DADISICK®

DK-CSR30 Series Ultrasonic Sensors - Quick Start

- Easy Installation
- Good water resistance
- Responsiveness

Precautions

- Please read the operating instructions of DADISICK before commissioning.
- Connection, installation and configuration must be carried out by trained DADISICK specialists.
- During debugging, the equipment should be protected from moisture and contamination.
- This device does not constitute a safety component according to the corresponding machine safety standards.
- Do not allow moisture or water to enter the internal components of the sensor and the output contacts of the wiring board.
- Protected against use in explosive atmospheres.
- Do not use solvents, paraffin, propylene glycol, gasoline or other chemically active substances to clean the sensor.
- The sensor should be installed away from moisture, water droplets, dust, corrosive and harmful substances, as well as high temperature, discharge and vibration.
- Do not use the sensor in corrosive environments where the atmosphere contains acids, alkalis, and other corrosive substances.
- In the process of operation and maintenance, DADISICK professionals recommend that you abide by the requirements of "User Electrical Equipment Technical Operation Regulations" and "Labor Protection Regulations in Electrical Equipment Operation". Before connecting the sensor, you must ensure that all connections are correct and that the power and signal lines must not be mixed, otherwise the sensor may be damaged or personnel may be injured.
- Sensors that have reached the end of their useful life should be disassembled and DADISICK recommends disposing of them through a facility that recycles ferrous and non-ferrous metals.

Packaged content

Sensor	1 pcs
Mounting Nut	2 pcs
Manual	1 pcs

Dimensions

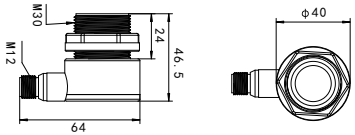


Figure 1 - DK-CSR30-2000 series dimensions

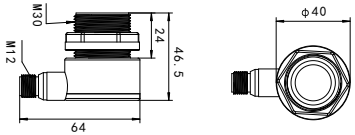


Figure 2 - DK-CSR30-3000 series dimensions

Model range

DK-CSR30 [ ] [ ]

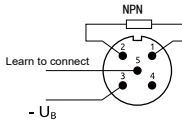
Working Distance		
Detection distance 100....2000mm	2000	
Detection distance 150....3000mm	3000	
Shell (size, material)		
output type		
Analog output: 4...20mA		I
Analog output: 0...10V		U
Dual analog outputs: 4...20mA + 0...10V		IU
switch output: 1 x NPN		E2/E4
switch output: 1 x PNP		E3/E5
Switching output: 2 x NPN		E7/E9
Switching output: 2 x PNP		E6/E8
Dual output: 4-20mA+ 1 x NPN		IE4
Dual output: 4-20mA+ 1 x PNP		IE5
Dual output: 0-10V + 1 x NPN		UE4
Dual output: 0-10V + 1 x PNP		UE5
Digital output: RS-485 (Modbus RTU)		R4

parameter

Detection Range	100. . . 2000mm	150...3000mm
Blind Spot	82mm	102mm
Signal Frequency	170KZH	112KZH
Running Media	Air (velocity ≤16 m/s)	
Resolution	0. 17mm	0. 17mm
Repeatability	±0. 15%	
Absolute Accuracy	±1mm	
Response time	82ms	102ms
Output type	PNP / NPN / 4...20mA / 0...10V / RS-485	
Switching Hysteresis	2mm	3mm
On-offlevel	10Hz	9Hz
Power-Up Timer	＜ 500ms	
Operating Voltage	DC 10. . . 30V	
Overpower Protection	200mA	
Load impedance	I ~300 Ohm, U > 1 kOm	
No-load current	≤ 30mA	
Housing type	Cylindrical, thread M30x1.5	
Shell material	Plastic, polyurethane foam	
Protection Class	IP67	
Connection type	M12 x 1.0 connector (5-pin)	
Ambient temperature	-25. . . +70°C	
Atmospheric pressure	460. . . 918 mm p.s.l.	
Storage Temperature	-40. . . +85°C	
Weight	62g	62g

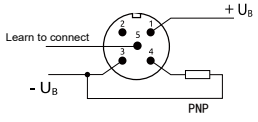
Electrical connection

symbol/connection：(E2/E4,NPN)



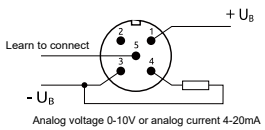
connection mode	
1.BN	DC 10...30 V
2. WH	NPN
3. BU	GND
4. BK	
5.GY	Teaching Signal

symbol/connection：(E3/E5,PNP)



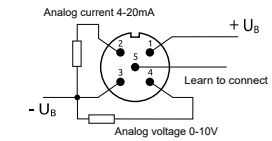
connection mode	
1.BN	DC 10...30 V
2. WH	Unused
3. BU	GND
4. BK	PNP
5.GY	Teaching Signal

Symbols/Connections:
(I/U, analog current or analog voltage)



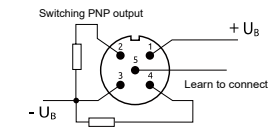
connection mode	
1.BN	DC 10. . . 30 V
2. WH	Unused
3. BU	GND
4. BK	Analog voltage U or analog current I
5.GY	Teaching Signal

Symbol/Connection: (IU, analog current + analog voltage)



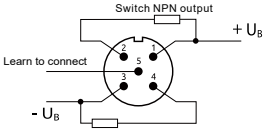
connection mode	
1.BN	DC 10. . . 30 V
2. WH	Analog current 4-20mA
3. BU	GND
4. BK	Analog voltage 0-10V
5.GY	Teaching Signal

Analog voltage 0-10V symbols/connections:
(IE5/UE5, analog + switch PNP)



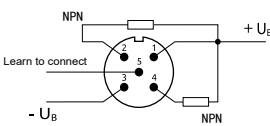
connection mode	
1.BN	DC 10. . . 30 V
2. WH	PNP
3. BU	GND
4. BK	Analog current I or analog voltage U
5.GY	Teaching Signal

Symbols/Connections:
(IE4/UE4, analog + switch NPN)



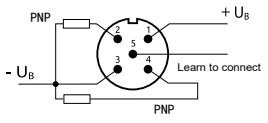
connection mode	
1.BN	DC 10...30 V
2. WH	NPN
3. BU	GND
4. BK	Analog current or analog voltage + NPN
5.GY	Teaching Signal

Standard symbols/connections:
(E7/E9, dual NPN output)



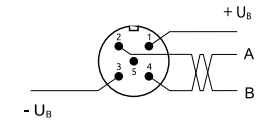
connection mode	
1. BN	DC 10. . . 30 V
2. WH	NPNoutput
4. BK	NPNoutput
3.BU	GND
5.GY	Teaching Signal

Symbol/connection: (E6/E8, double PNP output)



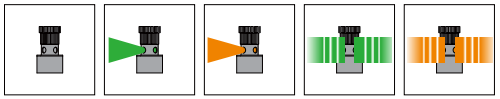
connection mode	
1. BN	DC 10. . . 30 V
2. WH	PNPoutput
4. BK	PNPoutput
3. BU	GND
5. GY	Teaching Signal

symbols/connections: (RS485 output)



connection mode	
1. BN	DC 10...30 V
2. WH	Signal A (RS-485)
3.BU	GND
4. BK	Signal B (RS-485)
5.GY	Unused

Indicator status



LEDs on the sensor housing indicate the status of the sensor. (DADISICK professionals remind: switch product overload protection green light, red light are on at the same time)

- Off - the sensor is off;
- Green - object detected;
- Red light on - no object detected;
- Green light flashes - the sensing range of the object is set;
- Blinking red light - complete setup for no object sensing range.

Instructions

Figure3-Ultrasonic sensor operating range

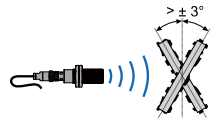


Figure 4 - Detecting non-smooth objects

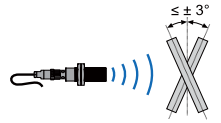


Figure 5 - Detecting smooth objects

- The sensor is installed at a distance from the object corresponding to "Zone 2" or "Zone 2+3" (see Figure 3), depending on the object and operating conditions (see points 8 and 15).
- The object must not be within a distance of "Zone 1" or "Zone 4" from the sensor corresponding to the "Zone"
- The sensor should be placed in front of the object so that the reflective surface perpendicular to the sensor axis does not deviate more than 3° from the vertical axis (Fig. 5). If the obliquity of the object increases, the reflected ultrasonic pulse may not be able to pick up the reflected sound waves, making the measurement impossible.
- If the surface of the object is uneven (e.g. gravel, gravel), the permissible deviation of the sensor from the vertical is 3° (Fig. 5). During installation, the sensor may deviate more than 3° from the vertical (Figure 4).
- The sensor should be placed in front of the object so that the reflecting surface is perpendicular to the sensor axis, with a permissible deviation of no more than 3° from the vertical axis (Fig. 5).
- If the tilt angle of the object increases, the reflected ultrasonic pulses may not reach the transducer, making measurements impossible. If the surface of the object is uneven (e.g. gravel, gravel), the permissible deviation of the sensor from the vertical is 3° (Fig. 5).
- During installation, the sensor may deviate from vertical by more than 3° (fig. 4).

Make sure the power and sensor are turned off before connecting/disconnecting the sensor connector.

Installation Notes

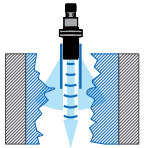


Figure 6 - Applying Ultrasonic Sensor

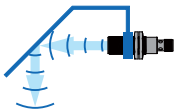


Figure 7 - Applying Reflector

- If there are multiple reflections in the ultrasonic propagation area, or if there is a risk of mechanical damage in the ultrasonic propagation area (e.g. multiple reflections in the ultrasonic propagation area), it is recommended to mount the receiver inside the waveguide.
- Mount the receiver in a waveguide made of highly reflective material and of any length (Figure 6).
- When measuring the liquid level in the container, if the sensor cannot be installed vertically downward due to the installation conditions or the medium vapor temperature is high, the sensor can be installed from the side, and through the smooth surface at an angle of 45° to the emitter surface, the reflector will Ultrasonic waves are guided vertically downward (Figure 7).
- Two nut mounts, included in the supplied set. The installation of the sensor should comply with the following requirements (allowable distances shown in Figure 8 below).
- If the minimum distance requirements are not met, the sensors will interfere with each other.

Model		
DK-CSR30-2000	⩾ 1.5 м	⩾ 10.0 м
DK-CSR30-3000	⩾ 2.0 м	⩾ 15.0 м

Figure 8 - Allowed distance operation between sensors

Reference curve

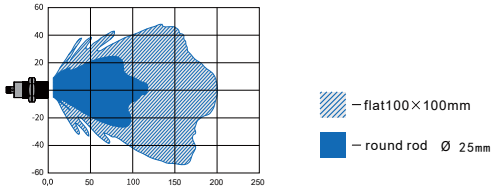


Figure 9 - DK-CSR30-2000 ultrasonic wave propagation area

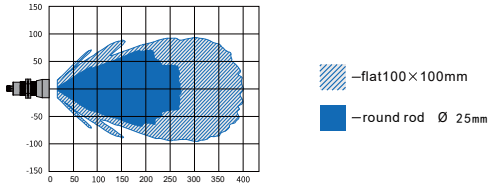


Figure 10 - DK-CSR30-3000 ultrasonic wave propagation area

- The blue area ("bar") in the figure represents "Area 2", where a circular bar reflector with a diameter of 25 mm was found
- The shaded area ("blade") in the figure represents "Area 3", where a square reflector with a diameter of 100x100 mm was detected. If the object is outside this area, measurements cannot be made.

When selecting a sensor, DADISICK professionals recommend that you consider the overall size of the object being tracked. For small objects, the main range ("Zone 2") in which the sensing distance is guaranteed should be determined. For small objects, the maximum measurable distance ("Zone 3") may not be reached, since the operation of the sensor is affected by the mounting position, the reflective properties of the object and other parameters described in "Zone 3".

Teach-in function

- Sensors with analog or digital outputs can be configured according to user ranges, and these modifications can optionally set the operating mode.
- The purpose of the adjustment is to set the threshold points A1 and A2 (see Figures 13 and 14), which determine the level of the output signal (see points 12 and 13).
- To set the user range, a special input is used - the teach input (pin 2). It is necessary to alternately close the teach input (see Figure 12) and the input between the +U and -U terminals (see Figure 12).

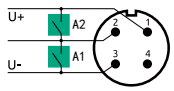


Figure 12 - Using the teach input

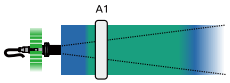


Figure 13 - Set Output Signal (A1)

Figure 14 - Set Output Signal (A2)

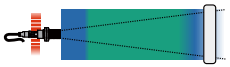


Figure 15 - Probing Errors

Setup steps:

- Turn on the sensor power and place the object within the sensor's working range (the green LED light should light up). Custom Range
- Adjustment: Custom range settings are available within 5 minutes of powering on the sensor.
- When setting the A1 value, place the object at the desired distance and the indicator light should light up green. The light should glow green. Input the -U signal to the teaching input terminal. Wait for the green light to blink. (about 3 seconds) and then open the circuit.
- When setting the A2 value, move the object to the desired distance from the sensor and the indicator should glow green. Input the +U signal at the teaching input terminal. Wait for the green indicator light to flash (about 3 seconds) and then turn on the circuit.
- Switch off all signals at the teach input. There is no need to repeat the above steps after switching off as the preset settings are already stored in non-volatile memory.
- If no object is detected (either outside the working range or the size/surface of the object does not reflect the signal well) when the threshold point (A1 or A2) is set, the sensor indicator light will flash red. The threshold point will take the maximum value.

Switching value (PNP/NPN) output operation mode

Depending on the object's position during adjustment, the sensor can be set to one of five possible algorithms:

a) Object distance single trigger (NC output)

Figure 16 - Single trigger when target is removed

- When the moving distance (S) of the object is greater than the set distance (A1), the output signal switches. The working principle is shown in Figure 16. When operating, it is necessary to set a custom user range: A1 = S, A2→∞
- In this mode, the sensor works like a proximity switch: when the distance to the object is less than A1, the output is off. When the distance to the object is greater than A1, the output turns on. In the image below, the green area corresponds to the distance at which the output is off, and the blue area corresponds to the distance at which the output is on.

b) Single trigger when close to an object (NO output)

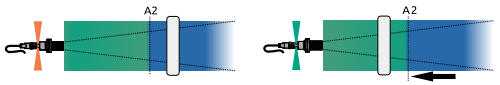


Figure 17 - Single trigger on approaching object

- The output signal switches when the object approach distance (S) is smaller than the adjustment distance (A2). The operating principle is shown in Figure 17. A user-wide setting must be implemented for operation: A2 = S. A1→∞
- In this mode, if the object is far away or not present, the sensor output is turned off. If the object moves to sensor A2 or closer, the output turns on.

When it is necessary to adjust the threshold point to the maximum value (no object), use the code A1(A2) -> ∞ in the working mode description.

c) Window mode (NO output)

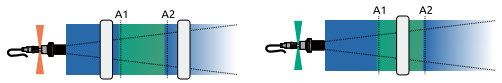


Figure 18 - Trigger on In Range (A1<S<A2)

- The output signal is switched when the object is located a distance (S) within the configured range. The working principle is shown in Figure 18. When the object is not present or outside the configured range, the output is turned on. The user range needs to be set during operation: A1 < A2.
- In this mode, if the object is not present outside of A1 or A2, the sensor output is off. If the object moves within the set distance from A1 to A2, the output turns on.

d) Window mode (NC output)

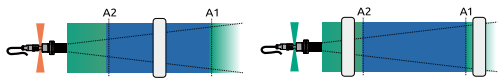


Figure 19 - Trigger on out of range: on approach (S<A2) or on approach (S>A1)

- The output signal toggles when an object is at a certain distance (S) within the configured range. The working principle is shown in Figure 19. When the object is not in or out of the set range, the output turns off. The user range needs to be set during operation: A1 > A2.

e) Target detection mode

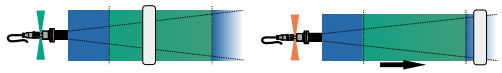


Figure 20: Object definition

- The output signal is switched when any object is found within the working range of the sensor. The output signal is switched when any object is detected within the sensor's working range. The settings must be made without objects during operation: A1→∞, A2→∞

Analog output operating mode (4...20 mA/ 0...10 V)

- Sensors with an analog output operate in the mode of measuring the distance to an object: the sensor generates an output signal proportional to the set working range. During the adjustment process, depending on the position of the object, the sensor can be set to one of the following three algorithms:

a) Rising signal mode

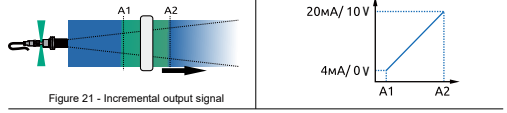


Figure 21 - Incremental output signal

- The sensor outputs a rising signal proportional to the measuring distance (4...20 mA/ 0...10 V). In this mode, an object needs to be brought close to the sensor to adjust the threshold point A1. Move the object close to the sensor adjustment threshold point A1 and away from the sensor adjustment threshold point A2.

b) Falling signal mode

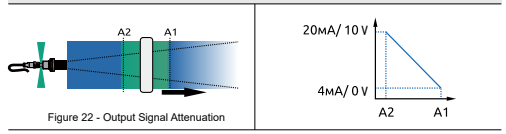


Figure 22 - Output Signal Attenuation

- The sensor outputs an inverting (falling) signal (20…4 mA/10…0 V) proportional to the measured distance. In this mode, you have to bring the object close to the sensor and set threshold point A2, then set threshold point A1 away from the sensor.

c) Reset user scope to factory settings

- If necessary, the user setting can be reset. The output signal will be reset to the rated operating range (see item 6). To restore the factory value, it must be adjusted without a target: (A1→∞, A2→∞)

After the sensor is turned on, the load will be automatically connected according to the load type. If the load is connected incorrectly, correct the connection error and restart the sensor.

RS48 digital output operating mode

Sensors with RS-485 digital output can be included in MODBUS industrial network.
Factory default network settings are used to communicate with sensors:

- ModBus RTU operating mode (8 data bits, 1 stop bit, no parity);
- Sensor address in ModBus network: 01, baud rate: 9600 (default)
- There are two sets of registers available for operation: reading and recording.

Read the registry			
Address	Data	Pattern	Unit
00H	Measure distance	HEX	0, 1 мм
01H	Internal temp	HEX	1°C
02H	Ultrasonic transit time	HEX	1μs

- The data in the read register is stored in HEX format. In order to read the result, the received value must be converted to decimal format.

To read registers, the 04 command must be used. For example:

- To read the measured distance, a command 01 04 00 00 00 01 31 ca must be sent. The sensor will respond to this request: 01 04 02 07 01 7A 8B. The number 701 in hexadecimal corresponds to the number 1793 in decimal. Therefore, the measured distance is 179.3 mm.
- To read the internal temperature, send the command 01 04 00 01 00 01 60 0A. The sensor will reply to the request: 01 04 02 00 17 B9 3A. The value 17 in hexadecimal format corresponds to the number 23 in decimal format. This means that the internal temperature of the sensor is 23°C.
- To read the time, the following command must be sent 01 04 00 02 00 01 90 0A. The sensor will reply to this request: 01 04 02 04 92 3A 5D. The hexadecimal value 492 corresponds to the decimal number 1170. Therefore, the propagation time of ultrasonic waves is 1170μs.

Record registration:		
Address	Data	Value
00h	External temperature command (0…100 0C)	0. . . 64
01h	Select temperature compensation type	0: Via internal temperature sensor 1: Via external temperature sensor
02h	ModBus network communication speed (240...256000)	01⋯0B
1Fh	Sensor address in the ModBus network (01...256)	0. . . 100

- These write registers are used to configure the operation of the sensor.
- The operating mode and communication parameters for thermal compensation can be configured by the user. When running thermal compensation in a mode using an external temperature sensor, the reading from that sensor must be written to a register. To run thermal compensation in a mode using an external temperature sensor, the reading from that sensor must be written to register 00h and the appropriate operating mode selected in register 01h. Use command 06 to record.

Example using record registers:

- To log the temperature, send the following command 01 06 00 00 00 1E 09 C2. The sensor will reply with this command: 01 06 00 00 00 1E 09 C2. The value 1E in hexadecimal format corresponds to 30 in decimal format. This means that the sensor will store a value of 30 °C.
- To select temperature compensation mode via an external temperature sensor, send: 01 06 00 01 00 01 19 CA. The sensor will respond to this command: 01 06 00 01 00 01 19 CA. By default, the register is set to 0 - temperature compensation via built-in temperature sensor.
- To record the baud rate, send the following command: 01 06 00 02 00 09 E8 0C: The sensor will reply: 01 06 00 02 00 09 E8 0C. A value of 9 is equivalent to a baud rate of 115 200. There are 11 speeds to choose from.
- To write the sensor address, send the command: 01 06 00 1F 00 10 B9 C0. The sensor will reply: 01 06 00 1F 00 10 B9 C0. The value 10 is equivalent to the decimal number 16. Therefore, the sensor address in the ModBus network will become 16.

01:	2 400	05:	19 200	09:	115 200
02:	4 800	06:	38 400	0A:	128 000
03:	9 600	07:	56 000	0B:	256 000
04:	14 400	08:	57 600		

Influencing factors

The measurement accuracy and working range of the sensor are affected by the following factors:

- Object surface temperature. If the air temperature changes suddenly (for example, if you are measuring the distance to hot metal), the ultrasonic waves will be refracted at the junction of cold and warm air and will not return to the sensor at right angles.
- Object surface material. Porous and sound-absorbing objects (such as wool, foam rubber, foam, feathers) reflect ultrasonic waves poorly. Due to the damping effect of the sound waves, the working range of the transducer is reduced.
- Environmental conditions. Air temperature and humidity, air velocity Air velocity and atmospheric pressure affect the speed and attenuation of sound waves.
- Object position. In order to operate stably on a smooth surface, the position of the sensor should be perpendicular to the object surface, and the allowable deviation from the vertical plane should not exceed 3°.
- If the surface of the object is uneven (such as gravel, gravel), the perpendicularity of the sensor is allowed to deviate not more than 3°.
- Formation and attachment of foreign matter on the sensor PE. During sensor operation, water, dust, or other substances may form on the sensor surface, limiting sensor performance. DADISICK recommends that you protect the sensor from external influences, clean the sensor or use a reflector (for mounting the sensor at an angle).

Transport and storage

- DADISICK sensors are transported and stored in independent factory packaging at an ambient temperature of -40~85°C, a relative humidity of 35~95%, and no condensation to prevent the packaging from being affected by atmospheric precipitation.
- DADISICK reminds you not to store the sensor in a room containing corrosive gases and other harmful impurities (acid, alkali).

Warranty

- Running Warranty - 12 months from date of sale*
- On the premise that the user abides by DADISICK's transportation, storage, installation, operation and maintenance rules, if the sensor fails during the warranty period, DADISICK promises to repair or provide technical support for free
- Conditions under which DADISICK Enterprises terminates its warranty obligations: internal components showing signs of opening and handling, chemical or mechanical damage," - dated on the delivery note (SDP) / promissory note