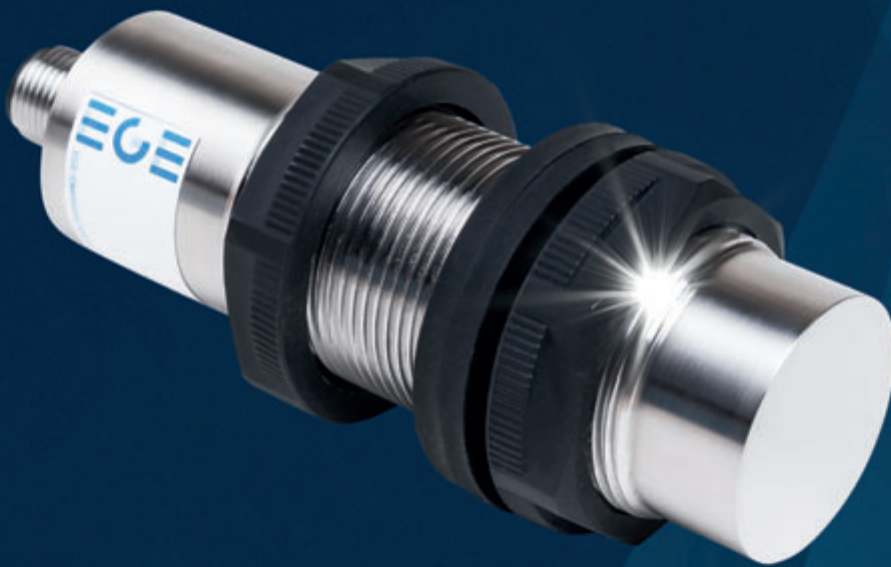




# Ultrasonic Sensors



Special-Sensors for Automation

# Ultrasonic Sensors

## Technique & Application

### Application note

#### Basics

Ultrasonic sensors are transmitting and receiving ultrasonic signals. These signals have a frequency range from 65 kHz up to 300 kHz. Ultrasonic sensors can be used for several different applications, for example:

- diameter detection
- looptension
- height detection
- level measuring
- counting

#### Application notes

##### Non-contact detection of:

- distances
- presence
- level
- diameter
- position

##### Independent of:

- material
- colour
- light
- smoke
- dust

#### Cycle period

A short ultrasonic pulse is transmitted at the time 0, reflected by an object. The sensor receives this signal and converts it to an electric signal. The next pulse can be transmitted when the echo is faded away. This time period is called cycle period. (Fig. 1)

#### Sensors with

- long sensing ranges have long cycle periods and slow reaction time.
- short sensing ranges have short cycle periods and fast reaction times.

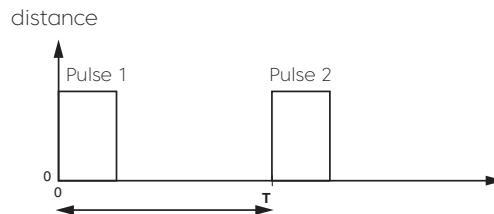


Fig. 1: cycle period T

#### Angle of beam

The energy of the ultrasonic pulse is transmitted in form of a cone along the transducer axis. The highest intensity is on the axis and decreases with rising angles. The angle of beam is defined by the angle through which the energy of the ultrasonic pulse is reduced of 33% of its maximum value. The best detection is given by an object that stands vertical to the transducer axis. To give a save detection, the object should not have an greater angle than half of the angle of beam ( $\alpha/2$ ). (Fig. 2) If the object is canted at a greater angle, there is no reflection of the ultrasonic pulses. An object with a flat surface and canted at an angle of  $45^\circ$  to the transducer axis refracts the ultrasonic pulse in an angle of  $90^\circ$ . An ultrasonic pulse can be compared to a light beam.

#### Acoustic beam width $\alpha$

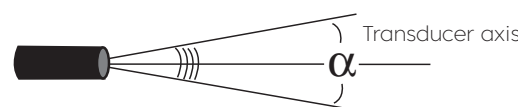


Abb. 2: angle of beam

#### Voltage amplitude

During the transmission the voltage amplitude of the ultrasonic pulse is approximate 80 V PP. The pulse period of the ultrasonic pulse depends on the duration of the transmission pulse and on the ringing time of the transducer. The voltage amplitude of the received echo is in the range of  $\mu\text{V}$ . (Fig. 3)



Fig. 3: voltage amplitude

#### Blind zone

It is not possible to receive an echo during the transmission of the ultrasonic pulse. This time period defines the range of the blind zone. In this blind zone it is not possible to measure a distance. (Fig. 4)

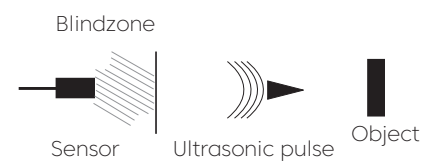


Fig. 4: Blindzone



# With switching point

Plastic miniature housing

DC 18...30 V

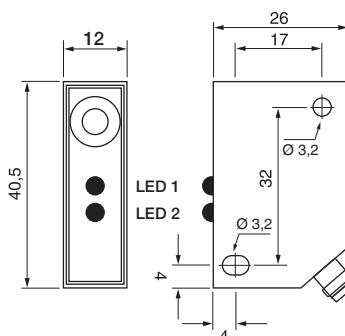
PNP output

Teach-in programming

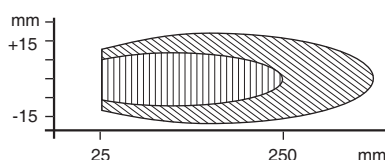


**Design** **DC PNP • rectangular housing 26x40x12**

*Dimensions*

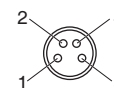
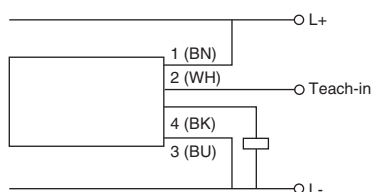


Sensing range	[mm]	25...250
Output		
ID-No.		P72026
Type		ARKS 250 GPP
Supply voltage	[V]	18...30 DC
Current consumption	[mA]	35
Switching current	[mA]	100
Switching frequency	[Hz]	50
Ambient temperature	[°C]	-20...+70
Protection	[EN 60529]	IP 67
Housing material		PBTP
Connection		M8 connector



mögliche Erfassung eines großen Objektes  
Possible detection of a large target

Sichere Erfassung eines großen Objektes  
Save detection of a large target



**Accessories** **M8 plug type connection, 2 m PVC-cable is part of delivery**



# With switching point

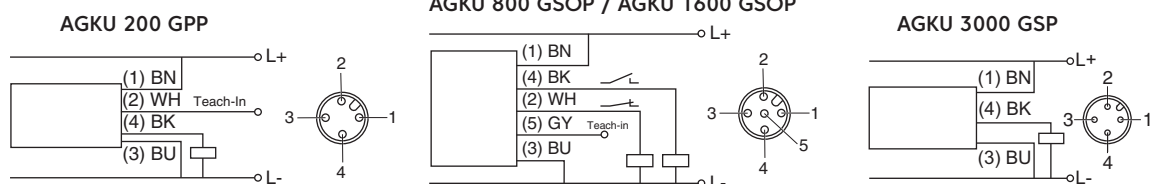
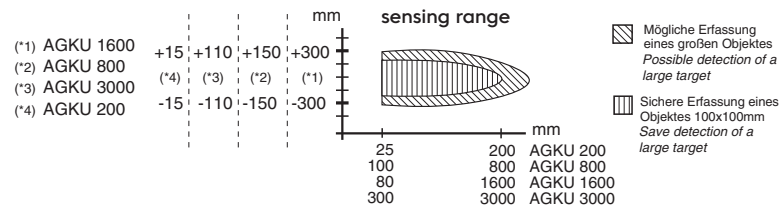
Metal / plastic thread  
 M12x1  
 M18x1  
 M30x1.5

DC 18...30 V

Sensing range adjustable



Design	DC PNP • M12x1	DC PNP • M18x1		DC PNP • M30x1.5
Dimensions				
Sensing range [mm]	25...200	100...800	80...1600	300...3000
Output				
ID-No.	P72018	P72030	P72031	P72003
Type	AGKU 200 GPP	AGKU 800 GSOP	AGKU 1600 GSOP	AGKU 3000 GSP
Supply voltage [V]	10...30 DC	12...30 DC	12...30 DC	18...30 DC
Switching current [mA]	100	500	500	400
Short circuit proof	•	•	•	•
Reverse protection	•	•	•	•
Switching frequency [Hz]	50	10	6	1
Ambient temperature [°C]	-15...+70	-20...+70		-15...+70
Protection [EN 60529]	IP 67	IP 67		IP 67
LED display	•	•		•
Housing material	AISI 316 Ti	PBTP		PBTP
Connection	M12 connector			



Accessories Connecting type SLG 4-2 (Z00445), SLG 3-2 (Z01076), SLG 5-2 (Z01150)



# Switching points and analog output

Plastic thread  
M18x1  
M30x1.5

DC 18...30 V

Two switching points PNP  
Sensing range adjustable



Design	Teach-in • M30x1.5	4...20 mA • M30x1.5	4...20 mA • M18x1
<b>Dimensions</b>			
Sensing range [mm]	250...2000	300...2500	200...1500
Output	2x		
ID-No.	P72005	P72011	P72010
Type	AGKU 2000 GIPP	AGKU 2500 GI	AGKU 1500 GI
Supply voltage [V]	19...30 DC	18...30 DC	18...30 DC
Current consumption [mA]	25	35	35
Load current [mA]	100	-	-
Current output [mA]	-	4...20	-
Load resistance $R_L$ [ $\Omega$ ]	-	0...500	-
Linear deviation [%]	-	0.5	-
Ambient temperature [ $^{\circ}\text{C}$ ]	-	-15...+70	-
Temperature drift [%]	-	0.5	-
Protection [EN 60529]	-	IP 67	-
Housing material	-	PBTP	-
Connection	M12 connector		
	<p>Mögliche Erfassung eines großen Objektes Possible detection of a large target Sichere Erfassung eines Objektes 100x100 mm Save detection of a target 100x100 mm</p>	<p>Mögliche Erfassung eines großen Objektes Possible detection of a large target Sichere Erfassung eines Objektes 100x100 mm Save detection of a target 100x100 mm</p>	
	<p>AGKU 2000 GIPP</p>	<p>AGKU GI</p>	
<b>Accessories</b>	Connecting type SLG 5-2 (Z01150), SLG 3-2 (Z01076)		



# Metal face sensors | Switching point

**M30**  
One piece stainless steel housing

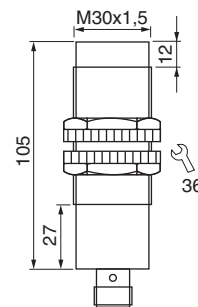
DC 18...30 V

PNP output  
Teach-in programming

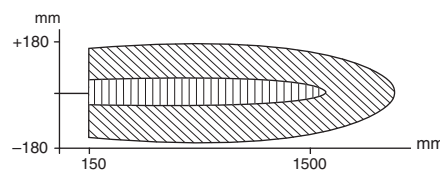


## Design Teach-in • M30x1.5

### Dimensions

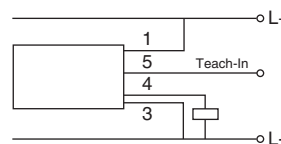
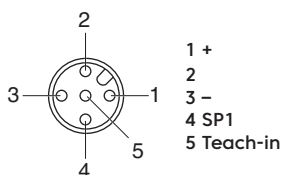


Sensing range [mm]	150...1500
Output	
ID-No.	P72033
Type	AGVU 1500 GSP
Supply voltage [V]	18...30 DC
Current consumption [mA]	< 40
Switching current [mA]	500
Repeatability [%]	±0.2
Switching frequency [Hz]	7
Ambient temperature [°C]	-15...+70
Protection [EN 60529]	IP 68 + IP 69
Housing material	AISI 316 Ti
Connection	M12 connector



mögliche Erfassung eines großen Objektes  
Possible detection of a large target

Sichere Erfassung eines 100x100 mm Objektes  
Safe detection of a 100x100 mm target



## Accessories Connecting cable type SLG 5-2 (Z01150)



# Metal face sensors | Analog output

**M30**  
One piece stainless steel housing

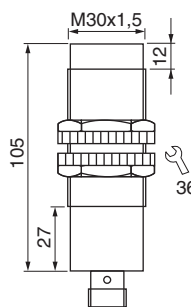
DC 18...30 V

Analog output  
Sync input

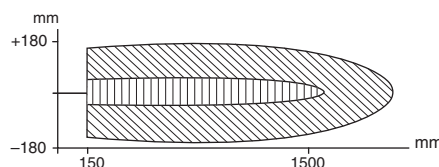


## Design M30x1.5

### Dimensions

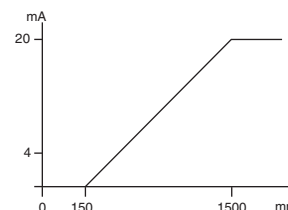
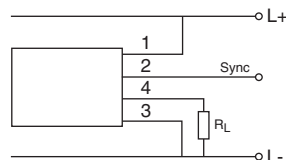
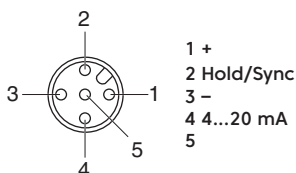


Sensing range	[mm]	150...1500
Output		
ID-No.		P72034
Type		AGVU 1500 GI
Supply voltage	[V]	18...30 DC
Current consumption	[mA]	< 40
Current output	[mA]	4...20
Load resistance R <sub>L</sub>	[Ω]	0...500
Linear deviation	[%]	< 0.3
Repeatability	[%]	±0.2
Ambient temperature	[°C]	- 15...+70
Protection	[EN 60529]	IP 68 + IP 69
Housing material		AISI 316 Ti
Connection		M12 connector



mögliche Erfassung eines großen Objektes  
*Possible detection of a large target*

Sichere Erfassung eines 100x100 mm Objektes  
*Save detection of a 100x100 mm target*



### Accessories Connecting cable type SLG 5-2 (Z01150)





# Two switching points

Rectangular housing 100x36 mm

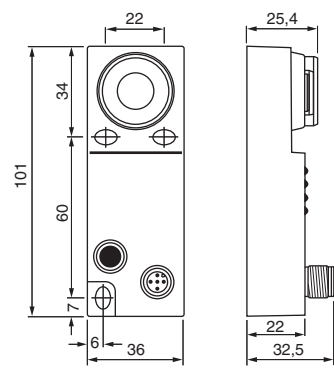
DC 12...30 V

Two independent switching points  
Teach-in programming  
Sync input

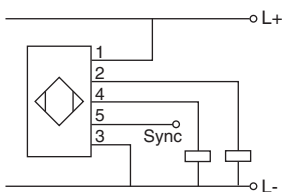
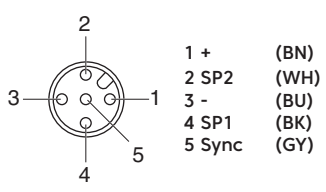
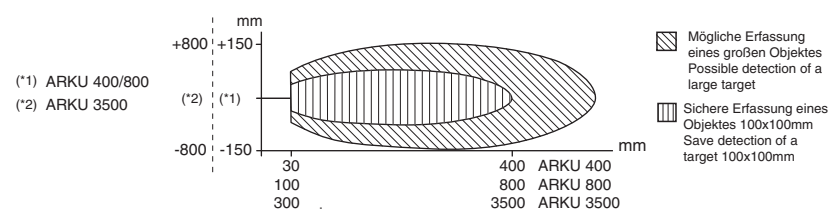


**Design** **DC PNP • rectangular housing 100x36**

**Dimensions**



Sensing range [mm]	30...400	100...800	300...3500
Output	2x	2x	2x
ID-No.	P72020	P72021	P72022
Type	ARKU 400 GPP	ARKU 800 GPP	ARKU 3500 GPP
Supply voltage [V]	12...30 DC		
Current consumption [mA]	35		
Switching current [mA]	400		
Repeatability [%]	0.2	0.1	0.2
Ambient temperature [°C]	-15...+70		
Protection [EN 60529]	IP 67		
Housing material	PBTP		
Connection	M12 connector		



**Accessories** Connecting cable type SLG 5-2 (Z01150), SLW 5-2 (Z01151)





# Analog output

Rectangular housing 100x36 mm

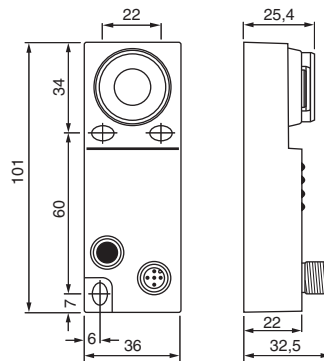
DC 15...30 V  
4...20 mA

Teach-in programming  
Sync input

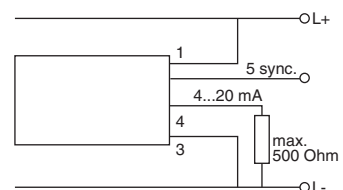
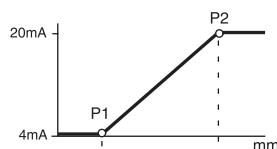
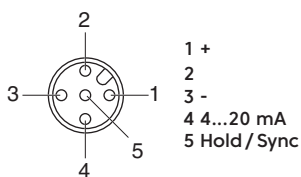
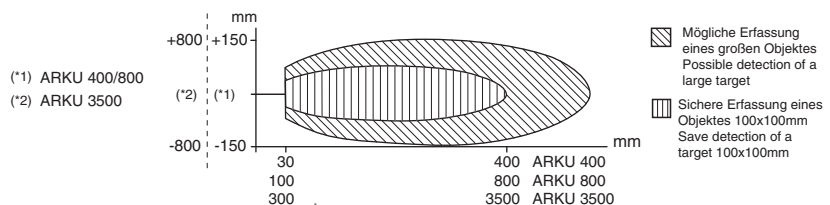


**Design** **4...20 mA • rectangular housing 100x36**

*Dimensions*



Sensing range [mm]	30...400	100...800	300...3500
Output			
ID-No.	P72023	P72024	P72025
Type	ARKU 400 GI	ARKU 800 GI	ARKU 3500 GI
Supply voltage [V]	15...30 DC		
Current consumption [mA]	40		
Current output [mA]	4...20		
Repeatability [%]	±0.2		
Ambient temperature [°C]	-15...+70		
Protection [EN 60529]	IP 67		
Housing material	PBTP		
Connection	M12 connector		



**Accessories** **Connecting cable type SLG 5-2 (Z01150), SLW 5-2 (Z01151)**



# Ultrasonic thru scan

Rectangular housing  
30x20x12 mm

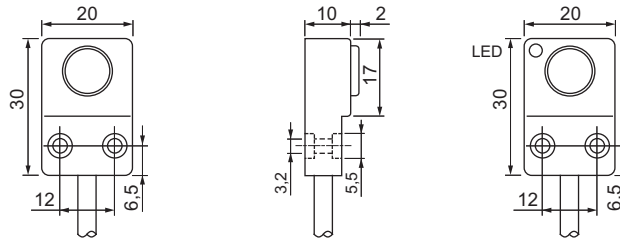
DC 18...30 V

High switching frequency

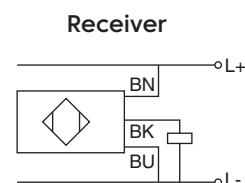
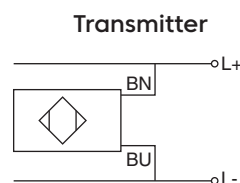
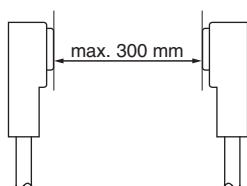


**Design** DC PNP • rectangular housing 30x20x12

**Dimensions**



Sensing distance max. [mm]	0...300	
Function	Transmitter	Receiver
Output		
ID-No.	P72029	
Type	ARK 300 GSP	
Supply voltage [V]	18...30 DC	
Current consumption [mA]	< 40	
Switching current [mA]	500	
Switching frequency [Hz]	150	
Ambient temperature [°C]	-15...+60	
Protection [EN 60529]	IP 67	
Housing material	PBTP	
Connection	2 m cable	



# Process Sensors

## Flow sensors

- Electronical monitoring of flow
- Lubrication monitoring
- Measuring range 1 ml/min...100 l/min
- Detection range 1...300 cm/s
- Reaction time 0.5 s

## Level sensors

- For level monitoring – 230...+230 °C
- Steam proof at a pressure of up to 30 bar
- For hot motor oil
- For liquid nitrogen
- For chemically aggressive media

## Pressure sensors

- Monitoring in pipes and containers
- Pressure up to 16 bar
- Level up to 10 m (±1 cm)
- Compact model with digital display
- Programmable

## Temperature sensors

- Monitoring in pipes and containers
- Temperature – 40...+120 °C (±0,3 °C)
- Pressure up to 100 bar
- Compact model with digital display
- Multi use output NO/NC + analog

## Infrared detectors

- Measurement of temperature
- Monitoring of hot media
- Position control

## Metal detectors

- Detection of metal parts
- For harsh environment
- Large sensing range up to 400 mm
- Monitoring of bulk materials
- Machine protection



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