CANScope

CANScope Analyzer

UM12090301   V1.01   Date: 2012/09/03   **User Manual**

Item	Contents
Terms	CANScope, safety on usage, hardware description, PC software, parameters
Abstract	This document is an overview on how to use the CANScope analyzer.

Revision History

Version	Rev. Date	Modifications
V1.00	2011-09-01	Original Chinese version
V1.01	2012/08/31	Revised Chinese version
V1.01	2012/09/03	Translated to English

Contents

Chapter 1: Notices on Safety Usages

The usage of this product may deal with high voltage hazard conditions; in order to avoid electric shock or other risks that may cause personal injury or even death, before using the product, please make sure that all the notices of the product listed in this chapter are fully known and understood.

1.1 Safety Information

Do not use product in any manner other than those specified in the user manual.

Do not install substitute parts or perform any unauthorized modification to the product. Please contact Guangzhou ZHIYUAN Electronics Stock Co., Ltd. and return the product to its technical support office for repair and maintenance.

The safety symbol of the product is shown in Figure 1-1:

Refer to Manual
for additional
Information

Figure 1-1: Safety symbol

CAT II (300V) IEC Measurement Category II, inputs may be connected to power sources (up to 300VAC) under category II over-voltage conditions.

WARNING

(1) Disconnect with main power and test input: Before repair, please unplug the power cable from instrument, and remove all the probes from all the terminals. Only qualified and trained personnel should remove the cover from instrument.

(2) Protection limits: To avoid damage to instrument and the risk of electric shocks, do not exceed the protection limits defined below. When the practical values stay within the limits of the protection, the protection circuit on CANScope Analyzer can effectively prevent damage to instrument and risk of electric shock. So for safe operation, do not exceed the limit values.

1.1.1 Test suite

The rated values and limits of the testing suite for CANScope:

- Banana plug: CAT II 1000V / Max 32A
- Test hook: CAT III 1000V / Max 10A

- Alligator clip: CAT II 300V / Max 15A
- Test probe: CAT III 1000V / Max 10A

WARNING

If user uses the test suite in anyway other than those specified by Guangzhou ZHIYUAN Electronics Stock Co., Ltd.; the protection of the test suite may be weaken. Do not use a damaged or broken test lead probe for measurement, it may result in damage to instrument or personnel injury.

1.1.2 Power supply connection

The rated values and limits of the CANScope power adapter:

- (Input) I/P: 100~240V / 50-60Hz, 0.55A
- (Output) OI/P：12V, 2A。

WARNING

To avoid damage to instrument and the risk of electric shocks, and to ensure there is an appropriate voltage supply to the instrument, please use the power adapter and cable provided by Guangzhou ZHIYUAN Electronics Stock Co., Ltd., or a national standard power adapter and cable. Also to avoid damage to instrument and the risk of electric shocks, please ensure that the instrument has a good grounding connection.

After confirming the power supply voltage, user can connect the power cable to the instrument and push the power button down and hold it to turn it on. Once the power is connected, the red PWR LED on the instrument will light up first, keep holding the button down until the instrument give out two beeps, it means that the instrument is fully on; user can then run the PC software and perform measuring works.

Chapter 2: Hardware Description

This chapter introduces the basic functions and operations of the CANScope Analyzer. Reading this chapter can help you quickly understand how to use CANScope Analyzer to perform basic measurement works.

2.1 Hardware interfaces
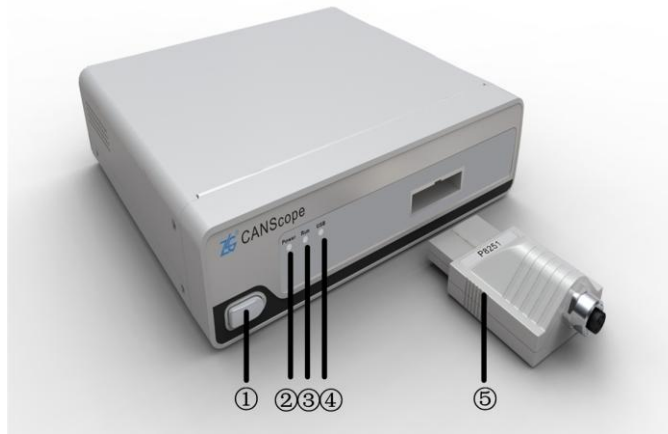
2.1.1 Front side interfaces

Figure 2-1: CANScope front side view

- ① Soft switch: After connection to 12V power, hold down it a while to turn on/off the analyzer, after power up, the butter will turn to red
- ② Power indicator: After connection to 12V power, the red PWR LED will light up.
- ③ Running status indicator: This yellow indicator lights up when the Analyzer is under monitoring or working state.
- ④ USB indicator: When CANScope host is working, the USB blue light will flicker.
- ⑤ Port connector: With built-in transceiver and uses M12 communication cable; it can be used to test CAN-bus communication.
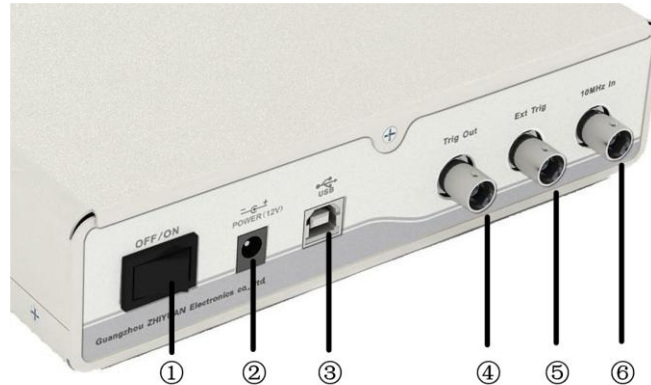
2.1.2 Backside interfaces

Figure 2-2: CANScope backside view

- ① Power switch: turn on/off power supply.
- ② Power supply: 12V DC power adaptor connector.
- ③ USB port: High speed port; connect to PC through the provided A-B USB cable.
- ④ Trigger output: synchronized trigger output signal for multiple devices.
- ⑤ Trigger input: external trigger signal input.
- ⑥ Clock input: external 10MHz clock source signal input for base clock.

2.1.3 M12 Communication cable

Figure 2-3: M12 communication cable

- Yellow connector: CANH signal.
- Green connector: CANL signal.
- Black connector: System grounding.
- Red connector: Reserved, do not connect it to any places
- Blue connector: System cable shielding

2.2 Device connections

The hardware connections of CANScope are listed as below:

1. Power cable: Plug the power cable to a 220V power outlet, and connect the other side of cable to the power port on the back of the CANScope.

2. USB Cable: Connect the A side of the cable to PC, and the B side to the USB port of the CANScope on its back.

3. M12 Cable: Connect connector side of the cable to the Port connector, and connect the test clips to the signal to measure.

4. Port connector: Connect between the CANScope and the M12 communication cable

Chapter 3: Software Installation

This chapter demonstrates how to install CANScope software to your computer, the basic function of the PC software for CANScope analyzer, and how to use it to perform basic measurement works.

The CANScope software is the PC software for CANScope Analyzer; it can communicate with the analyzer hardware through USB connection, and controls the analyzer to perform operations and measurements. This software can perform all operations provided by the CANScope, including message collection, waveform display, oscilloscope, hardware eye diagram, software eye diagram, bus interference, data storage, network sharing, protocol analysis, and other functions.

3.1 Install CANScope software

3.1.1 System requirements

CANScope software supports the Windows XP, Windows Vista, Window 7 operating systems. The basic PC hardware requirements are: 1.6GHz CPU (dual core is recommended), 1GBytes RAM (2G Byes is recommended), and 1GBytes free space on hard disk, USB2.0/USB1.1 host controller.

3.1.2 Steps to install the software

1. Launch the setup program

Download the software setup program from our website or find it within the product CD; double click on the execution file icon, as Figure 3-1 shows, to launch the software setup program, as Figure 3-2 shows.

Figure 3-1: Software Setup program file

Figure 3-2: CANScope setup program: getting start

Click next to proceed, then the install path window will appear, as Figure 3-3 shows.

2. Set installation path

Default path is: "C:\Program Files (x86)\zhiyuan\CANScope", user can specify a new path for installation. After path setting, click next to proceed.
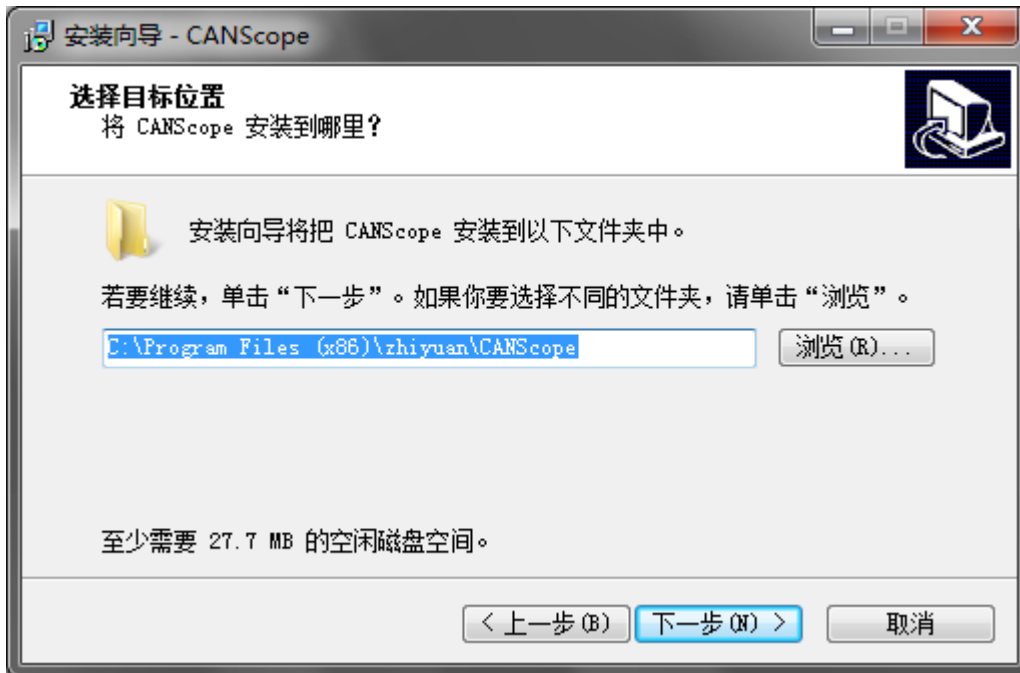

Figure 3-3: Specify installation path

3. Start menu settings

This window can configure the location of the software icon in "Start menu" the default location is "zhiyuan\CANScope", user can redefine this location. After this, click next to proceed; as Figure 3-4 shows.
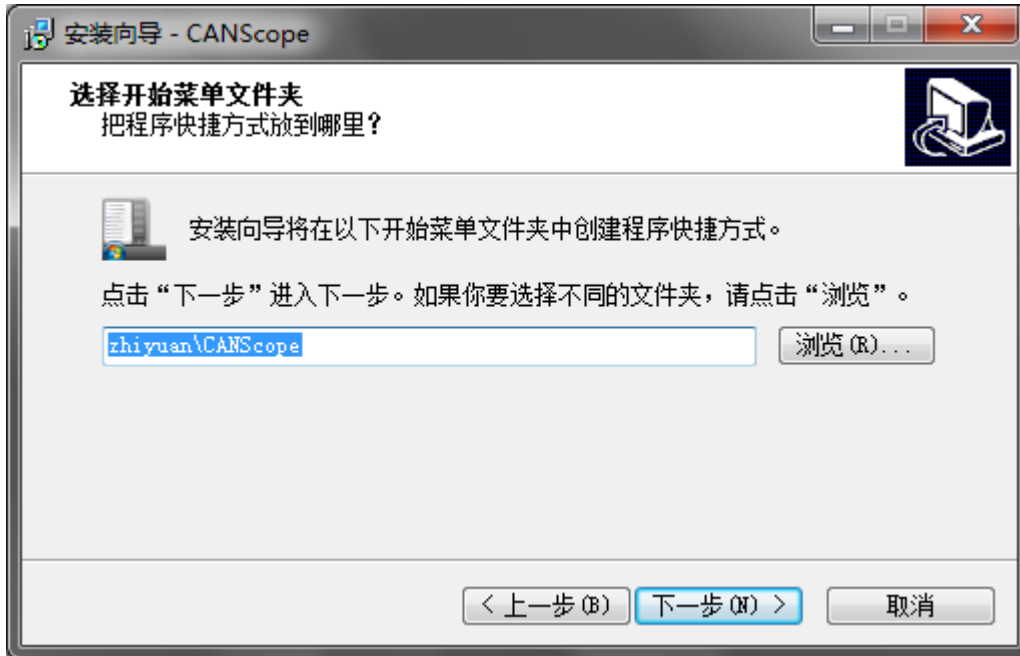

Figure 3-4: CANScope setup program: start menu options

4. Desktop icon settings

Check the create desktop icon option to add software shortcut icon to desktop, then click next to proceed to next window, as Figure 2-6 shows.
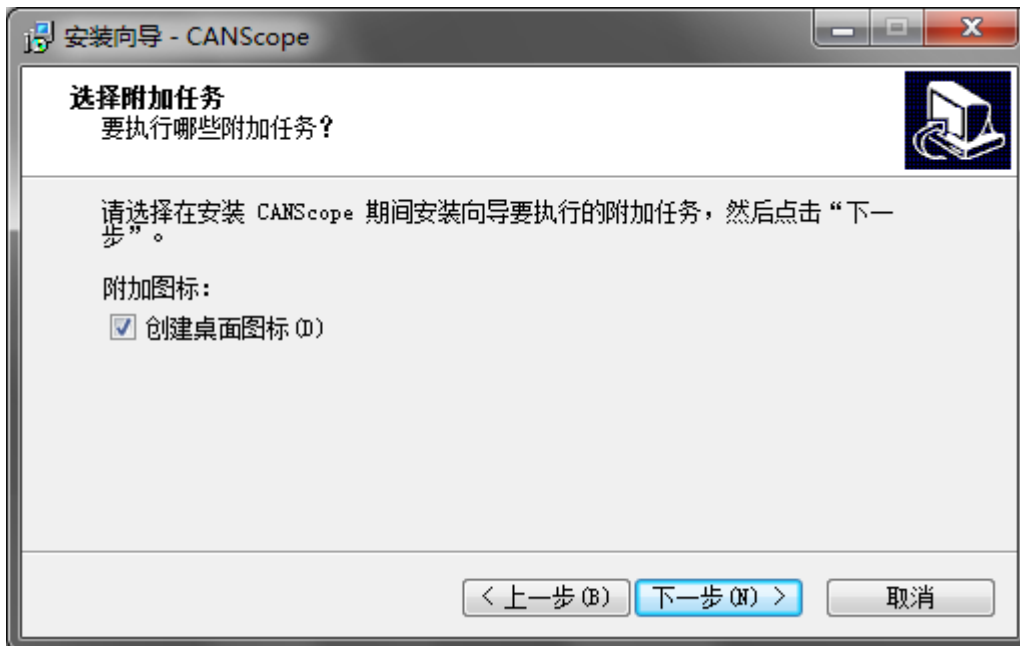

Figure 3-5: Create desktop icons

5. Get ready to install files

As Figure 3-6 shows, all the installation information configured previously will be listed out by this window, user can use back button to go back for modifications, when all information is correctly set, click the next button to proceed, and then a file installation progress window will pop up.
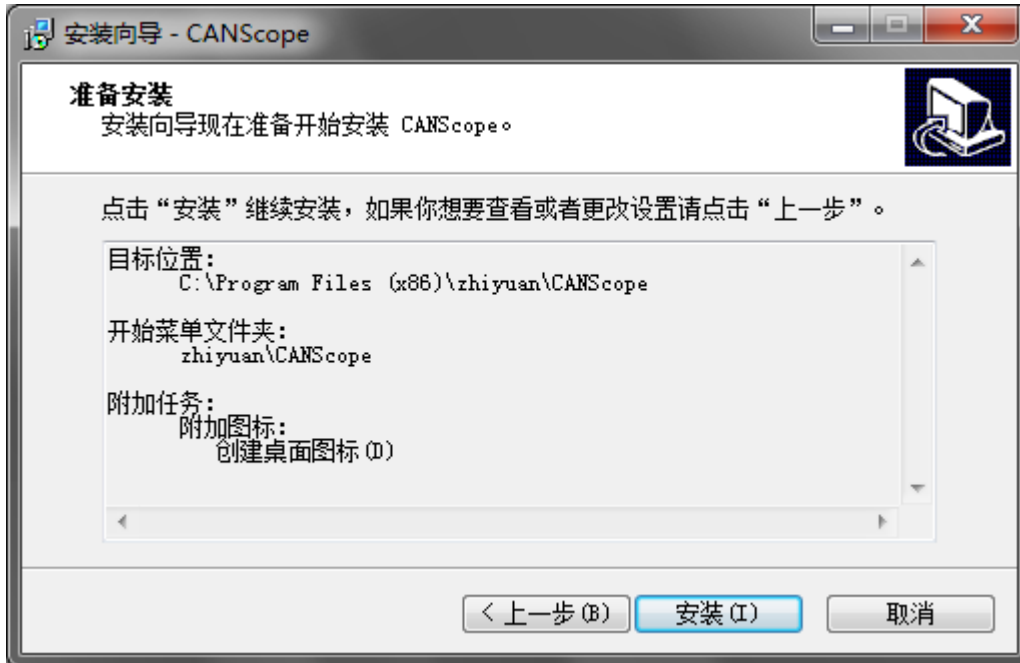

Figure 3-6: CANScope setup program: get ready to install files

6. Start the file installations

As Figure 3-7 shows, wait till the installation of software files is complete, an installation complete window will then pop up, click the finish button to finish the installation.
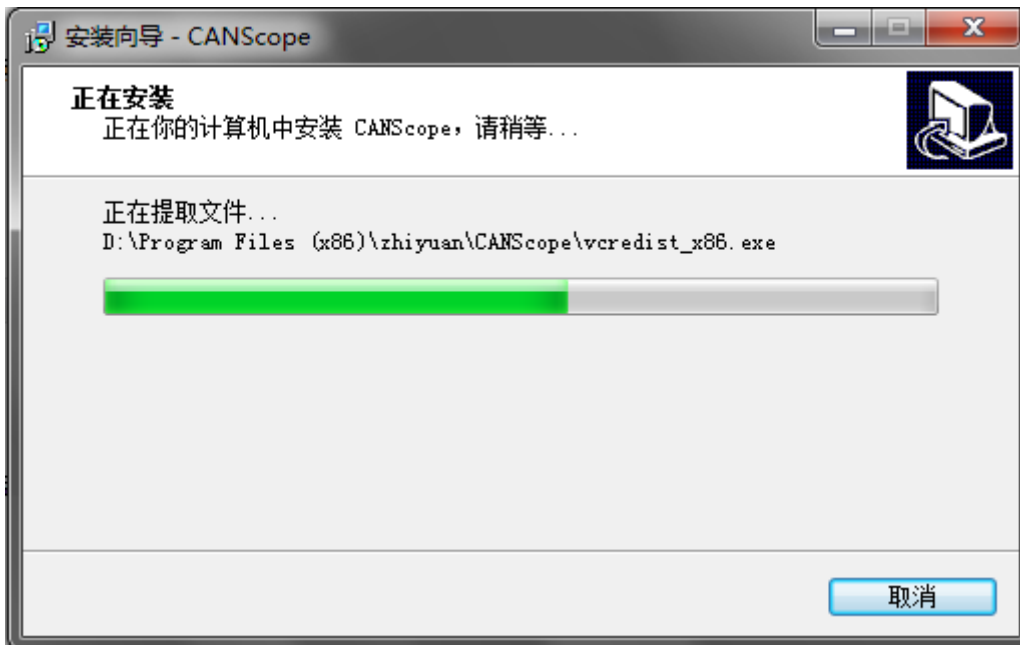
Figure 3-7: CANScope setup program: file installation in progress

7. Installation completed

Now the installation is completed, as Figure 3-8 shows, If user checked the run CANScope option within the finish window, then the software will be run immediately after the installation of the software.

Figure 3-8: CANScope setup program: Installation complete

3.2 Software Operations

3.2.1 Main window

Figure 3-9 shows the main window of the software.

Figure 3-9: Main window of the CANScope software

Notice: if there is an "offline" quoted after the top middle title of the main software window, it means that the software is not connected with the device, after connection, the quoted content will be "online".

3.2.2 CAN Messages

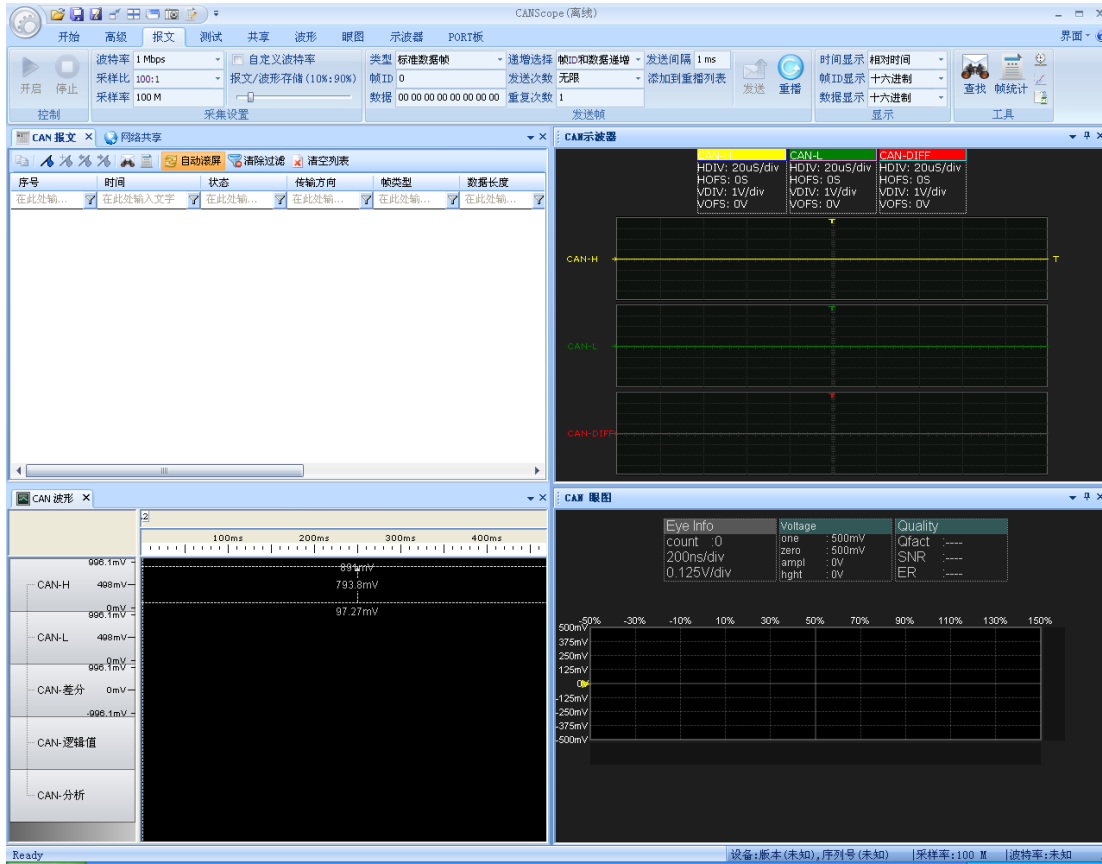Single click on the "CAN Messages" option within the main menu to open the "CAN Messages" analysis window; as Figure 3-10 shows.
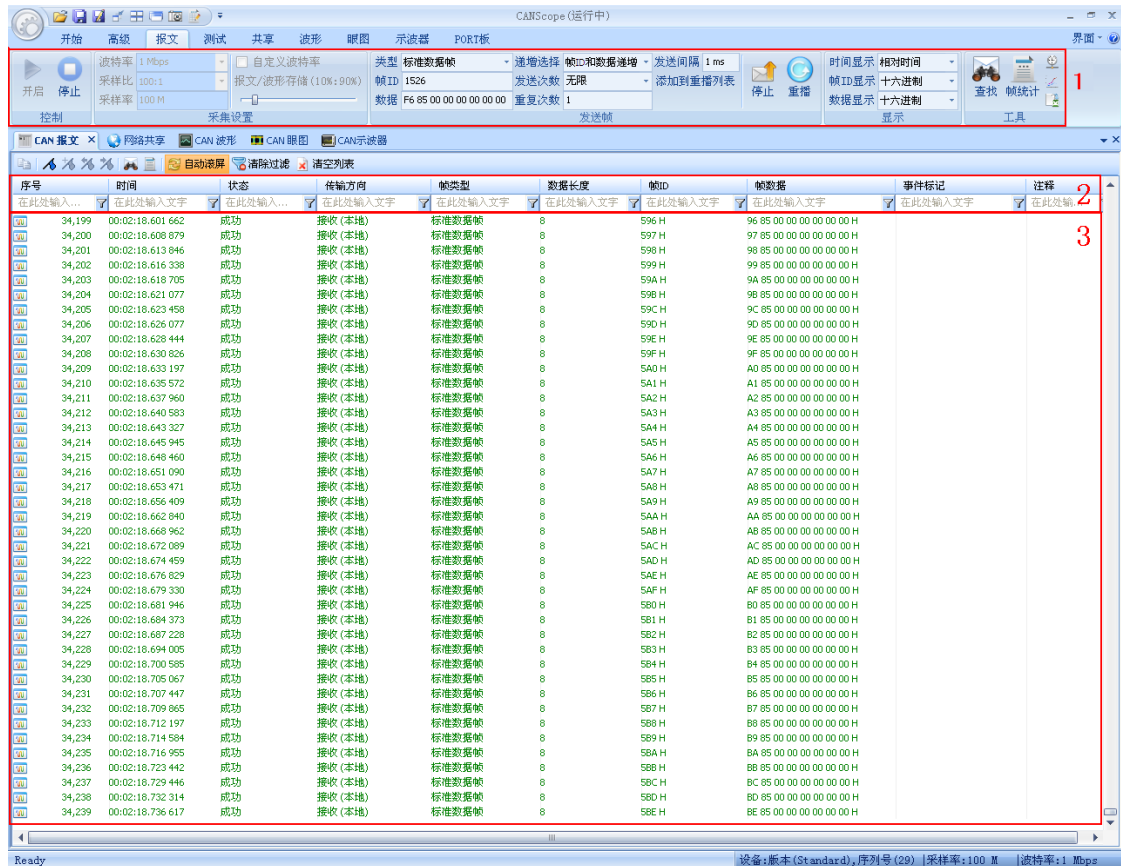
Figure 3-10: CAN messages window

Within Figure 3-10, number 1~3 mark areas with different functions:

① Menu area: Contains basic operations for CAN message module

② Data filter area: Allow user to set filter conditions to filter display data within the data list

③ Data list area: List out data collected from the device

3.2.2.1 Operations

Step 1:   Open CAN message analysis window and configure the data collection settings.

Step 2:   Single click on the " 开启 " button within the "Control" field, then CANScope will enter data listening state.

Step 3:   Configure the frame contents to send within the "Send Frames" field; after this, single click on the " 发送 " button to start the send function of the CAN

message; now CANScope works in normal state.

Step 4: Within the data list area, the receive data will be shown in the list window, the default settings of the list window is auto scroll display. If user doesn't need this function, just uncheck the "Auto scroll" option within the menu area.

Step 5: During the receive process; modify the data settings within the "Send frames" field to observe change of data within the data list area.

Step 6: Single click the " 停止 " button to stop sending can messages.

Step 7: To filter data, just fill in the filtering condition within the data filter field.

Step 8: User can specify the data display mode within the data list area, including the time display mode, frame ID display mode, and data display mode.

Step 9: Single click on the " 查找 " button within the tool area to open the search window, user can find data by specifying search conditions within this window.

Step 10: Single click on the " " button within the tool area to see the statistic information of the frames.

Step 11: Single click on the " " button within the tool area to see the utilization rate of the bus.

Step 12: Single click on the " " button within the tool area to see the message and utilization rate of the bus.

Step 13: Single click on the " " button within the tool area to export message data.

Step 14: Single click on the " 停止 " button within the tool area to stop collecting data.

3.2.3 Network and sharing

Network and sharing function allows user to share data to the server, allowing other users to access them through server connection. To use CANScope itself as a server, simply configure the corresponding server parameters within the "Server settings" area. To connect CANScope to an existing server for data access, just configure the corresponding parameters within the "Connect to server" area.

Single click the "Share" tag on the main menu can bring up the network and sharing page, as Figure 3-11 shows.
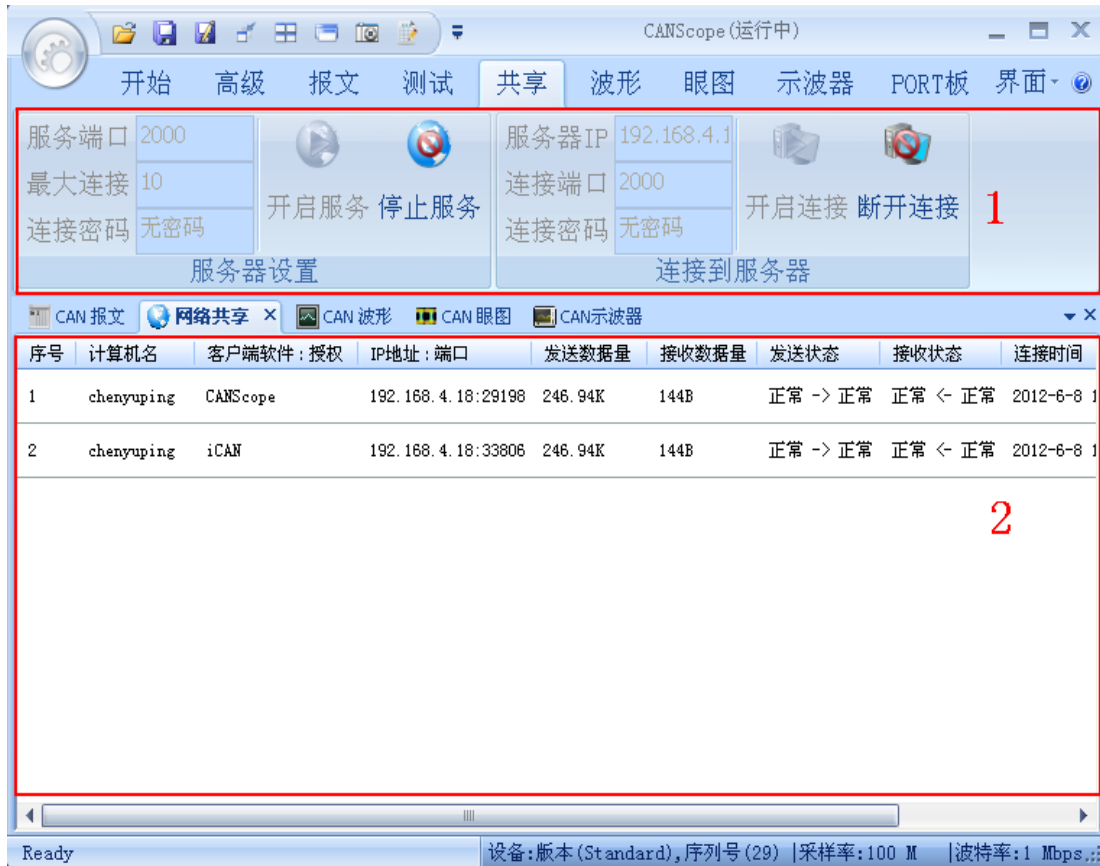
Figure 3-11: Network and sharing window

Within Figure 3-11, number 1~2 marks areas with different functions:

① Menu area: contains basic operations of the network and sharing function.

② Connections area: list out information of the connections that already established.

3.2.3.1 Operations

Step 1:　Open the network and sharing window, and configure parameters within the menu area

Step 2:　Server settings: including ports, maximum connections, and connection password. Click "Activate service" to activate the selected services.

Step 3:　Connect to server settings: including Server IP (default IP is the local IP of CANScope itself), connection port, and connection password (this password should be matched with the server setting). Then click the "Connect" button to establish connect.

Step 4:　After establishing a connection, the details of the connection will be listed out in the connection area.

Step 5:　Single click on the "Stop service" or "disconnect" button can close the server or disconnect from other server.

Notes: *On the client side, user can use CANScopeEx software to connect with the server to access share data.*

3.2.3.2 Connection List

Figure 3-12 shows the connection list, details of a connection can be found in this place.

序号	计算机名	客户端软件 ...	IP地址：端口	发送...	接收...	发送状态	接收状态	连接时间	其他操作
1	HUANGFAN...	:已授权	192.168.4.104...	0B	96B	正常 -> 正常	正常 <-...	2011-9-...	更多操作

Figure 3-12: Network and sharing: connection list

3.2.4 CAN Waveform

This function can display a CAN message in waveform mode.

Single click on the "CAN Waveform" tag to bring up the "CAN Waveform" page, as Figure 3-13 shows.

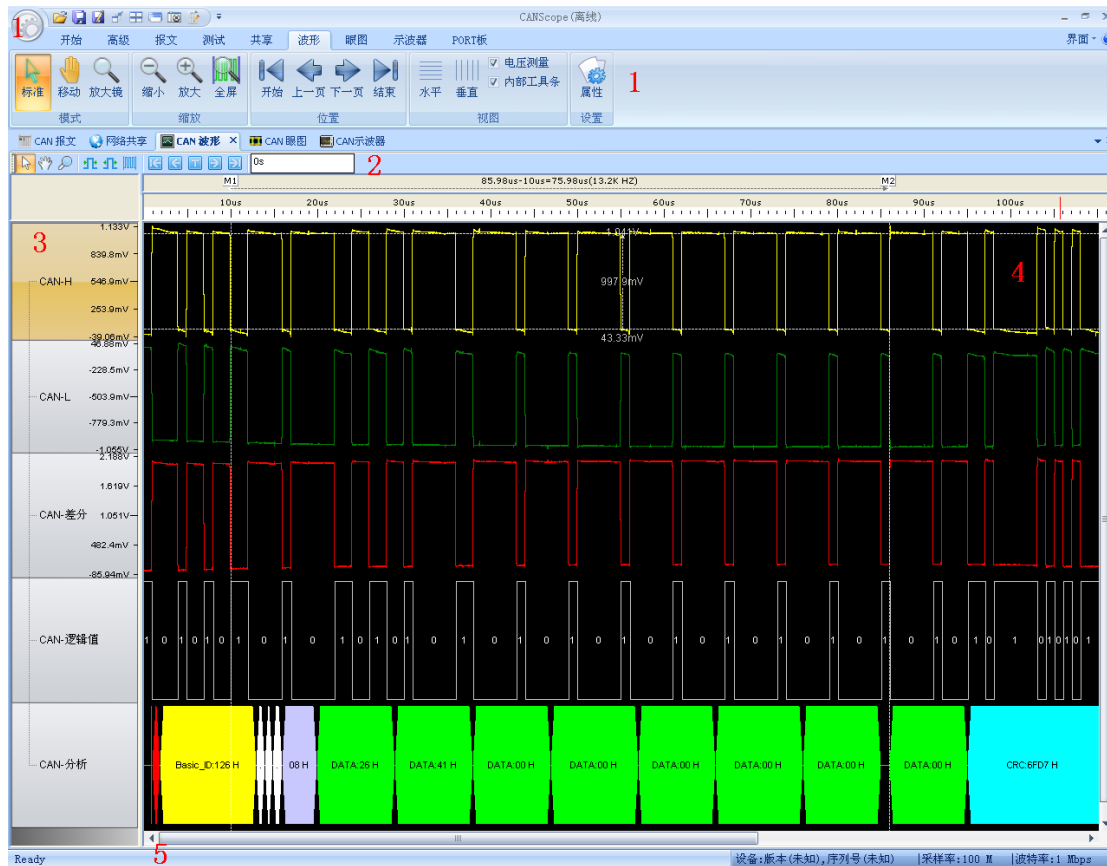**Figure 3-13: CAN waveform**

Within Figure 3-13, number 1~5 marks areas with different functions:

① Menu area: contains basic operations of the CAN waveform function.

② Toolbar: including functional buttons for waveform display controls.

③ Left control area: list out waveform names in tree structure.

④ waveform display area: Display CAN-H, CAN-L, CAN differential, CAN logic, CAN analysis waveforms

⑤ Navigation bar: Drag to control the waveform display, allow user to observe the complete waveform.

The CAN waveform menu area contains 5 options, which are mode, zooming, position, view, and settings; as Figure 3-14 shows.

Figure 3-14: CAN Waveform: menu area

The toolbar for CAN waveform window is shown in Figure 3-15.

Figure 3-15: CAN waveform: toolbar

3.2.4.1 Operations

Step 1: Select a fame of CAN message that has a mark in front of its serial number within the "CAN message" page, switch to "CAN Waveform" page, then the waveform of this CAN message will be show in the waveform window.

Step 2: Move mouse cursor onto the waveform, then the information of this waveform will show up.

Step 3: Right click on the left control area to bring up the dropdown menu, select a display mode of the waveform.

Step 4: Adjust waveform display.

Step 5: Single click on the button within the zooming field of the menu to zoom in, zoom out, or full screen display the waveform.

Step 6: Single click on the button on the toolbar can also zoom in or zoom out the waveform, or display the whole waveform within the window.

Step 7: Single click on the button within the menu area, then move the cursor to the waveform window, then the cursor will change to a "+", at the same time a transparent rectangular box will show up, move the cursor to let the rectangular box to cover a segment of waveform, then left click, the waveform display will zoom in to display this segment of waveform.

Step 8:   Within the display area, right click to bring up the dropdown menu; in its options, user can select "zoom in/zoom out/whole view" to change waveform display.

Step 9:   Move the cursor to the display area, hold down the [ctrl] key, the cursor will change to " 🔍 ", then a left click (with [ctrl] key down) can zoom in the waveform, right click can zoom out the waveform.

Step 10:   Adjust the height of the waveform to an appropriate size.

Step 11:   Adjust the display position of the waveform. Enter the time offset within the "Time offset" blank within the toolbar (unit: s, ms, or ns), press enter or single click outside of the "Time offset" blank to let the time offset setting take effect. Then the waveform display will adjust to start from this offset. Dragging the scroll bar under the waveform display is another way to change the time offset.

Step 12:   Adding labels. Right click on the waveform that you want to label, select the "Add label" option to add label to it.

3.2.5 CAN Oscilloscope

Click the "CAN Oscilloscope" tag within the main menu can bring up the "CAN Oscilloscope" page, as Figure 3-16 shows.
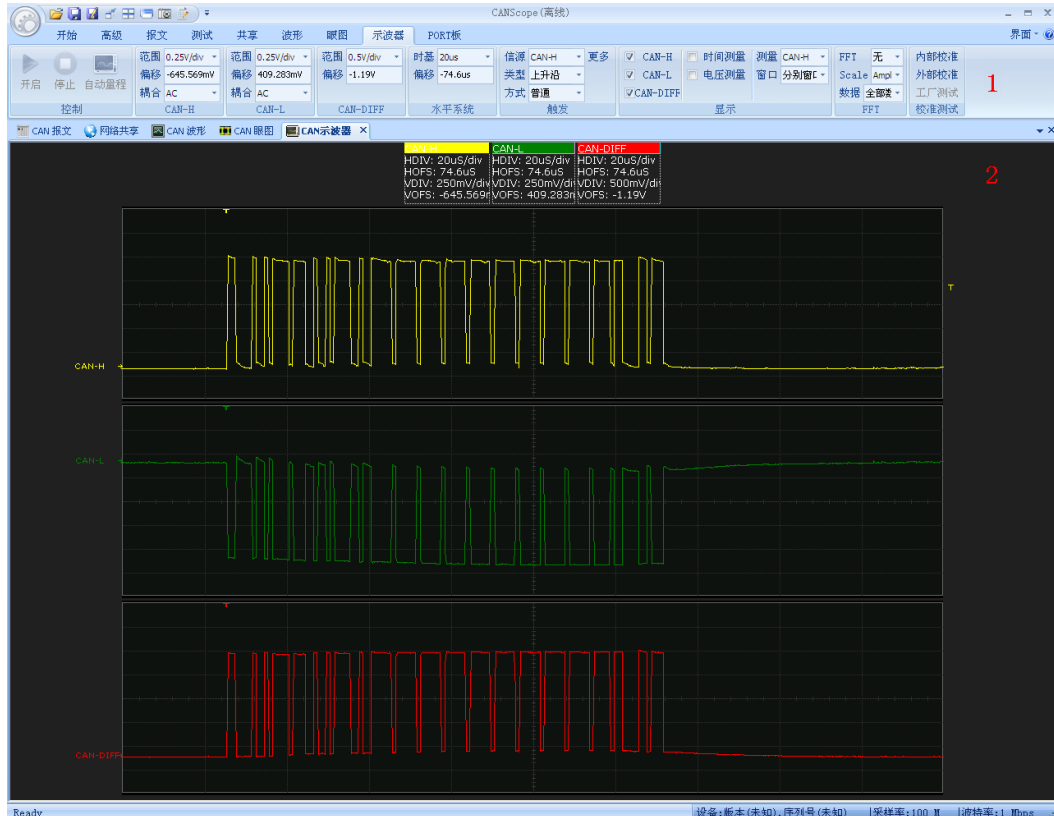

Figure 3-16: CAN Oscilloscope

Within Figure 3-16, number 1~2 marks areas with different functions:

① Menu area: contains basic operations of the CAN oscilloscope function.

② Display area: display CAN oscilloscope waveforms.

3.2.5.1 Operations

Step 1: Open "Port board" interface and activate oscilloscope and terminal resistor function.
Check "Enable oscilloscope" to activate oscilloscope function.
Check "Enable terminal resistor" to activate terminal resistor function.
Select the differential mode from "Math" (Mathematical result of CANH-CANL subtraction, not actual differential signal on the bus) or "Hardware" (actual CAN-bus differential signal)

Step 2: Open "CAN Oscilloscope" interface.

Step 3: Single click the " 开启 " button to start the oscilloscope.

Step 4: Single click the " 自动量程 " button to automatically set the waveform display to the best mode.

Step 5: Within the display area, configure the waveform display options to display the required waveforms and hide not required ones.
Check "CAN_H", "CAN_L", or "CAN_DIFF" to display their corresponding waveforms.
Check "Time measurement" or "Voltage measurement" to show time value or voltage value.
Check "Common window" or "Independent window" to show all waveforms in a common window or show them in separated windows.

Step 6: Set the waveform properties within the "CAN-H, CAN-L and CAN-Diff" field.

Step 7: Set trigger condition within the trigger setting field.

Step 8: Adjust horizontal offset: move the cursor to the "T" label on top of the wave, then it will change to a double arrow, hold down the left mouse button and drag it left or right, then the corresponding offset value within the menu will changed following the drag direction.

Step 9: Adjust trigger level: move the cursor to the "T" label on the left of the wave, then it will change to a double arrow, hold down the left mouse button and drag it left or right, then the corresponding offset value within the menu will changed following the drag direction.

Step 10: Within the oscilloscope window, hold down the left mouse button and drag a transparent rectangular box, then the details of the waveform covered by the box will appear, including name of waveform, starting abscissa, and ending abscissa.

Step 11:   Within the oscilloscope, right click to bring up the dropdown menu, then select "save as…" option to save the current waveform to BMP, JPEG, GIF, TIFF, and PNG format image files.

3.2.6 CAN Eye Diagram

The Eye Diagram is a diagram of overlapped logic pulses signal on oscilloscope display, it can be used to measure signal quality.

Single click on the "CAN Eye Diagram" tag to switch the main window to the "CAN Eye Diagram" window page, as Figure 3-17 shows.
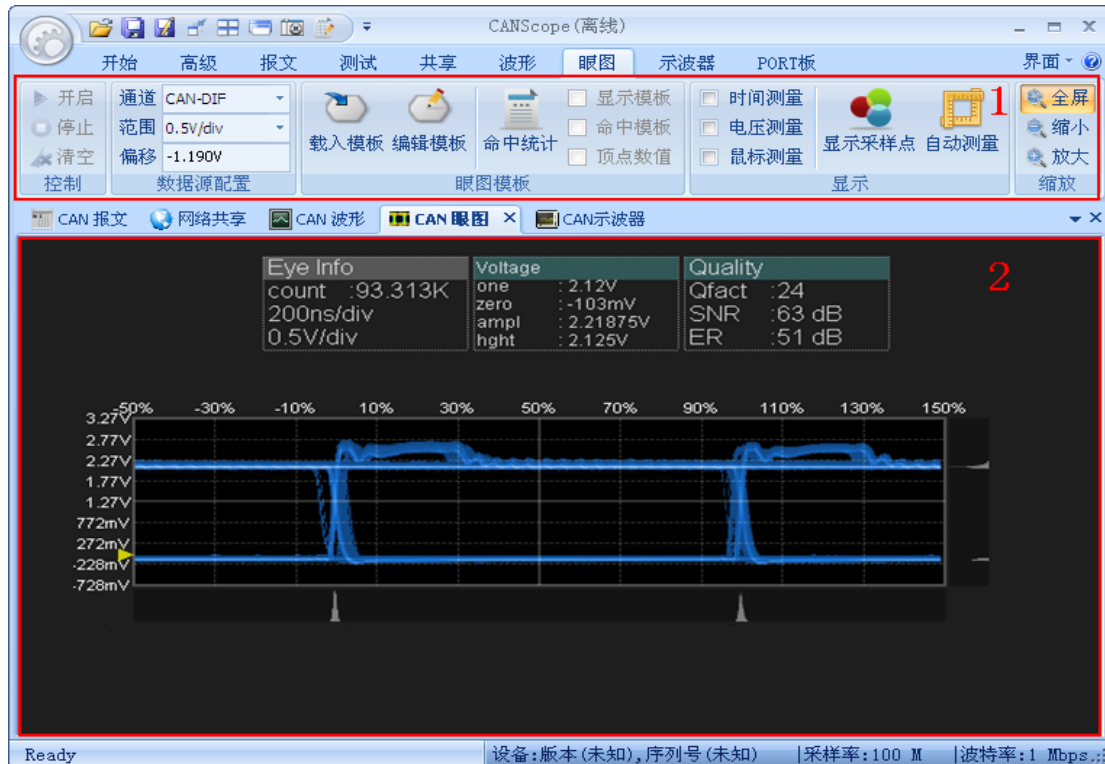
Figure 3-17: CAN Eye Diagram window

Within Figure 3-17, number 1~2 marks areas with different functions:

① Menu area: contains basic operations for CAN eye diagram display.

② Display area: displays the CAN eye diagram.

3.2.6.1 Operations

Step 1:   Single click on the "开启" button to open CAN eye diagram display.

Step 2:   Single click on the "停止" button to close CAN eye diagram display.

Step 3:   Single click on the "清空" button to clear CAN eye diagram.

Step 4: Single click on the "load pattern" to load eye pattern for comparison. Single click on the "match" option to match the eye diagram to loaded pattern. Check the "display pattern" and the "Matched part" option can select to show the loaded pattern and the matching part.

Step 5: Check the "Time measurement", "Voltage measurement", or "Mouse measurement" options can perform measurements to time or voltage value. Single click on the "Auto measurement" button can let the software perform time and voltage measurement automatically.

Step 6: Single click the zoom in/zoom out/full screen button can adjust the display of eye diagram

3.2.7 Protocol analysis

3.2.7.1 Enter protocol analysis mode

The protocol analysis is under the "Advance" tag of the main menu, as Figure 3-18 shows.

Figure 3-18: Advanced protocol analysis

Single click on the "Protocol analysis" button, then a Protocol list window will pop up, as Figure 3-19 shows.

Figure 3-19: Protocol list

Within Figure 3-19, there are 4 protocols:

- CANopen: CANopen protocol defines the application standard and CAN application layer communication protocol for distributed industrial automation system.
- DeviceNet: a kind of open field bus standard based on CAN-bus
- iCAN: iCAN is the application layer protocol for industrial applications, it defines the ID and data distribution and application of CAN messages. It establish a uniformed device module, defines the I/O resources and access rule.
- J1939: J1939 is a high speed communication network protocol between multiple ECUs that supports close loop control.
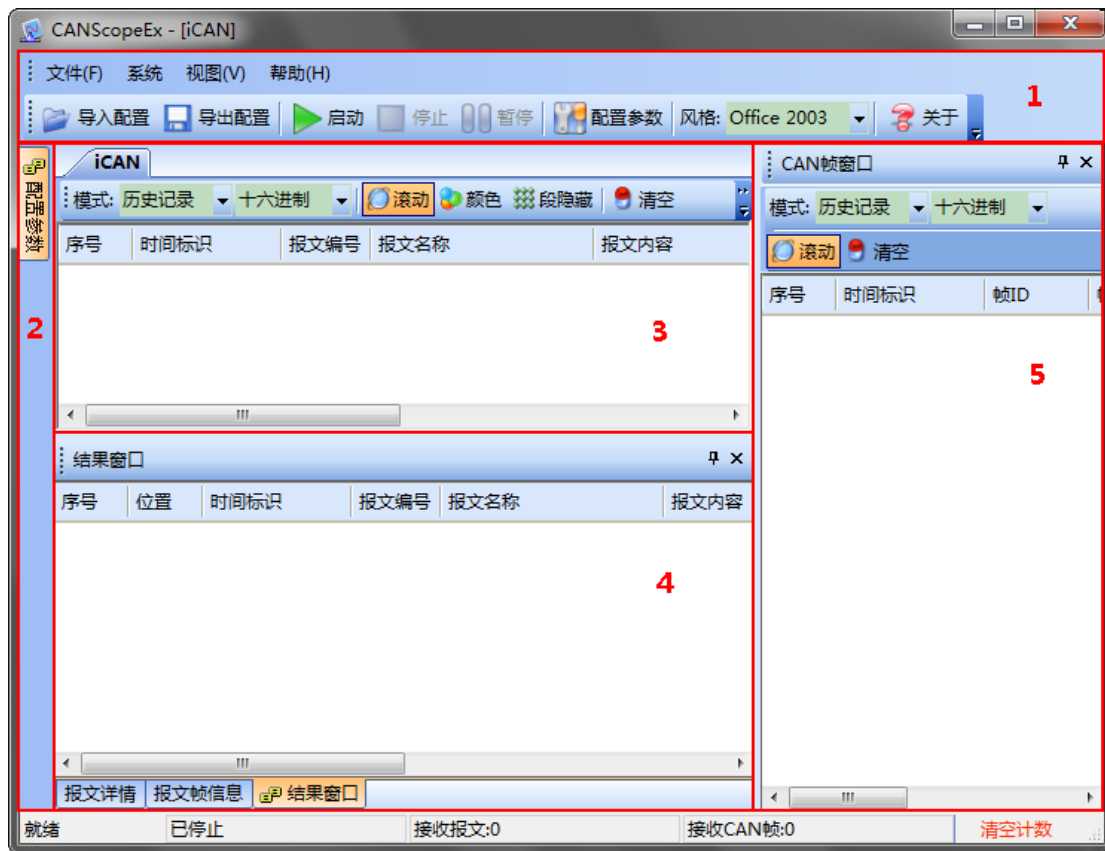
Figure 3-20: Protocol analysis window

Within Figure 3-20, number 1~5 marks areas with different functions:

① Menu and tool bar area: main menu and toolbar for CAN protocol analysis.

② Parameter configuration area: parameter configuration, connection to server.

③ iCAN display area: displays data shared by the server, the name of this display area will change based on the selected protocol, in this figure, the selected protocol is iCAN.

④ Other windows area: including message frame information, result window and message details window

⑤ CAN frame window: display frame information.

3.2.7.2 Operations

Step 1: Run the "protocol analysis" software.

Step 2: Open the "Configure parameters" window. By default this window will be opened when the protocol software is run. User can open it from the menu "View=>Configure parameters", or click the "configure parameter" shortcut on toolbar.

Step 3: After parameter configurations, left click the "Run" button to establish connection with the server, after connection user can observe server data on the iCAN display area.

Step 4: Click the "Find" button on the toolbar can bring up the search dialogue for data searching.

Step 5: Select a message of data within the iCAN display area, the corresponding information about this message will be shown in the "message frame information" window, "message details" window, and "CAN frame" window.

Step 6: User can perform operations to the message data through the shortcut operations provided by the toolbar.

Chapter 4: Parameters

4.1 Instrument

Table 4-1: CANScope instrument parameters

Power supply voltage	+12V
Power consumption	6W (Max)
Current consumption (Max)	500mA@12V
Working Temperatures	0~55ºC
Dimensions (Port connector not included)	18.9cm×4.7cm×17.7cm (W×L×H)
USB Transmission rate	480Mbps

4.2 Hardware eye diagram

Table 4-2: Hardware eye diagram parameters

Data source	CAN-H, CAN-L, CAN-DIFF
Overlapping Rate	500,000UI/s, Depends on signal transmission rate
Vertical Sensitivity (V/div)	0.125, 0.25, 0.5, 1, 2.5, 6.25
Horizontal Range	Depends on base timeline of oscilloscope module
Measuring Mode	18.9cm×4.7cm×17.7cm (W×L×H)
Module	System standard module, user defined module

4.2.1 Oscilloscope

Table 4-3: Oscilloscope parameters

Collect	**Number of Channels**	2
	Real-time Sampling Rate(Max)	100MSa/s (each channel)
	Storage Depth	512Mpts
	Vertical Resolution	8-bit
Vertical System	**Analogue Bandwidth (-3dB)**	DC to 60MHz
	AC Coupling	3.5Hz~60MHz
	Rising Time (0.35/Bandwidth)	~8.75ns
	Input resistance	1MΩ±1%
	Vertical Sensitivity (V/div)	0.125V/div, 0.25 V/div, 0.5 V/div, 1V/div, 2.5V/div, 6.25 V/div
	Input Capacitance	~ 20pF
	Coupling mode	AC, DC
	Static discharge tolerance	±2kV
Horizontal	**Scanning range (s/div)**	1μs/div -1/div (1-2-5 step)
	Working mode	Main mode
Triggering system	**Triggering mode**	Auto, Normal
	Source of triggering	CAN-H, CAN-L, CAN-DIFF, CAN-RXD, CAN-TXD, Frame start, External signal
	Triggering type	Rising edge, falling edge, double edge, positive pulse, and negative pulse.
	Triggering mode	Auto, Normal
	External triggering voltage	-10V~+10V
FFT	**Number of points**	1024 (Standard version), 4096 (Professional version)
	FFT data source	CAN-H、CAN-L、CAN-DIFF
	Data range	All data, window display part
	Horizontal unit selection	Logarithm, virtual value, amplitude
Measuring	**Cursor**	Supports voltage and time measurement

4.3 Port Parameters

Table 4-4: Port parameters

Transceiver (standard component) P8251T, P1040T				
Terminal resistor	Isolation voltage	Transient Voltage	Communication port	Supported Protocol
120Ω	2500V	-200V~200V	M12 Connector, compliant with DeviceNet and CANopen Standard	Supports CAN2.0A/CAN2.0B Protocol, compliant with ISO/DIS 11898 standard

Table 4-5: P8251T and P1040T connector parameters

Parameters	P8251T	P1040T
Data Transmission Rate	5Kbps~1Mbps	20Kbps~1Mbps
CANH, CANL Voltage Limit	-36V~+36 V	-27V~40V
Positive Differential Voltage	1.5V~3.0V	1.5V~3.0V
Negative Differential Voltage	-0.1V~1.0V	-50mV~50mV
Differential Threshold Voltage	-	0.5V~0.9V
Positive CANH Voltage	3.0V~4.5V	3.0V~4.25V
Positive CANL Voltage	0.5V~2.0V	0.5V~1.75V
Negative CANH Voltage	2V~3V	2V~3V
Negative CANL Voltage		
Common Mode Resistance	5k~25kΩ	15k~35kΩ
Differential Input Resistance (120Ω opened)	25k~75kΩ	20k~100kΩ
CANH Short Current	100mA (CANH to -36V)	95mA (CANH to 0V)
CANL Short Current	200mA (CANL to 36V)	100mA (CANL to 40V)

Chapter 5: General Features

- Power supply: 220V, 50Hz.
- Power consumptions: 6W (Max).
- Storage temperature: 0ºC~55ºC.
- Working environment: Full precision 0ºC~55ºC, 80%R.H. no condensing.
- Communication Ports: USB2.0 High Speed.
- Development Language: Microsoft Visual C++.
- Warranty period: 1 Year
- Dimensions: 18.9cm×4.7cm×17.7cm

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