1. Product Overview

HW-HY004 is the company's latest single-board thermal radiation flame alarm sensor module. The passive single sensor detection adopts: thermal radiation induction judgment method, using the Curie temperature of lithium carbonate crystal material, for flame temperature 250-4000℃ and above, wavelength 380-750nm flame accurate detection and warning. The relative dielectric constant is small, and within a wide range of room temperature, for fire warning, there can be obvious temperature difference high contrast polarity changes, the detector performance is stable, when a fire occurs, it can quickly capture the response to trigger an alarm within 1 to 2 seconds, and is used for various types of open flame induction fire warnings: fire warning, security warning, industrial plants, mining areas, chemical combustible alarms, family residences, charging piles, gas stations, chargers, equipment and machinery, etc.

2.Operational Principle

HW-HY004 is a flame detector using lithium carbonate crystal composite materials. It uses filters to test spectra of different bands to detect visible or invisible light radiation generated when materials burn, while generating smoke and releasing heat. It uses the light characteristics of flames for shorter ultraviolet bands and longer infrared bands. When different materials burn, the red and ultraviolet spectra they emit are different. The environmental spectrum is distinguished from the flame spectrum, thereby causing the sensor electric field phase change and outputting a warning signal.

3.Product Features

HW-HY004 ternary sensor captures signals with wide coverage, high consistency, low power consumption, meets ROHS.CE.KC.UL and other certification requirements, and has strong anti-interference ability, and is not affected by ambient temperature, humidity, airflow, dust, noise, brightness, etc. Special anti-interference ability. It can better adapt to the application occasions of secondary development of most smart products. When this product is used indoors, the sensing effect is better; when used outdoors, due to the influence of the environment, the sensing distance is slightly shortened or the sensitivity is slightly weaker. This is a normal phenomenon, and users do not need to question the product. This product is mostly used in macro scenes.

4.Induction Time

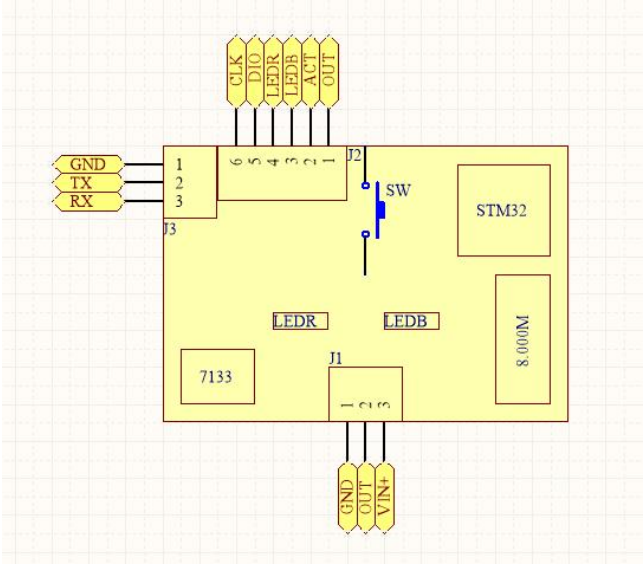
Fire warning capture time, when the trigger condition is reached, the trigger signal will be output continuously, and the LED indicator will be always on. When the flame disappears, the flame sensor source will reset within 3-5 seconds and resume detection mode. The sensing time is determined by the occurrence of the fire.

5.Parameter Specifications

Model	HY004	Flame alarm module	Three probes long distance 394351
VCC	Min:3.3V	Middle value: 5v	Maximum value: 12v (withstand voltage 3.3v-18v-300mA)
V/A	＜30mA		
OUT-Siginal	TTL signal	AD/SLK DIO serial port signal	
Induction method	Passive flame thermal radiation detection		
Induction Distance	1-50m	Determined by the heat source coefficient	Thermal radiation proportional coefficient
Blackbody threshold	500k	1HZ 0.3-3BPS	Default 500K
Induction time	Continuous high level when there is fire	Reset within 30 seconds after fire extinguishing	
Induction angle	10-110°		Window angle
Sensor wavelength	380-750nm		Flame thermal radiation wavelength (refer to the following text)
Spectral wavelength of filter	(refer to the following text)		Chemical combustible spectrum(refer to the following text)

Size	41.5mm x26.7x12mm	rectangle	
Port	Data output 1.25mm-6pin	Port 1.25mm-3pin	
working temperature	-20----+70		

6.Product inspection wiring diagram and CAD diagram



As shown in the figure, VIN can supply DC5V, and various identification data interfaces are for the microcontroller to collect signals.

Port J1: The output port is the flame output port and the positive and negative input of the power supply.

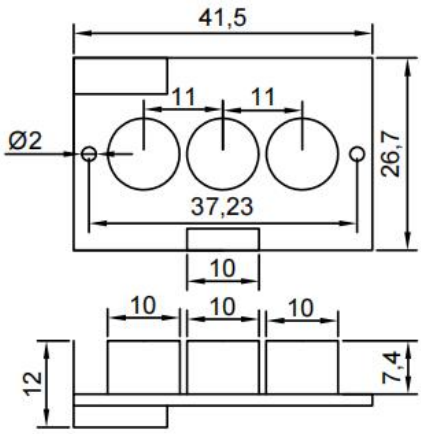
Port J2: External serial port data output.

Port J3: Software editing and burning port.

Button SW: Data reset switch.

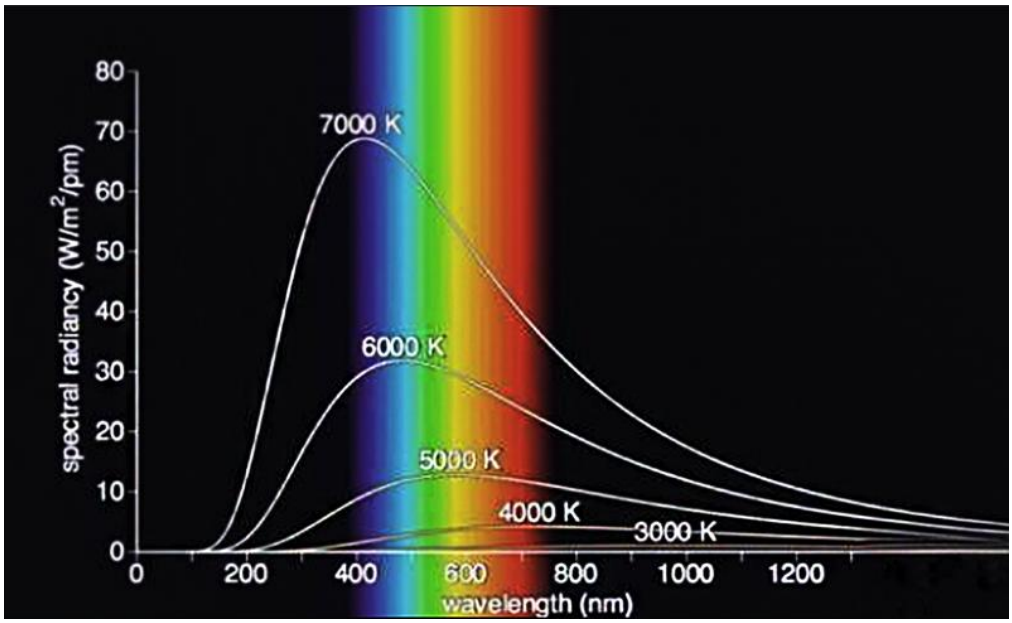
Later, the J1 port can be used to output a high-level signal. If there is a fire in the detection area, the LED will light up red to alarm, and the LED will flash blue, which is the sentry mode. The red LED will continuously trigger the signal: connect the security fire warning circuit, trigger circuit-MOS tube-thyristor-relay-MCU to collect signals to alarm the occurrence of fire, etc.

CAD Dimensions:

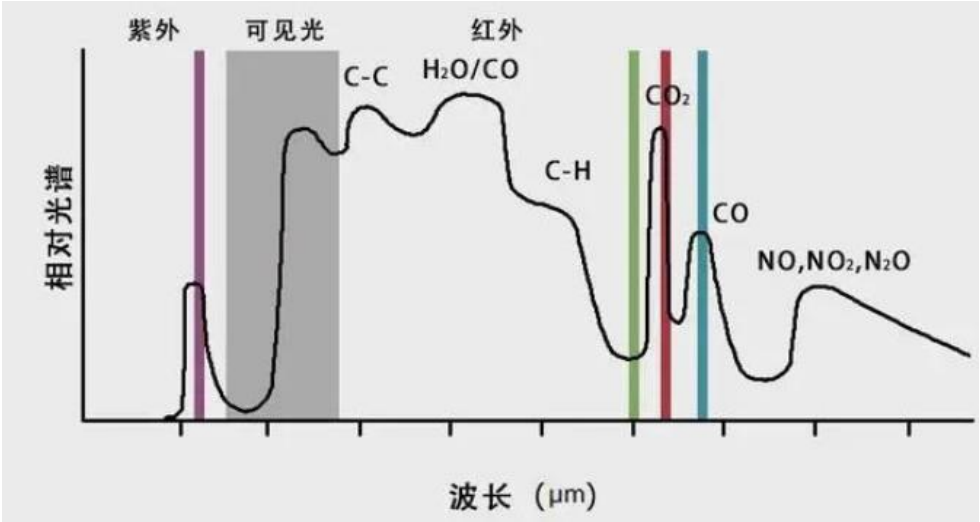


7.Thermal radiation spectrogram

1.As shown in the figure: This reference image is obtained by measuring instruments, all of which are based on indoor 100 square meters and indoor temperature of 25 ℃. The flame thermal radiation coefficient is simulated by the testing instrument. This image is for official guidance and reference, and actual applications need to be tested according to the usage environment. The coefficient of thermal radiation transfer of chemical flames can be referred to (Figure 2).



(Figure 1)



(Figure 2)

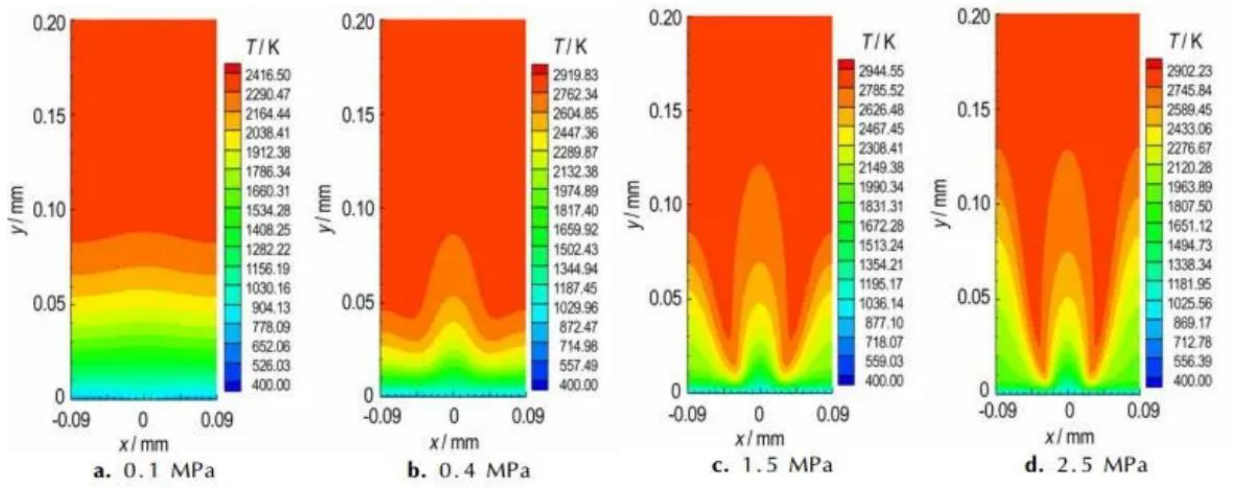
A flame detector uses filters to test the spectra of different wavelengths to detect visible or invisible light radiation that is generated while smoke and heat are released during material combustion. It utilizes the optical characteristics of flames in the shorter ultraviolet and longer infrared wavelengths to make use of them.

When different substances burn, their emitted red and ultraviolet spectra differ, but the three protruding parts of the flame radiation curve can be clearly seen from the flame spectrum diagram. One of them is the part below 0.28μm in the ultraviolet range, and the other two are near 4.3μm and 4.6μm in the infrared range. The solar radiation curve on the surface is located at the trough position in these three bands.

In general, the center wavelength of the filter in the flame detection band is around 4.3μm and 4.4μm, and different bandwidth designs can detect the mid infrared wavelength infrared signals radiated by CO2 and CO gases emitted from hydrocarbon combustion flames in the range of 4.0μm to 4.6μm.

The flame radiation is significantly weaker near 3.8μm and 5.0μm, and is commonly used as a monitoring channel and auxiliary channel for flames, to monitor non fire thermal radiation and solar radiation.

For the 0.185-0.260μm wavelength ultraviolet radiation generated during flame combustion, a solid substance such as silicon carbide or aluminum nitrate can be used as a sensitive element; For the 2.5-3μm wavelength infrared generated in flames, sensors made of aluminum sulfide materials can be used; Sensors made of lead selenide or aluminum tantalate materials can be used for the infrared radiation of 4.4-4.6μm wavelengths generated by flames. Different sensors can be selected based on the spectra emitted by different fuel combustion. The sensing coefficient of the sensor corresponds to a chart, which can be used for various chemical substances such as organic and combustible substances (as shown in Figure 3). This sensor triggers an extreme heat radiation flame spectrum in the range of 380-750 or above, which can achieve alarm perception.



2.The combustion temperature of common combustibles

Material	temperature/℃	Material	temperature/℃	Material	temperature/℃	Material	temperature/℃
methane	1800	crude oil	1100	wood	1000-1170	liquefied gas	2100
ethane	1895	gasoline	1200	Magnesium metal	3000	natural gas	2020
acetylene	2127	kerosene	700-1030	Metallic sodium	1400	petroleum gas	2120
methanol	1100	heavy oil	1000	lithium battery	1427	Match flame	750-850
ethanol	1180	bituminous coal	1647	carbon monoxide	1680	Burning cigarettes	700-800
Ether	2861	hydrogen	2130	sulfur	1820	paper	650-850
acetone	1000	coal gas	1600-1850	carbon dioxide	2195	rubber	1600

(Figure3)

8.Flame thermal radiation sapphire filter

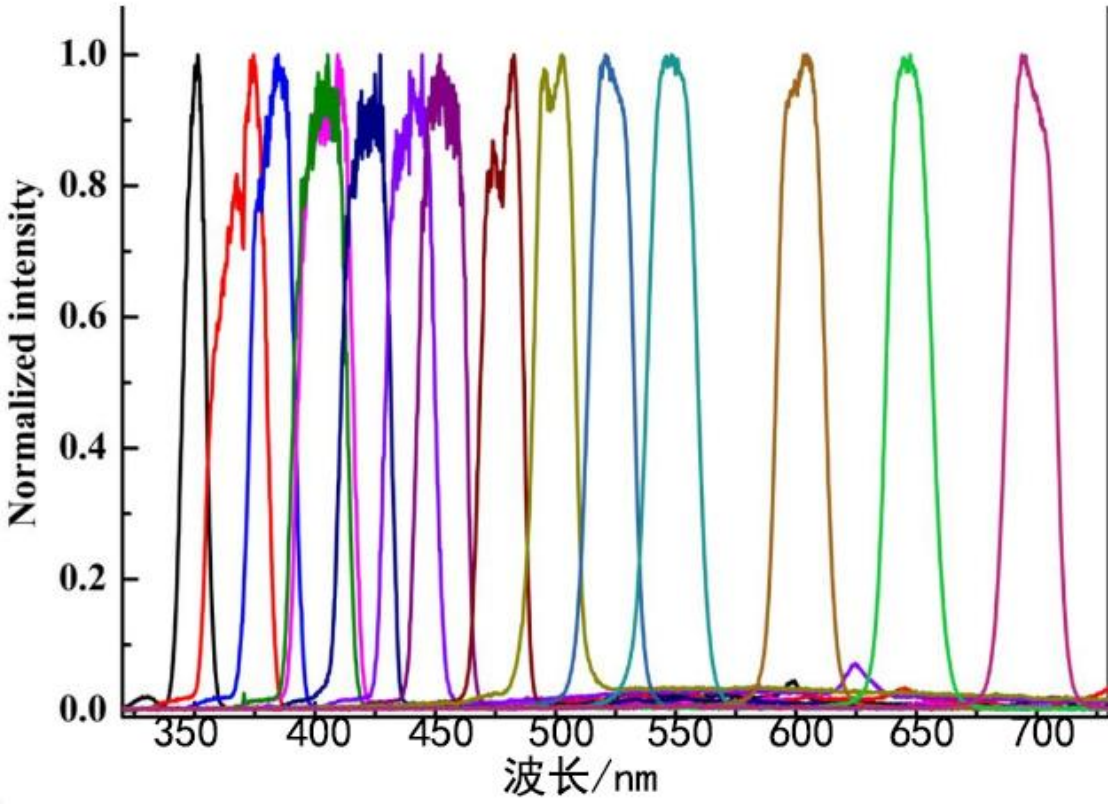
From a material perspective, filters provide sensors with the filtering effect of natural chaotic spectra, including optical glass coatings, colored glass, and plastic infrared filters. This refers to near-infrared filters. If it involves mid to far infrared, materials such as Si, ZnSe, Sapphire, CaF2, quartz glass, etc. From the perspective of optical properties, there are two types of filters: long wave pass IR filter and bandpass IR bandpass filter. Among them, the long wave pass type.

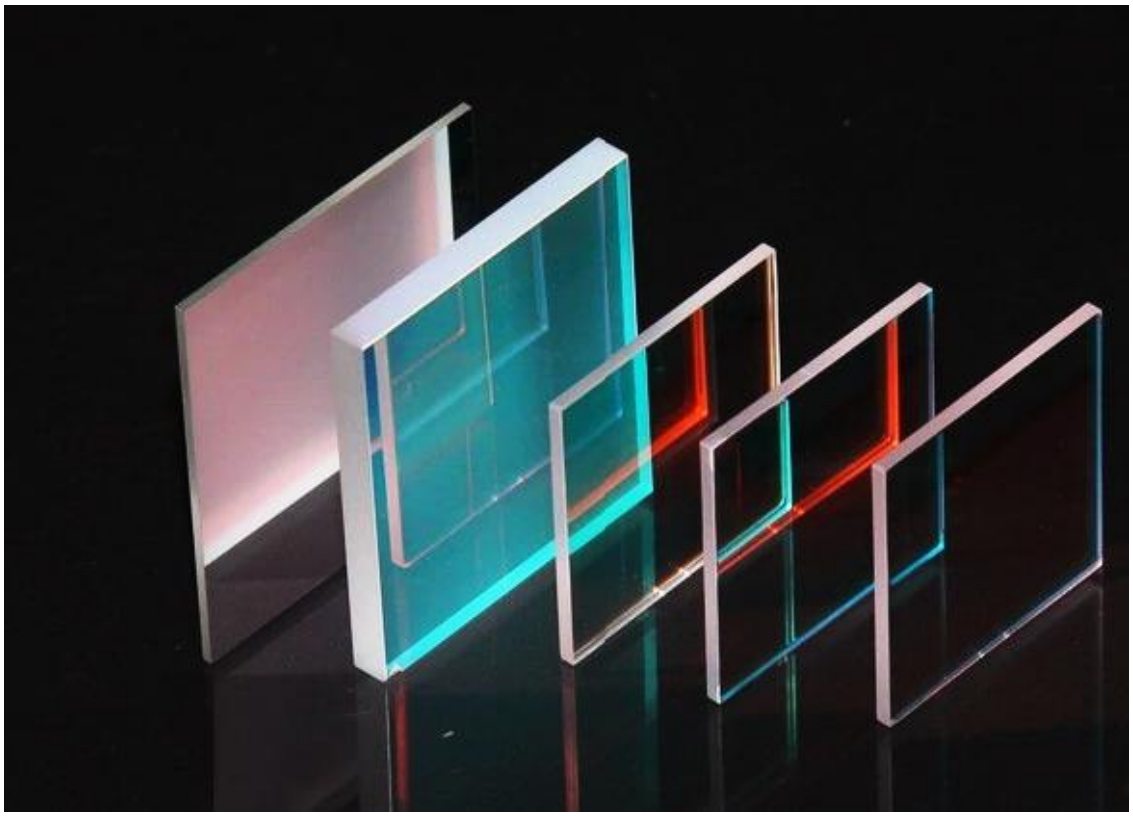
(1)Made of sapphire colored glass, usually black, such as IPG-800. It absorbs visible light and allows infrared light to pass through. If you look at the sun through this infrared filter, you can still see a red sun. Suitable for infrared imaging.

(2) Infrared filters, such as IPGC-720, are made by vacuum coating on optical white glass. This type of filter, also known as optical cold mirrors, reflects visible light and allows infrared light to pass through. The appearance looks silver, like a mirror. If it is a medium to far infrared filter, it needs to be coated on Si, Sapphire, and quartz glass.

(3) The infrared plastic filter made of special plastic has a black appearance. If you look at the sun through this infrared filter, you can also see a red sun. The material of this plastic can be PC or PMMA.

The bandpass filters are all made by vacuum coating. For near-infrared bandpass, it is coated on white glass. If it is mid to far infrared, it will be coated on Sapphire. Everyone can add. The corresponding light sources for the near-infrared bandpass filter are mainly infrared IR LEDs and infrared lasers, so the main wavelengths are 808nm, 850nm, 905nm, 940nm, 1064nm, as well as the less commonly used 780nm. So the wavelengths of commonly used near-infrared filters are mainly these. The corresponding models include BPF-850, NBF-808, and BPF-940.





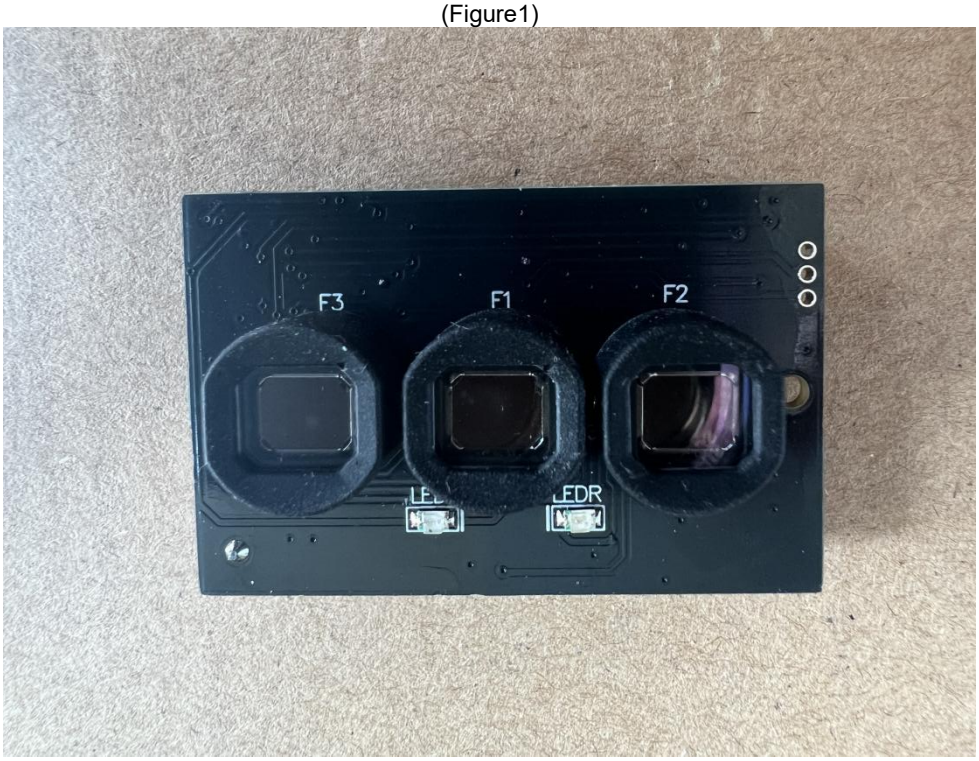
(Figure1)



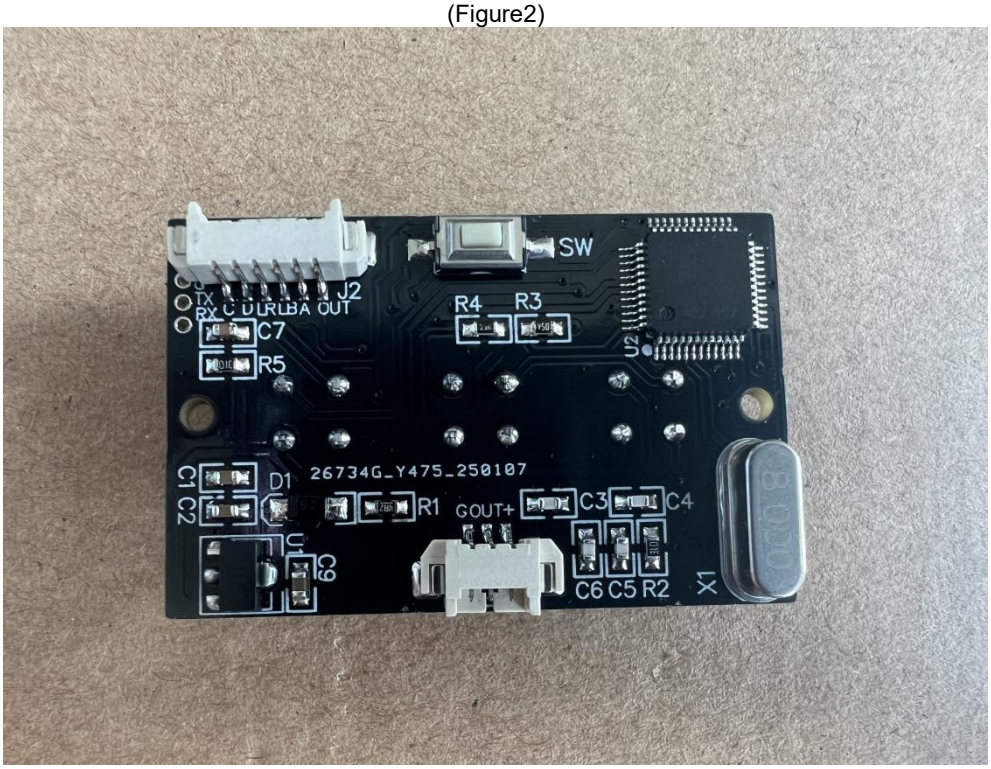
(Figure2)

9.Product physical pictures

(Figure1)



(Figure2)



10.Sensor installation process

●Product usage scenarios and installation renderings



During product installation testing and actual assembly, please make sure to keep the sensor module stable, and do a precise sealing that is waterproof, moisture-proof, and dust-proof to prevent internal water damage to the sensor. The sensor installation needs to keep the mirror surface clean and tidy, and the outer glass should not have cracks or damage. There should be no obstacles blocking the sensing surface glass. Prevent direct sunlight, high-power visible light, or close proximity to obstacles, etc.

●About power supply

It is recommended to use a qualified DC stabilized power supply, that is, a DC stabilized power supply that meets the output voltage, current, and ripple coefficient standards. Otherwise, it will affect the stability of this product and may cause some abnormalities, such as false alarms, no induction, and cycle self start.

●About false positives

1. To ensure the qualification of the power supply, please refer to the first item above.

2. During testing, ensure that the tested product matches the direction of the fire source in the detection area, senses the size of the flame, and performs filtering attenuation.

3. There is approximately 5 seconds of initialization time after initial power on, during which it belongs to abnormal induction.

4. When conducting outdoor testing, it is necessary to face flames or objects that emit heat from the fire.

5. Electromagnetic interference, heat source interference, pay attention to the operation of high-frequency radio electromagnetic interference sensors during product debugging.

●Regarding sensitivity

This product is set at the factory and has been equipped with official standard blackbody thermal radiation detectors with relevant parameters. The induction corresponding table refers to the radiation chart in the specification book. The

corresponding settings require serial port signal acquisition and mastery of certain circuit algorithms and code instruction requirements. If there are special usage problems, it is recommended to contact our engineers for assistance in debugging.

●About induction time

This product is set at the factory and has been set to capture within 100ms of detecting a fire hazard. It is recommended to do not cut off the power during use, and the induction time should be extended. In order to continuously output a TTL signal for fire warning, this product has an LED indicator light as the flame warning output.

●The shell assembly of this product

This sensor is a high-precision product, and outdoor installation requires a waterproof, moisture-proof, and dust-proof packaging with a metal shell that is not easily damaged. Pay attention to the installation height and angle, and when assembling wireless products, pay attention to sealing and maintaining a distance.

11.Regarding the manufacturer - HW INDUSTRIAL CO.,LTD

HW INDUSTRIAL CO.,LTD is a high-tech enterprise that integrates research and development, production, sales, and after-sales service. We have been focusing on infrared and microwave induction technology for more than ten years. We specialize in providing a variety of sensor components, sensitive electronic devices, intelligent electronic devices, and other series of products, such as pyroelectric infrared probes and their supporting ICs and Fresnel lenses; Infrared sensing module; Microwave induction module; Audio players, and can provide technical development and design, customized processing, and technical support for products. Our products are widely used in lighting fixtures, public security, advertising and media, traffic safety, and more.

Please recognize our brand [HW].

HW INDUSTRIAL CO.,LTD