Gowin Analyzer Oscilloscope

User Guide

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Revision History

Date	Version	Description
02/20/2017	1.0E	Initial version published.
09/05/2018	1.3E	The function on exportting the waveform data added.
10/26/2018	1.4E	Supports GW1NS-2, GW1NZ-1, and GW1NSR-2C.
11/23/2018	1.5E	1. GW1NSR-2 supported; 2. GW1N-6ES, GW1N-9ES, and GW1NR-9ES deleted.

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1 About This Guide

1.1 Purpose

The guide describes the operation flow of the Gowin Analyzer Oscilloscope (GAO). The purpose of this document is to familiarize users with the use of the GAO configuration file (.gao) and GAO interface as a means of improving the efficiency of design analysis. The software screenshots and the supported products listed in this guide are based on Windows 1.8.1 Beta. As the software is subject to change without notice, some information may not remain relevant and may need to be adjusted according to the software that is in use.

1.2 Supported Products

The information in the guide applies to the following products:

- GW1N series of FPGA products: GW1N-1, GW1N-2, GW1N-2B, GW1N-4, GW1N-4B, GW1N-6, GW1N-9;
- GW1NR series of FPGA products: GW1NR-4, GW1NR-4B, GW1NR-9;
- GW2A series of FPGA products: GW2A-18 and GW2A-55;
- GW2AR series of FPGA products: GW2AR-18;
- GW1NS series of FPGA products: GW1NS-2, GW1NS-2C;
- GW1NZ series of FPGA products: GW1NZ-1;
- GW1NSR series of FPGA products: GW1NSR-2C, GW1NSR-2.

1.3 Related Documents

The latest user guides are available on the Gowin website. Refer to the related documents at www.gowinsemi.com:

Gowin Software User Guide

1.4 Abbreviations and Terminology

Table 1-1 shows the abbreviations and terminology that is used in this guide.

Table 1-1 Abbreviations and Terminology

Abbreviations and Terminology	Full Name
FPGA	Field Programmable Gate Array
JTAG	Joint Test Action Group
GAO	Gowin Analyzer Oscilloscope
AO	Analysis Oscilloscope
IO	Input/Output

1.5 Support and Feedback

Gowin Semiconductor provides customers with comprehensive technical support. If you have any questions, comments, or suggestions, please feel free to contact us directly using the information provided below.

Website: www.gowinsemi.com

E-mail: support@gowinsemi.com

Tel：+86 755 8262 0391

2 Introduction

GAO is a digital signal analyzer that was independently designed by Gowin. It was created to help users more easily analyze the timing relationships between the signals in a design, quickly conduct system analysis and fault location, and improve design efficiency.

The GAO operates on the following basic principle: When in operation, the FPGA saves the signal in real time to memory according to the trigger conditions set by the user. It reads the signal state and displays it on the GUI through the JTAG interface in real-time. The GAO includes the Gowin Core Inserter and the Gowin Analyzer Oscilloscope. The Gowin Core Inserter is mainly used to insert position information into the design, which is predominantly based on sampling clock, trigger unit, and trigger expression. The Gowin Analyzer Oscilloscope connects the software and target hardware through the JTAG interface and visually displays the data related to the sample signal set by the Gowin Core Inserter through the waveform.

The GAO incorporates the following features:

- Ability to control one or more AO at the same time.
- Each AO supports one or more port triggering.
- Each AO supports one or more trigger levels.
- Each trigger port supports one or more matching units.
- Each matching unit supports six types of trigger matching.
- AO uses window collection mode, which supports the collection of one or more windows.
- Ability to use data ports to save device resources.

3 GAO Config File

The AO of GAO consists of two parts: AO_Control and AO. The AO_Control is the communication controller of all AO and JTAG scanning circuits. It is mainly used for configuring trigger signals and collecting and storing data. The AO_Control connects the upper computer and the AO. It receives instruction and sends it to the AO during configuration. It also transmits the data collected by the AO to GUI as the data is being read. The AO directly communicates with, and receives commands from, the AO_Control, and collects and transfers data according to the instructions provided by the user.

GAO Config View is mainly used to configure and change the AO_Control and its parameters. It helps users quickly and easily analyze data signals after design file synthesis, placement, and routing. It also improves timing analysis efficiency.

3.1 Standard Mode GAO Configuration File

3.1.1 Start Standard Mode GAO Configuration File Interface

Before starting the Standard Mode GAO Config View, you first need to create or load the configuration file (.gao).

Create Standard Mode GAO Configuration File

Please refer to the following steps to create a standard Mode GAO configuration file:

1. In "Design", right-click and select "New File...".
   The "New" dialog box will open, as shown in Figure 3-1.
2. Select the "GAO Config File" and click "OK".
   The "New GAO Wizard" dialog box will open, as shown in Figure 3-2. Select “Standard Mode”, and click “Next”.
3. Enter the config file name in "New", as shown in Figure 3-3, and then click "Next".
4. Check the GAO config. file mode and path, as shown in Figure 3-4. Click “Finish” to complete the configure file creation. Please refer to "GAO

Config Files" in Design View for further details about the GAO configuration file.

Figure 3-1 Create Standard Mode GAO Configuration File

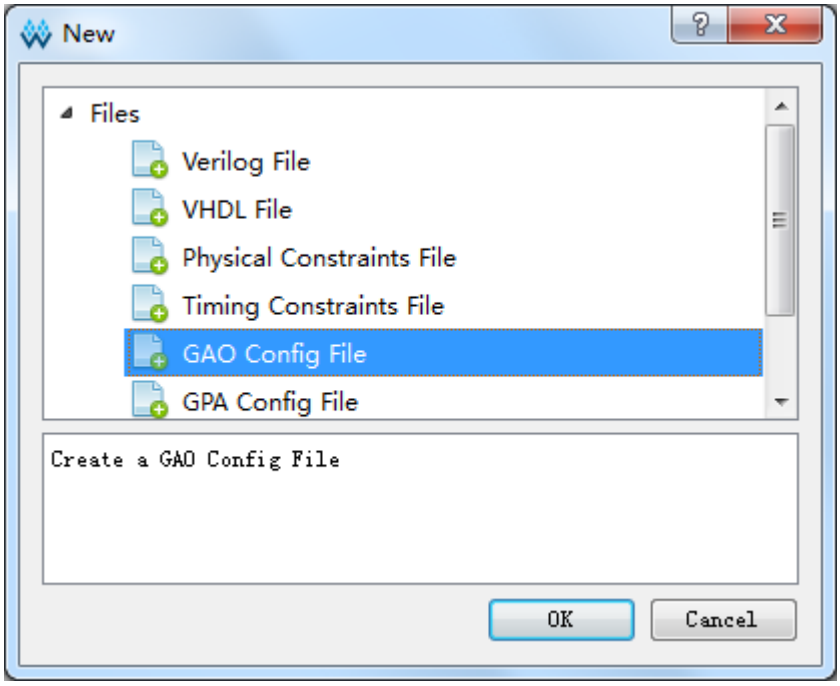


Figure 3-2 New GAO Wizard (Standard Mode)

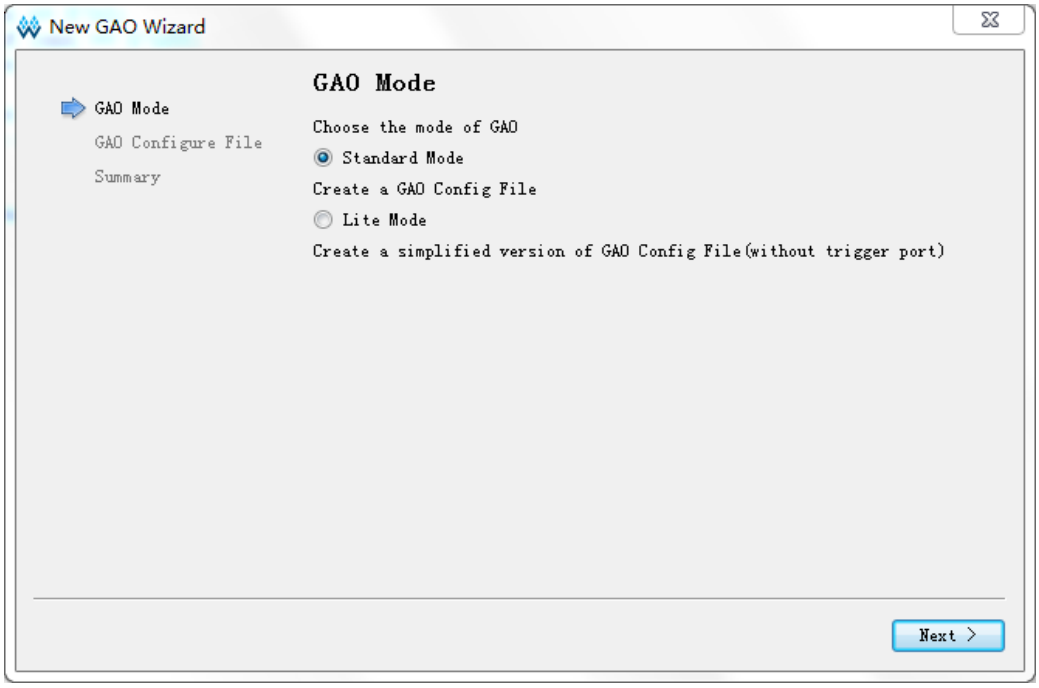


Figure 3-3 Standard Mode GAO Configuration File Name

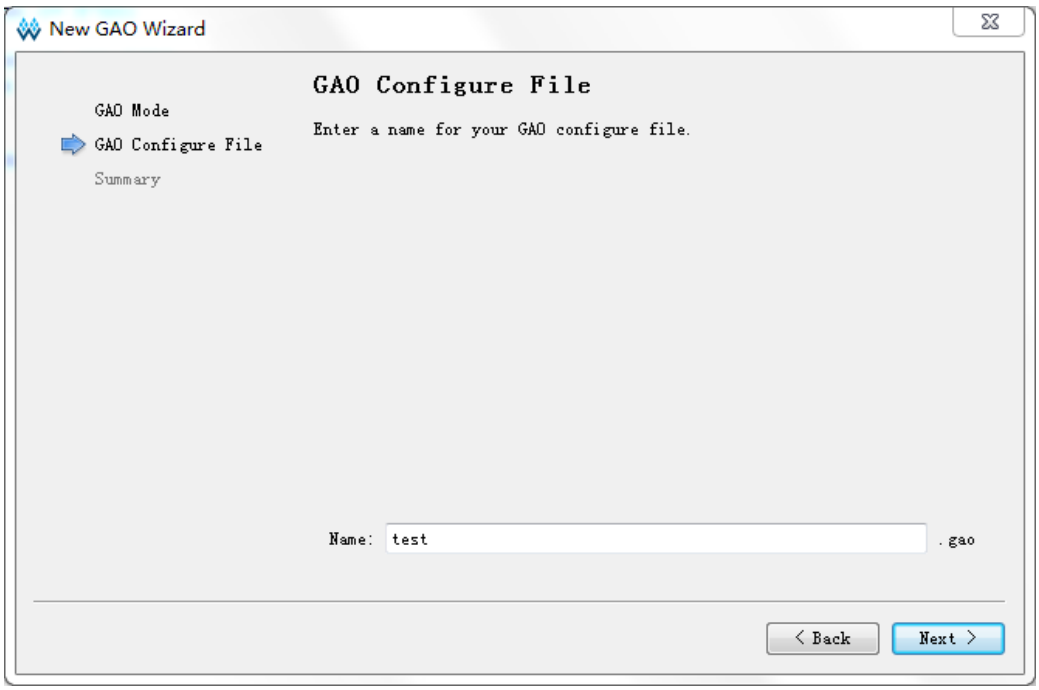
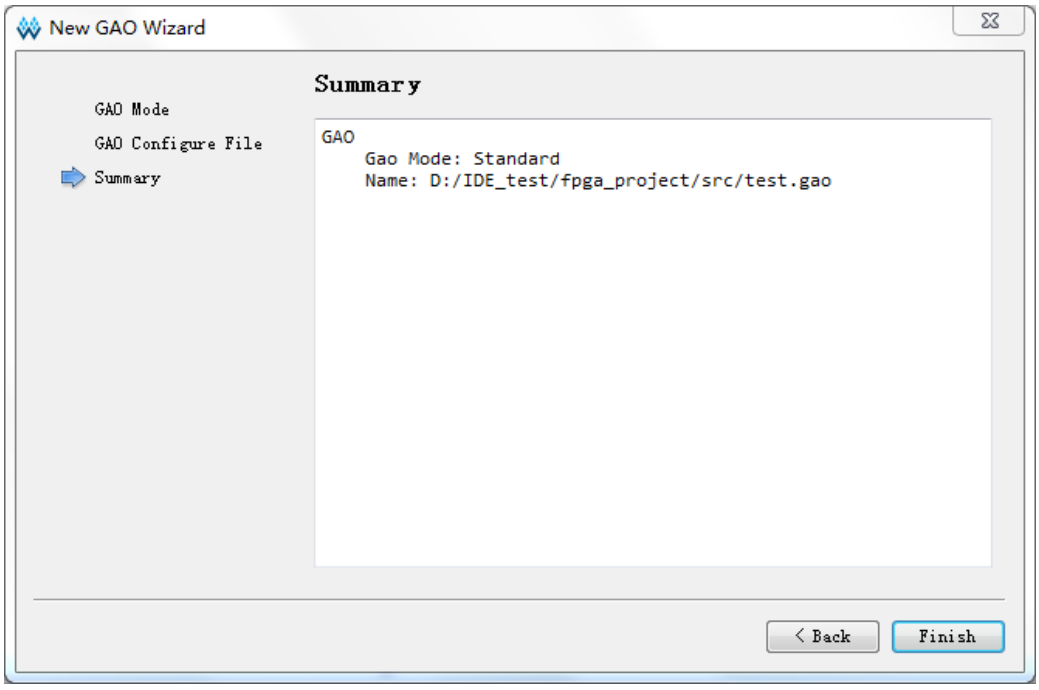


Figure 3-4 GAO Configuration File Mode and Path (Standard Mode)



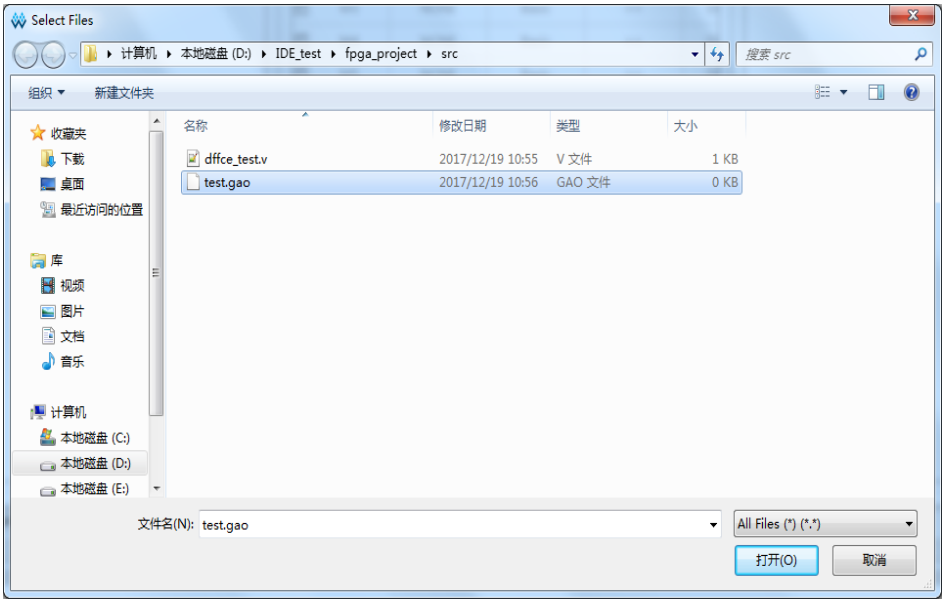
Add a Standard Mode GAO Configuration File

Please refer to the following steps to create a standard mode GAO configuration file:

1. In the "Design" View, right-click and select "Add Files...".
   The "Select Files" dialog box will open.
2. Select the existing standard mode configuration file (.gao), as shown in Figure.

3. Click "Open". See the added GAO configuration file in "Design > GPA Config Files".

Figure 3-5 Add Standard Mode GAO Configuration File

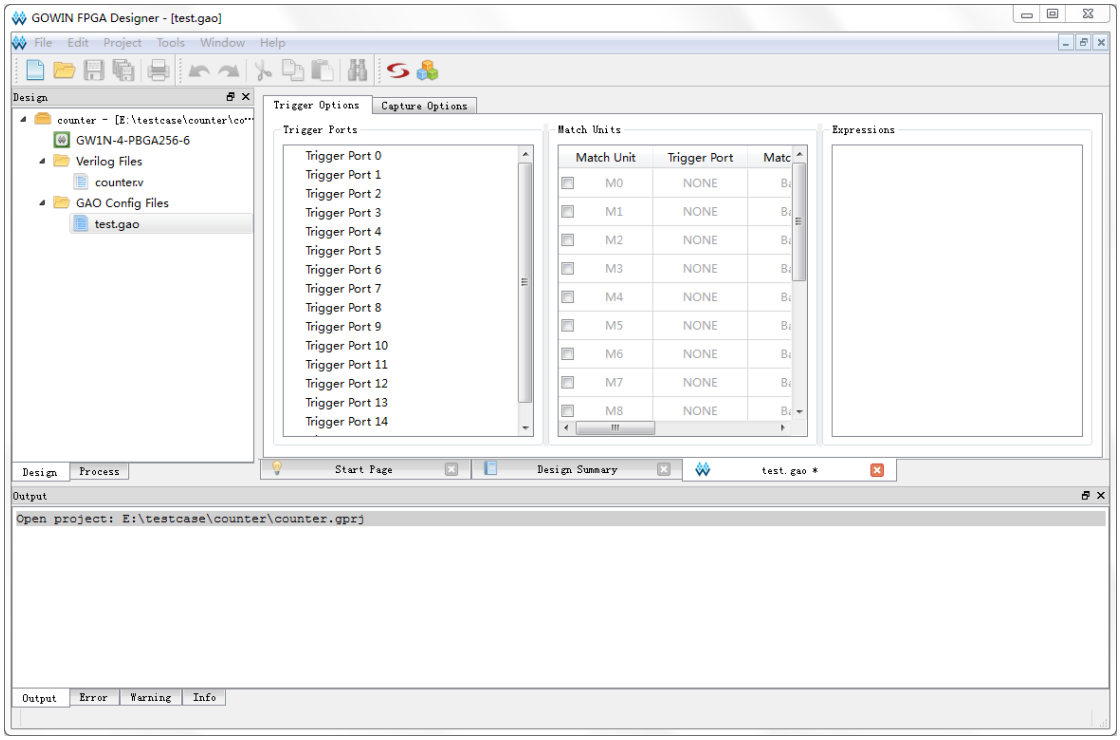


Start Standard Mode GAO Configuration File Interface

Double-click on the configuration file (.gao) in the "Design" view. The "GAO Config View" will open in the Gowin YunYuan main window. Start the Gowin Core Inserter, as shown in Figure 3-6.

The "GAO Config View" includes trigger options for configuring trigger conditions and capture options for configuring signal sampling criteria.

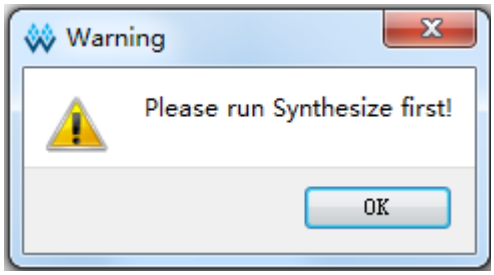
Figure 3-6 Gowin Core Inserter (Standard Mode)



Note!

- If post-synthesis, eligible design files are required to start the Gowin Core Inserter;
- If RTL, start the Gowin Core Inserter only after synthesis and completing the Compile Netlist;
- If Compile Netlist failed, when the user double-clicks on the configuration file (.gao), the "Warning" prompt box will open, as shown in Figure 3-7.

Figure 3-7 Compile Netlist Warning (Standard Mode)



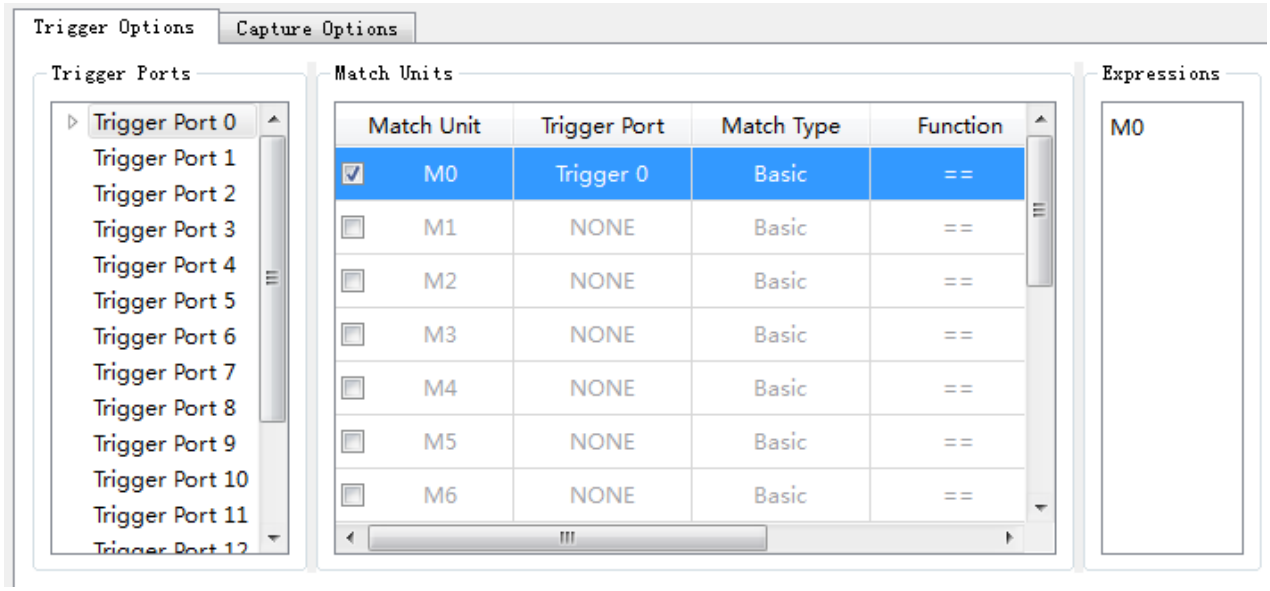
3.2 Configure Standard Mode GAO

The "GAO Config View" is used to configure signal triggering conditions and signal sampling conditions.

Trigger Condition Configuration

Trigger options are used to configure signal trigger conditions, as shown in Figure 3-8. The Trigger Ports view is used to configure the AO trigger ports. The Match Units view is used to configure the trigger match units, and expressions view is used to configure trigger expressions.

Figure 3-8 Trigger Options View



Trigger Ports Configuration

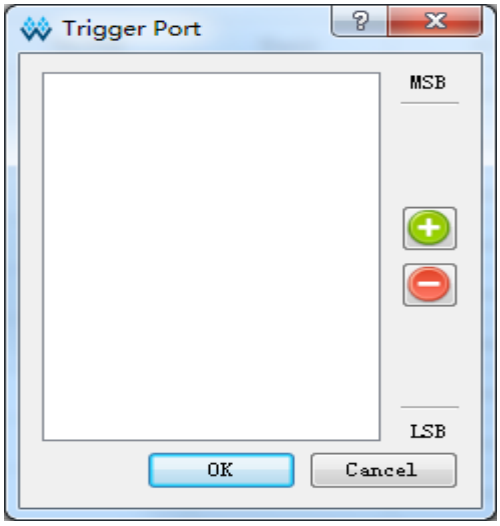
The Trigger Ports view is used to configure the AO Trigger ports by following the steps outlined below:

1. Double-click trigger port. The dialog box will open, as shown in Figure 3-9.
2. Click on the “ ” icon. The "Search Nets" dialog box will open. Click "Search", as shown in Figure 3-10.
3. Select trigger signal and click "OK" to finish selecting the trigger signal.

Note!

There are 16 Trigger Ports (Trigger Port 0 ~ Trigger Port 15), and each trigger port width range is between 1 and 64.

Figure 3-9 Trigger View

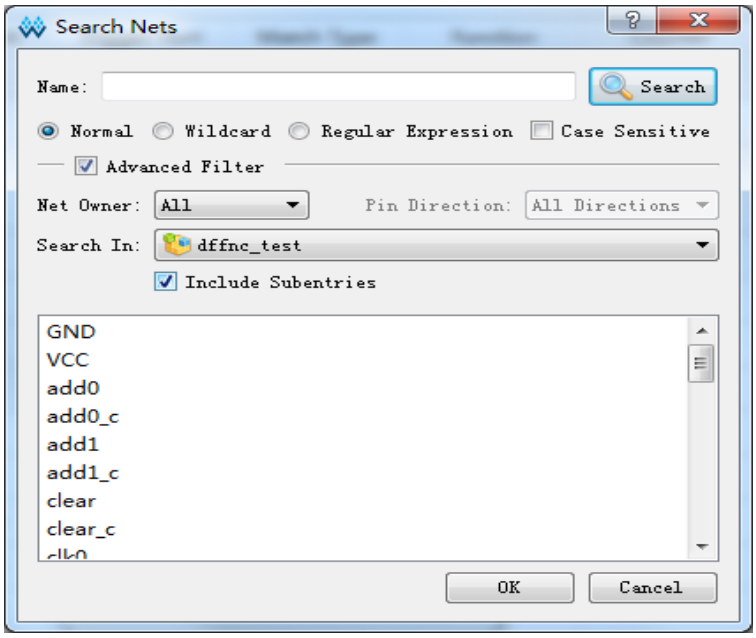


Note!

- MSB and LSB in Figure 3-9 indicate the high and low significant bit of trigger ports;

- To delete the trigger signal, left click to select the trigger signal, or use Shift + left and Ctrl + left to select multiple trigger signals, and then click the " " icon to delete.

Figure 3-10 Search Nets Dialog Box



Normal, Wildcard, and Regular Expression are mutually exclusive. Normal denotes searching in the standard way. In this mode, click on the Search button to match all the nets containing the string types in the name text box, as shown in Figure 3-11. Wildcard means searching with a Wildcard. In this mode, click Search to match all the nets containing the string typed in the name text box. The string contains wildcards (*,?), as shown in Figure 3-12. Regular expression demotes searching with a regular expression. In this mode, click on the Search button to match all the nets containing the string typed in the name text box. The string contains Regular Expression. If "Case Sensitive" is checked, the case-sensitive rule will be applied during signal matching.

The signal area in the search nets dialog box supports single select with left-click, or multiple select using Shift + left and Ctrl + left.

Figure 3-11 Normal Mode

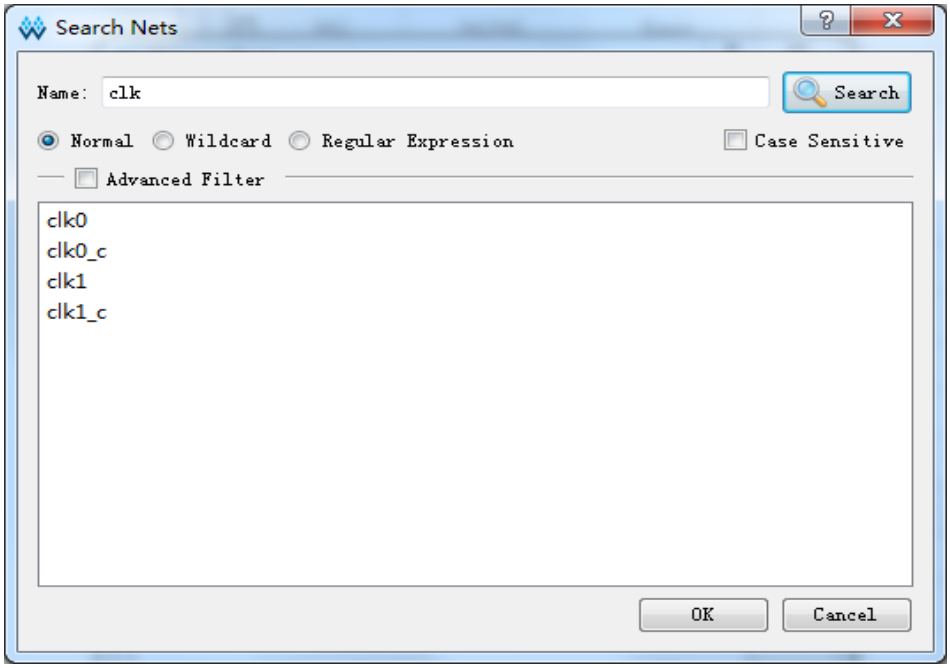
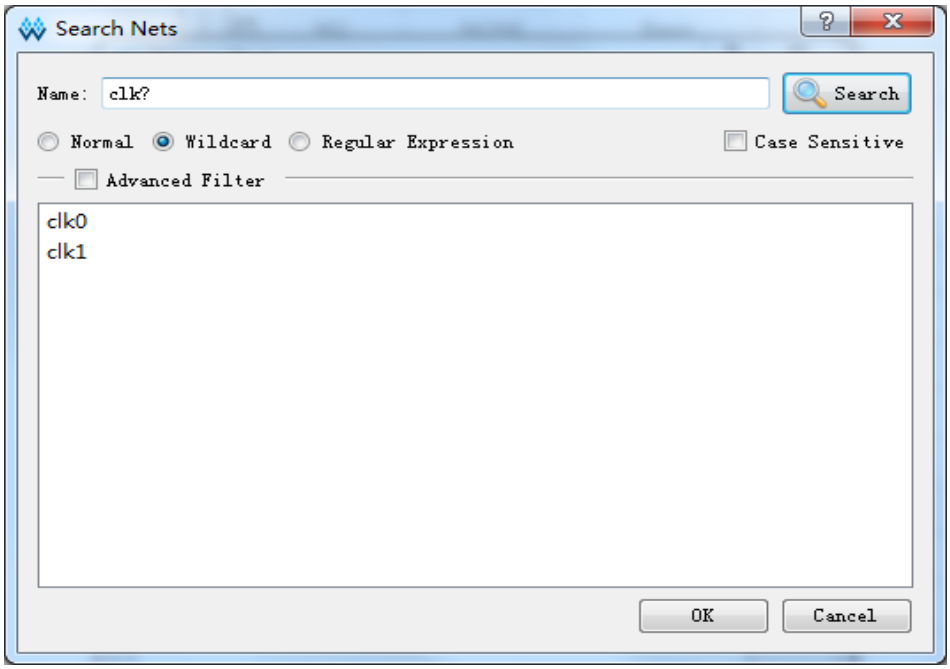


Figure 3-12 Wildcard Mode

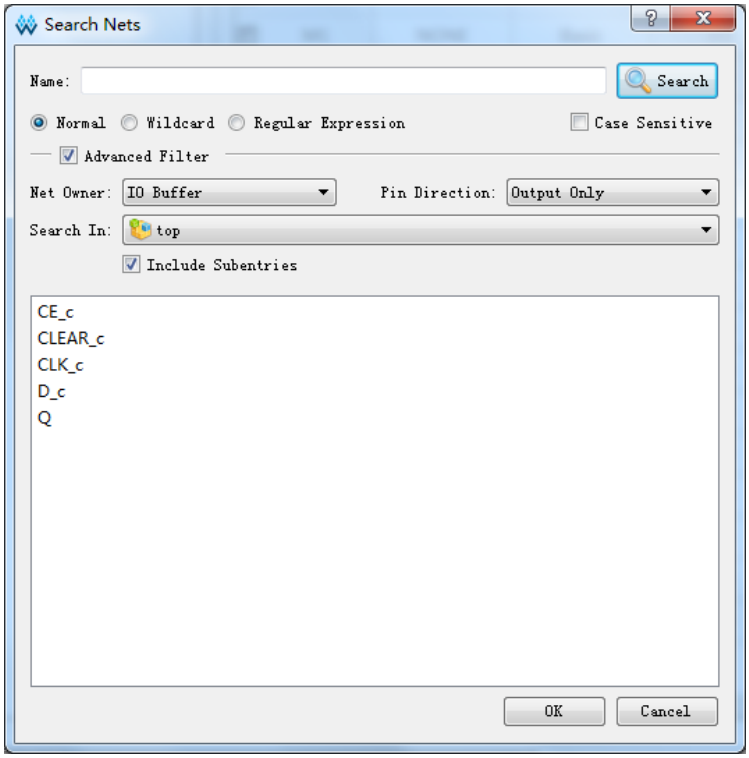


Select the “Advanced Filter” checkbox to further define filter conditions as a means of more specifically searching the required signals. “Net Owner” is used to set the type of signal module by selecting a module or “All”; “Pin direction” is used to set the signal output only, input only or all directions; “Search In” is used to specify in which module to filter the signal. The “Include Subentries” checkbox is used to set whether to filter the signal from the submodule.

As shown in Figure 3-13, the net owner selects io_buffer, pin directions selects output only, search in selects top, and selects include subentries.

Click on the “Search” button to display all output signals associated with the top modules and their sub-modules.

Figure 3-13 Advanced Filtering



Match Unit Configuration

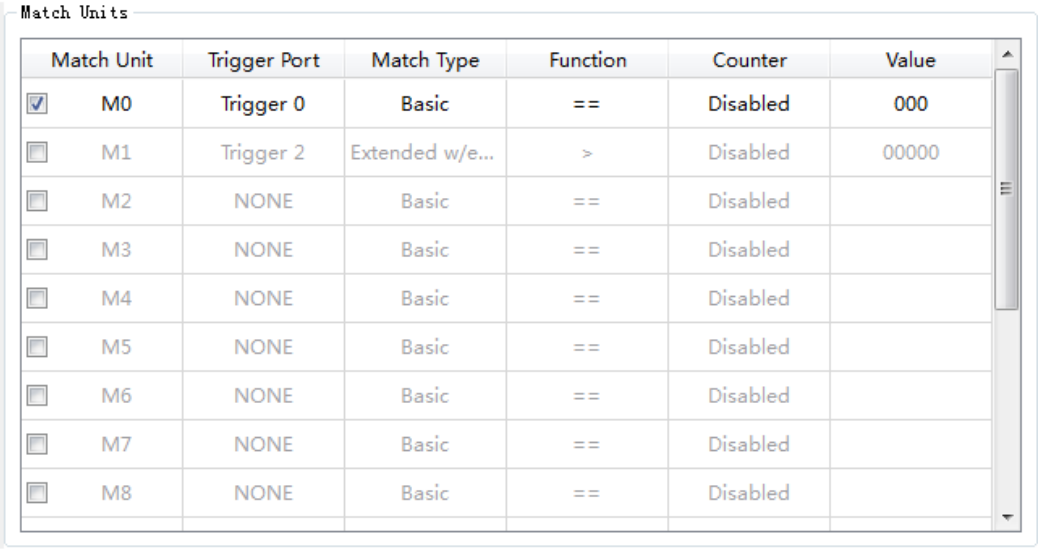
The match units view is used to configure the matching unit of trigger ports. There are up to 16 trigger match units, which range from M0-M15. Match unit is the minimum unit required for the GAO to achieve trigger conditions. AO sets the trigger port signals designed by the user through the matching unit and realizes the trigger if the trigger signal port signals meet the requirements.

Note!

- A trigger port can use one or more trigger match units, but a trigger match unit can only belong to one trigger port.
- All trigger ports can only use up to16 trigger match units.

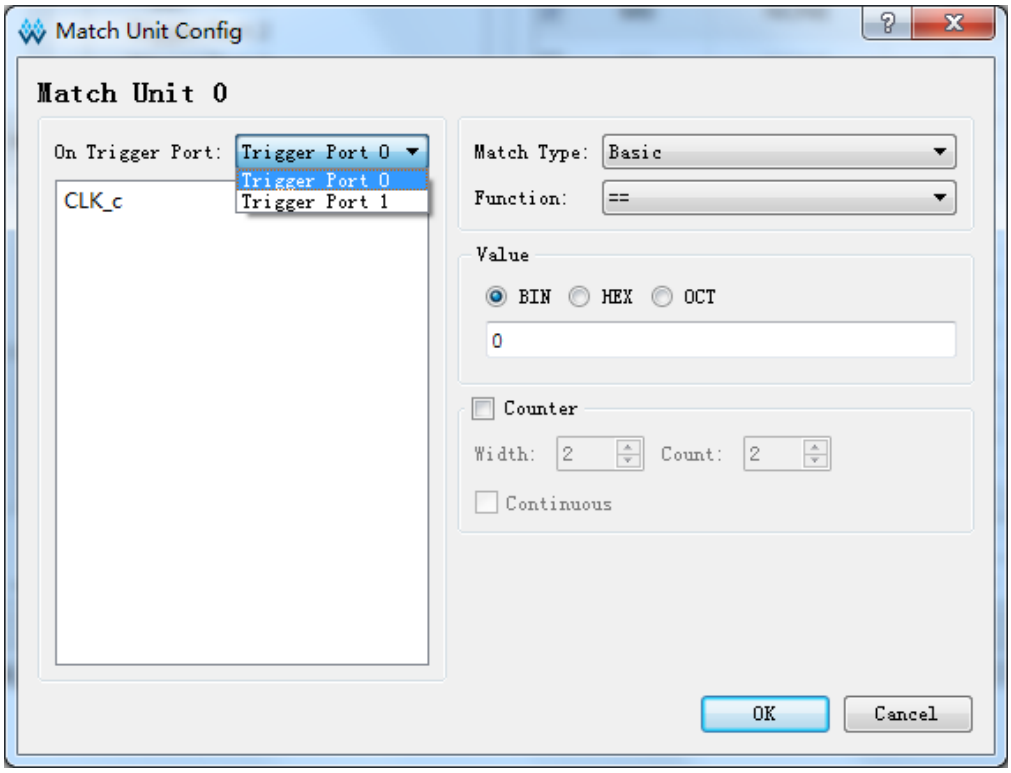
In the Match Units view, check the "Match Units" checkbox to select the trigger matching unit, as shown in Figure 3-14.

Figure 3-14 Match Units View



Double-click one match unit to open the "Match Unit Config" dialog box and configure the trigger conditions, as shown in Figure 3-15.

Figure 3-15 Match Unit Config Dialog Box



Click the "On Trigger Port" drop-down list and select the trigger port.

Select the match type and function from the “Match Type” and “Function” drop-down lists respectively. The available options are as follows:

- Basic: Execute "= =" and "! = " operation, which are used for

general signal comparison and are a form of economical resource.

- Basic w/edges: Execute "= =" and "! = " and the jump test operation for control signal jumping.
- Extended: Execute operation “==”、“!=”、“>”、“≥”、“<”、and “≤” for the value of address or data signal.
- Extended w/edges: Execute the“==”、“!=”、“>”、“≥”、“<”、“≤” operations for the value of address or data signal or signal jumping.
- Range: Execute “==”、“!=”、“>”、“≥”、“<”、“≤”, to detect outside and inside of the range of the value-specific range of addresses or data signals.
- Range: Execute “==”、“!=”、“>”、“≥”、“<”、“≤”, to detect outside and inside of the range, and signal jumping for the value specific range of addresses or data signals and signal jumping.

Value is used to set the bit value that correlates with the match type, as shown in Table 3-1. The bit value currently supports binary, hexadecimal, and octal forms.

Table 3-1 Match Type Supported by Trigger Match Unit

Type	Bit Values	Matching Function	Description
Basic	0, 1, X	==,!=	Use for general signal comparison. Is a form of economical resource.
Basic w/edges	0, 1, X, R, F, B, N	= =,! =, jump detection	Use for control signal jumping.
Extended	0, 1, X	==,!=,>,≥,<, ≤	Use for the value of address or data signal.
Extended w/edges	0, 1, X, R, F, B, N	==,!=,>,≥,<, ≤, jumping detection	Use for the value of address or data signal and jumping signal.
Range	0, 1, X	==,!=,>,≥,<, ≤, detection inside or outside of range	Use for the value of address or data signal in particular range.
Range w/edges	0, 1, X, R, F, B, N	==,!=,>,≥,<, ≤, detection inside or outside of range, jumping detection	Use for the value of address or data signal in particular range and jumping detection.

Note!

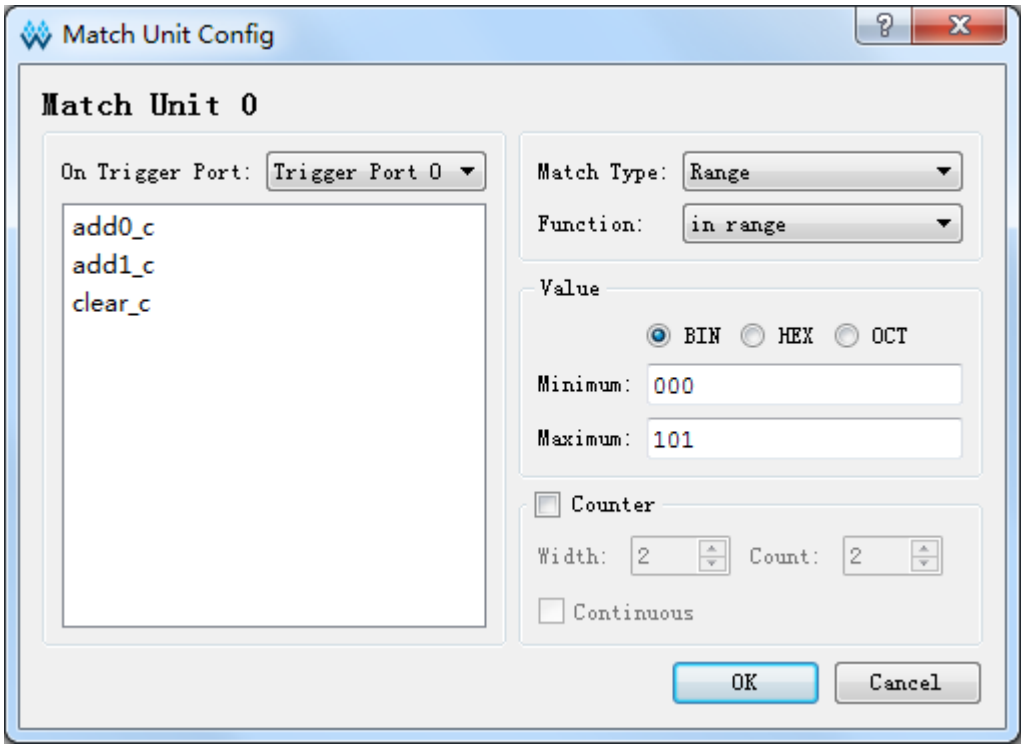
In bit values:

- "0" means low level 0;
- "1" means high level 1;
- "X" means both;
- "R" indicates the change in rising edge 0->1;
- "F" indicates the change in falling edge 1->0;
- "B" indicates transition in upward or downward edge;
- "N" means no logical level conversion.

If the match type is range or range w/edges, and function is in range or not

in range, the value specified in the “Minimum” field is the lower limit value, and the value in the “Maximum” field is the upper limit value, as shown in Figure 3-16.

Figure 3-16 Minimum/Maximum Setting for Detection in/not in Range



Each trigger matching unit has a counter for sampling data after the trigger conditions are met N times, where N is the counter value.

- Check "Counter" to set and use the counter. If the counter is unused, collect data after matching 1 time by default;
- Check "Counter", enter the value directly in “Width”, and modify or add/remove data in the box by clicking the up and down buttons on the right or using the scrolling wheel in the middle of the mouse;
- The effective range of the counter width is [1, 16], which determines the maximum value that the counter allows;
- If the counter width is set to 3, the maximum value is 2^3;
- Input n in "Count". This triggers after matching n times. If the “Continuous” checkbox is checked, enter value n in the “Count” field. This triggers after matching n times.

Note!

- When the configuration file (.gao) is saved, if the number of the signal trigger unit changes but the match unit is not modified accordingly, the error prompt box will open, as shown in Figure 3-17;
- If the error prompt is displayed, click the “Hide Details” to display the error description;
- If the trigger port belonging to the match unit is not configured, the error prompt box will open when the gao configuration is saved, as shown in Figure 3-18.

- When the Function of the matching unit is specified as being out of range or within range, if the minimum is greater than the maximum, the “Value Invalid” dialog box will appear, as shown in Figure 3-19.

Figure 3-17 Prompt Box "Match Unit And Trigger Port Mismatch"

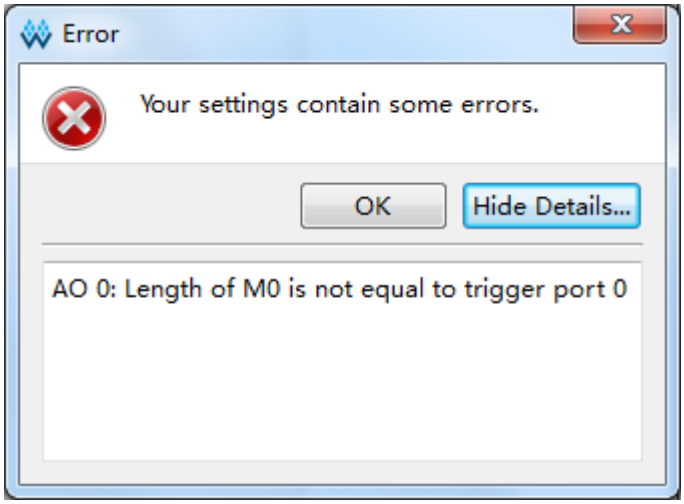


Figure 3-18 Prompt Box "Trigger Port Does Not Select Match Unit"

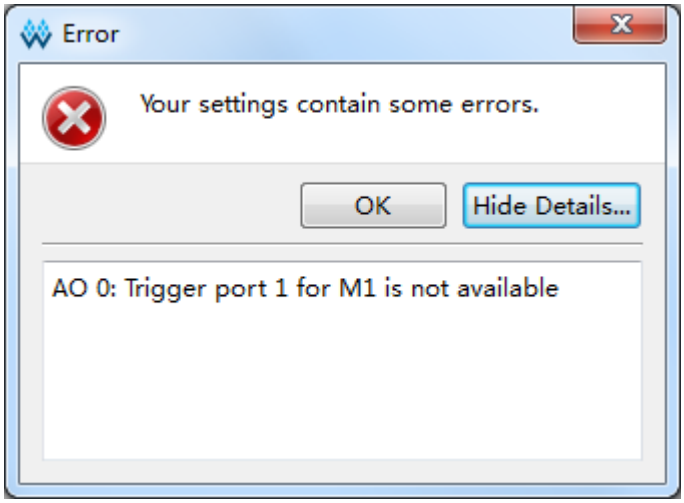
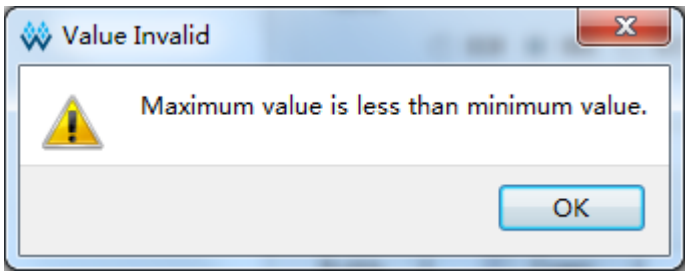


Figure 3-19 Value Invalid Prompt Box



Trigger Expression Configuration

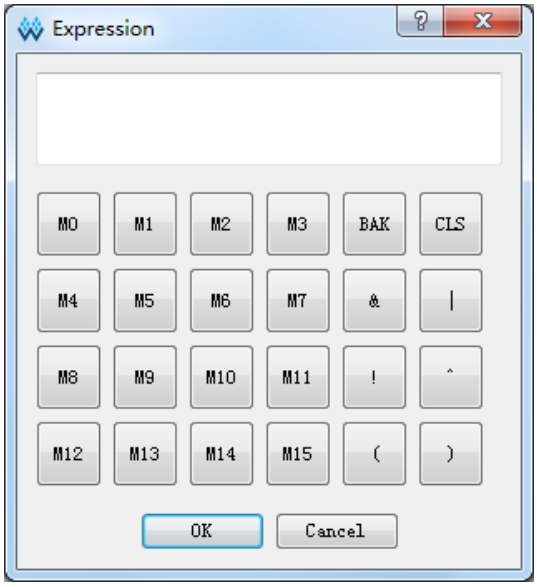
Expressions are used to set the trigger expressions. An AO has 16 trigger expressions at most.

In the “Expressions view” window, the trigger expression is sorted by expression and ranges from M0-M15.

The related operations are as follows:

- Double-click at any position of “Expressions” or right-click on “Expressions”, select "Add". The Expression dialog box will open, as shown in Figure 3-20. You can configure the trigger expressions in the dialog box;
- Select the expression you wish to delete, right-click and select "Remove" to remove the trigger expression.

Figure 3-20 Expression View



Expression 0 to Expression 15 correspond to Trigger Level 0 to Trigger Level 15. When setting the AO trigger conditions, the minimum Trigger Level is Level 1 (Level 0), and the maximum is 16 (Level 0 to Level15). The Trigger Level series corresponds to the number of trigger expressions. If the Trigger Level is Level N and the Level 1 Trigger condition is met, the Level 2 Trigger condition will be estimated, and so on, until the Level N Trigger condition is met, the final trigger signal is generated, and AO begins to sample data.

Trigger expressions can logically combine one or more trigger match units, which follow these rules:

1. Support with (&), or (|) and non-(!) Logical operators, and operators "()";
2. Trigger expression can only logically combine the selected trigger match units;
3. The same trigger match unit can be used one or more times in a trigger expression;
4. The logic combination that triggers match unit between different trigger expressions is not affected, and the same trigger match unit and operator can be used;

5. Different expressions can invoke the same trigger match unit, or the same number or a different number of trigger match units.

For example, if the user sets eight match units, for each level of trigger expressions, any number of the matching units from these eight can be logically combined, and the form of each match unit is M (0 ~ 7). For example:

M0&M1

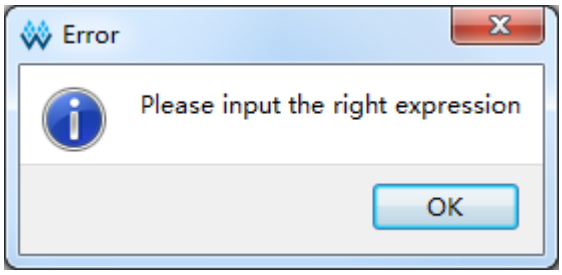
!M4&(M3|M6)

……

Configure an expression by double-clicking the text box in the expression dialog. Click "OK" after completing the configuration.

If the wrong syntax format exists in the expression, the following message will be displayed when the user clicks “OK” to save: "Please input the right expression" (See Figure 3-21).

Figure 3-21 Wrong Expression



Note!

- When the configuration file (.gao) is saved, the window depicted in Figure 3-22 will pop up to prompt the user the match the unit error if the unselected match units are used in expressions.
- An AO can add up to 16 expressions. If more than 16 expressions are added, an error dialog box will open, as shown in Figure 3-23.

Figure 3-22 Error

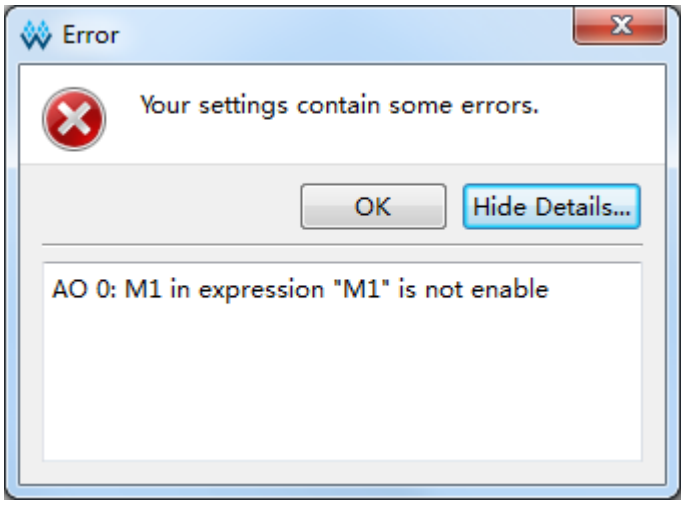
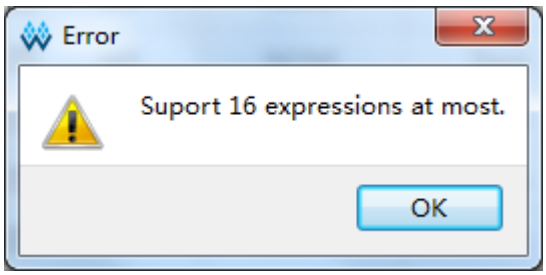


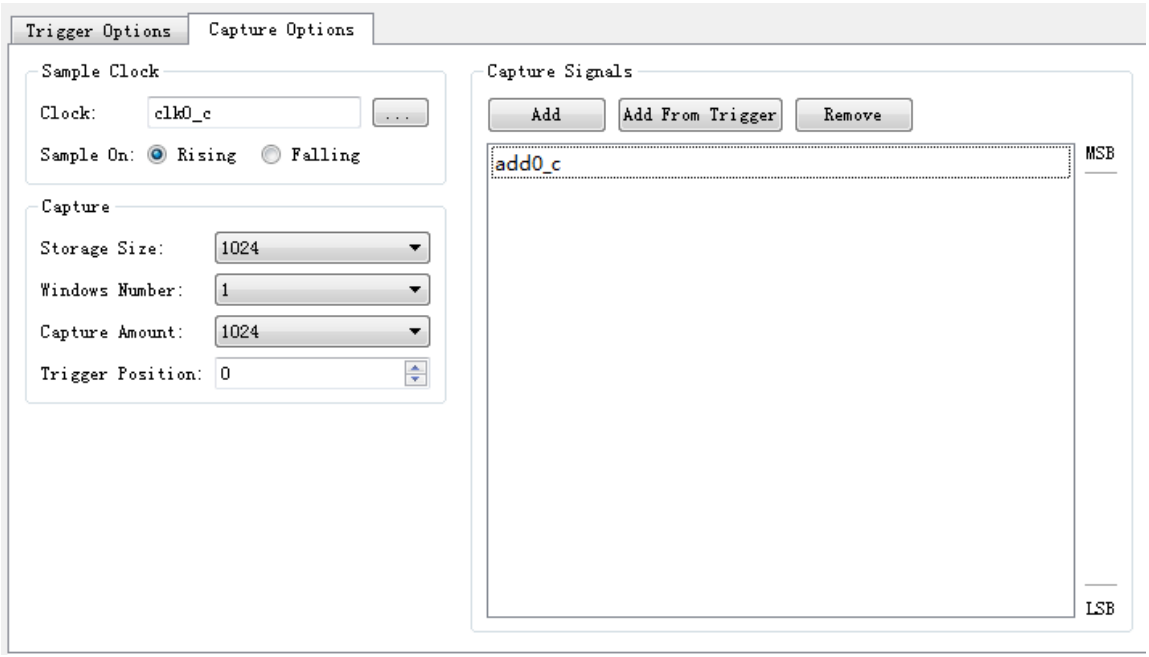
Figure 3-23 Upper Limit Error



Capture Options

As shown in Figure 3-24, the “Capture Options” tab includes the “Sample Clock”, “Storage Size”, and “Capture Signals” settings, etc.

Figure 3-24 Capture Options

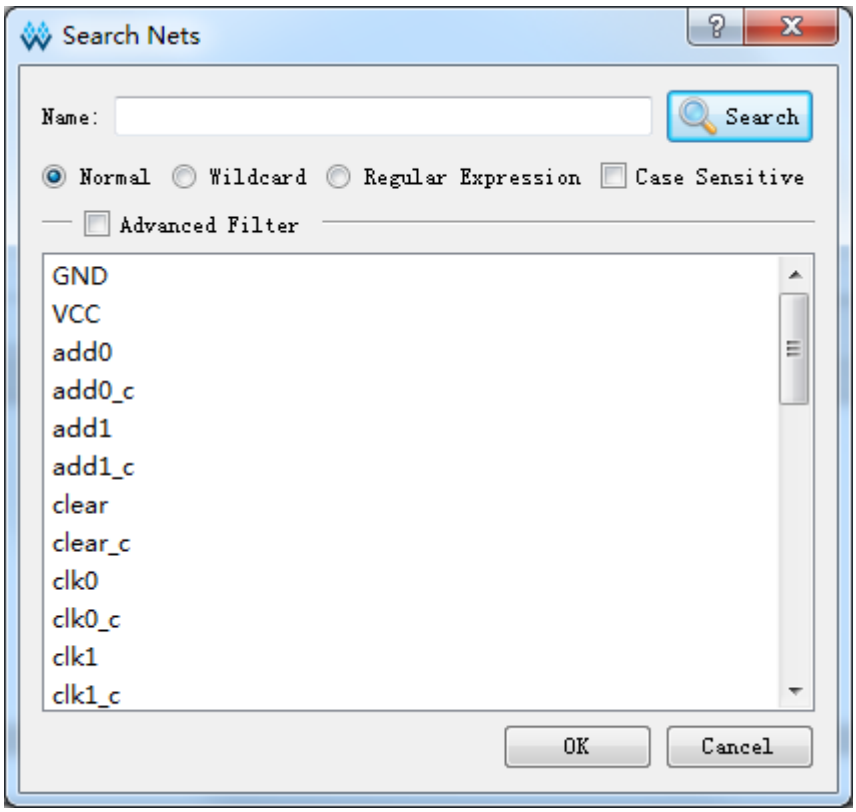


Users can use the sample clock area to select the clock signal. The other signals can also be refined. The sample clock supports sampling on rising edge and falling edge.

Users can employ the following two methods to add sample clock signals:

1. Enter the sample clock name in the “Clock” field;
2. Click on the “ ... ” icon that appears next to the “Clock” textbox. The “Select Nets” dialog box will open. Select the required sample clock signal, as shown in Figure 3-25. Click “OK” to add the signal to the “Clock” textbox.

Figure 3-25 Select Nets Dialog Box



Note!

- The sample clock frequency should be double or above the frequency of the configured expression and the sample data signal. It is recommended that the configured expression and sample data signal belong to the same clock domain;
- If the configured sample clock does not exist when the configuration file (.gao) is saved, the error prompt box will appear, as shown in Figure 3-26;
- If there is no sample clock, the error dialog box, "No sample clock specified", will appear, as shown in Figure 3-27.

Figure 3-26 Error - Sample Clock Inexistence

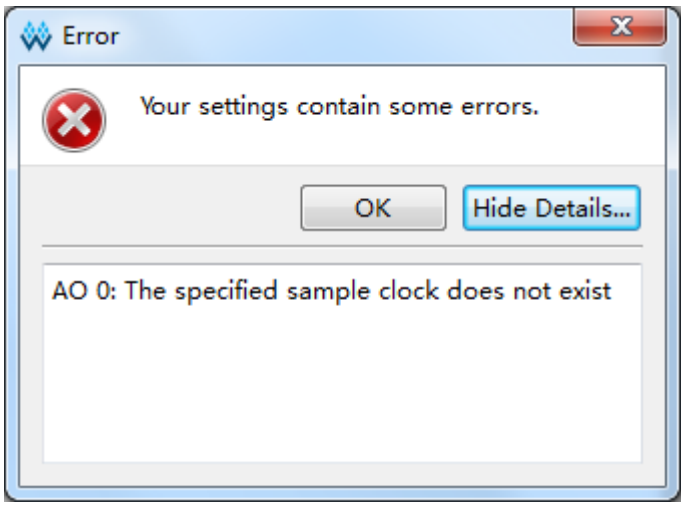
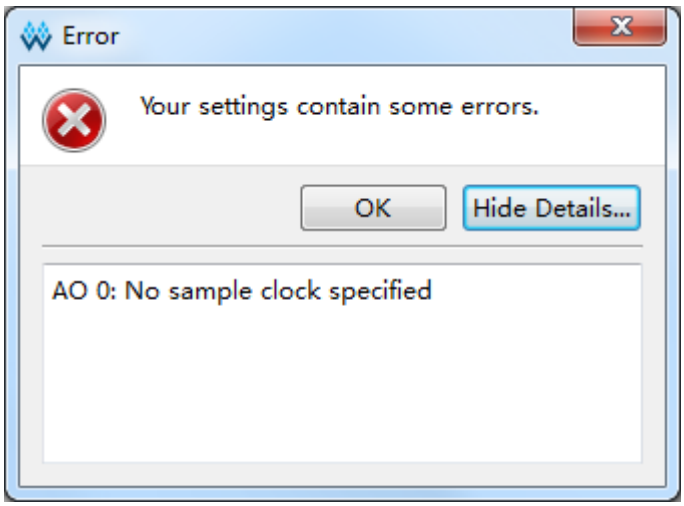


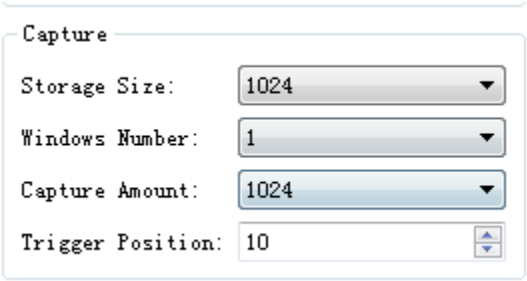
Figure 3-27 Error - No Sample Clock Specified



Configure Storage Info.

As shown in Figure 3-28, storage info includes storage size, windows number, capture amount, and trigger position.

Figure 3-28 Capture Configuration



1. “Storage Size” is the maximum storage size permitted for data sampling.

   Click on the “Storage Size” drop-down list box and select the required size from the list: 256, 512, 1024, 2048, 4096, 8192, 16384, 32768, or 65536.

2. “Windows Number” is the number of capture windows; i.e., the number of page numbers in the capture buffer.

   AO uses the window collection mode, and the capture buffer is divided into one or more pages that have the same or multiple capacities. Each AO supports 8 windows at most and 1 window at least. Select the number of “Windows Number” from the drop-down list.

3. “Capture Amount” is the capture length; i.e., the address length of the actual memory being used on each capture buffer page.

   Each capture window has the same capture amount, and the total capture size cannot be more than the configured storage size. Select the capture amount from the “Capture Amount” drop-down list.

4. “Trigger Position” is the sampling data in memory when triggering.

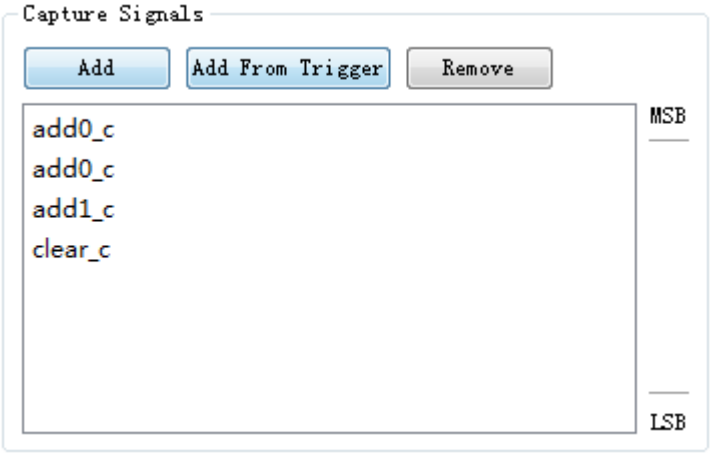
   Enter or select the required value in the “Trigger Position” text box. The

storage address starts from 0.

Configure Capture Signals

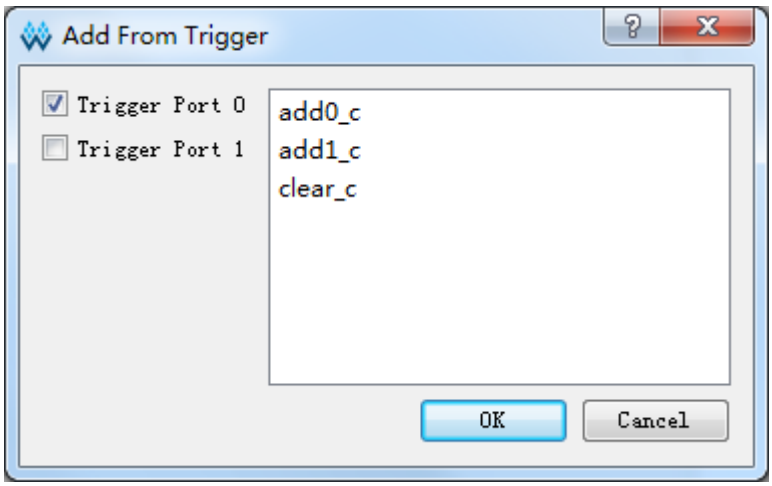
Figure 3-29 shows the configuration options that can be used to configure the capture signals. The data port signal refers to the input signal of the data port incorporated in the user design.

Figure 3-29 Capture Signals Configuration



- The “Add” button is used to select the capture signals that an AO requires to capture memory data;
  a). Click on the "Add" button and the “Select Nets” dialog box will appear;
  b). Select the required data port signal, and click "OK" to finish configuring.
- “Add From Trigger”allows users to sample trigger signals as capture signals by using trigger ports directly;
  a). Select one or more trigger ports from the port list in the “Add From Trigger”view;
  b). Use the selected trigger port signals as capture signals, as shown in Figure 3-30.

Figure 3-30 Select "Add From Trigger"

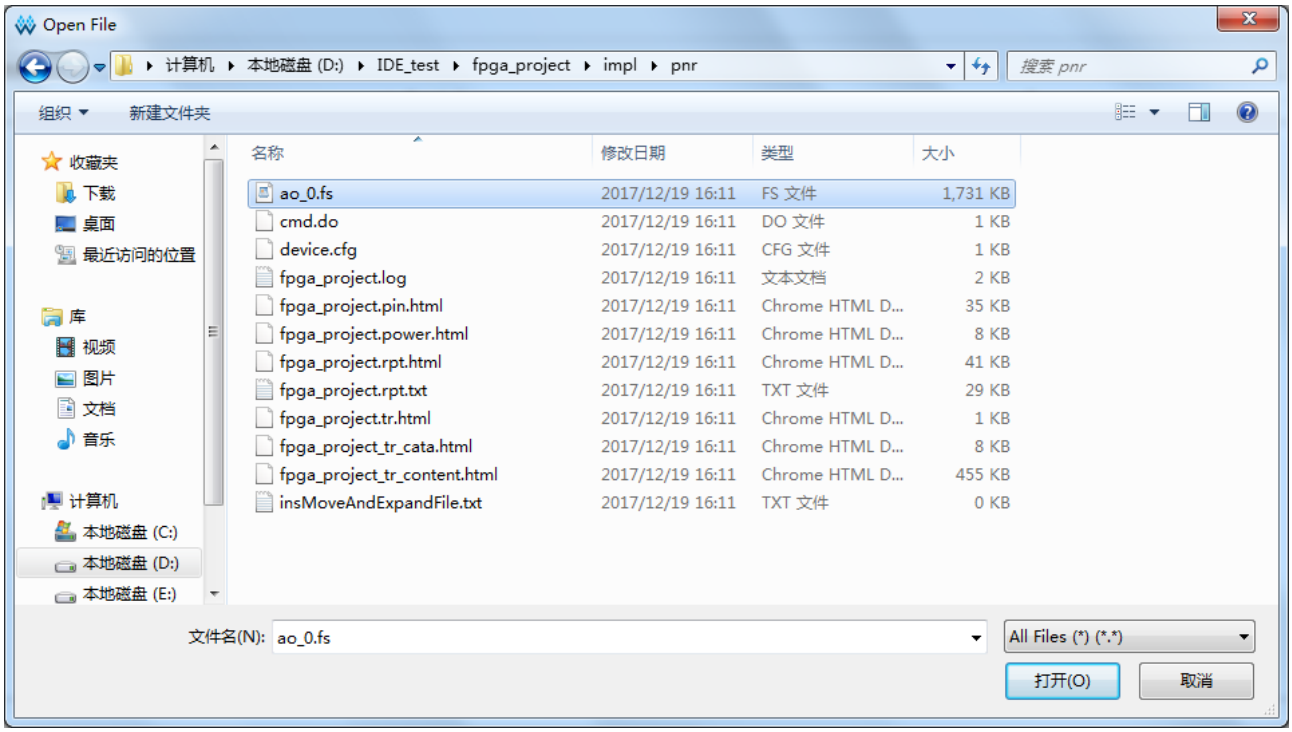


- "Remove" is used to delete the selected signals.

3.3 Generate Bitstream File

After configuring the GAO files, double-click on the "Place & Route" tab in the Process View. Generate one or more bitstream files containing user designs and GAO configuration. The files are named after AO name by default, such as "ao_0.fs", and they are put in the project path "/impl/gao/" by default, as shown in Figure 3-31.

Figure 3-31 Bitstream File (Standard Mode)



3.4 Lite Mode GAO Configuration File

3.4.1 Start Lite Mode GAO Configuration File Interface

Before starting the Lite Mode GAO Config View, you first need to create or load the configuration file (.gao).

Create Lite Mode GAO Configuration File

Follow the steps outlined below to create the standard Mode GAO configuration file:

1. In the "Design" view, right-click and select "New File..."
   The "New" dialog box will open, as shown in Figure 3-32.
2. Select the "GAO Config File" and click "OK".
   The "New GAO Wizard" dialog box will open, as shown in Figure 3-33; select “Lite Mode”, and then click “Next”.
3. Enter the config file name in "New", as shown in Figure 3-34, and then click "Next".
4. Check the GAO config. file mode and path, as shown in Figure 3-35. Click “Finish” to complete the configure file creation. Please refer to "GAO Config Files" in Design View for the GAO configuration file.

Figure 3-32 Create Lite Mode GAO Configuration File

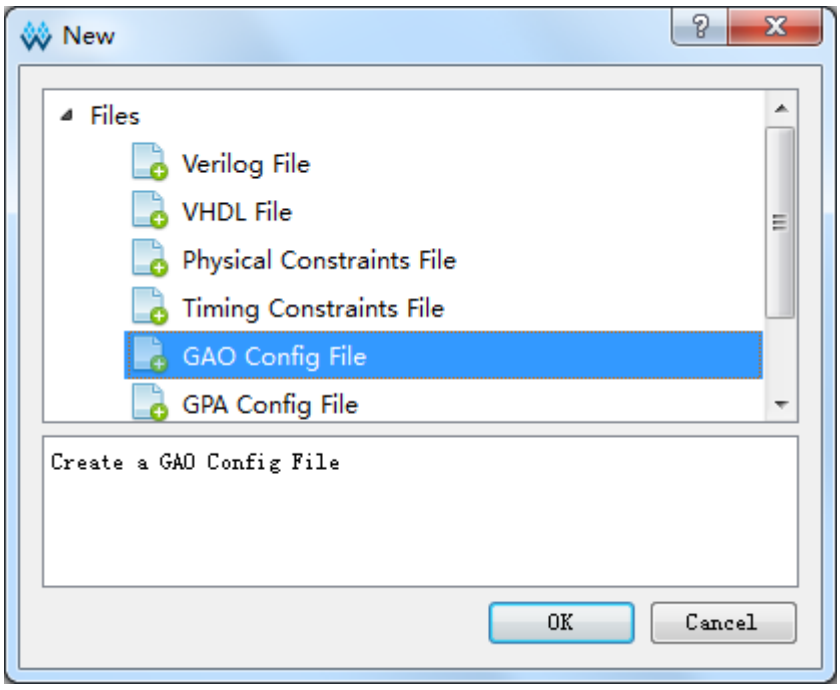


Figure 3-33 New GAO Wizard (Lite Mode)

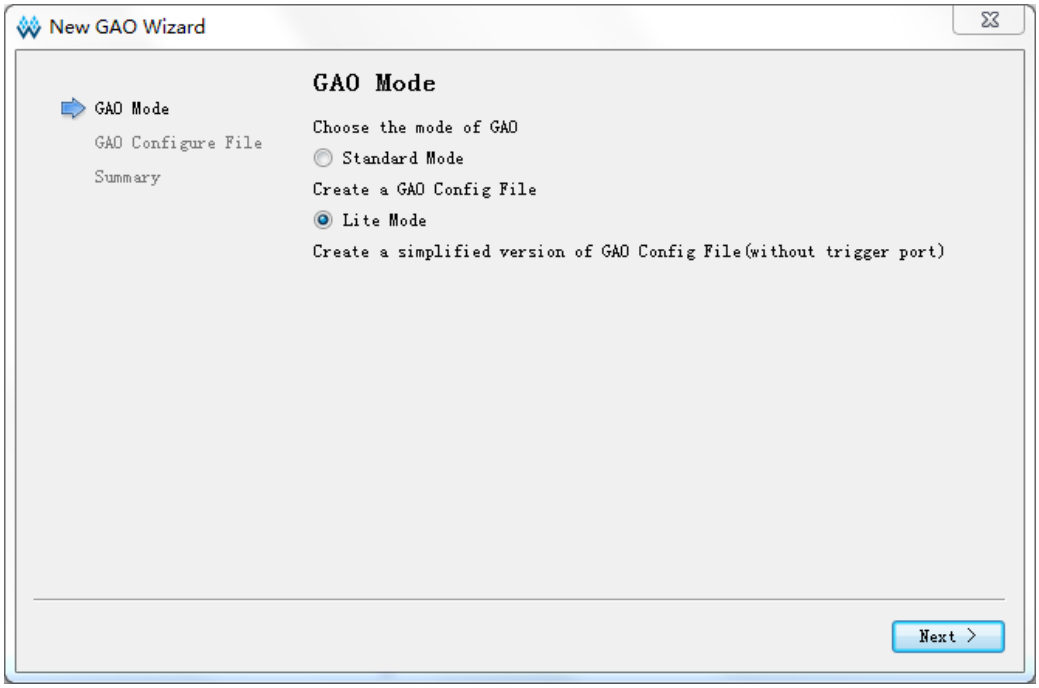


Figure 3-34 Lite Mode GAO Configuration File Name

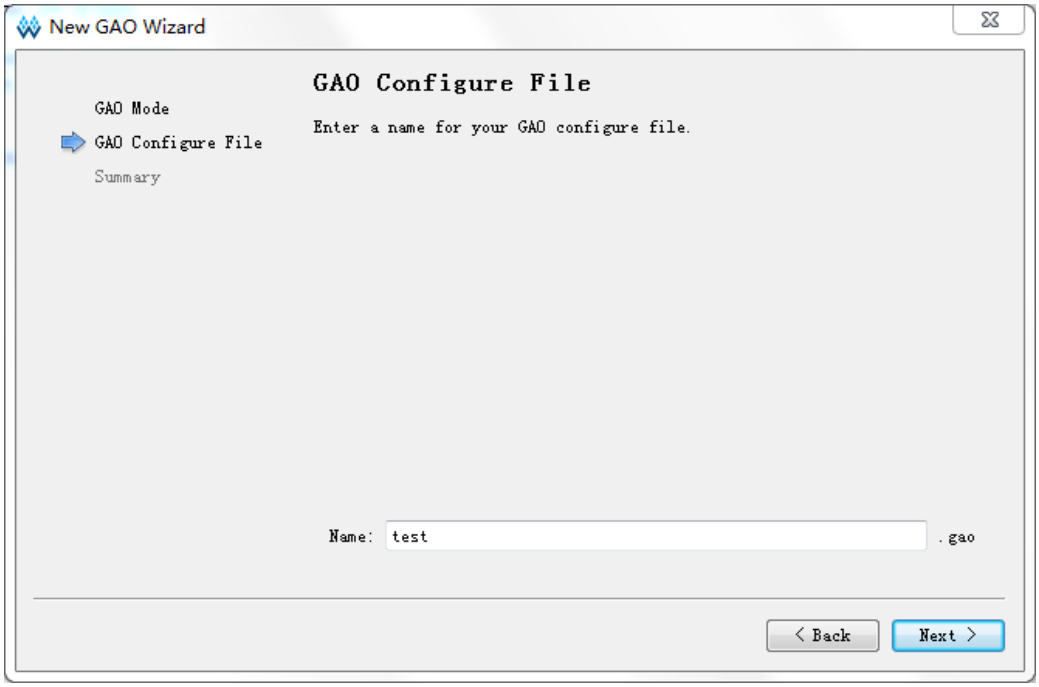
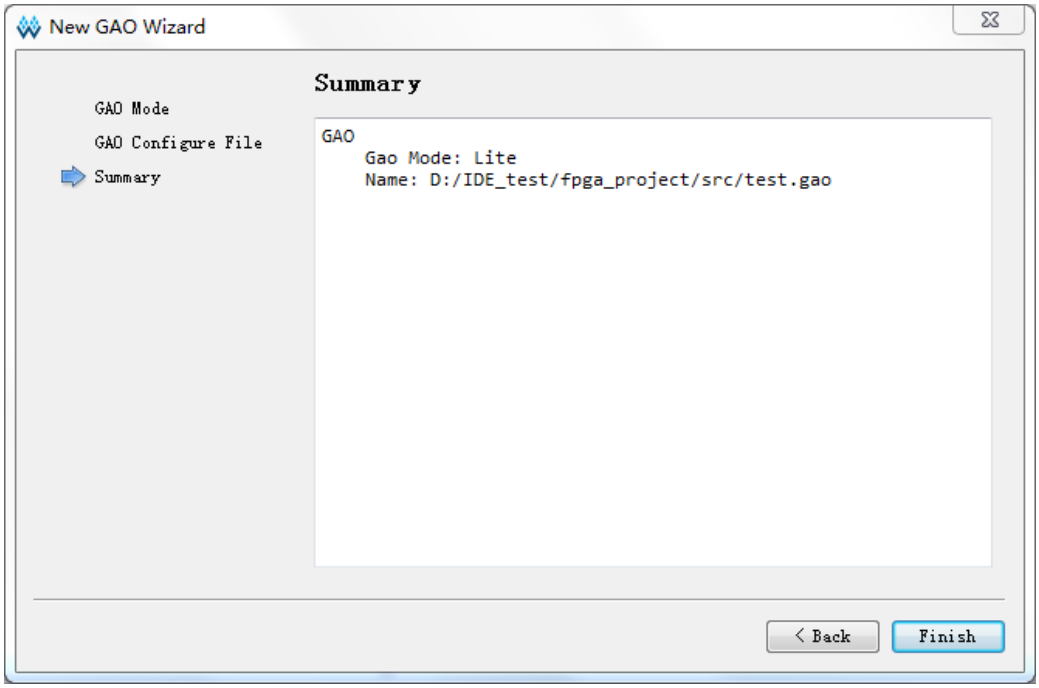


Figure 3-35 GAO Configuration File Mode and Path (Lite Mode)

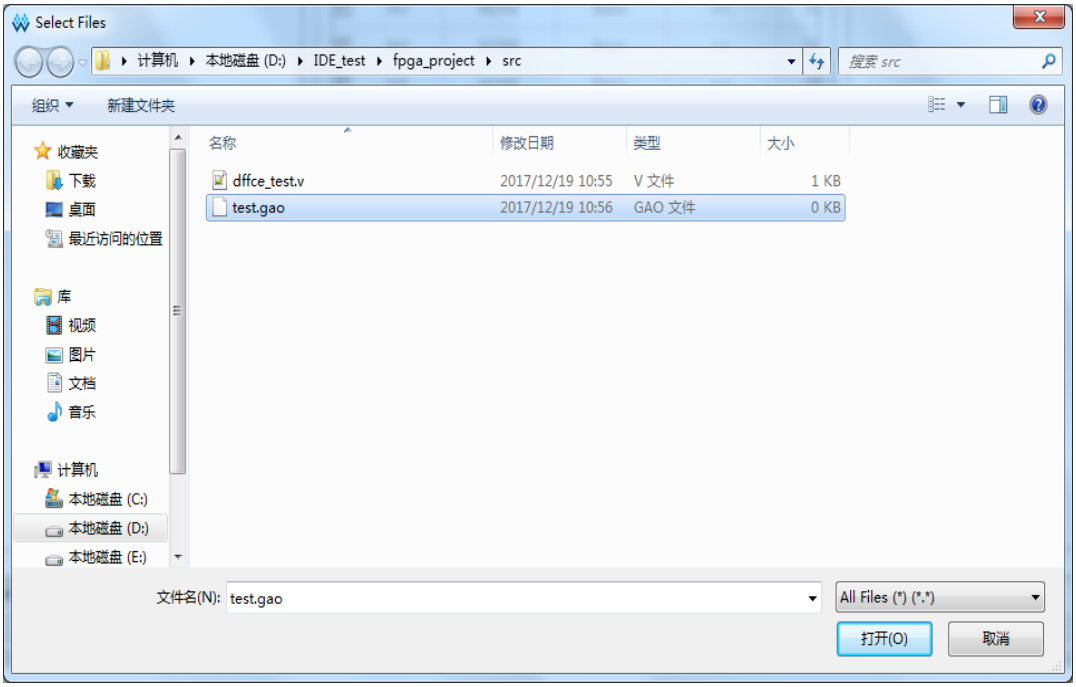


Add Lite Mode GAO Configuration File

Please follow the steps outlined below to create a standard mode GAO configuration file:

1. In the "Design" view, right-click and select "Add Files...".
   The "Select Files" dialog box will open.
2. Select the existing lite mode configuration file (.gao), as shown in Figure 3-36.
3. Click "Open". See the added GAO configuration file in "Design > GPA Config Files".

Figure 3-36 Lite Mode GAO Configuration File

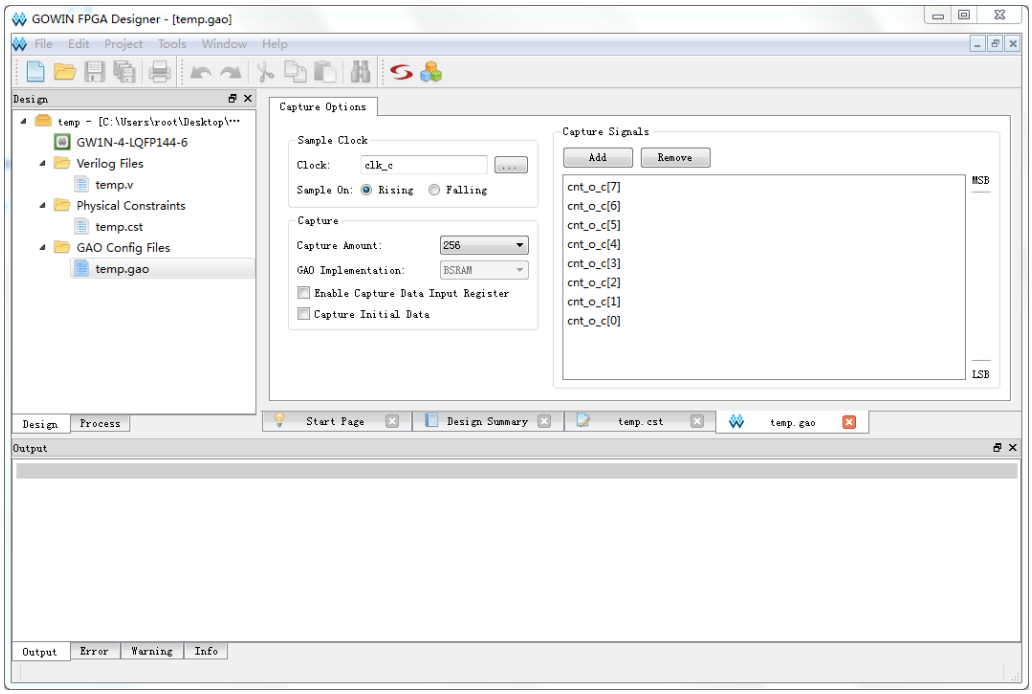


Start Lite Mode GAO Configuration File Interface

Double-click on the configuration file (.gao) in the "Design" view. The "GAO Config View" will open in the Gowin YunYuan main window. Start the Gowin Core Inserter, as shown in Figure 3-37.

The "GAO Config View" includes the capture options for configuring the signals sampling criteria.

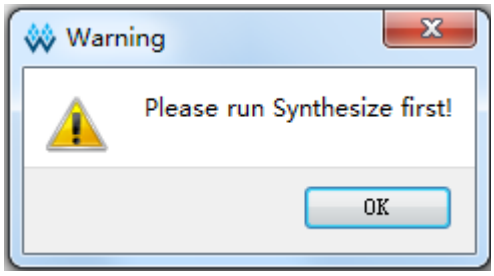
Figure 3-37 Gowin Core Inserter (Lite Mode)



Note!

- If post-synthesis, eligible design files are required to start the Gowin Core Inserter;
- If RTL, start the Gowin Core Inserter only after synthesis and completing the Compile Netlist;
- If the Compile Netlist failed, when the user double-clicks on the configuration file (.gao), the "Warning" prompt box will open, as shown in Figure 3-38.

Figure 3-38 Compile Netlist Prompt Box (Lite Mode)



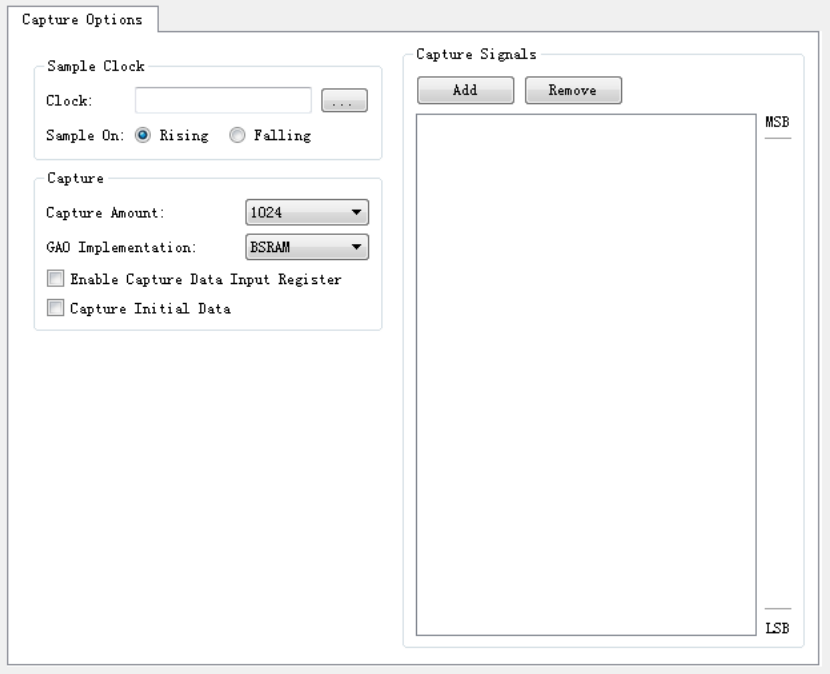
3.5 Configure Lite Mode GAO

The "Lite Mode GAO" is used to configure the signal sampling conditions.

Configure Capture Options

As shown in Figure 3-39, the capture options functions mainly include Sample Clock, Capture Amount, and Capture Signals, etc.

Figure 3-39 Capture Options (Lite Mode)

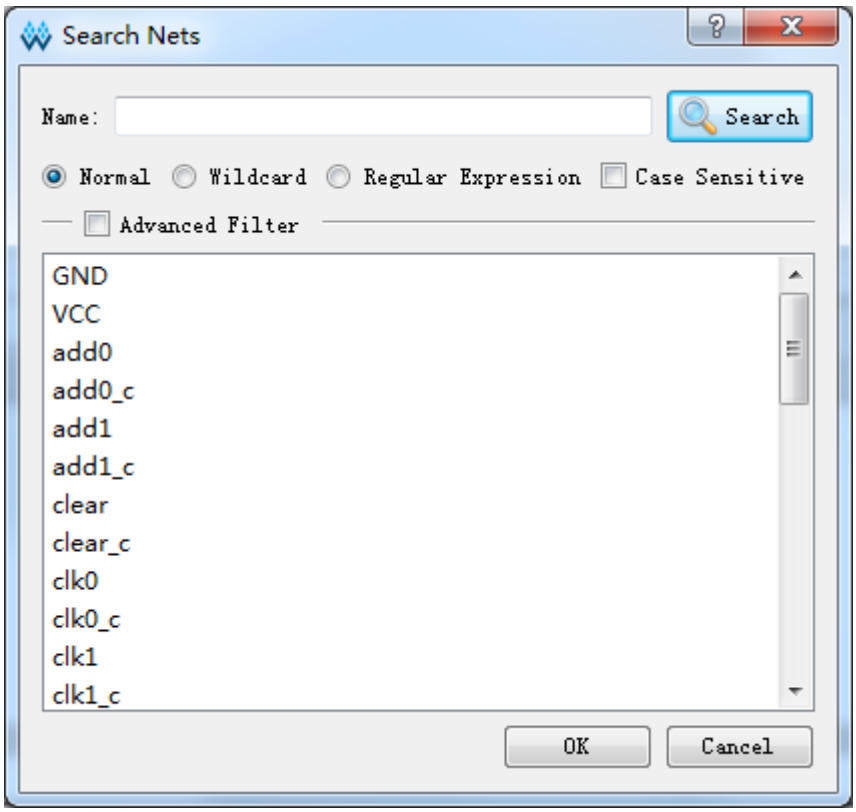


Users can use the Sample Clock area to select the clock signal that is incorporated into their design. The other signals can also be refined. The sample clock supports sampling on rising edge and falling edge.

Users can employ the following two methods to add sample clock signals:

1. Enter the sample clock name in the “Sample Clock” field;
2. Click on the “ ... ” icon that appears next to the“Sample Clock” textbox. The “Select Nets” dialog box will open. Select the required sample clock signal, as shown in Figure 3-40. Click“OK”to add the signal to the “Clock” textbox.

Figure 3-40 Select Nets Dialog Box (Lite Mode)



Note!

- If the configured sample clock does not exist when the configuration file (.gao) is saved, the error prompt box will appear, as shown in Figure 3-41;
- If there is no sample clock, the error dialog box, "No sample clock specified", will appear, as shown in Figure 3-42.

Figure 3-41 Error - Sample Clock Inexistence (Lite Mode)

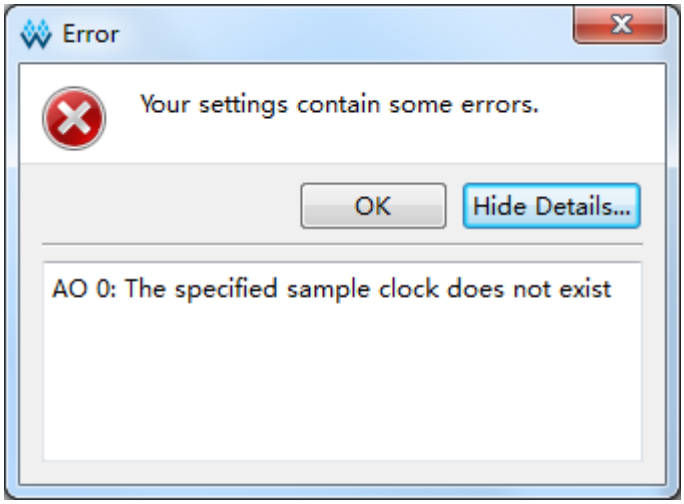
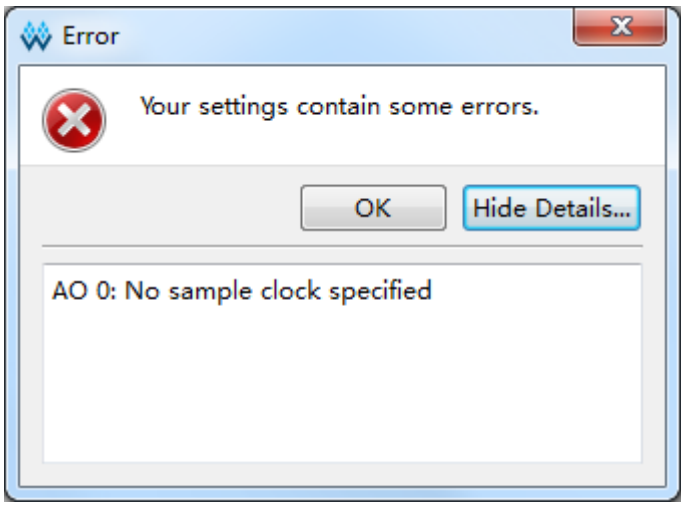


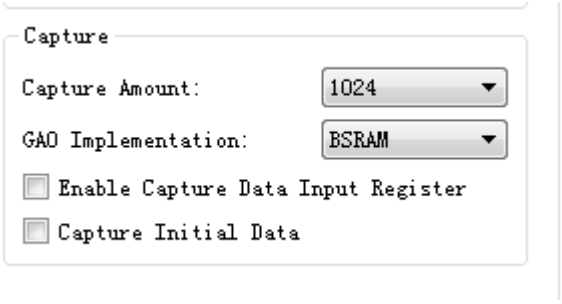
Figure 3-42 Error - No Sample Clock Specified (Lite Mode)



Configure Storage Info.

As shown in Figure 3-43, the storage info includes storage size, windows number, capture amount, and trigger position.

Figure 3-43 Capture Options (Lite Mode)



1. Capture Amount: Capture length, i.e., the address length of the actual memory being used on each capture buffer page.
2. GAO Implementation: Captured data signals storage mode.

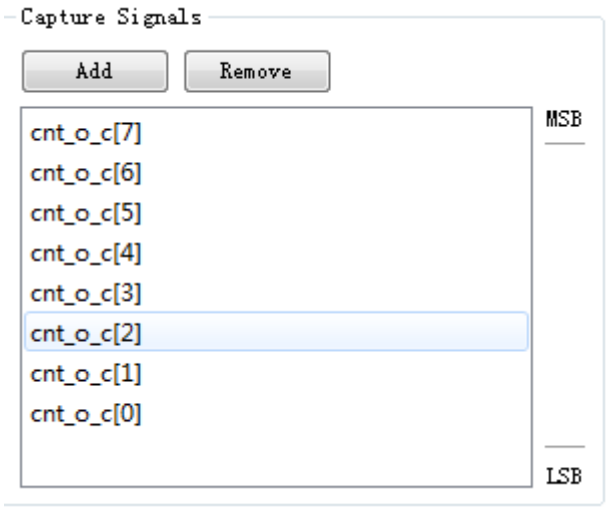
   Captured data signals can use the BSRAM resource or logic resource. Users can select the storage resource from the “GAO Implementation” drop-down list.
3. Enable Capture Data Input Register: Adjust timing.

   If your design has a big delay from clk to GAO, you can select this option to adjust the timing to add a layer of reg for capturing data.
4. Capture Initial Data: Select this option to capture the data at the moment of power-on.

Configure Capture Signals

The “Capture Signals” window displayed in Figure 3-44 can be used to configure capture signals. The data port signal is the input signal of the data port specified in the user’s design.

Figure 3-44 Capture Signal Configuration



- The “Add” button is used to select the capture signals that an AO requires to capture memory data.
- “Remove”: Used to delete the selected signals.

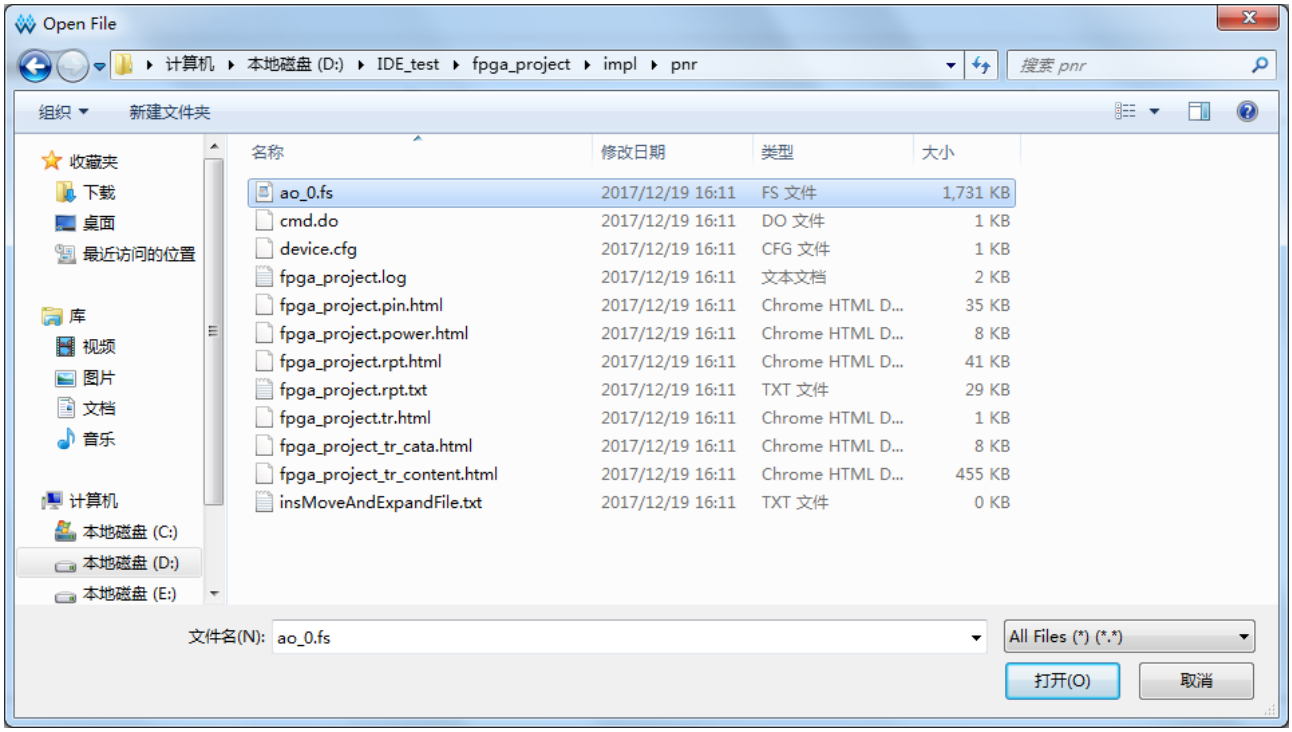
“Add” Options

Click on the "Add" button, and the “Select Nets” dialog box will appear. Select the required data port signal, and click "OK" to complete the configuration.

3.6 Generate Bitstream File

After configuring the GAO files, double-click on the “Place & Route” option in the “Process” view. Generate one or more bitstream files containing user designs and GAO configuration. The files are named after the AO name by default, such as “ao_0.fs”, and they are stored in the project path “/impl/gao/”by default, as shown in Figure 3-45.

Figure 3-45 Bitstream File (Lite Mode)



4 How to Use the GAO

The GAO is mainly used to display the capture signal waveform. It can also be used to reconfigure the AO capture window number, capture amount, and some matching conditions for match units via the JTAG interface. It helps users to observe data signals much more directly and visually.

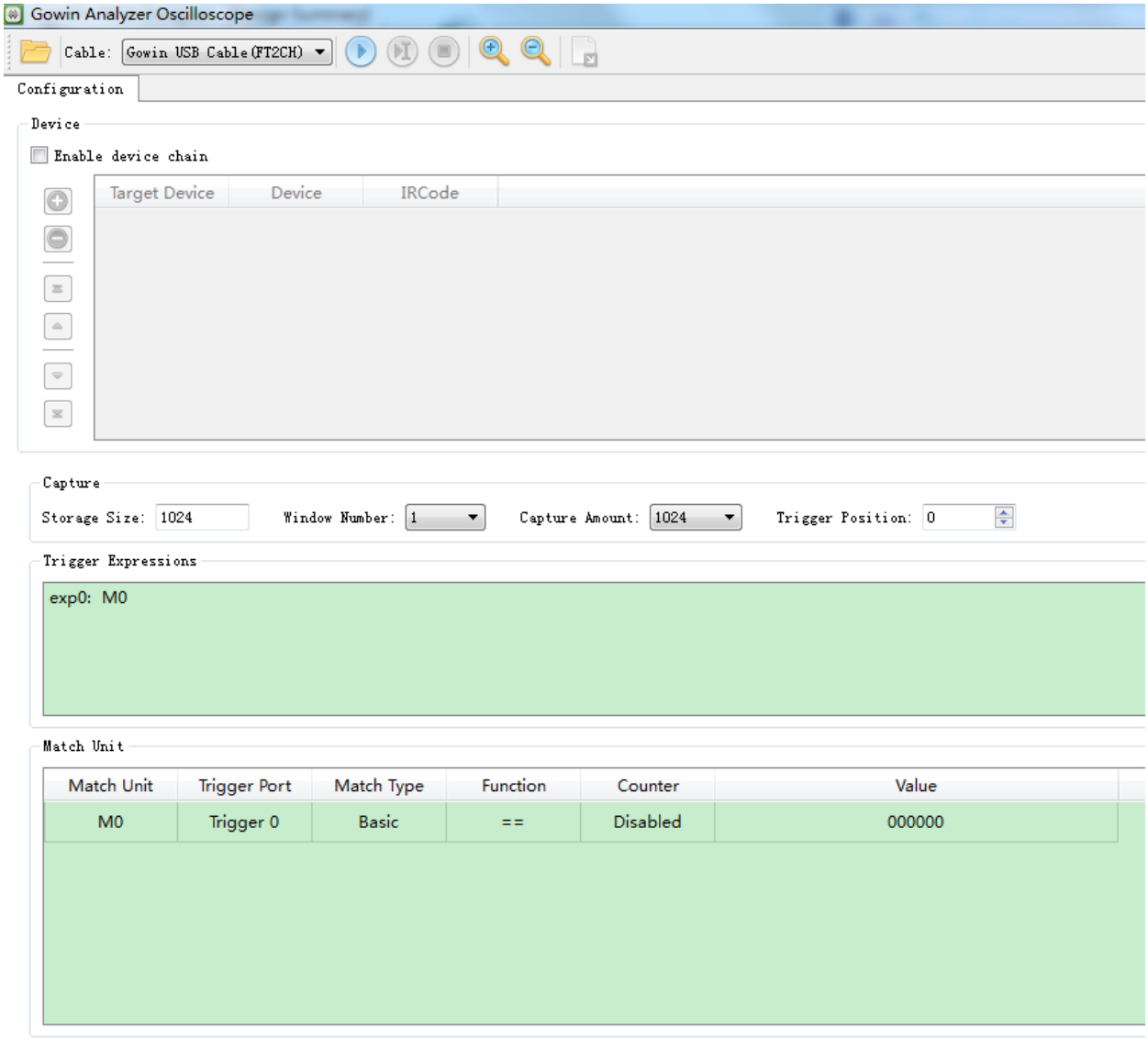
4.1 Standard Mode GAO Operation

4.1.1 Start Standard Mode GAO

Follow the steps outlined below to create a standard mode GAO:

1. Select “Tools” from the menu bar;
2. Select “Gowin Analyzer Oscilloscope” from the pop-up pull-down list to start GAO. Click "Open" to select the required standard mode gao configuration file (.gao), as shown in Figure 4-1.

Figure 4-1 Gowin Analyzer Oscilloscope (Standard Mode)



4.1.2 Run GAO

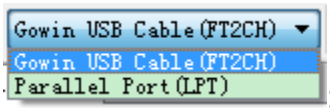
As shown in Figure 4-1, the GAO view includes the toolbar, Configuration view, and Window view. The toolbar can be used for adding the configuration files (.gao), device initialization, etc. The Configuration view is used to configure the dynamic parameters of the AO. The Window view is used for waveform display.

Tool Bar Operation

The GAO toolbar includes "Open…", start/stop control, force triggering, Zoom In/Out, etc., as shown in Figure 4-2.

Figure 4-2 Tool Bar (Standard Mode)

An overview of the functions is provided below:

- “ ”: Open, add configuration files (.gao);
- 

: The waveform download cable supports Gowin USB Cable and Parallel Port (LPT). You can select from the drop-down list;
- “ ”, “ ”, “ ”: Start, force triggering, and stop running GAO;
- “ ”, “ ”: Zoom in/out waveform;
- : Export waveform data;

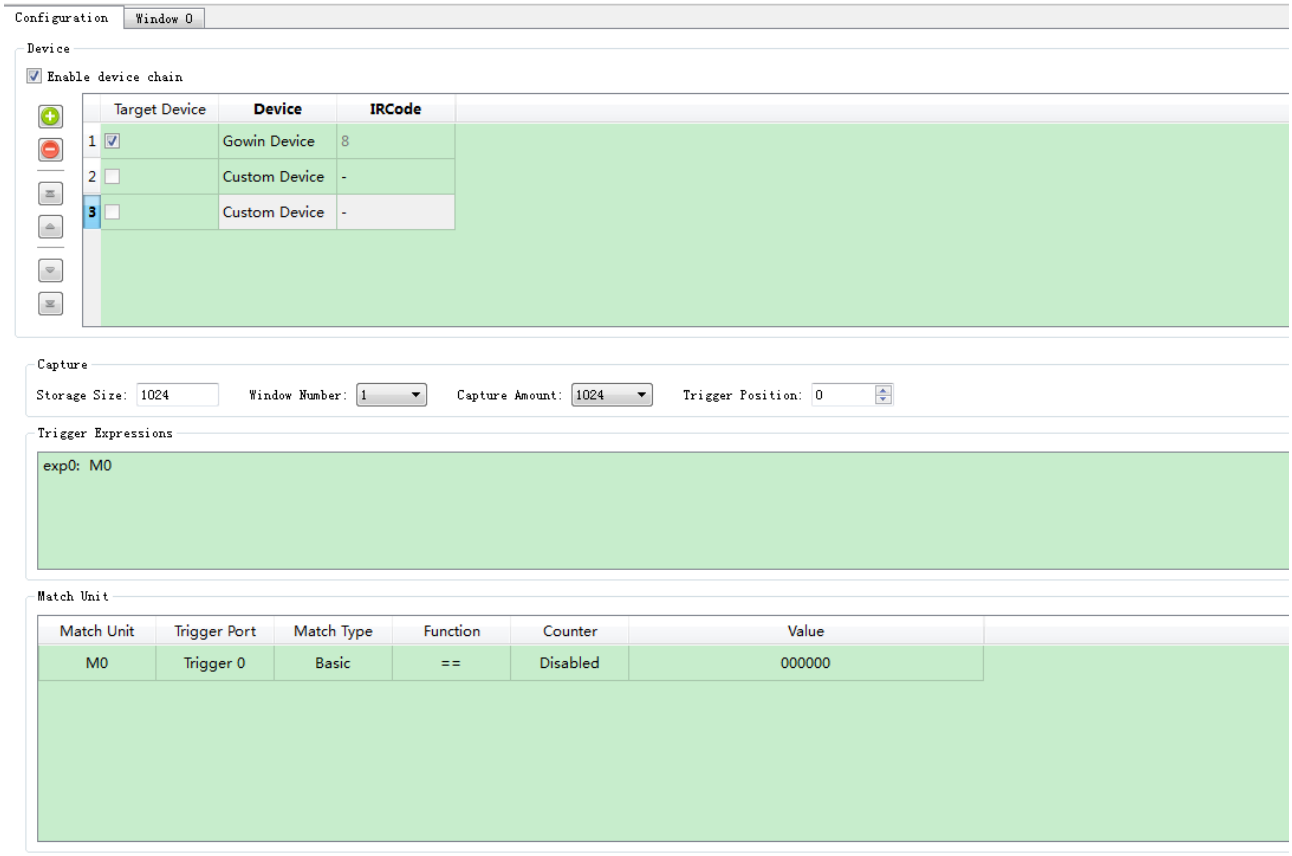
AO Configuration

The Configuration view mainly contains the following functions:

- The device chain configuration: Custom Device or Gowin Device can be selected;
- Display AO info, including the sampling data, trigger expressions, and match unit;
- Modify the sampling data info. and match unit info.

The Configuration view includes Device, Capture, Trigger Expressions, and Match Unit functionality, as shown in Figure 4-3.

Figure 4-3 Configuration



The Device view includes the following functions:

- Enable the device chain by clicking “Enable device chain”. Click the “ ” icon to add a Target Device. The defaulted type of the target device is “Custom Device”. The range of IRCode is 1-16. Double-click on the column of “Device”, and then a drop-down arrow will appear. You can select ”Gowin Device” from the drop-down list. The IRCode is 8 by default and it can not be modified;
- Move one Device up and down by selecting one column and clicking the upward and downward triangleson the left.

The Capture view includes the following functions:

- Display storage size, windows number, capture amount, and trigger position;
- Change storage size, windows number, capture amount, and trigger position.

Note!

For the parameter configuration rules, please refer to Capture Options, Configure Storage Info.

Trigger Expressions shows the expressions for the current AOs.

Match unit includes the following functions:

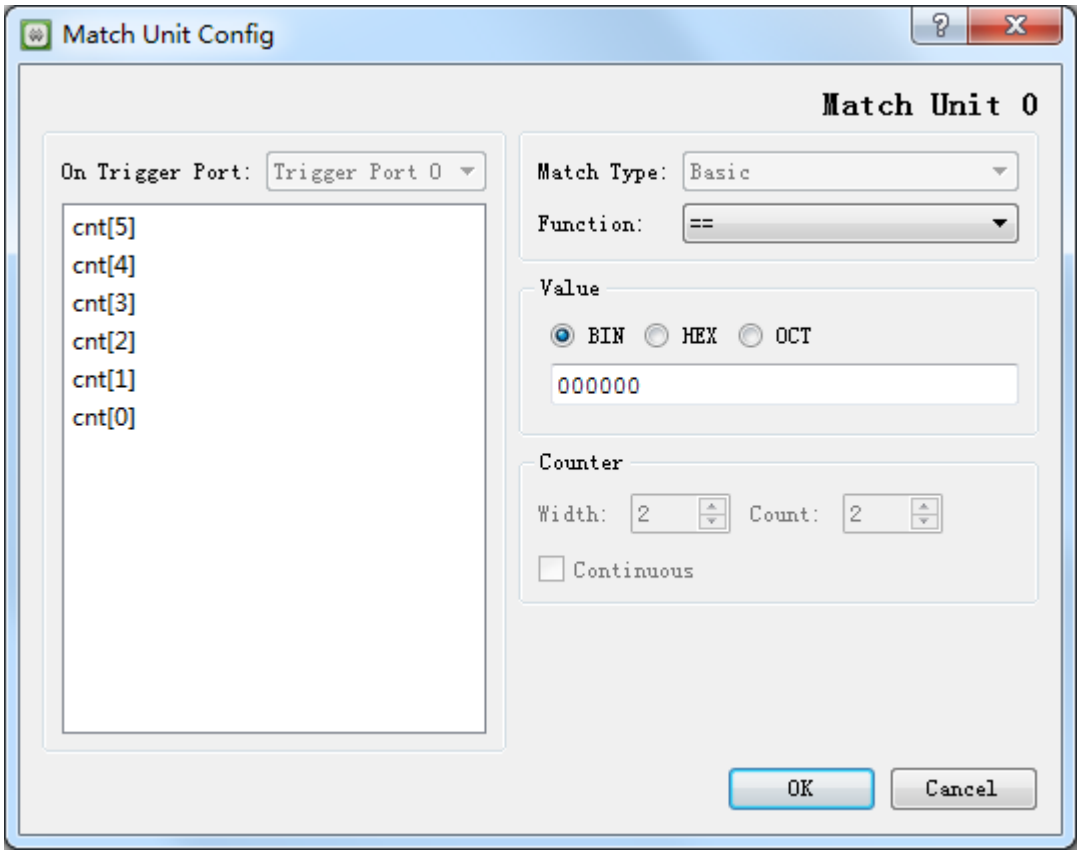
- Display the name, trigger port, and match type, etc., of the match units for the current AOs;

- Double-click on the Match Unit option, modify the matching functions and bit value in the “Match Unit Config” dialog box, such as counter, as shown in Figure 4-4.

  Note!

  For the parameter rules, please refer to 3.2 Configure Standard Mode GAO

Figure 4-4 Match Unit Config Dialog Box



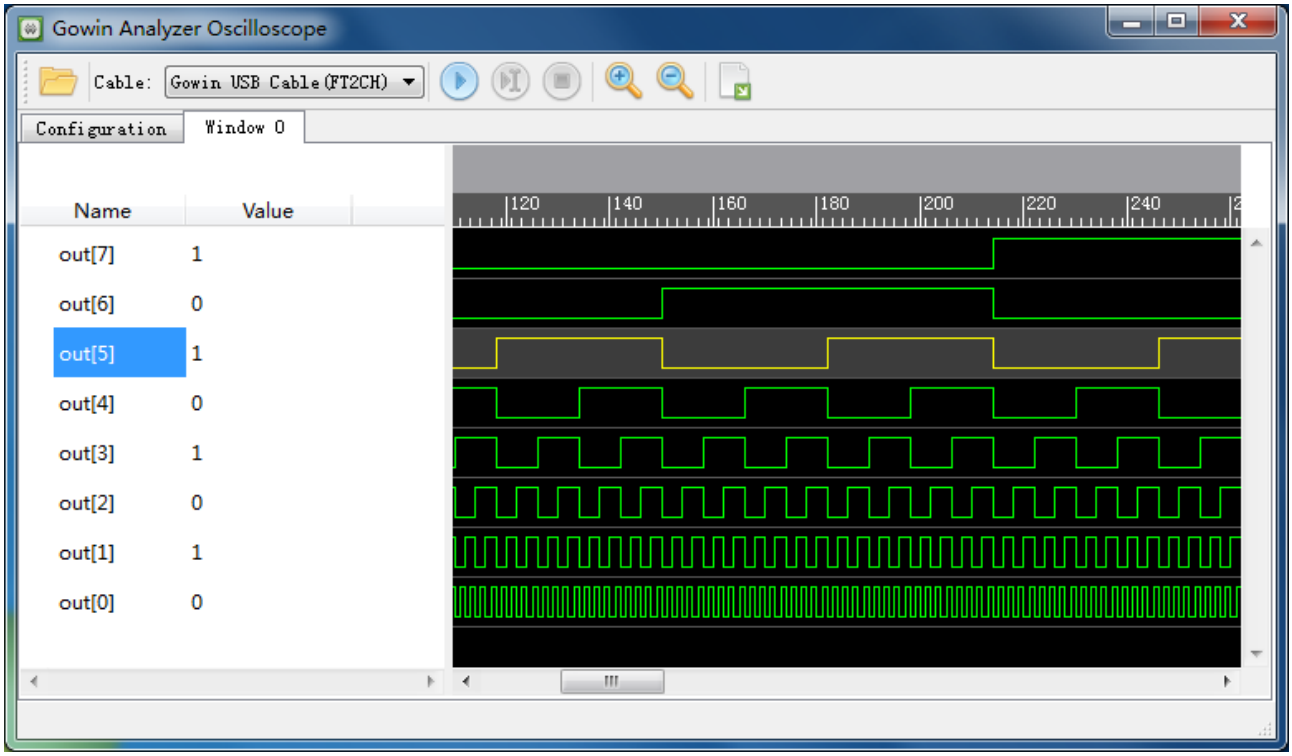
Display Waveform

The Windows view is used to display the captured sampling signal waveform and supports the following functions:

- Mark the position with nonius;
- Waveform zoom in/out;
- Change the sort order of the signals;
- Bus signals combination and separation; BIN/HEX/OCT conversion of value.

Click on the “ ”icon to start running GAO. When the triggering conditions are met, the GAO displays Windows number, which is equal to the configured number of capture windows. Figure 4-5 shows the capture signal name, value, and waveforms. When a user clicks on a waveform, it will be highlighted in yellow.

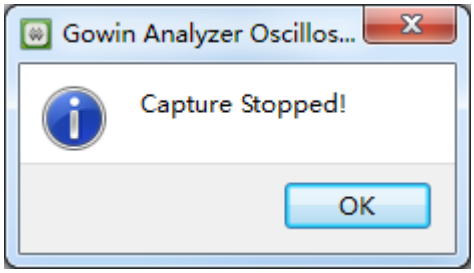
Figure 4-5 GAO Waveform Display (Standard Mode)



Note!

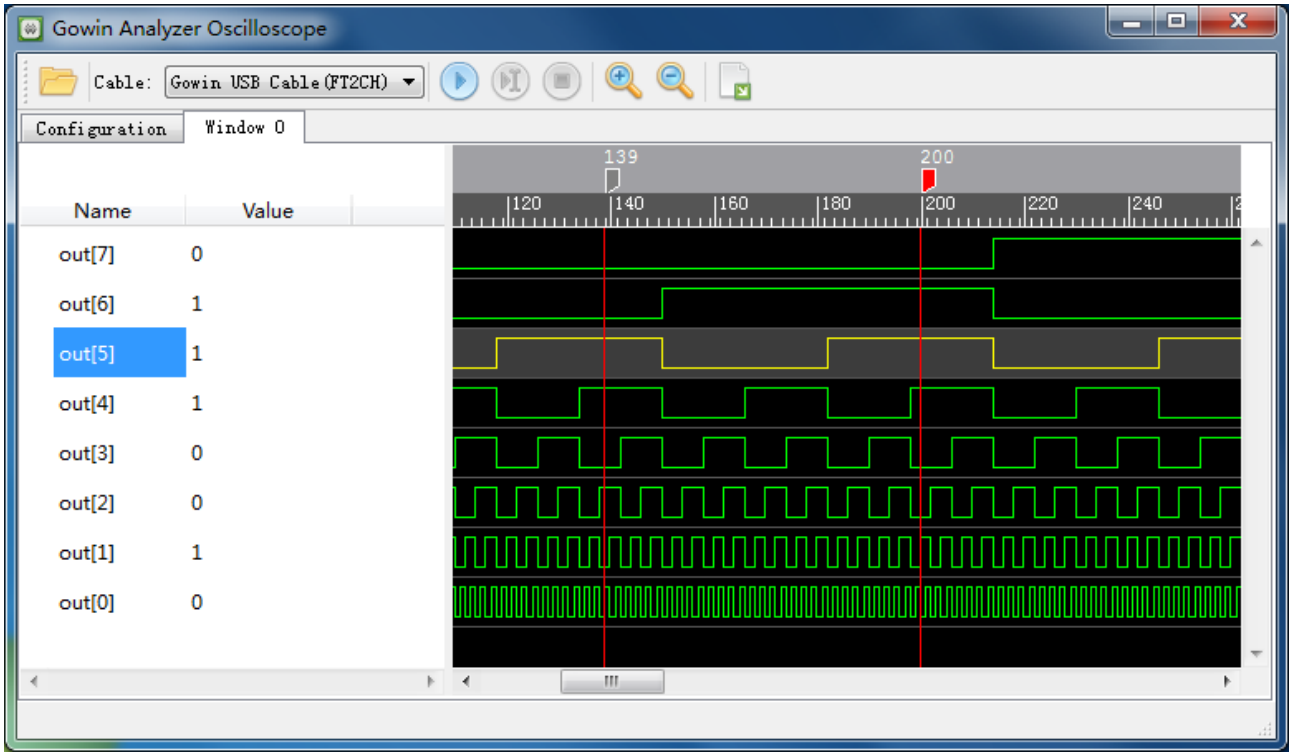
- If trigger conditions are not met, click “ ” to force triggering to display windows and the captured sampling signals waveform;
- If trigger conditions are not met, click “ ” to stop running. The "Capture Stopped!" dialog box will appear, as shown in Figure 4-6.

Figure 4-6 Capture Stopped (Standard Mode)



As shown in Figure 4-5, the initial position of nonius is the trigger position by default. The trigger point is marked with a yellow vertical line. Move the mouse cursor over the nonius, left-click the mouse to drag the nonius, and then right-click the mouse in the blank above the nonius to add a new nonius, as shown in Figure 4-7.

Figure 4-7 Nonius Display (Standard Mode)



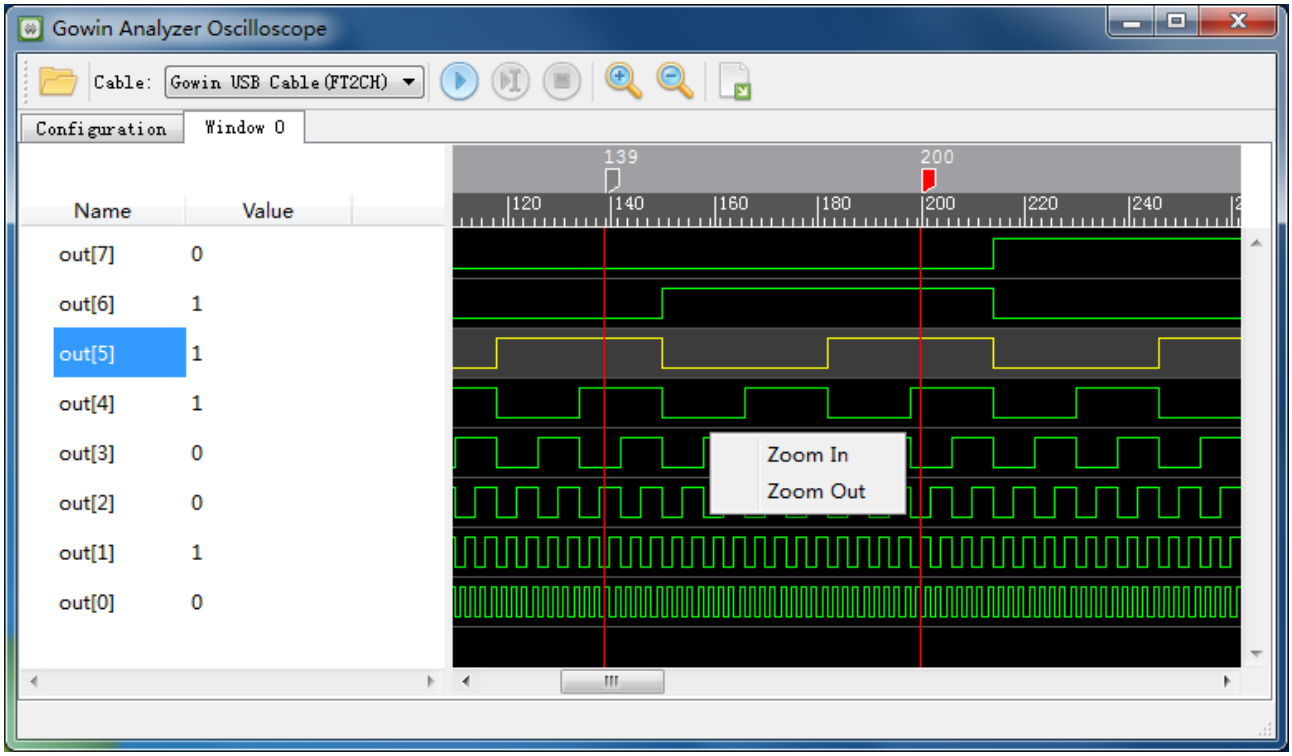
Note!

Select one nonius and right-click, and then select "Remove Marker" in the next window to delete the nonius.

Right-click in the waveform display area to open the pop-up menu, as shown in Figure 4-8.

Click “Zoom In” or “Zoom Out”, or press Ctrl+mouse wheel, to zoom in/out of the waveform.

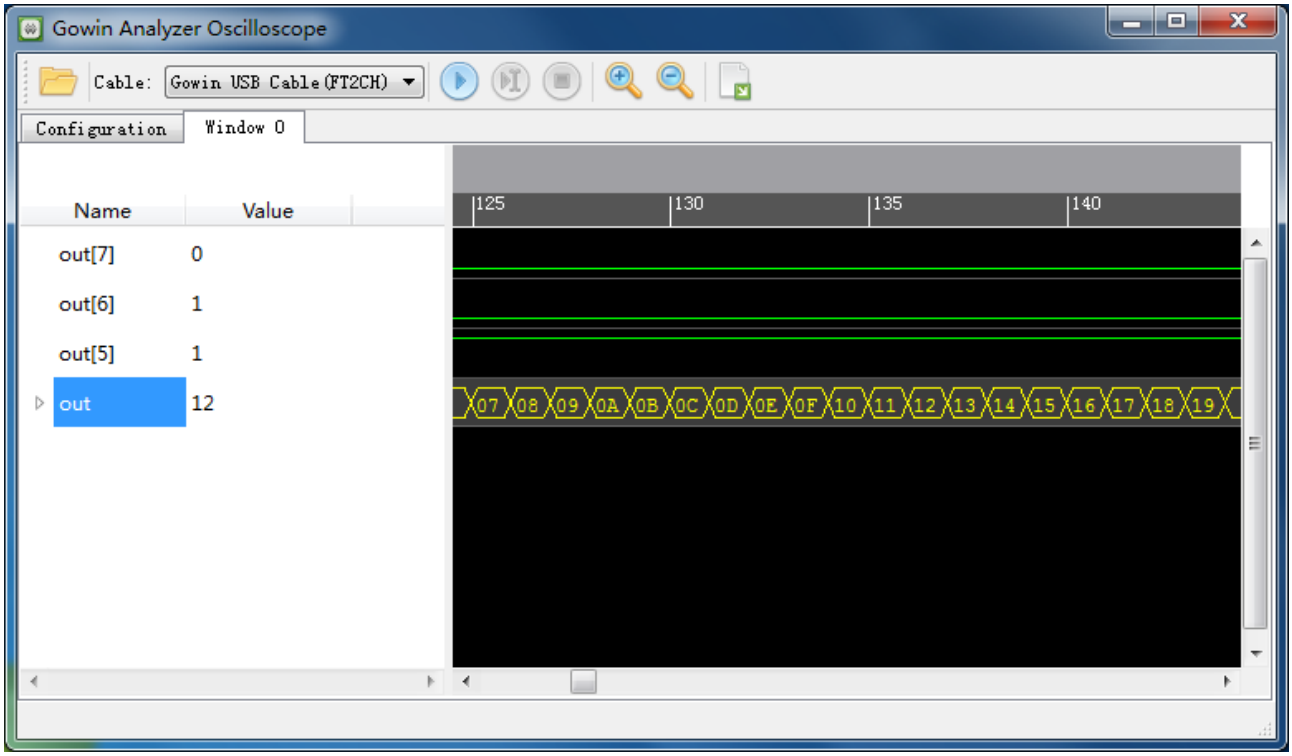
Figure 4-8 Right-Clicking Menu of Zoom In/Out (Standard Mode)



Change the order of signals by clicking on the signal names in the “Name” column and pressing the left mouse button and dragging or using the mouse wheel.

In the “Name” column, use the Shift+left mouse button or Ctrl+left mouse button to select multiple signals. Right-click and select “Group Signals to Bus” in the pop-up menu to combine the bus signals. The name of the combined bus signal is related to the first signal name, as shown in Figure 4-9.

Figure 4-9 Combined Bus Signal (Standard Mode)



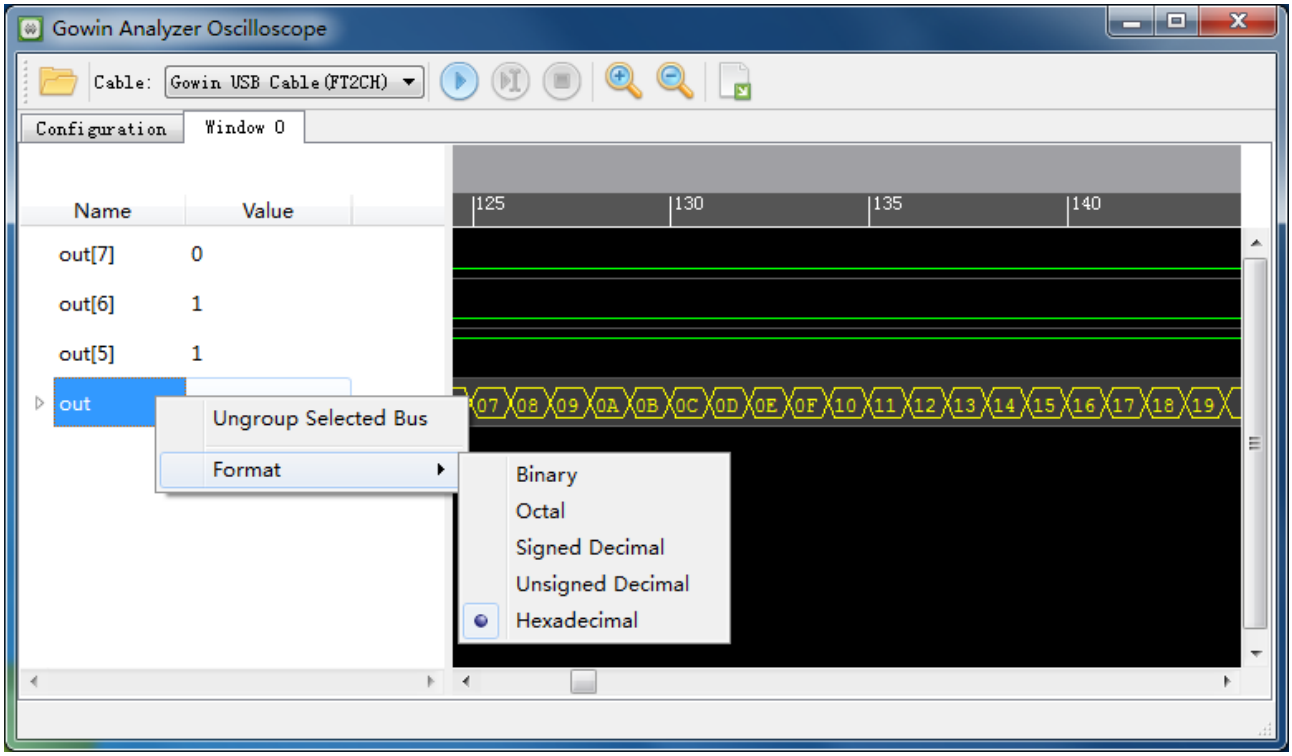
Note!

- Click on the “ ”icon again to capture the sampling signals waveform. The bus signal still exists.
- Right-click on the bus signal name in the “Name” column and select “Ungroup selected Bus” in the pop-up menu to ungroup the bus signal.

Right-click in the value display area to access the pop-up menu, as shown in Figure 4-10.

Select“Bin/Oct/Dec-Signed/Dec-Unsigned/Hex” for the sampling signals value display, which is displayed as bin by default.

Figure 4-10 Right-Clicking Menu of Format (Standard Mode)

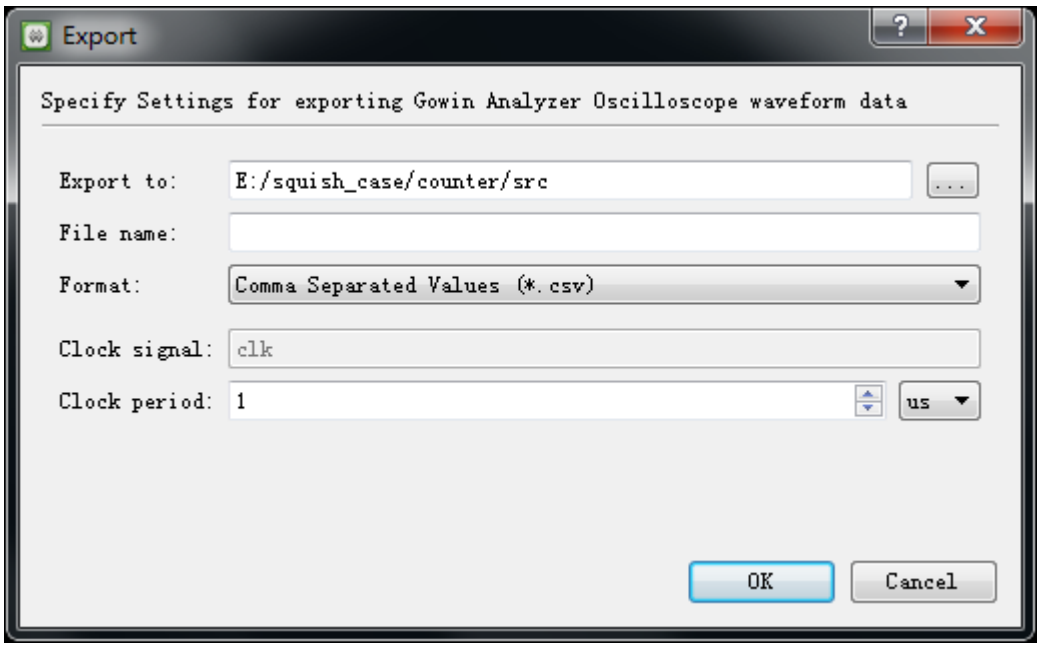


4.1.3 Export Waveform Data

The operation steps are as follows:

- Click on the waveform export button “ ” in the toolbar;
- The waveform export dialog box will pop up. Specify the waveform file information, including “Export to”, “File name”, “Format”, “Clock Signal”, “Clock period”. The Clock Signal is the sampling clock signal specified in the GAO, and the signal cannot be changed; the Format supports Comma Separated Values-(*.csv), and Value Change Dump-(*.vcd); The Clock period supports us, ns, ps, as shown in Figure 4-11.

Figure 4-11 Waveform Data Export



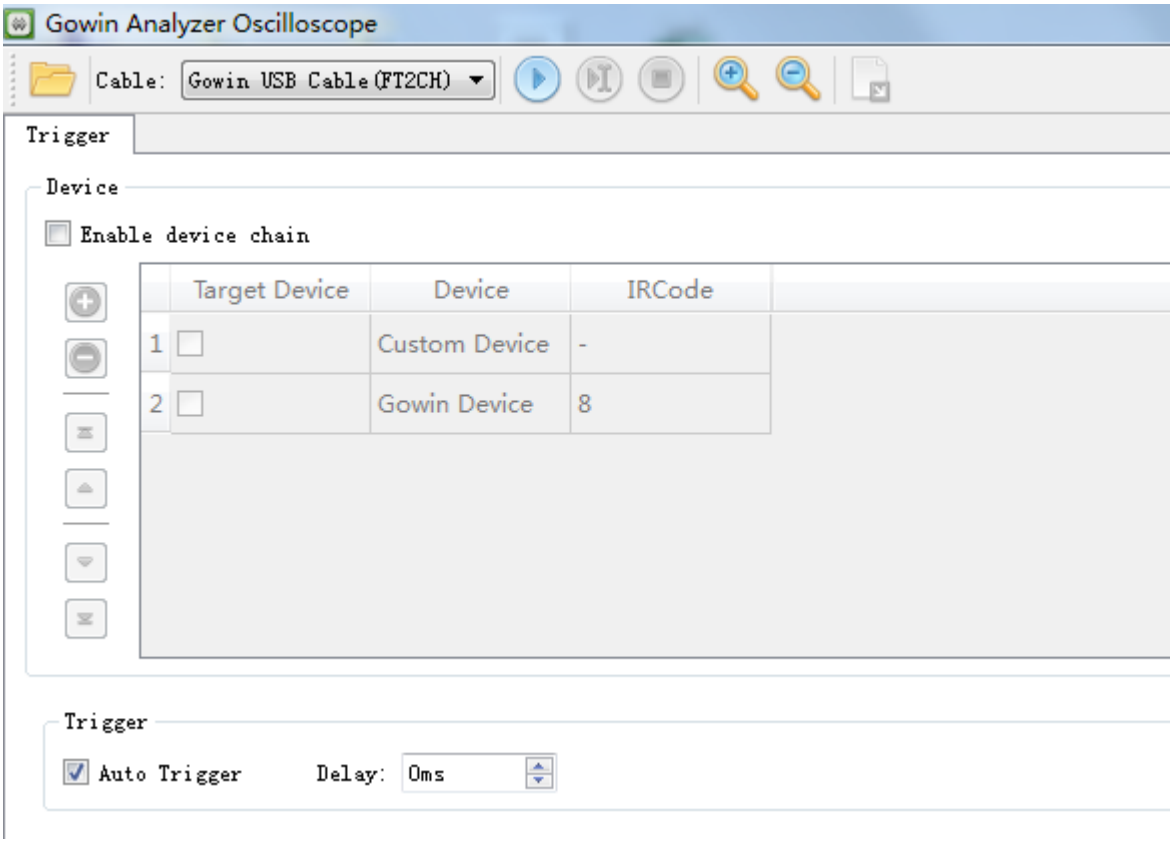
4.2 Lite Mode GAO Operation

4.2.1 Start Lite Mode GAO

Follow the steps outlined below to create a Lite Mode GAO:

1. Select “Tools” from the menu bar;
2. Select “Gowin Analyzer Oscilloscope” from the pull-down list to start the GAO. Click "Open" to select the required Lite Mode gao configuration file (.gao), as shown in Figure 4-12.

Figure 4-12 Gowin Analyzer Oscilloscope (Lite Mode)



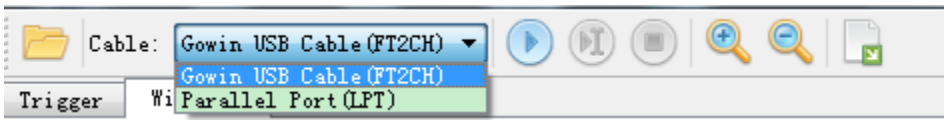
4.3 Run GAO

As shown in Figure 4-12, the GAO view includes the toolbar, Trigger view, and Window view options. The toolbar can be used for adding configuration files (.gao), device initialization, etc. The Trigger view is used to set automatic trigger and its delay. The Window view is used for waveform display.

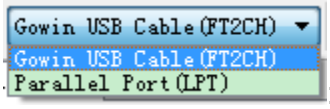
Tool Bar Operation

The GAO toolbar includes the "Open…", Cable, Start/Stop Control, Force Triggering, Zoom In/Out, etc. options, as shown in Figure 4-13.

Figure 4-13 Tool Bar (Lite Mode)



The detailed function description is as follows:

- " ": Open, add configuration files (.gao);
- 

: The waveform download cable supports Gowin USB Cable and Parallel Port (LPT). You can select from the

drop-down list;

- “ ”, “ ”, “ ”: Start, force triggering, and stop running GAO;
- “ ”, “ ”: Zoom in/out waveform;
- “ ”: Export the waveform data.

Device View

The Device view includes the following functions:

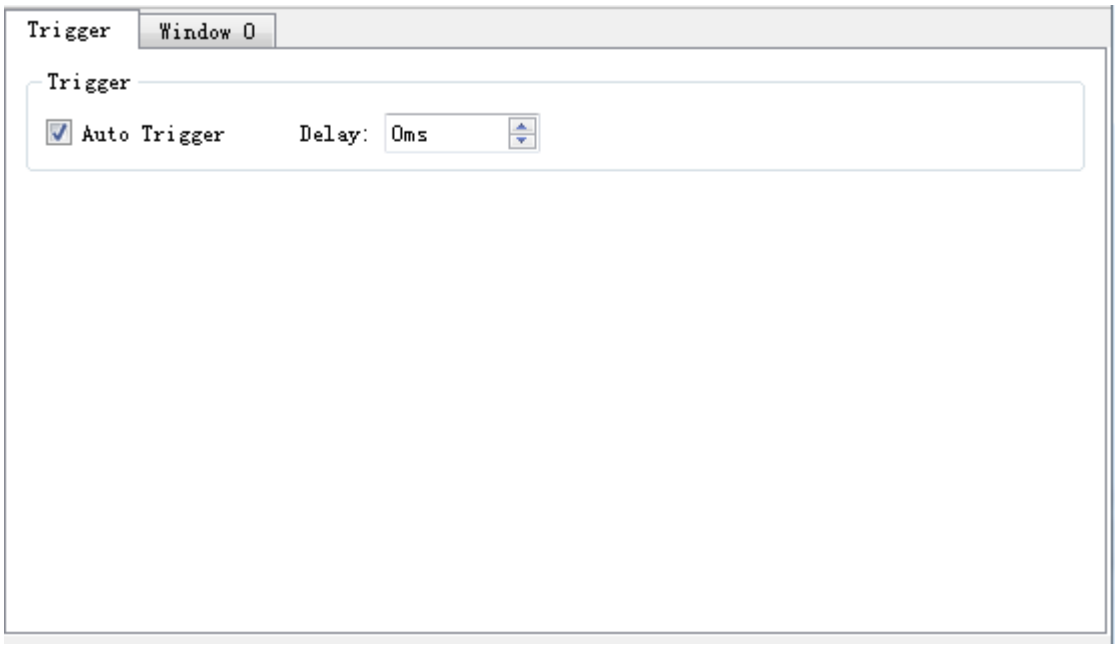
- Enable the device chain by clicking “Enable device chain”. Click the “ ” icon to add a Target Device. The defaulted type of the target device is “Custom Device”. The range of IRCode is 1-16. Double-click on the column of “Device”, and then a drop-down arrow will appear. You can select ”Gowin Device” from the drop-down list. The IRCode is 8 by default and it can not be modified;
- Move one Device up and down by selecting one column and clicking the upward and downward triangleson the left.

Trigger View

The Trigger view is as shown in Figure 4-14. Its main functions are as follows:

- Auto Trigger: Click “Start” to trigger automatically when you select this option;
- Delay: Configure the trigger delay.

Figure 4-14 Trigger View



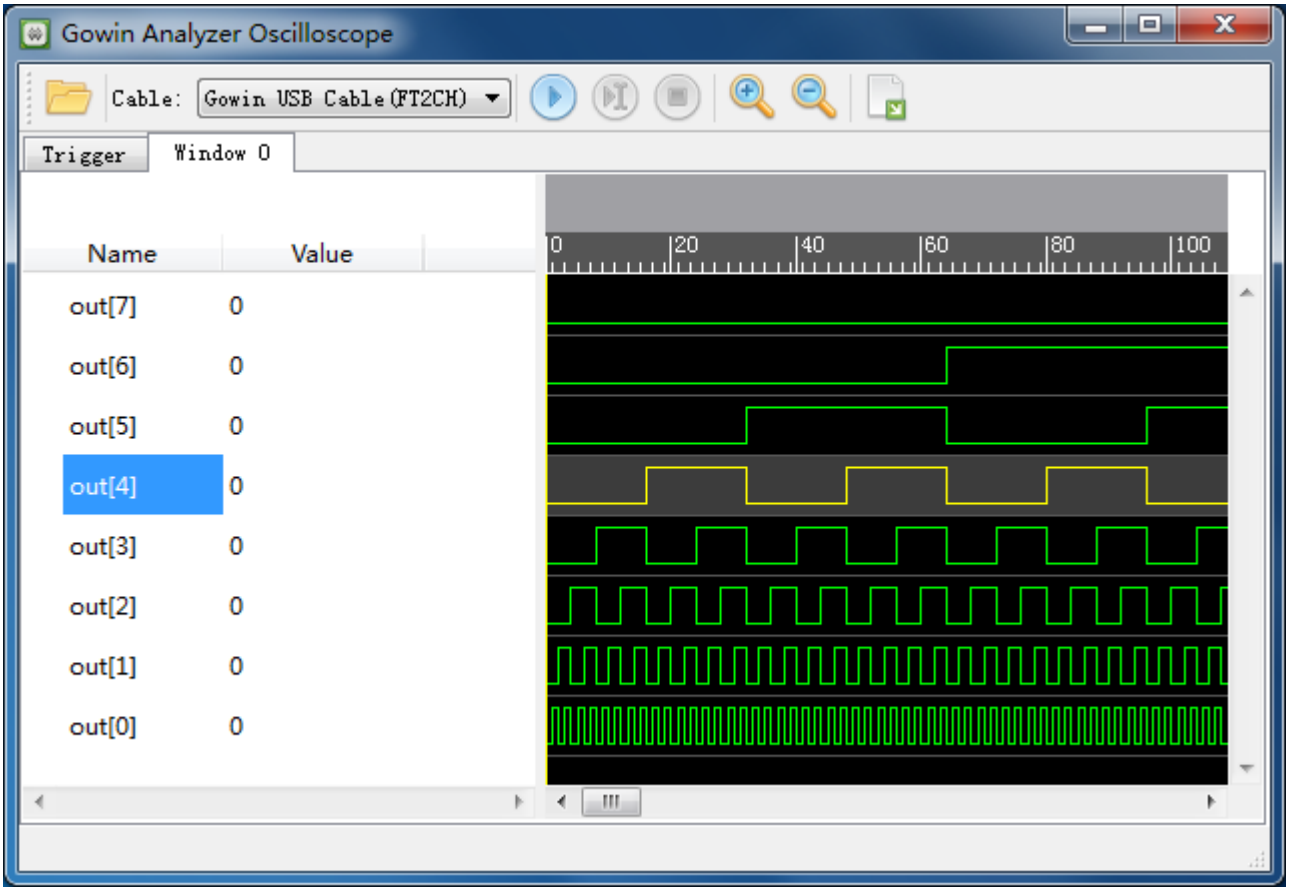
Display Waveform

The Windows view is used to display the captured sampling signal waveform and supports the following functions:

- Mark the position with nonius;
- Waveform zoom in/out;
- Change the sort order of signals;
- Bus signals combination and separation; BIN/HEX/OCT conversion of value.

Click on the “ ”icon to start running the GAO, and then click “ ” to force triggering. Alternatively, select “Auto Trigger” in the Trigger view, and then click on the “ ” icon to trigger automatically. When the triggering conditions are met, the GAO displays the Windows number. Figure 4-15 shows the capture signal name, value, and waveforms. When the user clicks on a waveform name, it will be highlighted in yellow.

Figure 4-15 GAO Waveform Display (Lite Mode)

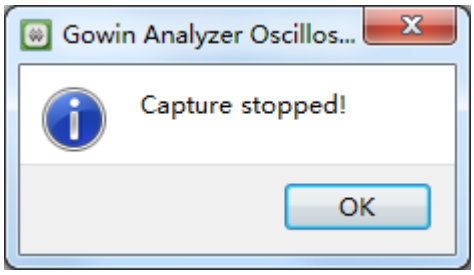


Note!

- If trigger conditions are not met, click on the “ ”icon to force triggering to display windows and the captured sampling signals waveform.

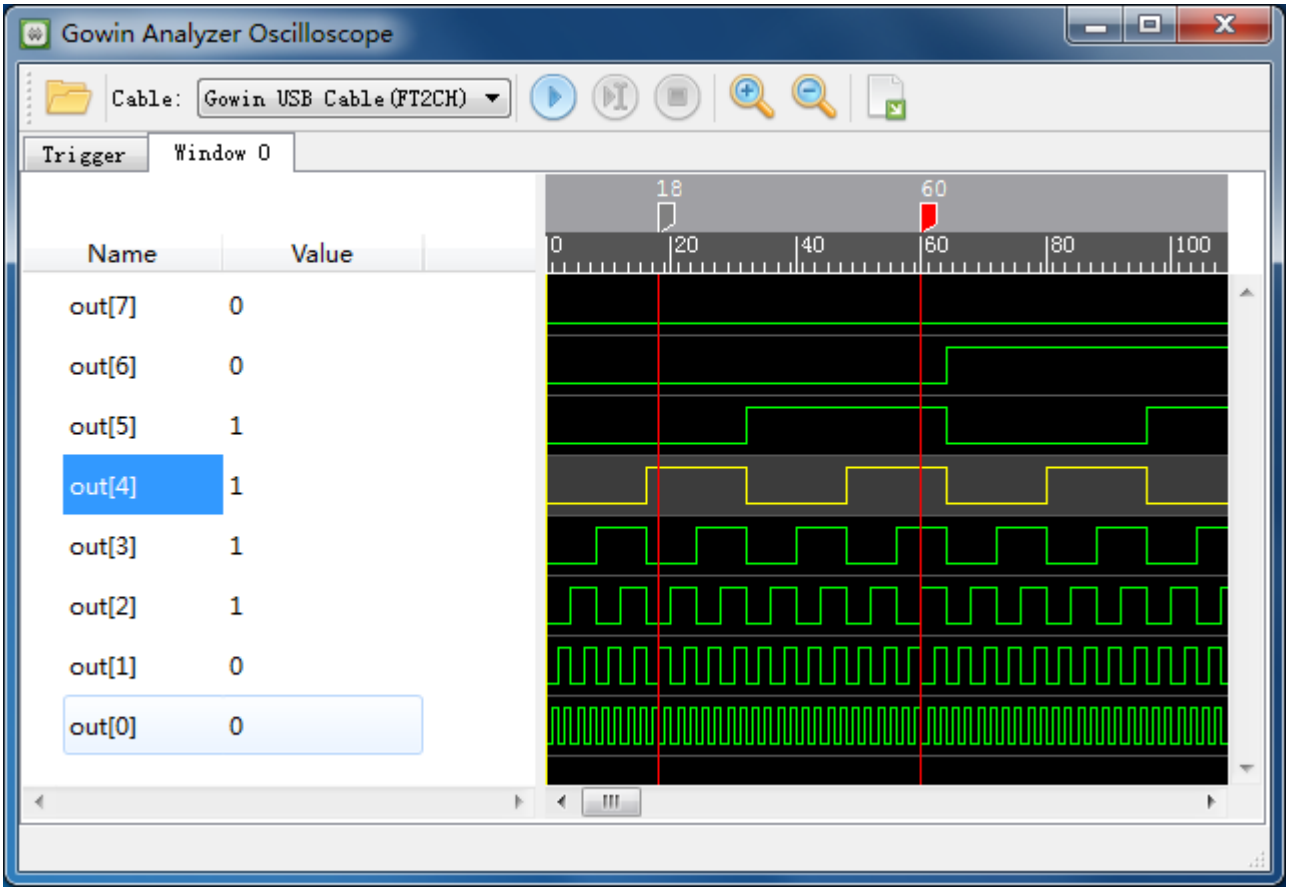
- If trigger conditions are not met, click on the “ ” icon to stop running. The "Capture stopped" dialog box will appear, as shown in Figure 4-16.

Figure 4-16 Capture stopped (Lite Mode)



As shown in Figure 4-15, right-click in the blank above the nonius to add a new nonius, as shown in Figure 4-17.

Figure 4-17: Nonius Display (Lite Mode)



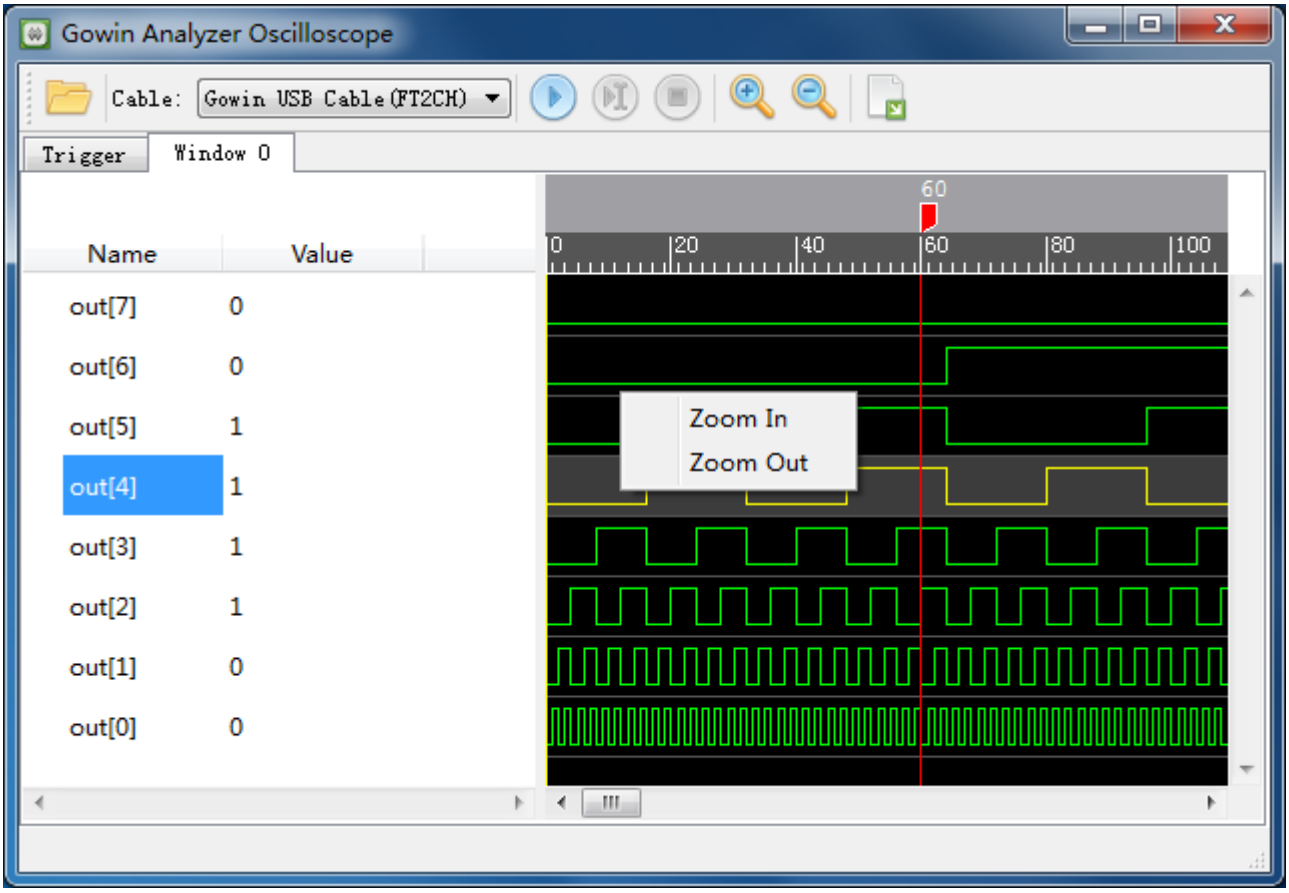
Note!

Select one nonius and right-click, and then select "Remove Marker" in the pop-up menu to delete the nonius.

Right-click in the waveform display area to open the pop-up menu, as shown in Figure 4-18.

To zoom in/out of the waveform, click “Zoom In” or “Zoom Out”, or press Ctrl+mouse wheel.

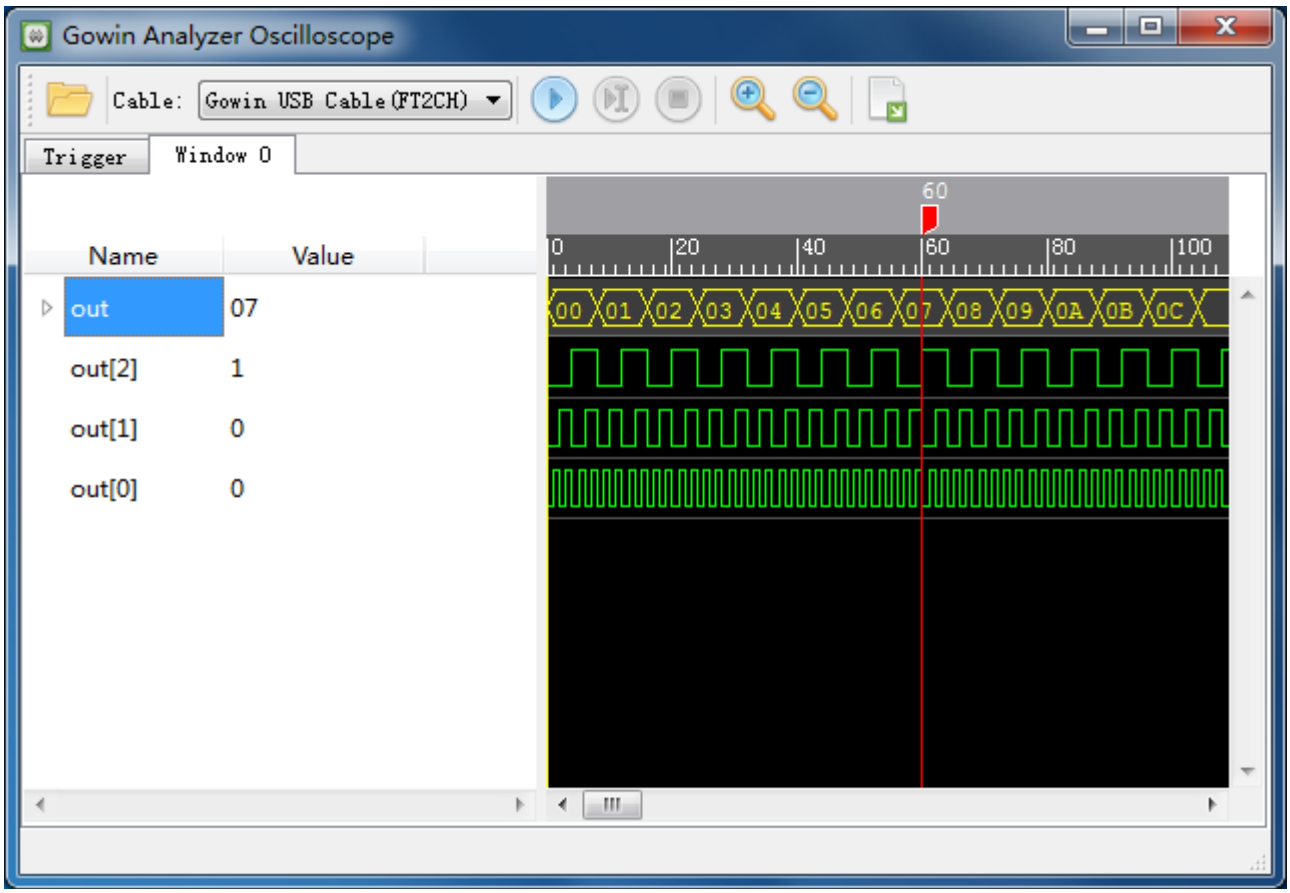
Figure 4-18: Right-Clicking Menu of Zoom In/Out (Lite Mode)



Change the order of signals by clicking on the signal name in the “Name” column and pressing and dragging the left mouse button or mouse wheel.

In the “Name” column, use Shift+left mouse button or Ctrl+left mouse button to select multiple signals. Right-click and select “Group Signals to Bus” in the pop-up menu to combine bus signals. The name of the combined bus signal is related to the first signal name, as shown in Figure 4-19.

Figure 4-19: Combined Bus Signal (Lite Mode)



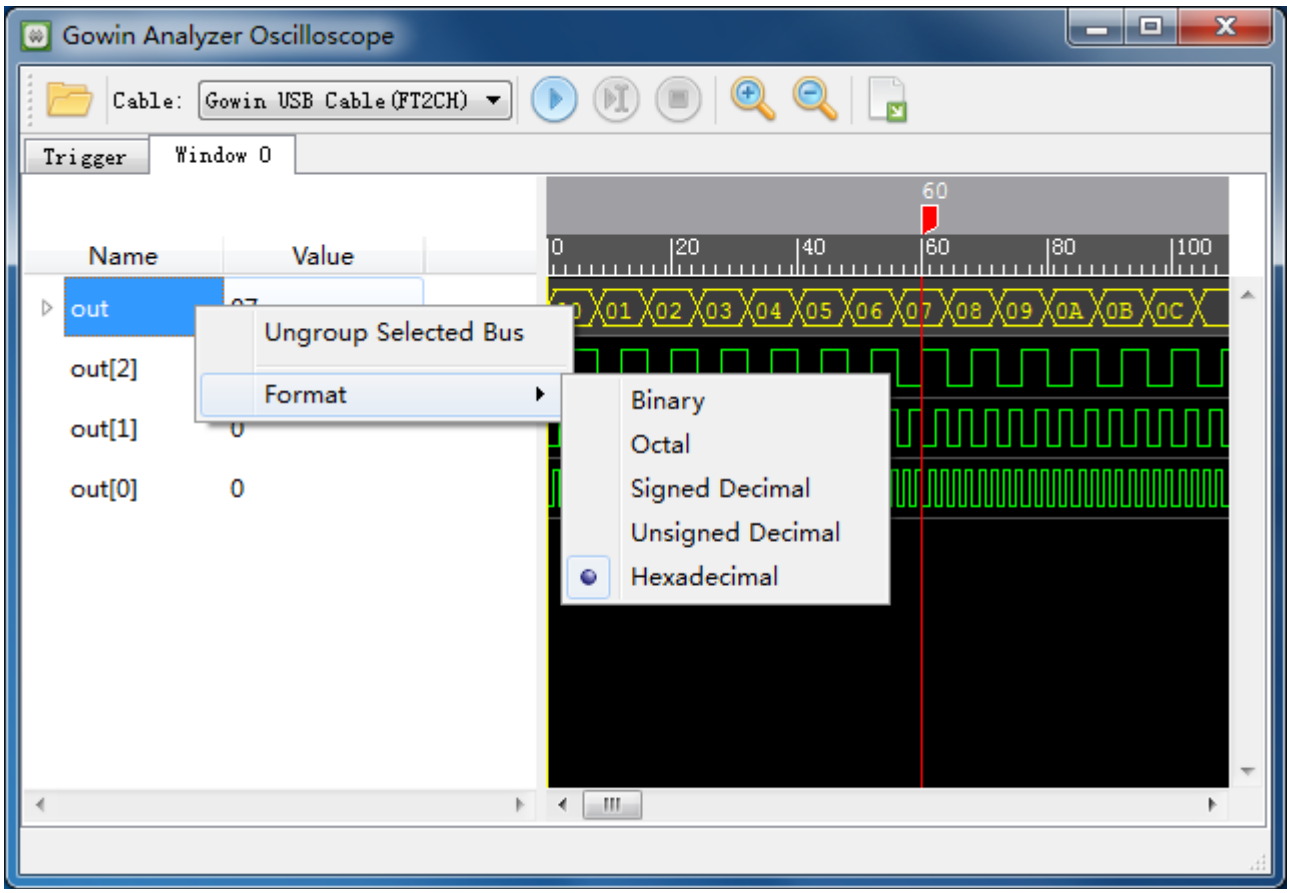
Note!

- Click on the “ ” icon again to capture the sampling signals waveform. The bus signal still exists.
- Right-click on the bus signal name in the “Name” column and select “Ungroup Selected Bus” in the pop-up menu to ungroup the bus signal.

Right-click in the value display area to open the pop-up window, as shown in Figure 4-20.

Select“Bin/Oct/Dec-Signed/Dec-Unsigned/Hex” for the sampling signals value display. It is displayed as bin by default.

Figure 4-20: Right-Clicking Menu of Format (Lite Mode)

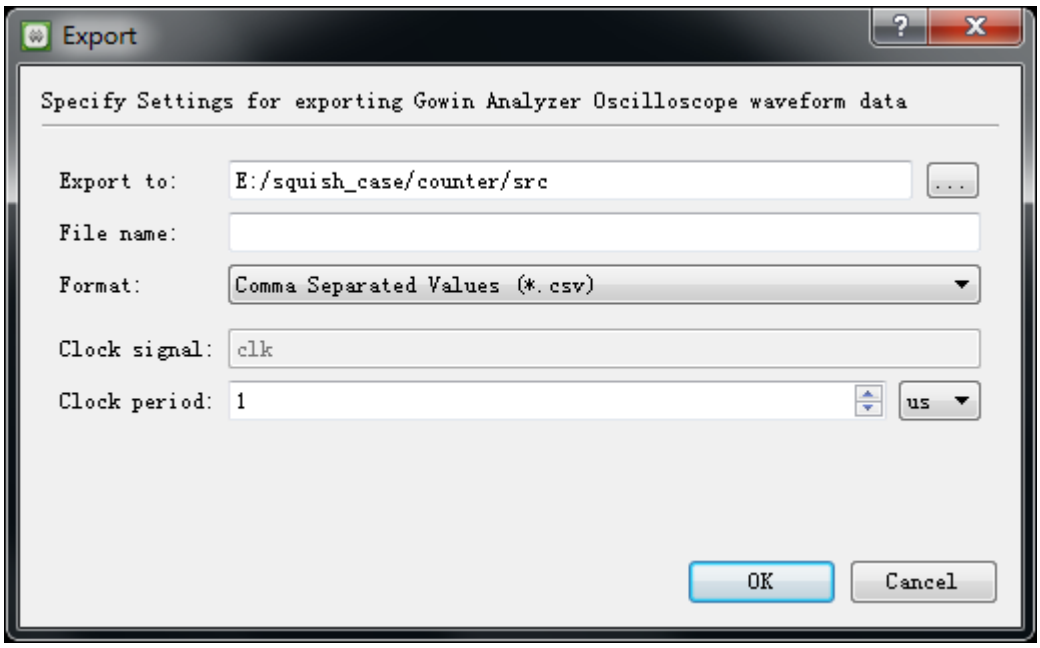


4.3.1 Export Waveform Data

The operation steps are as follows:

- Click on the waveform export button “ ” in the toolbar;
- The waveform export dialog box will pop up. Specify the waveform file information, including “Export to”, “File name”, “Format”, “Clock Signal”, “Clock period”. The Clock Signal is the sampling clock signal specified in the GAO, and the signal cannot be changed; the Format supports Comma Separated Values-(*.csv), and Value Change Dump-(*.vcd); The Clock period supports us, ns, ps, as shown in Figure 4-21.

Figure 4-21 Waveform Data Export



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