# VK7018   Ethernet/USB 8-Channel DAQ

## Hardware Manual V1.30

**-VK7018   Model Number**          **-VK7018-PRO 型 Model Number**

# Shenzhen VKinging Electronics Co.,Ltd

### ——Precision Accurate Fast Reliable

## VK7018   Appliance：

- Multi-Card Data Acquisition
- High Resolution Signal Measurement
- Signal Trigger Acquisition System
- IoT Information System
- Differential Bridge Application Measurement

# Directory

# 1. Products

## 1.1 Characteristics

VK7018 is an Ethernet/USB type high-speed data acquisition card with 8-channel true differential inputs, 24-bit resolution, maximum single-channel sampling rate of 256ksps, 8-channel synchronous total of 2.048Msps, precision preamplification, Gigabit Ethernet transmission unit, integrated IEPE/ICP hardware support. This product uses a number of high-precision 24-bit ADC unit and with the company's many years of accumulation of the development of the front differential amplification module, making the product has a high speed, high resolution, high precision, ultra-low noise, high rejection ratio, a wide range of measurements, and low temperature drift, suitable for precision and high speed acquisition of a variety of occasions. Collector internal integration linux system, application layer interface is open to the user, can be flexible and easy to achieve embedded application redevelopment. Acquisition card supports Ethernet interface/USB interface communication, SD offline data storage, etc., BNC type VK7018-PRO, 16-channel type VK7016, and supports highly customised services.

All components of VK7018 capture card are industrial grade, with full metal shielding, which can be adapted to the application of strong industrial interference, and has the advantages of moisture-proof, shock-proof and anti-interference.

## 1.2 List of characteristics

| High precision and high resolution | 24-bit resolution |
|---|---|
| Ultra-low noise pre-differential amplification | Minimum measurable uV |
| High-speed simultaneous acquisition | Maximum 256kS/s (256k points per second) for a single channel, 4.096MS/s for 16 channels. |
| Embedded in a Linux system | Algorithms can be embedded into the hardware to work independently, the application layer of the system is open to customers, convenient for secondary development. |

| Support SD storage | Online/offline/timed/conditionally triggered storage |
|---|---|
| IEPE/ICP Drive Receive | Supports 2/4mA ICP/IEPE standard sensors |
| Scope of transferees | 0 ~± 10V Eight-step switching |
| Integration of 2 PWM outputs | 16- Bit Adjustable PWM |
| 2 DAC outputs | 0 ~ +/-9V, 500kS/s |

## 1.3 System Block Diagrams
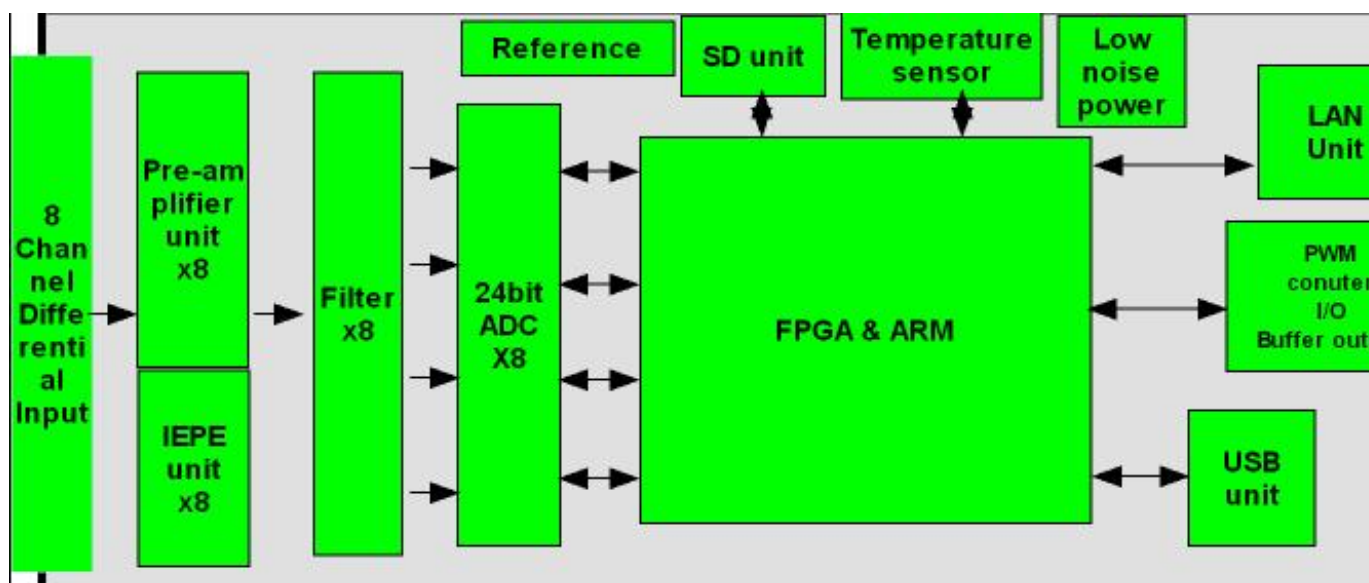


## 1.4 Port Functions

| | | Name | Functionality | 备注 |
|---|---|---|---|---|
| 2 | Digital IO Ports | VCC | Digital power supply 3.3V output to provide external drive current up to 100mA | |
| | | DIO1 | DIO1——Configured as a digital input/output port | |
| | | DIO2/ PWM1 | DIO2——Configured as a digital input/output port<br>PWM1——Configured as a PWM output port | 功能 2 选 1 |
| | | DIO3/ PWM2 | DIO3——Configured as a digital input/output port<br>PWM2——Configured as a PWM output port | 功能 2 选 1 |
| | | DIO4/ CNT/ Ext Trig | DIO4——Configured as a digital input/output port<br>CNT——Configured as a counter/frequency meter input port | 功能 3 选 1 |

| | | | Ext Trig——Configuring externally triggered acquisition | |
|---|---|---|---|---|
| | | DGND | Digital    land | |
| 9 ~ 10 | Analogue interfaces | AinX- | Negative analogue input, single-ended input mode by connecting AINX to AGND (VK7018-PRO is a single-ended BNC input). | Using AGND as a reference |
| | | AinX+ | Analogue input positive input | |
| 11 | | AGND | Analogue | |
| | | AoutX | Analogue voltage output | |

# 2   Hardware parameters and interface description

## 2.1 Product port function descrip



1) 8~24V power supply

2) Digital IO port SD

3) SD memory card

4) USB connection indicator

5) Gigabit LAN port

6) USB port

7) Synchronised signal input

8) Synchronised signal output

9) Analogue input interface

10) Analogue input interface

11) Analogue output interface

12)
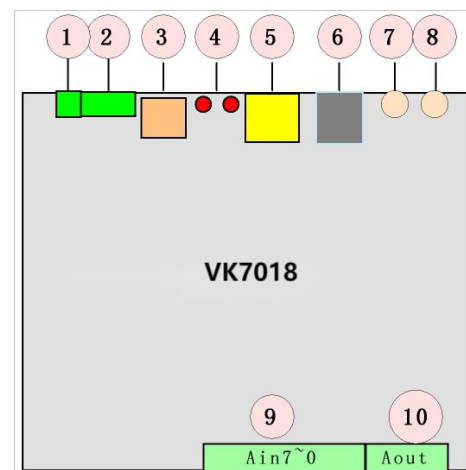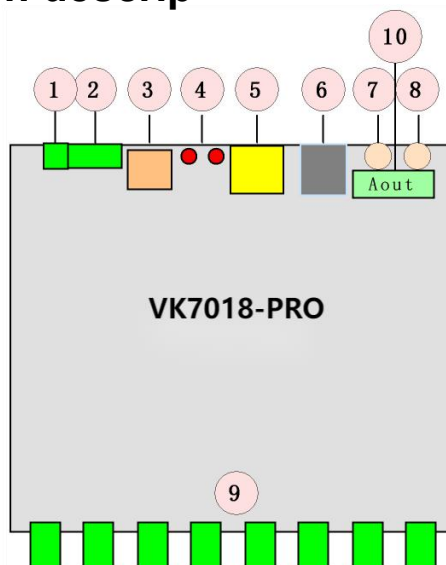
| DGND | DIO4 /CNT | DIO3 /PWM2 | DIO2 /PWM1 | DIO1 | VCC |
|---|---|---|---|---|---|

**-VK7018 Model**

9)

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| + A7 - | | + A6 - | | + A5 - | | + A4 - | | + A3 - | | + A2 - | | + A1 - | | + A0 - | |

**-VK7018-PRO 型**

9)

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH15 | CH14 | CH13 | CH12 | CH11 | CH10 | CH9 | CH8 | CH7 | CH6 | CH5 | CH4 | CH3 | CH2 | CH1 | CH0 |

| 4 | 3 | 2 | 1 |
|---|---|---|---|
| AGND | | Aout2 | Aout1 |

## 2.2 Integrated electrical parameters

| Sports event | Unit (of measure) | Typical value | Scope/Remarks |
|---|---|---|---|
| USB supply voltage | V | 5 | 4.5~5.5 |
| USB Current Limit | mA | 200 | |
| 8-24V supply port voltage | V | 8-24 | 5~40 |
| 8-24V supply port current | mA | 400mA@12V<br>200mA@24V | |
| ADC analogue port input voltage | V | | +/-10 |
| ADC analogue signal input bandwidth | Hz | 65K @ 0 档(+/-10V)<br>120K @ 1 档(+/-5V)<br>300K @ 2 档(+/-2.5V)<br>300K @ 3 档(+/-1V)<br>300K @ 4 档(+/-500mV)<br>200K @ 5 档(+/-100mV)<br>200K @ 6 档(+/-20mV) | |
| Digital port input VL low | V | 0 | -0.3~1 |
| Digital port input VH high | V | 3.3 | 2~5.5 |
| Digital Port Output Voltage | V | 3.3 | 3.2~3.4 |
| Digital port output drive current (when output is high) | mA | 10 | |
| Digital port input absorption current (at 5V input voltage) | uA | 170 | |
| ADC Maximum Sample Rate | ksps | | 256( 8-channel synchronisation) |
| Minimum Resolution Voltage | uV | | 0.1 |
| DAC Analogue output resolution | | 16bit | |
| DAC Update Rate | | 500ks/s | |
| Aout Output Voltage | V | | 0 ~ +/-9V |
| PWM output frequency (DIO2/PWM1, DIO3/PWM2 ports) | Hz | | 0~100k |
| PWM duty cycle (DIO2/PWM1, DIO3/PWM2 ports) | % | | 0~100 |

| Counter input maximum frequency (DIO4/CNT port) | Hz | | 100K |
|---|---|---|---|
| Counter input maximum count value | | 2^64th power | |
| Ethernet interface rate | Mb | 1000 | |
| Working temperature: | degrees centigrade | | -40~ 85 |
| Storage temperature | degrees centigrade | | -40~ 105 |
| Physical dimensions (LWH) | mm | 190*150*50 | Without connector length |

## 2.3 Safe use of the absolute maximum

| sports event | unit (of measure) | numerical value | |
|---|---|---|---|
| USB supply voltage： | V | -1~+6 | *  Exceeding the absolute maximum value may damage the device and cause irreversible damage. |
| ADC Analogue Port | V | -15V~+24V | |
| Digital Ports | V | -1V~+5V | |
| DAC output port | V | -15V~+15V | |
| Electrostatic input (ESD) on all ports | V | 2000 | |

## 2.4ADC analogue conversion unit

## 2.4.1 ADC Input Detailed Electrical Parameters

| sports event | unit (of measure) | typical case | Note |
|---|---|---|---|
| Common mode rejection ratio(CMRR) | dB | 130 | |
| Input Bias Current | nA | 1 | |
| Input bias voltage | uv | 10 | |
| Input Equivalent Voltage Noise | nVp-p | 200 | Maximum value is 400 when +-10V is selected for the input range. |
| Input equivalent current noise | pAp-p | 1 | Maximum value is 2 |
| Equivalent Input Capacitance | pF | 400 | |

| input resistance | GΩ | 1 | |
|---|---|---|---|
| ADC Reference Accuracy | | 0.1% | |
| Overall maximum temperature drift of ADC amplification acquisition unit | ppm/℃ | 6 | Maximum 2ppm/°C |

## 2.4.2 Input Range vs Bottom Noise

| Setting values(Program set) | Corresponding measuring range | background noise | Note |
|---|---|---|---|
| 0 | -10V~+10V | 100uV | Test conditions: Sampling rate 1kS/s Input shorted to AGND |
| 1 | -5V~+5V | 50uV | |
| 2 | -2.5V~+2.5V | 20uV | |
| 3 | -1V~+1V | 6uV | |
| 4 | -500mV~+500mV | 4uV | |
| 5 | -100mV~+100mV | 3uV | |
| 6 | -50mV~+50mV | 3uV | |
| 7 | -20mV~+20mV | 1.5uV | |

# 3  Precautions for use

## 3.1 Ground is divided into digital and analogue ground

The ADC acquisition side is used in conjunction with the analogue ground (AGND), thus avoiding digital interference from the digital input to the analogue input.
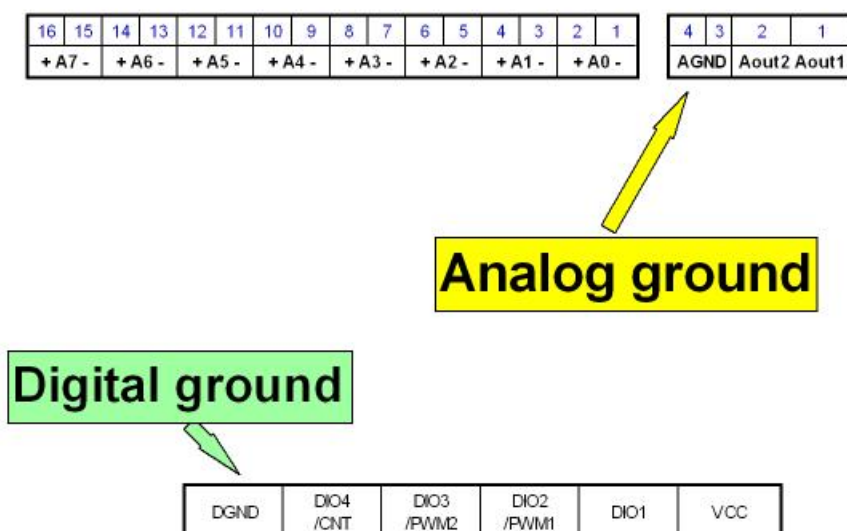
## 3.2 Differential mode of ADC inputs

The differential method is the least noisy input method and effectively suppresses all kinds of common mode interference. However, care must be taken to provide the input with the correct input loop. Correct common ground is the first step in securing the input loop.
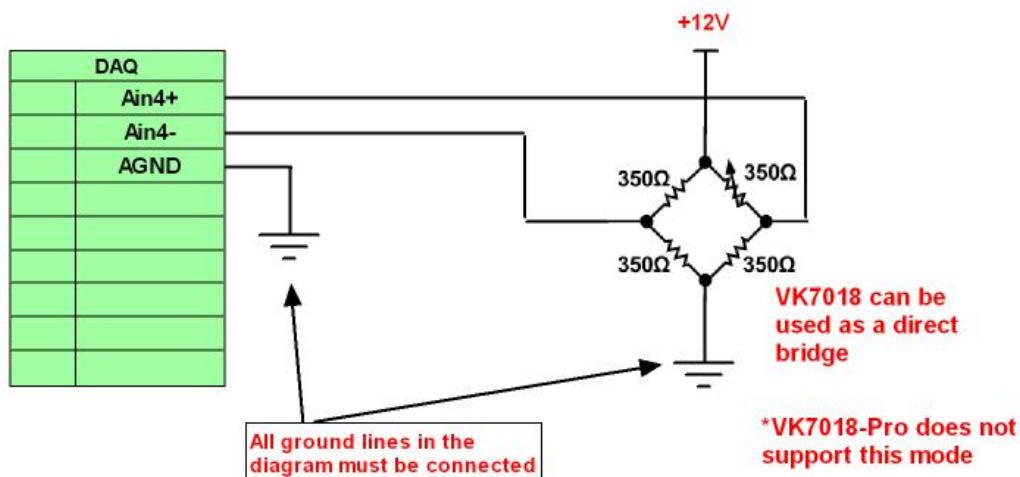


If the inputs do not share a common ground, you can create an input return path in the following way. (Software set to Differential input mode)
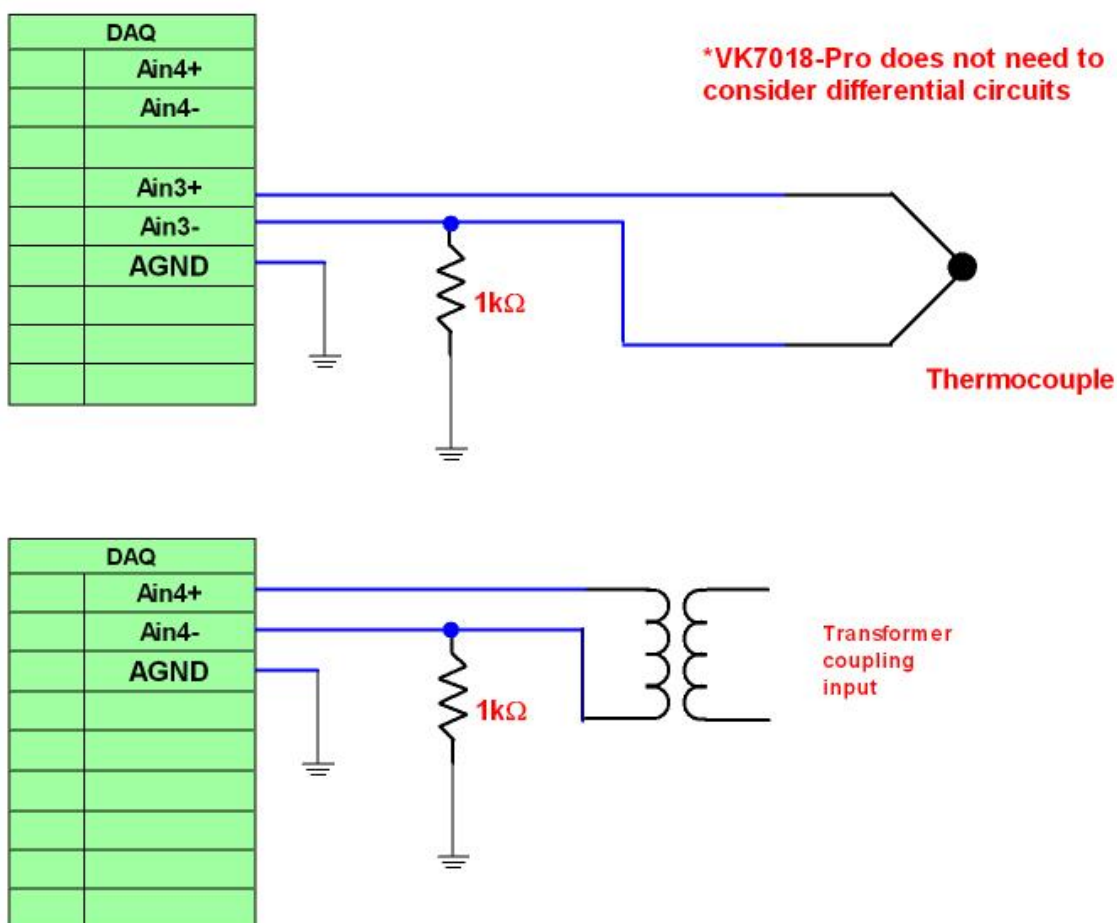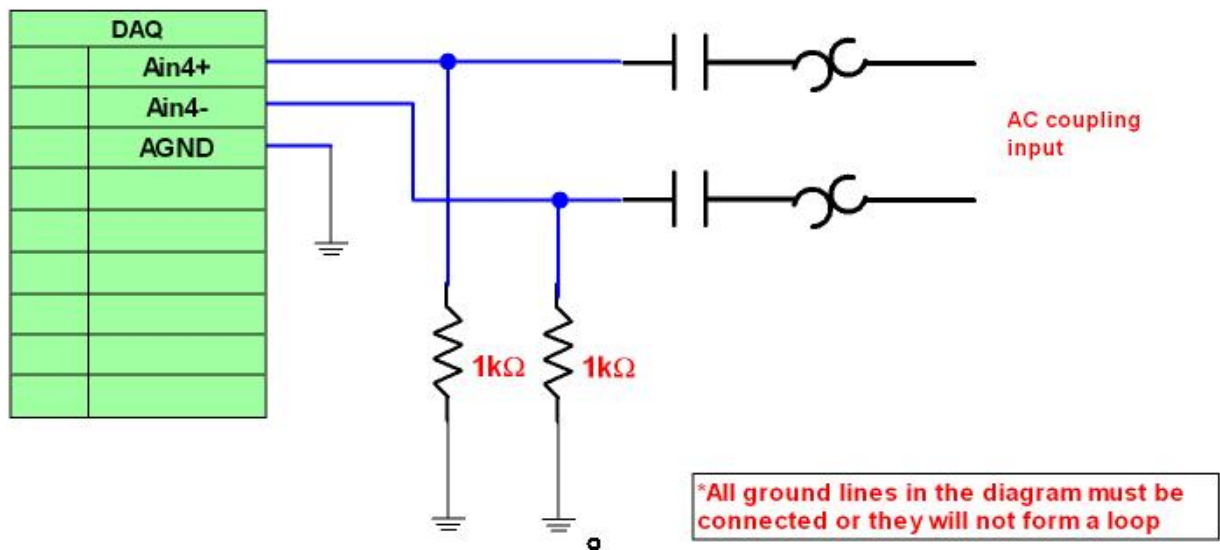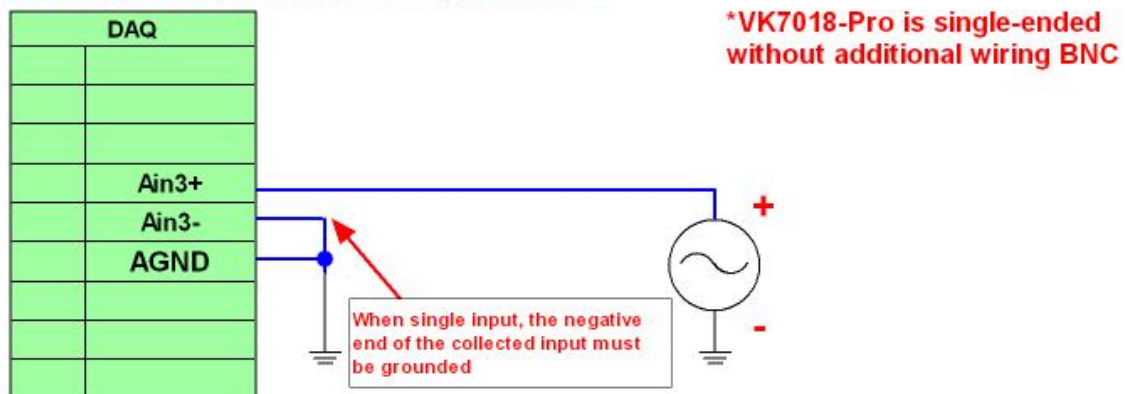
## 3.3 Application of Single-Ended Inputs for ADC Inputs

When the input is a single signal terminal input, the negative end of the differential input must be grounded. When this capture card is used to capture non-differential signals, it can also perform well with a high rejection ratio, and can eliminate the noise introduced by the ground line very well.
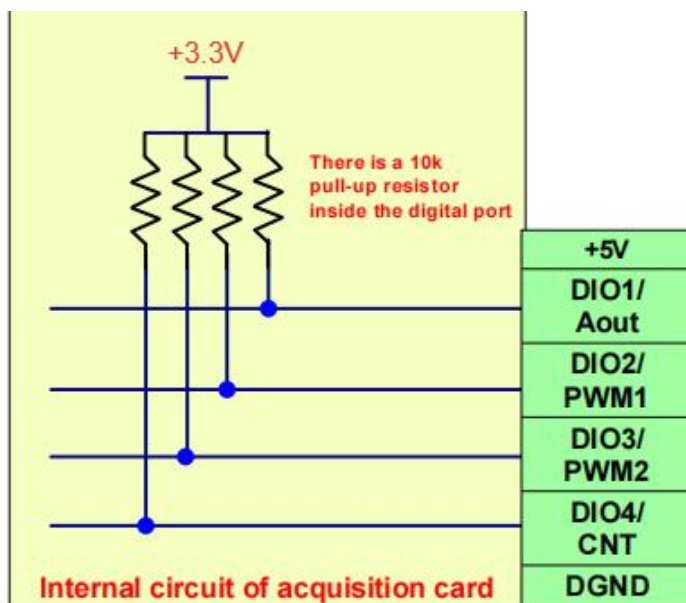
Software set to Single-end input mode
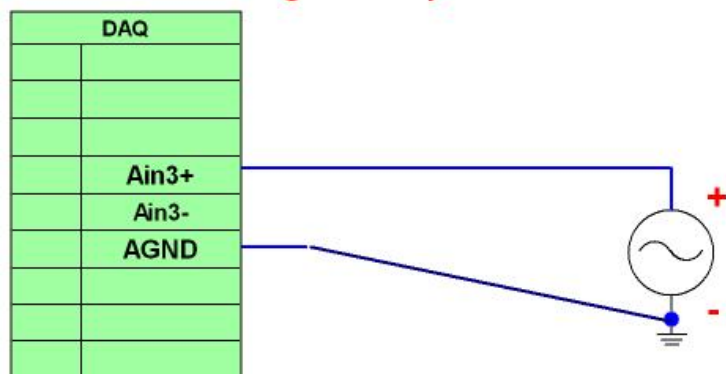


AIN3-hanging, or
connected to AGND
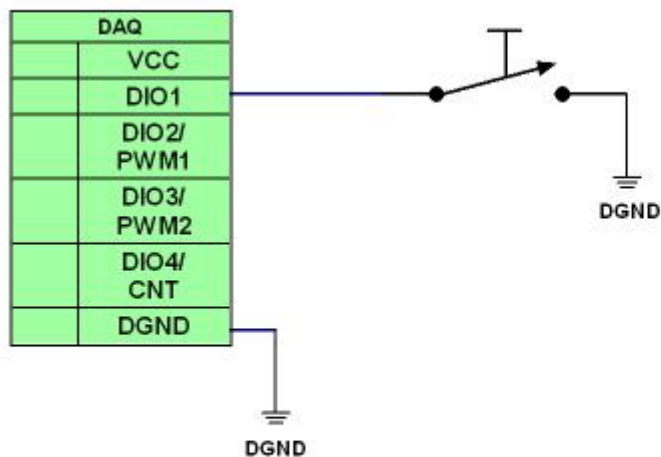
## 3.4 Digital port as input application

When the capture card is used as an input, its internal pull-up resistor can be used more conveniently.



## 3.5 Key Input Usage

When the capture card is used as an input, its internal pull-up resistor can be used more conveniently.

*All ground lines in the diagram must be connected or they will not form a loop

## 3.6 Connections using hardware digital encoders

The card has two built-in digital encoder units, DIO1/DIO2, DIO3/DIO4.



## 3.7 Uses internal 5V power supply to power sensor inputs

When the capture card is used as an input, its internal pull-up resistor can be used more conveniently.
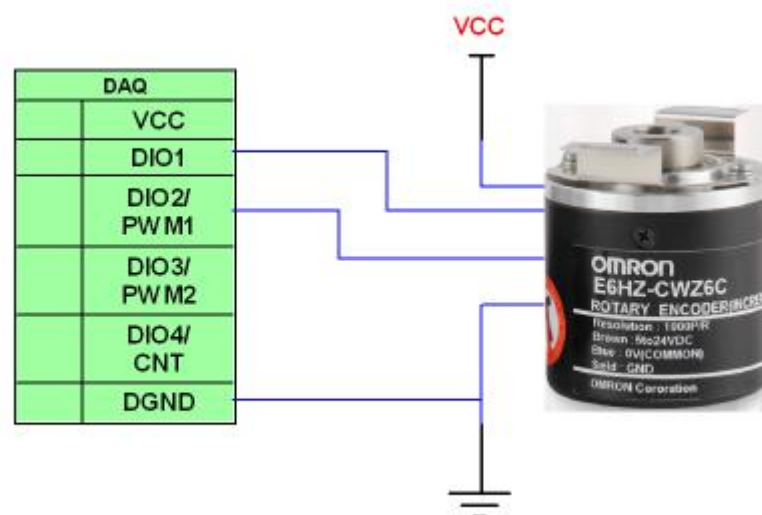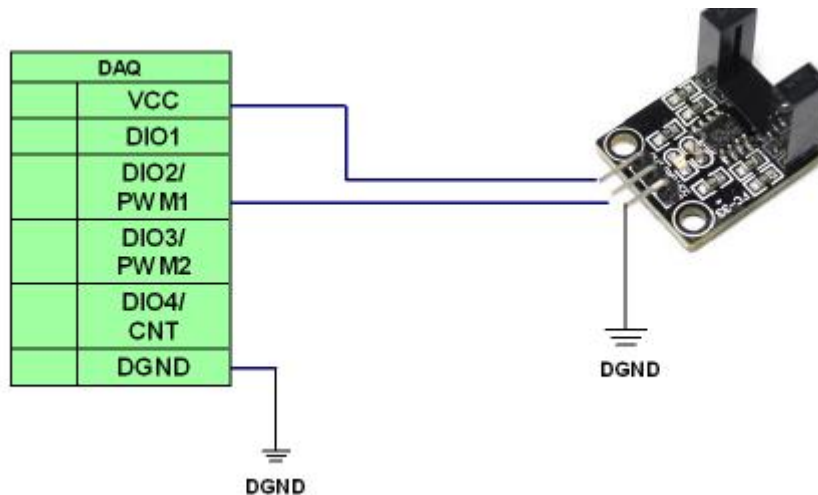
## 3.8 IEPE Model Description
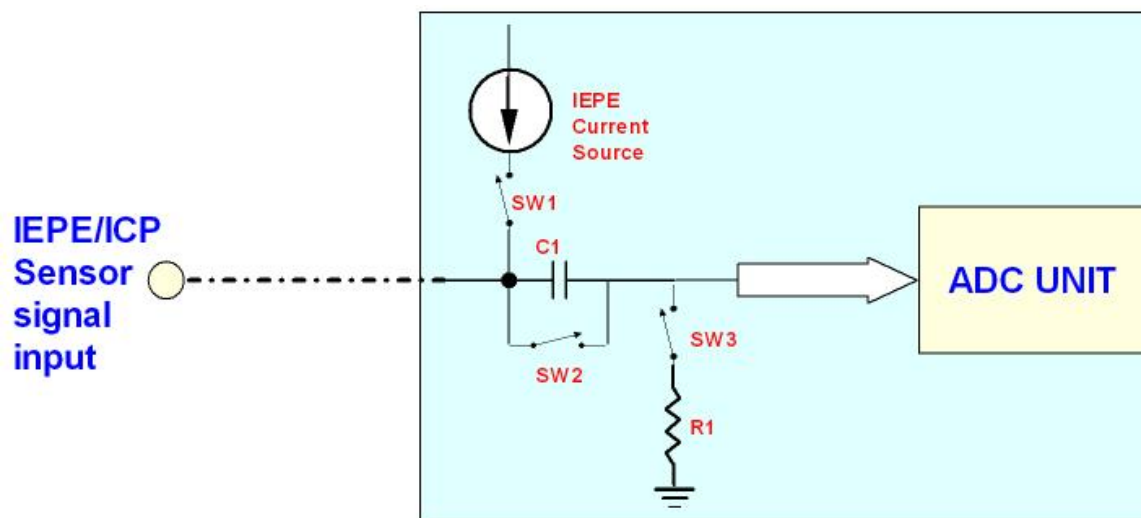


- This capture card has integrated IEPE/ICP hardware support.
- The capture card integrates a 24V power supply unit, a constant current driver and a receiver unit, and each channel can be individually switched to the commonly used "Analogue Input Mode" or "IEPE Mode" through software settings.
- In IEPE mode, the output is 24V 4mA (2mA compatible), and the relative ADC input is AC-coupled.
- 8 channels can be independently switched controllable.
- differential input connection can further reduce transmission interference.

## 3.9 Input port to IEPE sensor

When connecting an IEPE sensor, AGND is used as the negative input and AIN+ is used as the positive input (*The corresponding input needs to be set to IEPE MODE in the software).
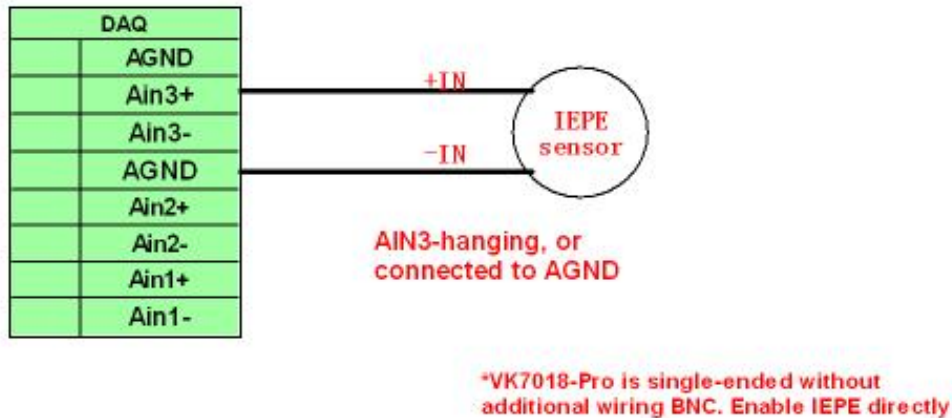


# 4.Acquisition Mode

# 4.1 Externally Triggered Acquisition Mode

Triggered Acquisition - Mode 1: DIO4 triggers N acquisitions (N acquisitions = finite number of acquisitions)
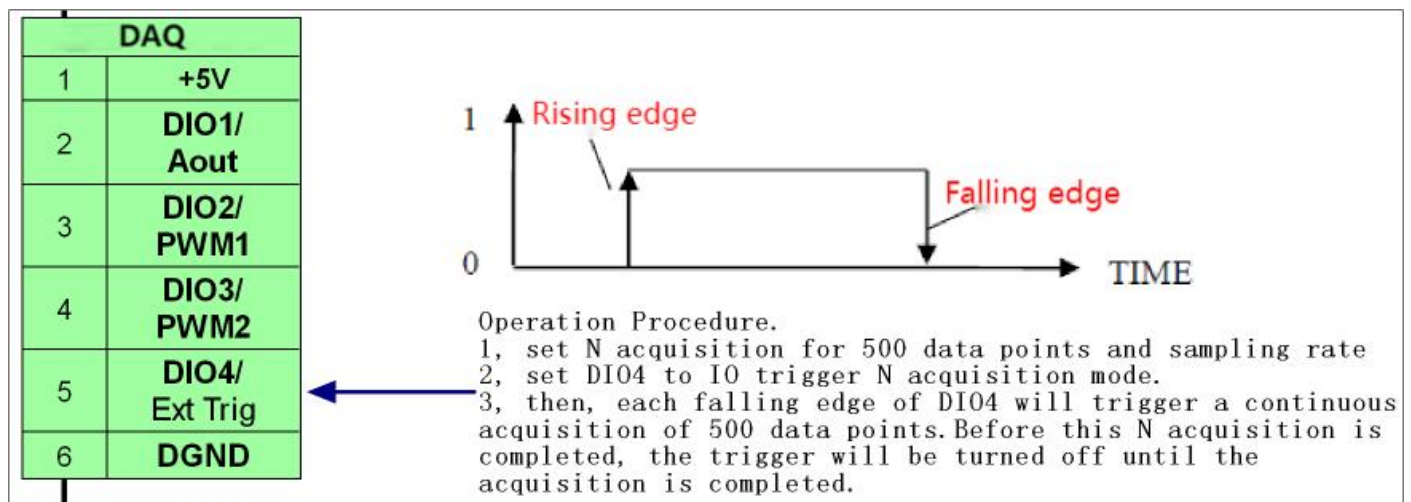


# 4.2 External Acquisition Clock Mode

Trigger Acquisition - Mode 2: SYNC is used as the acquisition clock input port for acquisition, one data point is acquired for each pulse (1 high and 1 low level for 1 pulse).

Operation process:
  1. Put PO 4 set IO to ADC sampling clock mode.
  2. PO. 4 input one data for each pulse collector The maximum input frequency is 100kHz; Input 1K pulses and output 1K groups of collected data

## 4.3 Analogue level-triggered acquisition mode

Trigger Acquisition - Mode 3: 8 input analogue input channels, use one of the channels as the trigger signal input, when the voltage value of the trigger channel meets the set voltage threshold condition, trigger acquisition starts to act.
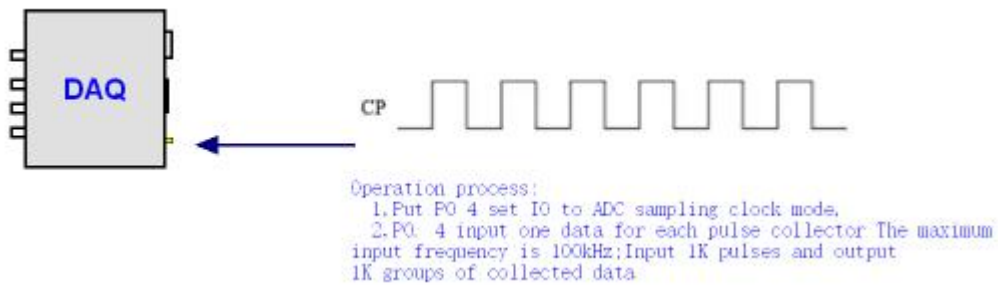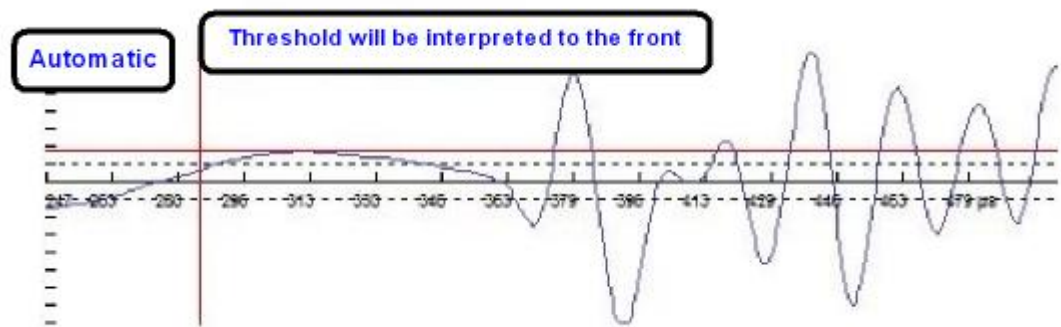


## 4.4 Multiple front-end acquisition at the same time

This acquisition system supports one acquisition terminal to collect multiple acquisition front-ends for time-sharing, which can easily build a multi-point measurement and monitoring system, and one transceiver supports a maximum of 255 acquisition front-ends.
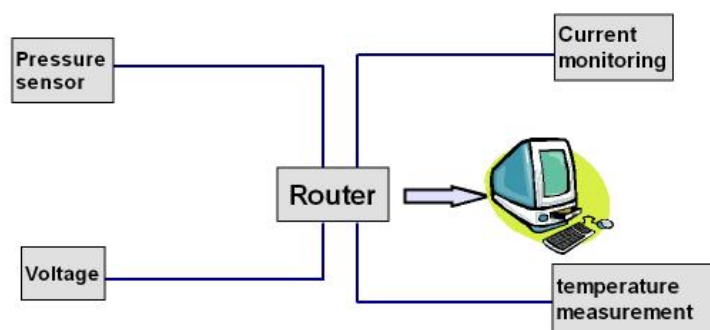
## 5 Quick installation and easy testing

Please go to our official website to download the information package directly www.vkinging.com

## 5.1 Installation of drivers and test software

This collector can be used directly without driver installation.

Our accompanying test software is for evaluation testing purposes, and various development routines are provided in the package.

The test software can be run directly after installation.

## 5.2 Easy to use test software for testing

We have test software, you can test the hardware directly.
The following picture shows the interface of the software:
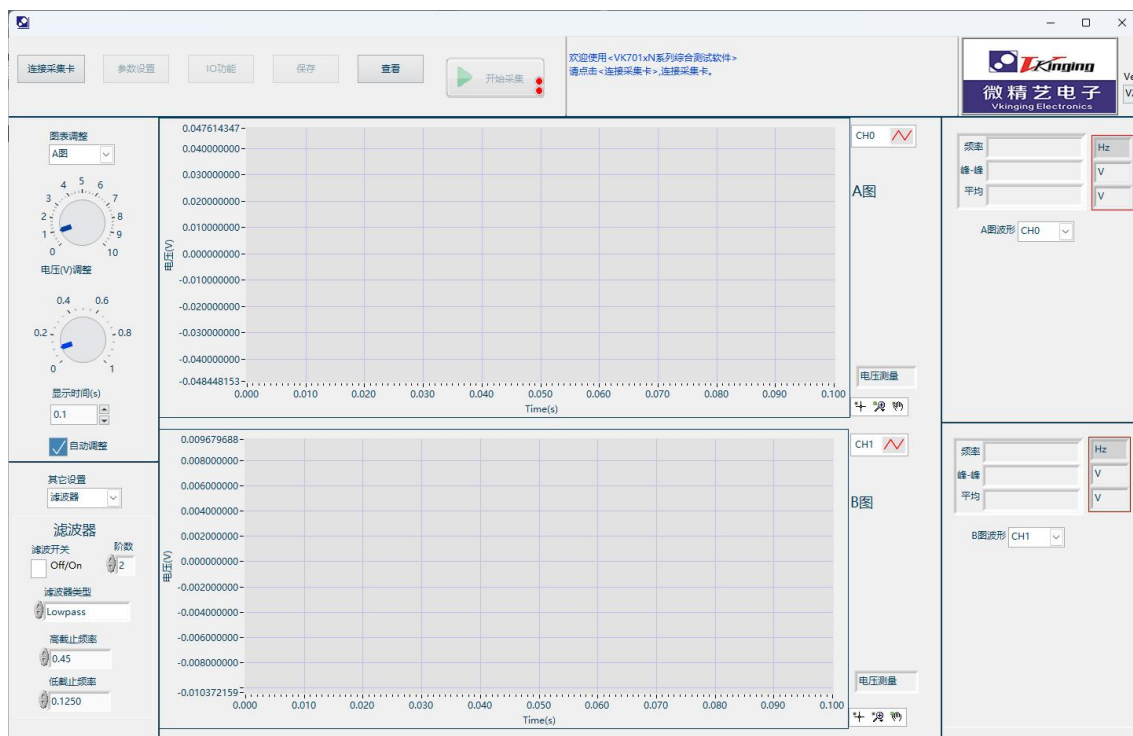


For more specific instructions on how to use the test software, please refer to the Test Software User's Guide included in our packages.                    +`

## 6.Advanced: Brief description of programming and development

Collector sampling standard TCP/IP protocol development, a variety of communication

methods are suitable for this standard, please refer to our TCP/IP protocol. We also provide DLL development mode, user configuration and development more convenient and concise.

This collector can be used across a variety of platforms, in addition we provide a variety of routines and Win7/8/10/11/Linux/Android development routines.

For more details, please refer to the "programme development related" folder in our package.
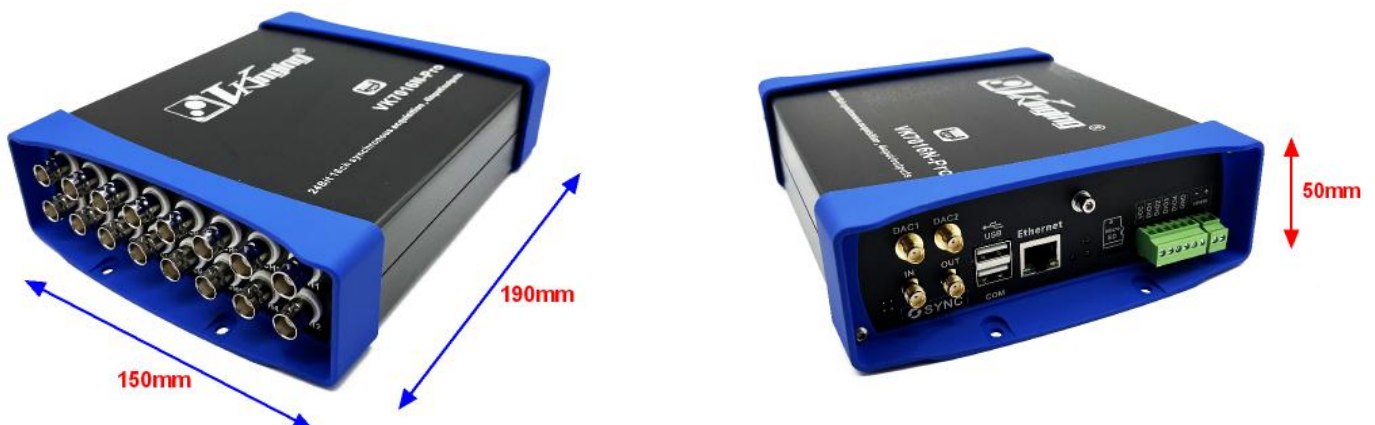
# 7 External dimensions and installation

## 7.1 VK7018Physical Dimensions



## 7.2 VK7018-PRO Physical Dimensions

# 8 Common Problems and Troubleshooting

| Description of the problem | Methods of elimination | Other notes |
|---|---|---|
| USB Driver Installation | Firstly, connect the computer with USB, make sure the indicator light is on. Then operate the computer, right-click on my computer -> click on Management -> Device Manager -> Port, to see if you can see the VKxx capture card word driver, if not, you need to install the driver, detailed steps, please refer to the package "USB driver installation instructions"! | |
| USB connection has a serial port but cannot communicate | A new serial port will appear when plugged in, confirm if a new serial port appears. If there is a new serial port then make sure<br>If there is a new serial port, make sure the serial port number and baud rate are correct. | The default virtual serial port baud rate is 9600 |
| USB plugged in cannot display the serial port | 1，part of the WIN7 system is optimised for the lack of relevant files.<br>2，individual computer system files are missing, please replace a computer or other operating systems and then test to confirm<br>3，Rule out poor contact with the USB cable or USB cable quality problems, replace a cable test. | |
| No response after USB power up | 1, if using USB power supply, ensure the quality of USB wire. If the voltage drop of the wire is too low, it will also cause the USB power supply and communication abnormality. At this time, please replace the USB cable test to confirm.<br>2, you can use the green power supply dedicated seat 8~24V power supply. | Troubleshooting: Use a multimeter to measure whether the 5V output of the IO terminal is 5V output to |
| USB easily disconnected | If there is strong interference in the neighbourhood, the USB may disconnect, which is determined by the transmission characteristics of the USB.<br>It is recommended to replace the LAN Ethernet communication method | LAN is recommended for industrial applications |
| LAN cannot communicate | 1, please confirm the IP address and port, check the IP of the local computer to make sure it is in the same network segment.<br>2, Make sure the light on the Ethernet cradle is blinking normally. If the light is not on, check the quality of the cable<br>3、Check the connection by other communication methods. | Network cable length support up to 100m |
| Multiple LAN card communication abnormality | 1, the IP address between different cards can not be the same, otherwise it will be conflict<br>2, whether there are other computers or devices within the network occupy the same IP<br>3，Check whether there is a possibility of duplicated MAC address | |
| SD offline mode is not available | 1，Confirm whether SD mode is set successfully<br>2，Check whether SD card format is correct<br>3，Can be formatted to confirm whether SD is normal | Please refer to our related materials to use |

| Large temperature drift | 1，confirm whether the power supply is normal and stable<br>2，exclude whether it still exists after resetting the hardware<br>3，exclude the possibility of sensor causes<br>4，Replace the sensor channel, compare and confirm the exclusion | |
|---|---|---|
| Indicator light is off. | 1, to confirm the power-up is correct, available USB power or switch to the dedicated port power<br>2, to confirm whether all the indicators do not light up<br>If still can not be solved, please contact our after-sales personnel | Usually caused by incorrect power supply |
| VK7016 upper computer software related issues | | Please refer to the VK7016-7018 Software User's Guide included in the packet. |
| | | |

# 9 After Sales & Warranty

One:Warranty:

The company with the attached warranty documents or directly affixed to the back of the equipment on the warranty sticker, to provide a one-year full warranty service, product warranty 10 years.

1 by our technical staff to confirm the initial product quality problems for the company, the customer will return to the product, within 3 days we confirm the maintenance and send back

2. If it is confirmed that the user is caused by improper use, we communicate with both sides to confirm that we will charge a certain amount of related costs.

Second:maintenance:

All of our products are provided with 10 years of free maintenance services, the first year of free warranty thereafter, such as the need to replace components in the maintenance process, then only the cost of components charged.

Third:exchange:

For new product failures the company provides three months of free replacement service, customers should first send back the faulty product in the form of logistics or express delivery, the company receives another new product back to the customer. Our company bears the freight cost of returning the product to the customer.

## 10 Edition and Revision History

| Releases | Clarification | Times |
|---|---|---|
| V1.00 | First version | 2023.02.01 |
| V1.10 | Add LORA function and related description | 2023.05.11 |
| V1.20 | Add SD storage related descriptions | 2023.08.21 |
| V1.30 | Remove LORA and RS485 writing errors. | 2023.11.13 |

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