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Introduction to Ultrasonic Technology

Suggestions of Use

Dauxi Technologies

Ultrasonic Business Division

Prompt: To download the detailed specification of models in the introduction, please enter official website of Dauxi Technologies, input the model (such as “KS109-485”) in the upper right corner of homepage, click “Search” to download the specifications of corresponding models.

Strengths & Weaknesses of Ultrasonic Technology

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➢ Technical Strengths

1. Take the vibration of piezoelectric ceramic piece as the ultrasonic excitation source;

1) Application model: Open type

KS101, KS102, KS102H, KS103, KS103-24V, KS103-20°, KS103-40°,

KS103-485, KS103-485-20°, KS103-485-40°, KS103-4852 (online address change)

KS103-MODBUS, KS103H (switching quantity), KS103H (auto detection), KS103H-24V,

2) Application model: **IP65-IP67** Waterproof model

KS104, KS104-MODBUS,KS104-CAN,KS114,KS114-MODBUS,KS104-CAN

KS105, KS105-MODBUS, (beam angle 15°, high-accuracy zero dead zone, high sensitivity)

KS106, KS106-CAN BUS (485# bus and CAN bus have spot goods)

KS107, KS107-MODBUS, (beam angle 15°, high-accuracy zero dead zone, good sensitivity)

KS108, KS108-MODBUS, (beam angle 30°, high-accuracy zero dead zone, high sensitivity)

KS136, KS136-CAN BUS (485# bus and CAN bus have spot goods)

KS202, KS203,KS207

Strengths & Weaknesses of Ultrasonic Technology

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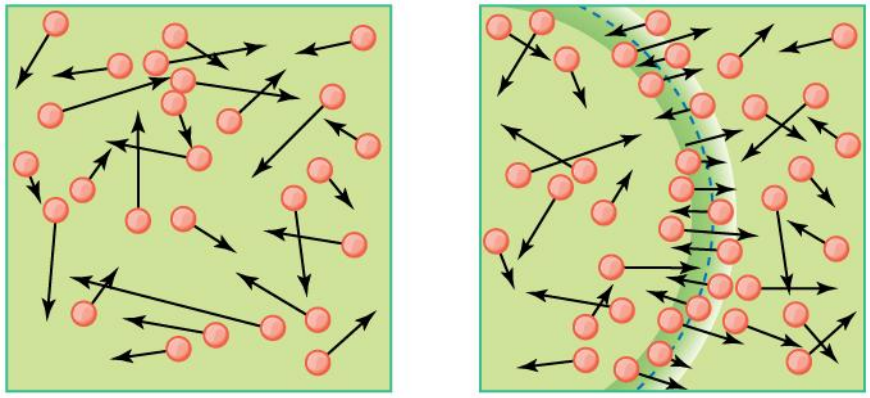
➢ Technical Features

2. Take the vibration of plane capacitor as ultrasonic excitation source;

Application model: KS109 (height measurement, measurement of high-speed mobile robot, medical position detection and driving test measurement)

KS109-485



(a) (b)

Strengths & Weaknesses of Ultrasonic Technology

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➢ Strengths

1. It can detect the transparent objects reliably, such as glass, plastic, water and oil;

2. Weather-proof; wind and rain have minor influence on the ultrasonic detection;

3. Strong or weak light has no influence on ultrasonic wave;

4. Small size, support detection of large 3D space; FOV is overlapped with depth camera and multi-line radar and it can replace the depth camera at 1/5 of cost of depth camera. Simple data, applies to the low-cost and high-reliability obstacle avoidance of unmanned vehicles, auto cleaning robots, patrol inspection robots and service robots, just like covering a circle of high-accuracy **air skin** to the robot;

5. High-accuracy, 0-30cm can be the fuzzy region of many sensors, while ultrasonic wave can realize precise detection.

6. Resistant to dust, aid, alkali and vapor; the coagulation point on ultrasonic head has no influence on detection effects;

The scenario of thick fog has no influence on ultrasonic detection

7. The tiny object with min. diameter of 0.1mm can be detected, such as hair

Strengths & Weaknesses of Ultrasonic Technology

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➢ Weaknesses

Effects are not ideal for wave-absorbing materials, such as: The sweater covered with fine hair;

2. Low frequency, high coding difficulty and weak anti-interference performance;

3. Low detection speed. For example, KS136 can update the data of one probe within 15-25ms, while KS104/KS114 can update it within 9ms;

KS104/KS114 9ms;

4. Small measurement range within 1cm-11m.

Comparison between Ultrasonic Wave and Depth Camera

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Equal scaling of picture size by material object	Dimensions (L*W*H)	FOV (angle)	Resistance to staining	0~30cm	Detection range	Cost	Transparent object	Data volume	Appearance	Privacy requirements	Service life
	90mm 25mm 25mm	90*60	Low (regular cleaning is required)	Fuzzy area	20cm~8m	High	Detection not supported	Complex	Mixed color	Not conform to most scenarios abroad (camera is prohibited in private places, some shops, military areas and toilets domestically)	3~5 years
 KS104	51mm 26mm 27mm	60*60 Real-time zoom 50*50	High (free from cleaning and maintenance)	Centimeter-level accuracy	1cm~3m Or 1cm~5m	Low	High reliability	Concise	Have consistent color with robot shell, color is customized	Conforming	Over 7~10 years
 KS114	51mm 26mm 27mm	100*50 Real-time zoom 90*40	High (free from cleaning and maintenance)	Centimeter-level accuracy	1cm~3m Or 1cm~5m	Low	High reliability	Concise	Have consistent color with robot shell, color is customized	Conforming	Over 7~10 years
 KS203	36mm 20mm 25mm	60*60 Real-time zoom 50*50	High (free from cleaning and maintenance)	Centimeter-level accuracy	1mm~3m or 1mm~5m	Low	High reliability	Concise	Have consistent color with robot shell, color is customized	Conforming	Over 7~10 years

Comparison between Ultrasonic Wave and Depth Camera

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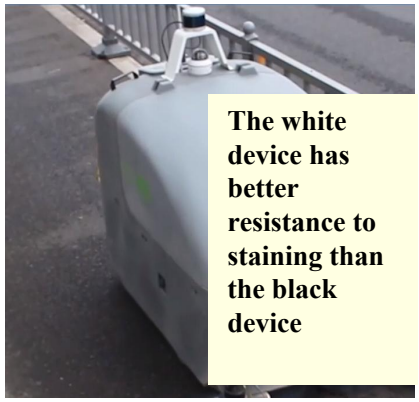
➢ Actual working conditions of cleaning robot

- **KS series ultrasonic device is maintenance-free, while laser and camera require cleaning and maintenance**

The 1st day



Several days later

Comparison between Ultrasonic Wave and Depth Camera

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➢ Actual working conditions of outdoor robot

- **KS series ultrasonic device is maintenance-free, while laser and camera require cleaning and maintenance**

Vehicle gauge level

Be resistant to ultra-low temperature and dirt; be allowed to be installed at low position

Introduction and Use Suggestions of KS136

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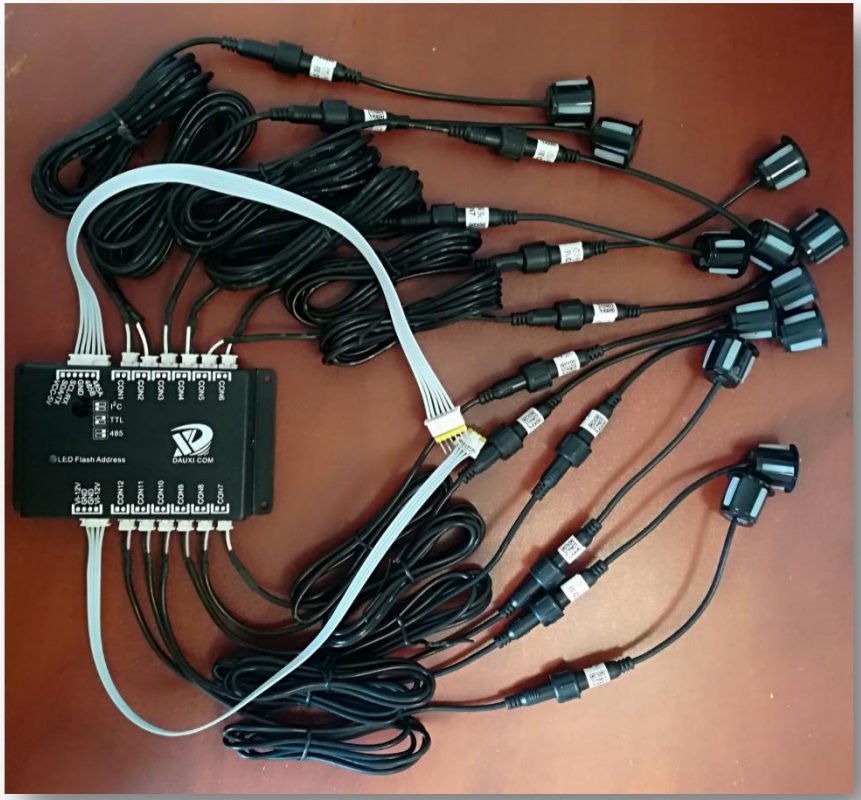
➢ Functional Characteristics of KS136

1. 12-way ultrasonic wave distance measurement;
2. Probe and wire enjoy IP67 waterproof grade;
3. IP67 waterproofing of complete unit can be customized;

   Aviation plug is used between mainboard and probe wire for isolation and waterproofing.
4. Support 485,I2C,UART TTL communication.
5. Support independent detection of single probe (14cm) or combined detection (2cm dead zone) of double probes
6. CE authentication and ROHS environmental protection authorization.
7. Support customized CAN bus interface, customization period is 1 day



Introduction and Use Suggestions of KS136

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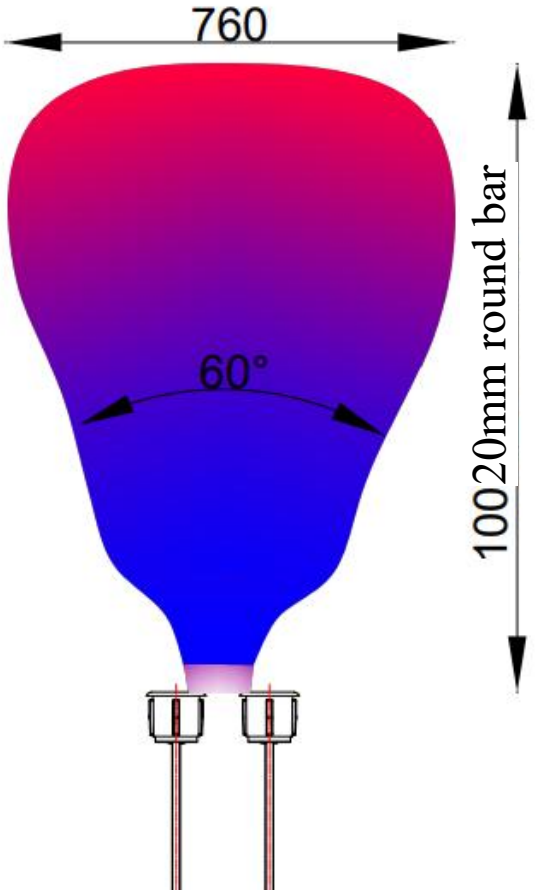
➢ KS136 beam angle

- **The beam angle of the 1st generation probe is shown in graph**



Download specification

Introduction and Use Suggestions of KS136

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➢ Compare KS136 with 485 communication

- **Format: Address + Register + Detection instruction**
- **Intercharacter timeout detection is optional**
- **Baud rate 9600-115200 can be modified by user**
- **And check, XOR check, parity check and CRC check are optional**
- **MODBUS interface is optional**
- **Suggested detection period is not less than 15ms for each probe; recommended time is 25ms.**

Introduction and Use Suggestions of KS136

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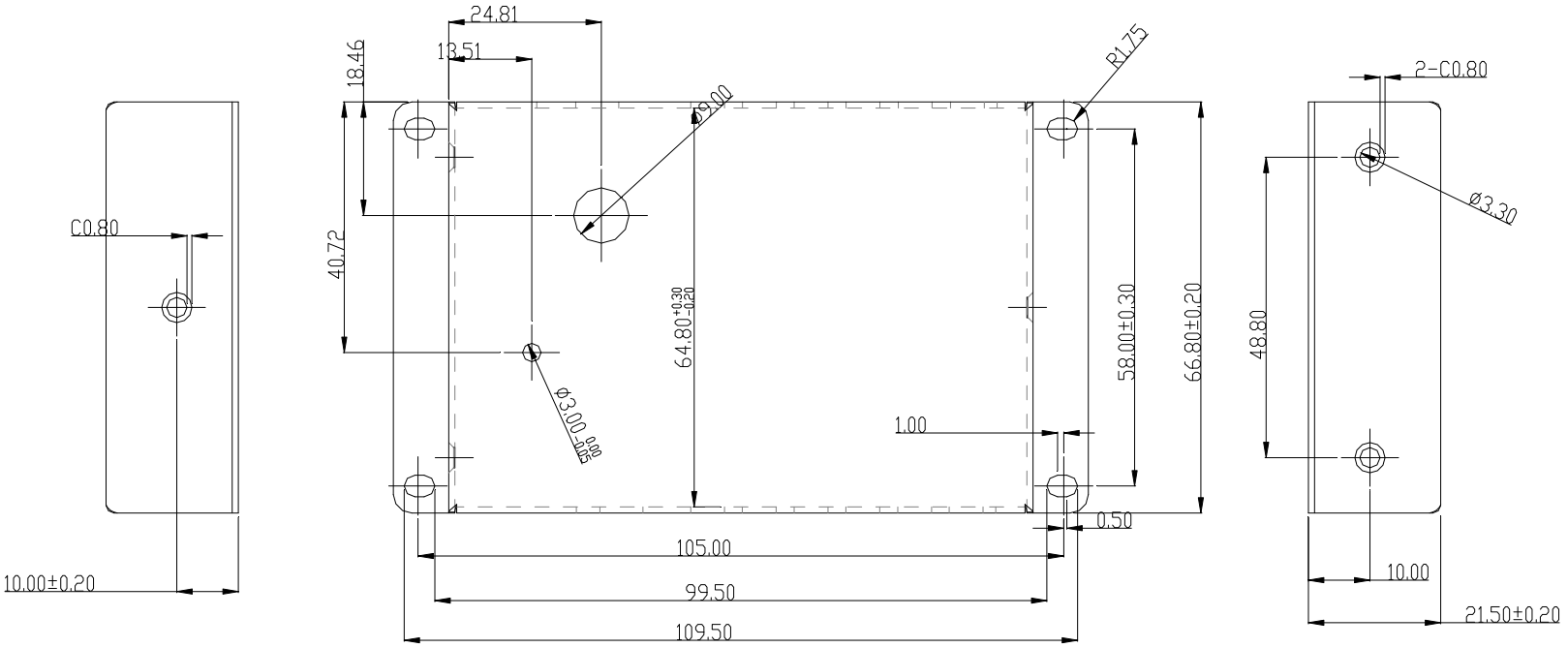
- **KS136 installation – 4-hole installation of host**



Introduction and Use Suggestions of KS136

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➢ KS136 installation – Installation of single probe

- Suggested diameter of installation hole is 19-19.2mm and thickness is not less than 1.5mm
- The probe is installed horizontally or inclined upwards for 4°
- The arrow direction of double-angle probe should face upwards

Single angle (70°)

Double angle (100° horizontally, 50° vertically)

Introduction and Use Suggestions of KS136

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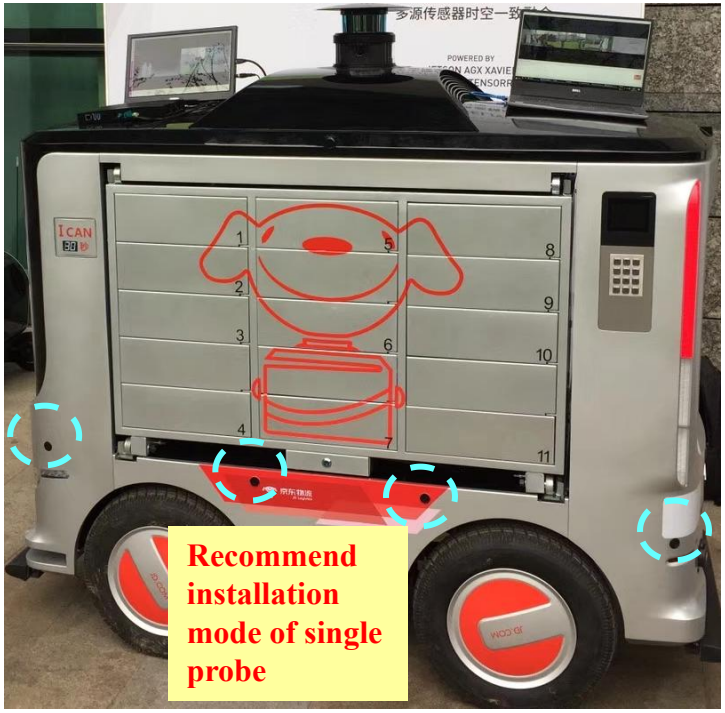
➢ KS136 installation – Installation of single probe

- Installation height ≥ Parking threshold/1.7 (or installation height ≥ parking threshold)
- The installation plane should be free from detectable bump to prevent it from being detected by ultrasonic wave



Introduction and Use Suggestions of KS136

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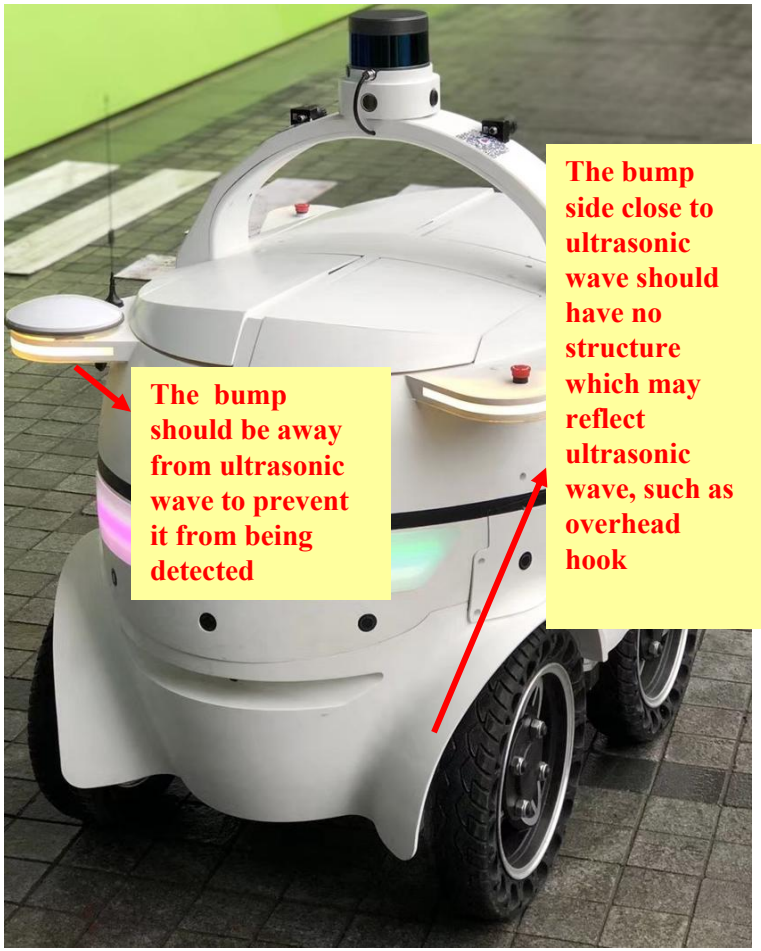
➢ KS136 installation – Installation of single probe

- When detectable bump structure exists, make sure the inclined angle between ultrasonic axis is over 30°, or the distance of ultrasonic wave is over 14cm
- Make sure to connect the probe by probe number, connect the wire with different length to the different positions; the wire with the same length can be exchanged



Introduction and Use Suggestions of KS136

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➢ KS136 installation – Installation of double probes

- Suggested diameter of installation hole is 19-19.2mm and thickness is ≤3mm
- Keep two probes at the same plane, with center distance ≥25mm
- The arrow direction at probe tail of double-angle probe should face upwards
- The beam angle and arrow vertical direction of double-angle probe should be 100° and arrow direction is 50°
- There are no direction requirements for single-angle probe

Introduction and Use Suggestions of KS136

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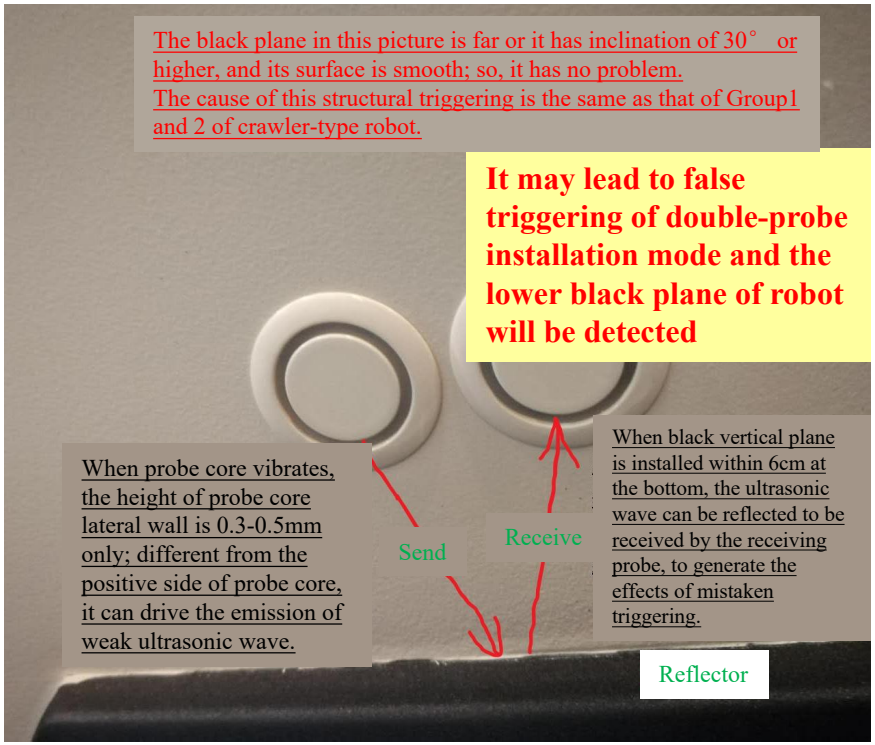
➢ KS136 installation – Installation of double probes

- **Suggested diameter of installation hole is 19-19.2mm and thickness should be higher than 1.5mm**
- **The installation plane should be free from bump that is in parallel with probe axis**



Introduction and Use Suggestions of KS136

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➢ KS136 installation – Installation of double probes

- **The installation plane should be free from bump that is in parallel with probe axis**

In this example, the probe needs to be uplifted to prevent it from being detected by bump plane, or switch the instruction to single-probe mode for detection

Introduction and Use Suggestions of KS136

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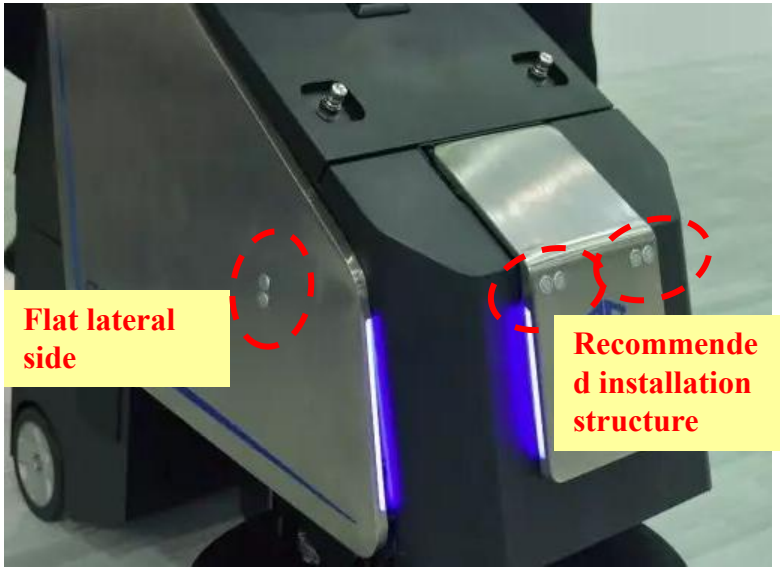
➢ KS136 installation – Installation of double probes

- **Recommended installation mode of double probes**



Introduction and Use Suggestions of KS136

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➢ KS136 installation – Installation of double probes

- **When double probes are installed, the reasonable hole diameter and shell thickness can reach the optimal hand feeling of installation and fixing effects. No gluing is required for fixing. Please use the silica gel with shore hardness ≤A25 when fixing the back side, and pay attention to the hardness stability between -30℃ and ＋85℃.**

Introduction and Use Suggestions of KS136

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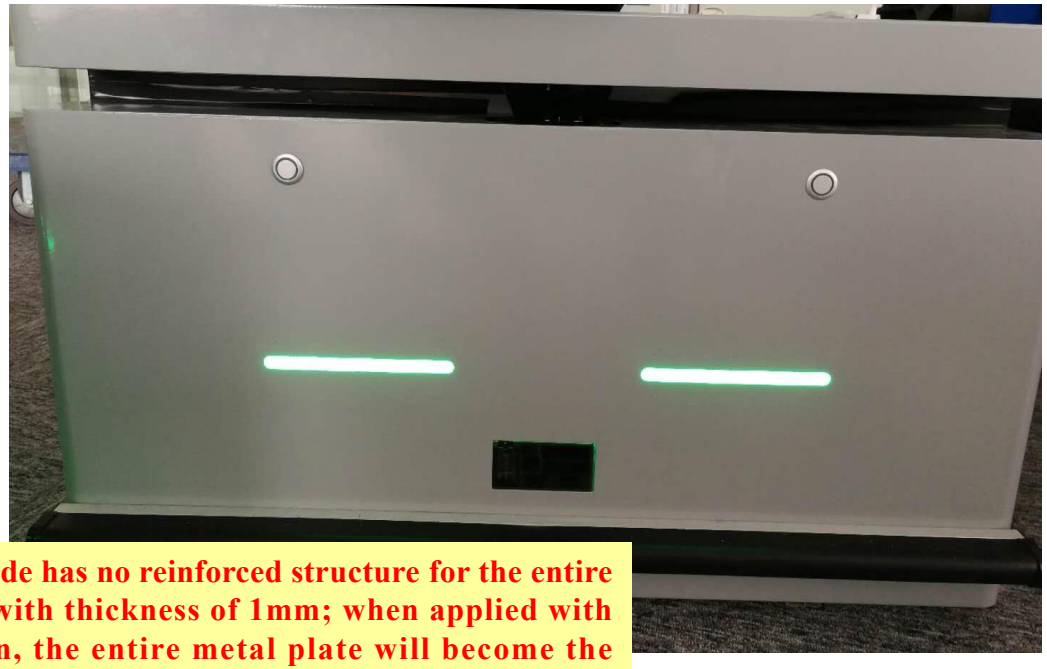
➢ KS136 installation – Structure design notes of probe installation plane

- There may have “Drum beat” sounds while knocking the plane in picture below, which should be avoided for it may lead to resonance with ultrasonic wave.



Cause of defect: The rear side has no reinforced structure for the entire plane is pure metal plate with thickness of 1mm; when applied with ultrasonic wave vibration, the entire metal plate will become the emission source of ultrasonic wave and lead to ultrahigh beam angle.

Introduction and Use Suggestions of KS136

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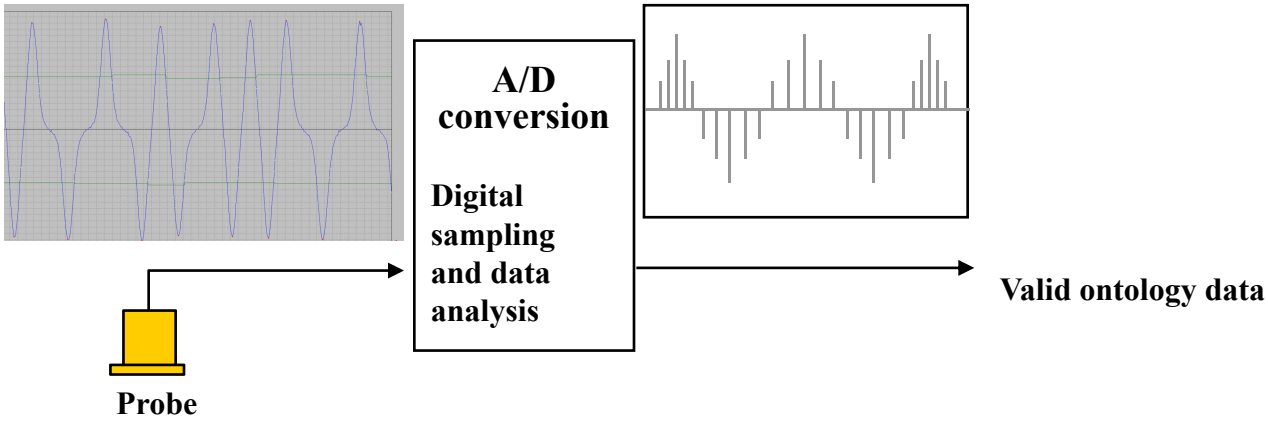
➢ New technology of KS136

1. Autologous sound wave recognition technology 70% avoid allosome sound wave or noise interference.



Introduction and Use Suggestions of KS136

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➢ Service life of KS136 probe

1. Service life of the 1st and 2nd generation probe: 5,000h; service life of the 3rd and 4th generation probe: Reject ratio/50,000h is lower than 2ppm.

2. Service life test period of KS136: 210d* 24h.

3. The complete unit of KS136 should have normal functions and all signal channels should have normal communication after being tested for 7 months; the probe vibration and sensitivity fluctuation should not exceed 10%.

4. It is not suggested to start the probe when motor is not running to avoid aging. When KS136 is not started, it will enter standby state automatically to save energy.

Introduction and Use Suggestions of KS136

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- **KS136 series**

1. KS106-4 probes.

2. KS106A-4 probes.

Introduction and Use Suggestions of KS136

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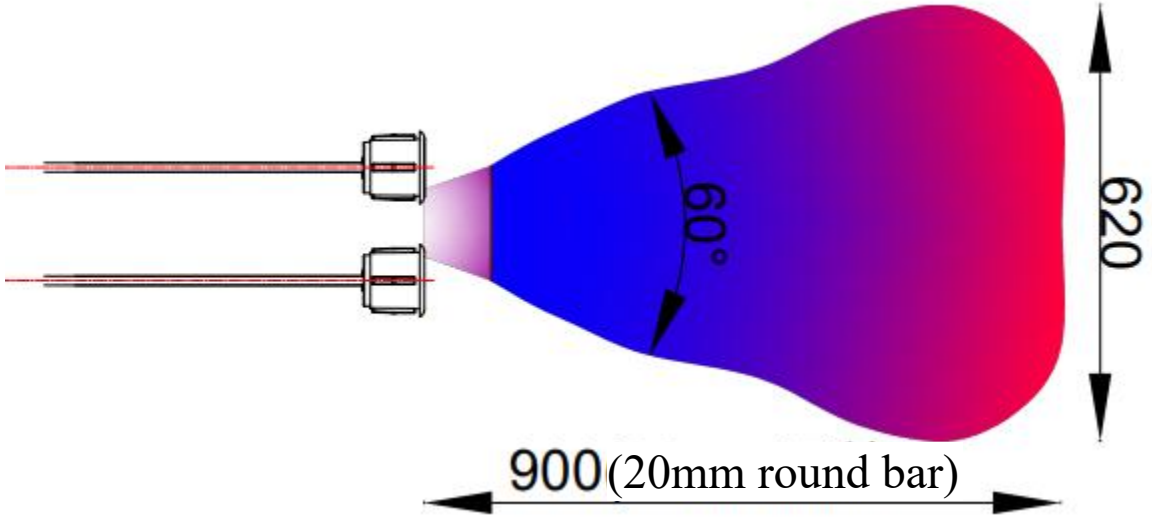
➢ KS136 series

1. Beam angle of KS106 single-angle probe.



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Introduction and Use Suggestions of KS136A

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➢ KS136A installation – Installation of double probes

- **Installation notes of double probes are partially the same with KS136;**
- **KS136A is fitted with the 4th generation probe; make sure the arrow at tail faces upwards to prevent detection of ground;**
- **Please use the silica gel with shore hardness ≤A25 when fixing the back side during installation of double probes, and pay attention to the hardness stability between -30℃ and ＋85℃.**
- **Note: The 12V or 5V power ripple of KS136A should not be over 120mV;**
- **The probe or ultrasonic wire should be away from the running motor or motor wire**

Introduction and Use Suggestions of KS136

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➢ KS136A installation – Installation of double probes

- **Recommended installation mode of double-angle probes (arrow on the back faces upwards)**

Introduction and Use Suggestions of KS136A

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- **KS136A series**

1. KS106A-4 probe

2 . The model marked with A means the 3rd generation or 4th generation probe; for details, please refer to the table in the page below

3 . It is decided by the service life and parameters in table below whether selecting KS136 or KS136A

4. Make sure to connect the probe by the probe number in single-probe mode, the wire with different length is located at different positions; the wire of the same length can be exchanged; this requirement does not apply to double probes

Introduction and Use Suggestions of KS136A

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Model	Main control box/mainboard of controller	Probe model	Probe center frequency	Probe wire length	Length of extended wire between probe and mainboard	Probe diameter	Beam angle	MTBF (be triggered in every 80ms)	Probe color	Probe appearance diagram	Probe trademark	Generation	Cost/ RMB	Recommended dimensions of installation hole
KS106	KS106-PCBA-40K-NA "NA": Without shell	KS40-19TRWP-L10C702	40K	Default length: 10cm (20cm supported)	Wire length: 30cm, 1m, 1.5m, 2.3m (factory default), 4m, 5m, 7m, 10m, 14m, 15m, 15.5m, 16m, 18m, 21m, 24m, 28m, all of which are spot goods (the price will increase when length exceeds 2.3m) Wire No.: LINE-XH2.54-WM-wire length, thickened wire No.: LINE24-XH2.54-WM-wire length For example, if wire length is 30cm, the wire code will be: LINE-XH2.54-WM-0.3M If wire length is 28m, the wire code will be: LINE-XH2.54-WM-28M	Plastic 18.3mm Silica gel 20.6mm	70±15°	Reject ratio within 5,000h is 1‰	Black, white, silver or other customized color		DAUXI.COM	The 1st generation	Low	19±0.1mm; thickness 1.5~4mm, positive and negative side of round hole undergo smoothing R0.2
KS136	KS136-PCBA-40K-NA "NA": Without shell													
KS106	KS106-PCBA-40K (No "-NA": With shell)	KS40B-19TRWP-L10C702				Plastic 18.9mm Silica gel 21.3mm	Vertical arrow direction 55±10° Horizontal 100 ±15°	Reject ratio within 15,000h is lower than three ten-thousandths	Black, white, silver or other customized color		DAUXI.COM	The 2nd generation	Low	19±0.1mm; thickness 1.5~4mm, positive and negative side of round hole undergo smoothing R0.2
KS136	KS136-PCBA-40K (No "-NA": With shell)													
KS106A	KS106A-PCBA-49K (No "-NA": With shell)	KS49-19TRWP-L10C702	49K			Plastic 18.9mm Silica gel 21.9mm	60±10°	Reject ratio within 50,000h is lower than three ten-thousandths	Black, white, silver or other customized color		DAUXI.COM	The 3rd generation	Medium	**19.7±0.1mm; thickness 1.5~4mm, positive and negative side of round hole undergo smoothing R0.2 Rigid connection is not recommended between probes during installation of the 3rd generation double probes, and it is not allowed to squeeze the probe; it is recommended to install double probes on the silica gel substrate with shore hardness of A35~ A40.**
KS136A	KS136A-PCBA-49K (No "-NA": With shell)													
KS106A	KS106A-PCBA-49K (No "-NA": With shell)	KS49B-19TRWP-L10C702				Plastic 18.3mm Silica gel 20.6mm	Vertical arrow direction 45±10° Horizontal 100 ±15°	Reject ratio within 50,000h is lower than three ten-thousandths	Black, white, silver or other customized color		DAUXI.COM	The 4th generation	Medium	19±0.1mm; thickness 1.5~4mm, positive and negative side of round hole undergo smoothing R0.2
KS136A	KS136A-PCBA-49K (No "-NA": With shell)													

Coding rules of probe model are shown in table below:

KS49-19TRWP	-	L10C702	

KS is head of model, 49: Frequency is 40k (another frequency is 40K); 49 with suffix "B": Double angles; it is single angle if there's no suffix "B"; 19 is the min. diameter 19 of probe; TR means integration of sending and receiving; WP means waterproof; L10 means probe wire length is 10cm (another length 20cm needs to be customized); 702 means bright black (101 means metallic silver; 100 means pearl white; 040 means yellowish brown).

Remarks: It is not recommended to choose the 3rd generation probe for its production will be halted. It is recommended to use the 4th generation of probe or the 5th generation of KS104/KS114.

Introduction and Use Suggestions of KS109

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➢ Function abstract of KS109

- By integrating the receiver and sender, KS109 can realize the min. beam angle of about 10°.
- Distance detection which supports real-time temperature compensation, high detection accuracy (0xb4 instruction accuracy is accurate to 1mm, take the metal net surface as benchmark);
- The emission sound is adjustable and the default emission sound is 55-65 dB; it can be adjusted to 45-55 or 40-45 dB;
- Wide range of working voltage (3.0V~5.5V);
- ROHS environmental protection.
- The hair with a diameter of 0.1mm can be detected

Introduction and Use Suggestions of KS109

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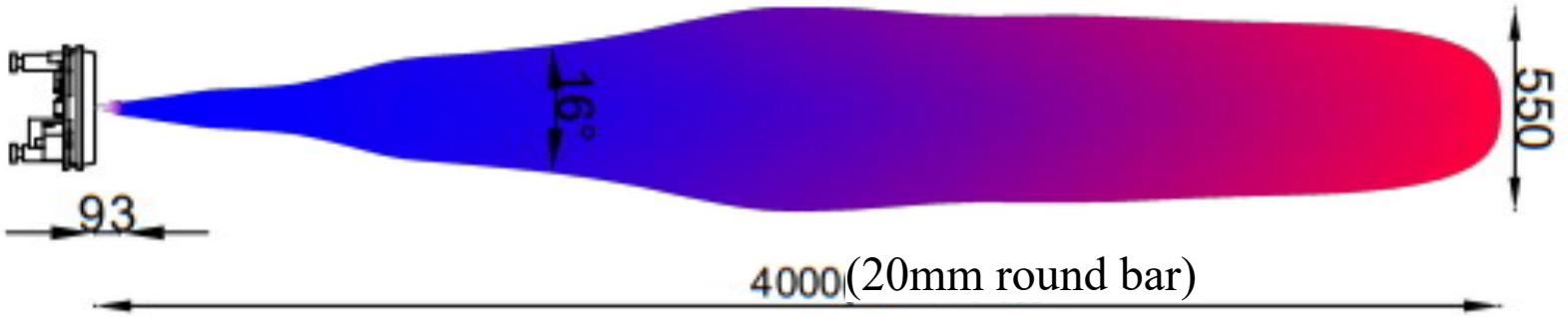
- **KS109 beam angle**



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Introduction and Use Suggestions of KS109

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➢ Application scope of KS109

- Detection scope KS109 (0xb2,0xba):4cm~11m; KS109 (0xb0,0xb4, 0xb8,0xbc):8cm~11m; it is recommended to use 0xb4 instruction in height detection.
- Be widely applied in measurement of strip objects with small beam angle, such as measurement of body height, sitting position and body position.
- Detect water accumulation in culvert to avoid danger of vehicles
- Being resistant to corrosion, KS109-TiO2 can be applied to scenarios with corrosions such as salt, alkali and seashores

Introduction and Use Suggestions of KS109

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➢ Application scope of KS109

- Medical devices
- Control over high-speed moving robots
- Control over approach accuracy of automatic charging pile
- Applies to low installation height below the robot
- Cover the dead zone of laser radar, applies to selective avoidance of small obstacles
- KS109-485 applies to scenarios with long-distance transmission
- Avoid use in saline, alkaline or highly-corrosive places. It is recommended to use Model KS109-TiO2 in saline, alkaline or highly-corrosive places, such as seashore.

Introduction and Use Suggestions of KS103

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➢ Function abstract of KS103

•Detection range 1cm~800cm (see Page 18) and 1cm~1000cm (10m)
•Have communication with host through ***I²C/serial port*** interface and have auto response to the ***I²C/serial port*** control instruction of host
•A total of 20 modifiable ***I²C/serial port*** addresses,
•Enter uA level sleep mode automatically if I²C control command is not received within 5s; it can be awakened by host I²C command at any time;
•Autologous ultrasonic wave identification function supported

Introduction and Use Suggestions of KS103

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➢ Function abstract of KS103

•The short-distance detection ranges from 10cm, 20cm, ……, to 470cm, to satisfy the short-distance detection
•1ms fast detection of light intensity, real-time detection and light intensity
•Industrial configuration adopted; work temperature (-30℃~+85℃);
•Wide range of working voltage (3.0V~5.5V);
•Communication rate at I²C mode: 50~100kbit/s;

Introduction and Use Suggestions of KS103

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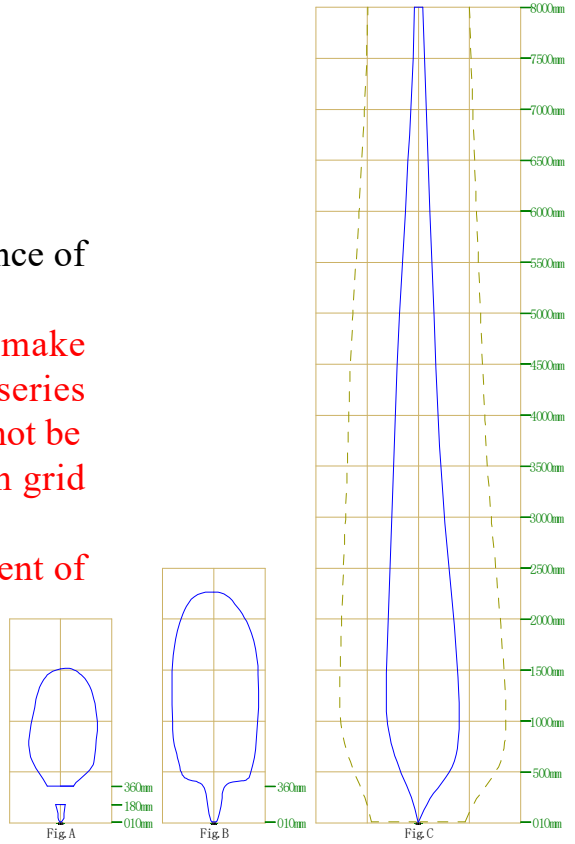
➢ Use notices of KS103

•The front of probe should not be blocked

•The beam angle is 20° at distance of 1-21cm, or 60° at distance of 21cm-8m, as shown in the right picture.

•If the grid like screen window is installed in front of probe, make sure the grid surface is closely fitted on the surface of KS103 series probe and the clearance should not exceed 0.5mm; the grid will not be mistakenly detected as obstacle if the probe is closely fitted on grid and the grid thickness should not exceed 0.6mm.

•The probe and robot shell should be bulged or aligned; the indent of probe should not exceed 1mm.



Drawing No. Condition	Size of reflector	Material	Distance of Probe to Ground	Voltage	Noise reduction level
Fig.A	Diameter 6mm	Wood	62mm	5V	0x71
Fig.B	Diameter 15.6mm	304 stainless steel	62mm	5V	0x71
Fig.C	L 920mm W 860mm	2 pits of corrugated boards	160mm	5V	0x71

Introduction and Use Suggestions of KS103

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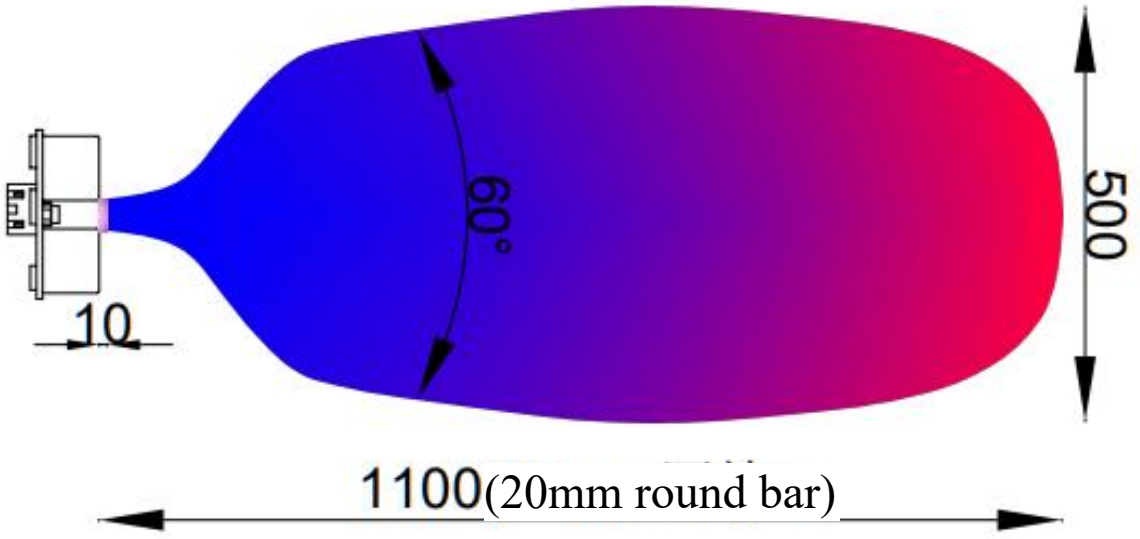
- **KS103 beam angle**



Download specification

Introduction and Use Suggestions of KS103

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➢ Application scope of KS103

- **Obstacle avoidance of moving robots.**
- **Control over approach of automatic charging pile**
- **Human body detection**

Application of KS103 in assistant robot in bank hall

Introduction and Use Suggestions of KS103

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➢ Application scope of KS103

Application of KS103 in assistant robot in bank hall

Protective metal net can be installed outside KS103. Be close to KS103 probe as much as possible

Introduction to KS103 series

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- **KS103H: Auto detection + switching quantity + autologous sound wave identification**

- **It is recommended to install one auto detection KS103H for each robot respectively**

Introduction to KS103 series

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- KS103-485:485 interface + autologous sound wave identification
- KS103-24V: KS103 with 12-24V power supply
- KS103H-24V: KS103H with 12-24V power supply

Introduction to KS103 series

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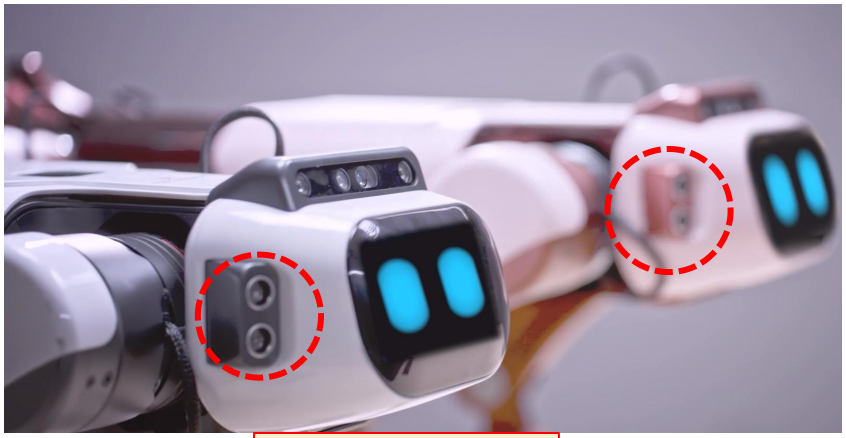
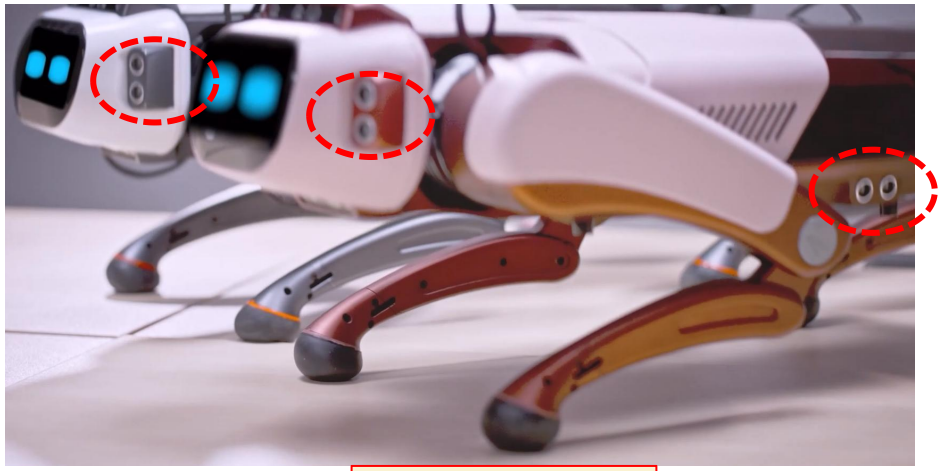
➢ Application cases of KS103 series – Robot dog



Application of robot dog series (KS103-485/KS203)



Application of robot dog series (KS103-485/KS203)

Introduction to KS103 series

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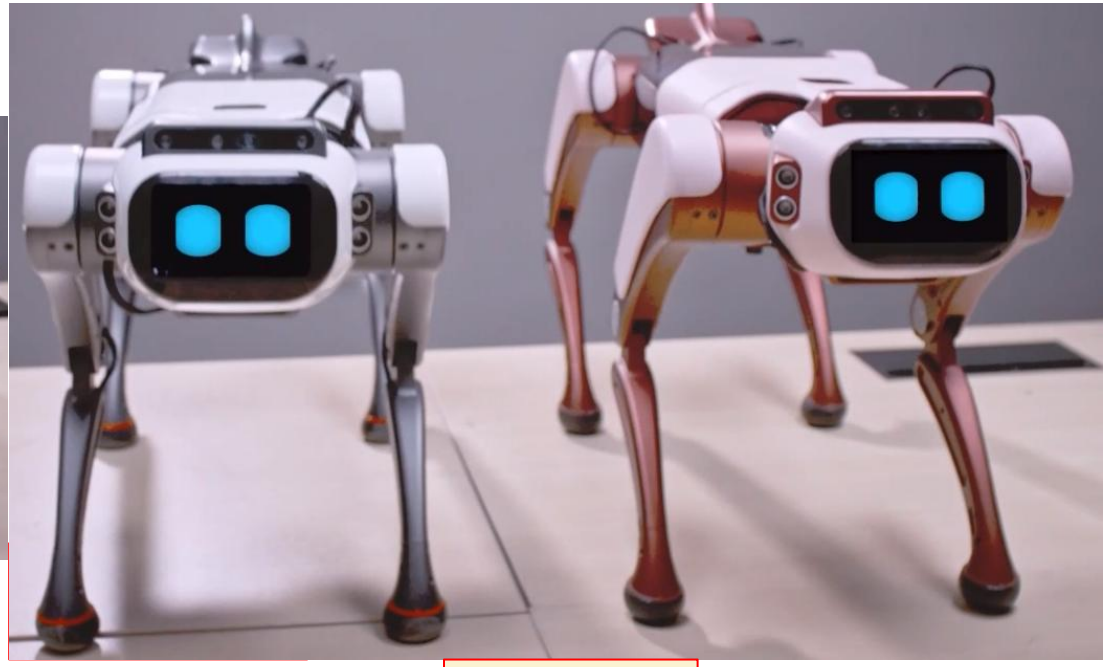
➢ Application cases of KS103 series – Robot dog

Application of robot dog series (KS103/KS203)



Application of robot dog series (KS103/KS203)

Introduction to KS103-485 series

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- **KS103-485:485 interface + autologous sound wave identification**

Introduction to KS103 series

DAUXI.COM

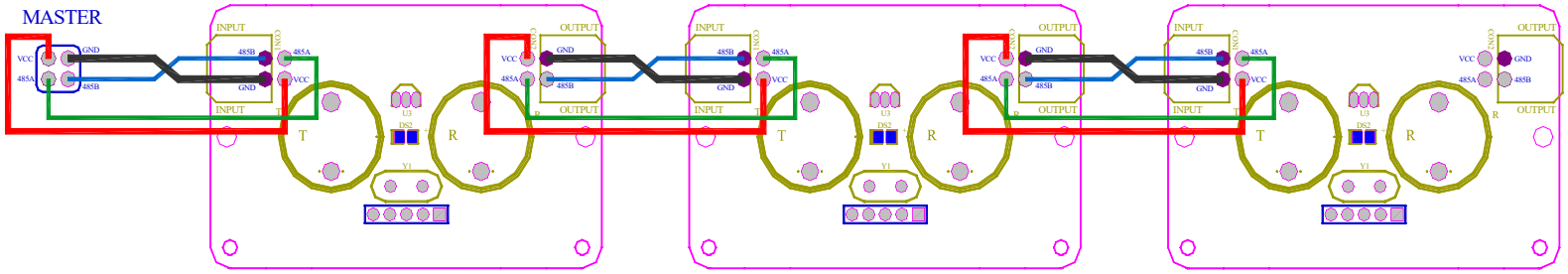
➢ KS103-4852: Support online address modification

- A total of 63 modifiable *485# serial port* addresses within the range of 0xC0 ~ 0xfe. Support broadcast address.
- Communication with timeout check and CRC check
- Serial connection with 60 sets and applies to cargo size measurement in container

Introduction to KS103 series

DAUXI.COM

- **KS103-4852: KS103-4852 which supports online address modification**
  - **When 62 sets of the same KS103-4852 are provided with serial connection according to the picture below, the address of all machines can be modified through the communication of upper computer**
  - **Reset all hosts of bus as the factory default address**
  - **Avoid the trouble of modifying KS103 address one by one**



Introduction to KS101 mini ultrasonic wave

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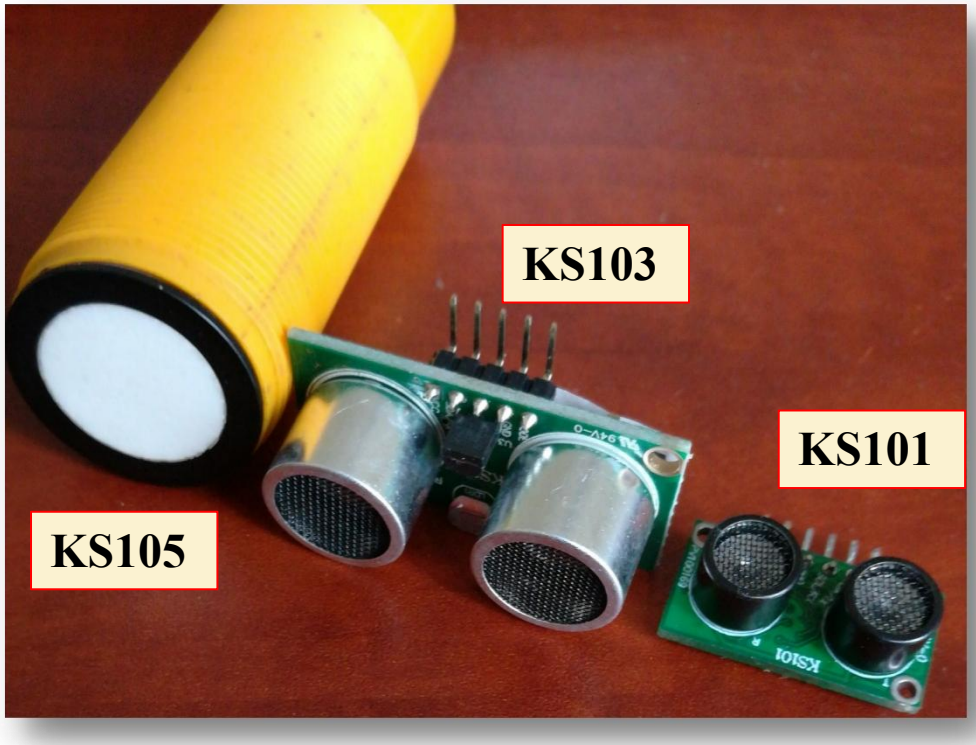


- KS101 applies to miniaturization design of robot

Introduction to KS102 mini ultrasonic wave

DAUXI.COM

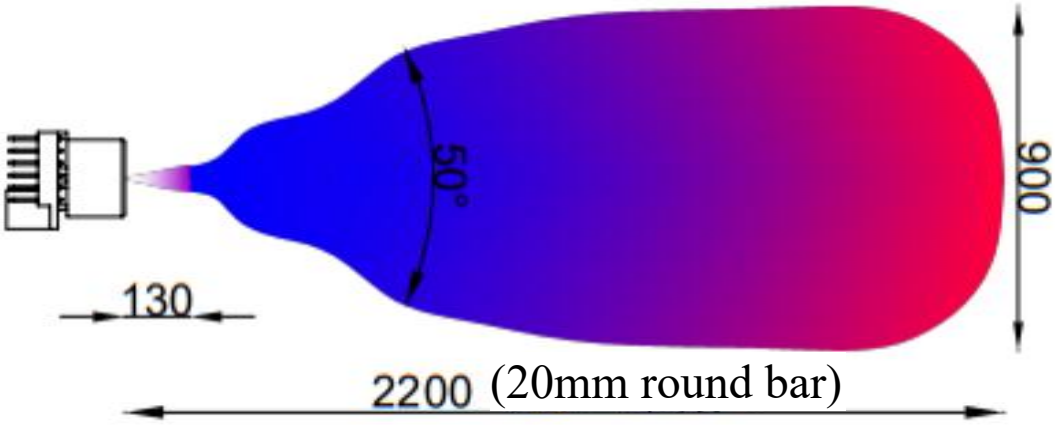
- KS102 applies to height fixing of UAV
- With miniaturization design, the robot equals to 1/2 of KS103.

KS102

Introduction to KS102 mini ultrasonic wave

DAUXI.COM

- **KS102 beam angle**
  FOV 50°



Download specification

Introduction to KS105 series ultrasonic wave

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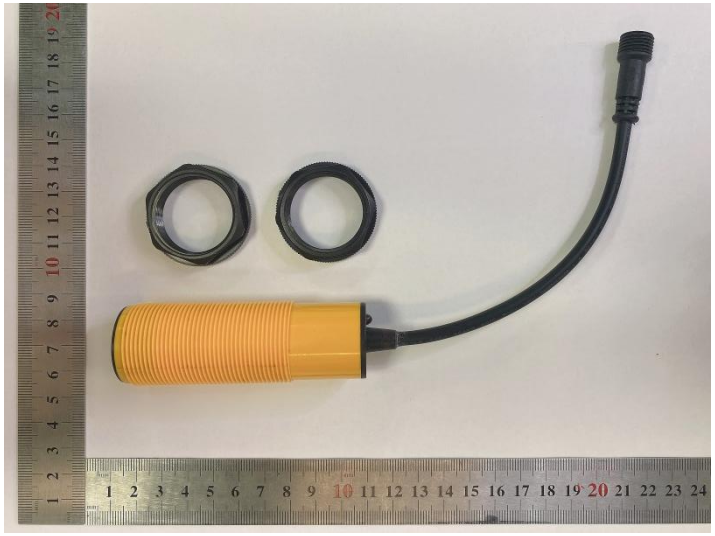
➢ KS105 waterproof small beam angle ultrasonic wave module

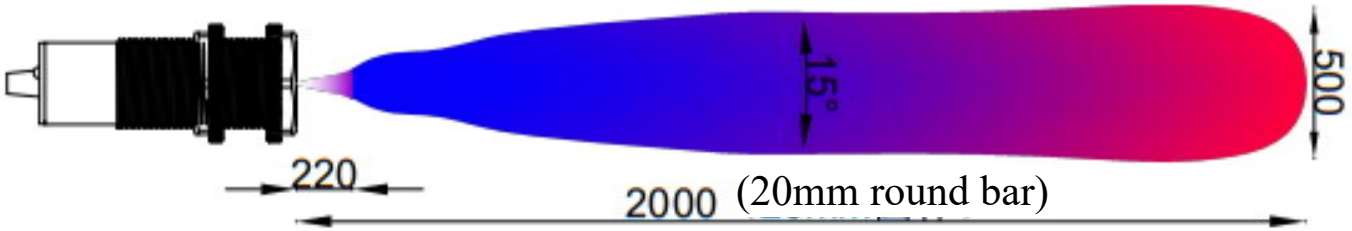
- Beam angle 15°
- Detection range 17cm-2.5
- Waterproof grade IP67
- Applies to accurate positioning of industrial robot manipulator
- Accurate measurement of liquid level
- Accurate position control over approach of robot to charging pile
- Accuracy 2mm
- Optional MODBUS RTU interface of KS105

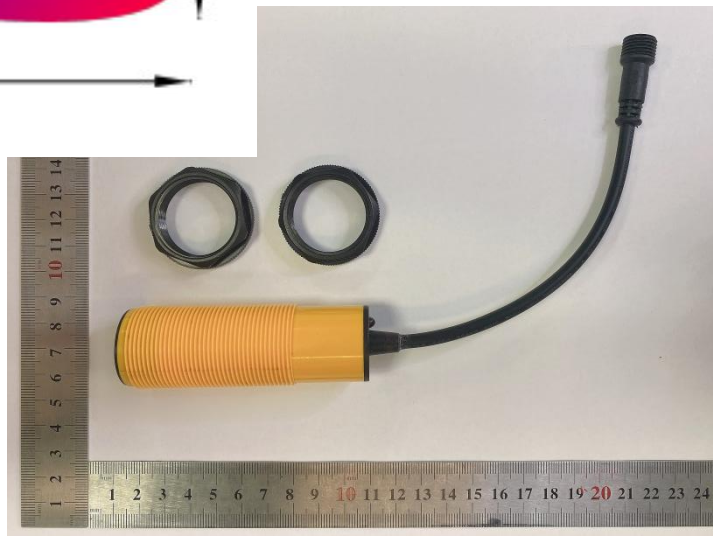


Introduction to KS105 series ultrasonic wave

DAUXI.COM

- **KS105 waterproof small beam angle ultrasonic wave module**
  - **Beam angle 15° as shown in picture**





Download specification

Introduction to KS107 series ultrasonic wave

DAUXI.COM

➢ KS107 waterproof small beam angle ultrasonic wave module

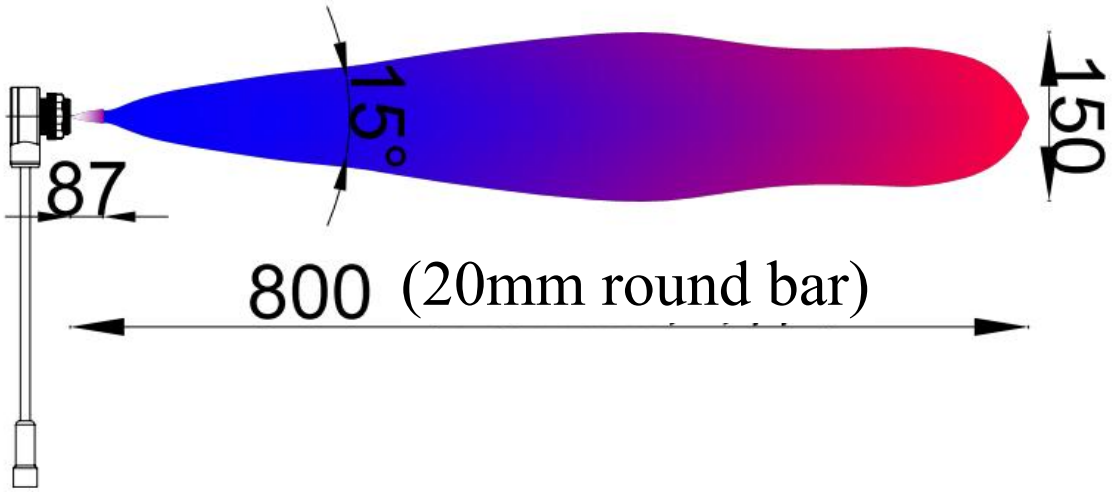
- Beam angle 15°
- Detection range 7cm-1.5m
- Waterproof grade IP67
- Applies to accurate positioning of industrial robot manipulator
- Accurate measurement of liquid level
- Accurate position control over approach of robot to charging pile
- As small as 30mm*30mm, applies to the miniaturization applications
- It can replace KS136/KS136A and apply to the scenarios with installation height below 15cm
- KS107 support s MODBUS RTU interface
- Accuracy 1mm

Introduction to KS107 series ultrasonic wave

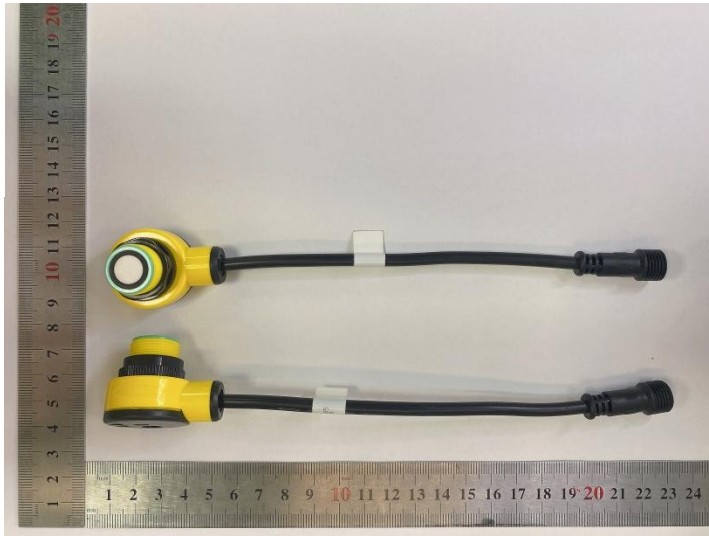
DAUXI.COM

➢ KS107 waterproof small beam angle ultrasonic wave module

- **Beam angle 15° as shown in picture**



Download specification



Introduction to KS107 series ultrasonic wave

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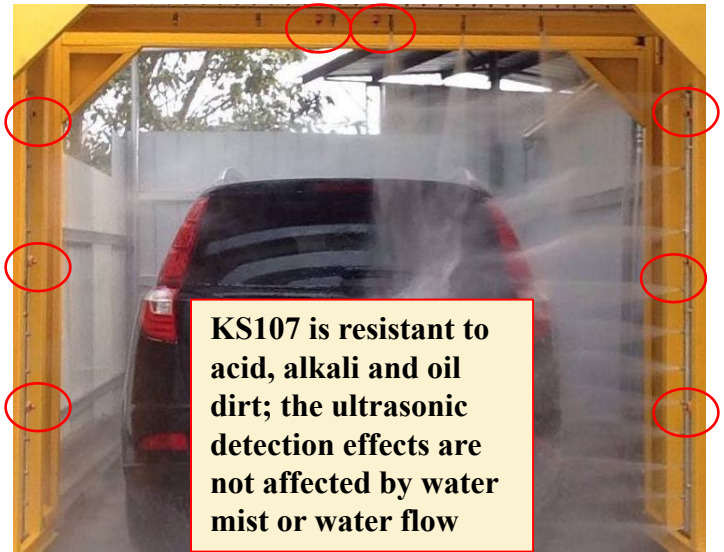
➢ Client application cases of KS107

- Automatic supplementation of nutrient solution of cell and bacteria
- Automatic measurement of workpiece in plant
- Auto reeling and thickness measurement of transparent adhesive tape
- Tortuosity measurement of cloth and sheet metal
- Oil painting and locating
- Accurate measurement of automobile contour of automatic washing machine



KS107 is resistant to acid, alkali and oil dirt; the ultrasonic detection effects are not affected by water mist or water flow

Introduction to KS108 series ultrasonic wave

DAUXI.COM

➢ KS108 waterproof small beam angle ultrasonic wave module

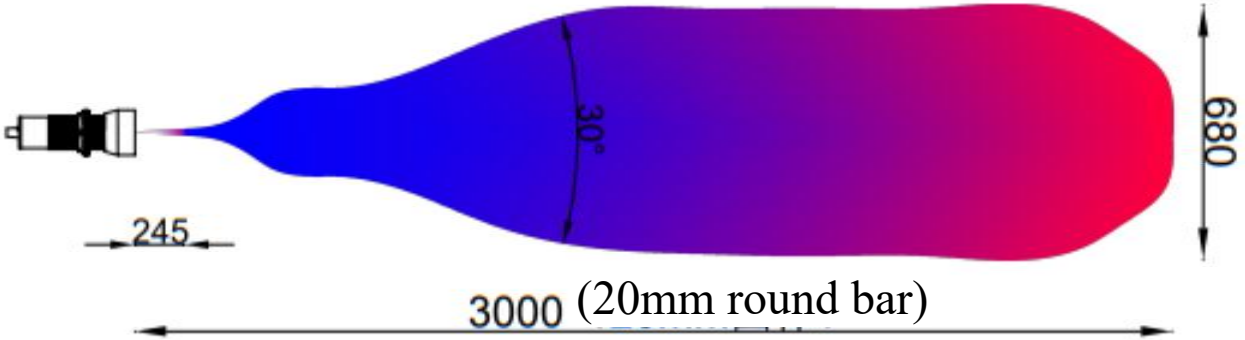
- Beam angle 30°
- Detection range is 24cm-6m, high sensitivity and long range, it can replace KS109 partially
- Waterproof grade IP67
- Applies to accurate locating of robot moving
- Accurate measurement of liquid level
- Accurate position control over approach of robot to charging pile
- It can replace KS109 and apply to the scenarios of high-speed moving, high sensitivity, large range and resistance to water and dust
- KS108 supports MODBUS RTU interface
- Accuracy 5mm

Introduction to KS108 series ultrasonic wave

DAUXI.COM

➢ KS108 waterproof small beam angle ultrasonic wave module

- **Beam angle 30° as shown in picture**



Download specification

Introduction to KS202 series ultrasonic wave

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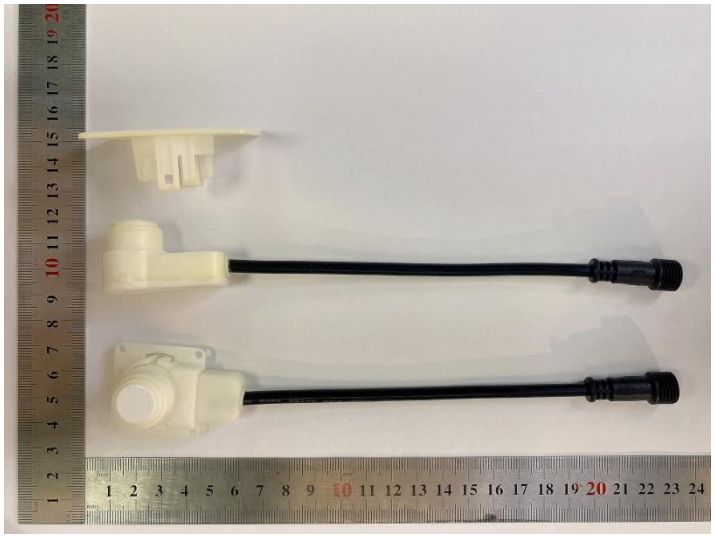
➢ KS202 waterproof double-angle ultrasonic wave module

- FOV horizontal 90° vertical 40° (2cm round bar)
- Single-probe type, detection range is 16cm-3m;
- Support screw installation and be compatible with built-in mounting of automobile radar
- IP67 waterproofing
- User-friendly appearance, partial circumference is visible, integrated appearance with mounting shell and customized color



Introduction to KS202 series ultrasonic wave

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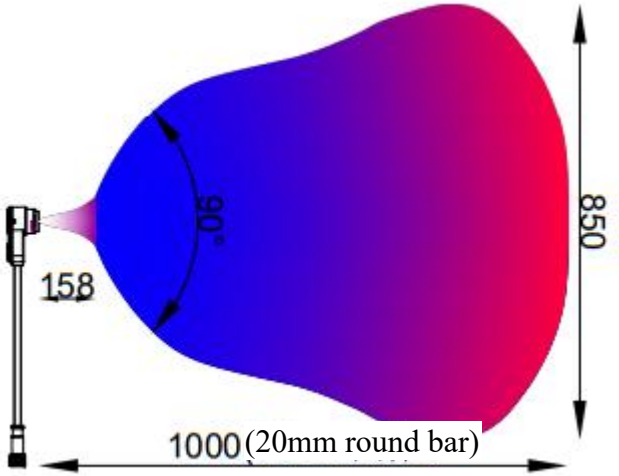
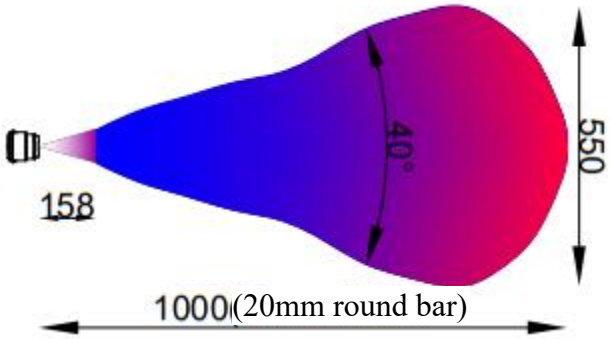
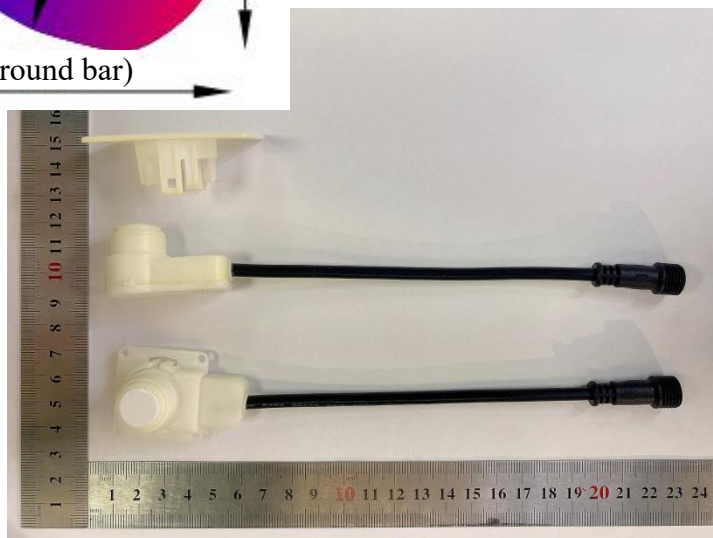
➢ KS202 waterproof double-angle ultrasonic wave module

- **Beam angle 90*40° as shown in picture**







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Introduction to KS203 series ultrasonic wave

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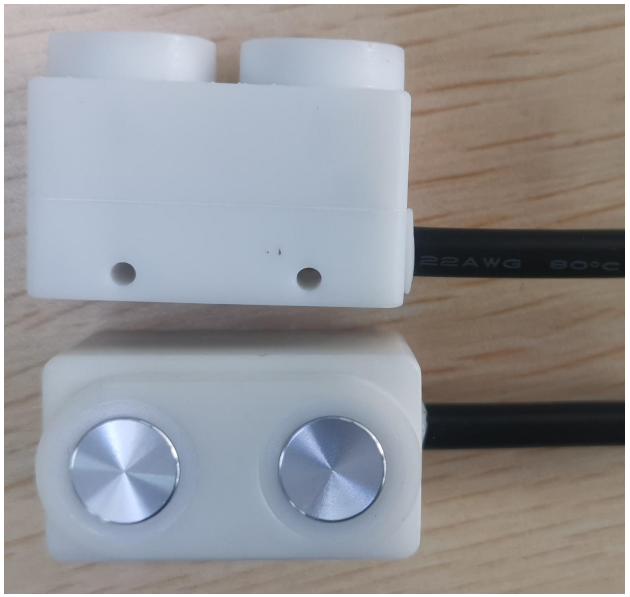
➢ KS203 waterproof ultrasonic wave module

- FOV 60° (2cm round bar);
- Detection range 0cm-3m;
- IP67 waterproofing;
- User-friendly appearance, partial circumference is visible, integrated appearance with mounting shell, black and white are optional, other colors are customizable;
- Small-size, waterproof and high-reliability 0~3m ultrasonic distance measurement module (the size is about half that of KS104/KS114)
- Exquisite and compact, applies to large commercial sweepers, household sweepers, large and medium-sized robot dog and patrol inspection robots.

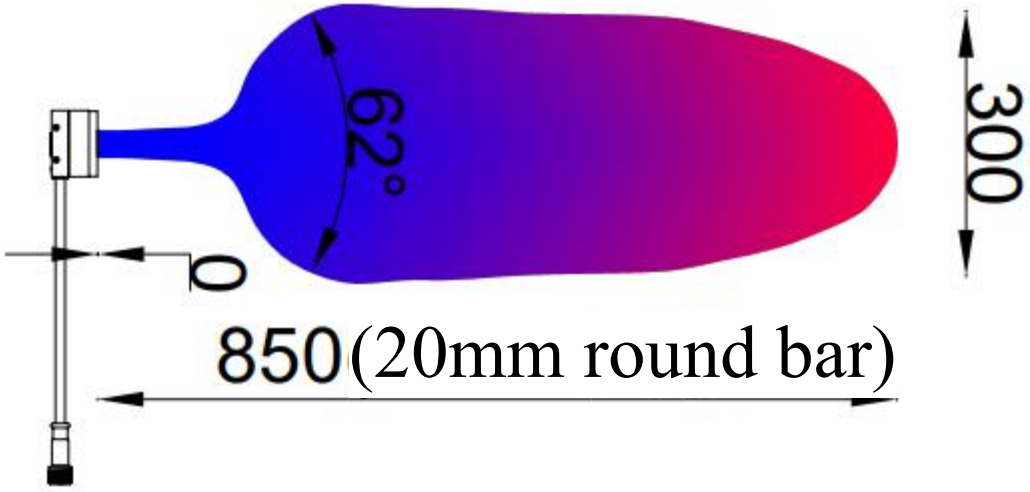


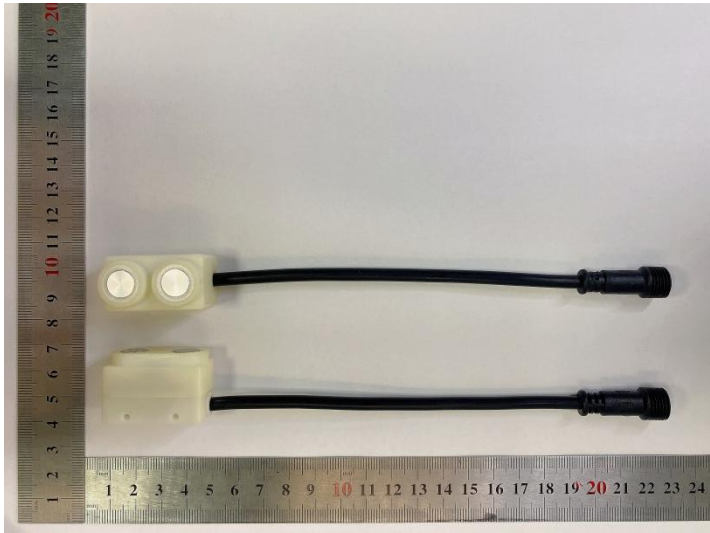
Introduction to KS203 series ultrasonic wave

DAUXI.COM

➢ KS203 waterproof double-angle ultrasonic wave module

- **Beam angle 60° as shown in picture**





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Introduction to KS203 series ultrasonic wave

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- **Application cases of KS203 – Miniaturization and outdoor robot dogs**

Introduction to KS104 series ultrasonic sound

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➢ KS104 waterproof ultrasonic module

- Both horizontal and vertical angle is 60° (instructions such as 0xb0) or 50° (instructions such as 0x0f) and support real-time zoom
- Detection range: 1cm-5m; accuracy: 2cm
- Waterproof grade IP67
- Applies to accurate locating of robot moving
- Working voltage: 3-5.5V; working temperature (-30℃~+85℃); Accurate position control over approach of robot to charging pile
- Default #485 interface), I2C interface compatible with KS103 protocol can be customized, TTL interface can be customized;
- Autologous sound wave recognition technology adopted, improving the anti-interference performance;
- KS104 can replace KS103,KS106,KS136,KS106A,KS136A

Compared with KS136/KS136A (dead zone 10cm), the KS104 dead zone is 1cm only; besides, KS104 has concise wiring in the robot and only one 4-core bus with diameter of 5mm is required regardless of the amount of KS104; high accuracy (error ≤2cm); save more energy; it has lower cost compared with KS136A double probes.

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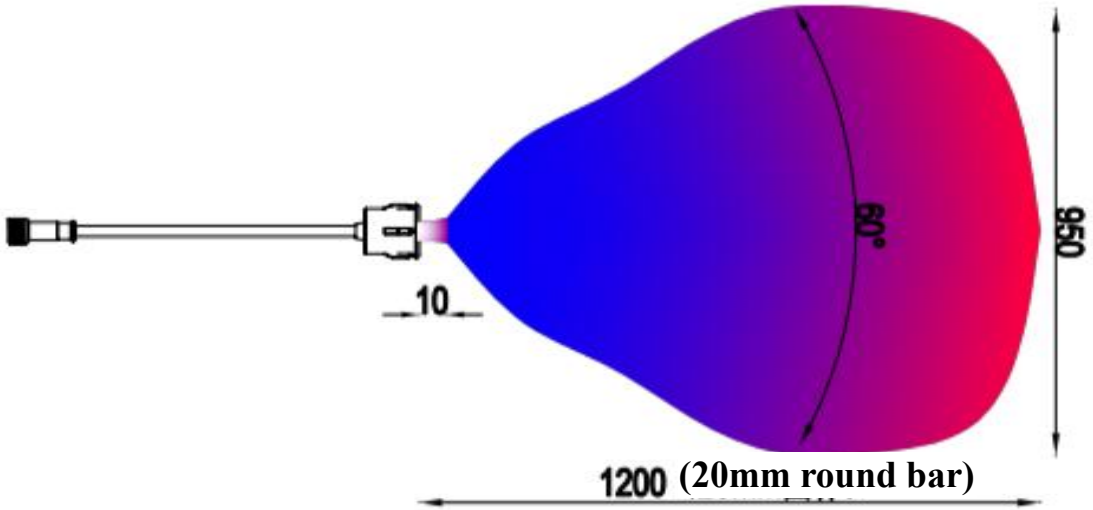
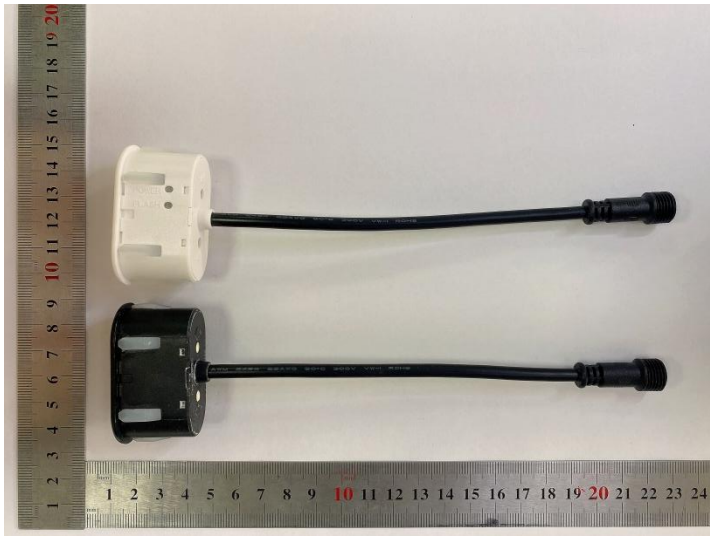
Introduction to KS104 series ultrasonic sound

➢ KS104 beam angle





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Introduction to KS104 series ultrasonic sound

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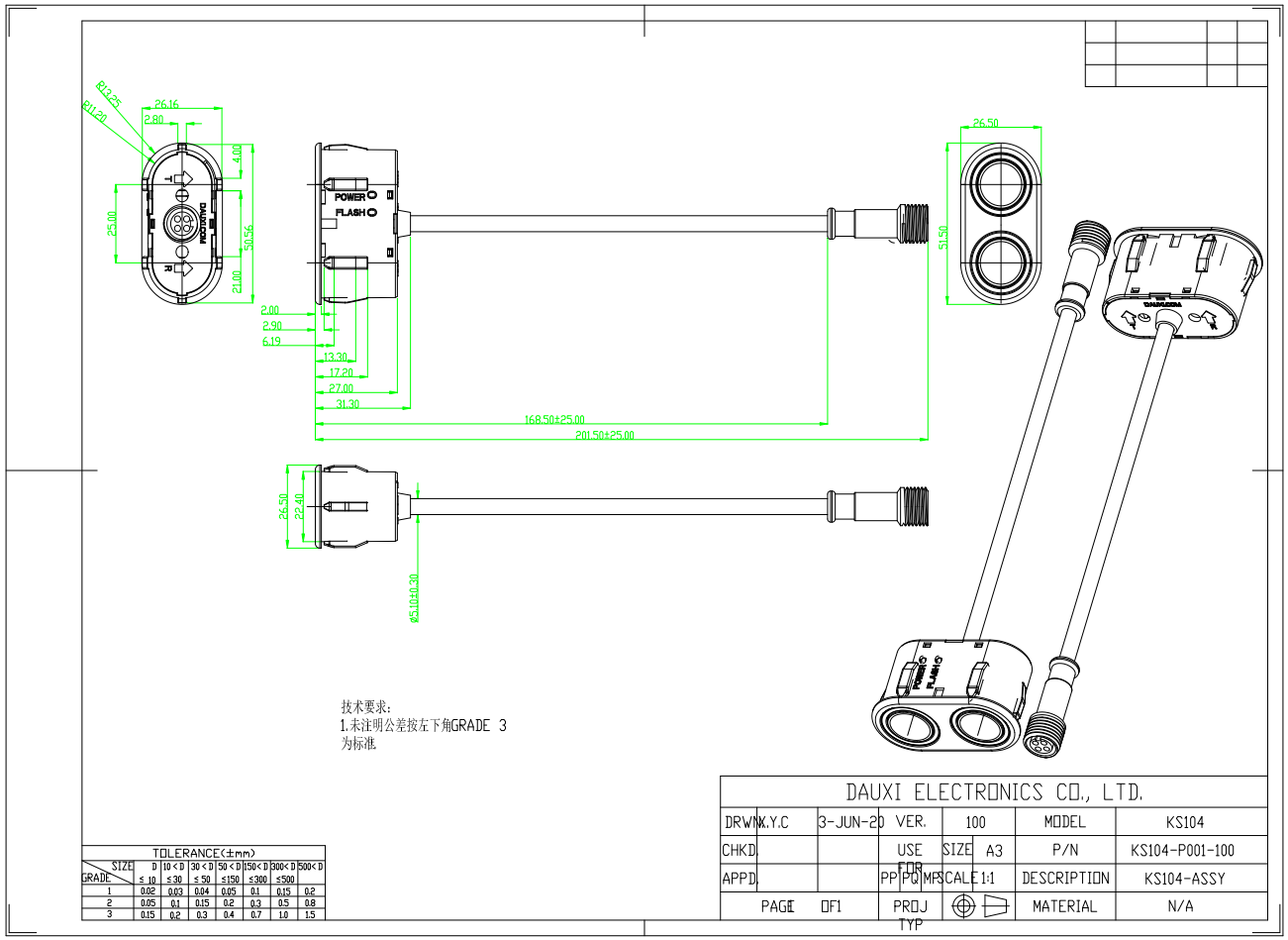
➢ Suggestions of KS104 installation

- KS104 assembly drawing is shown in picture, the reference installation mode is: Be fixed through 6 elastic silica gels; or bucket mounting is adopted (use the long holes at front and rear side of KS104 for bucket fixing)



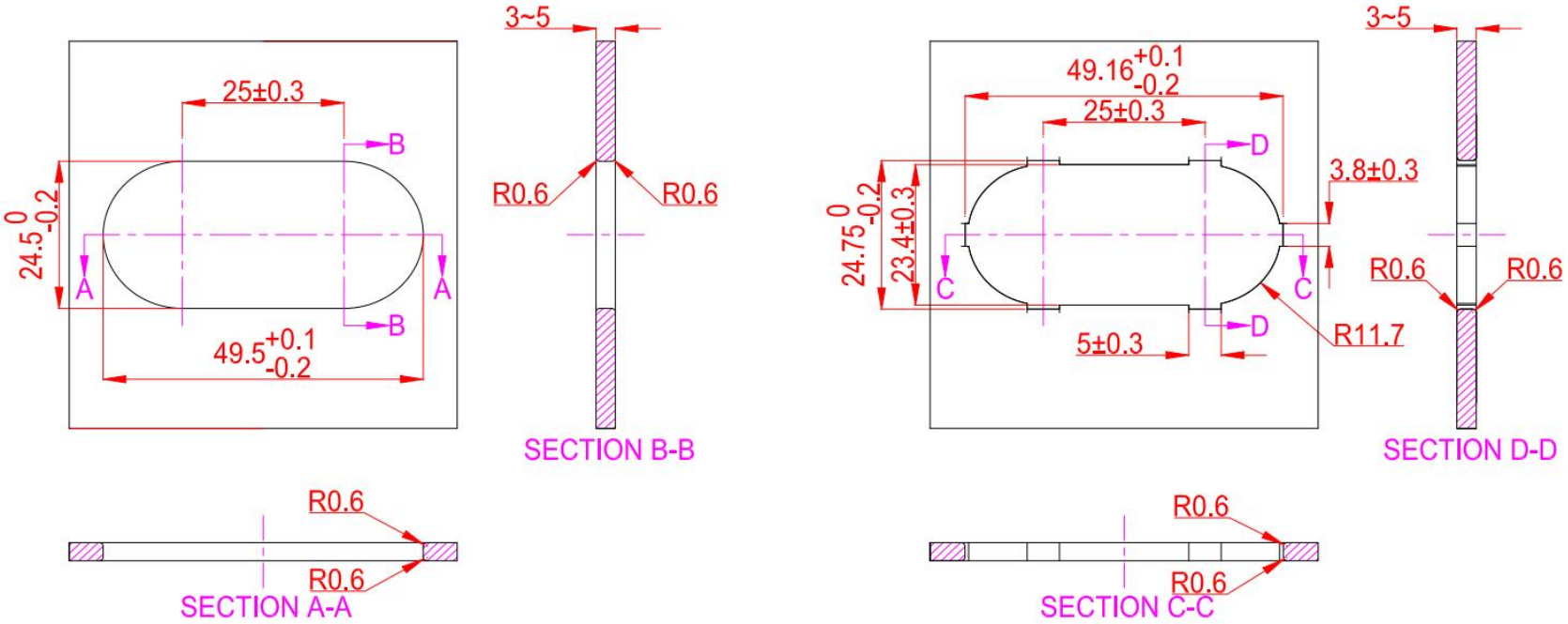
Introduction to KS104 series ultrasonic sound

DAUXI.COM

➢ Suggestions of KS104 installation

- **Both of the installation holes in picture below are accepted. Both of positive and negative side of KS104 silicone contact edge should undergo smoothing for R0.5~1mm. The recommended thickness of installation panel is ≥3mm .**
- According to the test, the installation is smooth while the tolerance in the left drawing is 24.5±0.4mm, and it is not dropped after vibration test

The tolerance size at other position can be neglected.

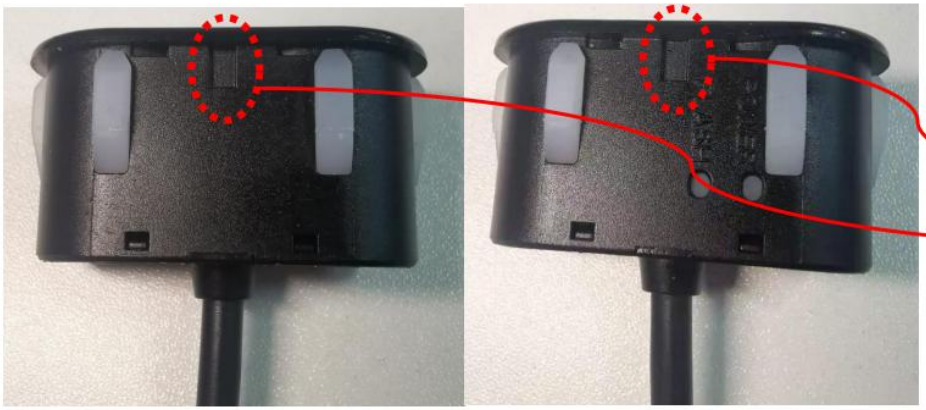


Introduction to KS104 series ultrasonic sound

DAUXI.COM

➢ Suggestions of KS104 installation

- The following bucket installation scheme can also be adopted. Design the buckle on the shell, press the KS104 into the shell and press the buckle on shell into the square slot in picture below to realize explosion-proof installation.



The positive/negative side shown in red dotted line can be used for designing the bucket installation.

Introduction to KS104 series ultrasonic sound

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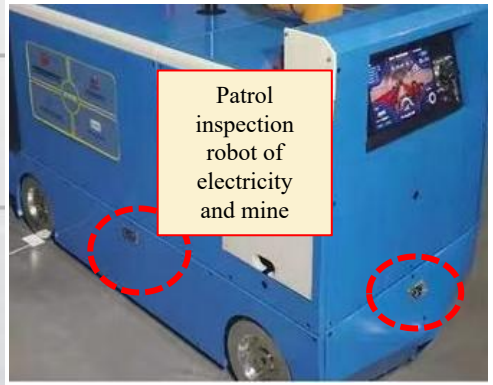
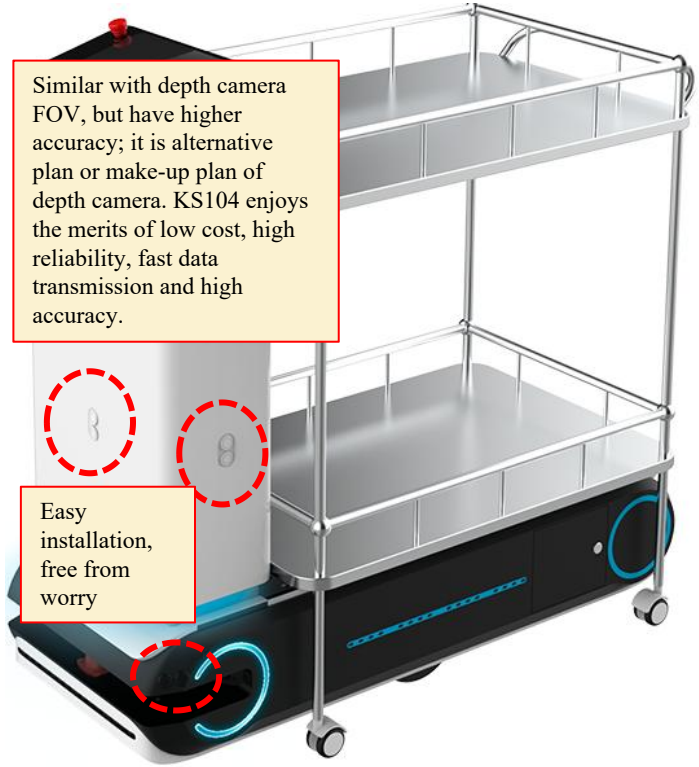
➢ Application cases of KS104

Patrol inspection robot of electricity and mine





Introduction to KS104 series ultrasonic sound

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- **Application cases of KS104 (360° high-accuracy air skin)**

Cleaning robot

Introduction to KS104 series ultrasonic sound

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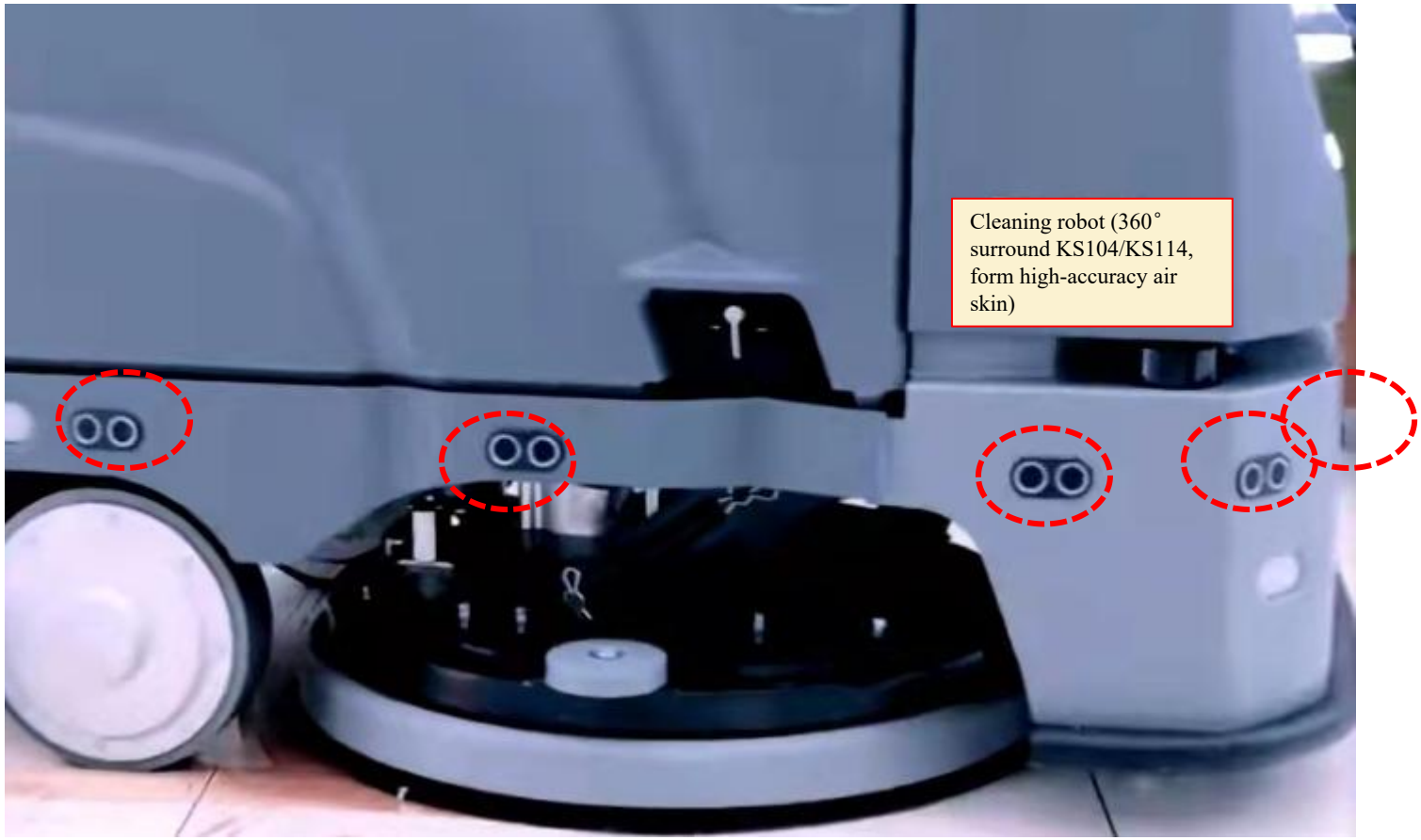
- **Application cases of KS104 (360° high-accuracy air skin)**



Introduction to KS104 series ultrasonic sound

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- **Application cases of KS104 (360° high-accuracy air skin)**

Operation robot (360° surround KS104/KS114, form high-accuracy air skin)

Introduction to KS104 series ultrasonic sound

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- **Application cases of KS104 (360° high-accuracy air skin)**

Cleaning robot (360° surround KS104/KS114)

Introduction to KS114 series ultrasonic wave

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➢ KS114 waterproof ultrasonic module

- Horizontal 100° and vertical 50° (instructions such as 0xb0), horizontal 90° and vertical 40° (instructions such as 0x0f)
- Detection range: 1cm-5m; accuracy: 2cm
- Waterproof grade IP67
- Applies to accurate locating of robot moving
- Working voltage: 3-5.5V; working temperature (-30℃~+85℃); Accurate position control over approach of robot to charging pile
- Default #485 interface), I2C interface compatible with KS103 protocol can be customized, TTL interface can be customized;
- Autologous sound wave recognition technology adopted, improving the anti-interference performance;
- KS114 can replace KS103,KS106,KS136,KS106A,KS136A

Compared with KS136/KS136A (dead zone 10cm), the KS114 dead zone is 1cm only; besides, KS114 has concise wiring in the robot and only one 4-core bus with diameter of 5mm is required regardless of the amount of KS114; high accuracy (error ≤2cm); save more energy; it has lower cost compared with KS136A double probes.

Introduction to KS114 series ultrasonic wave

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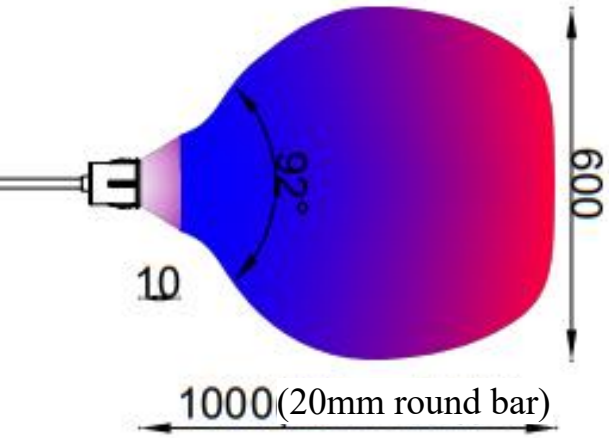
➢ KS114 waterproof series can replace the depth camera

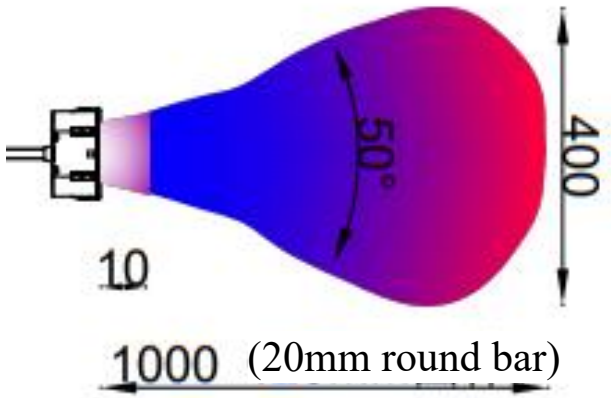
- FOV is similar with depth camera;
- Its cost is about 20% that of depth camera;
- High reliability, free from worry and durable;
- Resistant to dust, sludge, mist, acid and alkali;
- Resistant to strong or weak light;
- Enjoy centimeter-level resolution at distance of 0-30cm, superior than depth camera or laser;
- It can be installed around the robot, to form a circle of high-accuracy air sensing skin;

Introduction to KS114 series ultrasonic wave

DAUXI.COM

➢ KS114 beam angle





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Introduction to KS114 series ultrasonic wave

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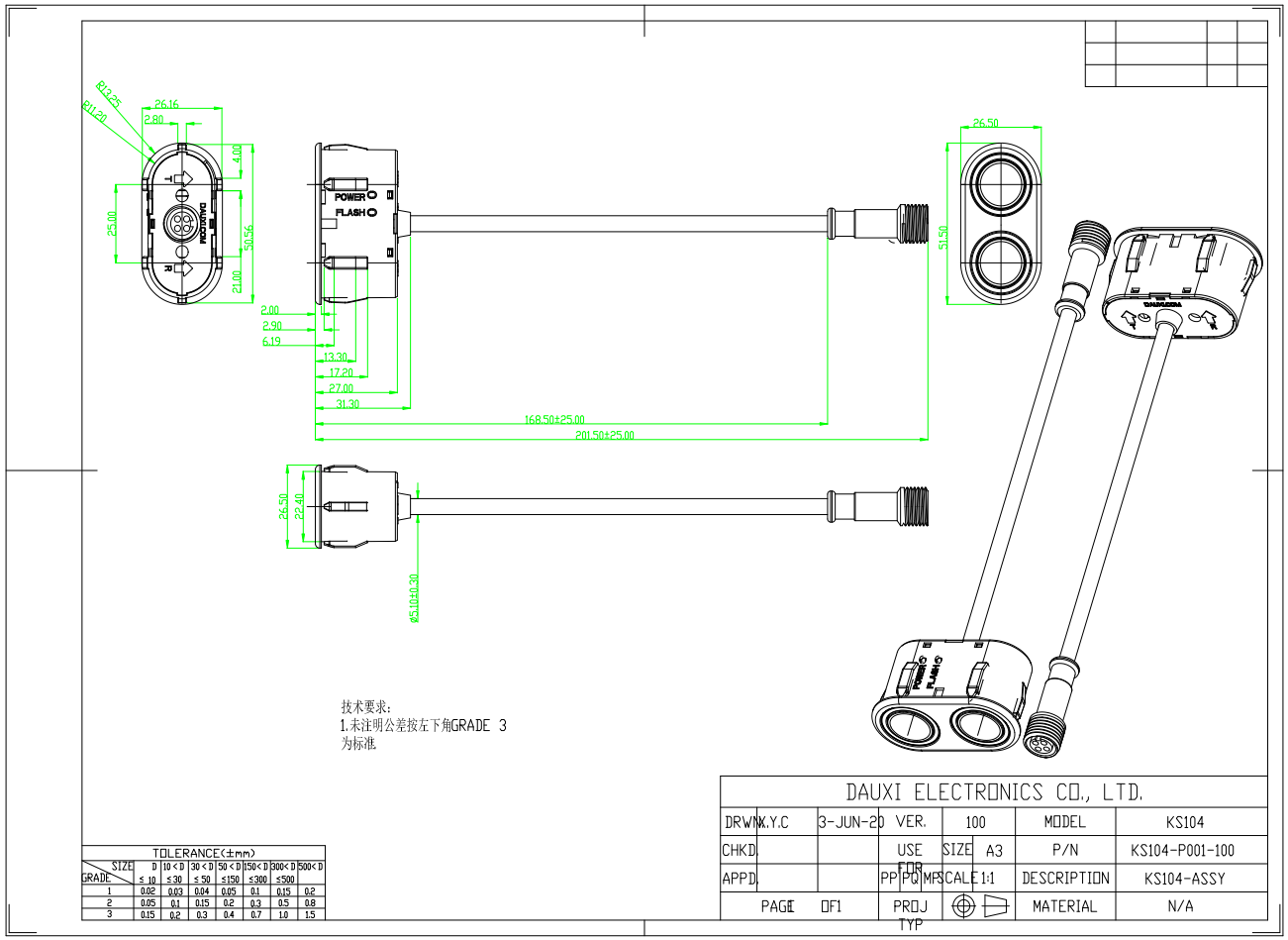
➢ Suggestions of KS114 installation

- KS104 assembly drawing is shown in picture, the reference installation mode is: Be fixed through 6 elastic silica gels; or bucket mounting is adopted (use the long holes at front and rear side of KS104 for bucket fixing)



Introduction to KS114 series ultrasonic wave

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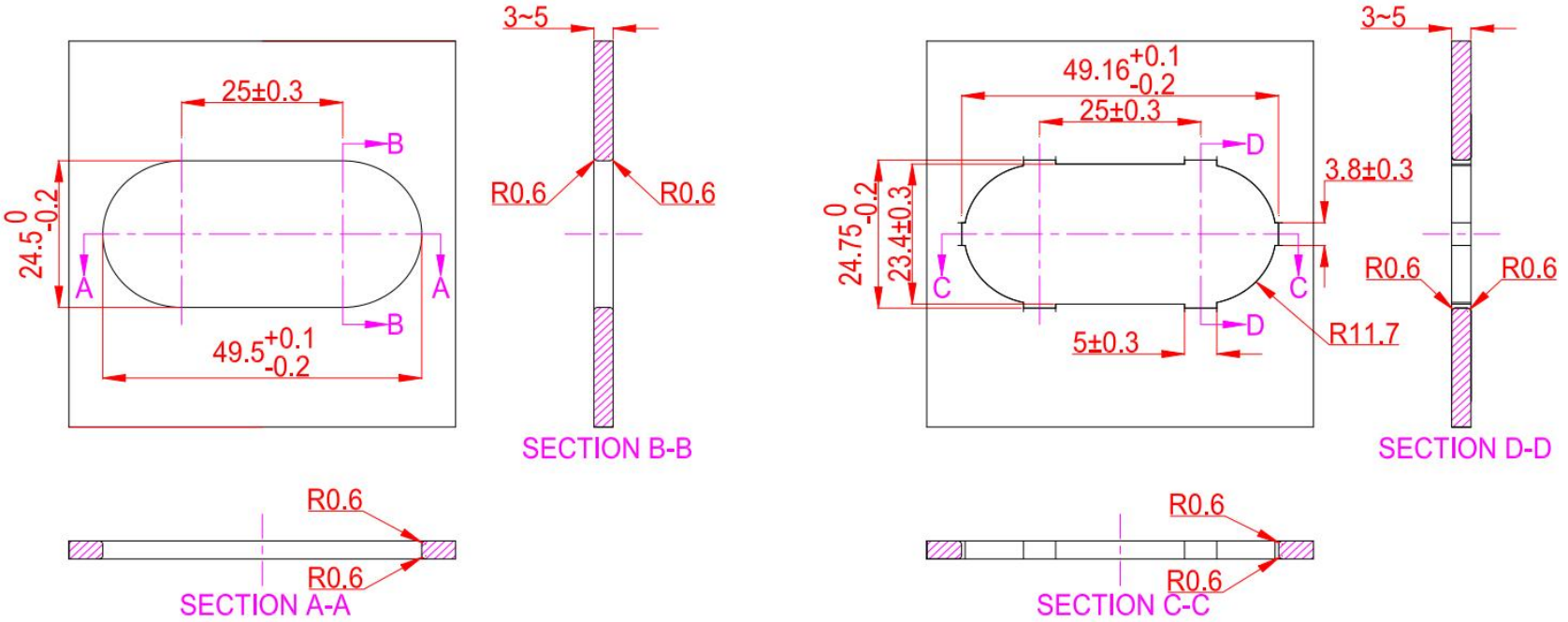
➢ Suggestions of KS114 installation

- **Both of the installation holes in picture below are accepted. Both of positive and negative side of KS104 silicone contact edge should undergo smoothing for R0.5~1mm . The recommended thickness of installation panel is ≥3mm .**
- According to the test, the installation is smooth while the tolerance in the left drawing is 24.5±0.4mm, and it is not dropped after vibration test The tolerance size at other position can be neglected.

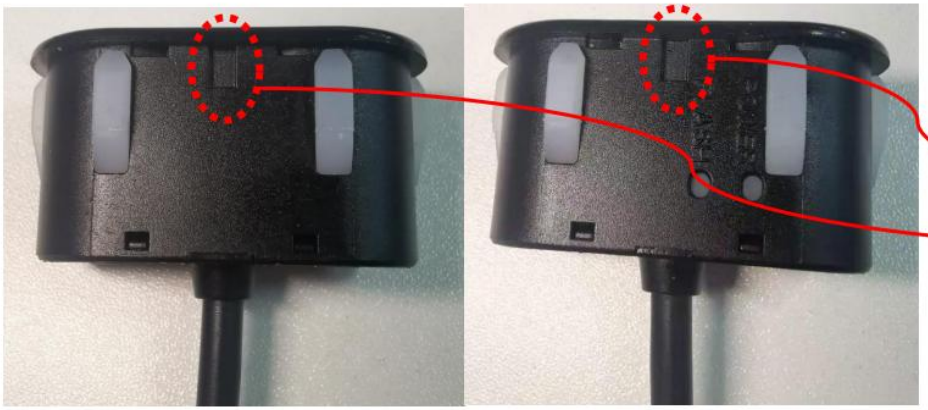


Introduction to KS114 series ultrasonic wave

DAUXI.COM

➢ Suggestions of KS114 installation

- The following bucket installation scheme can also be adopted. Design the buckle on the shell, press the KS104 into the shell and press the buckle on shell into the square slot in picture below to realize explosion-proof installation.



The positive/negative side shown in red dotted line can be used for designing the bucket installation.

Introduction to KS114 series ultrasonic wave

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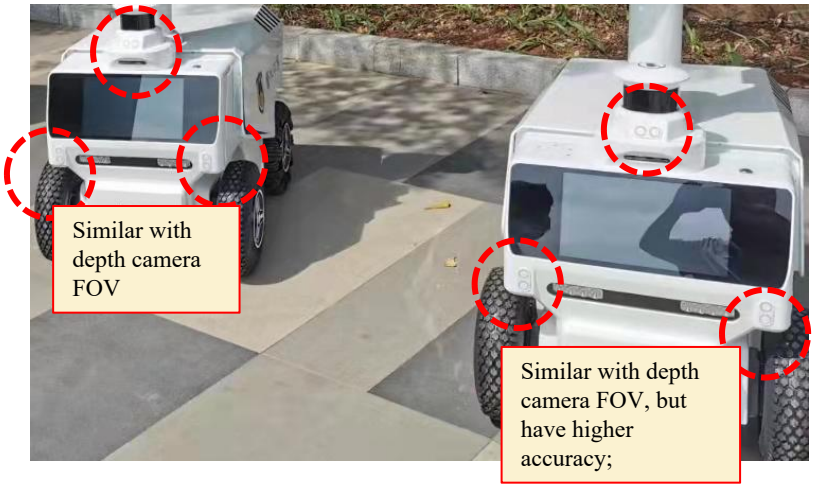
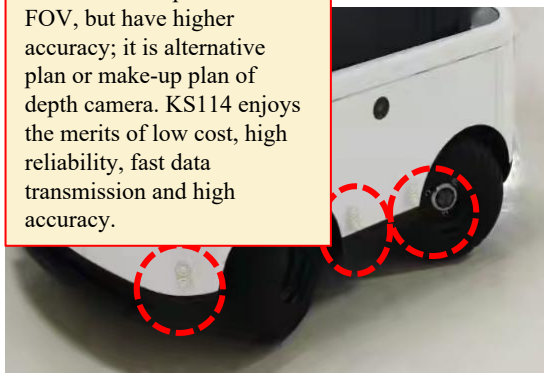
➢ Application cases of KS114





Introduction to KS114 series ultrasonic wave

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- **Application cases of KS114 (replace depth camera)**

Cleaning robot

Cleaning robot

Introduction to difference between KS114 and KS104

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➢ Difference between KS114 and KS104

- **Difference of appearance:**

KS114 and KS104 are shown respectively at the upper and lower side of right picture;

Installation is fully compatible; vertical installation of KS114 is recommended to ensure horizontal wide angle; this not applies to KS104

- **Difference of beam angle:**

KS104 – Both of horizontal and vertical angle is 60° (instructions such as 0xb0) or 50° (instructions such as 0x0f)

KS114- Horizontal 100° vertical 50° (instructions such as 0xb0) or horizontal 90° vertical 40° (instructions such as 0x0f)

Multi-unit parallel connection plan of KS114 and KS104

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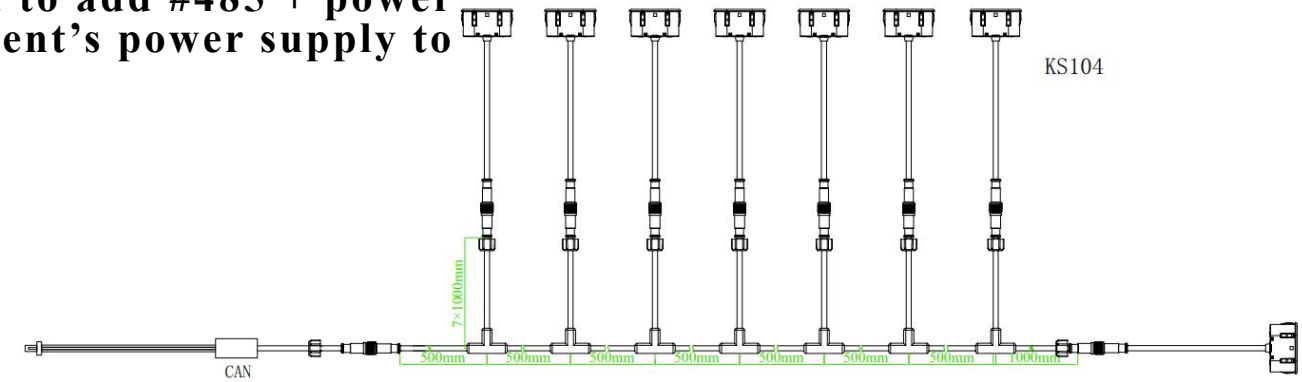
➢ Multi-unit parallel connection of KS114 and KS104

- The length of each position should be designed as required; one wire is arranged in the robot to the end and wiring is concise;
- Support 485# bus and CAN bus;
- Support 3-5.5V and 9-24V power supply;
- Support customization of total isolation plan of #485 and power supply;
- It is recommended to add #485 + power insulation plan to client's power supply to ensure high reliability



Suggestions for noise reduction point of KS104/KS136/KS136A series

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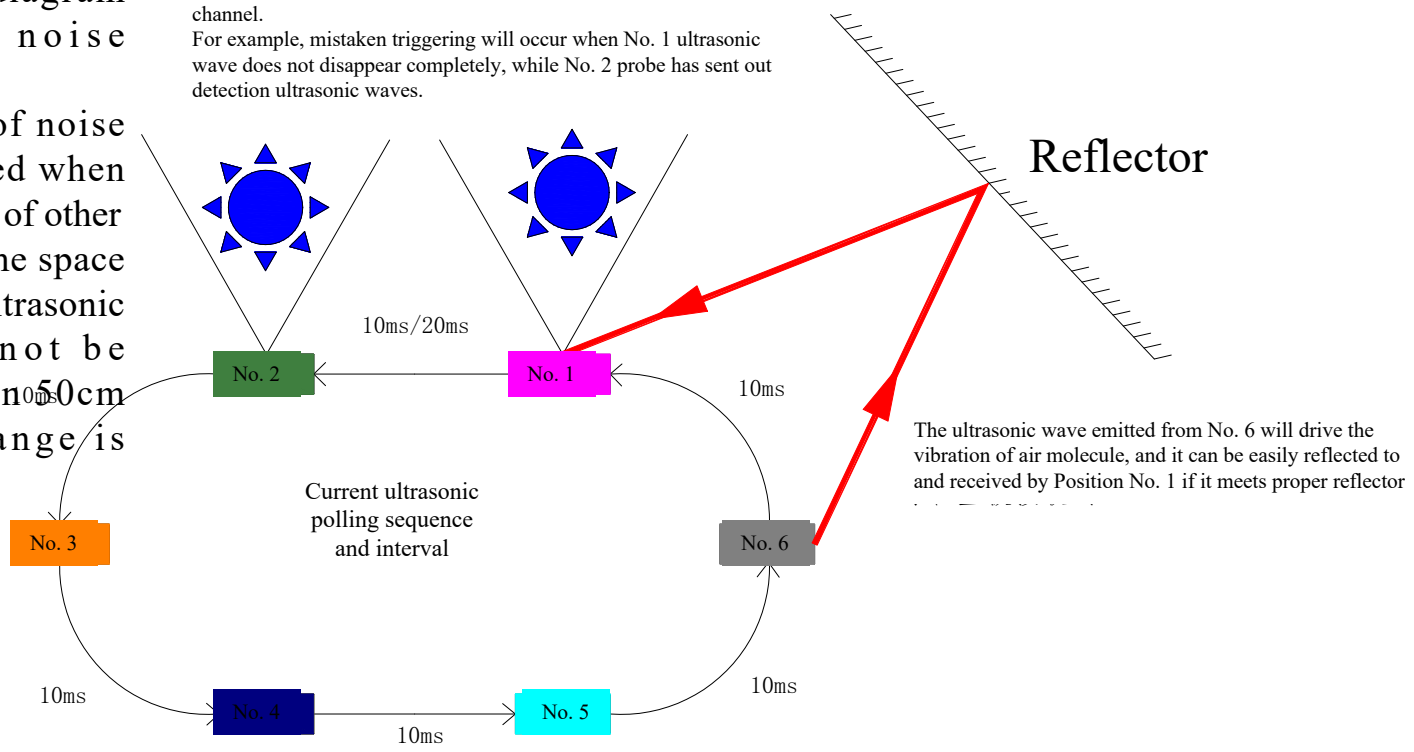
➢ Cause for noise production of KS136/KS136A/KS104/KS114

- The right picture shows the schematic diagram for cause of noise production point
- Small amount of noise will be generated when ultrasonic device of other robots in the same space is running, the ultrasonic energy may not be restricted within 50cm when 50cm range is adopted.

When KS136 has range of 50cm, the calculation time of ultrasonic wave is 9ms, and the adjacent two ultrasonic waves will have interference when machine has fine movement or enters the narrow channel.
For example, mistaken triggering will occur when No. 1 ultrasonic wave does not disappear completely, while No. 2 probe has sent out detection ultrasonic waves.



The ultrasonic wave emitted from No. 6 will drive the vibration of air molecule, and it can be easily reflected to and received by Position No. 1 if it meets proper reflector

Suggestions for noise reduction point of KS104/KS136/KS136A series

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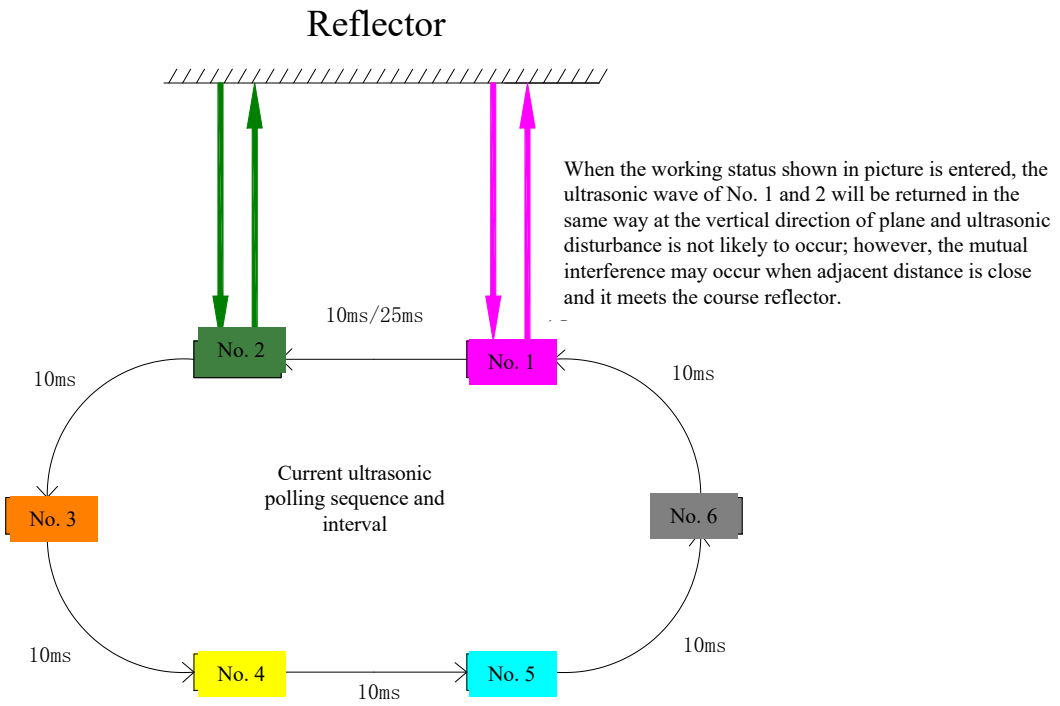
➢ Cause for noise production of KS136/KS136A/KS104/KS114

- Noise point can be generated when two groups of probes in the right picture are too close, but it may be safe if they are far and face the same direction The ultrasound is unlikely to reflect on the opposite smooth plane, but go back at the same way



Suggestions for noise reduction point of KS104/KS136/KS136A series

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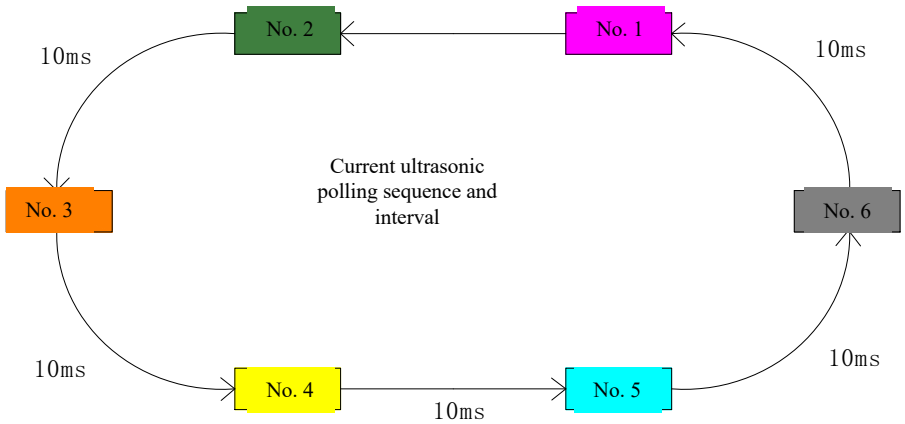
➢ Technical solutions for solving noise points of KS136/KS136A/KS104

- Autologous sound wave recognition technology
  Simple coding, 70% can avoid noise points.
  The remaining 30% is noise point generation window. The solutions for solving mistaken triggering of noise point are as follows:

I. Avoid occupation of adjacent probes in the same air signal channel.
Cause: The previous ultrasonic wave may still exist due to short spatial distance of adjacent probes, which means, the air molecule will keep vibrating and be detected by the next group of probes at small probability.
The solution algorithm is as follows:
1.1) Change sequence method. Avoid successive polling of adjacent probes, which is similar to the disordered detection. For example: The 0x01~0x06 instruction double-probe mode is adopted in 1 set of KS136A and it surrounds the No. 1~6 installed at robot position, and the layout is as follows:



Suggestions for noise reduction point of KS104/KS136/KS136A series

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➢ Technical solutions for solving noise points of KS136/KS136A/KS104

According to the layout in picture above, the reasonable polling sequence of probe is arranged as follows:

Group 1: 0x01,0x03,0x06,0x04,0x02,0x05;
Group 2: 0x02,0x06,0x04,0x01,0x03,0x05;
Group 3: 0x03,0x01,0x04,0x06,0x02,0x05;
Group 4: 0x01,0x04,0x02,0x06,0x03,0x05;
……
Group N: 0x02,0x06,0x04,0x01,0x03,0x05;

If the fixed distribution time of each instruction is 25ms, the Group 1, for example, can send 0x01 instruction when T1=0; when return data are received, it can send 0x03 instruction when T2=25ms; when return data are received, it can send 0x06 instruction when T3=50ms; when return data are received, it can send 0x04 instruction when T4=75ms; when return data are received, it will send 0x02 instruction when T5=100ms; when return data are received, it will send 0x05 instruction when T6=125ms;

When probe polling of Group 1 is finished, the probe polling sequence in the next group will be selected based on the random number between 1~N. When multiple robots exist at site, the ultrasound device will report 0xeeee error code and the trigger possibility will decrease significantly due to inconsistent pace of polling.

Suggestions for noise reduction point of KS104/KS136/KS136A series

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➢ Technical solutions for solving noise points of KS136/KS136A/KS104

1.2) Change time method The change sequence method mentioned in 1.1 is still used, but only one group of polling sequence is adopted. For example, Group 1 has polling according to the sequence of "0x01,0x03,0x06,0x04,0x02,0x05". The time distributed to each module is not 25ms, but a random number between 20~30ms. So, it can reduce the proportion of 0xeeee error code effectively and also reduce the mistaken triggering.

1.3) The probe moving to forward direction should be triggered, while the one moving to negative direction should not be triggered. So, it can reduce the proportion of 0xeeee error code and improve the detection efficiency.

1.4) Noise points may occur randomly when two robots work for a long period or hundreds of robots work at the same time, even if KS104/KS114 has Autologous sound wave recognition technology; so, it is recommended to set the brake time as dozens of ms, then check the next data and when the data are recovered, it can be judged as the noise point. This possibility is low, but such details can bring higher intelligence, SNR and reliability to the robots.

Suggestions for noise reduction point of KS104/KS136/KS136A series

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➢ Technical solutions for solving noise points of KS136/KS136A/KS104

II. Pay attention to the wiring of KS136/KS136A (not applies to KS104) and it is not recommended to bind the signal wire with motor drive wire, especially the motor; otherwise, it may report 0xeeee error code;

III. The power ripple of KS136/KS136A should be lower than 120mV (not applies to KS104) and the small robots should be designed with power isolation module to separate the ultrasound power supply with the robot power supply (such as MORNSUN isolated power supply). The power supply may also bring interference through 485A and 485B in some compact robots and lead to reporting of 0xeeee error; it is recommended to eliminate the interference by isolating power supply, even if it has no influence on use.

IV. Installation and Fixing (not applies to KS104)

1. **KS136/KS136A should not be fixed on the vibrating and thin plate. Error will be reported when resonance occurs.**
2. **The rear side of probe will be glued by some clients to fix double probes. The arrow of the 4th generation probe should face upwards. The silica gel with shore hardness not above A25 should be applied; besides, the hardness change of glued position between -40℃ and 85℃ should not exceed the shore hardness of A25; otherwise, it may also report an error.**

New Technology of Ultrasonic

DAUXI.COM

➢ The 5th generation ultrasonic KS104/KS114 has been widely equipped on outdoor robots

- Fully replace the waterproof ultrasonic applications, bus type layout is adopted and only one wire is required in the robot
- Replace the dustproof in-plant ultrasonic applications gradually
- Replace the indoor maintenance-free robot applications requiring good appearance (KS104/KS114 can be matched with any color of robots by adjusting the shell color)

New Technology of Ultrasonic

DAUXI.COM

➢ The 6th generation KS236

- Autologous sound wave recognition technology is fully adopted
- Temperature range is extended to -40℃~+125℃
- The power ripple range supports 500mV ripple and the max. ripple is 2000mV; it can share the power supply with motor
- The warranty of complete unit (including probe and wire) is extended to 5 years and 7 years

New Technology of Ultrasonic

DAUXI.COM

➢ Carpet recognition ultrasound KS207

- Realize intelligent recognition of carpet through ultrasound technology
- Enjoy better reliability and durability than camera
- It also has anti drop detection function
- It is applicable to carpet recognition of cleaning robot, grass recognition of mowing robot, anti drop detection of various mobile devices, etc
- High precision distance measurement

Please scan the code to watch the video of KS207 dynamically identifying carpets and tiles

Download specification