

User's Guide

Hantek4032L

PC USB Logic Analyzer

www.hantek.com

General safety summary	1
Introduction	2
Chapter 1 Getting started	3
1.1 System Requirements	4
1.2 Installing Software	5
1.3 Installing Driver	8
1.4 User Interface	11
Chapter 2 Menu	12
2.1 File	13
2.2 View	13
2.3 Setup	14
2.4 Analyzer	14
2.5 Help	15
Chapter 3 Advanced	16
3.1 Control Panel	17
3.2 Bus Panel	18
3.3 Waveform Panel	20
3.4 Measurement Panel	22
3.5 Export Data	23
Chapter 4 Bus Plug-in	24
4.1 Summary	25
4.2 Example	27
Chapter 5 Trigger	
5.1 Base Trigger Setup	31
5.2 Advance Trigger Setup	33
5.3 Immediately Trigger	33
Appendix	34
Hardware Specification	35
Channels	
Block Diagram	
Cleaning and maintenance	38

Content

General safety summary

Understand the following safety precautions to avoid injuries and to prevent damage to the product or the product of any product link. To avoid possible dangers, be sure to use the product in accordance with the regulations.

- Only qualified personnel to perform maintenance procedures.
- Prevent fire and personal injury.
- Use the right power cord. Only the country in which the authorized use of this product for the power line.
- Correctly inserted. Probe or test voltage wire connected to the source, please do not plug.
- Products will be grounded. This product through the power of the grounding wire grounding. To avoid electric shocks, grounding conductor must be connected to. In this connection the import or export of products before the end, be sure to correct grounding for this product.
- Properly connected probe. Probe the ground with the same potential. Do not connect high-voltage ground.
- See all the terminals rating. To avoid excessive current fire and the impact, see the product of all the ratings and tags; please connect products in the product manual inspection prior to understand the detailed ratings information.
- Do not run the product if you open the cover or panel.
- Avoid the exposed circuit. Do not connect power after contact with the exposed joints and components.
- Suspected products to failure do not operate. If you suspect that this product has been a failure, can be qualified maintenance personnel to be checked.
- Maintain proper ventilation.
- Do not operate in the humid environment.
- Do not flammable and explosive environment operation.
- Please keep the product clean and dry surface.

Introduction

The Hantek4032L is a sophisticated 32-channel logic analyzer used for testing, analysis, and troubleshooting of digital circuits. It is equipped with features found only in more expensive bench type instruments. The use of advanced large-scale integrated circuits, integrated USB 2.0, CPLD, FPGA, high-frequency digital circuitry, and other advanced technology, make the Hantek4032L to be portable, and easy-to-use. The Hantek4032L is very suitable for electronic measurement engineers, college students in scientific research and development and teaching assistants.

The User's Manual describes in detail the operation of the Hantek4032L as well as installation of the software.

The device has a sufficient number of input channels and is capable of simultaneously observing a lot of information or data flow direction control information, and in some way of capturing narrow pulse interference.

It has the feature of delayed ability to capture the required observation points around the waveform, in a variety of digital information capture function.

The Hantek4032L has intuitive and flexible displays to facilitate dynamic analysis, can transform the information, and the user can use the binary, decimal, hexadecimal or ASCII that information to facilitate the repair process and debug.

It can be triggered in a variety of ways, can display a very long data stream, on the basis of the analysis of that part of the information to make accurate positioning, and capture appropriate information for software analysis by using its tracking function trigger operation procedures. For hardware, trigger function can be detected in the system and that the interference and Burr.

The Hantek4032L has reliable Burr detection ability. As competition in digital circuit, the signal crosstalk, interference and power coupling factors, often mixed with irregular signal in the burr, which will run from an incorrect circuit.

Chapter 1 Getting started

This chapter focuses on the following topics:

- System Requirements
- Installing Software
- Installing Driver
- User Interface

1.1 System Requirements

Minimum System Requirements Operating System Windows XP/Vista/Win 7

Memory

128MB

Graphic Card

Microsoft DirectX supported Screen resolution: 1024x768 Color depth: 16bit

1.2 Installing Software

- 1. While in Windows, insert the installation CD into the CD-ROM drive.
- 2. The installation should start up automatically. Otherwise in Windows Explorer, switch to the CD-ROM drive and run "Setup.exe".



3. The Hantek4032L Installation is started. Click 'Next' to continue.



4. Choose a destination directory. Click 'Next' to continue.

📲 Hantek4032L Ver1.0.0	X
Destination Location	<u>e</u>
Setup will install Hantek4032L Ver1.0.0 in the foll	llowing folder.
To install into a different folder, click Browse, and	d select another folder.
You can choose not to install Hantek4032L Ver1.	1.0.0 by clicking Cancel to exit Setup.
Destination Folder	
C:\Program Files\Hantek4032L	Browse
Wise Installation Wizard?	
	< Back Next > Cancel

5. Check the setup information. Click Next to start copying of files.

🔏 Hantek4032L Ver1.0.0	×
Start Installation	Ø
You are now ready to install Hantek4032L Ver1.0.0.	
Click the Next button to begin the installation or the Back button to reenter the installa information.	ation
Wise Installation Wizard?	
< <u>B</u> ack	Cancel

6. This status dialog is displayed during copying of files.

Hantek4032L Ver1.0.0	
Installing	
Current File Copying file: C:\WINDOWS\system32\Drivers\LA4032IA6	64.sys
All Files	
Wise Installation Wizard?	< <u>B</u> ack Next> Cancel

7. Updating Your System Configuration.



8. The installation is complete.



1.3 Installing Driver

- 1. Connect the A-Type Plug of USB cable to your PC's USB port.
- 2. Connect the B-Type Plug of USB cable to Hantek4032L's USB port.
- 3. New hardware is found.



4. New hardware search wizard starts.

Found New Hardware Wiz	car d
	Welcome to the Found New Hardware Wizard This wizard helps you install software for: LA-4032
	If your hardware came with an installation CD or floppy disk, insert it now. What do you want the wizard to do?
	Install from a list or specific location (Advanced) Click Next to continue. < Back Next > Cancel

5. New hardware search wizard starts to search.

Found New H	ardware Wizard
Please wait	while the wizard searches
H	LA-4032
	< <u>Back</u> Next > Cancel

6. New hardware wizard installs software.

Found New Hardware Wizard	
Please wait while the wizard installs the software	
LA-4032	
LA4U32X86.SIS 到 C:\WINDOWS\System32\Drivers	
K Back	Next > Cancel

7. Finish new hardware search wizard.

Found New Hardware Wiz	ard
	Completing the Found New Hardware Wizard The wizard has finished installing the software for: LA-4032
	Click Finish to close the wizard.
	< <u>B</u> ack Finish Cancel

Caution:

Do not disconnect any device from the USB bus while the computer is communicating with the Hantek4032L, or you may lose data and/or your ability to communicate with the device.

If the LED is illuminated but then turns off, the computer has lost communication with the Hantek4032L.To restore communication, disconnect the USB cable from the computer, and then reconnect is. This should restore communication, and the LED should turn back on.

1.4 User Interface

Hantek4032L provides users with a simple and full-featured interface so that users needn't spend a lot of time to learn.

At the same time, it provides control panel, waveform panel, bus panel, measurement panel, trigger panel.

📕 Hant ek4032L	Ver 1	. 0. 0					
<u>F</u> ile <u>V</u> iew Set	up Ana	lyzer <u>H</u> elp					
- El 👌 🖬 🥝	<i>p p</i>	P 🔾 🕞 🗲) 🕐				
Signal	٩ /	Logic Analyzer			Þ	Control	ųΧ
Bus1 A0 B0 A1 B1 A2 B2 A3 B3 A4 B3 A4 B4 A5 B5 A6 B6 Messure						Horizont Sample Rate 2MS/s V Sample Depth 2K V Thresho V Level A 1.50 V Level B 1.50 V Trigger	
нчьы							
Running						2	7-02-2013 10:51

Chapter 2 Menu

This chapter focuses on the following topics:

- ♦ File
- View
- Setup
- Analyzer
- Help

2.1 File



- Export As CSV File:
- Export data to file as "CSV" Export data to file as "TXT"
- Export As TXT File: Export As BMP File:
- Print...:
- **Print Preview:**
- Pint Setup:
- Exit:

•

Print the current waveform Preview the current waveform Setup print type

Export data to file as "BMP"

Exit Hantek4032L

2.2 View



- Toolbar:
- Status Bar:
- **Control Window:**
- **Measure Window:**
- Zoom In:
- Zoom Out:
- Zoom All: •

Show or hide the toolbar window Show or hide the status window Show or hide the control window Show or hide the measure window Enlargement waveform view Reduction waveform view

Show entire waveform view

2.3 Setup



- Signal Name Setup: Modify the signal name.
- **Bus Setup:** Configure the bus and signals.
- Trigger Setup: Configure the trigger condition.

2.4 Analyzer



- Scroll to First Sample: Causes the waveform view to roll to the first sample position
 Scroll to Trigger: Causes the waveform view to roll to trigger
- position.
- Scroll to Last Sample: Causes the waveform view to roll to the last sample position

Create a new Mark

Create a new measurement.

- New Mark:
- New Measurement:
- Zoom In: Enlargement waveform view
- Zoom Out: Reduction waveform view
- Zoom All: Show entire waveform view

2.5 Help

Content... (2) <u>A</u>bout LA...

- Help Content:
- About:

Open the User Manual Show the copyright of the device

Chapter 3 Advanced

This chapter focuses on the following topics:

- Control Panel
- Bus Panel
- Waveform Panel
- Measurement Panel
- Export Data

3.1 Control Panel

Horizo	ontal
Sample Rate	
2MS/s 🔽	
Sample Depth	
Thres	hold
Level A	
1.50 🔽 🗸	
Level B	
1.50 💙 V	\sim
Trigg	jer
Trigger Condition	Force Trigger
Stop	Single

• Horizontal:

Set the clock and sample rate

Sample Rate: User can select the sample rate from 1MS/s to 400MS/s. **Sample Depth:** User can set the sample depth 1k, 2k, 10k.

• Threshold:

Configure the input trigger level.

• Trigger:

Trigger Condition: Popup the trigger setup dialog.

Force Trigger: Trigger immediately once.

- Stop: Stop trigger.
- **Single:** Trigger under the trigger condition once.

3.2 Bus Panel

Bus Setup	
Bust Bust	A B 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 0 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
	Add Delete OK Cancel

Click the menu "Setup"-> "Bus Setup..." to open the dialog.

Hantek4032L has 32 signals channels, A0 ~A15, B0~B15. You can assign the parts of them to some bus.

The list box contains all of the bus; you can add or delete the bus.

For example: Assign a bus "My Bus" which has 7 signals "A0, A1, A2, A3, A4, A5 and A6".

1. Click the button "Add". Then a new bus is added to the list.

	0 1 2 3	A 4 5 6 7 8 9 10	11 12 13 14 15 0 1	B 2 3 4 5 6 7 8 9 10 11	12 13 14 15
Sus0					
Bus1					
lewBus1					

2. Click the pane under the A0, A1, A2, A3, A4, A5, and A6. If the pane is filled of red, it means you have add the signal to the bus.

	0 1 2 3 4	11 12 13 14 15 0 1 2	B 3 4 5 6 7 8 9 10 11 12	13 14 15
Bus0				
Bus1				
NewBus1				

3. Double-click the name of the bus, which is "NewBus1" in this example. Then popup an edit box, in which you can input the bus name "My Bus".

3us0	0123	A 1 5 6 7 8 9 10	11 12 13 14 15 0 1	B 2 3 4 5 6 7 8 9 10	11 12 13 14 15
Bust My Bus IewBus					

4. Then Click "OK", the "My bus" has been added to the waveform.

				т			
	-80.00 us	-40.00us	-20.00us	T+0.00ns	+20.00us	+40.00us	+60.00us
Bus0							
Bus1				0h			
- My Bus							
- <mark>-</mark> A0							
- A1							
- A2							
- A3							
- A4							
- A5							
- A6							

3.3 Waveform Panel

-Bus1	-30.00ns	-20.00ns	-10.00 ns	T+0.00ns	+10.00ns	+20.00ns	+30.00ns
- A0							
- A0							
- A0				(h			
H AU							
- A1							
- A2 - A3							
A3							
- A4							
- A5							
- A6							
- A7							

You can observe the waveform by the waveform panel in the main window. The list contains all of the bus in bus panel in the left part of the waveform panel.

Click the name of the bus with the right mouse button, you can configure the bus.

⊟Bus1		
- A0	Display Format	Binary
	Display Order	Decimal
A1	Display Style	▶ 🖌 Hex
- A2	Color	
A3	Show Property	
A4		
- A5		
- A6		

- 1. **Display Format:** The format of the bus data displayed on the waveform.
- 2. **Display Order:** The order of the signals displayed in the list.
- 3. **Display Style:** You can set the display style of the bus in the waveform, Analog or Digital.
- 4. Color: You can modify the color of the bus displayed in the waveform.
- 5. Show Property: Open the bus setup panel.

Click the waveform with the right mouse button, the waveform help menu popup. You can operate the Hantek4032L by the menu.

\mathcal{A}	Show Grid				
$\overline{\mathcal{A}}$	Show Trigger				
$\overline{\mathcal{A}}$	Show Mark				
4	Show Measurement				
	New Mark				
	New Measurement				
	Set M1				
	Set M2				
	Scroll to M1				
	Scroll to M2				

3.4 Measurement Panel



Click the measurement panel with the right mouse button, then the menu popup.

Interval T - M1 = 984.00ns Cycles BCLK M1 - M2 = 0		
	New	
	Delete	
	Show Property	

Click the "New" in the popup menu or "Analyzer"->"New Measurement" in the main menu, you will add a new measurement to the list in the measurement panel.

Nev Ieasu	rement	X
From	M2 💙 To T 💙	
Measure	Interval 💌	
(OK Cancel	

Select the "Measure" combo box. You can modify the types of measurement. There are 4 types for you, such as Interval, rate, transitions and cycles.

Click the "Delete"; you can delete the measurement item selected in the list. Click the "Show Property"; you can modify the measurement.

Also, you can click the main menu "Analyzer"->"New Mark" to add new mark for measurement.

3.5 Export Data

Export As CSV File Export As TXT File Export As BMP File

Click the menu "File"; you can export the data to file.



If you select the CSV file, you will export the data as the following.

-				-						-	
	A	В	С	D	E	F	G	Н	I	J	K
1	Sample Pe	Trigger S	CompressI	Data							
2	500 MS/s	2048	FALSE								
3	Sample Nu	NewGroup1	ACLK	BCLK	AO	BO	A1	B1	A2	B2	NewGroup2A0
4	0	ffh	1	1	1	1	1	1	1	1	11h
5	1	ffh	1	1	1	1	1	1	1	1	11h
6	2	ffh	1	1	1	1	1	1	1	1	11h
7		ffh	1	1	1	1	1	1	1		11h
8	4	ffh	1	1	1	1	1	1	1	1	11h
9	5	ffh	1	1	1	1	1	1	1	1	11h
10	6	ffh	1	1	1	1	1	1	1	1	11h
11	7	ffh	1	1	1	1	1	1	1	1	11h
12	8	ffh	1	1	1	1	1	1	1	1	11h
13	9	ffh	1	1	1	1	1	1	1	1	11h
14	10	ffh	1	1	1	1	1	1	1	1	11h
15	11	ffh	1	1	1	1	1	1	1	1	11h
16	12	ffh	1	1	1	1	1	1	1	1	11h
17	13	ffh	1	1	1	1	1	1	1	1	11h
18	14	ffh	1	1	1	1	1	1	1	1	11h
19		ffh	1	1	1	1	1	1	1		11h
20		ffh	1	1	1	1	1	1	1		11h
0.4							-				

Chapter 4 Bus Plug-in

This chapter focuses on the following topics:

- Summary
- Example

4.1 Summary

Click right mouse, select "Bus Plug-in"-> "I2C".



The list box contains all of the plugs installed in your computer. You can add them to waveform by checking them.

User can modify the property of the plug in the box.

SPI							
MOSI	MISO						
ON/OFF	ON/OFF						
Name MOSI Out	Name MISO In						
Signal A0 💌	Signal A1						
Data Color	Data Color						
Setup							
Clock Signal A2 💌	CS Signal A3 💌						
Frame Length 8	Trans Mode MSB						
SPI Mode CPOL=0 CPHA=0 🗸	Data Format Hex 💌						
☑ Data is avalible when CS is low							
OK							

11C			×
Property		Color —	
Name	I2C Data	Data	✓
SCL	A0 🗸	Start	~
		Stop	~
SDA	A1 💌	ACK	~
Data Format	Hex 💌	R/W	×
	ок		Cancel

UART			X
RXD Bus		TXD Bus	
0	I/OFF		ON/OFF
Name F	RXD Data	Name	TXD Data
Signal /	40	Signal	A1 💌
Data Color	~	Data Color	•
Property			
Baud Rate	9600 💌	Data Length	8
Parity Mode	None	Trans Mode	LSB 💙
Stop	1 💌	Data Format	Hex 💌
Other Setup -			
Start	🚽 Parity	~	Stop
Reverse			
	ок		Cancel

4.2 Example

If you want to analyze the l^2C bus, you should go with the steps following.

1. Click menu "Setup"->"Bus Setup" or toolbar , open the bus setup dialog.

Bus Setup					
		A		В	
Bus1	0 1 2 3 4 5	6 7 8 9 10 11 12 13	14 15 0 1 2 3 4 5	6 7 8 9 10 11 12 13 14 1	5
1			······		
	Add	Delete	ОК	Cancle	

 Open the plug manager and the I²C setup dialog. Click right mouse and select "Bus Plug-in"->"I2C" to open the setup dialog.



11C			×
Property)	Color —	
Name	I2C Data	Data	×
SCL	A0 💌	Start	•
		Stop	~
SDA	A1 💌	ACK	
Data Format	Hex 💌	R/W	~
	ок		Cancel

3. Click menu "Setup"-> "Trigger Setup" or toolbar 0, open the bus setup dialog, do these steps:

Trigger Setup		×
Han Trigger Type Han-Single signal Han-Bus 	Data value and rising edge trigger	
- Data value delay - Data and edge - Advance - Immediately	Trigger at the appearance of a specified value on the selected bus and rising edge of the selected signal	
	Target Bus SDA V = Oh Target Signal A1 V occur Rise V	
Pre-Trigger Pos: 25 %	0	ОК

4. Then you can see the following.

		1	Г			M1 M2					
	-1.00ms	-800.00us	-600.00us	-400.00us	-200.00us	T+661.76us	s +200.00us	+400.00us	+600.00us	+800.00us	+1.00ms
⊞Bus0	Oh	Oh	R R R R R R R R R R R R R R R R R R R		0h		Oh	I I A D E I I I I I I I I I I I I I I I I I I	Oh		3h
SCL						nnkh					
SDA											
I2C		S	0x30h			0xA0h		0x89h			i

.....

 Usually, after doing the five steps, you can see the stable and sensitive I2C signals. If there is measuring instrument line interference, user can adjust the trigger voltage value. Set initial trigger voltage value for SCL and SDA is 1.5V, try to adjust the value to obtain the stable signal.



Chapter 5 Trigger

This chapter focuses on the following topics:

- Base Trigger Setup
- Advance Trigger Setup
- Immediately Trigger

5.1 Base Trigger Setup

Click the menu "Setup"-> "Trigger Setup", you can configure the trigger condition.

Trigger Setup		
 ■ Trigger Type ➡ Single signal ➡ Bus ➡ Advance ➡ Immediately 	Immediate trigger Triggered immediately after the sampling starts	
Pre-Trigger Pos: 50 %	0	OK

Hantek4032L provides 6 base triggers for you.

- **Single signal**: Rising edge; Falling edge; Rising or falling edge.
- **Bus:** Data, Data value delay, Data and edge

1. Rising edge:

Select the "Rising edge" in the tree; select the signal in the combo box. Then it will triggered by a rising edge appeared on the selected signal.

				Т	
	-1.50ms	-1.00ms	-500.00 us	T+151.04us	+500.00us
AO					
⊞Bus1				Oh	

2. Falling edge:

Trigger by a falling edge appeared on the selected signal.

3. Rising or falling edge:

Trigger by a rising or falling edge appeared on the selected signal.

4. Data:

Trigger at the appearance of a specified value on the selected bus.

		Т	
	-1.50ms	-1.00ms	-500.00 us
A0			
⊡Bus1	1h 0h	l 1h) Oh
A0			

5. Data value delay:

Trigger at x time after the appearance of a specified value

6. Data and edge:

Trigger at the appearance of a specified value on the selected bus and rising, falling, or rising or falling edge of the selected signal.

		1	Г		
	-600.00us -	400.00us	-200.00us	T+288.00us	+200.00us
A 0					
⊟Bus1	0h			1h	
- <mark>-</mark> A0					
- A1					

5.2 Advance Trigger Setup

If the base trigger can't satisfies you, may be you want the advance trigger. Click the "Advance" in the tree, then you can configure the advance trigger.

Trigger Setup				
I Trigger Type ing-Single signal	Trigger A Condition			Trigger Mode
⊷ Bus ⊷ Advance Immediately	Vata While value of Bus1	Duration For duration Samples	✓ Edge While edge of AO ▼	 Only Trigger A is Satisfied
	Equal to Max V MAX Fh MIN Oh	Equal to Max V MAX Ah MIN 1h	occur Rise 💌	
	Relative Trigger Value			Only Trigger B is Satisfied
	-Trigger B Condition-			
	🔽 Data	✓ Duration	✓ Edge	CEither Trigger A or Trigger B is Satisfied
	While value of Busi 💙	For duration Samples 💙	While edge of BO 💌	
	MAX Fh MIN Oh	MAX Ah MIN 1h	occur Rise 💌	OBoth Trigger A and Trigger B are Satisfied
	Relative Trigger Value			
Pre-Trigger Pos: 50 %			}	
				ОК

There are two trigger conditions: trigger A and trigger B. You can set the trigger mode by clicking the Trigger Mode group box.

There are four parts in each condition, Data, Duration, Edge and Relative trigger value.

5.3 Immediately Trigger

Click "Setup -> Trigger Setup" and select Immediately.

Immediately: Triggered immediately after the sampling starts.

Trigger Setup		
E Trigger Type E-Single signal E-Bus Advance base link bit	Immediate trigger	
Immediately	Triggered immediately after the sampling starts	
Pre-Trigger Pos: 50 %	0	
		ОК

Appendix

- Hardware specification
- Input connector pin assignments
- Block Diagram
- Cleaning and Maintenance

Hardware Specification

Sampled channels	32
High input impedance	200K (C=10p)
Input voltage range	-60V~60V
Logic threshold Range	-6V~6V
Max Sample Rate	400 MSa/s
Max input Signal bandwidth	150 MHz
Min time resolution	2.5ns
Sample Depth	64M
Buffer Depth	2G
Trigger's Max rate	200 MHz
Compatible input	TTL,LVTTL,CMOS,LVCOMS,ECL,PEC L,EIA
Electrostatic Protected	15KV
Power Adapter	5V
Temperature range	-10℃~60℃
Dimension	Length: 105mm Width: 80mm Height: 25mm
Weight	0.38Kg
Accessories	A USB cable; A set Little Test Hook; A Power Adapt; A Logic Analyzer Cable A CD;

Channels

Level A

Pin Number	Wire ID	Wire Color
1	Ground	Black
2	ACLK	Grey
3	Ground	Black
4	A0	Grey
5	A1	Grey
6	A2	Grey
7	A3	Grey
8	A4	Grey
9	A5	Grey
10	A6	Grey
11	A7	Grey
12	A8	Grey
13	A9	Grey
14	A10	Grey
15	A11	Grey
16	A12	Grey
17	A13	Grey
18	A14	Grey
19	A15	Grey
20	AST0	Grey

Level B

Pin Number	Wire ID	Wire Color
1	Ground	Black
2	BCLK	Grey
3	Ground	Black
4	B0	Grey
5	B1	Grey
6	B2	Grey
7	B3	Grey
8	B4	Grey
9	B5	Grey
10	B6	Grey
11	B7	Grey
12	B8	Grey
13	B9	Grey
14	B10	Grey
15	B11	Grey

r		
16	B12	Grey
17	B13	Grey
18	B14	Grey
19	B15	Grey
20	AST1	Grey

Block Diagram



Cleaning and maintenance

Cleaning

In order to maintain the cleanliness of equipment, you need to check whether the channels are dusty or not. Please clean the out surface of the equipment follow these matters.

- 1. Use velvet cloth contact the surface of the equipment.
- 2. Pease do not use any corrosive or chemistry.

Caution: Please make sure the equipment is dry enough before going to work. Avoid mangling the equipment or hurting body because of water!

Maintenance

Don't put the equipment under the sun for a long time. Put it in wind to the best of one's abilities

Caution

In order to not mangle the equipment, you should not put it in fog, water or impregnate.