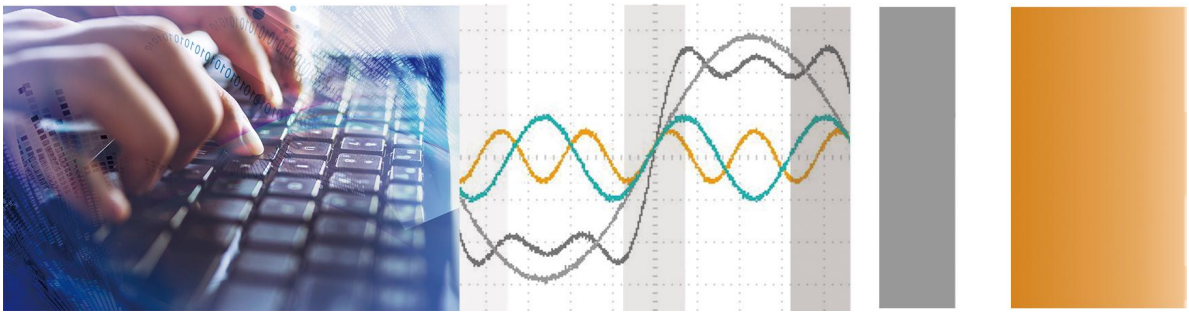
OWON®, a product of Lilliput

VDS6000 Series PC Oscilloscopes (VDS6102/A, VDS6102P)

User Manual



Warranty

Thanks for choosing OWON product, in the coming days, really hope you will enjoy the time that OWON product accompanies you.

OWON product, created and made by Lilliput.

Since the delivery date, OWON product been granted 36 natural months' warranty for device, and 12 months' warranty for attached parts / accessories.

* The delivery date here means the one written onto formal shipping documents given to first-hand buying party.

Within warranty period of OWON product, provided any non-outside force defects appear, Lilliput provides 3 options for first-hand buying party -

option 1. to return the defective product only;
option 2. to replace the defective product;
option 3. to repair the defective product.

To assure the timely service within warranty period of OWON product, the first-hand buying party should notify Lilliput of the non-outside force defects in no time, in written form.

This warranty shall not apply to any defect, damage caused by improper operation, or improper / inadequate maintenance towards OWON product. Lilliput shall not be obligated to under this warranty -
a). repair damages resulted from attempts by personnel other than those from Lilliput, or authorized one by Lilliput to repair or service OWON product;
b). repair damages resulted from improper operation, or improper connection to incompatible equipment towards OWON product;
c). service OWON product that has been modified or integrated with other products, provided the effect of such modification or integration increases the difficulty of servicing non-original OWON product.

THIS WARRANTY IS GIVEN BY LILLIPUT WITH RESPECT TO OWON PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. LILLIPUT AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. LILLIPUT'S RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. LILLIPUT AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER LILLIPUT OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

Table of Contents

I. General Safety Requirements

! Before using the device, Lilliput strongly recommend to browse "**Safety Warnings**" carefully and completely, so as to avoid any possible human body injury, or any damages to the device, or its accessories, or communicating facility. !

Safety Warnings

i. The device only been allowed to work within specified application scenario.

ii. Before communicating the device with PC, please refer to user manual to familiarize the allowed rating value completely.

iii. Making sure the allowed rating value of all terminals been well-followed, so as to avoid any potential short circuit or electric shock.

iv. NO direct human body touch with any naked conductor of device when working the device. The naked conductor covers joints, connecting probe tip, communication interface, and others.

v. No further operation is allowed provided any undetermined failure appears when working the device, better to seek the assistance of qualified technicians.

vi. DO NOT work the device in humid environment.

vii. DO NOT work the device in the explosive atmospheres.

viii. Keep the device in good ventilation environment, and always keep the device surface clean and dry.

ix. Better to send the device to qualified technicians for necessary maintenance.

II. Safety Terms and Signs

Safety Terms

Terms in this user manual. It covers,

Warning which indicates the condition or the operation may cause body injury or permanent life loss.

Caution which indicates the condition or the operation may cause device damage, or its accessory damage, or communicated facility damage.

Terms on the device. It covers,

Danger	which indicates the operation may result in the immediate human body injury.
Warning	which indicates the operation may result in potential human body injury.
Caution	which indicates the operation may result in potential damage to the device, or its accessory, or communicating facility.

Safety Signs

Signs on the device. It covers,

 Hazardous Voltage

 (please refer to user manual for further details)

 Protective Earth Terminal

 Chassis Ground

 Communication Interface Ground

To avoid possible human body injury, and / or device damage, and / or its accessory or communicating facility damage, before working the device, Lilliput strongly recommend to read the following safety information,

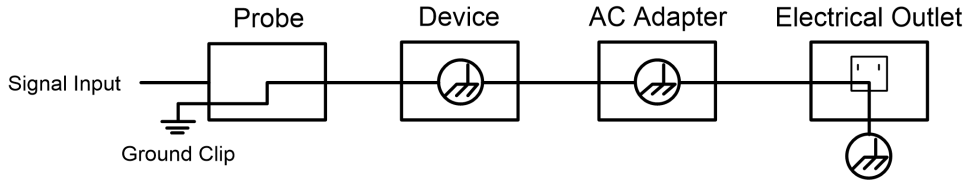
Warning

To avoid any potential short circuit or electric shock, DO use the power adapter of original local standard, or recommended by Lilliput.

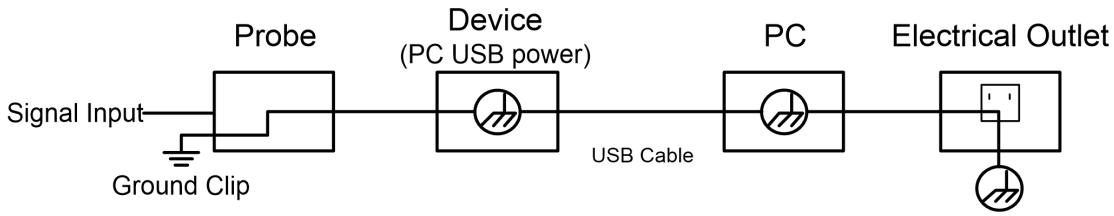
Warning

The channels of the device is non-isolated electrically. When working the device, to avoid possible short circuit, the ground of two probes are NOT allowed to connect to 2 different non-isolated DC level.

The illustration of the device's built-in ground wire connection -



When the device communicating with PC via USB communication interface (with PC powered by AC power source), the illustration of the ground wire connection -



It is NOT allowed to measure AC power when the device been powered by AC power source through the adapter, or when the device powered by PC through USB connection cable (via USB communication interface of PC, with PC powered by AC power source).

Warning

When the device input is getting through the voltage larger than 42 Vp-p (30Vrms), or on circuit of 4800+VA, to avoid any potential short circuit or electric shock -

i. DO use probes and adapter come along with the original device, or those ones recommended by Lilliput.

ii. Before working the device, DO check probes and accessories carefully to see whether any mechanical damages exists, making sure probes and accessories in normal-working status.

iii. When device in non-working condition, to remove probes and accessories firstly, then put them in suitable places.

iv. When working the device in CAT II environment,

DO NOT get the 40+ V input voltage from earth surface through any non-isolated input;

DO NOT get the 40+ V input voltage of dropout voltage through any non-isolated input

v. DO NOT input the voltage larger than the rated one, especially when probe attenuation set in 1:1, since the voltage from probe tip will go through to the device itself.

vi. NO NOT contact the exposed part of metal BNC terminal directly by hand or any other human body part.

vii. DO NOT insert any metal object into connectors.

- Note -

i). The rated voltage mentioned in point v. is the fixed value of working voltage, matching VACrms / 50 - 60Hz under AC sine wave application, and VDC under DC sine wave application;

ii). CAT II indicates local level for electrical appliance and portable device.

III. PC Configuration Requirements

Minimum System Requirement

CPU:	Pentium® 4/ 2.4 GHz
Internal Memory:	1GB
Effective Hard Disk Space:	1GB

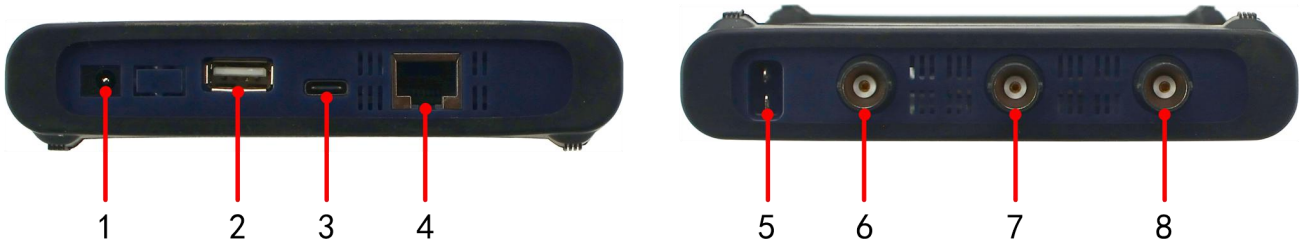
Recommended System Requirement

CPU:	Pentium® Dual-Core/ 2.4 GHz
Internal Memory:	2GB
Effective Hard Disk Space:	2GB

Other Requirement

Operating System:	Windows 10, or Windows 8 / 7 / Vista / XP (32-bit, or 64-bit)
Communication Interface:	USB 2.0, or USB1.1; LAN
LCD Resolution:	1024 x 768, or above

IV. Communication Interface Introduction



Figue IV-1. Communication Interface of the Device

1. power input: for AC-DC adapter

2. USB host: for Wi-Fi extension

3. USB device (type-C): for PC communication
Note: when the device powered by PC through USB connection cable (via USB communication interface of PC, with PC powered by AC power source), without adapter connection, the input current should reach 1.5A or above

4. LAN: for PC communication within network

5. Built-in Signal (3.3 V/1 kHz) Output: for probe compensation

6. MULTI: for signal output of function generator

7. CH2: for signal input

8. CH1: for signal input

V. How to Communicate the Device with PC

to communicate the device with PC, it's a must to install software firstly.

i. software installation solution

i). full installation

Target user(s): general PC oscilloscope user(s), and programmer(s) gets secondary development need

Installation process -

- On the basis that NI-VISA driver or similar VISA driver already worked normally onto PC, to install "VDS6000Series_PC_Software.exe" from accompanying CD which comes along with device.

- Provided no proper VISA driver found onto target PC, as first step, to install "ni-visa_19.5_online_repack.exe*" from accompanying CD which comes along with device.

*. This .exe file will instruct the user(s) to download NI-VISA driver, and the user(s) could choose necessary NI package kit in the process as well.

The second step is to run "VDS6000Series_PC_Software.exe".

ii). simple installation

Target user(s): general PC oscilloscope user(s)

Installation process -
To install Runtime version NI-VISA driver from accompanying CD which comes along with device firstly, after that, to run "VDS6000Series_PC_Software.exe".

iii). minimum installation

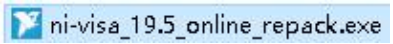
Target user(s): PC oscilloscope user(s) who only need to communicate the device with PC via direct network cable (no requirements for USB communication)

Installation process -
To run "VDS6000Series_PC_Software.exe" from accompanying CD which comes along with device directly.

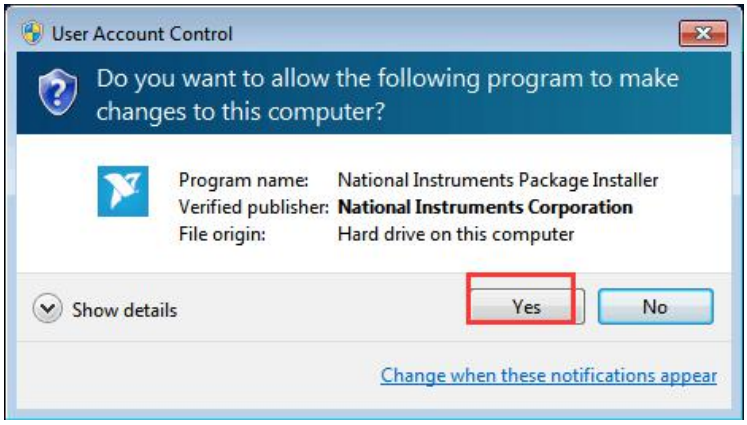
ii. to install NI-VISA driver

To assure PC software running normally, and smoothly, it is a must to install NI-VISA driver firstly.

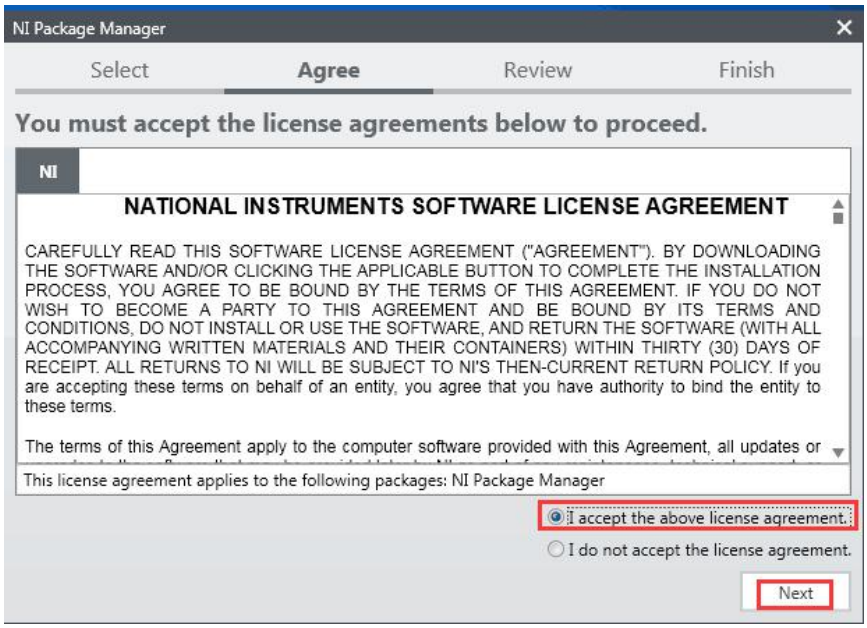
Note: On condition that NI-VISA driver, or similar VISA driver already worked normally onto the target PC, step ii could be skipped.

To run 

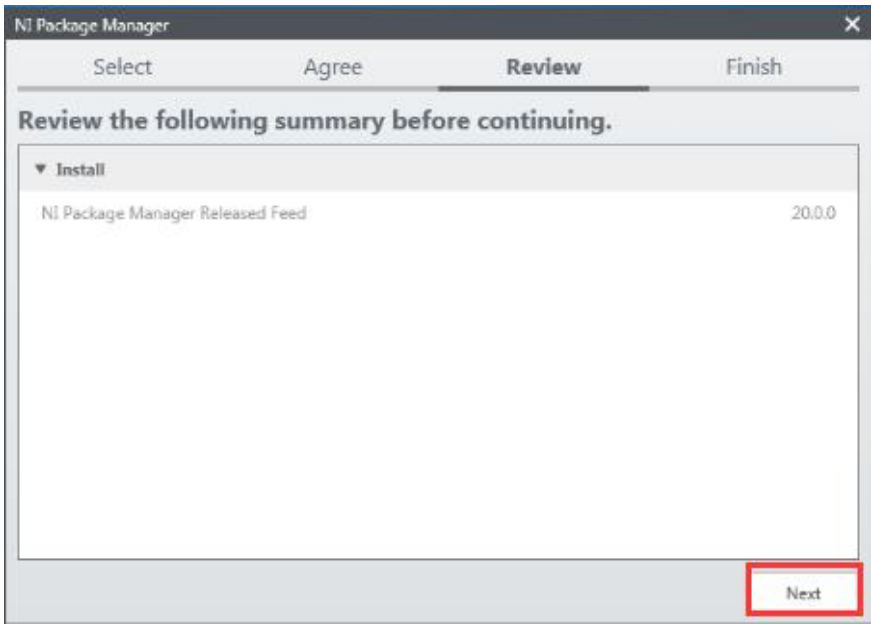
from accompanying CD which comes along with device, to start NI-VISA driver installation,



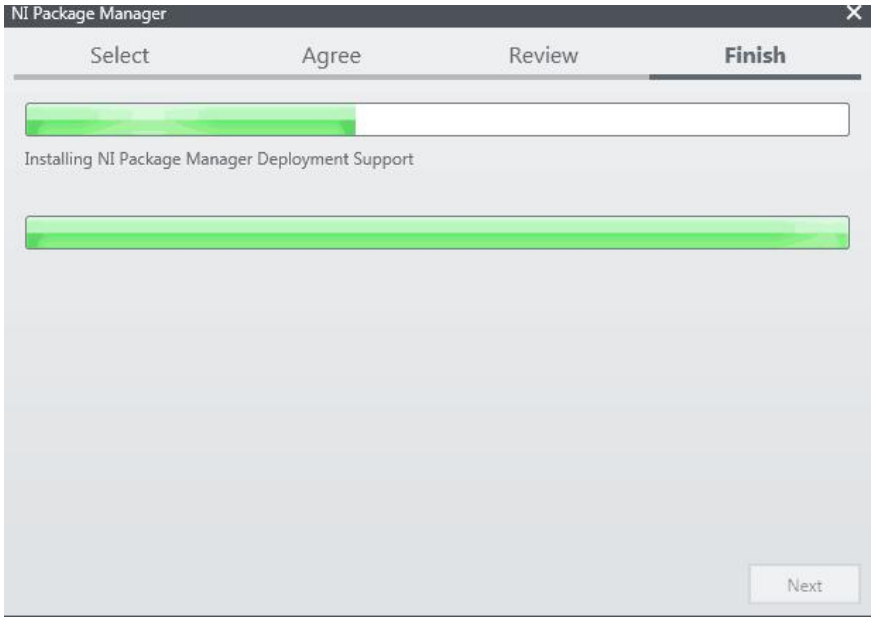
click “Yes” to continue, and following window comes,



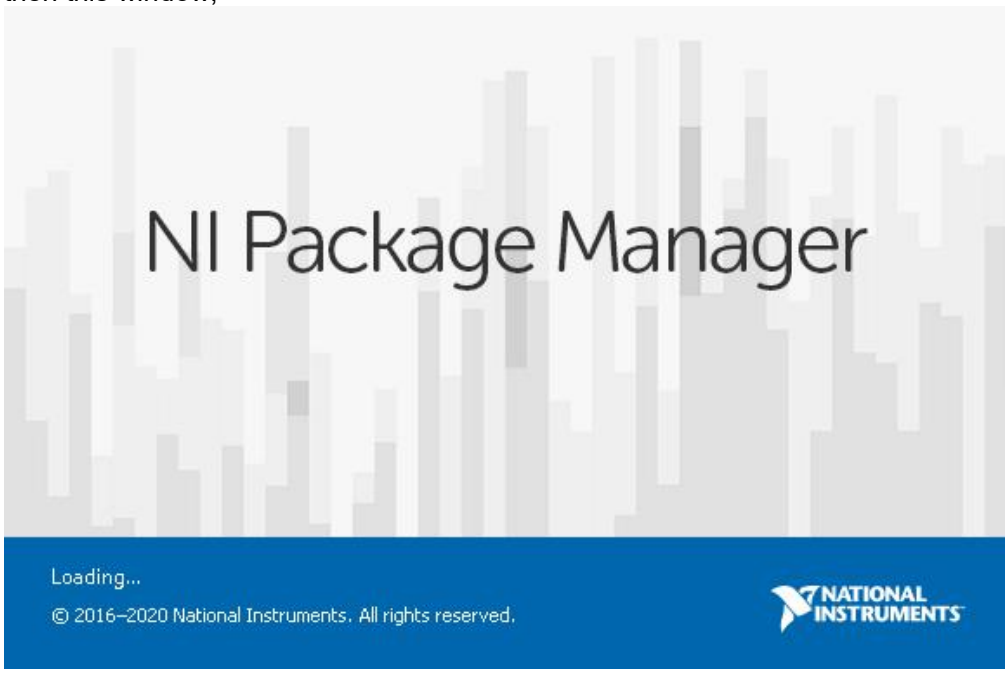
dot-tick "**I accept the above license agreement**", then "**Next**",



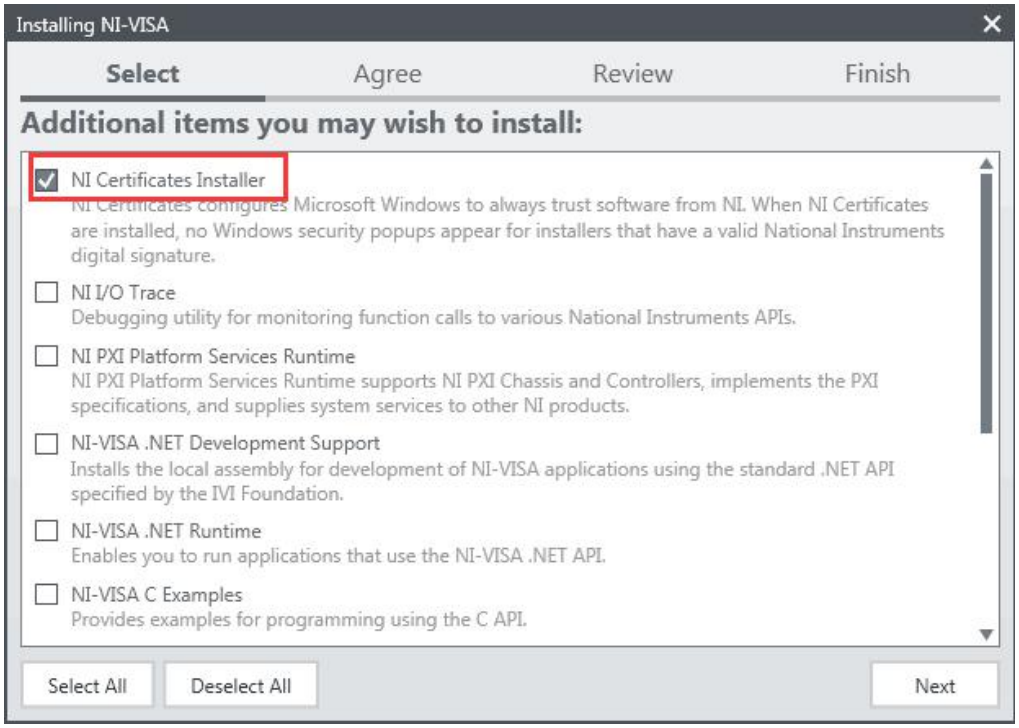
another “Next”, to enter into NI Package Manager processing window,



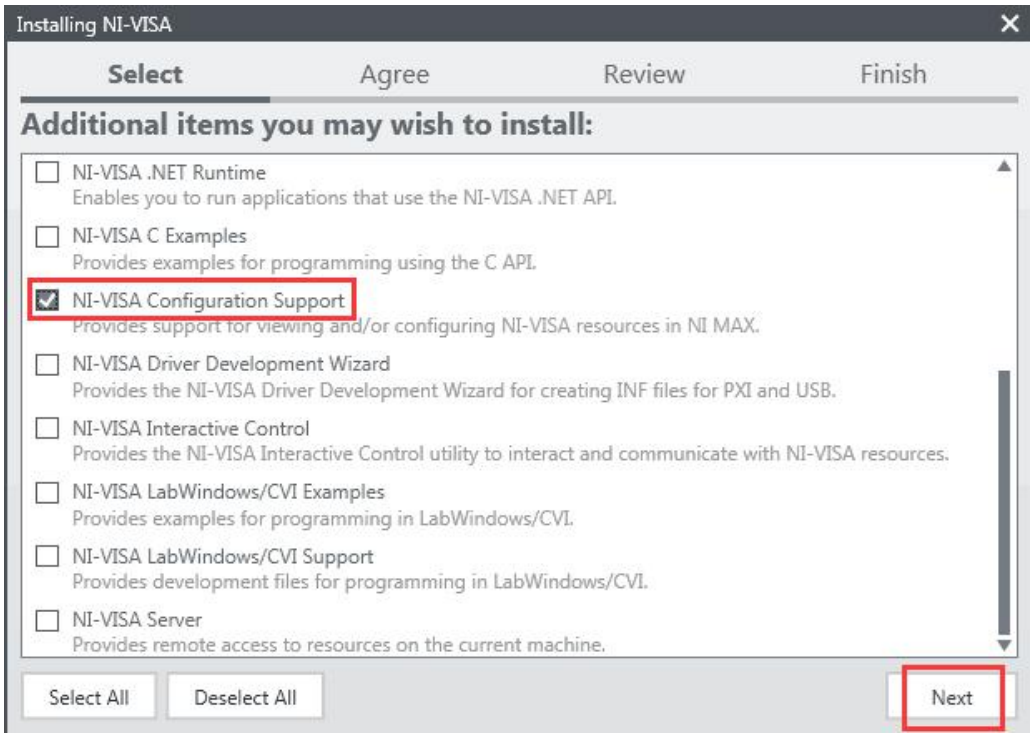
then this window,



later, when following window appears,

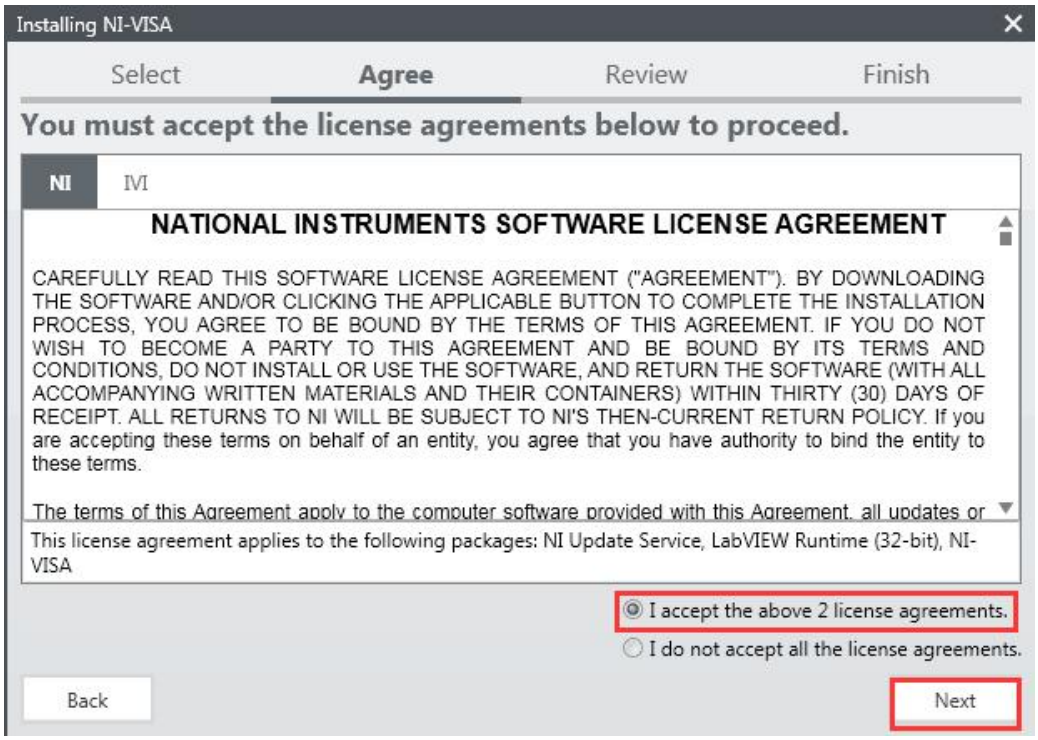


to select additional items you may wish to install,



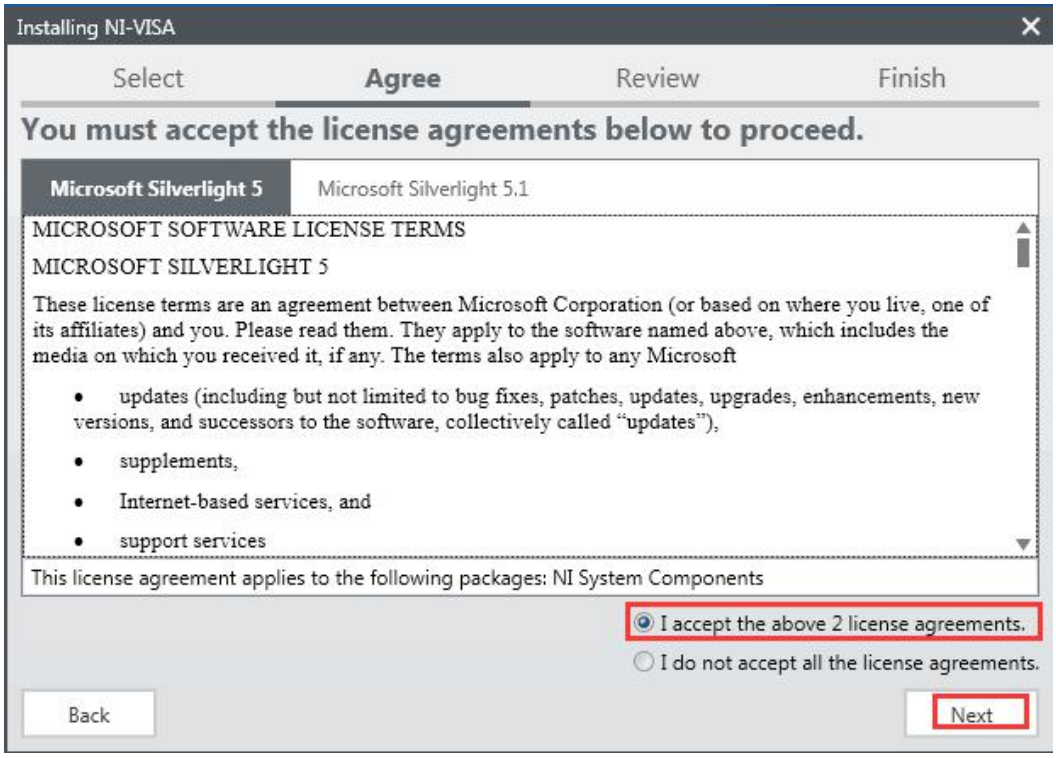
via scroll bar, to select more necessary options,

from here,



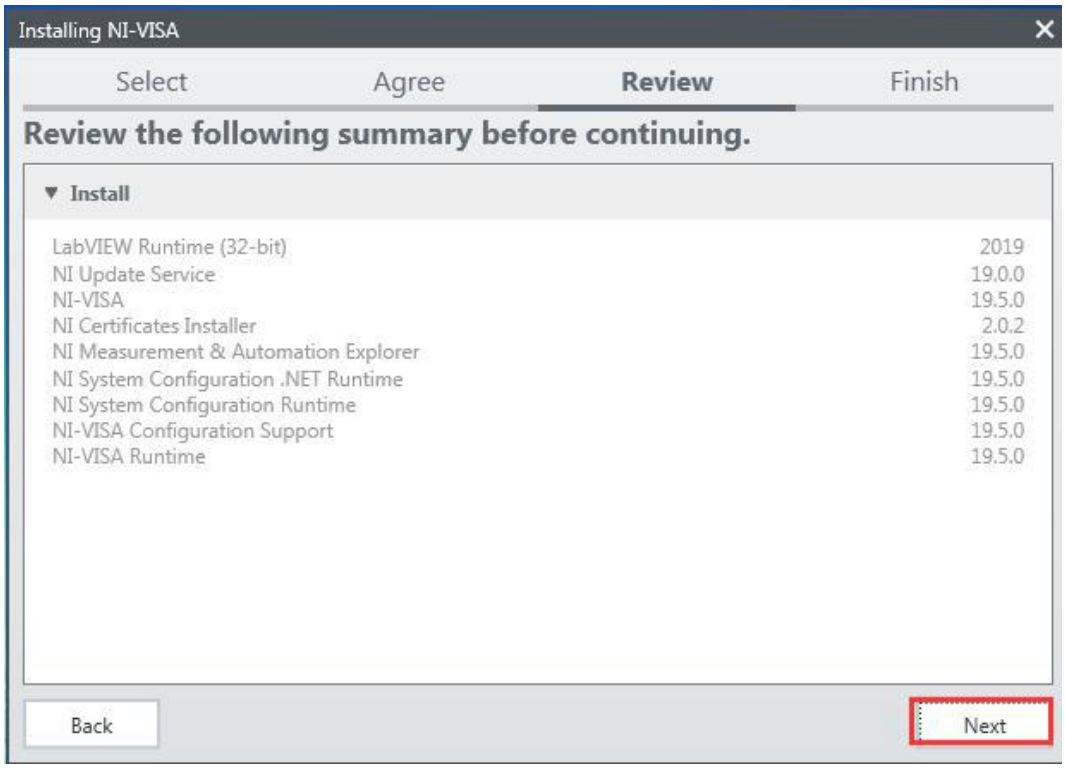
dot-tick "**I accept the above 2 license agreements**", again "**Next**",

until this window,



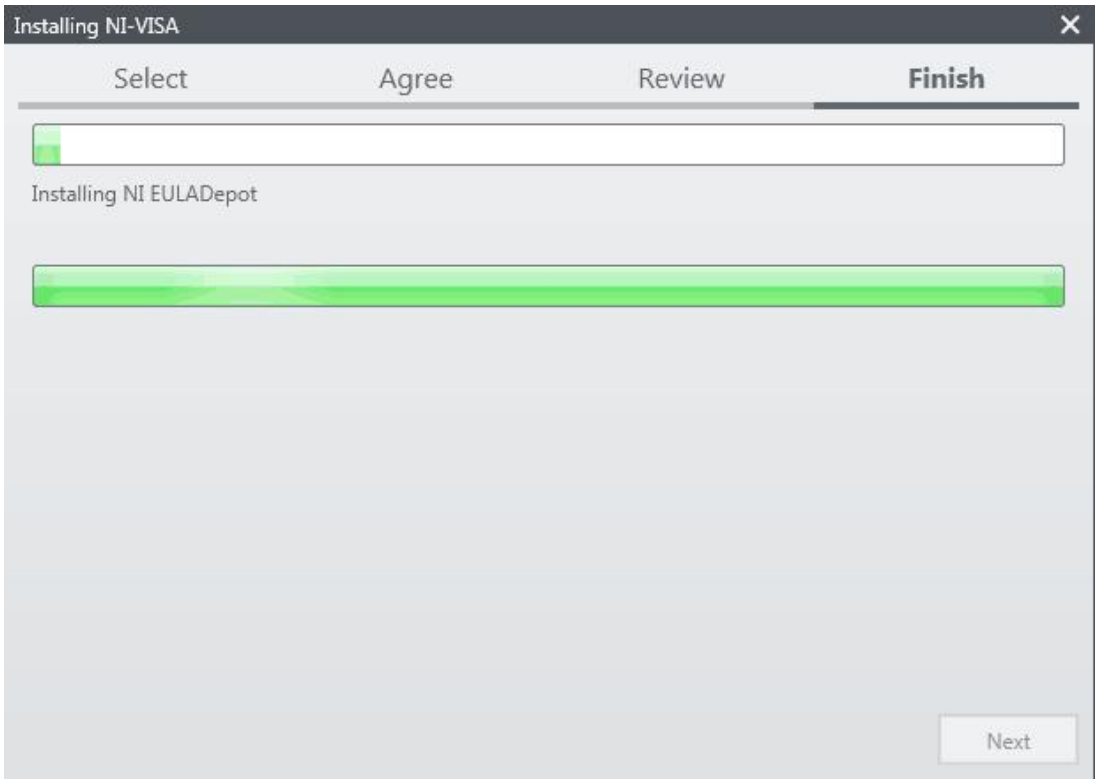
dot-tick "**I accept the above 2 license agreements**" for another time, and another "**Next**",

to welcome “Review” window,



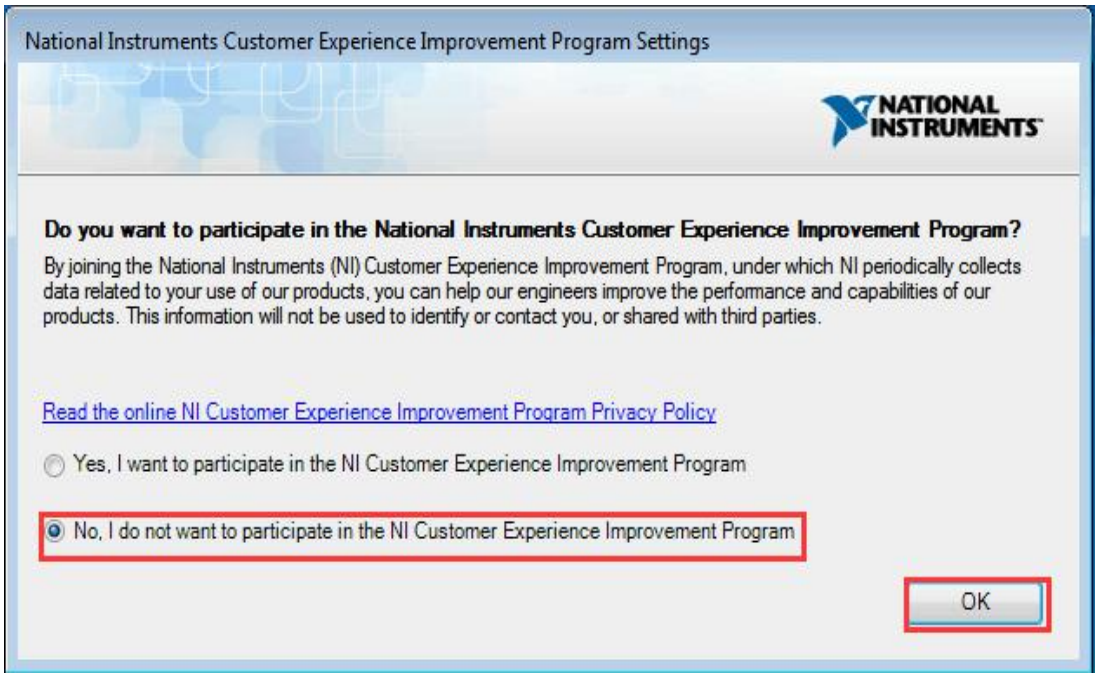
via “Next”,

to get access to NI-VISA installation,



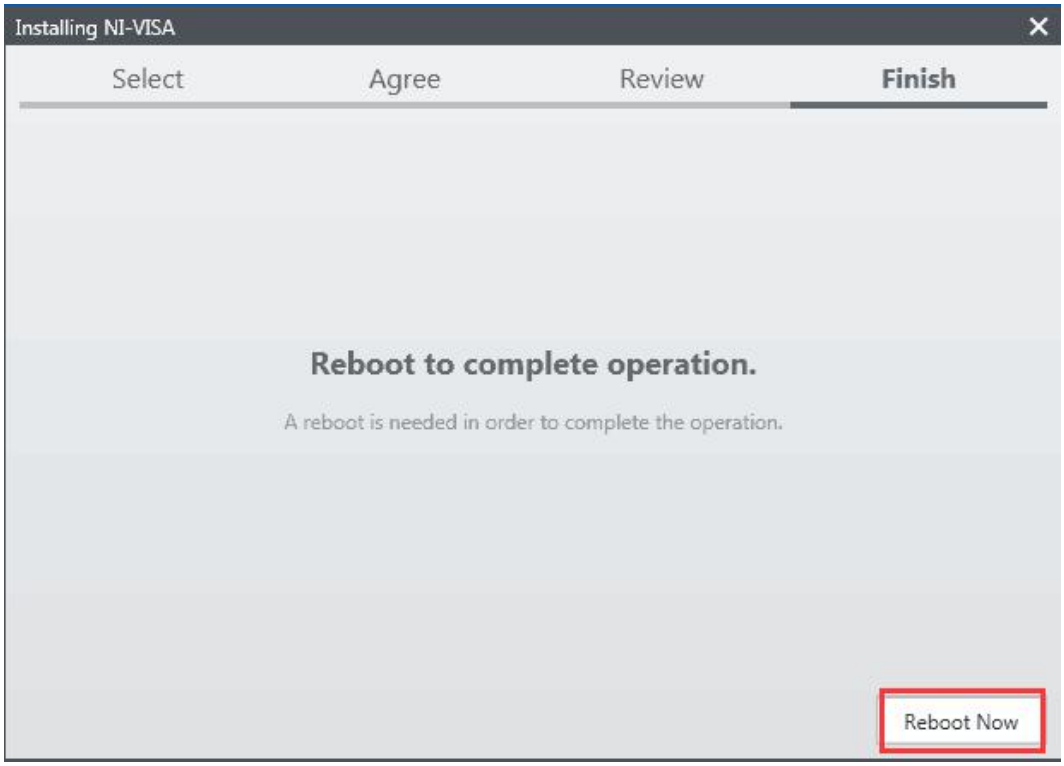
one more “Next”,

to make your decision at this window,



then press “Ok” to finish the whole process,

this window indicates the successful installation,



to reboot the PC through mouse-clicking “Reboot Now”

After PC restarts, the NI-VISA driver been installed onto target PC successfully.

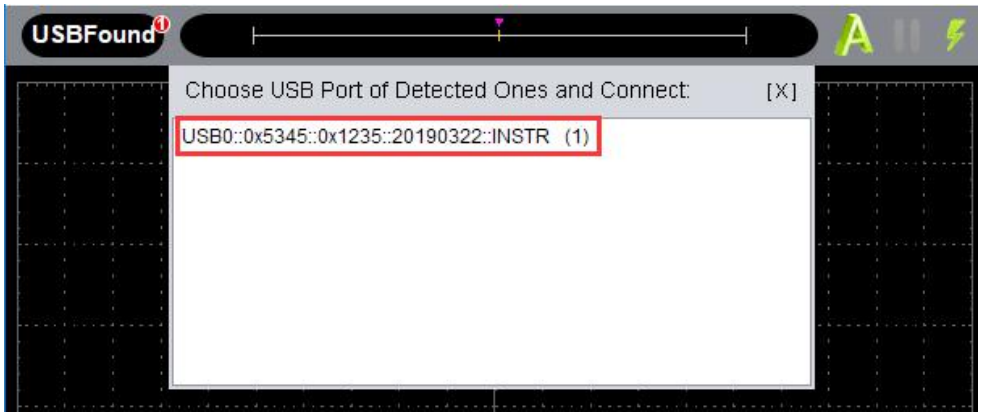
iii. to install PC Software
To run “VDS6000Series_PC_Software.exe” from accompanying CD which comes along with device directly, to install PC software accordingly.

iv. to work PC Software
Via short-cut to PC software from the desktop of target PC, double-click “VDS6000 Series PC DSO” to start the software.

v. to communicate the device with PC
The user(s) gets 2 options to communicate the device with PC: through USB communication port, or through LAN port.

to communicate the device with PC through USB communication port
After powering the device via AC-DC adapter, its status indicator lights red for seconds.

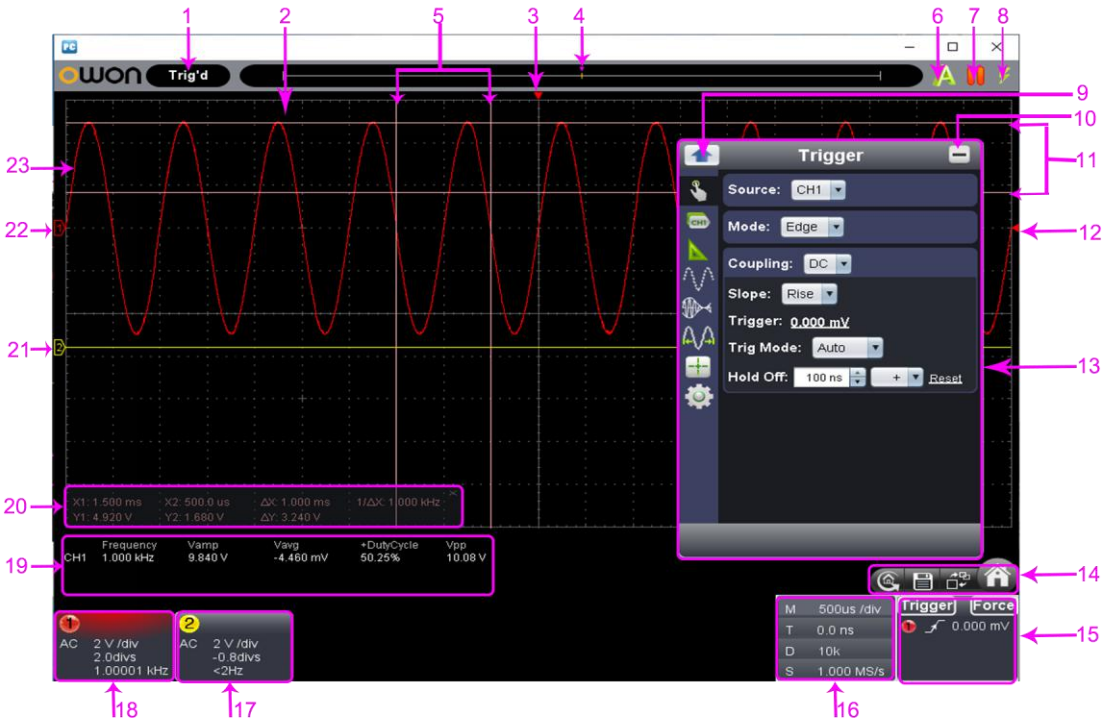
Via USB connection cable (type-C), through matching communication interface, to connect the device with PC. When the status indicator lights green, PC software detects effective USB port, mouse-click the detected option to communicate the device with PC.



to communicate the device with PC through LAN port
2 solutions available to communicate the device with PC through LAN port -
Solution 1. By socket connection, upon with the combination of IP address and port, please refer to xiii. how to use socket connection from VII. Device Operation.

Solution 2. By adding LAN/LXI network device, please refer to xiv. how to use LAN communication interface from VII. Device Operation, and xv. how to work WiFi with PC software from VII. Device Operation.

VI. Operation Interface of PC Software



12. Red Pointer: the trigger level position of Channel 1;
    Yellow Pointer: the trigger level of Channel 2.

    Via dragging Red / Yellow Pointer upwards or downwards, to adjust the trigger level position of Channel 1 / 2.

13. Function Menu: to hide/show it via mouse-clicking  ; each side-bar icon matches corresponding function, please refer to Home of Function Menu for details -

14. Shortcut to back to default factory settings, please refer to "Default" ;

    Shortcut to export signal data, please refer to "Pause & Export" ;

    Shortcut to switch between 3-window / 1-window VIEW. When working in 3-window VIEW, the upper-left window is for XY mode.

    Shortcut to hide/show Function Menu

15. Trigger extension window, please refer to iv. how to set the trigger system from PC software
16. Sample and Period extension window, please refer to iii. how to set the horizontal system from PC software
17. Channel extension window for Channel 2, please refer to ii. how to set the vertical system from PC software
18. Channel extension window for Channel 1, please refer to ii. how to set the vertical system from PC software
19. Measurement Details extension window for Channel 1 and Channel 2, please refer to vi. how to use automatic measurement
20. Cursor Measurement extension window, please refer to ix. how to use cursor measurement
21. Yellow Pointer: to show the grounding base point (zero point) of Channel 2; provided no Yellow Pointer comes, it means Channel 2 is off.
22. Red Pointer: to show the grounding base point (zero point) of Channel 1; provided no Red Pointer comes, it means Channel 1 is off.
23. The Displayed Area of Input Signal of Channel 1.

Status Details List

i. following status appears when communicating the device and PC

Linking	the device is communicating with PC
Connect	the device successfully communicates with PC
Match	the PC software is matching the device as per model type
Syncing	the PC software is synchronizing the device's settings

ii. following status reflects the communication between the device and PC

Offline	no communication between PC software and the device
USBFound	the device found
USBDrvErr	USB driver installation error appears
MachineNotSupport	the device not identifiable

iii. following status indicates the working of the device

Auto	automatic trigger mode
Ready	ready for receiving trigger
Trig'd	signal triggered
Scan	slow scan mode
Stop	the device stops acquiring signal data
Error	error occurred
ReSyncing	re-synchronize with the device
AutoSet	in process of auto setting

Keyboard Shortcuts

F5	Run/Stop
Ctrl + Enter	Auto Set
Q	1 division less from Channel 1’s voltage division
A	1 division more from Channel 1’s voltage division
W	1 division less from Channel 2’s voltage division
S	1 division more from Channel 2’s voltage division
←	1 division less from time base
→	1 division more from time base

VII. Device Operation

i. how to set the probe compensation

Before working the probe with either of input channels (Channel 1 / Channel 2), better to adjust its compensation, so as to assure ideal measurement effect. Following operation steps to adjust probe compensation -

i) From PC software operation interface, mouse-click  to get access to device function menu, choose "Channel";

ii) then "**CH1**", set the "**Probe Rate**" at certain option (either **x1**, or **x10**, or **x100**, or **x1000)**. Next, from physical probe, switch the probe attenuation to the matching option correspondingly.

Note: The probe compensation setting from function menu will keep valid until new setting change introduces.

Caution:

The default probe compensation setting into PC software reads **x10**, before working the probe with the device, making sure the probe compensation of both places is matching.

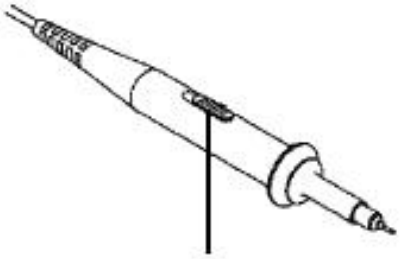
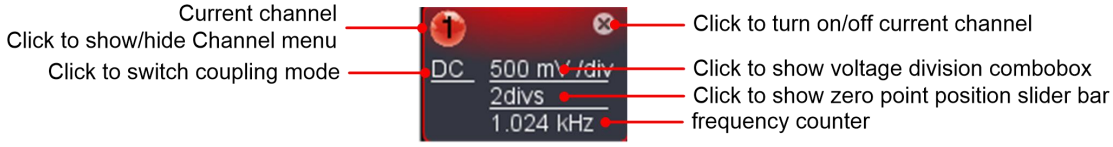


Figure VII- 1. Probe Attenuation Switch Position

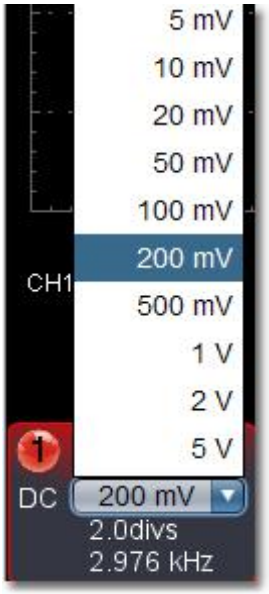
Caution:

For physical probe, when the compensation set in **x1**, the probe itself will limit the device bandwidth at 5MHz.

To reach the full bandwidth, the physical probe's compensation should be set in **x10**, or above.

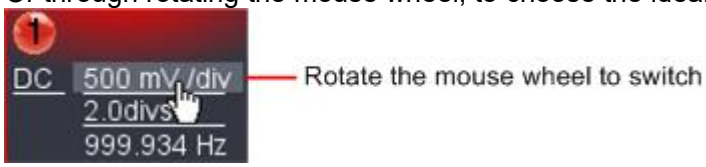


Through voltage divisions,

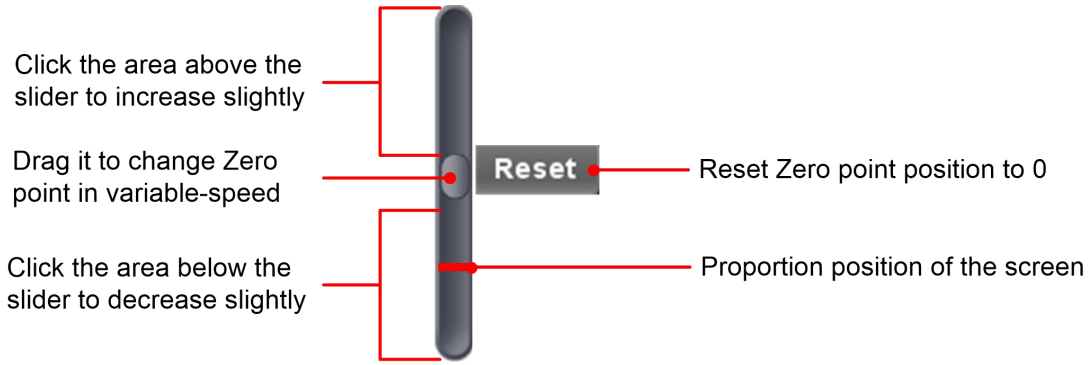


choose the ideal option.

Or through rotating the mouse wheel, to choose the ideal option.



Through zero point position control bar,



to reset zero point position will change the vertical position of the signal, via moving the slider upwards, or downwards - the farther slider from the center of control bar, the faster the vertical position changes.

Another solution is to drag the zero point pointer upwards or downwards (as item 22 and 21 goes under VII. Operation Interface of PC Software).

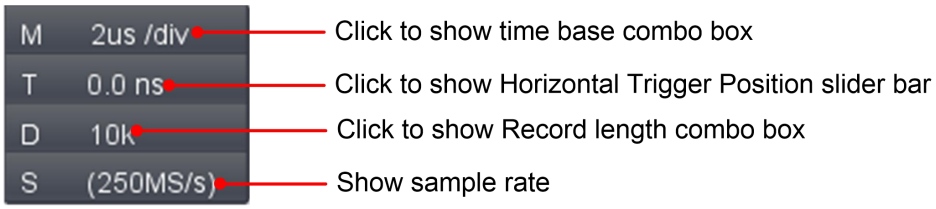
Keyboard Shortcuts	
Q	1 division less from Channel 1's voltage division
A	1 division more from Channel 1's voltage division
W	1 division less from Channel 2's voltage division
S	1 division more from Channel 2's voltage division

Frequency Counter

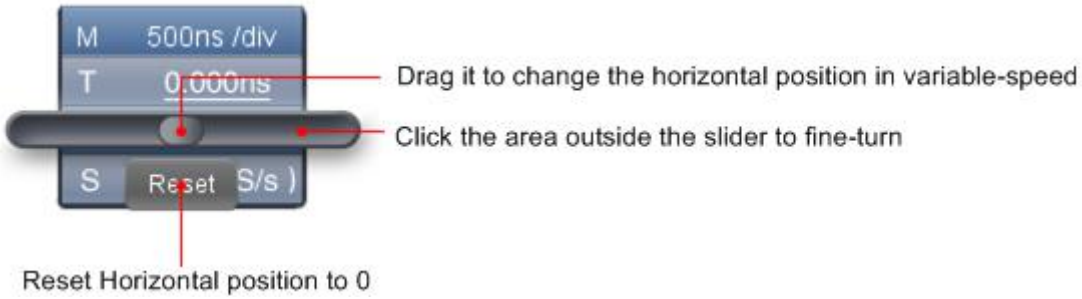
The device gets built-in 6-digit frequency counter, with frequency measurement range starts from 2Hz till full bandwidth.

iii. how to set the horizontal system from PC software

Via “Sample and Period extension window” (as item 16 described under
VII. Operation Interface of PC Software), related options of horizontal system could be adjusted accordingly.



Through horizontal position control bar,



to reset the horizontal position of the signal, via moving the slider leftwards, or rightwards - the farther slider from the center of control bar, the faster the horizontal position changes; or through dragging the red pointer to reset the horizontal position of the signal (as item 3 goes under
VII. Operation Interface of PC Software).

Keyboard Shortcuts	
←	1 division less from time base
→	1 division more from time base

iv. how to set the trigger system from PC software

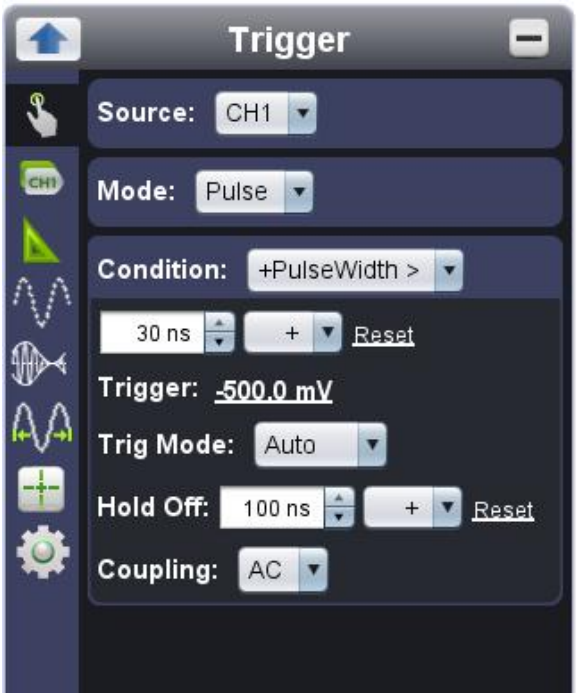
The “trigger” commands the device to capture the signal at what time, and then output the result - in the form of waveform. Once trigger been set properly, the output result will be valuable waveform over unstable signal segmentation.

How trigger works ? When trigger been set, before trigger condition met, the device will collect the data as more as possible so as to output the ideal result in the left side of the trigger point; then once trigger condition met, the device will capture the data continually, and completely to output the ideal result in the right side of the trigger point.

Mouse-click  to get access to Function Menu,

Note: For first operation, after mouse-clicking , the Home of Function Menu comes,

via to choose "**Trigger**" option (or mouse-click Trigger from right-bottom extension window to show this option).



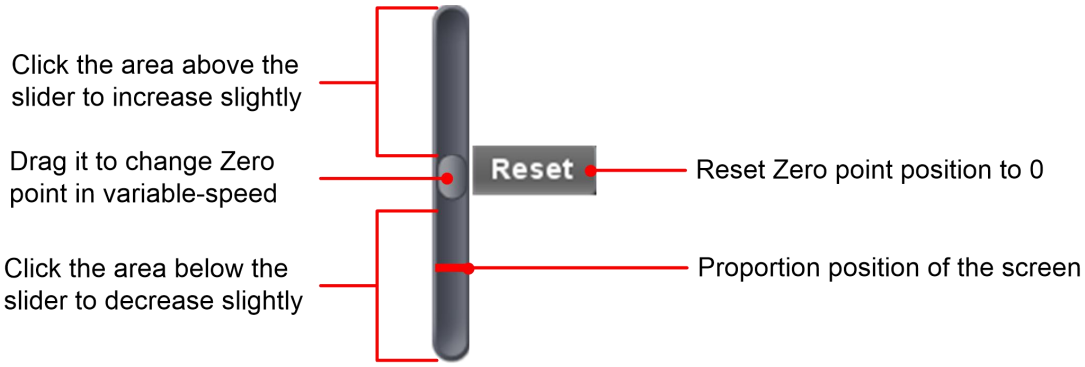
The **Trigger** option here indicate single trigger, it is the one to use one trigger signal to capture data from two channels, simultaneously, the operation steps -

i). choose “CH1” or “CH2” from “Source”;
ii). next “Mode”, 4 options under “Mode”: edge trigger, video trigger, slope trigger and pulse trigger.

Edge Trigger: when certain level gets through trigger signal input at certain direction, edge trigger happen

Video Trigger: field / line trigger on standard video signal
Slope Trigger: triggers on signal's rising / falling rate
Pulse Trigger: to capture certain pulse width at given trigger condition

1 Edge Trigger
i. choose "Edge" from "Mode", to trigger on the threshold value of input signal;
ii. choose "Rise" under "Edge" to trigger on the rising edge of input signal; and to choose "Fall" to trigger on falling edge of input signal;
iii). click the voltage value after "Trigger" (below "Rise" or "Fall") to show slider bar. The Red / Yellow Pointer could be dragged to adjust the trigger level position, please refer to item 12 under VII. Operation Interface of PC Software ;



iv). use suitable "Trig Mode" from 3 options -

Auto	in this trigger mode, the device could capture the signal without set trigger condition
Normal	in this trigger mode, only capture the signal with set trigger condition met
Single	in this trigger mode, only capture the signal once with set trigger condition met once, then stop

v). input "Hold Off" time
It's for setting the time interval to re-activate the trigger, the timespan ranges 100ns till10s.

Setting method: choose "+"/"++"/"+++", click ▲, or ▼, the last/middle/first digit will go upwards/downwards by 1.

Click "Reset" after this option to get Hold-off time back to default status, say, 100ns.

Or to set options through "Trigger extension window":

Force (Trigger): to create a trigger signal by force, mainly work for "Normal" and "Single" mode under "Trig Mode".

2) Video Trigger
i) choose "Video" from "Mode", to trigger on fields / lines of video signals;
ii) choose NTSC, or PAL, or SECAM standard under "Video";

iii) pick up one trigger synchronization method from Line / Field / Odd Field / Even Field / Line Number. The concrete line number could be set when "Line Number" is picked up.
iv) Hold Off setting, please refer to point v) under **1) Edge Trigger**.

3) Slope Trigger

i) choose "Slope" from “Mode”, to set the trigger condition on the positive/negative slope within the specified time;
ii) pick up suitable slope “Condition”;
iii) set slope time;
iv) set the upper limit of “High Level”, and the lower limit of “Low Level”;
v) set “Trig Mode”, please refer to point iv) under **1) Edge Trigger** ;
vi) set “Hold Off”, please refer to point v) under **1) Edge Trigger**.

Slew rate comes as a result by auto-calculating, it = (High Level vale - Low Level value) / slope time

4) Pulse (Width) Trigger

i) Choose “Pulse" from “Mode”.
Under pulse trigger, the pulse width decides the trigger time, and the unusual pulse could be captured through setting special pulse trigger condition.
ii) pick up suitable pulse “Condition”;
iii) set pulse time;
iv) set “Trigger” level;
v) set “Trig Mode”, please refer to point iv) under **1) Edge Trigger** ;
vi) set “Hold Off”, please refer to point v) under **1) Edge Trigger**.

Know more about icons from “Trigger extension window” -

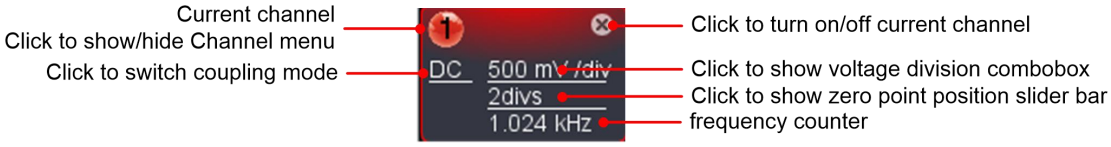
 Rise in Edge mode
 Fall in Edge mode
 synchronized trigger in Line under Video mode
 synchronized trigger in Field under Video mode
 synchronized trigger in Odd Field under Video mode
 synchronic trigger in Even Field under video mode
 Rising Condition in Slope mode
 Falling Condition in Slope mode
 +Pulse Width Condition in Pulse mode
 -Pulse Width Condition in Pulse mode

v. how to set channel from PC software

From Function menu, via  to choose certain channel, or to mouse-click  or  from “Channel extension window for Channel 1 / Channel 2” (please refer to item 18 / 19 under VII. Operation Interface of PC Software) to choose certain channel.

to turn on/ turn off Channel 1 / Channel 2

Press "CH1" or "CH2" to choose target channel, check "On" to turn on the target channel, uncheck “On” to turn off the target channel. As alternative method goes, from “Channel extension window for Channel 1 / Channel 2”, click right-upper icon as marked below.



to invert a displayed waveform

waveform invert: to turn the displayed waveform in 180 degrees against the earth potential
Press "CH1" or "CH2" to choose the target channel, check "Invert" to invert the displayed waveform in 180 degrees, uncheck “Invert” to back to normal display status.

to set bandwidth limit

Mouse-click “20M”, or "Fullband"

20M: set the channel bandwidth at 20MHz - it’s for reducing the noise of displayed waveform

Fullband: restore the channel bandwidth to full bandwidth.

to set channel coupling

DC: when this option chosen, both direct and alternating components of the input signal could get through
AC: when this option chosen, the direct component of the input signal will be shielded
Ground: when this option chosen, the input signal be disconnected

From “Channel extension window for Channel 1 / Channel 2”, click certain icon functions the same.

to set the probe compensation

To assure ideal measurement result, the built-in probe compensation setting from Function menu should always match the one onto physical probe for target channel (please refer to
i. how to set the probe compensation).

Giving one example: when the attenuation of the physical probe for target channel set in x1, the built-in probe compensation setting from Function menu should be set in x1 as well.

to measure current
It's possible to measure current via certain unit conversion, the detailed operation is, to use probe to measure the voltage drop across certain resistor.

Press "CH1" or "CH2" to choose target channel, then check "Measure Current On", via  or  to set the A/V ratio (Amps/Volts ratio).

Amps/Volts ratio = 1/Resistor value.

vi. how to use automatic measurement

From Function menu, via  , enter into "**Measure**" option.
When moving the mouse at the main display area, on the left,  will appear, click it, the Measure menu will hide; another click will show the Measure menu.

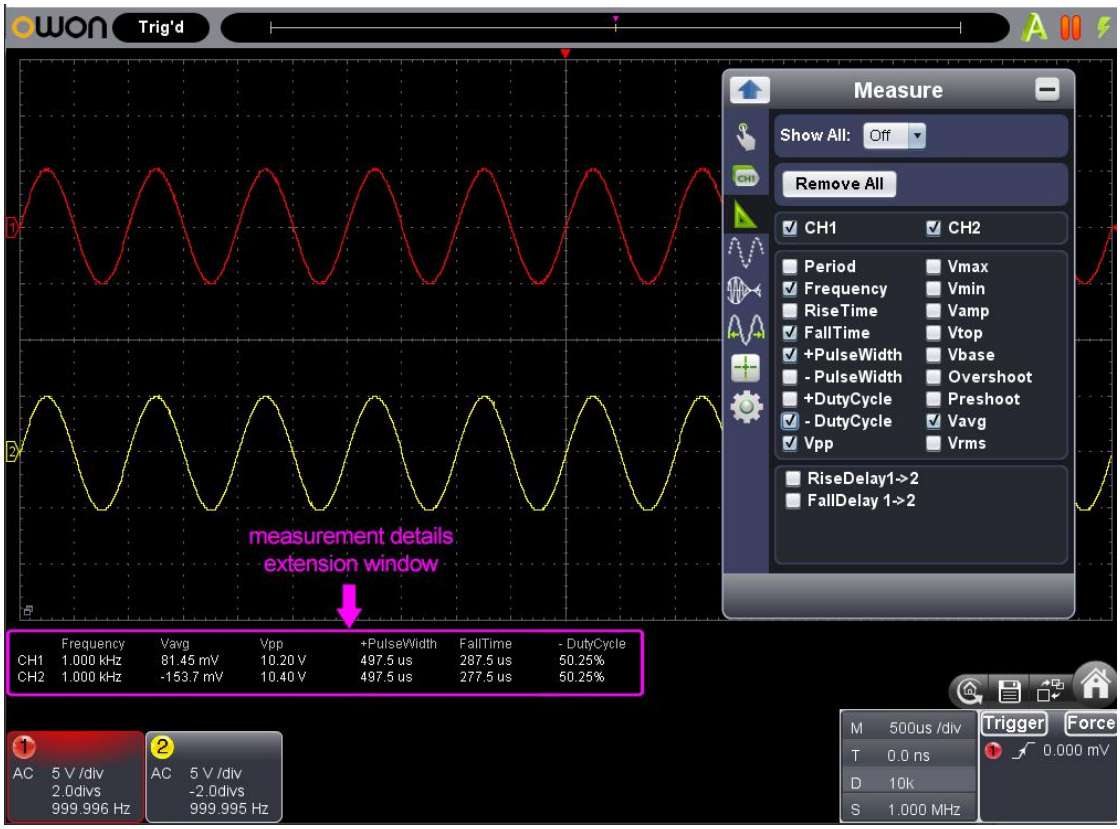
Automatic measurement available in 20 options under Measure menu. From the left-bottom of the main display area, up to 8 measurement options could be accommodated.

All of 20 automatic measurement options go in Vpp, Vmax, Vmin, Vtop, Vbase, Vamp, Vavg, Vrms, Overshoot, Preshoot, Frequency (abbreviated as "Freq"), Period, Rise Time, Fall Time, Delay A→B, Delay A→B , +Width, -Width, +Duty, -Duty.

The "**Measure**" option covers several useful functions -
Show All: When choosing Channel 1, or Channel 2 from "Show All", one window will be called out, to show all of involved measurement values from Channel 1, or Channel 2.

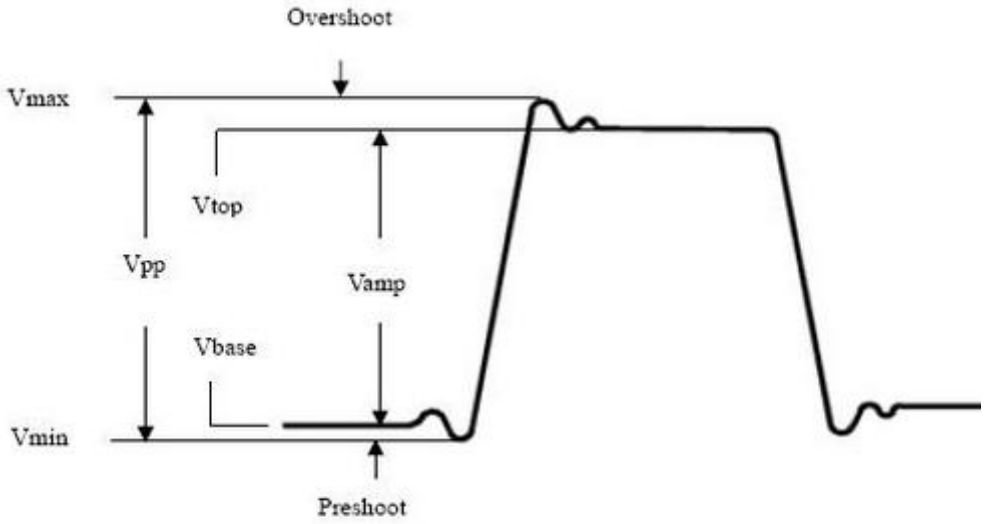
Add measurement: Check CH1, or CH2, or both firstly, the measurement results will come in full details at the left-bottom of the main display area. Provided any/all of the current 8 measurement options not the required, another 8 measurement options possible to add for each channel. The new measurement option(s) will replace the current one(s) in the order of first till last.
Note: The measurement results of both channels possible to come together.

Remove measurement: Uncheck certain measurement option (20 options in total) to remove it. Mouse-click "Remove All" button to remove all of 20 measurement options.



automatic measurement options towards voltage value
10 options involved: Vpp, Vmax, Vmin, Vavg, Vamp, Vrms, Vtop, Vbase, Overshoot and Preshoot.

Following illustration to assist better understanding different measurement options,



Definitions about these options -

Vpp voltage between upper peak and lower peak from measured signal

Vmax voltage between upper peak and ground (GND)

Vmin voltage between lower peak and ground (GND)

Vamp voltage between flat top and flat base from measured signal

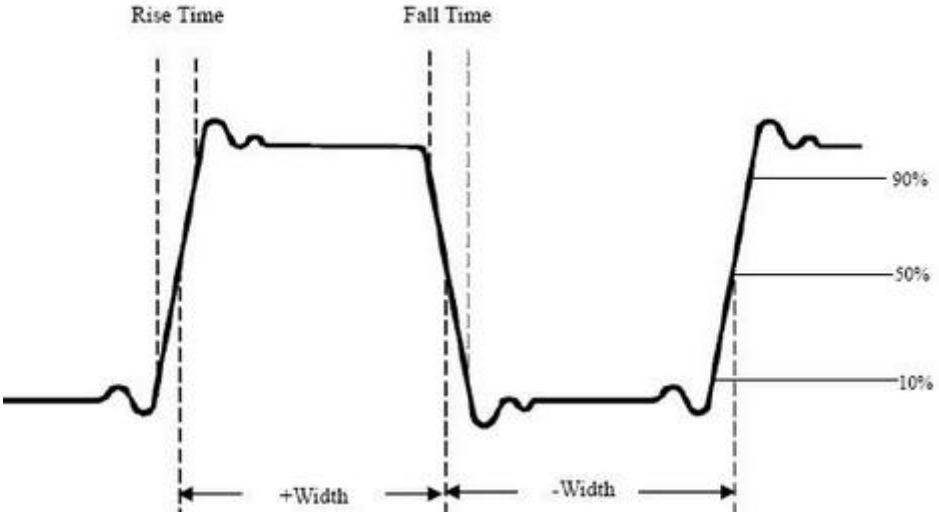
Vtop voltage between flat top and ground (GND)

Vbase	voltage between flat base and ground (GND)
Overshoot	equals (Vmax - Vtop) / Vamp
Preshoot	equals (Vmin - Vbase) / Vamp
Vavg	the arithmetic average voltage value of complete measured signal, or chosen part of measured signal
Vrms	true RMS voltage value over complete measured signal, or chosen part of measured signal

automatic measurement options towards time measurement

10 options involved: Frequency (abbreviated as “Freq”), Period, Rise Time, Fall Time, +Width, -Width, Delay 1→2, Delay 1→2, +Duty and -Duty.

Following illustration to assist better understanding different measurement options,

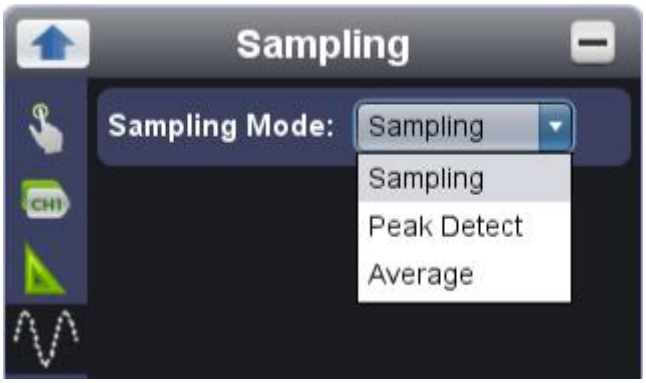


Definitions about these options -

Rise Time	the time span for signal amplitude rise from 10% to 90%, judged by the rising edge of its first pulse
Fall Time	the time span for signal amplitude fall from 90% to 10%, judged by the falling edge of its first pulse
+Width	the pulse width that the first positive pulse at 50% amplitude point
-Width	the pulse width that the first negative pulse at 50% amplitude point
Delay 1→2	the time delay of Channel 1 and Channel 2 at rising edge
Delay 1→2	the time delay of Channel 1 and Channel 2 at falling edge
+Duty	measured by +Width / Period
-Duty	measured by -Width / Period

vii. how to set sampling mode

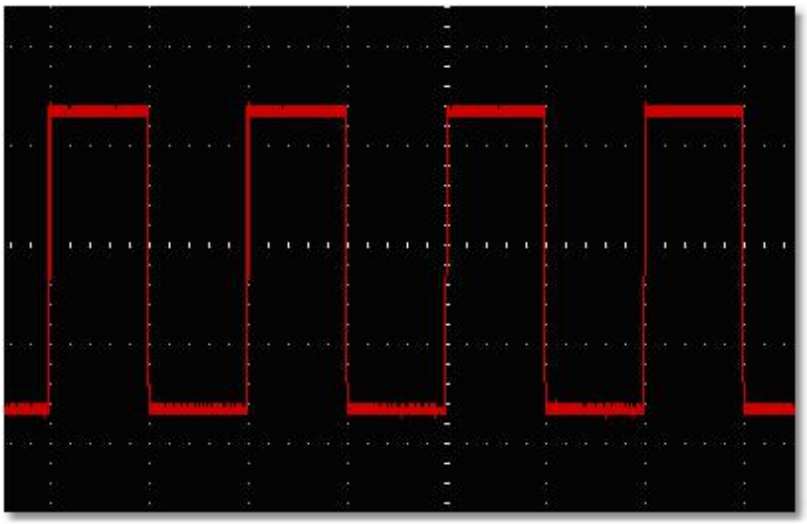
From Function menu, via , enter into "**Sampling**" option.



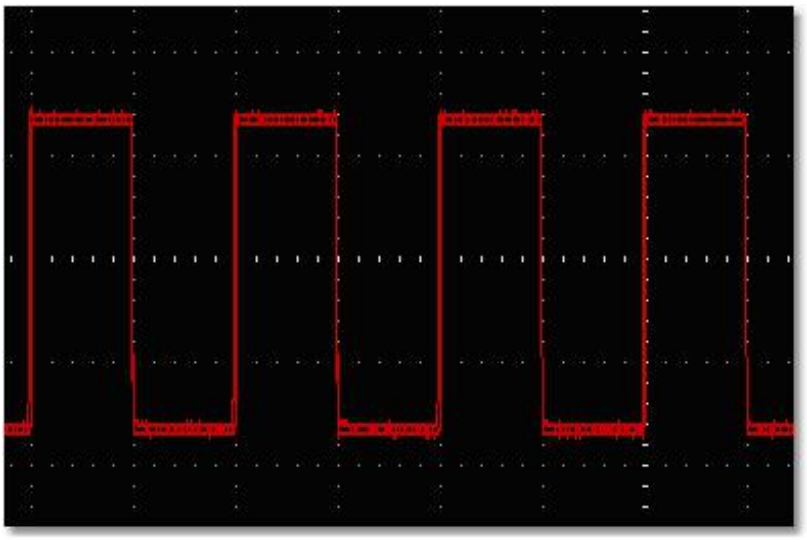
To know more about different sampling mode -

Sampling	indicates normal sampling mode
Peak Detect	this sampling mode always been used to capture interrupting signal noise
Average	this sampling mode is to reduce random / irrelevant signal noise, with set range from 1 to 128 (1≤ the set no. ≤128)

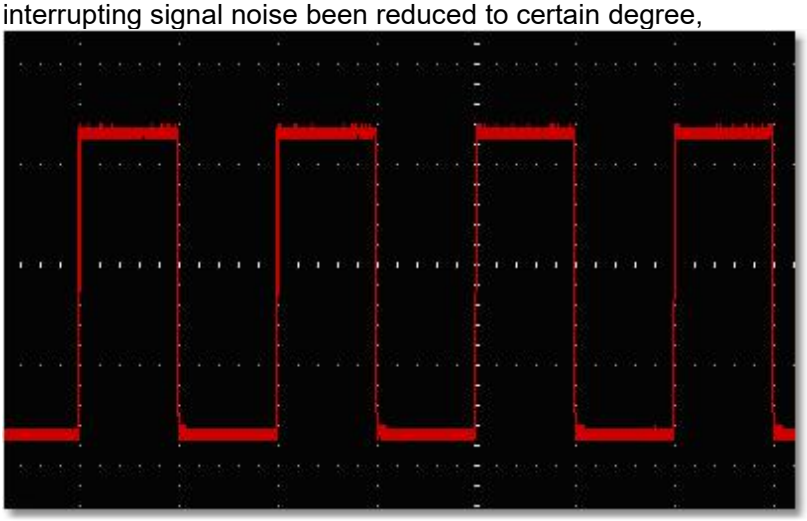
Following illustration is signal output under normal Sampling mode, no interrupting signal noise been captured,



Following illustration is signal output under Peak Detect mode, the interrupting signal noise been captured in details,

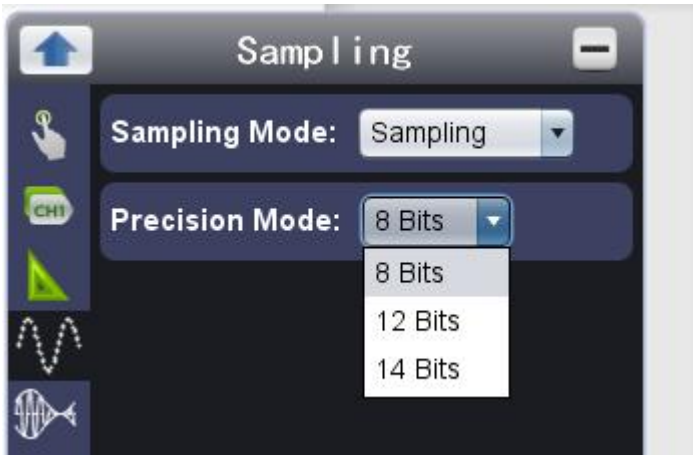


Following illustration is signal output under Average mode, with average number set in 16, from here, the interrupting signal noise been reduced to certain degree,



vertical resolution option
this option is available only in VDS6102A / VDS6102P

Via “Precision Mode”,

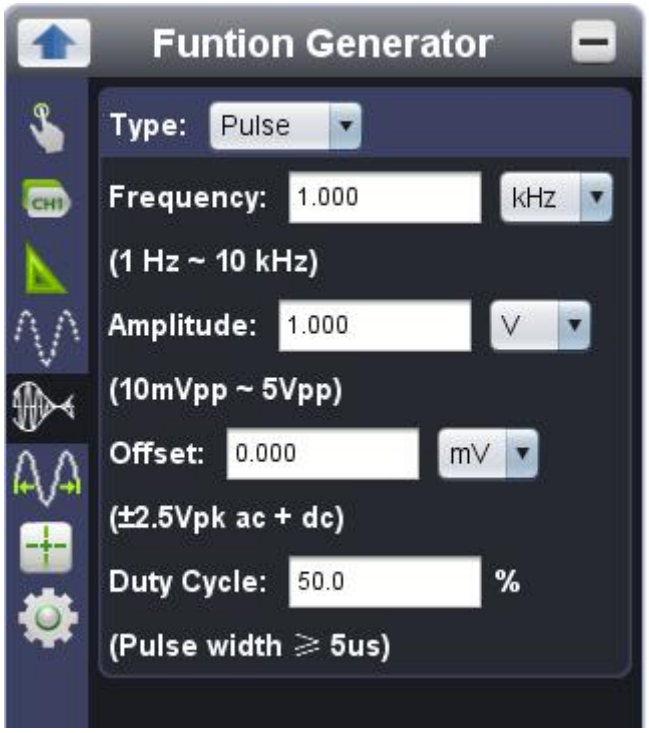


to know more about this option -

8 Bits	indicates the device works in 8-bit vertical resolution from ADC
12 Bits	indicates the device works in 12-bit vertical resolution from ADC
14 Bits	Indicates the device works in 14-bit vertical resolution from ADC

viii. how to set built-in function generator
The built-in function generator of 5MHz frequency output available from the device, with 4 basic waves output - sine, square, ramp and pulse, through MULTI communication interface.

From Function menu, via  , enter into "**Function Generator**" option.



i) choose preferred wave type from "Type", either Sine, or Square, or Ramp, or Pulse;
ii) input Frequency range, remember to match its unit - Hz / kHz / MHz;
iii) set Offset correctly

Further, Symmetry option comes under Ramp wave Type; and Duty Cycle option available in Pulse wave Type.

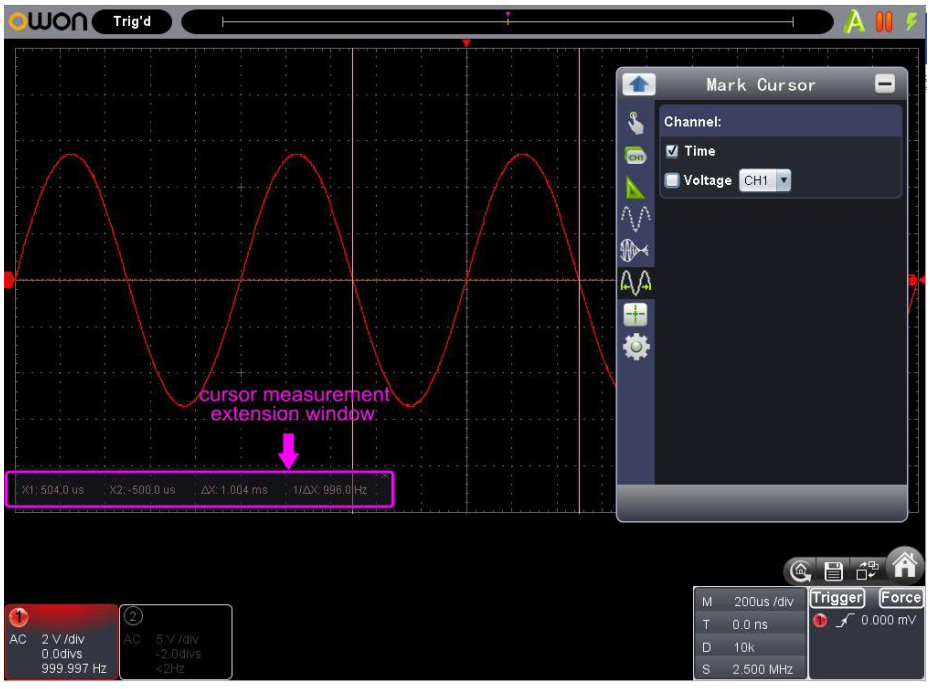
ix. how to use cursor measurement

From Function menu, via  , enter into "**Mark Cursor**" option.

i) check / uncheck measurement type, available in Time and Voltage option, cursor measurement works for either Time, or Voltage measurement, or both measurement at the same time;
ii) when in Voltage measurement type, the target channel could be chosen from “CH1” and “CH2” option;

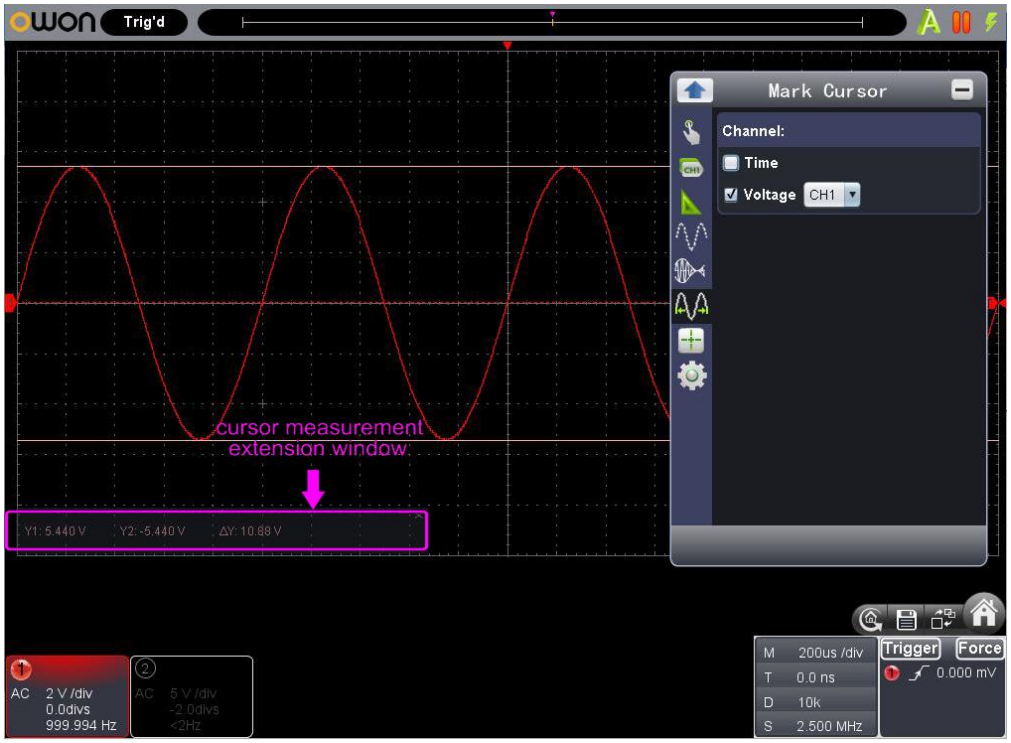
time cursor measurement: Check "Time" option, from the vertical direction of main display area, two lines in light color appears, indicating Cursor 1 and Cursor 2.

When moving mouse pointer through Cursor 1 or Cursor 2, it shapes ↔ , drag ↔ leftwards, or rightwards to adjust the measurement range between Cursor 1 and Cursor 2. The cursor measurement extension window (located at the bottom-left of main display area) tells the current time of Cursor 1 / Cursor 2, the absolute time difference between Cursor 1 and Cursor 2, and the frequency, as the illustration goes,



voltage cursor measurement: Check "Voltage" option, from the horizontal direction of main display area, two lines in light color appears, indicating Cursor 1 and Cursor 2.

When moving mouse pointer through Cursor 1 or Cursor 2, it shapes ↕ , drag ↕ upwards, or downwards to adjust the measurement range between Cursor 1 and Cursor 2. The cursor measurement extension window (located at the bottom-left of main display area) tells the current position of Cursor 1 / Cursor 2, the absolute value of the voltage amplitude difference between Cursor 1 and Cursor 2, as the illustration goes,



x. how to set the display system

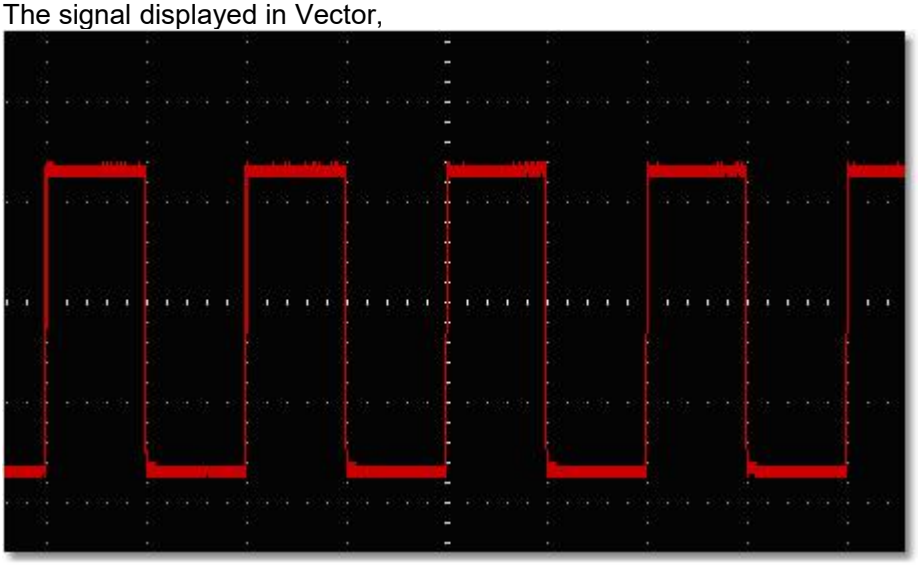
From Function menu, via  , enter into "**Display**" option.

Available in 2 display type, “Vector” and “Dots”.

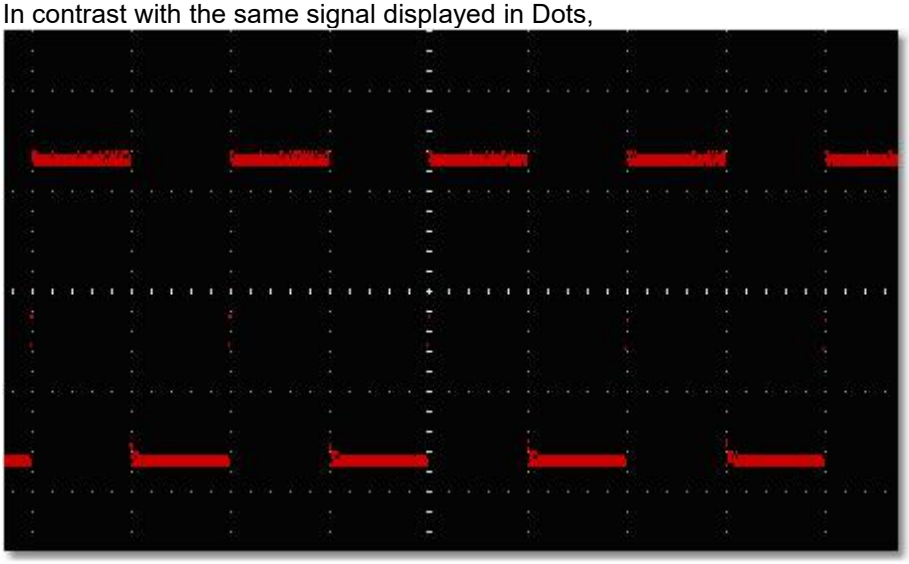
Vector to fill the room between the two adjacent sampling points, in dots of vector

Dots to display sampling points only

The signal displayed in Vector,



In contrast with the same signal displayed in Dots,



XY Mode

Check "XY Mode", the main display area switches to 3-window VIEW mode. In the XY mode window (upper-left window), the first channel reflects in X axis, the second channel in Y axis.

Note: When the device works in XY Mode, the record length been restricted at 1K points. The record length setting changes to 1K points automatically.

Persistence

When “Persistence” chosen, the device emulates the persistence display effect of CRO: the originally captured signal data in fading color, and the new data in fresh color, in cycle, continually.

The option of “Persistence” lasting available in Off, 0.5s, 1s, 2s, 5s, and Infinite, when set in “Infinite”, the recording point continues to be there, until the persistence lasting option been changed. Press “Clear”to clear the current persistence.

Note: When any changes introduced towards time base, voltage division, or record length, or channel been turned on/off again, the current persistence will be cleared automatically, then to record the signal data after the aforementioned operation, again.

Grid Brightness
Drag the slider to adjust the grid brightness from main display area.

xi. how to change utility setting

From Function menu, via , enter into “Utility” option,

Language
Available in 2 options: English and Chinese (simplified).

Skin
Works for operation interface skin color, either Black or Blue. After different color chosen from the current one, “Restart Effect” option comes, press "Restart" after the option, the PC software will restart in newly-set operation interface skin color.

Print Preview
Press the option to open the Print Preview Window for main display area.

The menus in Print Preview Window:

File

Page Set	to set Printer Page Space
Print	to print the current page onto chosen printer
Exit	to close the Print Preview Window

View

Page Transform	to switch the current page between horizontal and vertical layout
Whole Page	function as full page display of the current page
Face Size	to display the current page in its actual size
Default Scale	to display the current page in preferred size (measured in %)

Show Wave Background Check the option to display the background color of main display area; uncheck the option to display the background color of previewed page.

Set Preview Page Background
Via this option, to change the background color of previewed page.

Save Image
To save the current page from main display area into .png, .bmp or .gif format image, excluding function menu page.

Pause & Export
Based upon the current record length, to export the captured signal in certain format file, with format supports .zip, .csv.

Mouse-click  from right-bottom functions the same as pressing “Pause & Export” button.

Self Cal
Via “Self Cal” operation, the device may reach the best ideal working status within short time, which assures the most accurate measurement result accordingly.

This operation works the device at anytime when the best ideal working status is a must. When the working temperature change hits ±5℃, or exceeds ±5℃, the device should do this operation.

Before doing this operation, remove off all device-connected-items, including but not limited to working probes / leads / clamps, then press "Self Cal", until the full process ends.

Default
Mouse-click "Default" to enter the device to default factory settings.

Mouse-click  from right-bottom functions the same.

Network
Through LAN, or WiFi, the device communicates with PC. Please refer to
“xiii. how to use LAN communication interface” and “xiv. how to work WiFi with PC software”.

Tips Window
4 categories’ contents covered -
"Channel", "Capture&Period", "Trigger" and “Keyboard Shortcuts”.

Under certain category, mouse-click any place from the current page to check the contents from next page.

Check “Don’t show again” from right-top of this window, to disable this window, and it will not come when starting the PC software next time, until unchecking “Don’t show again”.

About
Via this option, to know the PC software version, device firmware version, device serial no., and official website information.

xii. how to use main action button

Main action button includes  (AutoSet),  (Run/Stop),  (Single Trigger), please refer to Item 6, 7, 8 under VI. Operation Interface of PC Software .

AutoSet

To set function items in certain value automatically, so as to generate more-suitable-for-observing waveform. Mouse-click  , the device capture the signal automatically, and promptly. The involved function items is as follows -

Trigger	
Trigger Type	Edge, or Video, as per the input signal
Trigger Mode	Auto
Trigger Coupling	DC
Trigger Slope	Rise
Trigger Level	mid-point setting
Channel	
Turn On / Off Channels	turn on the channel with signal input
Zero Point Position	been adjusted to the proper position
Vertical Scale	been adjusted to the proper division
Horizontal Level	middle
Horizontal Sale	been adjusted to the proper division
Sampling	
Run/Stop Status	Run
Acquisition Mode	current
Display	
Display Format	YT

Run/Stop

To start or stop sampling on input signals.

Single Trigger

To set trigger mode in “Single”, under this trigger mode, when set condition met, the device will capture the input signal once, then stop signal capturing.

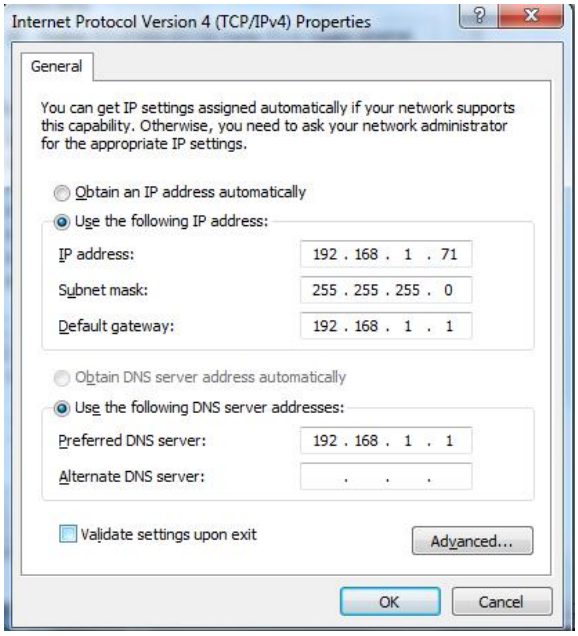
Keyboard Shortcuts	
Ctrl + Enter	AutoSet
F5	Run/Stop

xiii. how to use socket connection

when the device communicates with PC by direct network cable
For the device, its default IP address / port goes in 192.168.1.172 / 8866.
When the device communicates with PC by direct network cable, the first 3 segments from the default IP address of PC should read the same as those from the device, giving an example, both of 2 parties read 192.168.1.xxx (the last segment “xxx” could be different).

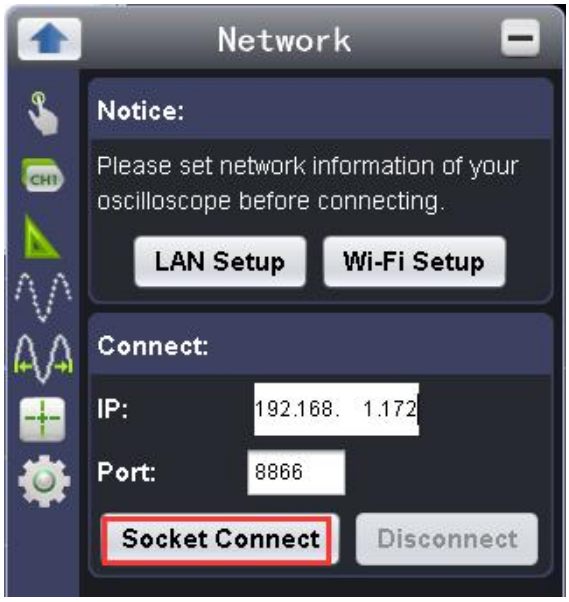
Note: The IP address of the device could not be modified before successfully communicating with PC.

i) to check target PC’s network setting
giving an example, here we set IP address in 192.168.1.71



ii) to communicate device with PC
a. to power the device through adapter, or through USB connection cable via suitable USB communication interface;
b. to communicate the device with PC via crossed network cable, each end connects each LAN port;
c. to start PC software;
d. to enter into “Utility” option, press “Network”;

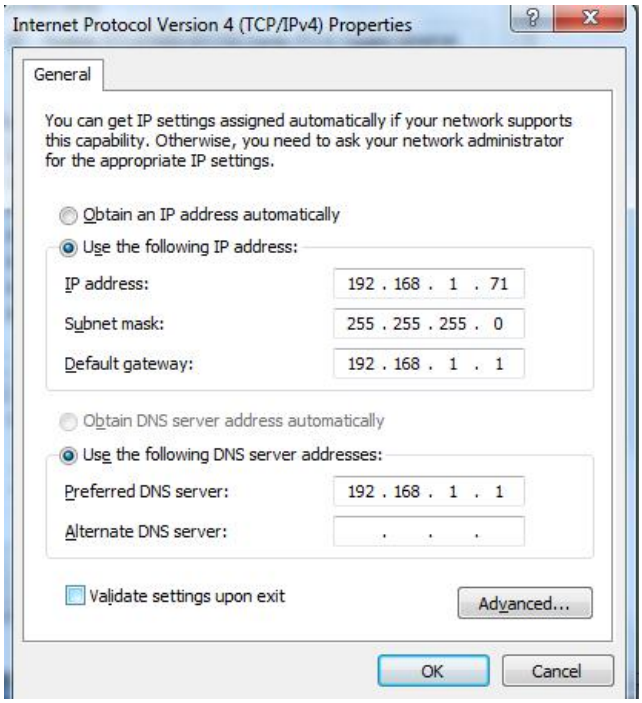
e. to activate “Socket Connect”, so as to work the device with PC software



when the device communicates with PC by router connection
For device, its default IP address / port goes in 192.168.1.172 / 8866.
When device communicates with PC by direct LAN cable, the first 3 segments from the default IP address of PC should read the same as those from the device, giving an example, both of 2 parties reads 192.168.1.xxx (the last segment “xxx” could be different).

Note: The IP address of the device could not be modified before successfully communicating with PC.

i) to check target PC’s network setting, its default Netmask and Gateway setting should read the same as the one for router, giving an example, provided the router / PC’s network setting goes in -
IP Address: 192.168.1.71
Netmask: 255.255.255.0
Gateway: 192.168.1.1



ii) to communicate device with PC

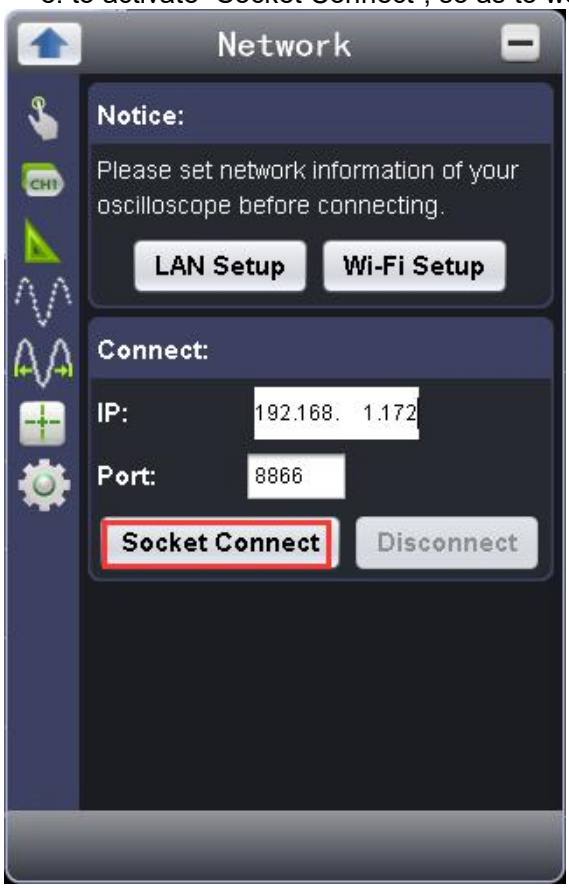
a. to power the device through adapter, or through USB connection cable via suitable USB communication interface;

b. to communicate the device with PC via same router, with respective network cable connects from LAN port to same router;

c. to start PC software;

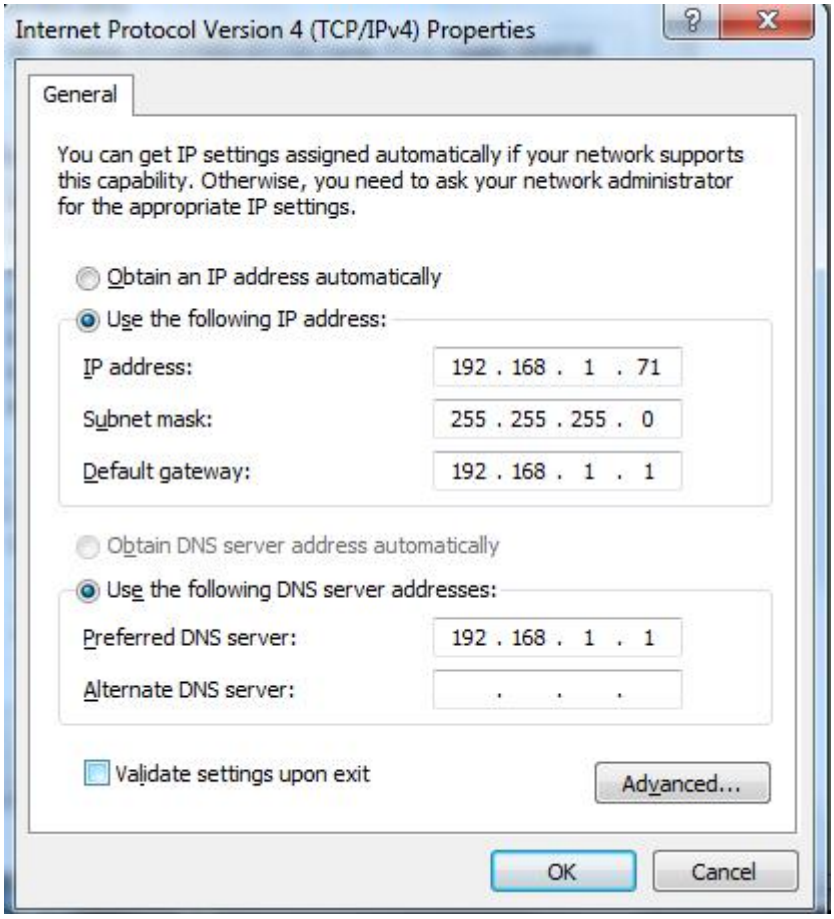
d. to enter into “Utility” option, press “Network”;

e. to activate “Socket Connect”, so as to work the device with PC software



xiv. how to use LAN communication interface
Through LAN communication interface, the device may communicate with PC directly, or via router connection

the device communicates with PC by direct LAN
i) to check target PC's network setting
giving an example, here we set IP address in 192.168.1.71



ii) to set device's network via "Network" button under "Utility" option
a. to communicate device with target PC through USB connection cable via suitable USB communication interface, after the communication successful (please refer to iv. to communicate device with PC under V. How to Communicate Device with PC), press "Network" button under "Utility" option from function menu

b. mouse-click "LAN Setup" to to enter into "MachineNetSetting" -
IP address: total in 4 sections, to set the first 3 sections the same as the one mentioned in part i), say, 192.168.1, the 4th section should be different, here do it in 192.168.1.252
Port: could try any value ranges from 0 till 65535, here put 8866
MAC: provided any reminder of "physical address conflict", change its value

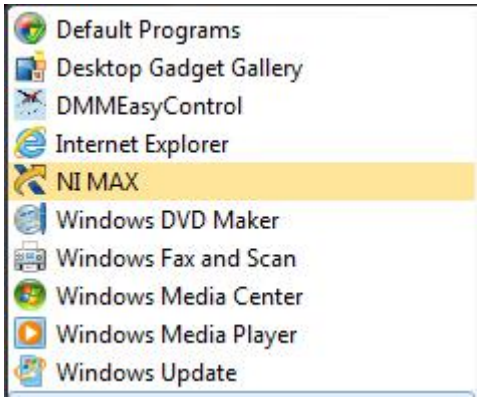
c. press “OK” to finish the “MachineNetSetting”

iii) to add NI network device

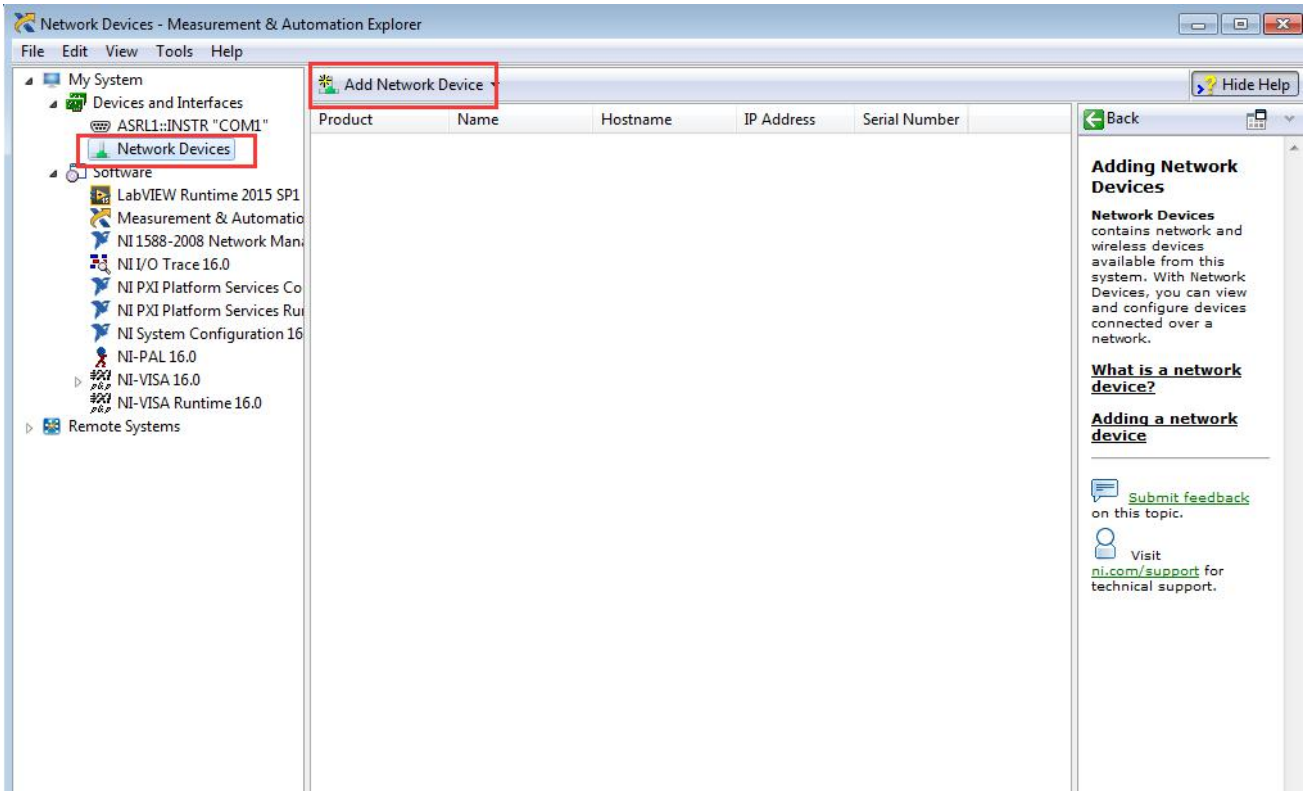
a. device powering. Either through AC adapter, or through USB connection cable, the device been powered, with indicator lights red for seconds.

b. LAN connection. To communicate device with target PC through LAN connection, via respective LAN communication interface.

c. choose NI Max from Windows Start menu.



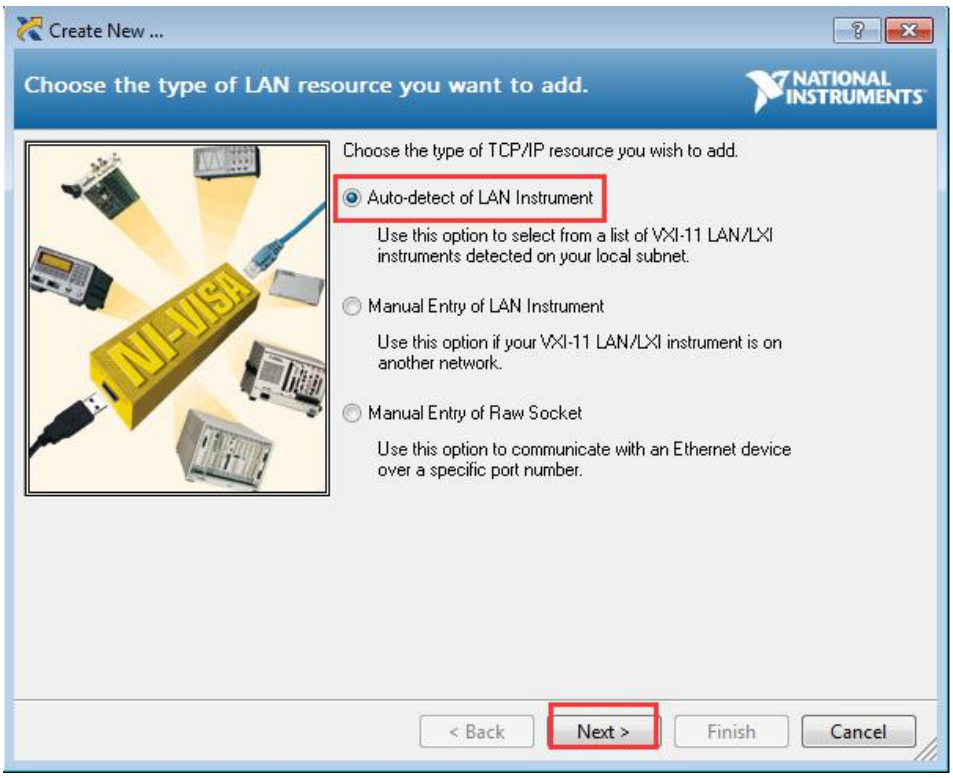
d. following page comes,



via “Devices and Interfaces”, then “Network Devices”, enter into “Add Network Device”

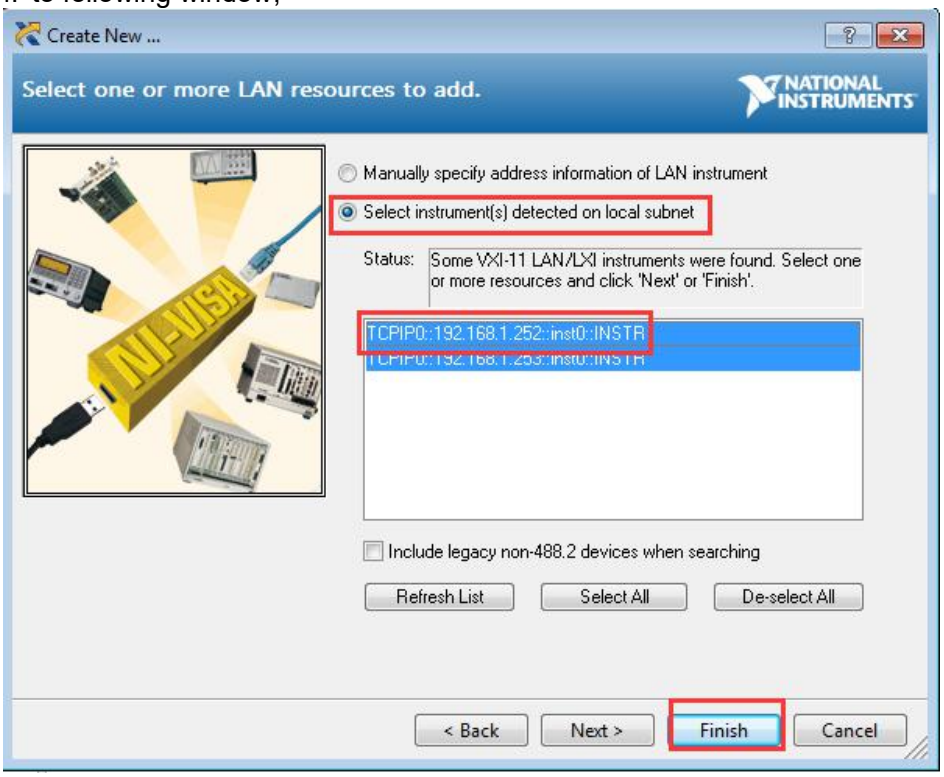
e. press 

to,



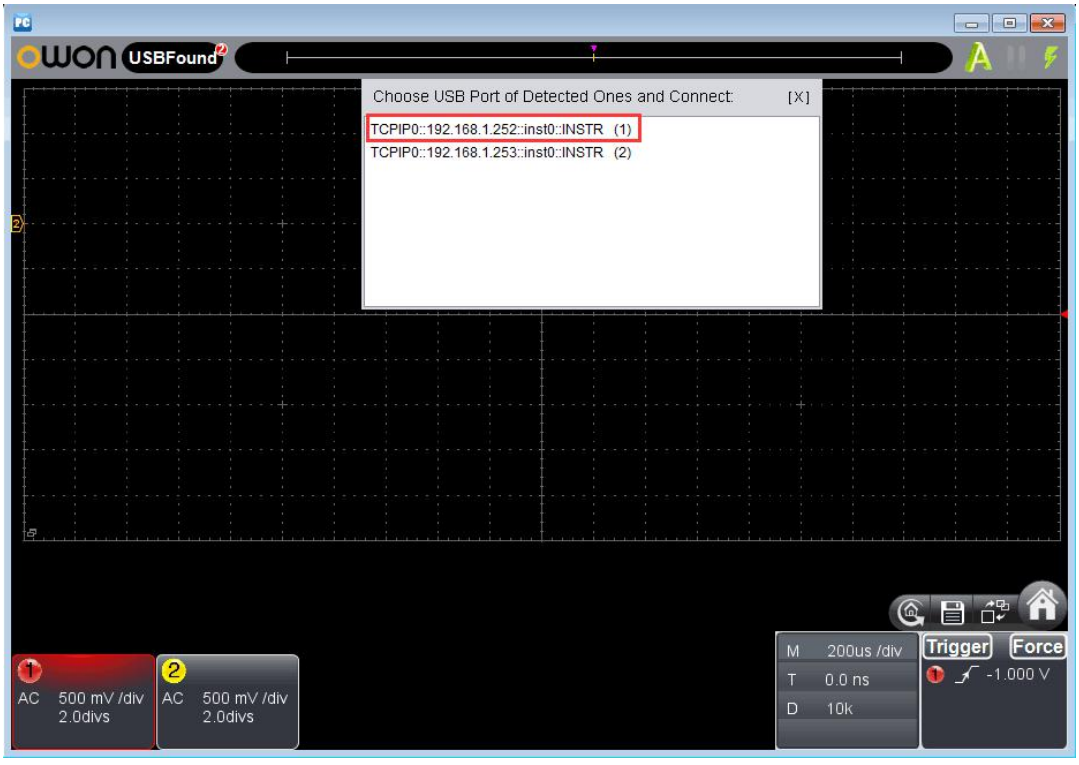
dot-tick “Auto-detect of LAN Instrument”, then “Next”

f. to following window,



dot-tick “Select instrument(s) detected on local subnet”, to choose “TCPIP0::(the previous IP connection just added)::inst0::INSTR”, then mouse-click “Finish”.

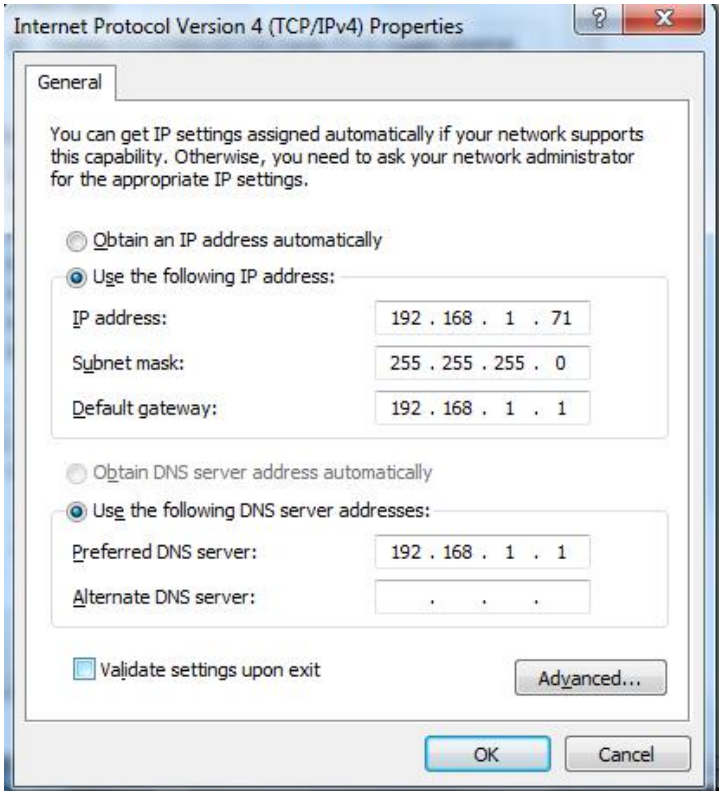
g. back to PC software, to press TCPIP0::(the previous IP connection just added)::inst0::INSTR to communicate with PC software,



the device communicates with PC by router connection

i) to check target PC's network setting, the Netmask and Gateway setting should read the same as the one for router, giving an example, provided the router / PC's network setting goes in -

IP Address: 192.168.1.71
Netmask: 255.255.255.0
Gateway: 192.168.1.1



ii) to set device's network via "Network" button under "Utility" option

a. to communicate device with target PC through USB connection cable via suitable USB communication interface, after the communication successful (please refer to iv. to communicate device with PC under V. How to Communicate Device with PC), press "Network" button under "Utility" option from function menu

b. mouse-click "LAN Setup" to to enter into "MachineNetSetting" -
IP address: total in 4 sections, to set the first 3 sections the same as the one mentioned in part i, say, 192.168.1, the 4th section should be different, here do it in 192.168.1.252
Netmask: the same as the one for router
Gateway: the same as the one for router
Port: could try any value ranges from 0 till 65535, here put 8866
MAC: provided any reminder of "physical address conflict", change its value

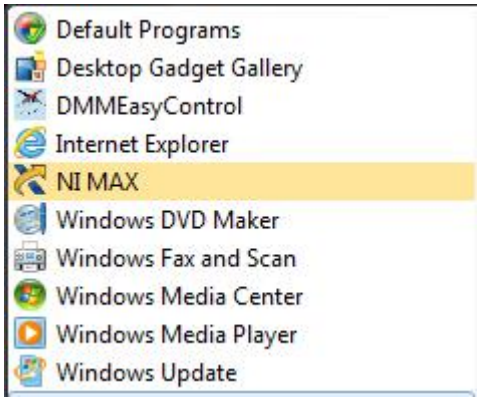
c. press “OK” to finish the “MachineNetSetting”

iii) to add NI network device

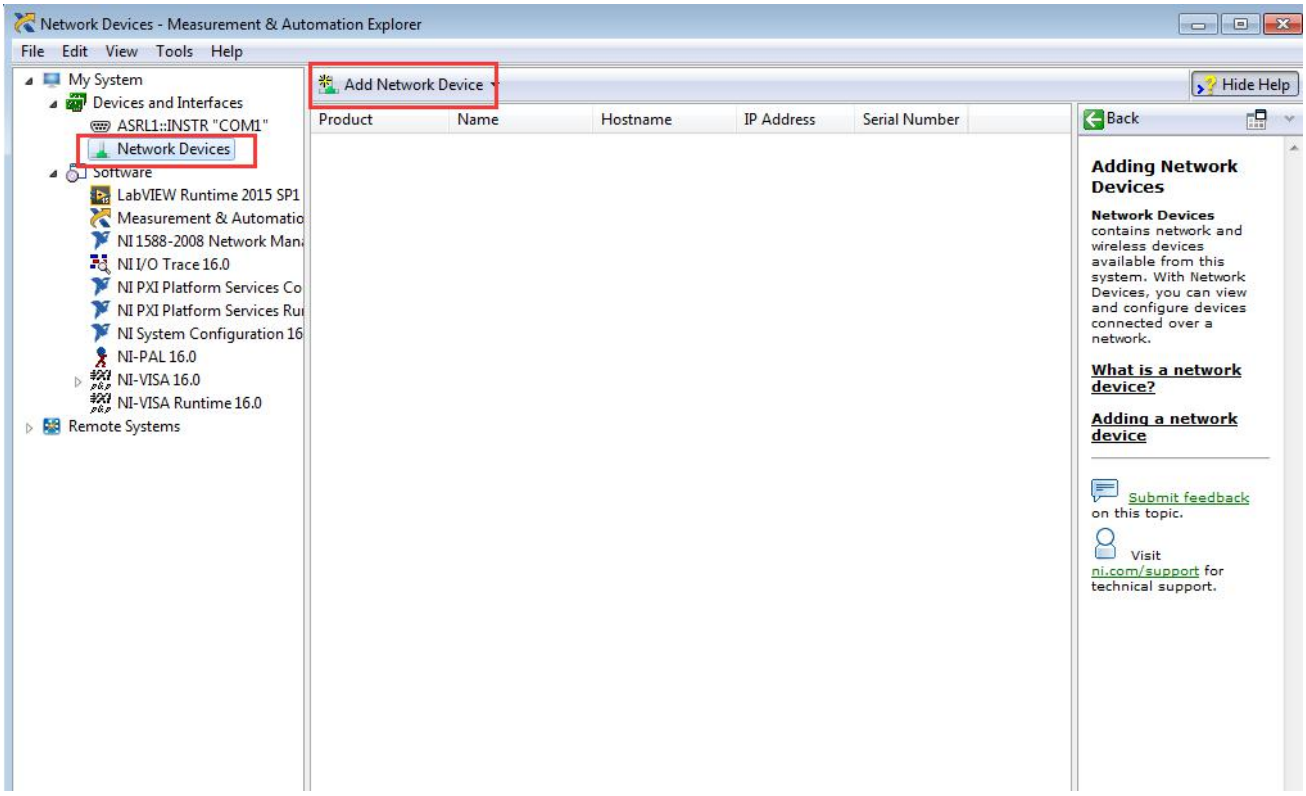
a. device powering. Either through AC adapter, or through USB connection cable, the device been powered, with indicator lights red for seconds.

b. LAN connection. To communicate device with target PC through LAN connection, via respective LAN communication interface.

c. choose NI Max from Windows Start menu.



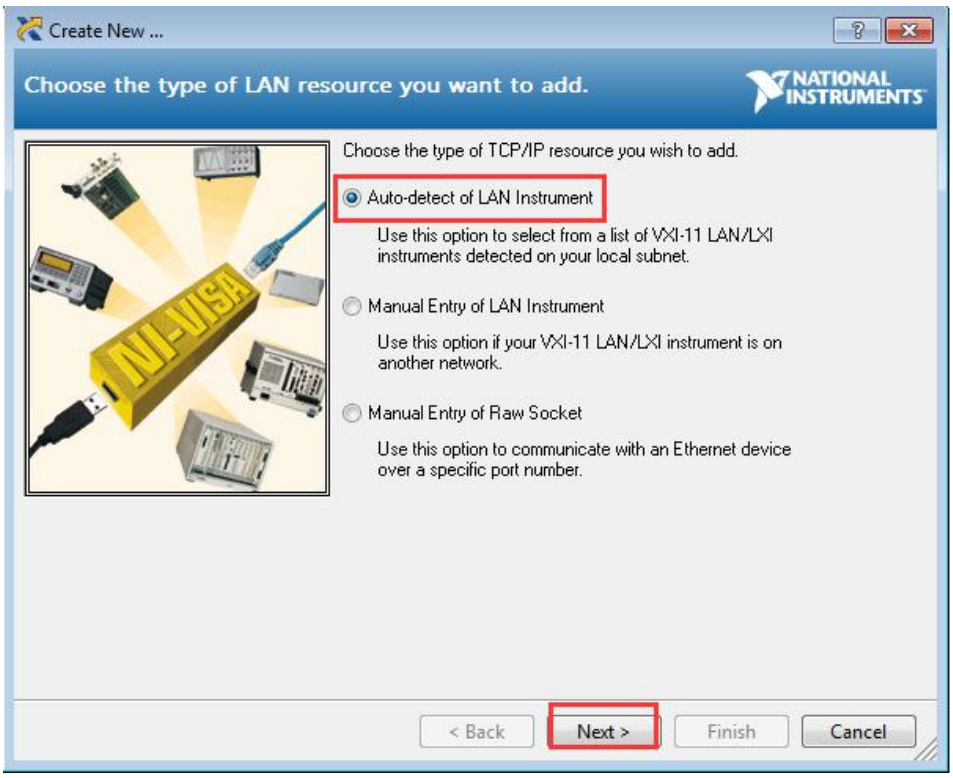
e. following page comes,



via “Devices and Interfaces”, then “Network Devices”, enter into “Add Network Device”

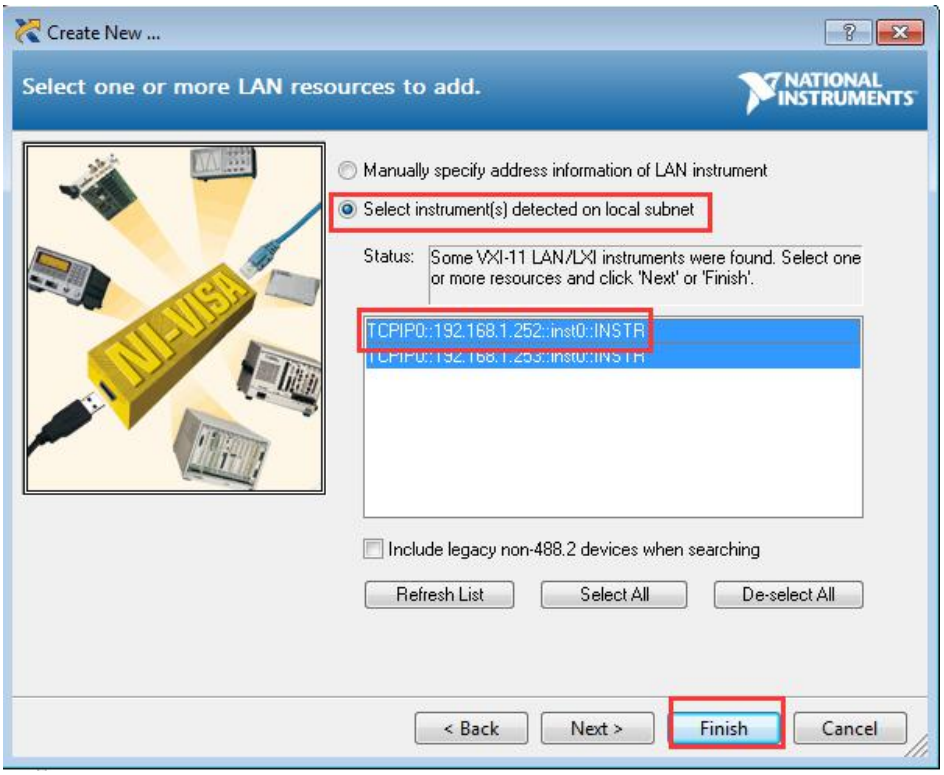
f. press 

to,



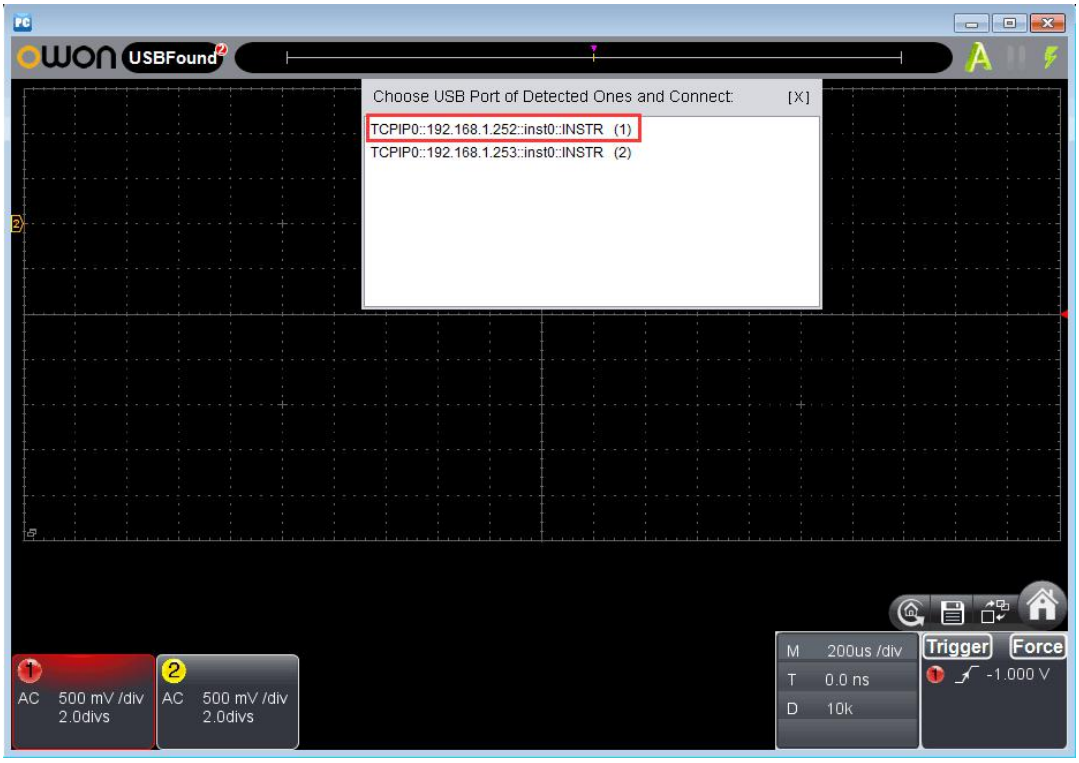
dot-tick “Auto-detect of LAN Instrument”, then “Next”

g. to following window,



dot-tick “Select instrument(s) detected on local subnet”, to choose “TCPIP0::(the previous IP connection just added)::inst0::INSTR”, then mouse-click “Finish”.

h. back to PC software, to press TCPIP0::(the previous IP connection just added)::inst0::INSTR to communicate with PC software,



xv. how to work WiFi with PC software

Note: Only the device equipped with optional WiFi module gets this function.

to work WiFi with PC software through device hotspot

The target PC should support WiFi communication, and the optional WiFi module should be inserted into USB host communication interface.

i) to set device's network via "Network" button under "Utility" option

a. to communicate device with target PC through USB connection cable via suitable USB communication interface, after the communication successful (please refer to iv. to communicate the device with PC under V. How to Communicate Device with PC), press "Network" button under "Utility" option from function menu.

b. in "Network", mouse-click "WiFi Setup" to "WiFiSetting", choose "AP" as "Connect Type", to set "SSID" and "Password", "IP" here fill 192.168.100.1, "Port" here use 8866 (could be any value, ranging from 0 till 65536).

c. press "OK" to confirm the "WiFiSetting".

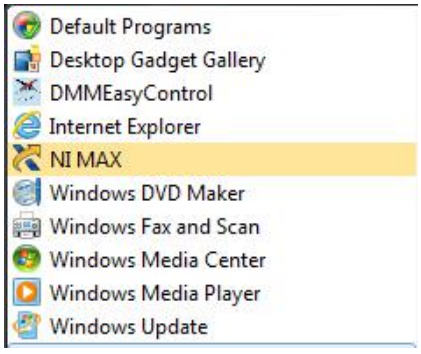
ii) to add NI network device

a. device powering. To disconnect the USB communication between the device and target PC, with AC adapter get through power source, then power the device, with indicator lights red for seconds.

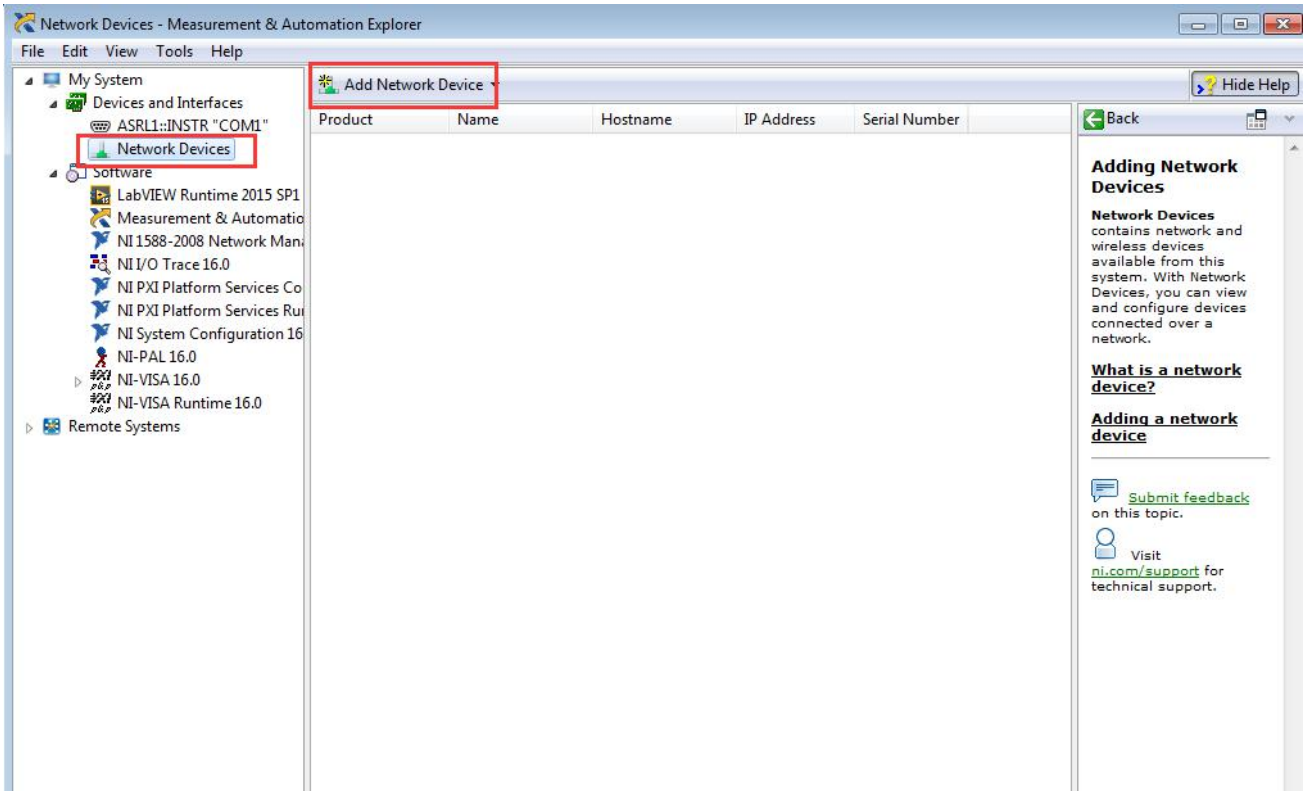
b. WiFi communication. To communicate the device with target PC through WiFi hotspot set onto device, as per correct SSID and Password.

Note: Provided not possible to auto-switch between WiFi and LAN connection onto target PC, disable LAN. Dot-tick "Obtain an IP address automatically" for the IP address onto target PC, or use the same first 3 sections of IP address set as point b. under i) part, say, 192.168.100

c. choose NI Max from Windows Start menu.



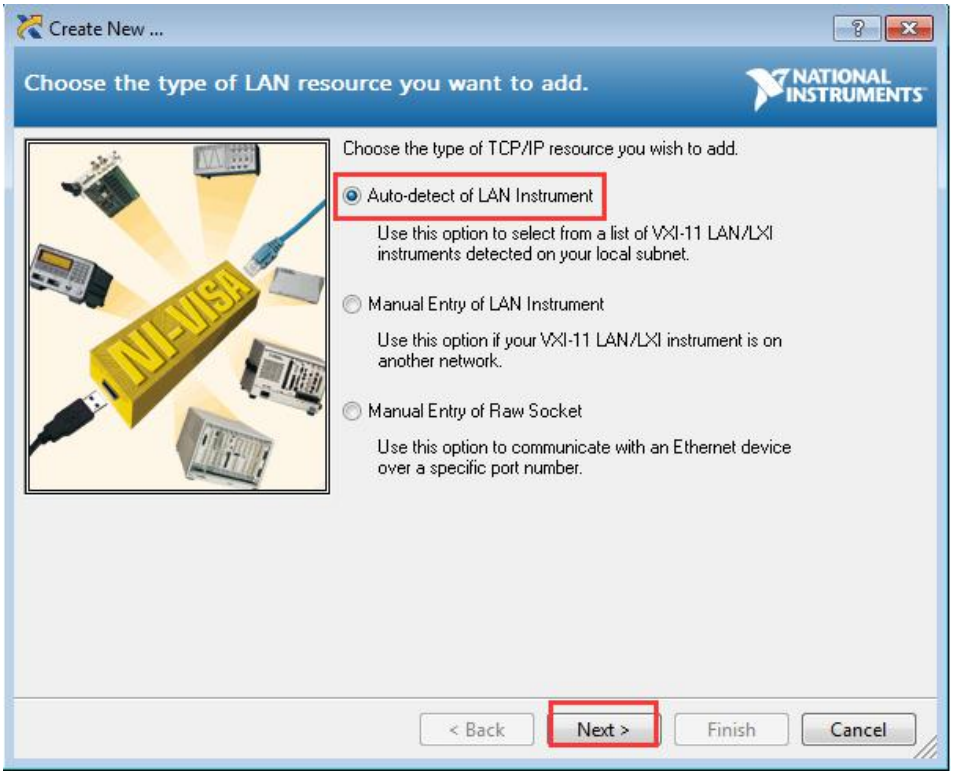
d. following page comes,



via “Devices and Interfaces”, then “Network Devices”, enter into “Add Network Device”

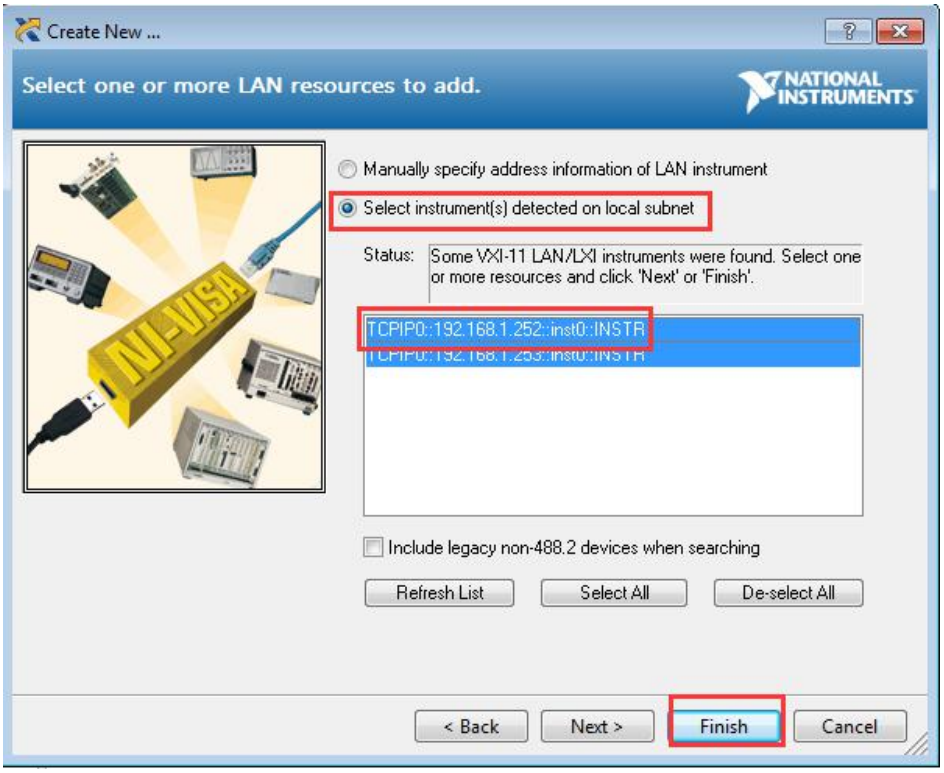
e. press 

to,



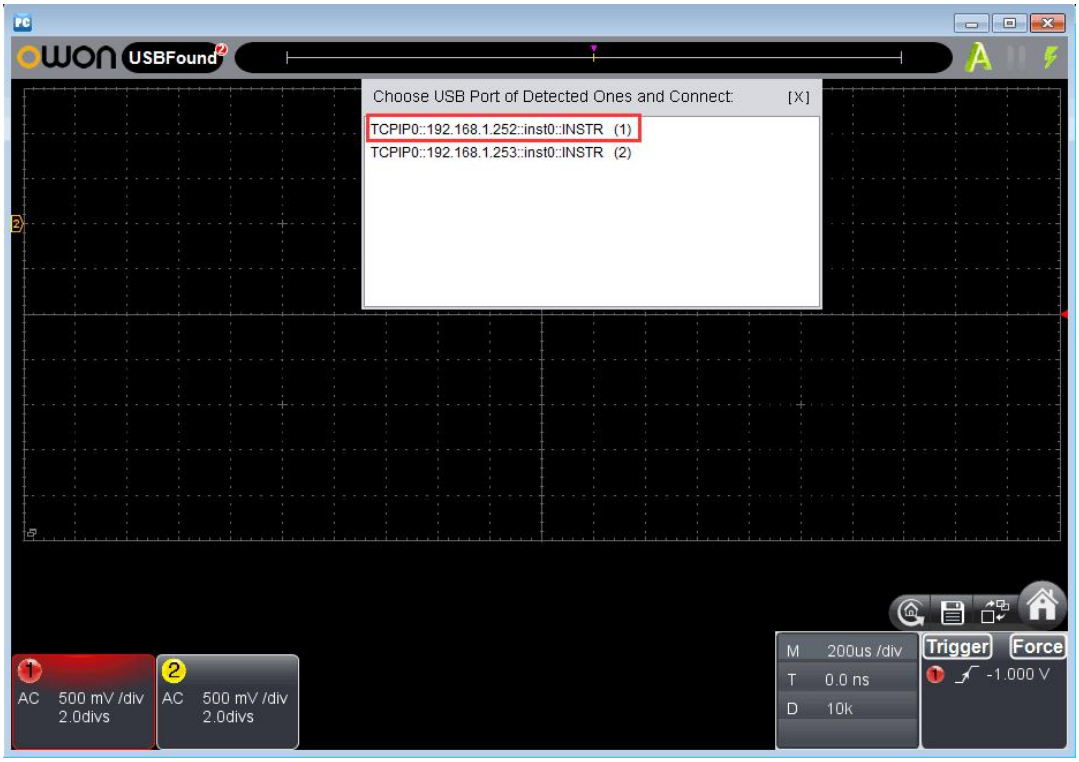
dot-tick “Auto-detect of LAN Instrument”, then “Next”

f. to following window,



dot-tick “Select instrument(s) detected on local subnet”, to choose “TCPIP0::(the previous IP connection just added)::inst0::INSTR”, then mouse-click “Finish”.

g. back to PC software, to press TCPIP0::(the previous IP connection just added)::inst0::INSTR to communicate with PC software,



to work WiFi with PC software through device station

The target PC should support WiFi communication, and the optional WiFi module should be inserted into USB host communication interface.

i) to set device's network via "Network" button under "Utility" option

a. to communicate device with target PC through USB connection cable via suitable USB communication interface, after the communication successful (please refer to iv. to communicate the device with PC under V. How to Communicate Device with PC), press "Network" button under "Utility" option from function menu.

b. in "Network", mouse-click "WiFi Setup" to "WiFiSetting" choose "STA" as "Connect Type", to set "SSID" and "Password", "Port" here use 8866 (could be any value, ranging from 0 till 65536).

c. input correct "SSID" and "Password" from WiFi router, here we use one available WiFi router - SSID in OWONTM, Password in lilliputowon, press "OK" to confirm the setting, after the step, "WiFiSetting" menu will be off. Re-enter "WiFiSetting" menu, press "Refresh" to update the IP address.

ii) to add NI network device

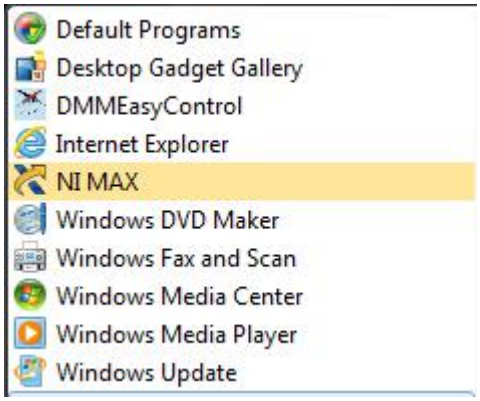
a. device powering. To disconnect the USB communication between the device and target PC, with AC adapter get through power source, then power the device, with indicator lights red for seconds.

b. WiFi communication. To communicate the device with target PC through WiFi hotspot set onto device, as per correct SSID and Password.

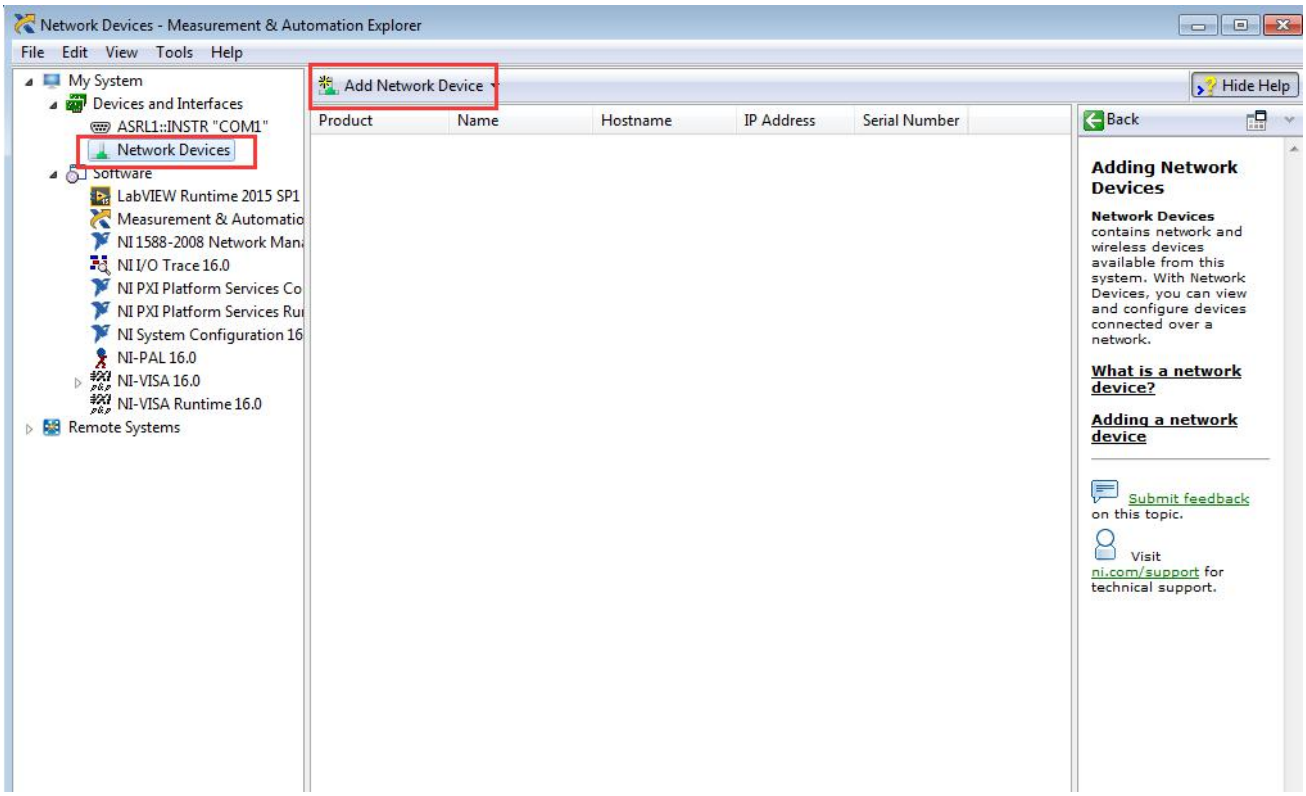
- Note -

Provided not possible to auto-switch between WiFi and LAN connection onto target PC, disable LAN. Dot-tick “Obtain an IP address automatically” for the IP address onto target PC, or use the same first 3 sections of IP address set as point b. under i) part, say, 192.168.100

c. choose NI Max from Windows Start menu.



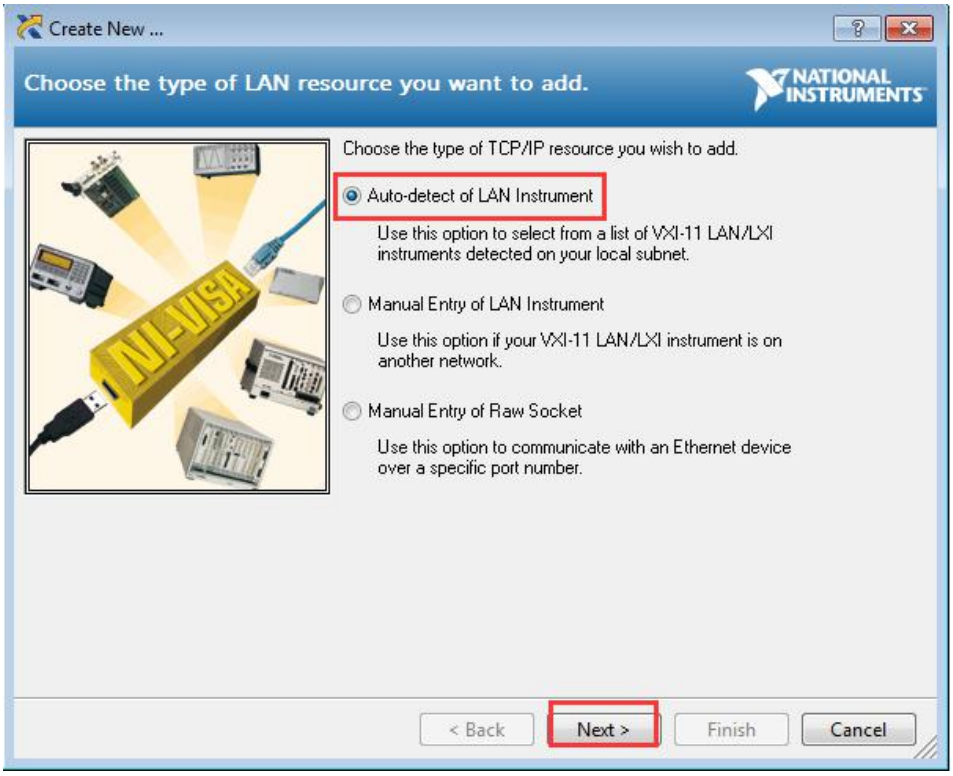
d. following page comes,



via “Devices and Interfaces”, then “Network Devices”, enter into “Add Network Device”

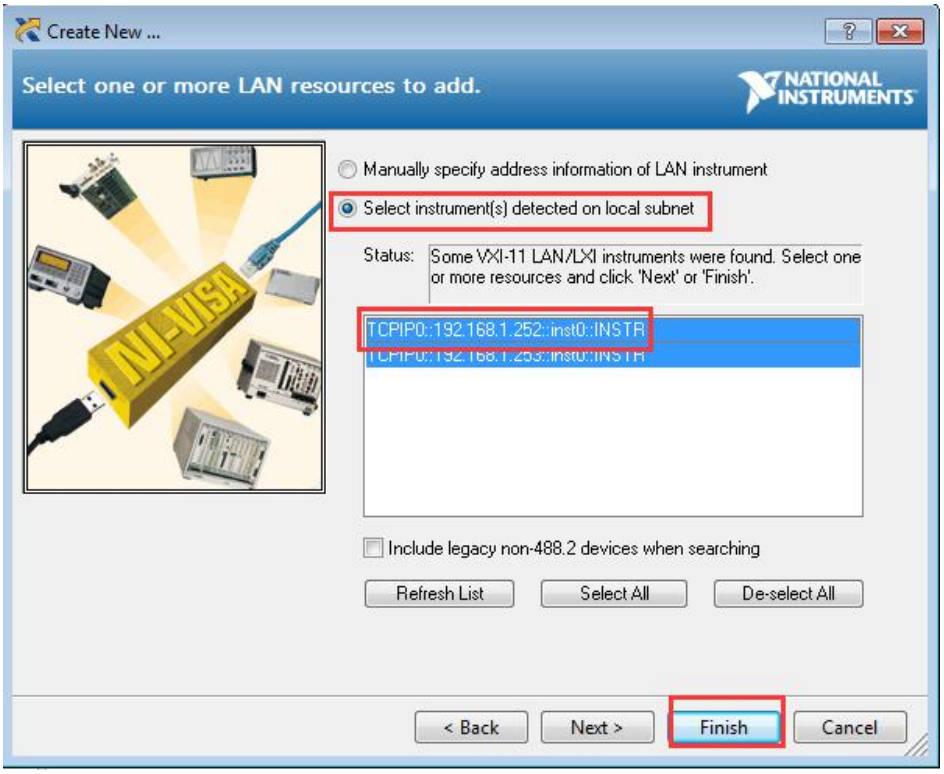
e. press 

to,



dot-tick “Auto-detect of LAN Instrument”, then “Next”

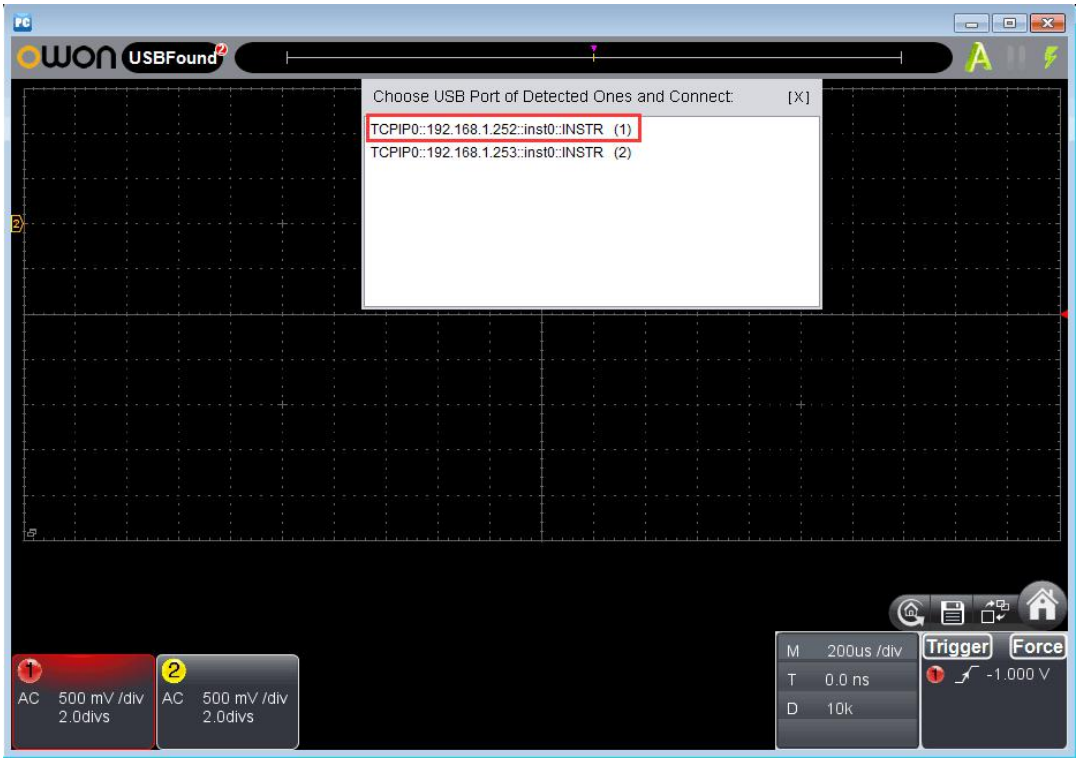
f. to following window,



dot-tick “Select instrument(s) detected on local subnet”, to choose “TCPIP0::(the previous IP connection

just added)::inst0::INSTR”, then mouse-click “Finish”.

g. back to PC software, to press TCPIP0::(the previous IP connection just added)::inst0::INSTR to communicate with PC software,



VIII. Technical Specifications

i. Set the probe compensation at x10 for physical probe;
ii. Under suitable operation temperature, work the device for 30+ minutes without interval;
iii. Provided the environment temperature gets 5 degrees more, or less, to self-calibrate the device through Utility menu, via “Self Cal” option (please refer to Self Cal).

The following technical specifications been measured on the basis of above operation,

Oscilloscope Part -

<table>
<tr><td colspan="2" rowspan="4">Bandwidth</td><td>VDS6102</td><td colspan="3">100MHz</td></tr>
<tr><td rowspan="3">VDS6102A
VDS6102P</td><td>8-bit mode</td><td colspan="2">100 MHz</td></tr>
<tr><td>12-bit mode</td><td colspan="2">100 MHz</td></tr>
<tr><td>14-bit mode</td><td colspan="2">20 MHz</td></tr>
<tr><td colspan="2" rowspan="2">Vertical Resolution (A/D)</td><td>VDS6102</td><td colspan="3">8 bits</td></tr>
<tr><td>VDS6102A
VDS6102P</td><td colspan="3">8 bits / 12 bits / 14 bits</td></tr>
<tr><td colspan="2">Channel Q'nty</td><td colspan="4">2</td></tr>
<tr><td rowspan="8">Acquisition</td><td>Mode</td><td colspan="4">sample, peak detect, average</td></tr>
<tr><td rowspan="7">Sampling Rate</td><td rowspan="2">VDS6102</td><td>2-CH working</td><td colspan="2">500 MS/s</td></tr>
<tr><td>1-CH working</td><td colspan="2">1 GS/s</td></tr>
<tr><td rowspan="5">VDS6102A
VDS6102P</td><td rowspan="3">2-CH working</td><td>8-bit mode</td><td>500 MS/s</td></tr>
<tr><td>12-bit mode</td><td>250 MS/s</td></tr>
<tr><td>14-bit mode</td><td>125 MS/s</td></tr>
<tr><td rowspan="3">1-CH working</td><td>8-bit mode</td><td>1 GS/s</td></tr>
<tr><td>12-bit mode</td><td>500 MS/s</td></tr>
<tr><td>14-bit mode</td><td>125 MS/s</td></tr>
<tr><td rowspan="6">Input</td><td>Input Coupling</td><td colspan="4">DC, AC, ground</td></tr>
<tr><td>Input Impedance</td><td colspan="4">1 MΩ ± 2%, in parallel with 15 pF ± 5 pF</td></tr>
<tr><td>Supported Probe</td><td colspan="4">x1, x10, x100, x1000</td></tr>
<tr><td>Max Input Voltage</td><td colspan="4">40V (DC + AC Peak)</td></tr>
<tr><td>Bandwidth Limit</td><td colspan="4">20MHz, or fullband</td></tr>
<tr><td>Channel Isolation</td><td colspan="4">100 : 1 @ 50Hz; 40 : 1 @ 10MHz</td></tr>
<tr><td>Time Delay Between Channel (typical)</td><td colspan="4">150 ps</td></tr>
</table>

<table>
<tr><td rowspan="19">Horizontal System</td><td rowspan="9">Sampling Rate</td><td rowspan="2">VDS6102</td><td>2-CH working</td><td colspan="2">0.5 Sa/s - 500 MSa/s</td></tr>
<tr><td>1-CH working</td><td colspan="2">0.5 Sa/s - 1 GSa/s</td></tr>
<tr><td rowspan="7">VDS6102A
VDS6102P</td><td rowspan="3">2-CH working</td><td>8-bit mode</td><td>0.5 Sa/s - 500 MSa/s</td></tr>
<tr><td>12-bit mode</td><td>0.5 Sa/s - 250 MSa/s</td></tr>
<tr><td>14-bit mode</td><td>0.5 Sa/s - 125 MSa/s</td></tr>
<tr><td rowspan="3">1-CH working</td><td>8-bit mode</td><td>0.5 Sa/s - 1 GSa/s</td></tr>
<tr><td>12-bit mode</td><td>0.5 Sa/s - 500 MSa/s</td></tr>
<tr><td>14-bit mode</td><td>0.5 Sa/s - 125 MSa/s</td></tr>
<tr><td>Interpolation</td><td colspan="4">sin (x)/x</td></tr>
<tr><td rowspan="8">Record Length</td><td>VDS6102
VDS6102A</td><td colspan="3">10M</td></tr>
<tr><td rowspan="6">VDS6102P</td><td rowspan="3">2-CH working</td><td>8-bit mode</td><td>100M</td></tr>
<tr><td>12-bit mode</td><td>50M</td></tr>
<tr><td>14-bit mode</td><td>50M</td></tr>
<tr><td rowspan="3">1-CH working</td><td>8-bit mode</td><td>250M</td></tr>
<tr><td>12-bit mode</td><td>100M</td></tr>
<tr><td>14-bit mode</td><td>100M</td></tr>
<tr><td>Scanning Speed (s/div)</td><td colspan="4">2 ns/div - 100 s/div, step by 1 - 2 - 5</td></tr>
<tr><td>Sampling Rate / Relay Time Accuracy</td><td colspan="4">±25ppm (typical, Ta = +25℃)</td></tr>
<tr><td>Interval (△T) Accuracy (DC - 100MHz)</td><td colspan="4">Single: ±(1 interval time + 25ppm x reading + 0.6ns);
Average>16：±(1 interval time + 25ppm x reading + 0.4ns)</td></tr>
<tr><td rowspan="8">Vertical System</td><td>Sensitivity</td><td colspan="4">2 mV/div - 5 V/div</td></tr>
<tr><td>Displacement</td><td colspan="4">± 2 V (2 mV/div - 50 mV/div)
± 20 V (100 mV/div - 500 mV/div)
± 40 V (1 V/div - 5 V/div)</td></tr>
<tr><td>Analog Bandwidth</td><td colspan="4">100 MHz</td></tr>
<tr><td>Low Frequency
(at input, AC coupling, -3dB)</td><td colspan="4">≥10 Hz</td></tr>
<tr><td>Rise Time
(at input, typical)</td><td colspan="4">≤ 3.5 ns</td></tr>
<tr><td rowspan="2">DC Accuracy</td><td>VDS6102</td><td colspan="3">±3% when ≥ 2mV</td></tr>
<tr><td>VDS6102A
VDS6102P</td><td colspan="3">±2% when ≥ 2mV</td></tr>
<tr><td>DC Accuracy (average)</td><td colspan="4">the voltage difference of any 2 points from the captured signal, after taking the average from ≥16 captured signals (△V): ±(2% rdg + 0.05 div)</td></tr>
<tr><td colspan="5">waveform inverted ON / OFF</td></tr>
</table>

Measurement	Cursor Measurement	△V and △T between Cursor 1 and Cursor 2	
	Automatic Measurement	Vpp, Vmax, Vmin, Vtop, Vbase, Vamp, Vavg, Vrms, Overshoot, Preshoot, Frequency, Period, Rise Time, Fall Time, Delay A→B卐, Delay A→B卍, +Width, -Width, +Duty, -Duty	
	Lissajous Figure	Bandwidth	full bandwidth
		Phase Difference	±3 degrees
Communication Interface	USB device (type-C), USB host (Wi-Fi extension supported), LAN		
	Wi-Fi module available in option		
Frequency Counter	supported		

Trigger

Trigger Level Range	Internal	±5 divisions from the screen center
Trigger Level Accuracy (typical)	Internal	±0.3 division
Trigger Displacement	on the basis of record length and time base	
Trigger Hold-off Range	100ns - 10s	
Edge Trigger	Slope	rising, falling
Pulse Trigger	Trigger Condition	positive pulse: >, <, = negative pulse: >, <, =
	Pulse Width Range	30ns - 10s
Video Trigger	Modulation	supported standard: NTSC, PAL and SECAM broadcast systems
	Line Number Range	NTSC: 1 - 525; PAL / SECAM: 1 - 625
Slope Trigger	Trigger Condition	positive pulse: >, <, = negative pulse: >, <, =
	Time Setting	30ns - 10s

Function Generator Part -

Standard Waveform	sine, square, ramp and pulse
Frequency Output	5 MHz
Sampling Rate	25 MSa/s
Channel Q'nty	1
Vertical Resolution	10 bits
Output Impedance	50 Ω (typical)

Frequency

Resolution	0.1 Hz, or 5-digit effective value
Stability	±50 ppm at 0 ℃ - (+40 ℃)
Aging Rate	±50 ppm per year

Sine	0.1 Hz - 5 MHz
Square	0.1 Hz - 200 kHz, with rising or falling time < 200ns
Ramp	1 Hz - 10 kHz, with rising or falling time ≥ 5μs
Pulse	1 Hz - 10 kHz, with pulse width ≥ 5μs

Amplitude (default load at 50Ω unless otherwise noted)

Output Amplitude	10mVpp - 5Vpp (≤5MHz) @ High Z
Amplitude Accuracy	±(1% of setting + 1 mVpp) (typical, 1kHz sine, 0V offset)
Amplitude Resolution	10 mVpp
DC Offset Range (AC+DC)	±(2.5 Vpk - amplitude Vpp/2)
DC Offset Accuracy	±(1 % of |setting| + 1 mV + amplitude Vpp x 0.5%)
DC Offset Resolution	10 mVpp

General Part -

Communication Interface	USB Device, USB Host (hi-speed USB 2.0), LAN (10/100Mbits)
Programming Language	SCPI
Compatibility	USBTMC, LXI, SOCKET

Power

Power Source	5V - 15V DC / 1.2A
Power Consumption	≤ 8W

Environment

Temperature	working temperature: 0 ℃ - (+40 ℃) storage temperature: (-20 ℃) - (+60 ℃)
Relative Humidity	≤ 90%
Height	operating: 3,000 m non-operating: 15,000 m
Cooling Method	air convection (cross-ventilation)

Mechanical

Device Dimension	w/h/d 190 x 120 x 18 mm
Weight	0.38 kg

Device Calibration Time Interval

After the device been operated for every 12 natural months (calculated from the first operation day), better to calibrate it one time.

IX. Appendix

Appendix A. Device Accessory List

Accessories -

- 2 x passive probe
- 1 x USB connection cable (type-C)
- 1 x hard copy quick guide
- 1 x AC-DC adapter
- 1 x BNC/Q9 cable
- 1 x PC software / user manual CD

Optional Accessories -

- 1 x Wi-Fi module
- 1 x soft case

Note: Optional accessories is subject to extra purchasing.

Appendix B. Device Maintenance

Storage

To avoid any possible damage to the device, and probe, keep these items FAR AWAY from sprays, liquids, or solvents.

Surface Cleaning

As per the operation condition requirements, DO check the device and probe surface from time to time.

When cleaning the device / probe surface, please follow up with operation steps as follows -

i. Before the surface cleaning, making sure the device been powered off, without any accessory / outer facility connected; making sure probe not working with device / outer facility.

ii. Use non-electrostatic soft cloth to remove the surface dust.

iii. For further surface cleaning, recommend to use a wet-but-no-water-dripping soft cloth, or soft detergent.

Note: To avoid permanent damage to the surface of device and probe, DO NOT introduce any corrosive chemical cleaner / detergent.

Warning:
After device surface cleaning, before working the device for next time, please confirm that the device surface in a relative dry condition, so as to avoid any short circuit risk, or possible human body injury caused by electric conduction from the wet surface.