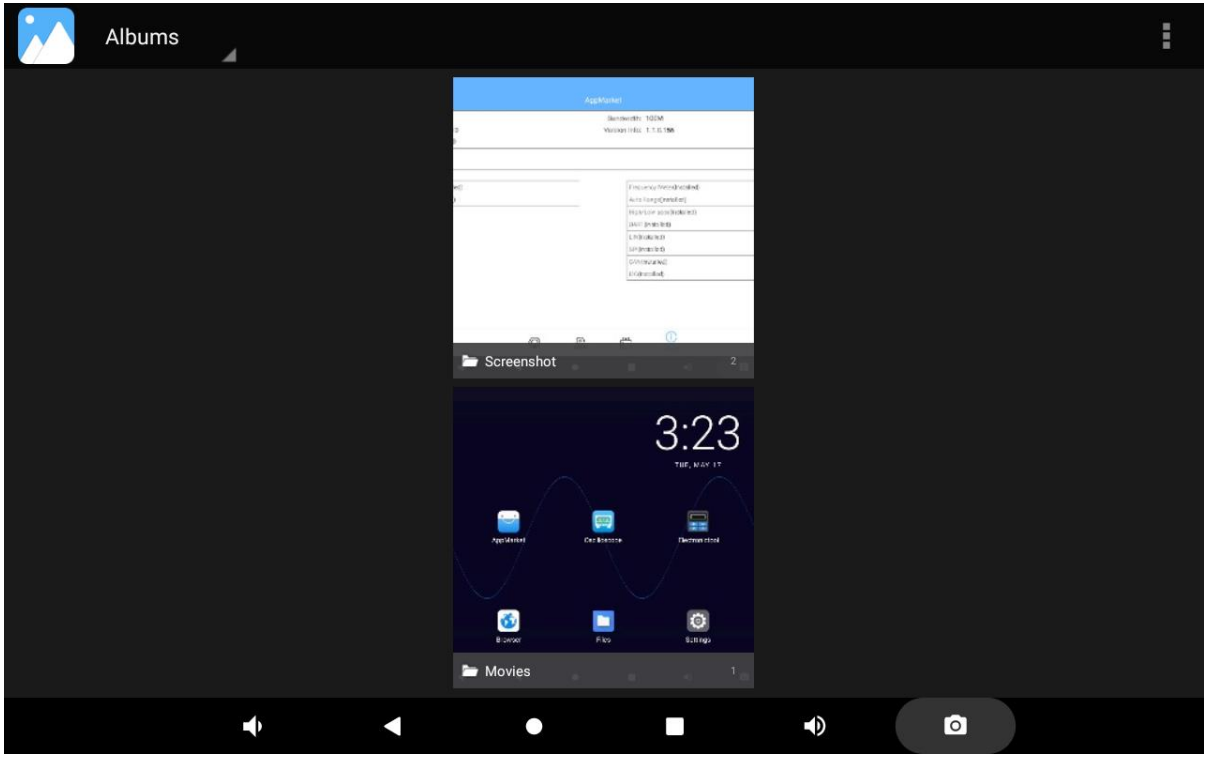

Figure 13-8 Picture Viewing Interface

Gallery provides locally stored photos/videos with the functions of picture/video viewing and photo editing.

In the picture view interface, pictures and videos can be classified into different categories according to the method in the upper left corner, and tap them to view pictures or videos.

When viewing pictures, click to display them in full screen. When viewing videos, swipe left and right to select the video you want to play. Click the triangle play button, and the video will play automatically. Tap the screen to pause play. Drag the pictures left and right when displaying in full screen to view previous and next pictures. Tap the back button to exit the full screen display, as shown in Figure 13-9.

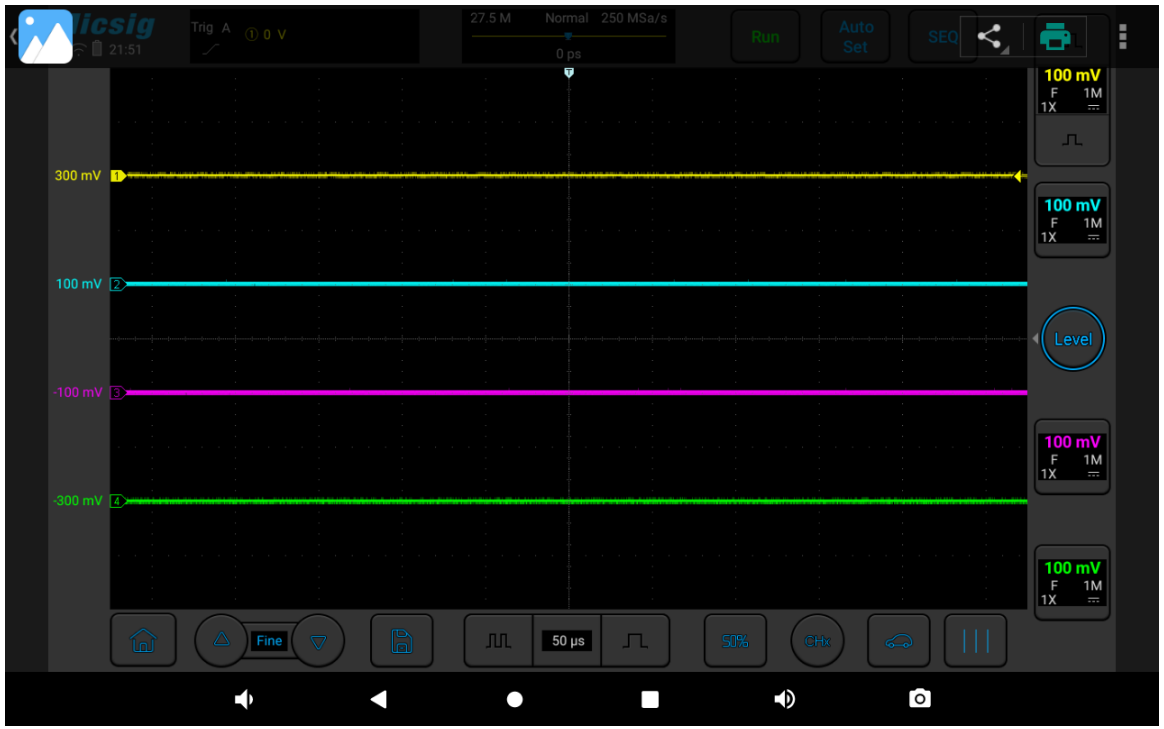

Figure 13-9 Full-Screen Picture Viewing Interface

When viewing pictures and videos, tap the option at the top right of the screen and click to select items. The pictures and videos can be selected. Click the recycle bin icon in the upper right corner of the screen to delete pictures or videos.

After the USB device is connected to oscilloscope, if there are pictures or videos in the USB device, they will be automatically displayed on the picture viewing interface.

13.8 Calendar

Tap the calendar app icon on the homepage to enter the calendar interface.

Tap TODAY at the top right of the screen to navigate directly to today's date.

Tap the date at the top left of the screen to adjust the calendar display style by day, week and month.

13.9 Electronic Tools

Electronic tools can provide a convenient set of electronic calculation tools.

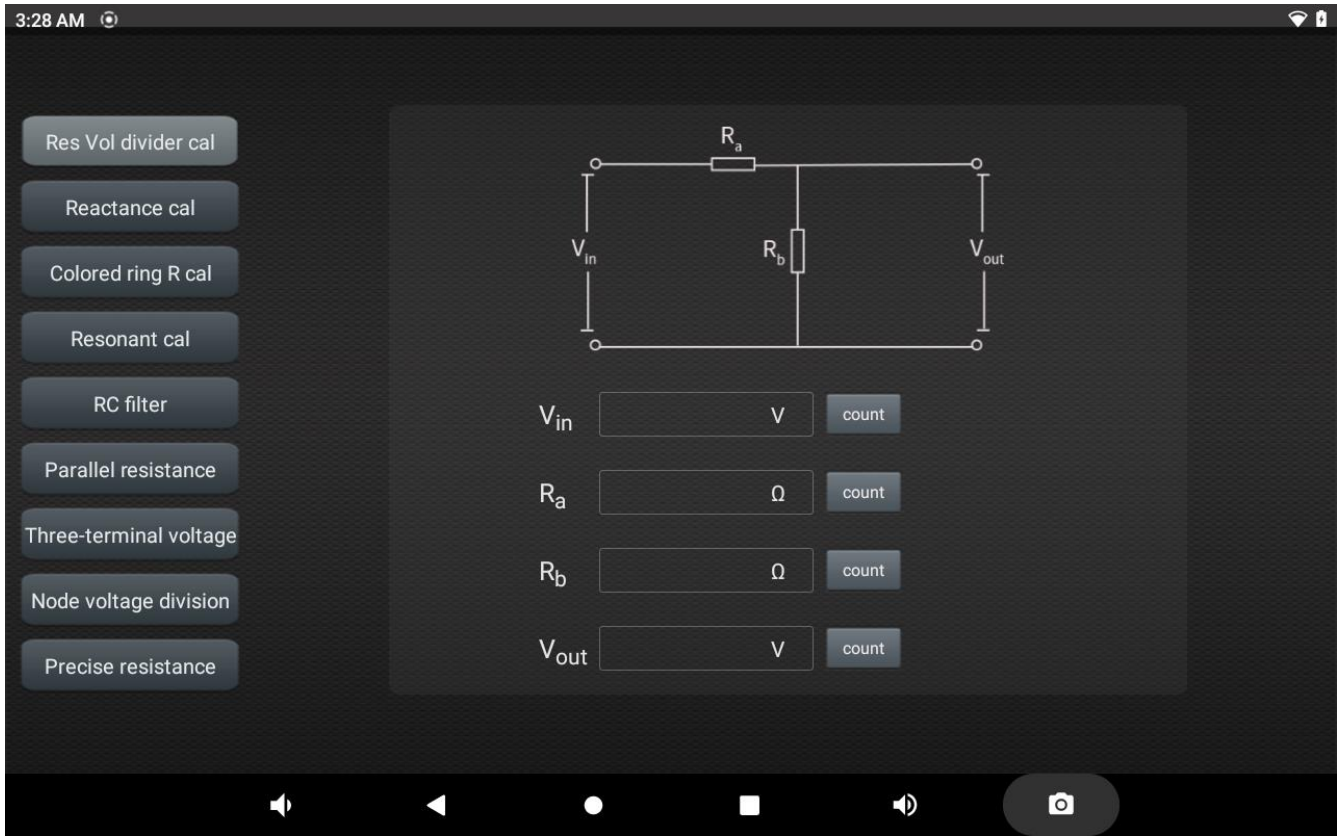

Figure 13-10 Electronic Calculation Tool Function

13.10 Clock

Tap time icon on the homepage or tap clock app icon to enter the clock settings screen, as shown in Figure 13-11.

Alarm clock

Add an alarm: Click “+” button below to add an alarm clock and create settings.

Alarm time: Drag pink dot in the dial to set the hour, and drag again to set the minute.

Repeat: Monday to Sunday available and click calendar icon on the right to enter the calendar for custom selection.

Alarm ringtone: Select alarm ringtone, support local ringtone, system ringtone, none.

Label: The alarm will be displayed on the screen when it rings.

Delete alarm: Click the alarm to be deleted in the list and select “delete” at the bottom of the alarm edit page.

Switch status: Click the switch behind the alarm to turn it on and off.

World clock

Add region: Click the bottom globe button and select city in the list of cities.

Timer

Add timer: Enter the hour, minute and second, click the triangle button to start countdown.

Delete timer: Click “DELETE” to delete the timer.

Pause: Click the double rectangle button to pause timer.

Stopwatch

Start: Click “Triangle” to start timing.

Pause: Click “Double Rectangle” below to pause the stopwatch.

Mark: Click the LAP to mark it.

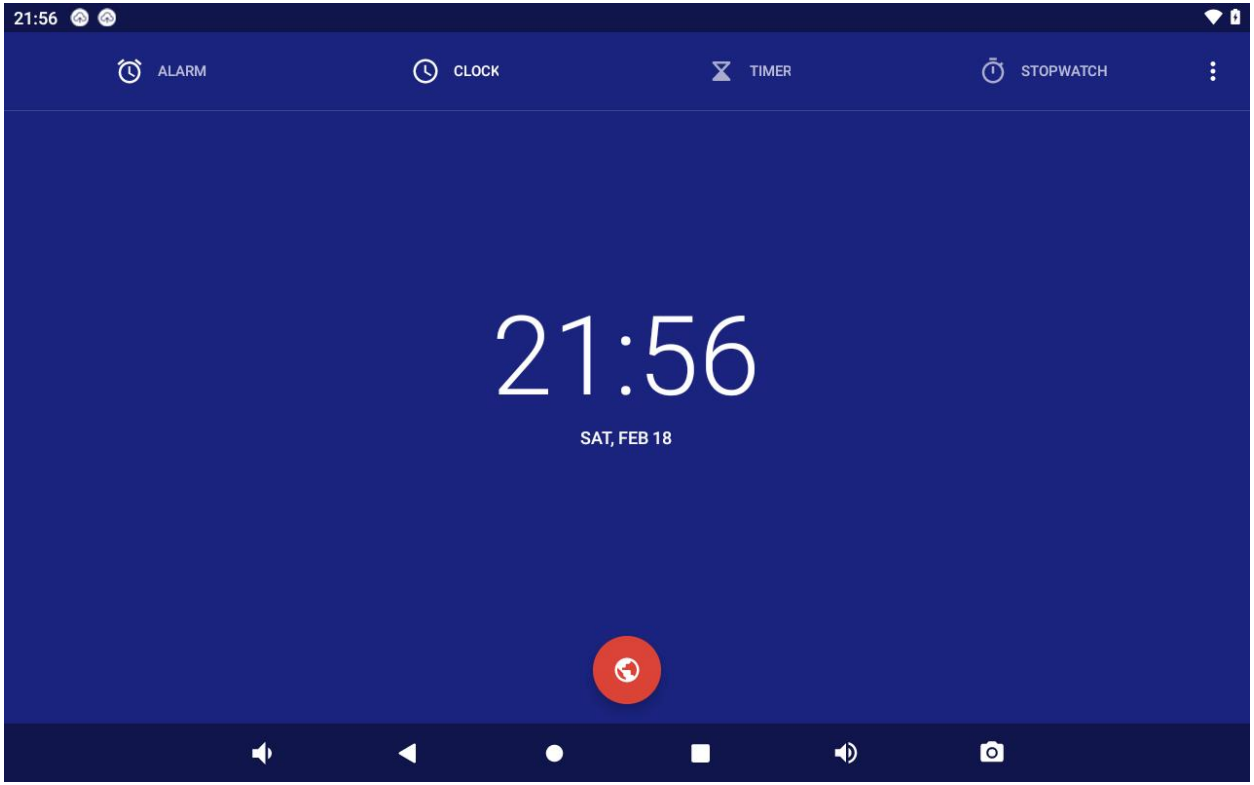

Figure 13-11 Time Setting

13.11 Power Off

Long press power button to enter the power off interface, as shown in Figure 13-12. Power off contains 4 options: Shutdown, Reboot, Standby, Lock Screen.

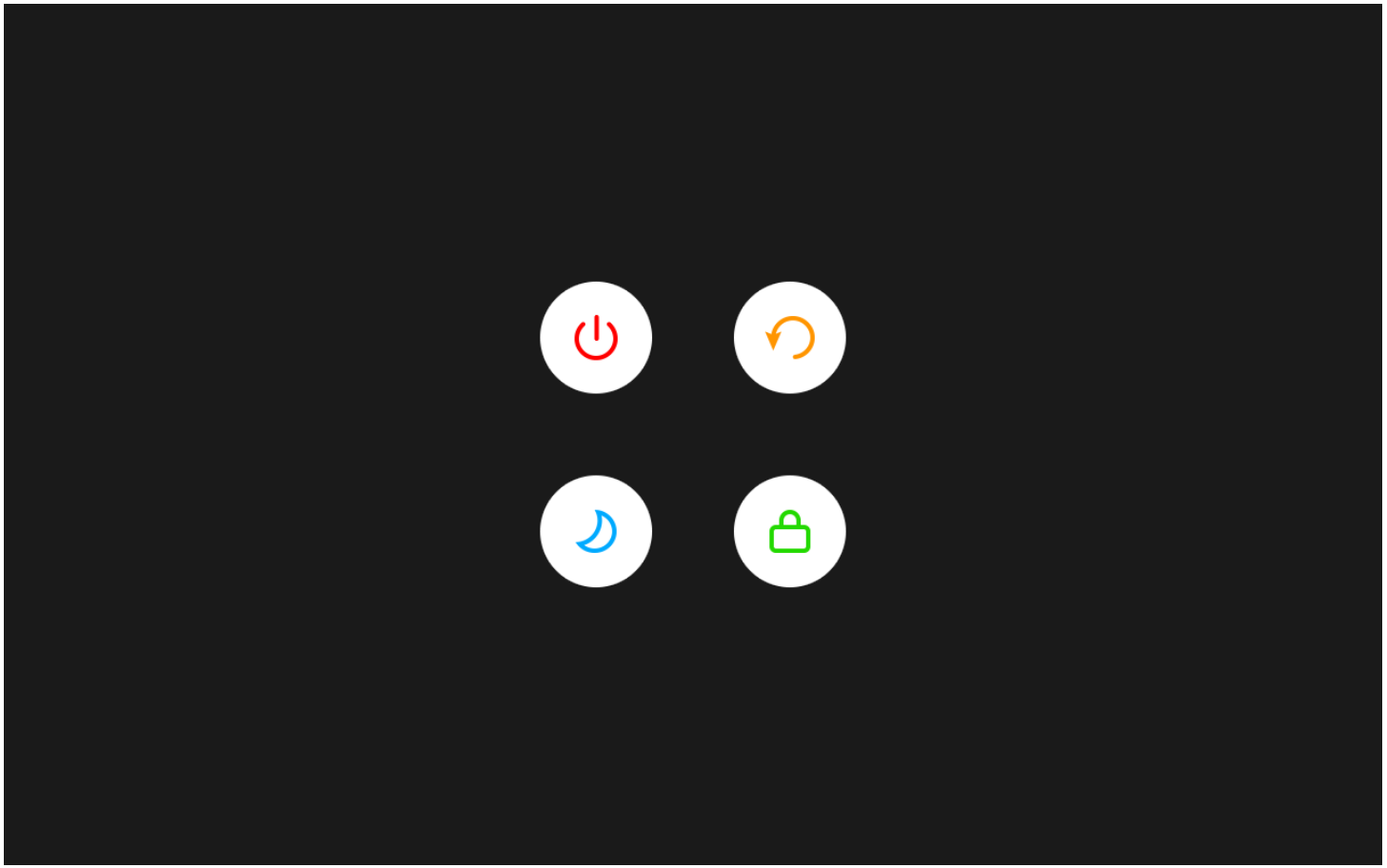

Figure 13-12 Power Off Interface

Shutdown: Click the  button to turn off the oscilloscope.

Reboot: Click the  button to restart the oscilloscope.

Standby: Click the  button to standby the oscilloscope, press power button  to wake.

Lock Screen: Click the  button to lock the oscilloscope screen, repeat the step to unlock.

Chapter 14 Remote Control

This chapter contains the application of host computer, mobile remote control, in order to understand remote control functions of the ATO series oscilloscope.

- Host computer
- Mobile remote control

14.1 Host Computer

To control the instrument using the host computer software, you need to install the NI driver first, then the RemoteDisplay software is downloaded and installed. This software is only suitable for Micsig ATO series oscilloscopes.

14.1.1 Installation of Host Computer Software

Note: The host computer software only supports Win7 or higher edition operating system. The computer needs to install NI-VISA driver first.

The host computer and needed NI-VISA driver can be downloaded from Micsig offical website:

http://www.micsig.com

Download the host computer software on official website of Micsig, open RemoteDisplaySetup.exe file, and complete the software installation.

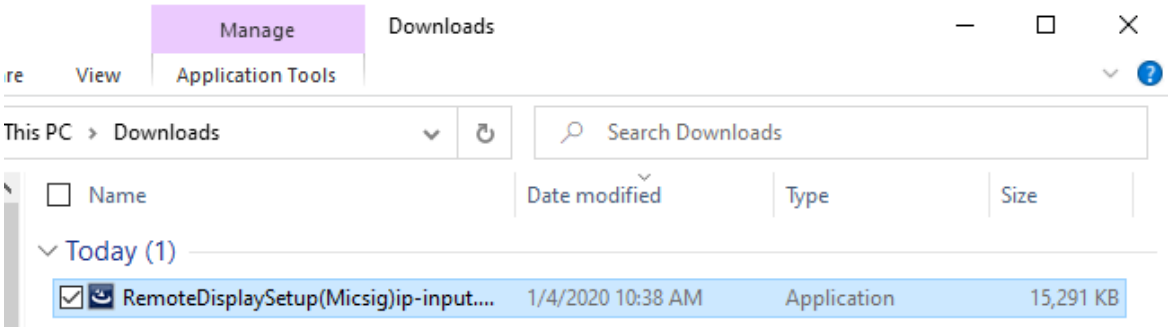

Figure 14-1 RemoteDisplay Software

14.1.2 Connection of Host Computer

USB connection: Connect USB Device to the computer and oscilloscope through USB data cable. After the computer recognizes the USB device, open the host computer, set the connection mode to USB 

, and display the device information in the device information display box in the lower right corner. This indicates that the oscilloscope has been found. Click to connect to the selected oscilloscope.

WIFI connection: Under the oscilloscope settings →WLAN menu, choose and connect the same WIFI with the computer to ensure that **the computer and the oscilloscope are in the same network**. Open the host computer, set the connection mode to Net 

, and display the device information in the device information display box in

the lower right corner. This indicates that the oscilloscope has been found. Click to connect to the selected oscilloscope.

Enter IP connection: In case of network connection (WIFI or LAN), directly type oscilloscope IP to be connected in the oscilloscope device information display box in the lower right corner, and then click the oscilloscope connection status button, the host computer will be connected to the oscilloscope corresponding to the entered IP address.

14.1.3 Main Interface Introduction

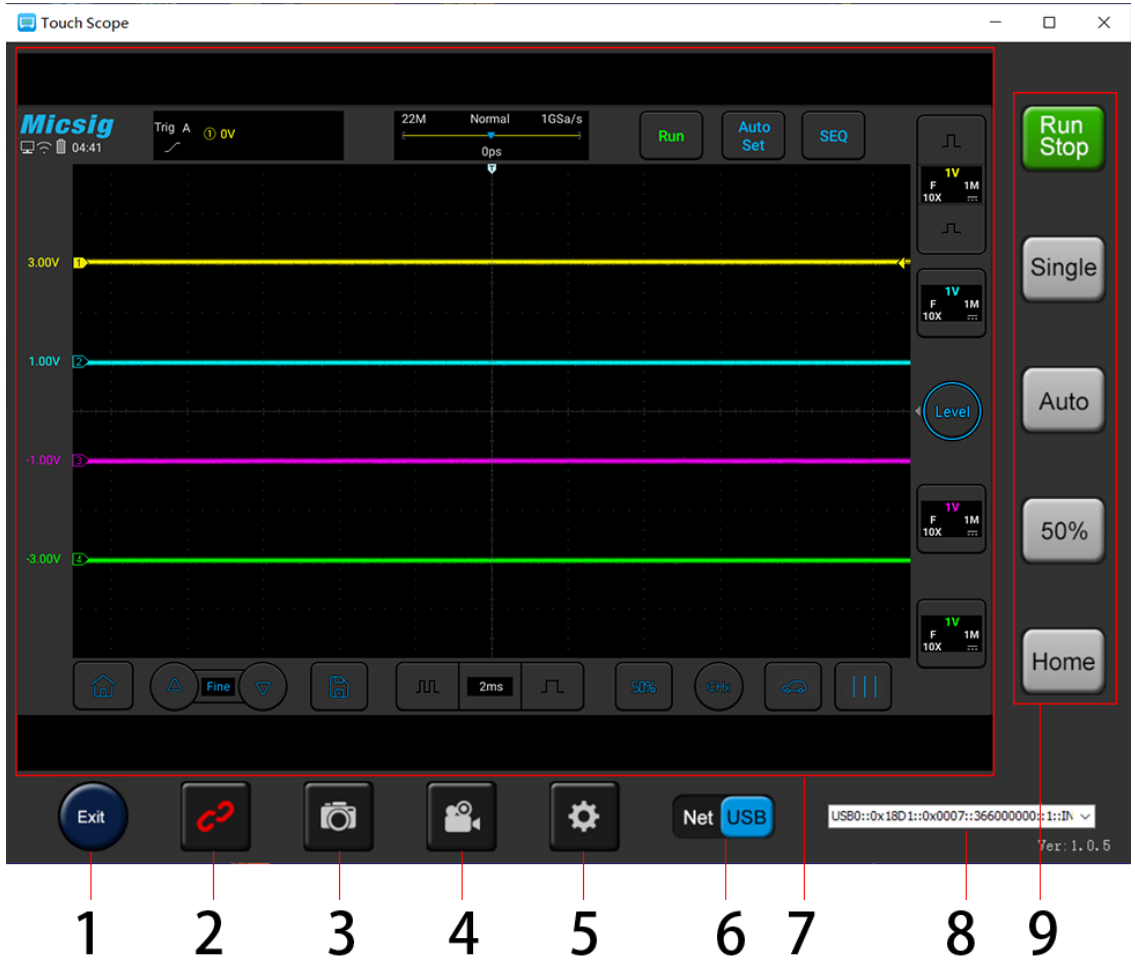

Figure 14-2 Host Computer Interface

1.  Host computer on/off button	Click to exit the host computer software
2.  Oscilloscope connection status button	The button has two states: Green: Connect to selected oscilloscope when clicked Red: Disconnect from oscilloscope when clicked
3.  Quick camera button	Click to take photo quickly. Pictures are stored in the local directory C:\Users\Public\Pictures
4.  Video record button	Click to open or close video record function. Videos are stored in local directory C:\Users\Public\Videos
5.  Host computer storage button	Set photo taking and video recording storage locations
6.  Select oscilloscope connection mode	USB and WIFI connections are available

	Note: WIFI connection must ensure that oscilloscope and computer are in the same network
7. Host computer display area	Synchronous display with oscilloscope
8. Oscilloscope information display	Display oscilloscope model, connection mode, SN, IP and other information, select the oscilloscope to be connected
9. Host computer waveform control area	Waveform control area button has the same function with that button on the oscilloscope

14.1.4 Operation Interface Introduction

The host computer and the oscilloscope are synchronously displayed, and the waveform operation mode and the menu opening and closing mode are the same as those on the oscilloscope; the left mouse button and the single finger operation mode are the same, and both of them can perform the operations of slide, click, drag, etc.

14.1.5 Storage and View of Pictures and Videos

Storage setting of pictures and videos:

Open the host computer storage setting  , set the storage location of pictures and videos, as shown in the figure below:

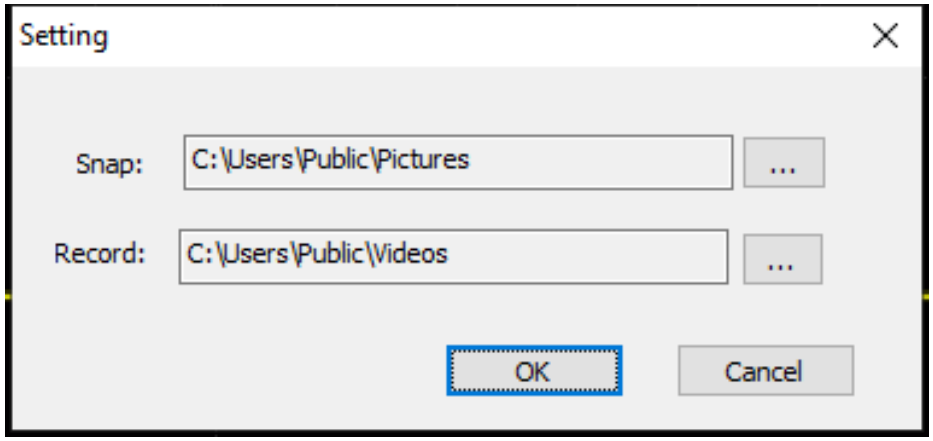

Figure 14-3 Host Computer Storage Setting

Pictures are stored in the local directory C:\Users\Public\Pictures by default. We can also store them under the directory defined by ourselves according to our own needs. For example, we store pictures in a “mini photo” directory under E-drive disk. We can set the video storage location in the same way, then click OK.

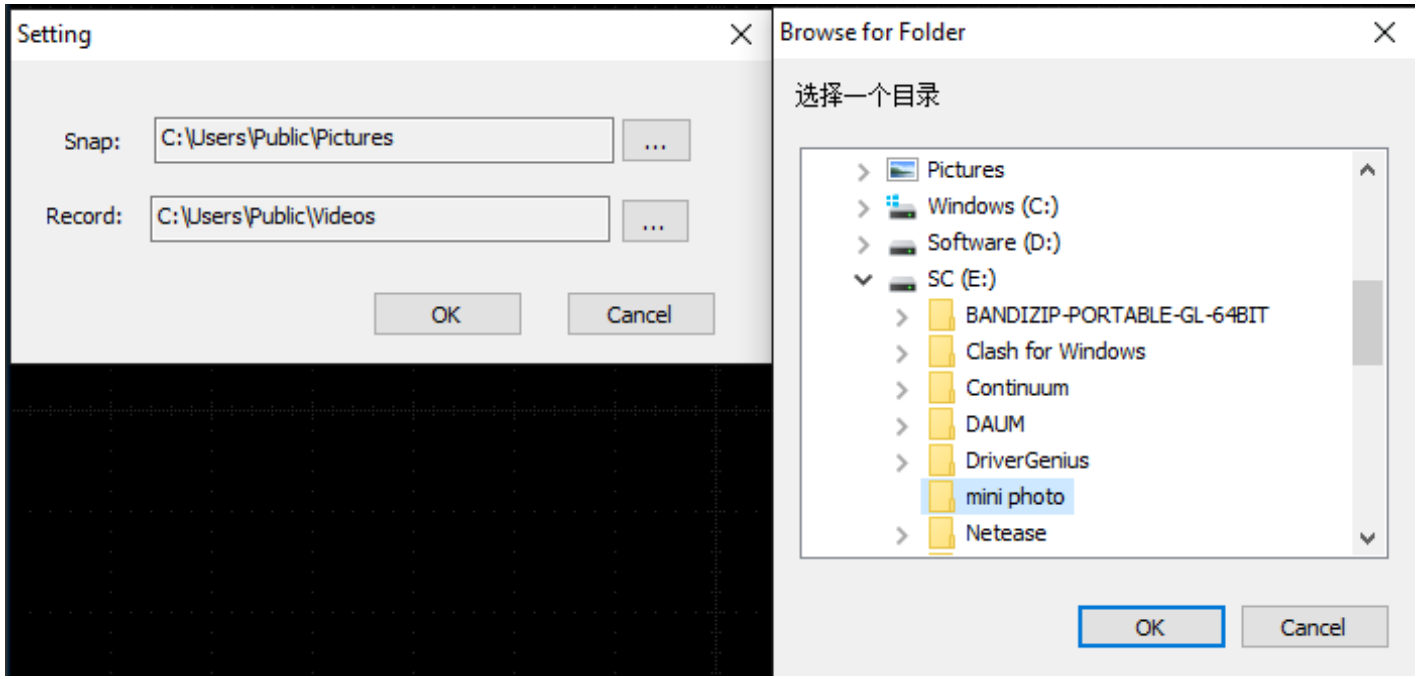

Figure 14-4 Change Storage Directory

View pictures and videos:

Open picture (video) storage directory to view pictures (videos) stored on the host computer.

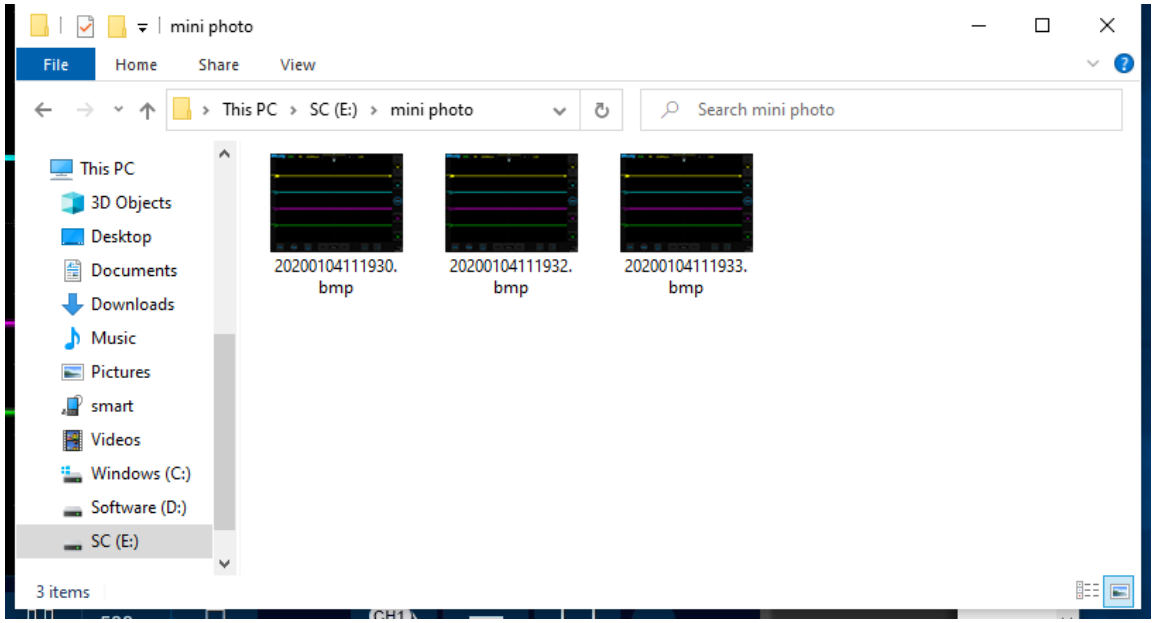

Figure 14-5 View Pictures

14.2 Mobile Remote Control

Micsig ATO series oscilloscopes support remote control on mobile phone (android & iOS). You need to download Android app from the official website of Micsig (address: http://www.micsig.com) and install it. For iOS, go to apple store search Automotive Oscilloscope or Micsig to get it.

After App is successfully connected, mobile device can be used to control the oscilloscope and display the oscilloscope interface in a real time manner.

Figure 14-6 APP interface

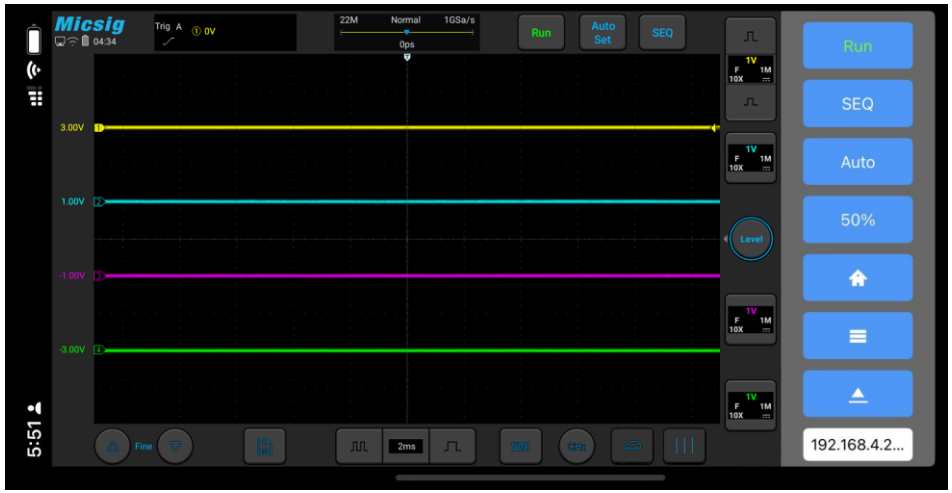

Figure 14-7 Successful Connection of APP

Android APP can be connected by two methods:

1. Use oscilloscope portable hotspot: Mobile phone can be connected to the hotspot of oscilloscope. Enter the oscilloscope IP 192.168.45.1 in the IP box at the lower right corner of the screen to connect successfully for control;

2. Connect mobile phone and oscilloscope to the network segment under the same router: view the IP address of the oscilloscope, and enters such IP address in the lower right corner of the mobile phone to connect successfully.

The first connection method is recommended.

Chapter 15 Update and Upgrade Functions

This chapter describes the methods of software update and increasing the optional function. You are recommended to read this chapter carefully understand the upgrade functions of the ATO series oscilloscope.

- Software update
- Add optional functions

15.1 Software Update

Micsig often releases software updates for its products. To update your oscilloscope software, you can connect the oscilloscope to WIFI for networking, and open the SystemUpgrade application to check and install update.

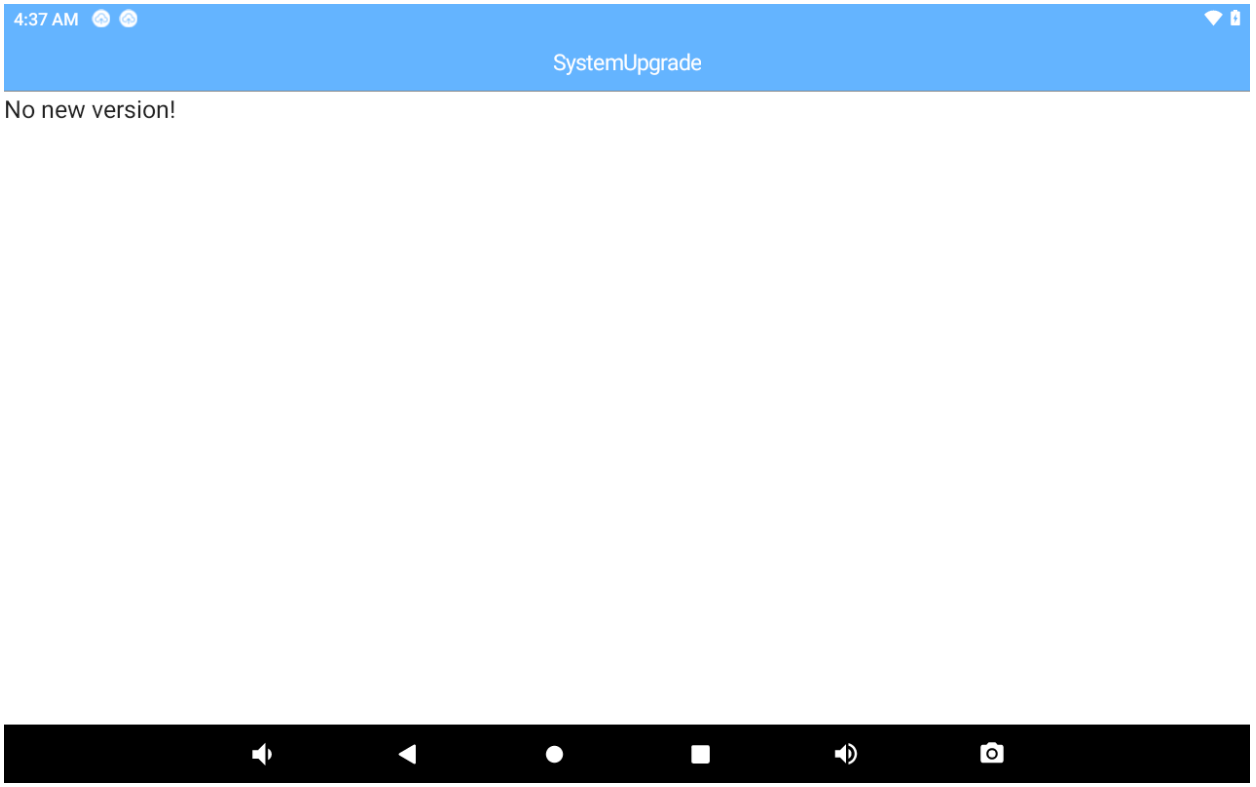

Figure 15-1 SystemUpgrade application

⚠ **Note:** Please pay attention to keep the oscilloscope power more than 50% when installing updates or connect the oscilloscope to the adapter, so as to prevent the oscilloscope from becoming abnormal due to insufficient power for update.

To view the currently installed software and firmware, tap the “App Store” software in the “Home” page to display the oscilloscope software and firmware information on the “About” screen. Please refer to 13.2 App Store.

15.2 Add Optional Functions

Tap the “App Store” software in the “Home” page to display the installed and uninstalled decoded options on the “About” screen. Please refer to 13.2 App Store.

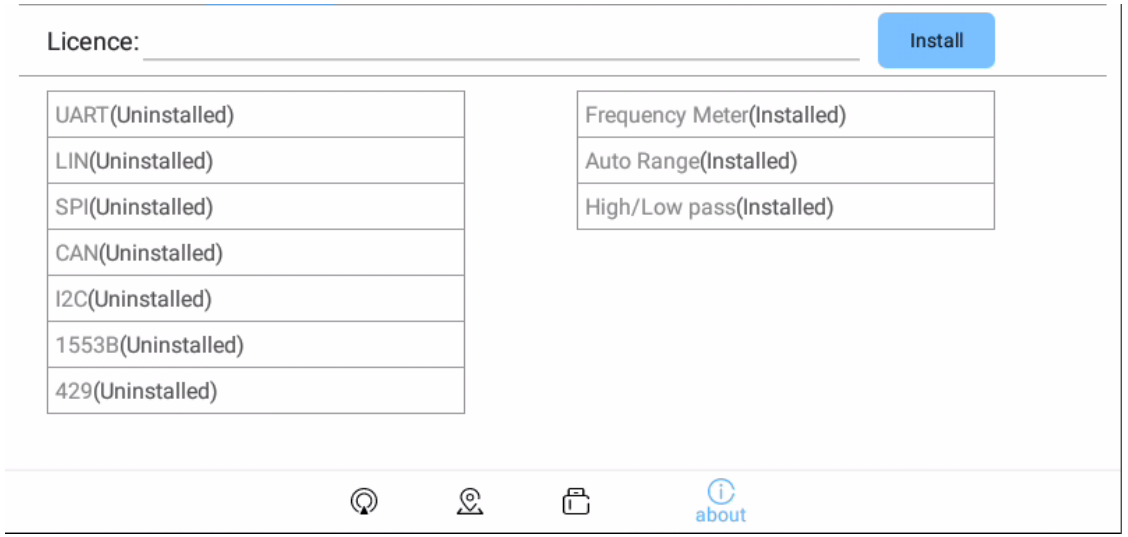

Figure 15-2 Decode Functions Not Installed

If you need the optional function service, please contact Micsig for license and enter the install option function at the license bar.

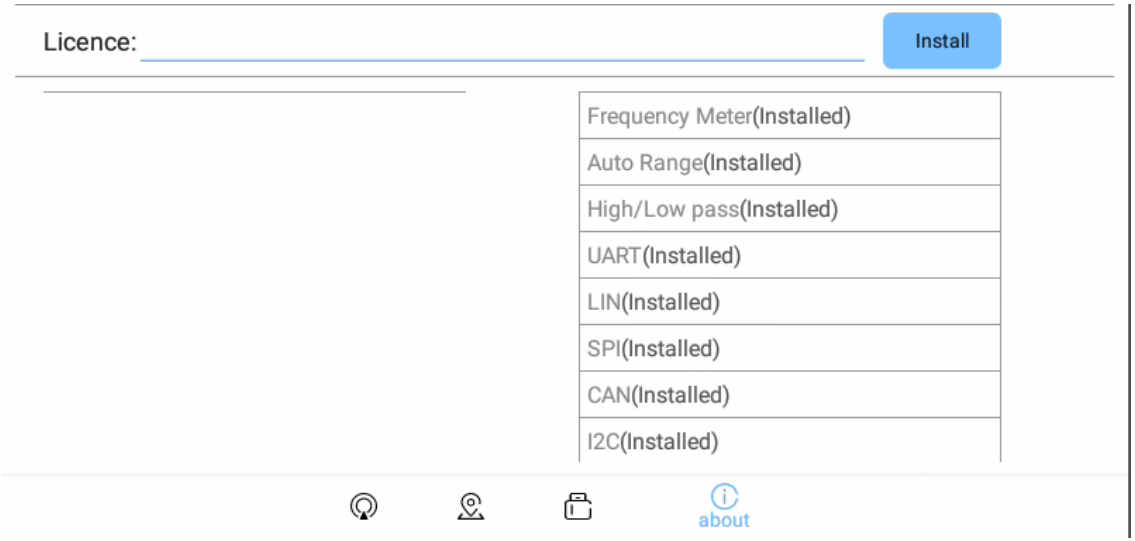

Figure 15-3 Decode Functions Installed

Chapter 16 Reference

This chapter contains the measurement category suitable for the oscilloscope and the environmental level of pollution degree supported. You are recommended to read this chapter carefully to understand the conditions of use of the ATO series oscilloscope.

- Measurement Category
- Pollution Degree

16.1 Measurement Category

Oscilloscope measurement category

Smart oscilloscopes are primarily used for measurements in Measurement Category I.

Measurement category definitions

Measurement category I is for measurements performed on circuits not directly connected to MAINS. Examples are measurements on circuits not derived from MAINS, and specially protected (internal) MAINS derived circuits. In the latter case, transient stresses are variable; for that reason, the transient withstand capability of the equipment is made known to the user.

Measurement category II is for measurements performed on circuits directly connected to the low voltage installation. Examples are measurements on household appliances, portable tools and similar equipment.

Measurement category III is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit-breakers, wiring (including cables, bus-bars, junction boxes, switches, socket-outlets)

in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with permanent connection to the fixed installation.

Measurement category IV is for measurements performed at the power source of the low-voltage installation. Examples are electricity meters and measurements on primary overcurrent protection devices and ripple control units.

Transient withstand capability

⚠ Maximum input voltage of the analog input

Category I 300Vrms, 400Vpk.

16.2 Pollution Degree

Pollution Degree	ATO series oscilloscopes can operate in environments with pollution degree 2 (or pollution degree 1).

Pollution Degree Categories	Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. For example: a clean room or air-conditioned office environment. Pollution degree 2: Normally only dry, non-conductive pollution occurs. Occasionally temporary conductivity caused by condensation may occur. For example: general indoor environment. Pollution degree 3: Conductive pollution, or dry, non-conductive pollution occurs which becomes conductive due to condensation. For example: sheltered outdoor environment. Pollution degree 4: Pollution that generates persistent conductivity through conductive dust, rain, or snow. For example: outdoor locations.

Chapter 17 Troubleshooting

1. If the oscilloscope does not start up at power on, please follow steps below:

- Check the power cord to verify whether it has been connected properly and whether the power supply is normal;
- Check the power on/off buttons to ensure it has been pushed, and if you are using battery, check whether the battery is in good condition;
- Check the Power-off lock on the side of oscilloscope;
- Contact Micsig if the problem persists, and we will provide service to you.

2. If acquired waveforms do not display on the screen when the signal source is connected, please follow the steps below:

- Check whether the probe is connected correctly in the BNC socket;
- Check whether the probe is connected correctly in the signal source;

- Check whether the trigger type is correctly selected;
- Check whether trigger conditions are set correctly
- Check whether signal source is working properly;
- Check whether the channel is turned on;
- Check whether the vertical scale factor is set correctly;
- Check whether the instrument is in single-sequence waiting state for trigger
- Tap 

to resample signal.

3. If the measured voltage amplitude is 10 times greater or smaller than the actual value:

- Check whether the set attenuation factor of the channel is consistent with the attenuation factor of the actually used probe.

4. There is a waveform display, but cannot be stable:

- Check the trigger source on the trigger type menu to ensure that it is consistent with the actually used signal channel;
- Check the trigger type: edge trigger is adopted for general signal, and video trigger mode for video signal. Only the correct trigger mode is used, the waveform can be displayed stably;
- Check signal source noise. Set the trigger coupling mode to be high-frequency rejection or low-frequency rejection to filter out high frequency or low frequency noise interference

5. A waveform is displayed but inconsistent with the input waveform:

- Check whether the coupling mode setting in the channel menu is correct.

6. If there is no display after pressing 

or 

button:

- Check whether the trigger mode is “Normal”, and whether the trigger level is beyond the scope of the waveform. Center the trigger level and set the trigger mode as “Auto”.
- Check whether the picture is displayed in full screen, and if so, exit the display.

7. If the display becomes slower after setting average times of sampling:

- If the average times are above 32, it is normal for the general speed to become slow.
- You can reduce the average times.

8. Staircase waveform is displayed:

- This phenomenon is normal because the horizontal time base is too low, and the horizontal time base may be increased to raise the horizontal resolution, and then improve the display;
- The display type may be “line”. The connection between sampling points may lead to the display of staircase waveform. This problem can be solved by setting the display type as “point” display mode.

9. There is persistence of vision in waveform display:

- This phenomenon is normal because the persistence time may be set too long, and the waveform persistence shows persistence of vision;
- The reason may be that sampling mode is set to envelope of sampling, and the sampling mode can be modified to normal waveform for normal display

10. During measurement, the measured value is displayed as -----:

- This phenomenon is normal. When the channel waveform displays beyond the waveform display area, the measured value is displayed as -----. If the channel vertical sensitivity or vertical position is adjusted, the measured value can be displayed correctly;
- This phenomenon is normal. When there is no full-cycle waveform in the waveform display area, the measured value may be displayed as -----. If the time base is adjusted, the measured value will be displayed correctly.
- This phenomenon is normal, and the measured value of the FFT waveform is displayed as -----.

11. CSV files cannot be selected when loading reference:

- CSV files are not the supported format that can be loaded into reference channels.

12. Tap the button during the use of oscilloscope, there is no beep sound:

- Check whether the sound volume setting is correct.

13. Oscilloscope backlight has low brightness:

- Check whether the backlight settings are correct.

14. A waveform being moved changes abruptly:

- Check whether the picture is displayed in full screen.

15. Turn off the channel at Auto state:

- This phenomenon is normal. At Auto state, the channel with an amplitude less than 10mV will be turned off.

16. Function buttons are pressed without response:

- Check whether the picture is displayed in full screen.

Chapter 18 Services and Support

Service Commitments : Micsig guarantees that the products are manufactured and tested according to national standards or enterprise standards, no unqualified products will leave our factory and the first-class customer services are provided for all sold products. The warranty period for our products is three years since date of shipment, and six months for the sold spare parts and the product repair and maintenance. For the details of warranty service, please read the “Scope of Limited Warranty and Services” chapter. Micsig provides lifetime repair and maintenance services for products. In accordance with the relevant provisions of after-sale service of industrial products and the enterprise’s own capacities, Micsig commit as follows:

Repair Commitments : Micsig commits to use the original factory parts for products returned by the user for repair (under warranty or not) and the commissioning and testing standards are identical with new products. Micsig the obligation to inform the customer, but without any other obligations for non-product defects or products with decreased performance not for objective reasons.

Service Time Commitments : Micsig will give a reply of the time and cost for repair within 2 working days after receiving the product returned by the user for repair. After the reply is confirmed, the repair period for a general fault is 5 working days and shall not exceed 10 working days for any special fault.

Contact us

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Annex

Annex A:Maintenance and Care of Oscilloscope

General maintenance

Do not put or leave the instrument in a place where the LCD display will be exposed to direct sunlight for long period.

⚠**Caution:** To avoid damage to the oscilloscope or probes, do not expose them to sprays, liquids, or solvents.

Clean oscilloscope

Examine the oscilloscope and probes as often as operating conditions require. To clean the exterior surface, perform the following steps:

- Use a soft cloth to remove floating dust on the outside of the oscilloscope and probes. Take care to avoid scratching the touch screen while cleaning.

- Use a soft cloth dampened with water to clean the oscilloscope while doing this please keep the power off. Wipe with a mild detergent and water. Do not use any corrosive chemical cleaning agent, in order to avoid damaging the oscilloscope or probe.
- Clean the ventilation hole with a soft brush to keep it unimpeded. Do not use any corrosive chemical cleaning agent, so as to avoid damage to the oscilloscope motherboard.
- If the fan needs to be cleaned, please consult the after-sales service personnel, so as to avoid damage to the oscilloscope.

⚠ Warning

Make sure the instrument is dry before recharging, to avoid electrical short circuit or personal injury caused by moisture.

Store oscilloscope

The lithium battery needs to be charged before storing the oscilloscope for a long period.

Battery charge

Upon delivery, the lithium battery may not be charged. It takes 6 hours to be fully charged (the oscilloscope is recommended to turn off to save the charging time). When running on battery power, the battery level indicator in the lower right corner of the screen will indicate the battery usage.

⚠**Caution:** In order to avoid charging battery from overheating, do not use beyond the permitted environmental temperature value given in the technical specification.

Annex B: Accessories

Standard accessories

1) 2 pcs for 10X standard probes (incl. grounding nut, grounding crocodile clip, standard rubber plug)

2) 4 x BNC banana lines (4CH);

3) 4 x alligator clips (4CH);

4) 4 X Flexible needle (4CH);

5) Power adapter (12V DC, 4A)

6) Power cord

7) Smart calibration certificate

8) Smart packing list

Optional accessories

1) Oscilloscope suitcase/handbag

2) Battery

3) High voltage probe

4) Differential probe

5) Current probe

This manual is subject to change without notice.

The contents of this manual are considered correct. If the user finds any error or omission, please contact Micsig.

The company will assume no responsibility for accident or hazard caused by the improper operation of the user.