

SPECIFICATION

Product Name: Smoke Sensor

Model No.: ATRS-1031

Version: V0.2

Date: Nov. 29, 2022

Revision

No.	Version	Content	Date
1	V0.1	Preliminary Version	2021.11.15
2	V0.2	Update low power mode description, delete deep sleep mode	2022.11.29
3			
4			

Smoke Sensor

ATRS-1031



Application

- Early warning and monitoring of Lithium ion battery thermal runaway
- Early warning and monitoring of energy storage power station safety
- Gas detection in Cabin

Description

ATRS-1031 smoke sensor, CAN effectively monitor the dust concentration and other indicators released before battery thermal runaway triggering, and transmit the measurement signal to BMS through CAN communication. This solution has the advantages of accurate measurement, fast response time, less cross interference, low power consumption, long life and high reliability.

Features

1. Mature vehicle level circuit design suitable for various automotive application
2. Low power consumption mode available
3. Wide measurement range
4. Long lifetime
5. CAN2.0 communication

Working Principle

According to the principle of light scattering, the light emitted by LED converges through the lens and meets dust to generate scattered light. The scattered light is detected by the sensitive detector after converging through the lens, and the concentration of dust is judged according to the size of the pulse signal. When no dust is detected, the photosensitive detector outputs a basal pulse; When dust is detected, the output pulse height increases, and the pulse signal is proportional to the detected light intensity. The pulse signal is amplified by the amplifier and calculated by the processor, then output the final detection result. Refer to below figure 1:

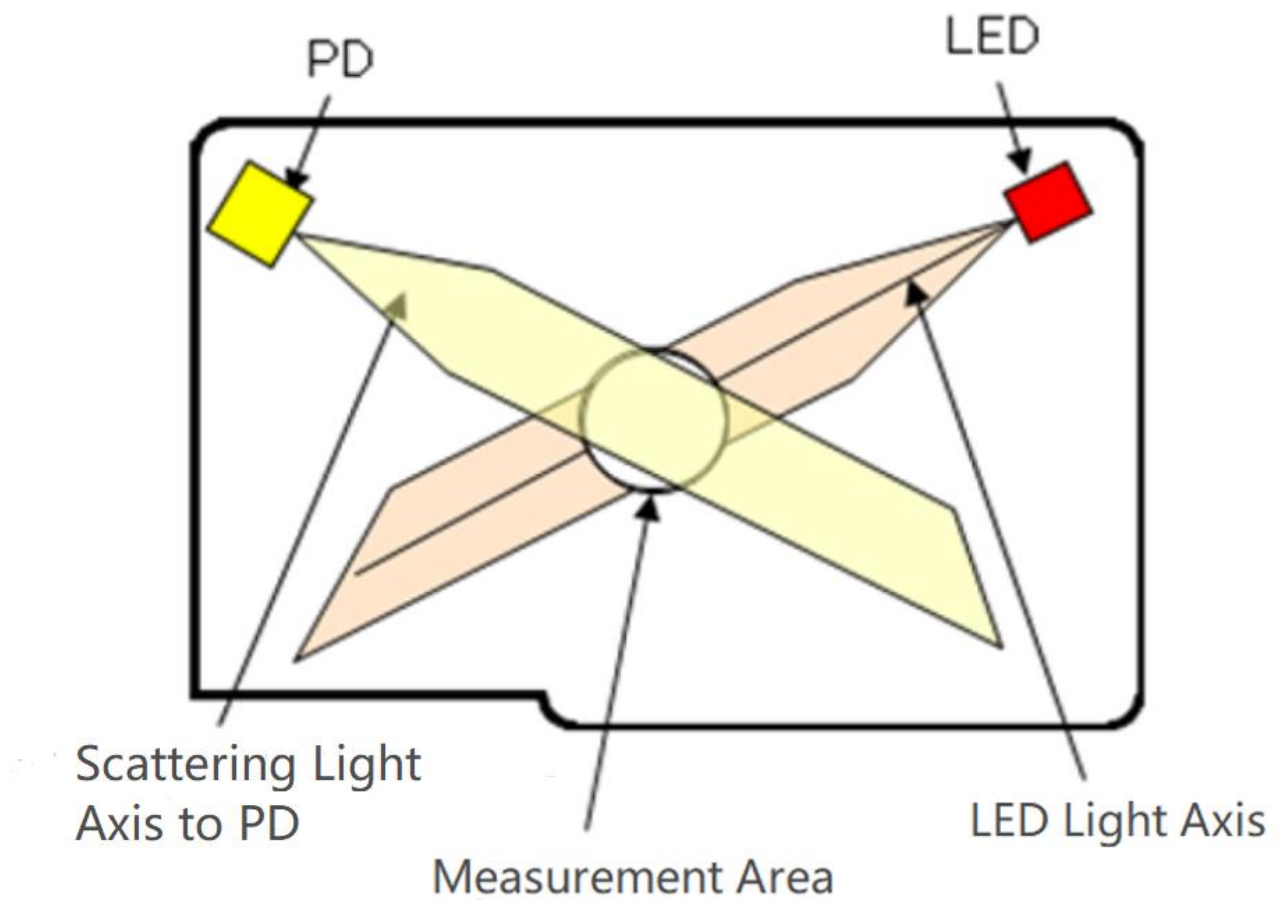


Figure 1

Specifications

General Performance	
Operating Principle	PM (particulate matter) : Infrared scattering
Detection Category	PM (particulate matter)
Measurement range	PM: 0-10,000ug/m ³
Resolution	PM: 1ug/m ³
Consistency	±15% of reading @5000ug/m ³ (room temperature, reference device is TSI8530 for calibration, cigarette smoke as dust source)
Data refresh time	1s
Digital output	CAN2.0
Design Lifetime	10 Years
Environmental	
Working condition	-40°C~+85°C; 0~99%RH (non-condensing)
Storage condition	-40°C~+95°C; 0~99%RH (non-condensing)
Working Pressure	60kPa~120kPa
Electrical	
Power supply	6~16VDC (standard voltage 12V DC)
Average Working Current	Normal Mode: ≤30mA, @+12VDC(sensor continuous working) Low Power Mode: ≤500uA, @+12VDC(sensor works intermittently, and the interval is 12.2 seconds)

Working Mode and Working Logics

Working Mode

- Normal Working Mode: While the vehicle is normally running on, the sensor continuously working. When the input request Req signal is high, the smoke sensor keeps working, the data refresh frequency is 1S, and the CAN message is output. When abnormality is detected, the smoke sensor sends warning signal to BMS.
- Low Power Mode: In this mode, the smoke sensor collects data of the concentration every 12.2s, when the smoke concentration is greater than 5000 ug/m³, working mode switch back to normal working mode-

Working Logics

➤ Wakeup Pin

When the sensor is in low power mode, once the sensor detects the concentration is greater than the set thresholds, the sensor sets the pin to high level, CAN chips starting signal outputs within 2S, BMS is woken up in the meanwhile. When BMS confirms that there is no abnormality, BMS sets the low level through the Request pin, then the sensor enters into low power mode, and the Wake-up pin signal sets the low level.

➤ Request Pin

The BMS switches the sensor working mode by controlling the Request pin. When the BMS sets the Request pin to a high level, the sensor works in continuous working mode, and outputs detection data through CAN messages within 2s. When the BMS sets the Request pin to a low level, the sensor operates in a low power mode.

➤ Self-diagnosis function

To ensure the validity of the sensor detection data, the sensor has a self-diagnosis function. Fault detection includes: photoelectric device fault, power supply overvoltage fault, power supply undervoltage fault. When the sensor self-diagnosis is abnormal, it will enter the normal working mode and output the sensor fault information through the CAN message for specific definitions.

➤ Mode Switch Logic

- BMS controls Request Pin to change the modes of sensor

BMS status \ Sensor Status	BMS Sleep	BMS Working	BMS Sleep
Sensor working mode	Low power	Normal mode	Low power
Request Pin	Low level	High level	Low level
Wakeup Pin	Low level	Low level	Low level
CAN Message	N/A	Send normally	N/A

- Switching logic of sensor when concentration changes in low power mode

Concentration Status	Lower than Threshold	Higher than Threshold	Lower than Threshold
Wakeup Pin	Low level	Low level	Low level
Sensor working mode	Low power	Normal work	Low power
BMS working mode	BMS Sleep	BMS work	BMS sleep
Request Pin	Low level	High level	Low level
CAN Message	N/A	Send normally	N/A

- Switching logic of sensor when concentration changes under normal working mode

Concentration Status	Lower than Threshold	Higher than Threshold	Lower than Threshold
Wakeup Pin	Low level		
Sensor working mode	Normal work		
BMS working mode	BMS work		
Request Pin	High Level		
CAN Message	Send normally		

When the sensor works in low power mode, and detects its own fault, the mode switches like below:

Fault status Status	No Fault	Has Fault	No Fault
Wakeup Pin	Low level	High level	Low level
Sensor working mode	Low power	Normal work	Low power
BMS working mode	BMS sleep	BMS work	BMS sleep
Request Pin	Low level	High level	Low level
CAN Message	N/A	Send normally	N/A

When the sensor works in continuous working mode, and detects its own fault, the mode switches like below:

Status	Fault status		
	No Fault	Has Fault	No Fault
Wakeup Pin	Low level		
Sensor working mode	Normal work		
BMS working mode	BMS work		
Request Pin	High level		
CAN Message	Send normally		

CAN Communication Protocol

CAN Communication

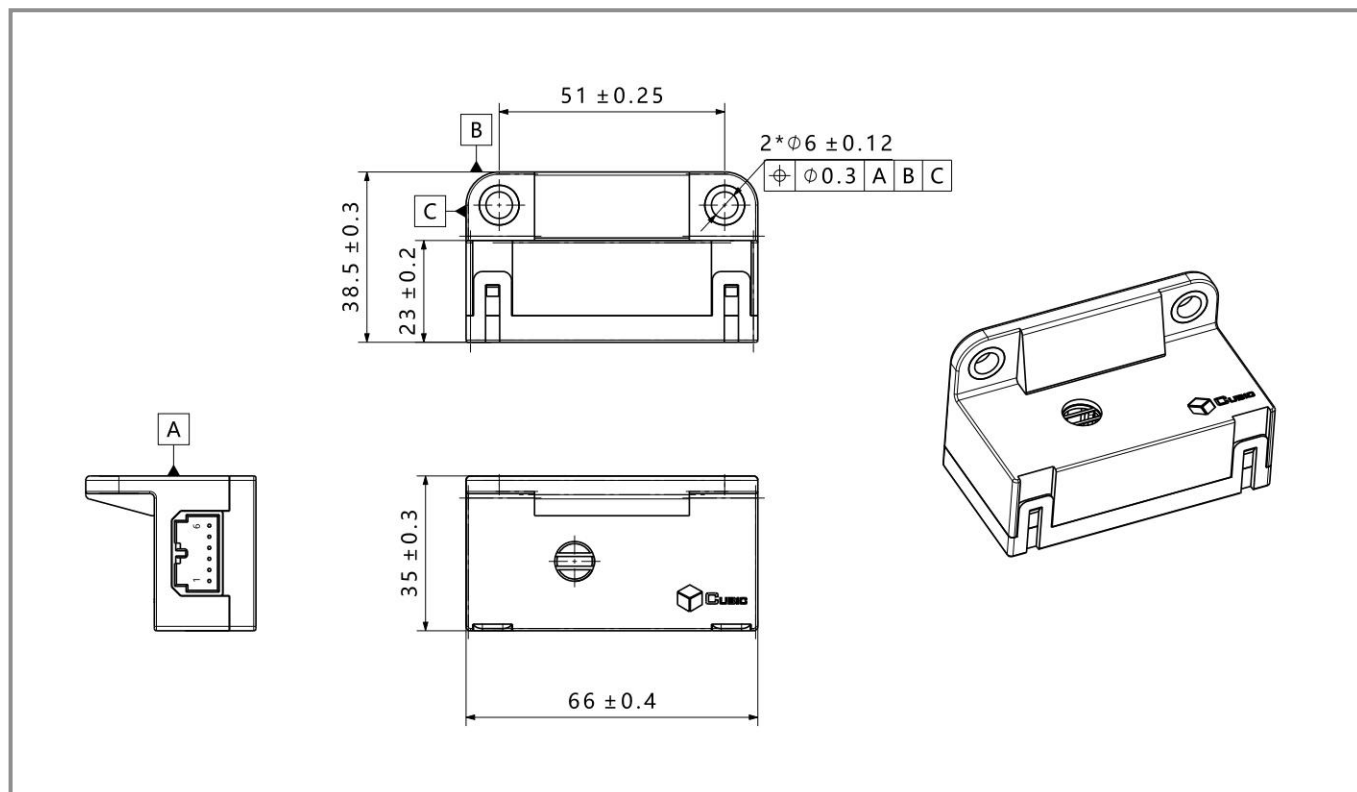
- Baud rate 500k bps
- Message cycle 1s
- Message ID: 0x3C4
- Message Length: 8 Bytes

CAN Message Format

OUT	IN	ID	Length of data	Cycle
Smoke sensor	BMS	0x3C4	8 Bytes	1s
Data				
Position	Name of Data		Description	
Byte 0	PM concentration high 8 bits			
Byte 1	PM concentration Low 8 bits			
Byte 2	Low power wake-up threshold high 8 bits			
Byte 3	Low power wake-up threshold low 8 bits			
Byte 4	0~2	Sensor status	0x00: Normal 0x01: Alarm Others: Reserved	
	3~7	Sensor Fault	0x00: Normal 0x01: Photoelectric device fault 0x02: power supply overvoltage fault 0x03: power supply undervoltage fault Others: Reserved	
Byte 5	/			
Byte 6	0~3	Rolling Counter		
	4~7	/		
Byte 7	CRC check code			

ATRS-1031 Dimensions

1. Dimension (mm)



2. Pin Definition

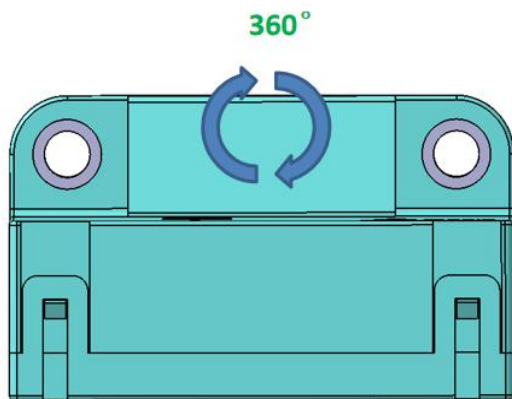
No.	Pin	Description
1	Req	Wake up input request
2	CAN_L	CAN communication low
3	CAN_H	CAN communication high
4	Wakeup	Wake up the output
5	GND	Power input (ground)
6	VCC	Power input (12V)

3. Connector

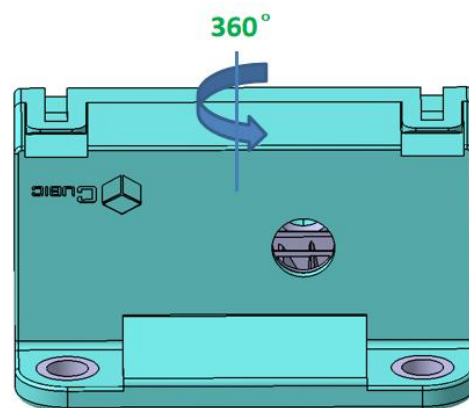
Type	Model	Pin Spacing	Brand
Matching Connector	TE 175507	2.5mm	TE

Recommended Installation

The ATRS-1031 is recommended to install as the direction below:



Recommended Installation A



Recommended Installation B

After-Sales Services and Consultancy

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