# AkuSense

Ultrasonic sensor
MC30 Series

User's manual

Thank you for choosing AkuSense products. Please read the instructions carefully before using the products. For your convenience, please keep this instruction carefully so that you can check it at any time.

Description

- M30 short-body ultrasonic sensor with M12 connector or cable (2m)
- Single output
  - Analog current output(4-20mA)
  - Analog voltage output (0-10V)
  - Switch output(NPN&PNP,NO/NC switchable)
- Dual output:
  - Analog current output (4-20mA) and switch output (NPN&PNP, NO/NC switchable)
  - Analog voltage output (0-10 V) and switch output (NPN&PNP, NO/NC switchable)
  - Double switch output (NPN&PNP, with MD standard window and adjustable hysteresis function)
- Adjust the distance (Window teach-in and target teach-in function)
- Comprehensive protection against electrical damage
- Multi-function double LED indicators
  - Yellow LED: output status, teach-in function and configuration NO/NC
  - Green LED: Echo
- Plastic housing

Circuit diagram

PNP NO/NC and Analog output	PNP dual switch output	PNP NO/NC and switch output	Analog output
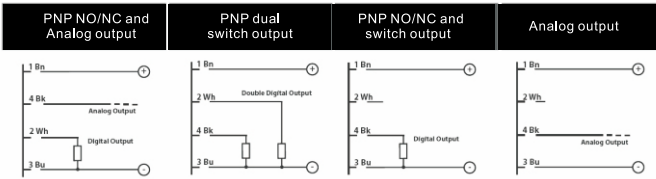
In case of combined load, resistive and capacitive, the maximum admissible capacity(C) is 0,3 uF for maximum output voltage and current.

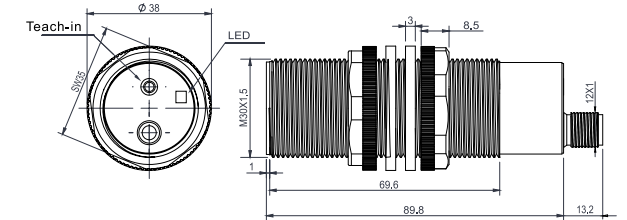| NPN NO/NC and Analog output	NPN dual switch output	NPN NO/NCand switch output
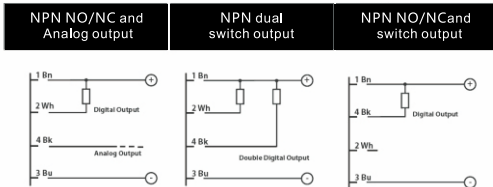
Packaging

- Sensor (Includes plastic nut and flexible washer)   1piece
- User's manual   1piece

Specifications

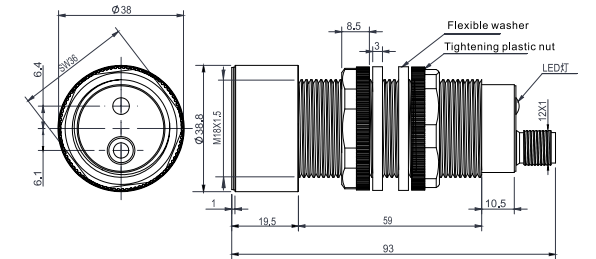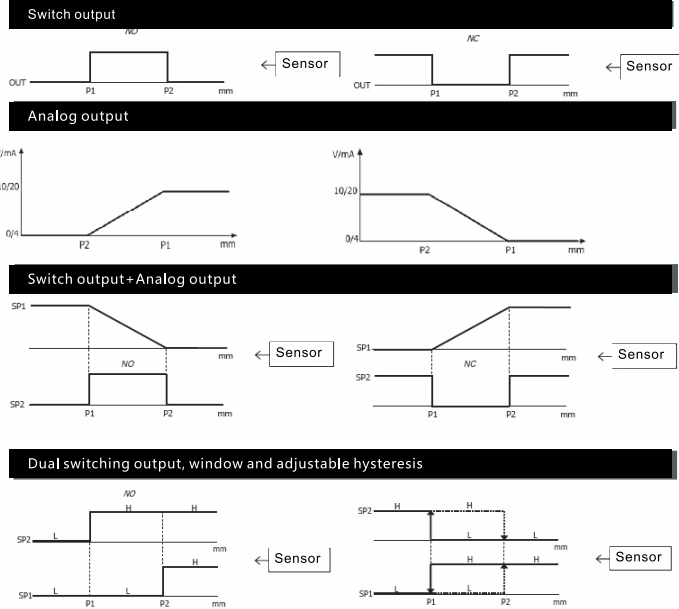| Type		MC30 Series	
Analog output	Voltage	MC30-350V	
	Current	MC30-350I	
Switch output	NPN	MC30-350N	
	PNP	MC30-350P	
Dual switch output	NPN	MC30-350N2	MC30-600N2
	PNP	MC30-350P2	MC30-600P2
Analog+Switch	NPN+Current	MC30-350NI	MC30-600NI
	PNP+Current	MC30-350PI	MC30-600PI
	NPN+Voltage	MC30-350NV	MC30-600NV
	PNP+Voltage	MC30-350PV	MC30-600PV
Sensing range		250~3500mm	350~6000mm
Resolution		4mm	6mm
Repeat accuracy		1%	0.5%
Hysteresis		1%	
linearity error		1%	
Opening angle		±7°	±9°
Switch frequency		2Hz	1Hz
Response time		Switch:250ms, analog:600ms	Switch:500ms, analog:600ms
Operating voltage		12~30VDC , Analog voltage output: 15~30V DC(±5%)	
Temperature compensation		Yes	
Temperature drift		±8% switch output ,±5% analog output	
Voltage drop		2.2V max. (1L=100mA)	
Max Load Current		≤50mA	
Current consumption		100mA	
Min.load resistance		3kΩ	
Leakage current		≤10μA@30V DC	
Sensitivity ajustment		External teach-in	
Operating temperature		-20℃~+70℃	
Storage tempeature		-35℃~+70℃(No freezing)	
Protective circuit		Reverse polarity protection, Short circuit (auto reset), Over voltage pulses protection	
Degree of protection		IP67	
material		Housing material：PBT；Sensing surface material：Epoxy-glass resin	
Weight		140g	170g

Dimensions(Unit:mm)

MC30-350

MC30-600

Error condition

Error condition	Sensor status	Corrective action
Teach-in P1=P2	Exit the OFF state until the correct teach-in operation is made again	Correctly repeat the teach-in operation
After Teach-in P1 (Max. distance) Tech-in P2(Min. distance)		
Teach-in P1 (Max.distance) within the detection range Teach-in P2 infinitely		

Output curve

The figure below shows the output state of PNP when the NPN output state is an inverse function

Switch output

Analog output

Switch output+Analog output

Dual switching output, window and adjustable hysteresis

* Available for single output models
* In models with standard window and adjustable hysteresis, the output state switches
   if the target is removed from the field of view of the sensor. Models without NO/NC
   function can pass the inverse logic of the control system (eg PLC).

Connection

M12 dual switch output

Switch output SP1
Analog output SP2

M12 switch or analog

Switch output/ Analog output
n.c.

M12 switch and analog

Switch output SP1
Switch output SP2

Characteristic curve

MC30-350

Distance(mm) / Parallel distance(mm)
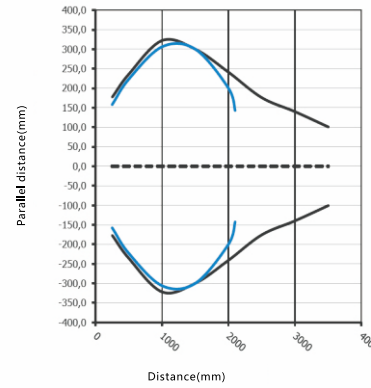
— Standard sensing object A   200*200mm
— Standard sensing object B   φ25mm

MC30-600

Distance(mm) / Parallel distance(mm)
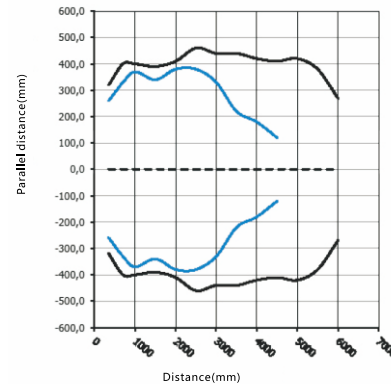
— Standard sensing object A   400*400mm
— Standard sensing object B   200*200mm

Adjustment

P1 and P2
P1 must be consistent with the maximum operating distance required; during the adjustment phase, the first point P1 must be set first.
P2 must be consistent with the minimum operating distance required; during the adjustment phase, P2 must be set at the second point.

Analog output
Positive slope: P1=10V or 20mA, P2=0v or 4mA
Negative slope: P1 = 0V or 4mA, P2 = 10V or 20mA

Regular operation
When the echo is received, the target object is between P1 and P2 (Window teach-in function) or the target object is within the detection range (teach-in function on the target), it is in the normally open state, and the orange LED lights on. When the echo is received, the green echo LED lights on.

Button teach-in adiustment function
Two teach-in adjustment functions are available
1.Window teach-in
2.Teach-in the target object

1) Window teach-in (Adjustment points: P1 and P2)
P1 point teach-in
Place the object at the correct distance of P1 and the green LED lights up. The single digital output PNP model connects the white wire to the brown wire for 2 seconds, and the single digital output NPN model and the single analog output model connect the white wire to the blue wire for 2 seconds. Then turn off the green LED, turn off the orange LED and flash rapidly at 5Hz for 2 seconds and then turn on the light. The orange LED will continue to flash until P2 is obtained.

P2 point teach-in
Place the target object at the correct distance of P2 and the green LED light off. The single digital output PNP model connects the white wire to the brown wire for 2 seconds, the single digital output NPN model and the single analog output model, connecting the white wire to the blue wire for 2 seconds. The green LED light is turned on, the orange LED light is turned off, and the light is turned on after 5 flashes at a low frequency, and the target object can be removed when the P2 point is acquired. P1 and P2 are programmed and the sensor operates normally according to the stored values. When the target is between P1 and P2 (in the normally open state or the analog output curve is positive slope), the orange LED and green light are on.

2) Teach-in the target object
P1 point teach-in
Place the object at the correct distance of P1 and the green LED lights up. The single digital output PNP model connects the white wire to the brown wire for 2 seconds, and the single digital output NPN model and the single analog output model connect the white wire to the blue wire for 2 seconds. Turn off the green LED, turn off the orange LED and flash rapidly at 5Hz for 2 seconds and then turn on the light. The orange LED will continue to flash until P2 is obtained.

P2 point teach-in
Keep the distance of the target at point P1 and the green LED light off. The single digital output PNP model connects the white wire to the brown wire for 2 seconds, and the single digital output NPN model and the single analog output model connect the white wire to the blue wire for 1 second. Turn off the orange LED light, flash rapidly 5 times at low frequency and turn on the light to get the P2 point position. P1 and P2 are programmed and the sensor operates according to the stored values. When the target is at P1 and the minimum detection distance and is in the normally open state, the slope of the analog output is positive, and both the orange LED and the green LED are in the ON state.

Note 1: Single-digital output PNP model, if there is no target in front of the sensor, white connecting the brown line for 2 seconds will get the distance of P1 point which longer than the maximum detection distance, and consistent with the minimum detection distance of P2 . This adjustment is not suitable for analog output. For the best accuracy, the working distance can be adjusted via the target teaching or window teaching function. The teach function is only helpful for the arrangement of the sensors. The single digital output NPN model and the single analog output model teach function are activated only when the white and blue lines are connected for 2 seconds.

Note 2: In the analog output state, the window teaching function must be used to achieve maximum accuracy.

Configuration of NO and NC states and slope of analog output curve

All ultrasonic sensors sent from AkuSense are normally open and the slope of the analog output is positive. In the switch output PNP model, by connecting the white wire to the brown wire for more than 6 seconds until the LED flashes at a high frequency of 13 Hz, the logic output of the sensor may be changed and the output state will be changed. During configuration and adjustment, the green LED will be in the NO state to prevent the sensor from receiving an echo. In normal operation of the sensor, the white line must be connected to a brown line.
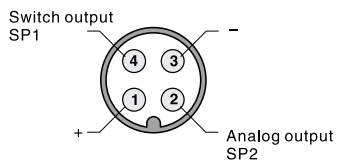
Installation Environment
The sensor must be installed with a plastic non-slip nut and a flexible washer (provided with the ultrasonic sensor, see configuration material) (under standard mounting conditions). To prevent non-standard mounting conditions, such as by threaded or unthreaded holes or by using metal nuts to secure the sensor directly in the metal block, the metal block and nut must be grounded. The minimum distance from the edge of the sensing surface to the metal block and nut is 5 mm, ensuring that the first 5 mm position of the threaded housing is not tightened.
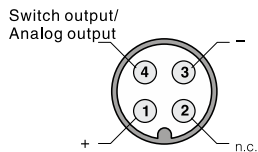
State retention
The sensor saves the last adjustment state, removes the working voltage and re-supplies, and the sensor operates according to the last values of P1 and P2.

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