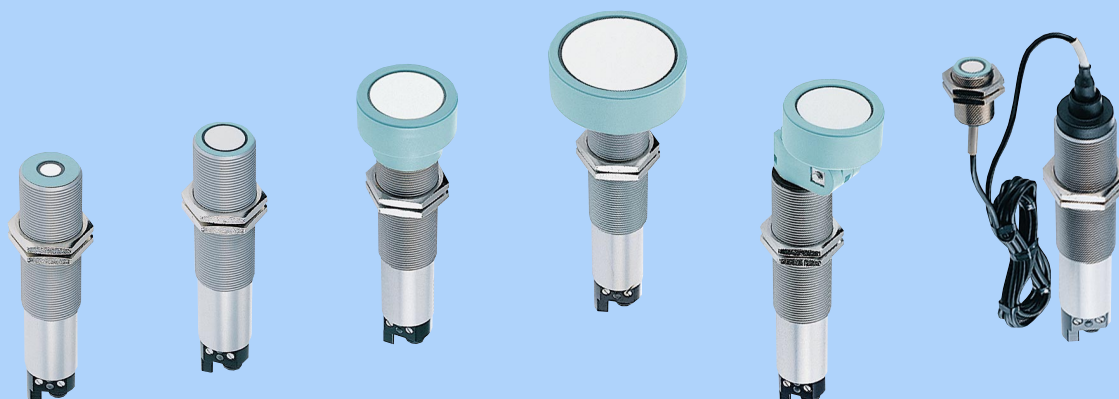


Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact ranges I, II, III with fixed, swivel and separate sensors



3RG60, 3RG61

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Compact range M 18, M 18 S



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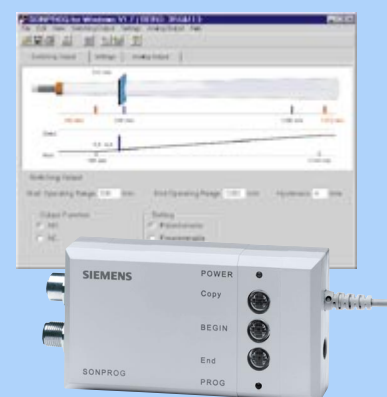
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SONPROG interface unit



3RX4 000

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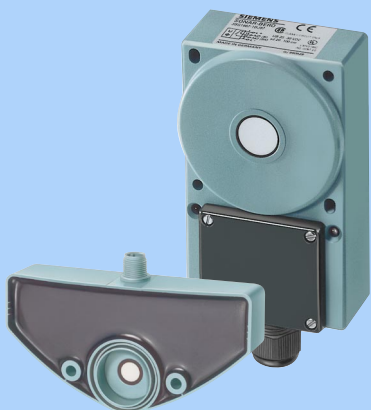
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Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact form



3RG62, 3SG16

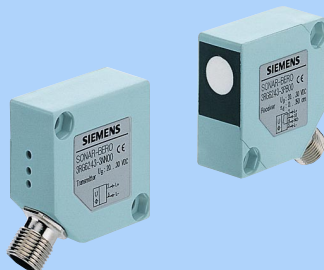
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Sonar thru-beam sensor



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Double-layer sheet monitoring



3RX2 210

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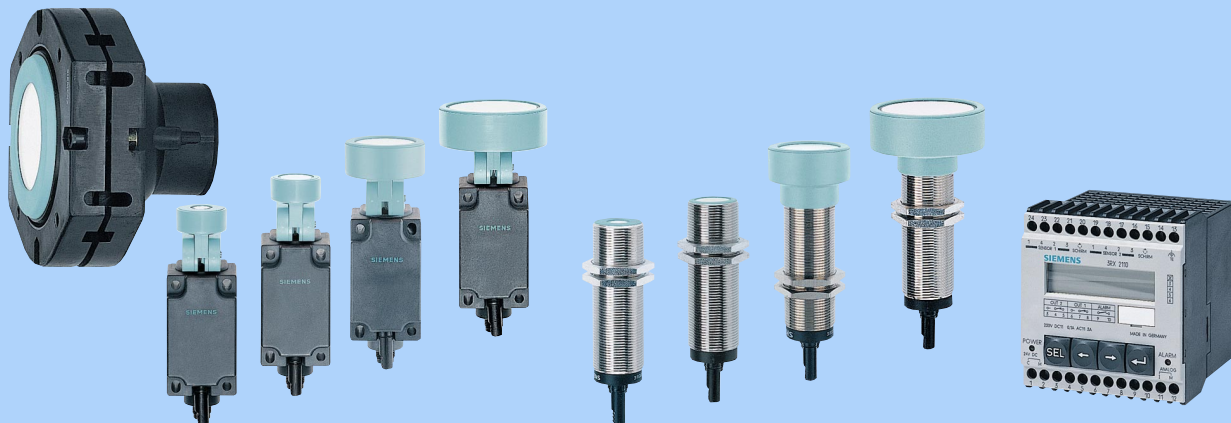
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Modular range II



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Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Introduction

Overview

The main technical features of each series are shown in the following table.

	Compact range 0	Compact range I	Compact range II	Compact range III	Compact range M 18	Compact form 3SG16	Compact form K 65	Sonar thru-beam sensor	Modular range II	Double-layer sheet monitoring
Mode of operation Diffuse sensor Reflex sensor Thru-beam sensor	■	■	■	■	■	■	■	■	■	■
Output 1 switching output 2 switching outputs 1 switching output + 1 analog output 2 relay outputs + 1 analog output 1 analog output 1 frequency output	■	■	■	■	■	■	■	■	■	■
Analog output 0 to 20 mA 4 to 20 mA 0 to 10 V	■			■	■				■	■
Setting 1 potentiometer 2 potentiometers SONPROG interface unit Jumpers Teach-in Keys Wiring	■	■	■	■	■	■	■	■	■	■
Parameters that can be changed with SONPROG Blind zone End of sensing range Lower limit of operating range Upper limit of operating range Differential travel NO/NC switching output function Lower limit of analog range Upper limit of analog range Analog output characteristic Analog output current range Mean-value generation Mode of operation Temperature compensation Enable/disable potentiometers			■	■	■		■			
Description	2/20	2/18	2/18	2/18	2/20	2/24	2/25	2/26	2/28	2/27
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Sonar-BERO programmable with SONPROG

- Available
- Only available for devices with switching output
- Only available for devices with analog output

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Introduction

Field of application

The applications listed in the following table are some of the most familiar and most frequent fields of application of the Sonar-BERO.

The device types marked as special designs feature special functions in addition to the series design.

Enquiries about special designs and continued support should be addressed to our Technical Support department. You will find information about this in the Appendix to this Catalog.

Applications	Compact ranges 0, I, II, III, M 18 (special design)	Compact ranges 0, I, II, III, M 18 (special design)	Compact range II with 2 switching outputs (sp. design)	Compact range II, M 18 (special design)	Compact form K 65	Compact range II with 2 switching outputs (sp. design)	Compact range II with frequency output	Compact range II (special design)	Sonar thru-beam sensor	Compact range II (special design)
In chemically aggressive medium Ultrasonic converter with Teflon film	■									
In food processing Ultrasonic converter with Teflon film, PPS ring, stainless steel casing V4A		■								
Lifting control for machines with minimum/maximum recognition 2 separately adjustable switching points			■							
Level monitoring for pump control with 1 switching output Separately adjustable switching points for "Full" alarm and pump stroke				■						
Level monitoring for pump control with 2 switching outputs For "Full" alarm with differential travel 1 For final shutdown with differential travel 2 Level-dependent signaling					■					
Winding diameter monitoring Warning with switching output 1 Final shutdown with switching output 2						■				
Threshold detection using LOGO! The frequency output is acquired by the counter inputs of the LOGO! controls: Several thresholds that are assigned to the relay outputs of the LOGO! control							■			
Gate control, drive-in control Parameterizable raising/falling delay, Sonar-BERO in reflex mode								■		
Conveyor belt control Reflex mode with emitter and receiver: No blind zone, max. switching frequency 200 Hz, insensitive to dirt and condensation									■	
Loop control for slack control Averaging and differential travel on echo pulse detection										■
Description				2/22	2/25		2/21		2/26	

Special versions

For ordering sensors with special designs or preset parameters, the order number must be supplemented with "-Z" and the required features should be specified in plain text.

Ordering example

Sensor of compact range II, sensing range 20 to 130 mm, 1 NO, stainless steel housing:

3RG6013-3AF00-Z
Z = Stainless steel housing

2

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Introduction

Field of application

Sonar-BEROs can be used as non-contact proximity switches in many fields of automation. Whenever distances through air have to be evaluated, these devices can be used, because they not only detect objects, but can also output and evaluate the absolute distance between the Sonar-BERO and the object. Changes in ambient conditions (e. g. temperature changes) are

balanced during evaluation of the measurement.

Objects

The objects to be detected can be solid, liquid, granular or powder. The material can be transparent or tinted, of any form with polished or matt surfaces.

Even at a maximum operating distance, all level or smooth surfaces can be reliably detected up to an angular variation of

approximately 3° from the sound cone. Depending on the peak-to-valley height of the object, the angular variation may also be higher.

As a rule, the objects can enter the sound cone from any direction.

Explosion protection

The Sonar-BEROs of compact ranges 0 to III, M 18 and K 65 as well as the sensors of modular

range II, sonar thru-beam sensors and compact form sensors are suitable for installation in Ex-Zone 2 and Ex-Zone 11.

Personnel safety

Due to their physical characteristics, the Sonar-BERO ultrasonic proximity switches cannot be used for safety-related applications (e. g. for the protection of personnel).

Mode of operation

The BEROs only operate through the medium of air and can detect any object that reflects ultrasound.

The sensors emit ultrasonic pulses cyclically. When these pulses are reflected by an object, the generated echo is received and converted into an electrical signal. The incoming echo is detected in accordance with its intensity which, in turn, is dependent on the distance between the object and the Sonar-BERO.

The Sonar-BEROs operate according to the echo propagation principle, i. e. the time difference between the emitted pulse and echo pulse is evaluated.

Sensing range

The sensing range of a Sonar-BERO is the range within which the Sonar-BERO can detect objects. Depending on the type, it can lie between 5 cm and 10 m.

The construction of the sensor causes the ultrasonic beam to be emitted in the shape of a cone. Only those reflecting objects within this sound cone are detected.

Within the blind zone, which lies between the sensor surface and the sensing range, echoes cannot be evaluated for physical reasons.

Temperature compensation

The Sonar-BEROs of compact range II, III and M 18 as well as modular range II are fitted with temperature sensors and a compensation circuit that equalizes changes in operating distances caused by temperature changes.

Compensation can be performed throughout the temperature range. This means that an absolute precision of +/- 1.5 % (compact range II and III) or +/- 2.5 % (compact range M 18) is achieved.

Accuracy

The accuracy is the permissible error that exists as the difference between the true distance and the indicated value. The accuracy of a Sonar-BERO depends on internal tolerances as well as certain physical parameters of the air such as humidity, atmospheric pressure and air movement. These parameters influence the sound propagation time and therefore the measured value received.

Atmospheric pressure

Any other atmospheric changes at a permanent site will have a negligible effect on the sound propagation time. Between sea-level and 3000 m altitude, the speed of sound is reduced by less than 1 %. Sound propagation is not possible in a vacuum.

Air humidity

At room temperature and at lower temperatures, the humidity will have a negligible effect on the sound propagation time. At higher temperatures, the speed of sound increases with humidity.

Air temperature

The sound propagation time is dependent on the air temperature. An air temperature of 20 °C is used as the reference variable here. The speed of sound changes with air temperature by 0.17 %/K. This temperature-dependent change in sound propagation time means that as the temperature increases, the distance to the object appears to become shorter.

A change in temperature of, for example, +10 °C results in a change in the speed of sound of approximately +1.75 % and therefore a change in the operating distance of +1.75 %.

Gas types

The Sonar-BERO is designed for operation in atmospheric air. If it is operated in other gases, different values for the speed of sound and attenuation can result in significant measurement errors and even malfunction (e. g. in carbon dioxide).

Air currents

Changes to the speed of sound as a result of constant changes in the flow direction and flow velocity of the air cannot be quantified by means of a generally applicable formula. High-temperature objects, such as glowing metal cause air turbulence. This will scatter or deflect the ultrasound. An echo will not be generated that can be evaluated.

The measured results are not affected by, e. g.:

Precipitation

Average levels of precipitation in the form of rain or snow will not adversely affect the functionality of the Sonar-BERO. The transducer surface should not however be wetted. Dewing permissible.

Paint spray

This has no determinable effect on the functioning of the Sonar-BERO. To prevent any detrimental effect on the sensitivity of the transducer, however, the paint spray must not be allowed to settle on the active transducer surface.

External sound

External sound is distinguished from the system-specific echoes and does not usually cause malfunctions.

Resolution

The resolution is the smallest change in the distance to the object that is necessary for a change in the output of the BERO. The internal resolution is 256 or 4096 steps. If values are entered during programming that exceed this resolution, they will be automatically corrected by the program. The corrected values will be displayed in a window with a message.

Example: Sonar-BERO 3RG6014-..... (60 to 600 cm)

For a sensing range of 60 to 600 cm, the resolution is 1.3 mm:

$6000 \text{ mm} - 600 \text{ mm} = 5400 \text{ mm}$
 $5400 \text{ mm} / 4096 = 1.3 \text{ mm}$
(12 bits)

If the measuring range is restricted, the step size is reduced because the distance that is split up into 4096 steps has reduced. The smallest step size is, however, limited to 1 mm by the electronics. If the sensing range is restricted, the resolution is enhanced.

Repeat accuracy R

The repeat accuracy is the value of the deviation in the indication or switching state for two successive measurements under specified conditions. The repeat accuracy of the Sonar-BERO is 0.15 % of full-scale.

Design and installation

Mounting

Sonar-BEROs can be operated in any mounting position. Mounting positions in which deposits can settle on the transducer surface must however be avoided.

The best results are obtained if the Sonar-BEROs are aligned such that the ultrasound waves hit the object as near to the vertical as possible. If this is not possible (e. g. in the case of bulk material), the maximum possible range must be determined experimentally. This depends on the material, surface and alignment of the objects.

To prevent undesirable reflections, a clearance a from disturbing objects must be maintained around the axis of the sound cone (see "Sound cones").

Between the sound cone axis and a smooth wall running in parallel to it, a clearance b must be maintained to prevent disturbing reflections. The clearance c must be maintained to ensure that no objects enter the blind zone (see "Sound cones").

Mounting multiple sensors

Mutual interference between Sonar-BEROs that can result in spurious signals is excluded by maintaining sufficient clearances between the sensors or an appropriate alignment.

If two Sonar-BEROs of an identical design are mounted opposite each other, distance d must be maintained between them. If two sensors of identical design are arranged in parallel, clearance e must be maintained between the sensors.

To avoid mutual interference, BERO sensors of compact ranges 0, II, III and M 18 can be synchronized or operated in multiplex mode (see "Functions").

In modular range II, a sensor connected to the terminals of sensor B will be activated in common mode with the operating sensor unless sensor B is operated as a reference sensor. By this method a mutual interference of these two sensors is excluded.

Fouling

The range of the BERO is reduced if the transducer surface is damaged or painted or if water or wet dirt is applied to it.

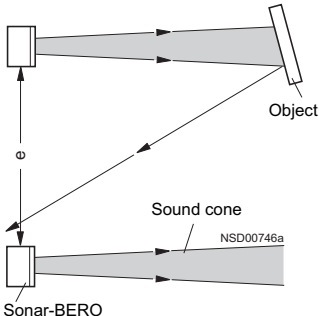
Distance d between two Sonar-BEROs with the same sensing range, opposite to each other

Sonar-BERO with sensing range cm	d cm
6 (5) to 30	> 120
20 to 130 (100)	> 400
40 to 300	> 1200
60 to 600	> 2500
80 to 1000	> 4000

Clearance e between two Sonar-BEROs with the same sensing range, arranged in parallel with object perpendicular to the sound cone axis

Sonar-BERO with sensing range cm	e cm
6 (5) to 30	> 15
20 to 130 (100)	> 60
40 to 300	> 150
60 to 600	> 250
80 to 1000	> 350

Clearance e between two Sonar-BEROs with the same sensing range, arranged in parallel; object unfavorably aligned

	The clearance e is to be determined experimentally. It depends on the angle of the object to the Sonar-BERO.
---	--

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Introduction

Programming

SONPROG interface unit

SONPROG The SONPROG 3RX4 000 programmer is used to adjust the operating parameters of the Sonar-BERO of compact ranges II, III and M 18 to the prevailing conditions. This program provides an interface that can be used to

- Check the parameters of the Sonar-BERO
- Change the parameters of the Sonar-BERO and
- Adapt the Sonar-BERO to the application.

This enables a Sonar-BERO to be optimized specifically for an application. The adjustments found can be saved or printed out to facilitate maintenance and documentation of the equipment. When a Sonar-BERO has been replaced, the new one can be programmed with the saved data quickly and easily. There is then no need to repeat the adjustment procedure.

The most important parameters that can be adjusted are:

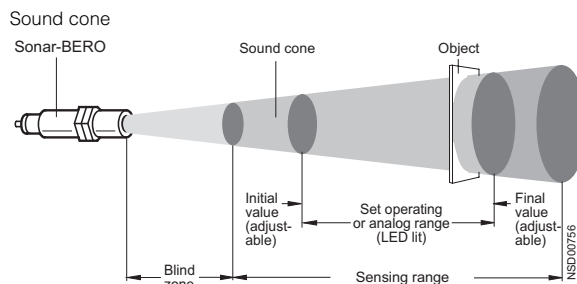
- Lower and upper limit of the operating range
- Differential travel
- NO/NC switching output function
- Switching frequency
- Lower and upper limit of analog characteristic (compact range III and M 18 only)
- Analog characteristic, rising/falling
- End of blind zone
- End of sensing range
- Mean-value generation
- Sensitivity

The function can also be set for the sensor:

- Multiplex function
- Temperature compensation
- Diffuse or reflex sensor.

A special function mode enables the Sonar-BERO to be optimized for level measurement.

Parameters



Operating range

The commands "Lower limit of operating range" and "Upper limit of operating range" are used to define a window within the sensing range of the Sonar-BERO.

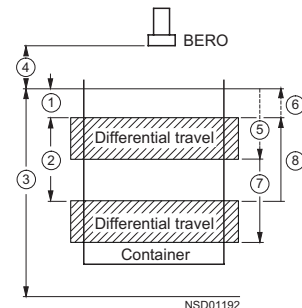
If an object enters the operating range, the switching output is active (in case of NO function). If an object is outside the operating range, the switching output is not active.

In the case of BEROs of compact range II with two switching outputs, the second switching output is active when an object is located between the end of blind zone and the operating range.

Differential travel

The differential travel can be adjusted to move the switch-on point and the switch-off point at the limits of the operating range away from each other. This prevents output flutter and level control tasks can be solved elegantly.

Example: Level monitoring with adjustable differential travel



- 1) Inhibit range
- 2) Operating range
- 3) Sensing range
- 4) Blind zone
- 5) Switching output upper limit - when level is rising
- 6) Switching output upper limit - when level is falling
- 7) Switching output lower limit - when level is falling
- 8) Switching output lower limit - when level is rising

Switching frequency

The Sonar-BERO can be switched over from standard switching frequency (in accordance with the technical data) and rapid switching frequency (3 times the standard value).

Important: A Sonar-BERO with a rapid switching frequency is more sensitive to disturbance.

Switching output function

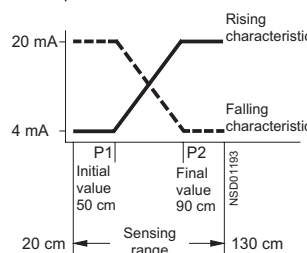
The function of the switching output that was set at the factory can be changed, e. g. from NO to NC.

The assignment of the connections is not changed, i. e. if a sensor is switched from NO to NC, the switching output does not change from Pin 4.

Analog distance measurement

BEROs with an analog output can detect the distance to an object. This distance is converted to an analog output signal that is proportional to it (0 to 10 V, 0 to 20 mA or 4 to 20 mA). The resolution of the analog output is at least 1 mm within the preset limits.

Example:



Blind zone

A value must not be set for the blind zone that is less than the minimum value. This is the time that the Sonar-BERO requires to switch over from send to receive mode.

The blind zone can be moved away from the BERO (i. e. increased) to ignore objects in the foreground. It is, however, important to ensure that the object does not reflect ultrasound so well that double or triple echoes arise that give the impression of a more distant object (a fault of this kind cannot occur during normal operation because only the first echo is accepted as valid).

However, the blind zone is adjusted, objects are still not permitted within the original blind zone.

In the above diagram, the disturbance echo is strong enough to be evaluated. This echo blocks the echo of the object to be detected. By extending the blind zone, the disturbance echo can be suppressed. The required object can then be detected. The range of the Sonar-BERO can be reduced in this case, because part of the echo from the object to be detected is suppressed.

Sensing range

The resolution of the Sonar-BERO can be enhanced by reducing the sensing range. With large sensing ranges, it is not possible to adjust some values in steps of one millimeter. The minimum resolution of a Sonar-BERO is 1 mm.

Mean-value generation

Unfortunate reflective conditions or moving surfaces (e. g. in the case of moving liquids and bulk material on conveyors) can cause the measured values to change continuously which results in constant switching. The Sonar-BERO allows a mean value to be generated from up to 255 measurements.

Failed signals (when no object is in the sensing range) are ignored on mean-value generation. After each measurement, a mean value is generated immediately from the new measured value and the stored number of old values. The response time of the Sonar-BERO is, therefore, not extended. A delay only occurs at the end of a measurement if the object is removed from the sensing range. This delay corresponds to the measurement cycle time multiplied by the saved number of mean values.

Sensitivity (see "Sound cones")

The susceptibility of the receive amplifier is reduced here. Weakly reflecting objects at the edge of the sound cone are suppressed. It is also possible to reduce the size of the sound cone here electronically. The permitted values are 0 (maximum sensitivity) to 7 (minimum sensitivity).

Teach-in

All Sonar-BEROs of compact ranges II, III and M 18 can now be adjusted to the limits of the operating range by means of a teach-in function. For this purpose, the order number must be supplemented with **"-ODT0"**.

Teach-in is activated via a Low signal (0 V) on terminal XI. This can be implemented with a button or bridge; teach-in is also possible via an electronic signal (e. g. PLC output). The timing of the signal is not critical but its duration must be greater than 150 ms.

Various adjustments can be implemented using the SONPROG V2.x software. The user can select which value is to be taught.

In compact ranges II and III, the selection can also be made via the potentiometer (set using SONPROG).

The following adjustments can be implemented using SONPROG V2.x :

- Teach-in mode:
 - Enabled
 - Disabled
- Teach-in mode (adjustable via potentiometer) for:
 - Start of range
 - End of range

Compact range M 18

For sensors with a switching output, the switching limit is taught that was specified in the SONPROG programming (setting as supplied: maximum switching limit).

For sensors with an analog output, the analog limit is taught that was specified in the SONPROG programming (setting as supplied: maximum analog value)

Compact ranges II and III

For compact range II, the switching limits are taught and or compact range III, the analog limits are taught.

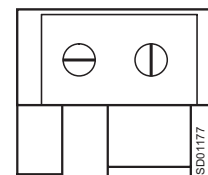
Teach-in procedure

- The LED flashes during teach-in.
- During teach-in, evaluation is performed using the set mean value.
- If no object is detected in the sensing range, teach-in remains active (LED flashes).
- On successful completion of a teach-in, the potentiometer for adjusting the switching range is disabled.
- The teach-in procedure can be repeated as often as required.

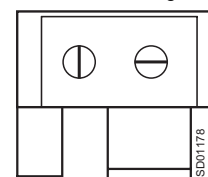
Adjustment with potentiometers

The potentiometers are used to select the required limit values (min. or max.).

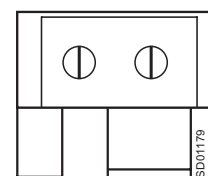
Minimum switching limit



Maximum switching limit



Standard operation;
Teach-in disabled



Functions

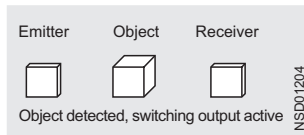
BEROs with switching output

The Sonar-BEROs with a switching output (the graphics describe sensors with NO function) can be used in the following operating modes depending on their type:

Only emitter, only receiver

Two Sonar-BEROs are required in each case for this operating mode. One is parameterized as a receiver and the other is parameterized as the emitter. There are two possible applications:

- Thru-beam sensor: It is only evaluated whether an object lies between the BEROs. The range is twice the normal range. Adjustment of the operating range and evaluation of the analog output is not relevant in this case.

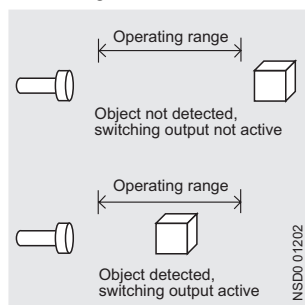


- Active measurement system: The propagation time of the ultrasonic signal from the emitter to the receiver is measured. The enabling inputs of the two BEROs must be connected together for this purpose. All functions of the BERO can still be used and the range is twice the normal range.

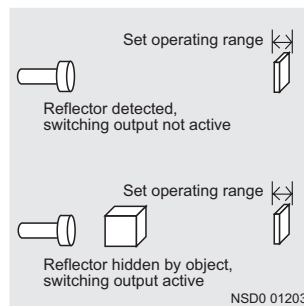
Emitter and receiver

This is the standard operating mode of the Sonar-BERO; it operates as a classical proximity switch.

- Diffuse sensor: In this case, the object that is to be detected acts as a reflector. As soon as an object enters the preset operating range, the echo from this object causes the output signal of the BERO to change.



- Reflex sensor: In this case, a permanently fixed reflector (e. g. a small metal plate) is mounted opposite the BERO. The operating range is adjusted to this reflector. If the path between the BERO and the reflector is interrupted, the sensor no longer detects the reflector and this triggers a change in the signal at the switching output.



Synchronization

In compact ranges II, III and M 18, several devices can be synchronized with each other by interconnecting the synchronization outputs of the devices (Pin 2 for NO function, Pin 4 for NC function). Up to 10 devices can be synchronized (or 6 devices in the case of compact range 0). This allows the sensors to be mounted extremely close to each other in many cases without causing mutual interference.

Advantages:

- No additional wiring overheads, simply connect the enable inputs of the individual BEROs.
- Fast response, because every BERO is constantly active.

Disadvantages

- The object cannot be assigned to a particular BERO.

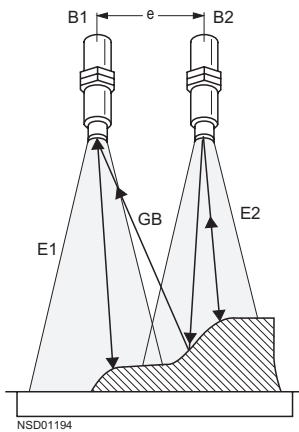
Example

Two Sonar-BEROs are mounted at a clearance e that is smaller than the minimum clearance (see mounting guidelines). An object is located in their common sound field. The echo from B2 can reach B1 by reflection (GB). Mutual interference can occur. The object is detected from the two echoes E1 and E2 by

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Introduction

Sonar-BEROs B1 and B2. If the two devices are synchronized, they may be no mutual interference, because, for example, echo E1 arrives after echo E2 at BERO B2. The devices only ever respond to the first echo.



An external multiplex mode can be configured when Sonar-BEROs have to be switched on and off in sequence via the enabling input. In this case, it is ensured that the Sonar-BEROs will not interfere with each other. In contrast to internal multiplex mode, more than 10 Sonar-BEROs can be operated in multiplex mode.

Connection of the enable input:

- Sonar-BERO active, Enable input XI at L+ or open.
- Sonar-BERO not active, Enable input XI at 0 to 3 V DC

Advantages

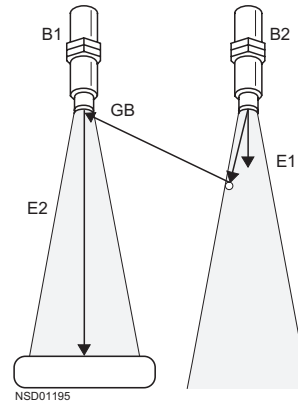
- Reliable protection against mutual interference.
- An object can be assigned to a BERO.

Disadvantages

- Additional connection overheads (e. g. a PLC).
- Longer response time than for a synchronization circuit because each BERO is only active briefly and then has to wait until all the other BEROs in the circuit have emitted.

Example: Recognition of narrow objects

Narrow objects are to be recognized and it shall be determined whether one, two or no objects are present.



In this example, echo GB would cause BERO B1 to mistakenly detect an object. Synchronization of the BEROs would not help here because echo pulse E2 would not arrive until after echo GB at BERO B1 and only a BERO only ever detects the first echo. In this example, a PLC must be used to switch cyclically to and fro between the two BEROs.

Internal multiplex mode

The Sonar-BEROs of compact ranges II, III and M 18 can be interconnected to form a network. Up to 10 devices (or 6 devices in the case of compact range 0) can be operated in series or parallel (see "Synchronization"). No additional electronics is required. The enable inputs of all the BEROs are simply connected together. On programming, each device is informed about the number of BEROs in the network as well as its own position (address) in the network. When they have been wired up and the supply voltage has been connected, the BEROs automatically operate in multiplex mode.

Multiplex function

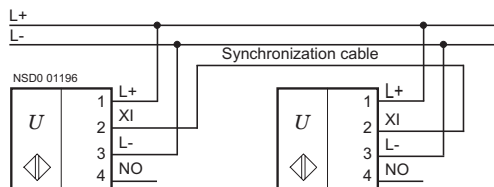
External multiplex mode

The fourth connection can be used as an external enabling input. This can be used to switch the Sonar-BERO to active or inactive using an external control without the need to switch the supply voltage on and off.

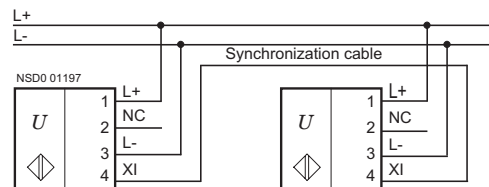
Connection diagrams

Synchronization

NO function

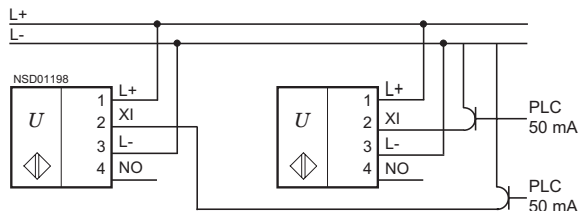


NC function

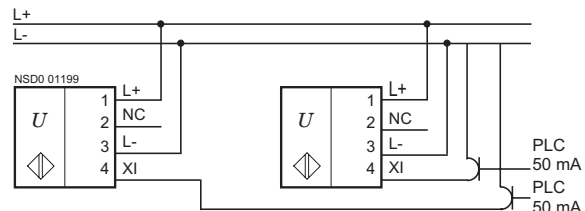


External multiplex mode

NO function

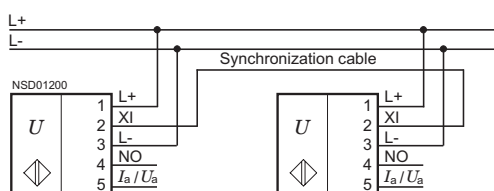


NC function

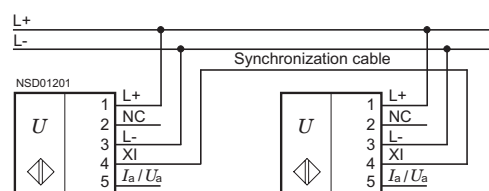


Internal multiplex mode (analog output)

NO function



NC function



Sound cones

The diagrams are the result of measurements taken by Sonar-BEROs with the production-related scatter at room temperature (20 °C). Radially moving standard reflectors within the possible sensing range of the Sonar-BEROs were detected.

The diagrams are applicable for the individual sensor types, for the specified reflectors and for larger reflectors.

- Measurement 1 with an aligned object at optimal reflection \Rightarrow Area around object is kept free that is not to be detected.

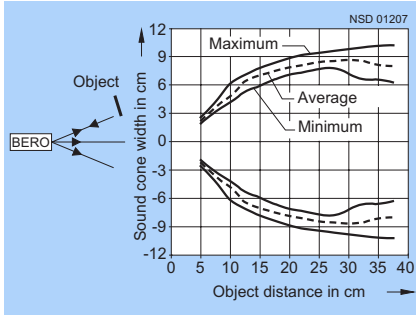
- Measurement 2 with an object that has partially aligned surfaces \Rightarrow Detection of rounded material and plates with rounded edges.
- Measurement 3 with an object with a flat surface that moves perpendicularly to the sound cone \Rightarrow Detection of level surfaces and edges.

Specified reflectors:

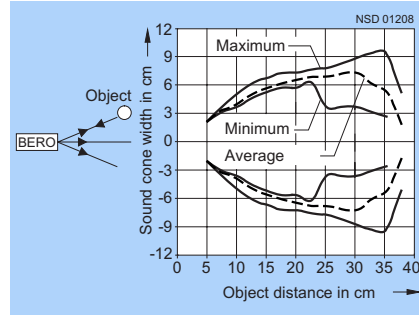
- Measurements 1 and 3: Flat object
 - 2 cm \times 2 cm, for sensors with sensing ranges up to 130 cm
 - 10 cm \times 10 cm, for sensors with larger sensing ranges
- Measurement 2: Cylindrical object, 8 cm in diameter.

Compact range 0, sensing range 6 to 30 cm

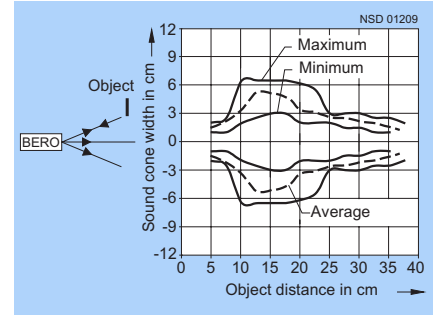
Measurement 1 (optimum reflection), sensitivity 0



Measurement 2 (cylindrical object), sensitivity 0

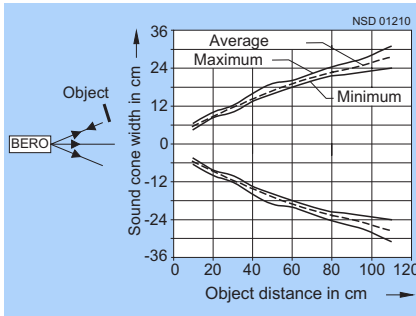


Measurement 3 (flat object), sensitivity 0

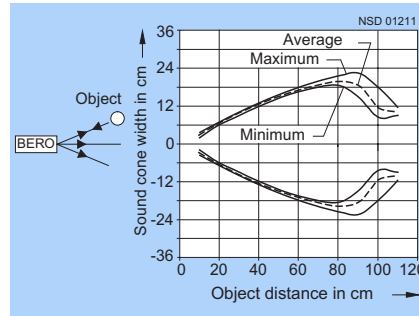


Compact range 0, sensing range 20 to 100 cm

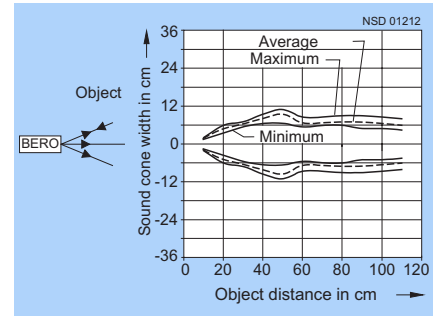
Measurement 1 (optimum reflection), sensitivity 0



Measurement 2 (cylindrical object), sensitivity 0

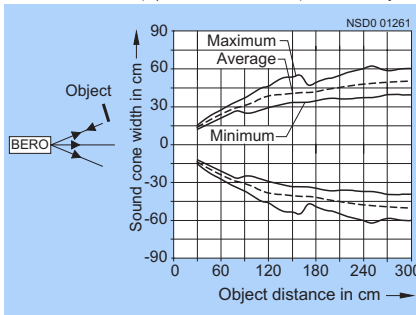


Measurement 3 (flat object), sensitivity 0

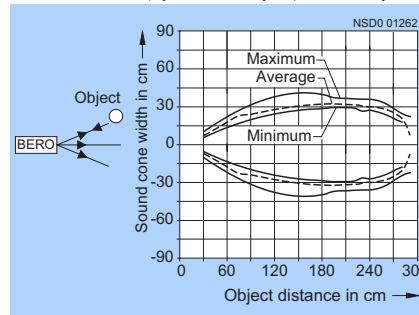


Compact form K 65, sensing range 25 to 250 cm

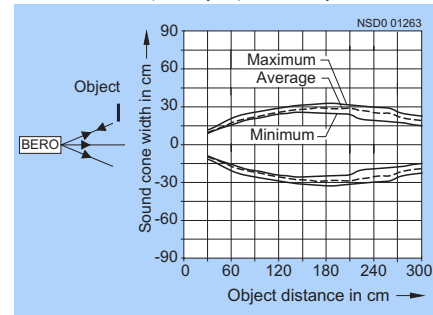
Measurement 1 (optimum reflection), sensitivity 0



Measurement 2 (cylindrical object), sensitivity 0

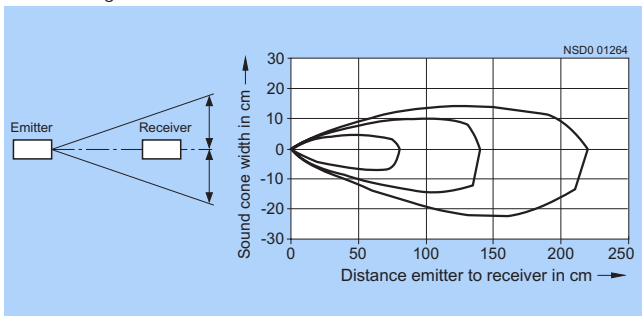


Measurement 3 (flat object), sensitivity 0

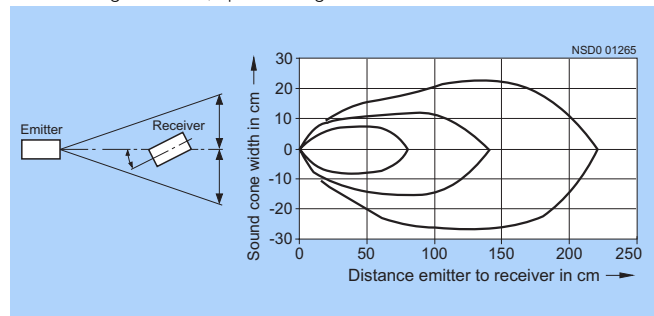


Sonar thru-beam sensor, sensing ranges 5 to 40 cm, 5 to 80 cm, 5 to 150 cm

Receiver angle 0°



Receiver angle variable, optimum alignment



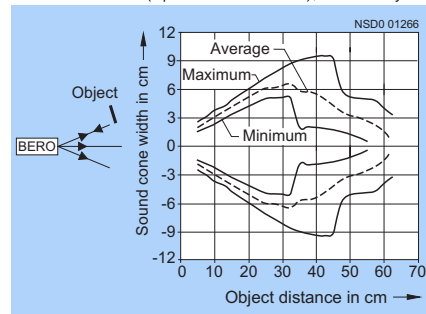
Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Introduction

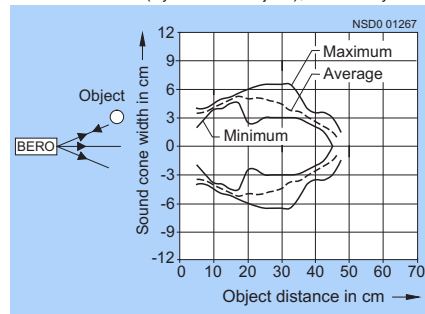
Sound cones

Compact range M 18, sensing range 5 to 30 cm

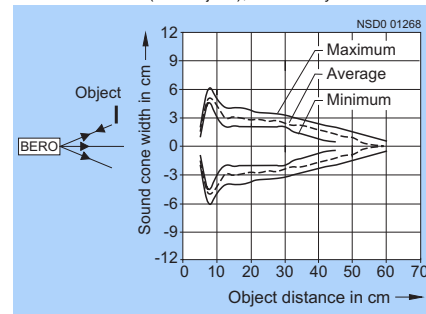
Measurement 1 (optimum reflection), sensitivity 0



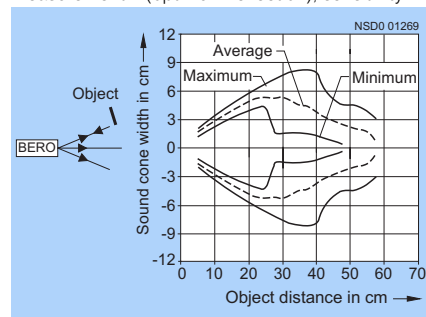
Measurement 2 (cylindrical object), sensitivity 0



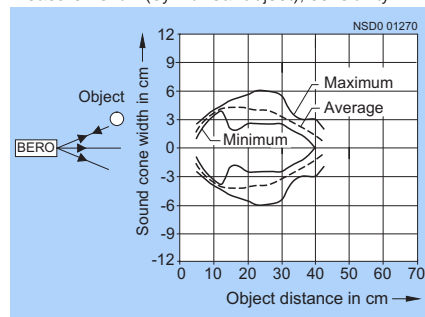
Measurement 3 (flat object), sensitivity 0



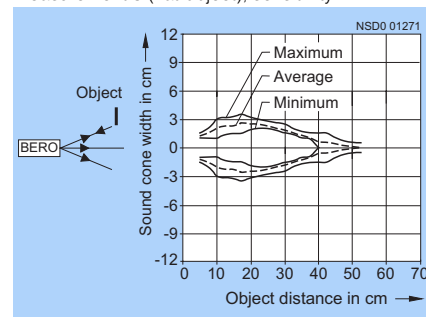
Measurement 1 (optimum reflection), sensitivity 2



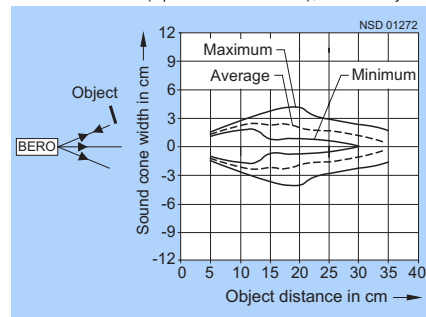
Measurement 2 (cylindrical object), sensitivity 2



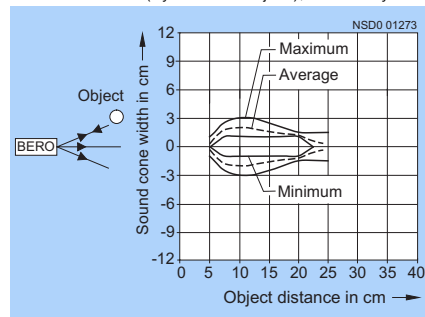
Measurement 3 (flat object), sensitivity 2



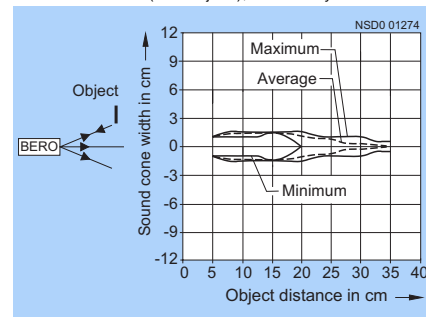
Measurement 1 (optimum reflection), sensitivity 4



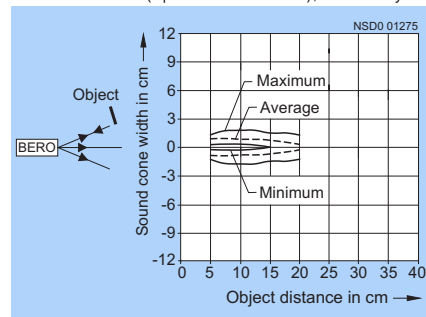
Measurement 2 (cylindrical object), sensitivity 4



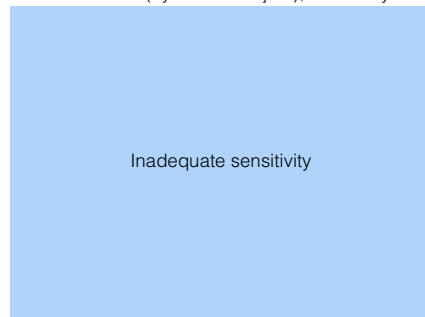
Measurement 3 (flat object), sensitivity 4



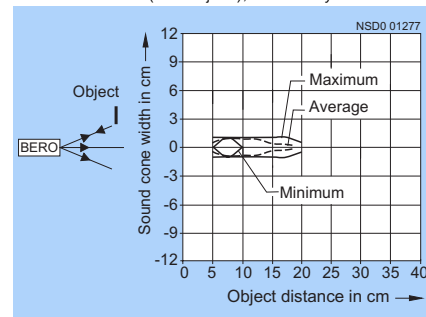
Measurement 1 (optimum reflection), sensitivity 6



Measurement 2 (cylindrical object), sensitivity 6



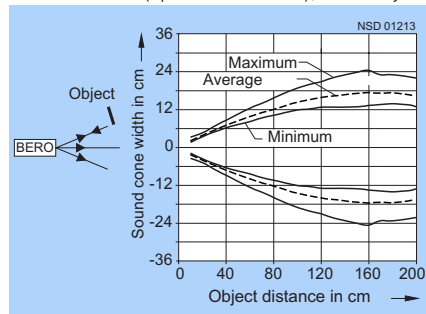
Measurement 3 (flat object), sensitivity 6



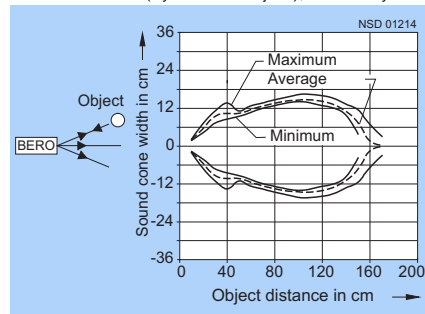
Sound cones

Compact range M 18, sensing range 15 to 100 cm

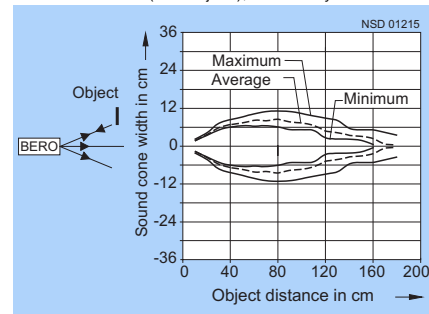
Measurement 1 (optimum reflection), sensitivity 0



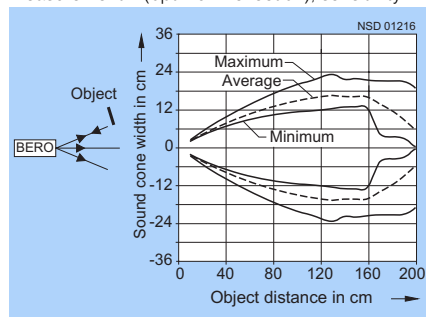
Measurement 2 (cylindrical object), sensitivity 0



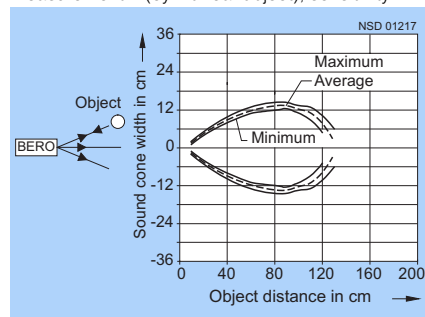
Measurement 3 (flat object), sensitivity 0



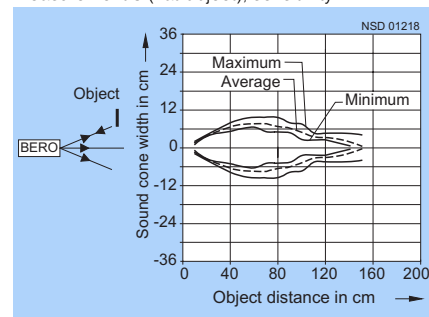
Measurement 1 (optimum reflection), sensitivity 2



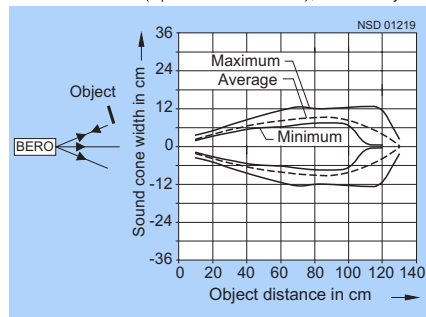
Measurement 2 (cylindrical object), sensitivity 2



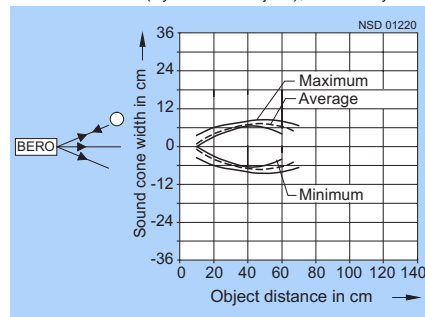
Measurement 3 (flat object), sensitivity 2



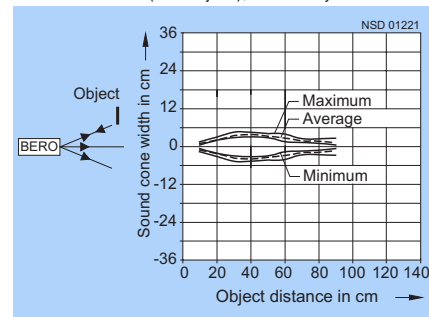
Measurement 1 (optimum reflection), sensitivity 4



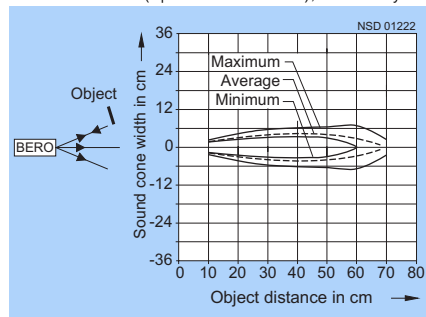
Measurement 2 (cylindrical object), sensitivity 4



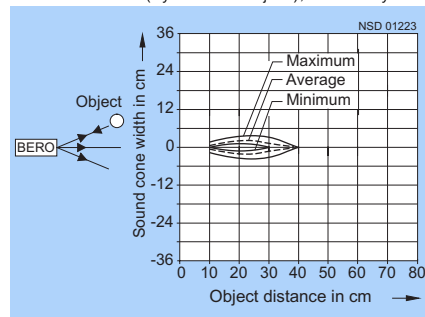
Measurement 3 (flat object), sensitivity 4



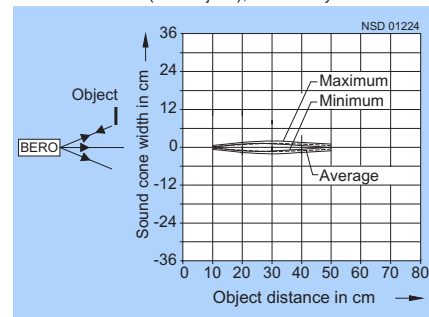
Measurement 1 (optimum reflection), sensitivity 6



Measurement 2 (cylindrical object), sensitivity 6



Measurement 3 (flat object), sensitivity 6



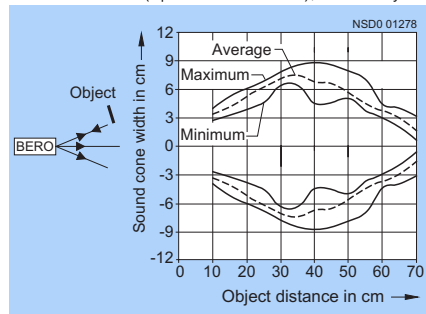
Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Introduction

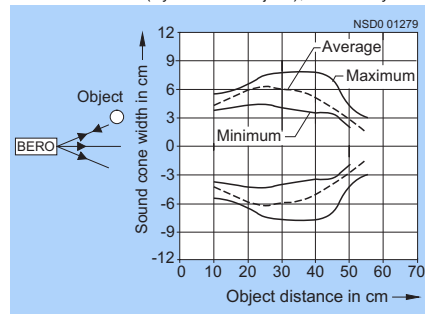
Sound cones

Compact ranges I to III and modular range II, sensing range 6 to 30 cm

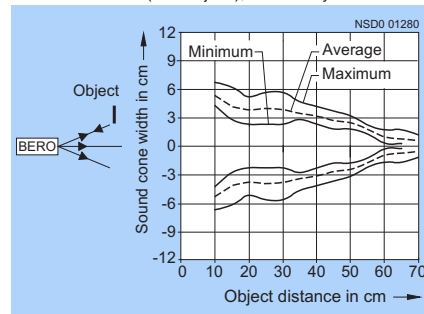
Measurement 1 (optimum reflection), sensitivity 0



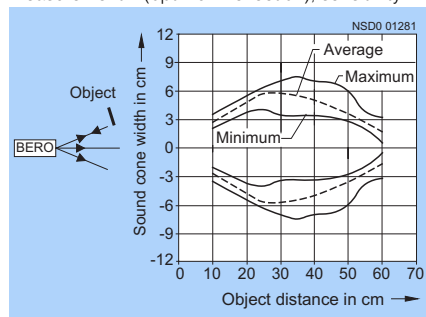
Measurement 2 (cylindrical object), sensitivity 0



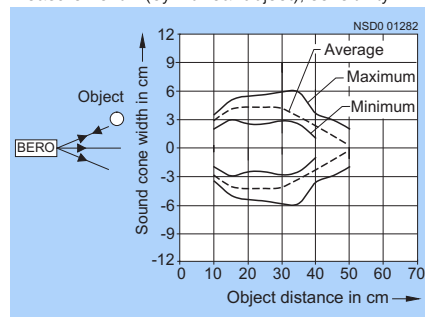
Measurement 3 (flat object), sensitivity 0



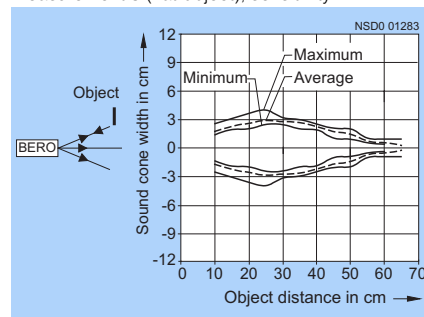
Measurement 1 (optimum reflection), sensitivity 2



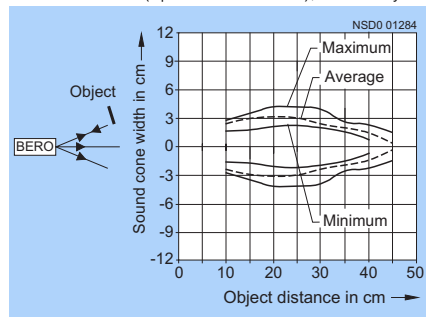
Measurement 2 (cylindrical object), sensitivity 2



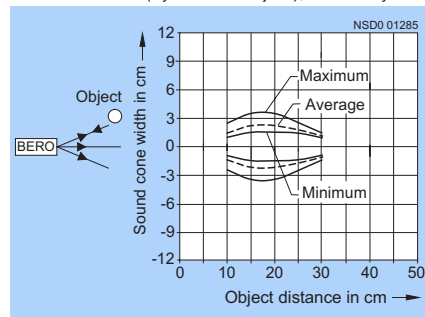
Measurement 3 (flat object), sensitivity 2



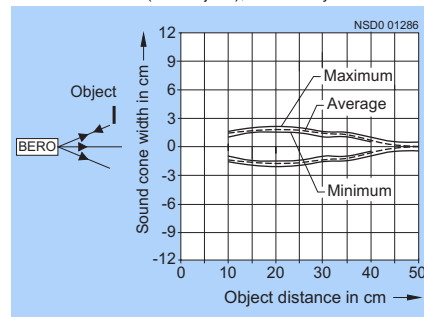
Measurement 1 (optimum reflection), sensitivity 4



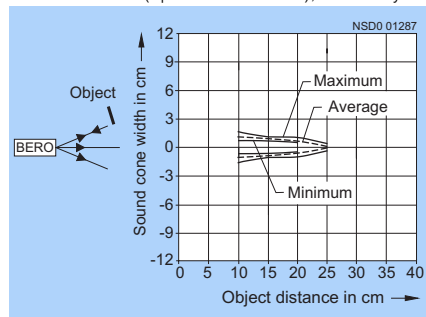
Measurement 2 (cylindrical object), sensitivity 4



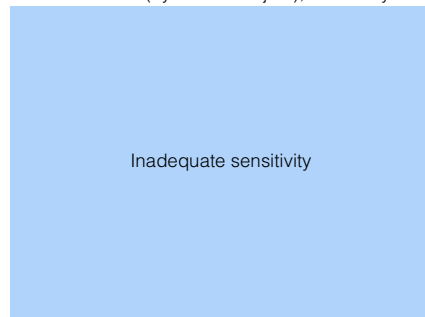
Measurement 3 (flat object), sensitivity 4



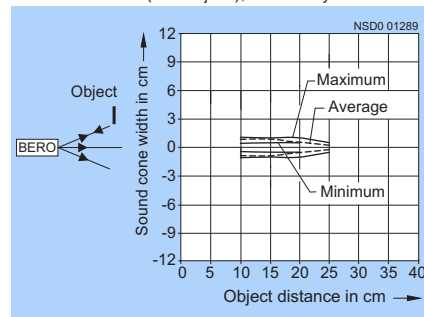
Measurement 1 (optimum reflection), sensitivity 6



Measurement 2 (cylindrical object), sensitivity 6



Measurement 3 (flat object), sensitivity 6

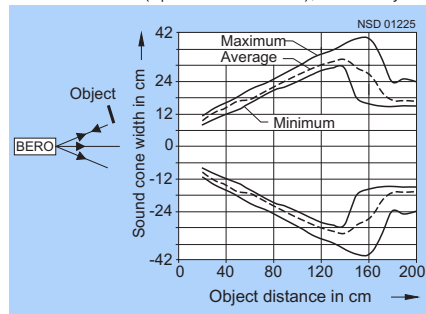


Note: For compact range I, only the sound cones with sensitivity 0 are applicable.

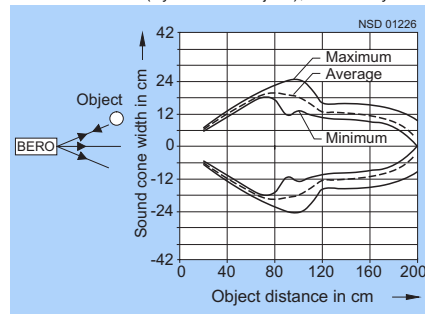
Sound cones

Compact ranges I to III and modular range II, sensing range 20 to 130 cm

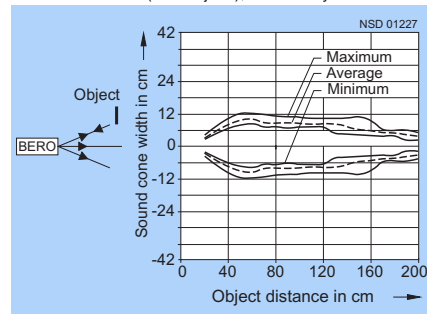
Measurement 1 (optimum reflection), sensitivity 0



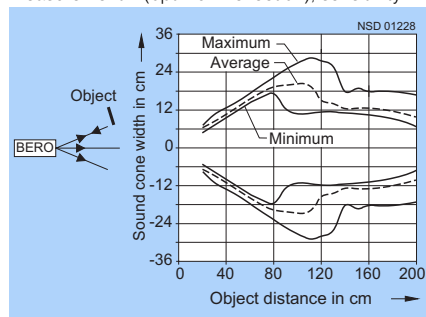
Measurement 2 (cylindrical object), sensitivity 0



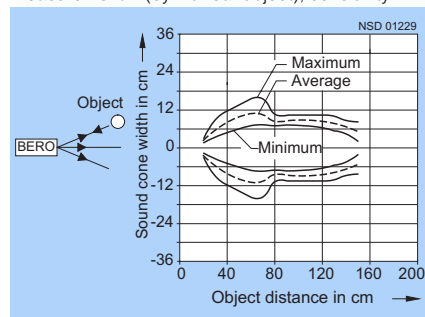
Measurement 3 (flat object), sensitivity 0



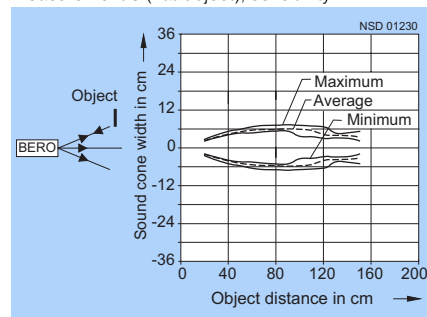
Measurement 1 (optimum reflection), sensitivity 2



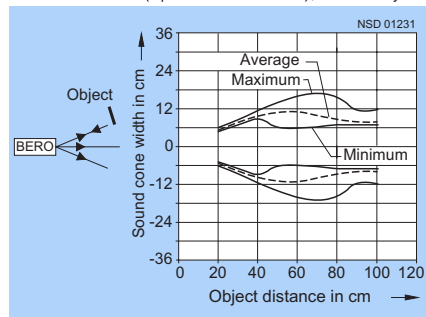
Measurement 2 (cylindrical object), sensitivity 2



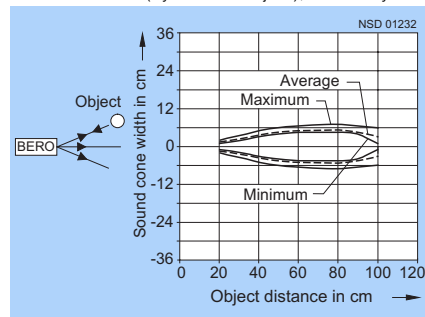
Measurement 3 (flat object), sensitivity 2



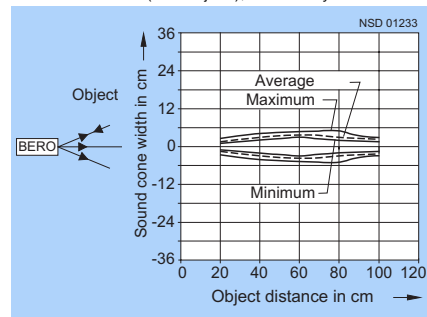
Measurement 1 (optimum reflection), sensitivity 4



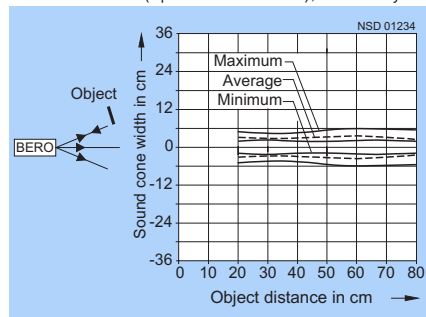
Measurement 2 (cylindrical object), sensitivity 4



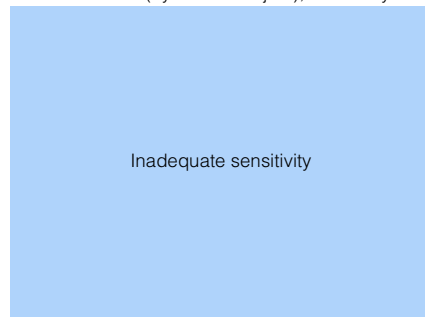
Measurement 3 (flat object), sensitivity 4



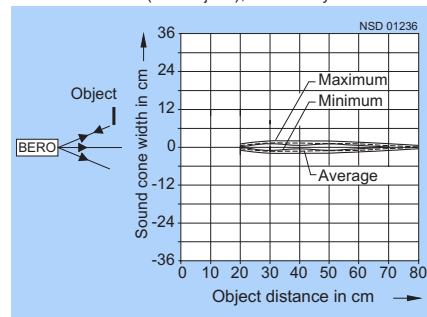
Measurement 1 (optimum reflection), sensitivity 6



Measurement 2 (cylindrical object), sensitivity 6



Measurement 3 (flat object), sensitivity 6



Note: For compact range I, only the sound cones with sensitivity 0 are applicable.

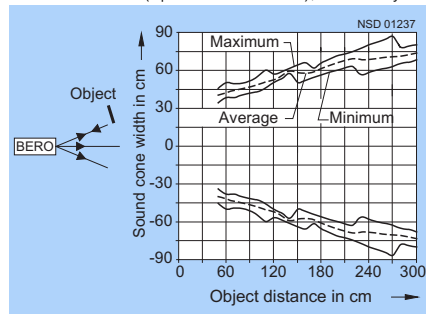
Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Introduction

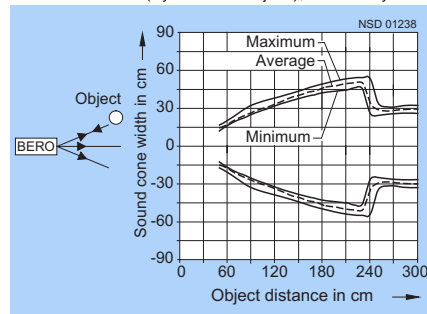
Sound cones

Compact ranges I to III and modular range II, sensing range 40 to 300 cm

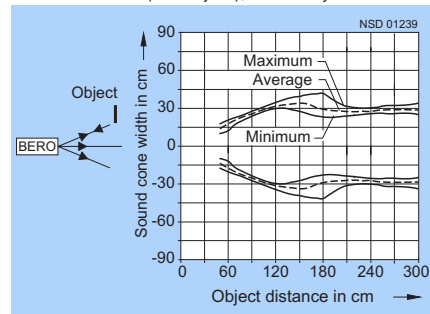
Measurement 1 (optimum reflection), sensitivity 0



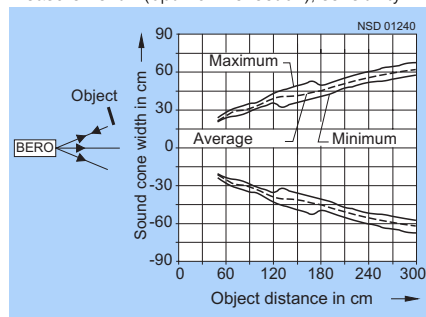
Measurement 2 (cylindrical object), sensitivity 0



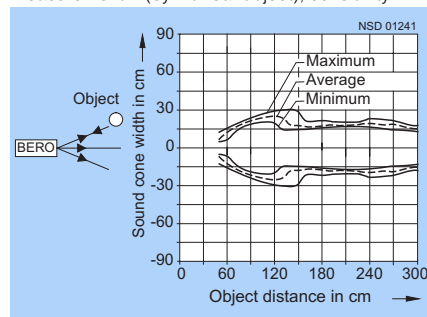
Measurement 3 (flat object), sensitivity 0



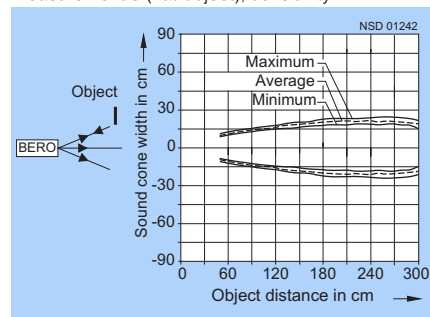
Measurement 1 (optimum reflection), sensitivity 2



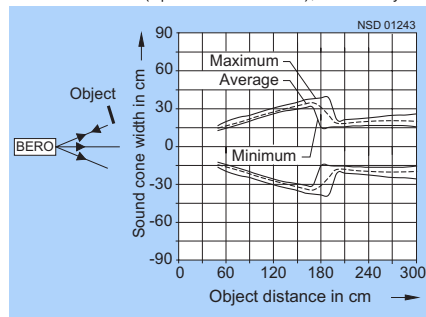
Measurement 2 (cylindrical object), sensitivity 2



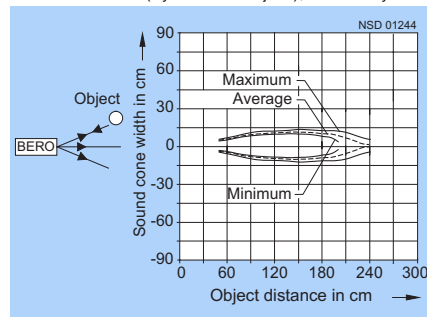
Measurement 3 (flat object), sensitivity 2



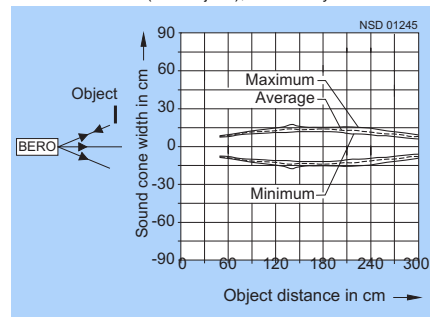
Measurement 1 (optimum reflection), sensitivity 4



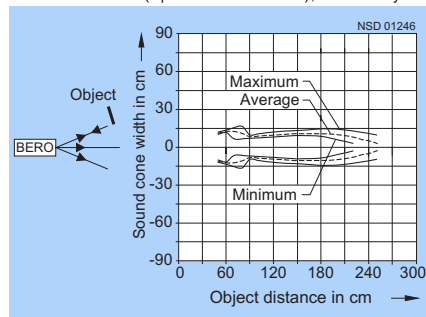
Measurement 2 (cylindrical object), sensitivity 4



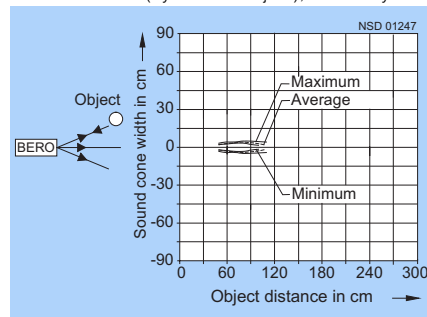
Measurement 3 (flat object), sensitivity 4



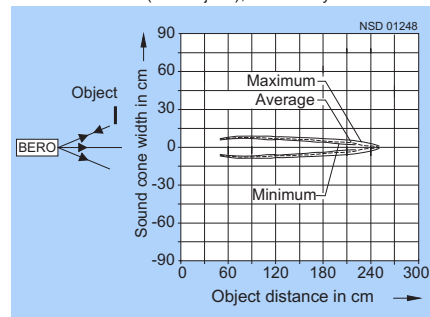
Measurement 1 (optimum reflection), sensitivity 6



Measurement 2 (cylindrical object), sensitivity 6



Measurement 3 (flat object), sensitivity 6

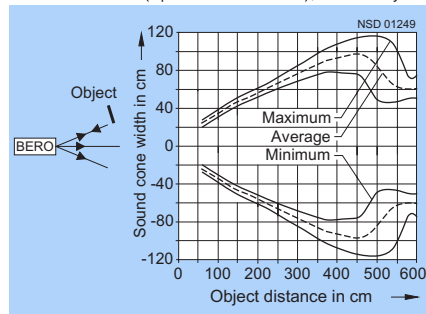


Note: For compact range I, only the sound cones with sensitivity 0 are applicable.

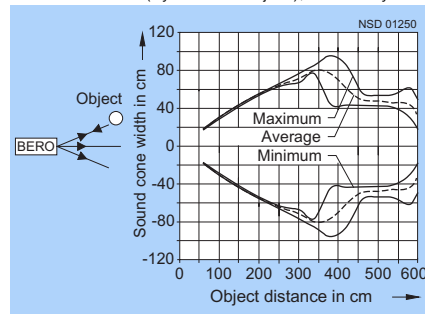
Sound cones

Compact ranges I to III and modular range II, sensing range 60 to 600 cm

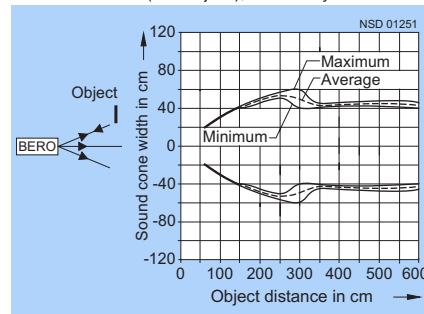
Measurement 1 (optimum reflection), sensitivity 0



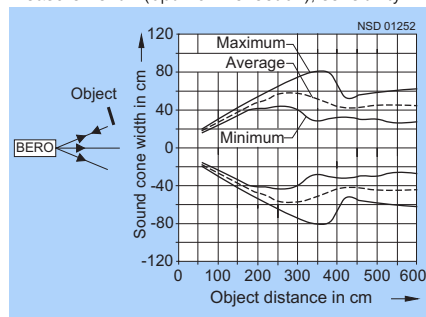
Measurement 2 (cylindrical object), sensitivity 0



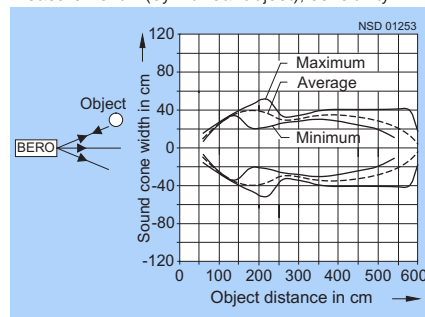
Measurement 3 (flat object), sensitivity 0



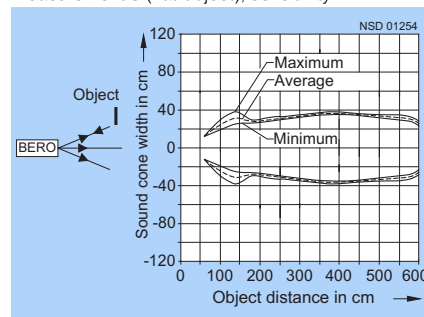
Measurement 1 (optimum reflection), sensitivity 2



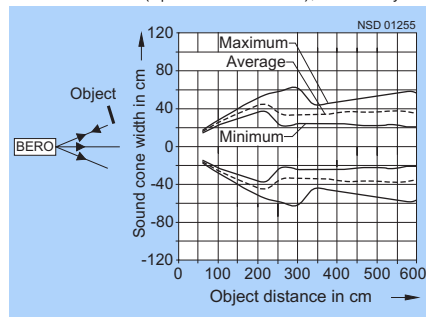
Measurement 2 (cylindrical object), sensitivity 2



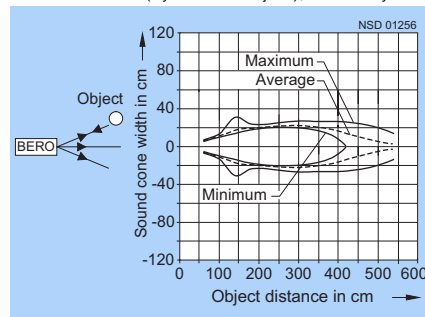
Measurement 3 (flat object), sensitivity 2



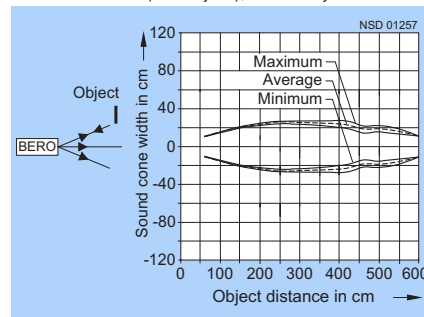
Measurement 1 (optimum reflection), sensitivity 4



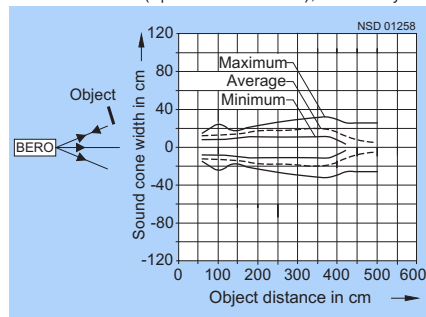
Measurement 2 (cylindrical object), sensitivity 4



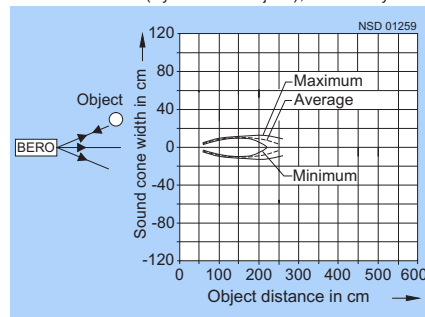
Measurement 3 (flat object), sensitivity 4



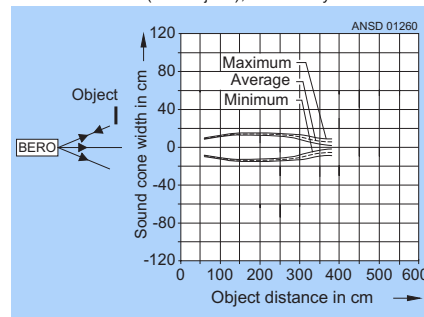
Measurement 1 (optimum reflection), sensitivity 6



Measurement 2 (cylindrical object), sensitivity 6



Measurement 3 (flat object), sensitivity 6



Note: For compact range I, only the sound cones with sensitivity 0 are applicable.

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact ranges I to III

Overview

The Sonar-BEROs of the compact ranges are complete, factory-assembled units, ready for connection. They differ with regard to their ranges, functional scope and adjustment and programming possibilities.

Compact ranges I to III



Mode of operation

Range definition and adjustability

Objects within the preset operating range or analog range will be reliably detected causing the switching output or analog output to change state.

The blind zone must be kept clear of any objects since this might cause false outputs. Objects at a distance from the sensor that is outside the operating range limits will not be signaled at the switching output.

Operating modes

Standard operating mode: Diffuse sensor

An object entering the sound cone from any direction causes the output signal to change when it enters the preset sensing range.

Reflex sensor

If a reflector is set up in the preset operating range, the Sonar-BERO can be actuated by all objects (including sound-absorbing objects) situated between the Sonar-BERO and the reflector.

Thru-beam sensor

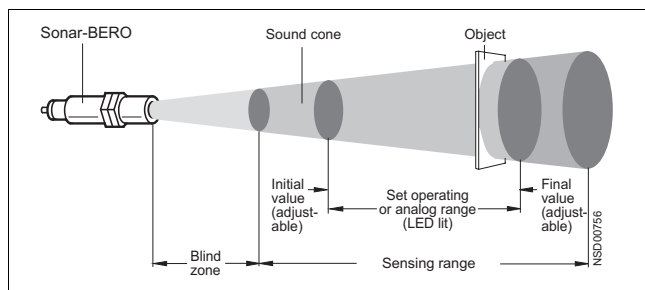
(compact ranges II and III only)

The Sonar-BERO only evaluates whether or not an object is located between the emitter and the receiver. The range of the arrangement is twice that of a single sensor.

Active measurement system

The propagation time of the ultrasonic signal is evaluated in order to determine the distance between the emitter and the receiver. The range of the arrangements is twice that of a single sensor. The system is insensitive to objects in the measurement path as long as they do not totally shield the ultrasonic pulses of the emitter from the receiver.

Sound cone



Programming

SONPROG

For optimum adjustment to the application requirements, all the devices in compact ranges II and III can be programmed by means of a PC and the SONPROG 3RX4 000 interface unit.

The following parameters can be changed:

- Lower and upper limit of the operating range
- Differential travel
- NO/NC switching output function
- Switching frequency

- Lower and upper limit of the analog range
- Analog characteristic, rising/falling
- End of blind zone
- End of sensing range
- Mean-value generation
- Multiplex function
- Temperature compensation
- Sensitivity

The proximity switches can also be ordered preset with values other than the standard values. These values must be submitted in plain text with the order.

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact ranges I to III

Forms

Standard version

In the standard version, the devices have a permanently installed sensor.

Version with separate sensor

The small physical size of the sensors makes them ideal for applications where space is limited.

The ultrasonic sensor is separate from the other parts of the electronics and housed in a cylindrical case. Switches of type 3RG6. 12 have the sensor in an M 18 screwed sleeve and switches of type 3RG6. 13 have the sensor in an M 30 screwed sleeve, each 25 mm in length.

Two nuts are included for securing the housing. The 1.6 m cable is permanently molded into the sensor. A preassembled coaxial plug provides the connection to the signal evaluator which is contained within an M 30 housing of the compact range. The connection is incorporated at the front of the case.

Version with swivel sensor

These devices correspond functionally to the other devices of compact ranges I to III. They are particularly suitable for applications where the standard types cannot be used due to space limitations.

The ultrasonic sensor is hinged with a swivel arm to the tubular housing of the signal evaluator. This allows rotation about the cylinder axes as well as perpendicular movement at about 100° to the cylinder axis.

Reflector

With the Sonar-BEROs of compact ranges I to III, a passive reflector 3RX1 910 can be clamped onto the sensor head (see "Accessories", Section 6).

Where space is limited, objects can be detected which are perpendicular to the Sonar-BERO (which reduces the installation depth). The blind zone is then reduced by about 6 cm.

Sonar-BERO with separate sensor



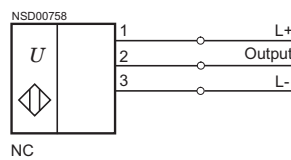
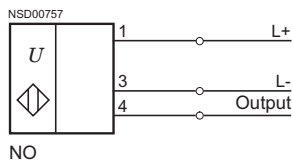
Sonar-BERO with swivel sensor



2

Connection diagrams

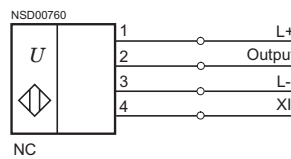
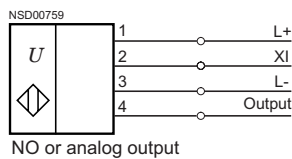
Compact range I



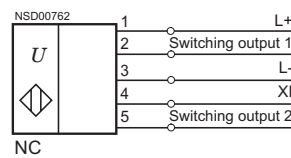
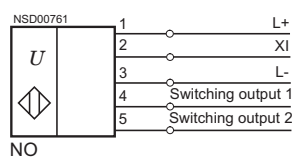
View onto rear of device



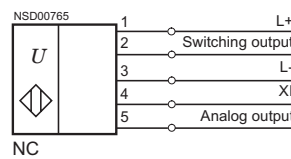
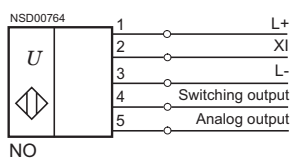
Compact range II



Compact range II with 2 switching outputs



Compact range III



Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact ranges 0 and M 18

Overview

The Sonar-BEROs of the compact ranges are complete, factory-assembled units, ready for connection. They differ with regard to their ranges, functional scope and adjustment and programming possibilities. The functions of the individual device types are presented in the table on Page 2/4.

Compact range 0



Compact range M 18



Compact range M 18 S



Mode of operation

Compact range 0

Compact range 0 is designed for simple applications. The devices are only suitable for operation as diffuse sensors.

The devices can be supplied with a switching output or analog output. The upper limit of the switching or analog range can

be set by means of a potentiometer.

Up to 6 devices can be mutually synchronized.

Compact range M 18

The devices are suitable for operation as diffuse sensors, reflex sensors and thru-beam sensors. The devices can be supplied

with a switching output, analog output or frequency output.

Up to 10 devices of compact range M 18 can be mutually synchronized via the enabling inputs. The devices are also suitable for multiplex operation.

For further details, see compact ranges I to III.

Compact range M 18 S

The versions available are diffuse sensors and reflex sensors. The devices can be supplied with a switching output or frequency output. Their wide range and reduced close range makes them suitable for numerous applications.

Programming

Compact range M 18

SONPROG

For optimum adjustment to the application requirements, all the devices in compact range M 18 can be programmed by means of a PC and the SONPROG 3RX4 000 interface unit.

The following parameters can be changed:

- Lower and upper limit of the operating range
- Differential travel
- NO/NC switching output function
- Switching frequency
- Lower and upper limit of the analog range
- Analog characteristic, rising/falling

- End of blind zone
- End of sensing range
- Mean-value generation
- Multiplex function
- Temperature compensation
- Sensitivity

The proximity switches can also be ordered preset with values other than the standard values. These values must be submitted in plain text with the order.

Compact range M 18 S

Devices with a switching output can be adjusted by means of a teach-in function via the device connection. The devices with a frequency output cannot be adjusted. The signals can be evaluated in a PLC or in a LOGO! mini controller.

Forms

Compact range 0

The devices of compact range 0 are supplied in the standard version with permanently installed sensors.

The devices of compact range 0 can also be supplied with separate sensors. The small physical size of the sensors makes them ideal for applications where space is limited.

The ultrasonic sensor is separate from the other parts of the electronics and housed in a cylindrical case. Switches of type 3RG63 42 have the sensor in an M 18 screwed sleeve and switches of type 3RG63 43 have the sensor in an M 30 screwed sleeve, each 25 mm in length.

Two nuts are included for securing the housing. The 1.6 m cable is permanently molded into the

sensor. A preassembled coaxial plug provides the connection to the signal evaluator which is contained within a housing of compact range 0. The connection is incorporated at the front of the case.

Compact range M 18

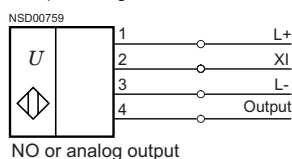
The devices of compact range M 18 are only supplied with permanently installed sensors.

Compact range M 18 S

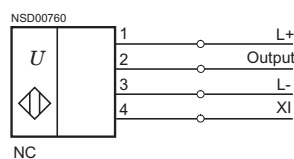
Compact range M 18 S can be supplied with an aligned sensor head or and angled sensor head. The small physical size of the sensors makes them ideal for applications where space is limited.

Connection diagrams

Compact ranges 0 and M 18



Compact range M 18 S
(as above, but ET instead of XI)



Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact range with LOGO!

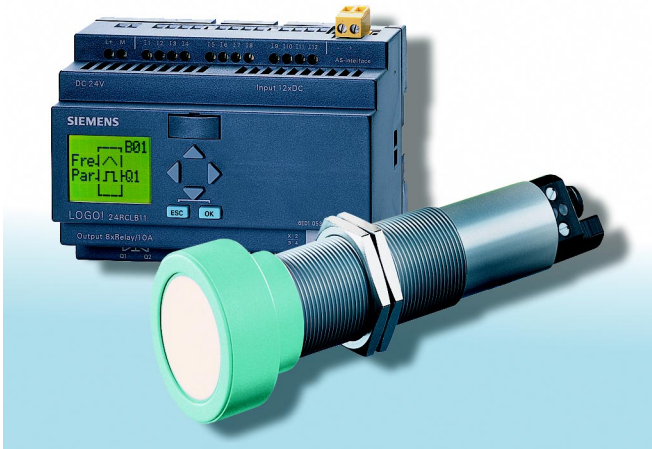
Field of application

When a Sonar-BERO with a frequency output (compact ranges II and M 18) is combined with the LOGO! mini controller levels of any form can be measured and controlled economically. The following features are available:

- Overflow protection
- Pump control
- No-load protection and
- Functions

Other applications include:

- Automatic door control
- Object detection
- Collision protection
- Gap measurement and
- Stack height measurement



Mode of operation

The Sonar-BERO emits short ultrasonic pulses at regular intervals. The time that elapses before the echo from the sound pulse is received following reflection by an object is mea-

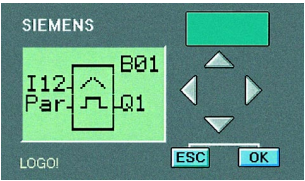
sured and the distance to the object is determined from this time. Depending on the type of Sonar-BERO used, objects at a distance of up to 6 m can be detected.

The BERO outputs a square-wave signal at its switching output which has a frequency proportional to the measured distance. With a control such as LOGO! the frequency of this

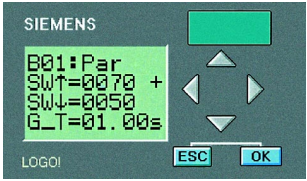
square-wave can be measured and indicated as an analog value or used in further processing.

Programming

The devices of the LOGO! range (DC version only) feature the special function "Threshold switch" with which the frequency output of the Sonar-BERO can be evaluated. The input to the special function must be connected to Input I11, I12 (for LOGO! Long) or I5, I6 (for LOGO! Basic) because only these are designed for frequencies up to 1 kHz.



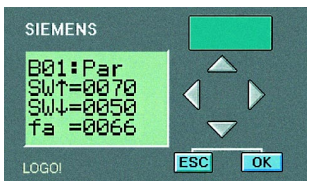
The switch-on threshold (SW↑) and switch-off threshold (SW↓) as well as the gate time (G_T) can be set as parameters of the threshold function. The gate time is the time taken to count the pulses at the input to the special function.



Example

The parameterization shown causes the switching output to be set by an approaching object with SW↑ (70 cm) and this is reset when SW↓ (50 cm) is undershot. When the object moves away, the switching output is set again for SW↑ and remains set until the object undershoots the switching threshold SW↓ again.

The Sonar-BERO (in this example, with a range of 20 to 130 cm) has a frequency of 66 Hz which corresponds to a distance of 66 cm for this device. If the gate time is set to 1 s, the flag "fa" in operating mode corresponds to the distance in cm.



Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact range for pump control

Field of application

The Sonar-BEROs of forms M 30 and M 18 with a switching output are suitable for pump controls, e. g. for applications with automated filling or emptying.



Design

The Sonar-BEROs of compact ranges II (M 30) and M 18 feature a switching output with either an NO function or an NC function as required.

In the case of the M 30 form, the standard design with a fixed sensor head as well as the devices with separate or swivel sensor heads can be used.

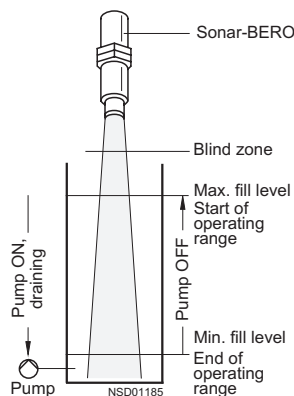
Mode of operation

Automated emptying

A Sonar-BERO with **NO function** is used for this purpose.

The fill level rises and approaches the Sonar-BERO:

The switching output is inactive while the level approaches the Sonar-BERO before the maximum fill height is reached. When the maximum level is reached, the Sonar-BERO switches the pump on and automatic emptying is performed until the minimum level is reached (dryrunning protection). During emptying, the switching output remains active.

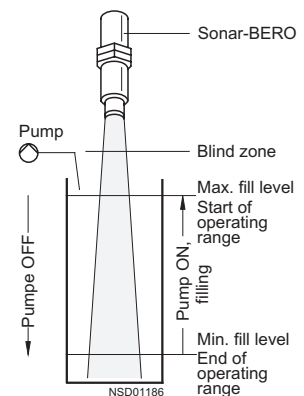


Automated filling

A Sonar-BERO with **NC function** is used for this purpose.

The fill level falls and moves away from the Sonar-BERO:

The switching output remains inactive as long as the falling fill level has not reached the minimum fill height. When the minimum level is reached, the Sonar-BERO switches the pump on and automatic filling is performed until the maximum level is reached. During filling, the switching output remains active.



Programming

The devices can be switched to fill level mode by means of the SONPROG interface unit.

The existing potentiometers, SONPROG software or teach-in keys of the SONPROG interface can be used to set the lower and upper limits of the operating range.

In the case of the M 30 form, the lower and upper limits of the operating range can be set using potentiometers, but with the M 18 form, only the upper limit can be set; in this case the lower limit is preset. It is important to set a mean value. Mean value generation over

100 measured values is recommended as standard.

The required parameters can also be set at the factory. For this purpose, the order number must be supplemented with **"-Z"**. Furthermore, **"Z = fill level software"** and the required parameters should be specified in plain text:

- NO (automatic emptying) or NC (automatic filling)
- Fill level limits adjustable via potentiometers or permanently programmed, then:
 - Lower limit of operating range (maximum fill level)
 - Upper limit of operating range (minimum fill level)
- Mean-value

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

SONPROG PC interface

Field of application

Using the SONPROG 3RX4 000 PC interface unit and the relevant software, the following Sonar-BEROs can be individually adapted to the respective application requirements:

SONPROG

- Compact ranges II and III
- Compact range M 18
- Compact form K 65.

Scope of supply

- PC interface
- Plug-in power supply unit
- Connecting leads to the PC and Sonar-BERO
- SONPROG software for Windows.



2

Programming

The new version of the SONPROG 3RX4 000 allows the user to program several Sonar-BEROs simultaneously. The lower and upper limit of the operating range can be saved at the click of a button for copying to other Sonar-BEROs.

For each BERO, the following parameters can be set:

- Lower and upper limit of the operating range
 - Differential travel
 - NO/NC switching output function
 - Switching frequency
 - Lower and upper limit of the analog characteristic
 - Analog characteristic, rising/falling
 - End of blind zone
 - End of sensing range
 - Mean-value generation
 - Sensitivity
- The function can also be set for the device:
- Multiplex function
 - Function as diffuse or reflex sensor
 - Fill level mode

The programmed values are saved in the BERO and are retained even after the interface or supply voltage has been disconnected.

The programmed values can be printed out and recorded. They will then be immediately available, for example, for series applications or for replacement of the Sonar-BERO.

Technical data

Type	3RX4 000
Required hardware	PC with VGA video card serial interface COM1 or COM2
Required software	MS-DOS, Version 3.1 upwards Windows 3.X, Windows 95, 98 Windows NT
Operating voltage range	100 to 240 V AC, 24 V DC

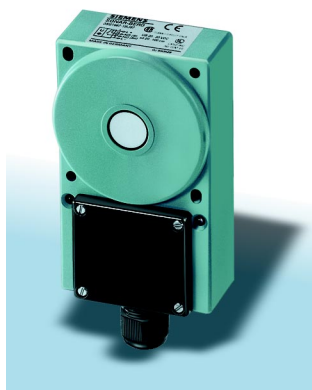
Software update on the Internet:
<http://www.siemens.de/bero>

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact range 3SG16

Field of application

The Sonar-BERO in compact form for DC is a complete factory-assembled unit, ready for connection. It cannot be combined with devices from the compact ranges and the modular range.



Design

All components are integrated into a single box-shaped housing. The ultrasonic converter and the terminal compartment are arranged on the same housing level.

The electrical connections are made via screw terminals in the terminal compartment; cable entry is through the M 20 cable gland.

Aligning unit

To make it easier to align the Sonar-BERO with the object to be detected, an aligning unit 3SX6 287 is available.

This apparatus allows swiveling about a horizontal and a vertical axis with an angle of rotation in each case of up to 30°.

Mode of operation

Range definition and adjustability

The Sonar-BERO outputs a signal as long as an object is located in the preset operating range or inhibit range within an aperture angle of approximately 5° (see the diagram).

The sensing range between 0.2 and 1 m is subdivided into 8 equal operating ranges of 0.1 m. Each operating range, B1 to B8, can be selected by setting a jumper in the terminal compartment.

The Sonar-BERO signals by means of one output and indicates with one diode (LED) whether objects are located in the preset operating range or in the so called inhibit range that lies before it.

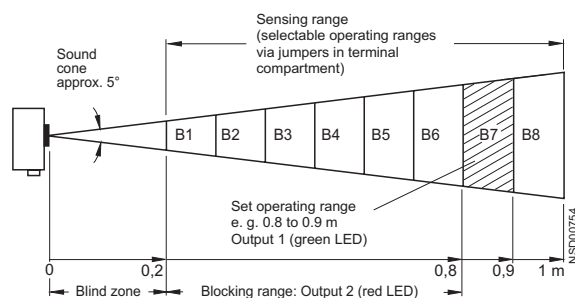
The programming connector supplied can be used to combine from two to eight of the existing individual operating ranges (B1 to B8) to form one extended switching range.

For each operating range that can only be coupled with adjacent areas, a programming connector is necessary. It is plugged into a pin connector in the terminal compartment of the unit. The possible pin assignments are shown in the cover of the terminal compartment.

Operating modes

Standard operating mode: Diffuse sensor

The Sonar-BERO switches when an object enters the sound cone from any direction; Output 14 (S) is set to the "1" signal when the object is located in a preset operating range (B1 to B8). Output 24 (SX) is set to "1" when an object is within the inhibit range. Objects within blind zone do not cause an identifiable signal change on Outputs 14 and 24.



Reflex sensor

If a reflector is set up in the preset operating range, the ultrasonic pulse can be interrupted by all objects (including sound-absorbing objects) situated in the inhibit range.

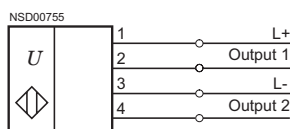
In this case, Output 14 (S) switches to the "0" signal. If a reflecting object is within the inhibit range, Output 24 (SX) will switch to the "1" signal simultaneously.

Series and parallel connection

Series connection of the Sonar-BERO (Terminal 2 or 4) is possible. The voltage drops must however be taken into account.

Parallel connection of the outputs is also possible. If the Sonar-BEROs connected in parallel are connected to different supply voltages, the outputs must be decoupled using diodes (diodes for 300 mA, 150 to 300 V blocking voltage; recommended diode type, for example, 1N4004).

Connection diagram



Sonar-BERO 3RG6 Ultrasonic Proximity Switches

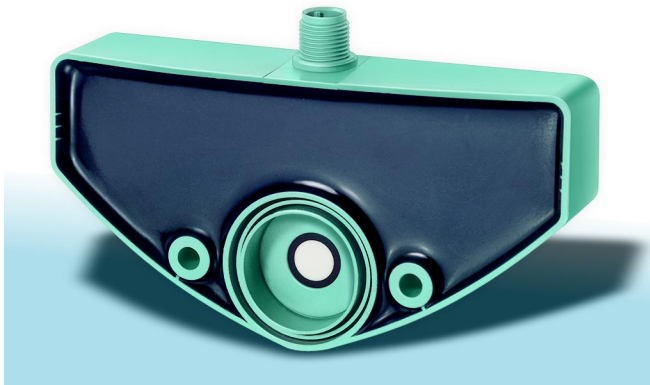
Compact form K 65

Field of application

The Sonar-BEROs of compact form K 65 are complete, factory-assembled units, ready for connection. They operate with a DC supply. Their housing design and function makes them ideal for level applications in small containers.

They cannot be combined with devices from the modular range.

The devices feature two switching outputs (S_{min} and S_{max}) to which a different distance can be assigned. This allows, for example, the minimum and maximum fill level in a tank to be evaluated. The values are set using SONPROG or by means of automatic alignment (teach-in function).



Design

All components are integrated into a rounded box-shaped housing. The ultrasonic converter is protected – set back slightly – in the housing. The integrated

circumferential seal allows the Sonar-BERO to be used directly as a cap with integrated level measurement.

The tank opening must have a minimum diameter of 26 mm. The Sonar-BERO can be connected to the tank using two M 5 bolts.

The electrical connection is made via an M 12 connector.

Mode of operation

Within the sensing range, the fill level of a container is detected. If the fill level reaches one of the two switching limits (S_{min} , S_{max}), the relevant output is set. During emptying or filling, the switching outputs remain set in accordance with the differential travel (H_{min} , H_{max}). This is signaled by the relevant LED. When the level lies between the two operating ranges, both outputs are reset (see "Definition of ranges").

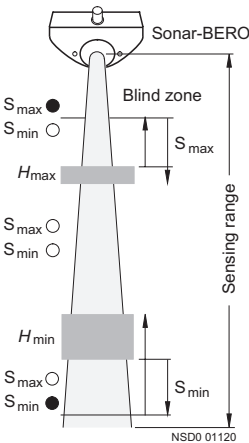
Objects within the blind zone can cause fault signals, so the customer must ensure with appropriate installation that the fill level cannot enter close range.

Adjustability

The product is supplied with the two ranges set (see Technical Data). The values are set using SONPROG 3RX4 000 or by means of automatic alignment. Alignment can be performed using the buttons of the SONPROG 3RX4 000 interface unit or via terminal XI. Special settings can be programmed on request. The following parameters can be changed using SONPROG:

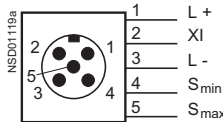
- Lower or upper limits of the two operating ranges S_{min} and S_{max}
- Differential travel (H_{min} , H_{max})
- Blind zone
- End of sensing range
- Mean-value generation
- Switching output S_{min} NO/NC

Definition of ranges



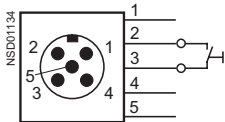
Connection diagrams

Connection



View onto rear of device

Automatic alignment



For automatic alignment, XI must be connected to L-.

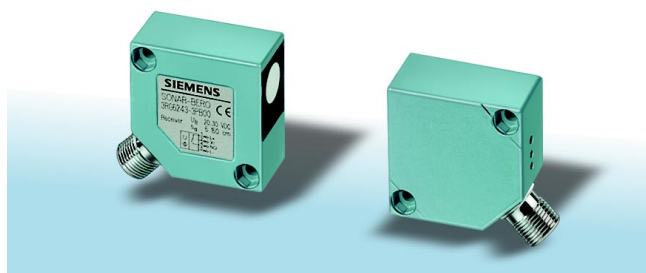
Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Sonar thru-beam sensor

Design

The sonar thru-beam sensor comprises an ultrasonic emitter and a receiver.

The emitter and receiver circuits are installed in separate box-shaped housings of molded plastic. Depending on the type selected, the electrical connection consists of either an M 8 or M 12 connector.



Mode of operation

Operating modes

The emitter of the sonar thru-beam sensor emits a narrowly focussed continuous tone in the direction of the receiver.

The receiver located opposite evaluates this ultrasonic signal. Interruption of the tone by an object will cause the output signal to change.

Adjustability

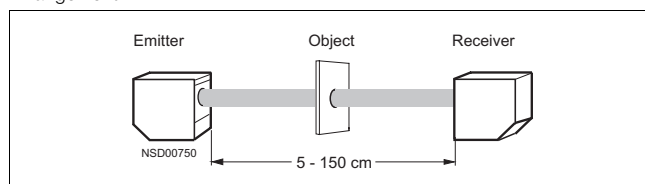
The sensitivity can be adjusted at the receiver module at terminal 2 (NO version) or 4 (NC version).

Application information

The minimum size of detectable objects depends on the distance between emitter and receiver. If the distance is less than 40 cm, objects 2 cm or larger will be detected. The gap width between two objects must be at least 3 mm.

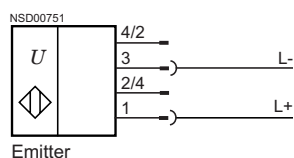
If the distance is shorter, gaps of <1 mm can even be detected. At maximum distance, objects greater than 4 cm in size can be detected. In this case, the gaps between the objects must be >1 cm.

Arrangement

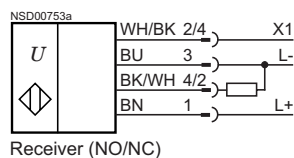
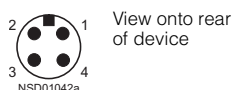


XI	Switching frequency	Emitter/receiver distance
Not connected	100 Hz	< 150 cm
L-	150 Hz	< 80 cm
L+	200 Hz	< 40 cm

Connection diagrams



Emitter



Receiver (NO/NC)

Overview

The 3RX2 210 Sonar-BERO for double-layer sheet monitoring comprises one signal evaluator and two ultrasonic sensors (emitter and receiver).

- Reliable monitoring of multilayer paper sheets, plastic sheets or metal foil
- Measuring range from 20 g paper to 1100 g card
- Manual or automatic adjustment
- Sonar sensors in M 18 housing
- Short-circuit-proof solid-state outputs (pnp)
- Connection via M 12 connector.



Mode of operation

The devices are used mainly for checking sheets of paper, plastic and metal foil. Each sheet is compared with the saved reference value and where a single-layer or double-layer sheet is measured, appropriate indication is given.

The 3RX2 210 signal evaluator constantly indicates the situation between the sonar sensors on the two outputs A1 and A2. Output A1 "Single-layer sheet" is active as long as only one sheet is positioned between the sensors. Output A2 "Double-layer sheet" is active as soon as there are two or more sheets between the sensors. Two LEDs also indicate the status of the outputs. The yellow LED A1 indicates a single-layer sheet and the red LED A2 indicates a double-layer sheet.

Programming

The signal evaluator can be set to two different modes.

Manual adjustment

Switch S1 (adjustment) is in position "1".

The device is adjusted to the material to be detected using either the "SET" button on the top of the device or a control signal on the "SET" input of the M 12 connector (Pin 5). The set value remains fixed until adjustment is performed again. The device is set by placing a single-layer sheet between the sonar sensors and activating the "SET" command.

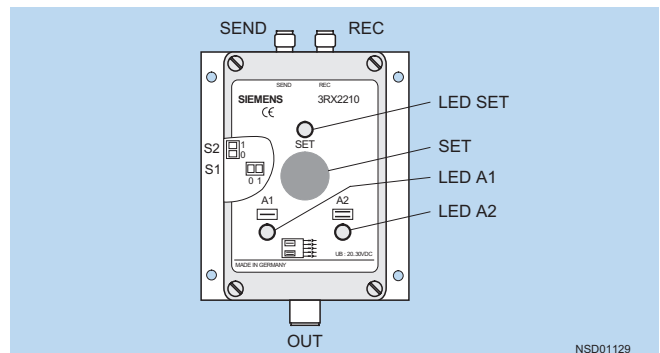
The 3RX2 210 requires up to 100 ms to readjust; i. e. the SET button must remain depressed or the "1" signal must remain applied (> 6 V) to Pin 5 for this time. During adjustment, the green LED "SET" flashes. When adjustment has been completed, it stops flashing and remains lit.

Automatic adjustment

Switch S1 (adjustment) is set to position "0" (factory setting).

Adjustment is performed either as described above, or automatically when a sheet arrives and the supply voltage is applied if a sheet lies between the sensors at this moment.

Automatic adjustment is performed when sheets are moving and when a sheet has not been detected between the sensors for 2 s.



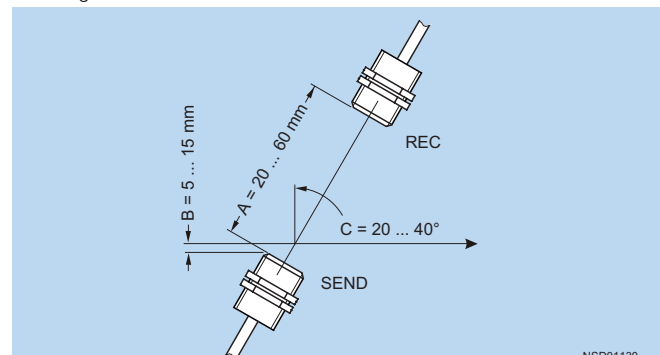
Design and installation

The emitter and receiver sensors are of an identical design and are installed at an angle of 30° (±10°) and 5° to the vertical. They are adjusted using the internal switch S2. If the system is operated at an angle between 5° and 20°, switch S2 (operating mode) must be set to position "1".

The material to be detected must be approximately 5 to 15 mm above the sensor. A larger angle of inclination will increase the flutter range, e. g. at 40° inclination, flutter is permissible within 60 % of the measuring field.

The distance between the emitter and the receiver must be at least 20 mm and can be up to 60 mm. They must be accurately aligned (±1°). If they are not aligned along the axis, the operating range is reduced.

Mounting the sensors



Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Modular range II

Overview

The Sonar-BEROs of modular range II comprise the

- 3RG61 sonar sensor and
- 3RX2 110 signal evaluator.

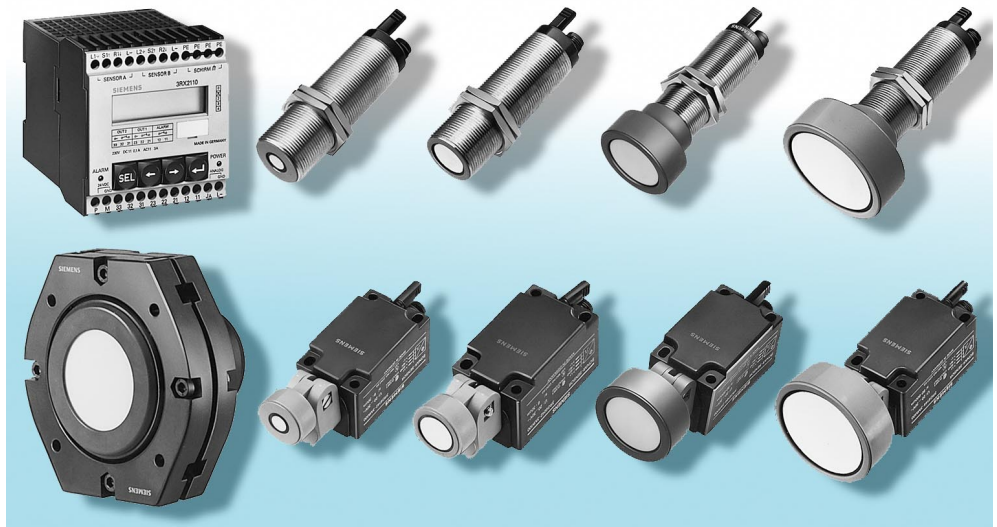
The signal evaluators are suitable for all sonar sensors of modular range II and adapt themselves automatically to the type of sensor connected.

The parameters can be set using four input keys through menu-assisted programming in English or German.

The extended version of the signal evaluator offers in addition:

- Differential measurement
- Multiplex operation with two sensors
- Calibration (correction of systematic measurement errors)

Signal evaluator and sonar sensors



Design

Sensors

There are three different sensor designs:

- Cubic sensors with a swivel sensor head
- Cylindrical sensors
- Spherical sensors

The spherical sensors can accommodate a larger converter and are therefore suitable for distances up to 10 m.

The temperature sensor is fitted to the sensor. It can also measure the ambient temperature at another location via a 2 m long extension cable 3RX1 516.

Signal evaluator

The signals output by the sensor are conditioned by the signal evaluator. It also provides the operating voltage for the sensors.

The signal evaluator is suitable for mounting on a 35 mm standard mounting rail to EN 50 022.

Control keys and an LCD display on the front panel are used for menu-assisted adjustment.

A green LED indicates the operating voltage and a red LED reports faults.

Programming

There are two menu sections for programming: The main menu and submenu. The main menu comprises the following parameters:

- Language
- Relative measurement Yes/No
 - If Yes: Reference zero point
- Lower and upper limit of the operating range

The submenu comprises the following parameters:

- Resolution
- Inhibit range expanded
- Operating range expanded
- Differential travel
- Arithmetic mean
- Switching frequency
- Axial speed
- Analog output
- Lower and upper limit of the analog range
- Reference measurement Yes/No
 - If Yes: Ref. meas. distance
 - Ref. meas. cycle

The extended version has an extended main menu with the parameters:

- Language
- Relative measurement Yes/No
 - If Yes: Reference zero point
- Differential measurement Yes/No
 - If Yes: Differential operating point
- Multiplex mode On/Off
 - If On: Min. operating point Sensor 1
 - Max. operating point Sensor 1
 - Min. operating point Sensor 2
 - Max. operating point Sensor 2

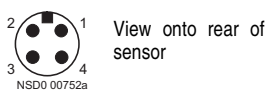
- Lower and upper limit of operating range (not for multiplex operation or differential measurement).

The submenu for the extended version also comprises the following parameters:

- Calibration On/Off
 - If On: Distance

Calibration is performed by entering the actual distance to the object. The signal evaluator calculates a correction factor from this value and the value measured by the sensor which is then applied to all the following measurements.

Connection diagram



Pin assignment
Pin 1: Supply L+
Pin 2: REC
Pin 3: Supply L-
Pin 4: SEND/TEMP

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact range III

Selection and ordering data

K III

Housing M 30 × 1.5

Adjustable via potentiometers or using SONPROG ¹⁾

SONPROG

Operates as diffuse sensor or reflex sensor

Foreground and background suppression

Synchronization capability, multiplex operation

Solid-state outputs:

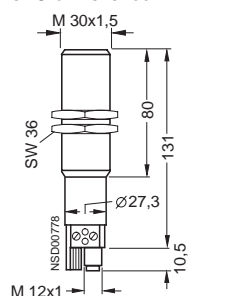
- Switching output
- Analog output

Electrical connection via M 12 connector, Type G

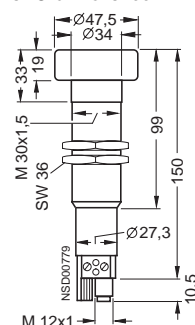
Temperature range:

- Operation –25 to 70 °C
- Storage –40 to 85 °C

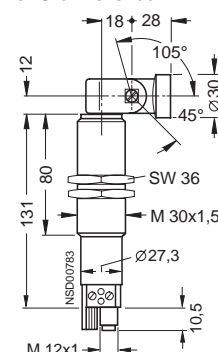
3RG 61 12–3..00
3RG 61 13–3..00



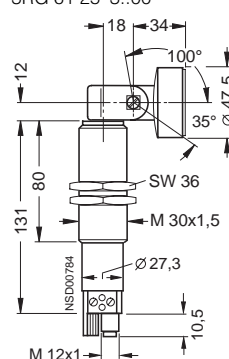
3RG 61 15–3..00



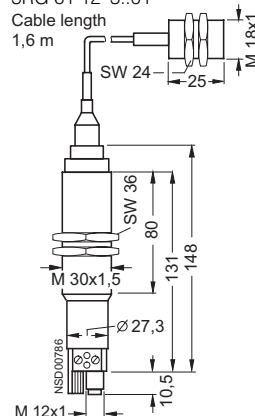
3RG 61 22–3..00
3RG 61 23–3..00



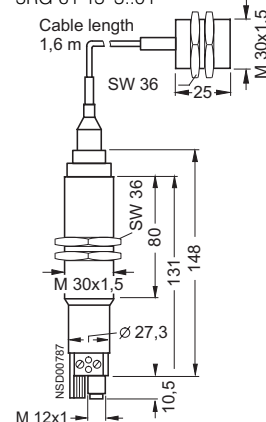
3RG 61 25–3..00



3RG 61 12–3..01



3RG 61 13–3..01



Sensing range	cm	6 to 30	20 to 130	40 to 300
Standard target	cm	1 × 1	2 × 2	5 × 5
Rated operational voltage (DC)	V	10 to 30 (± 10 % residual ripple included; for 10 to 20 V sensitivity reduced by 20 %)		
Rated operational current (NC/NO)	mA	300/150		
No-load supply current I_0	mA	< 60		
Switching frequency	Hz	5	4	2
Response time	ms	100	120	200
Power-up delay	ms	280		
Differential travel H	mm	10	10	20
Repeat accuracy R	mm	± 0.45	± 2	± 5
LED (switching state)		Yellow		
Ultrasonic frequency	kHz	400	200	120
Housing material		Brass, nickel-plated; converter cover CRAFTIN; converter coating Epoxy resin		
Degree of protection		IP 65		
Weight, approx.	kg	0.21	0.21	0.34

	Order No.	Order No.	Order No.
	Preferred type	Preferred type	Preferred type
Analog output 4 to 20 mA	1 NO, pnp 1 NC, pnp	3RG61 12–3BF00 3RG61 12–3BE00	3RG61 15–3BF00 3RG61 15–3BE00
Analog output 0 to 20 mA	1 NO, pnp 1 NC, pnp	3RG61 12–3CF00 3RG61 12–3CE00	3RG61 15–3CF00 3RG61 15–3CE00
Analog output 0 to 10 V	1 NO, pnp 1 NC, pnp	3RG61 12–3GF00 3RG61 12–3GE00	3RG61 15–3GF00 3RG61 15–3GE00
With swivel sensor			
Analog output 4 to 20 mA	1 NO, pnp 1 NC, pnp	3RG61 22–3BF00 3RG61 22–3BE00	3RG61 25–3BF00 3RG61 25–3BE00
Analog output 0 to 20 mA	1 NO, pnp 1 NC, pnp	3RG61 22–3CF00 3RG61 22–3CE00	3RG61 25–3CF00 3RG61 25–3CE00
Analog output 0 to 10 V	1 NO, pnp 1 NC, pnp	3RG61 22–3GF00 3RG61 22–3GE00	3RG61 25–3GF00 3RG61 25–3GE00
With separate sensor			
Analog output 4 to 20 mA	1 NO, pnp 1 NC, pnp	3RG61 12–3BF01 3RG61 12–3BE01	–
Analog output 0 to 20 mA	1 NO, pnp 1 NC, pnp	3RG61 12–3CF01 3RG61 12–3CE01	–
Analog output 0 to 10 V	1 NO, pnp 1 NC, pnp	3RG61 12–3GF01 3RG61 12–3GE01	–

1) Parameters can be preset to non-standard values. A programming supplement will be charged in this case per Sonar-BERO.

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact range III

Selection and ordering data

K III

Housing M 30 × 1.5

Adjustable via potentiometers or using SONPROG ¹⁾

SONPROG

Operates as diffuse sensor or reflex sensor

Foreground and background suppression

Synchronization capability, multiplex operation

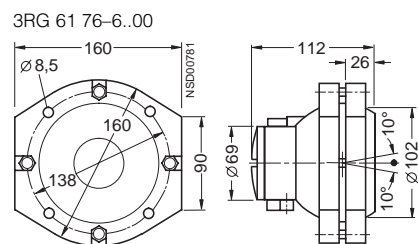
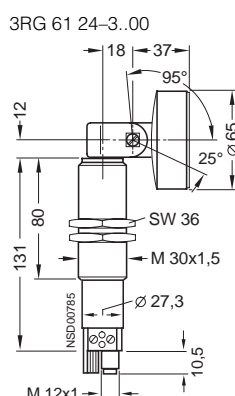
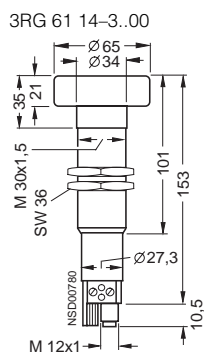
Solid-state outputs:

- Switching output
- Analog output

Electrical connection with M 12 connector, Type G or screw terminals

Temperature range:

- Operation –25 to 70 °C
- Storage –40 to 85 °C



Sensing range	cm	80 to 600	100 to 1000
Standard target	cm	10 × 10	10 × 10
Rated operational voltage (DC)	V	10 to 30 (± 10 % residual ripple included; for 10 to 20 V sensitivity reduced by 20 %)	
Rated operational current (NC/NO)	mA	300/150	
No-load supply current I_0	mA	< 60	< 75
Switching frequency	Hz	1	0.5
Response time	ms	400	800
Power-up delay	ms	280	
Differential travel H	mm	60	10
Repeat accuracy R	mm	± 9	± 2
LED (switching state)		Yellow	
Ultrasonic frequency	kHz	80	200
Housing material		Brass, nickel-plated; converter cover CRAFTIN; converter coating Epoxy resin	CRAFTIN; converter coating Epoxy resin
Degree of protection		IP 65	IP 65
Weight, approx.	kg	0.38	0.5

		Order No.	Weight, approx.	Order No.	Weight, approx.
		► Preferred type	kg	► Preferred type	kg
Analog output 4 to 20 mA	1 NO, pnp	► 3RG61 14-3BF00	0.38	—	
	1 NC, pnp	3RG61 14-3BE00	0.38	—	
		3RG61 14-3CF00	0.38	—	
		3RG61 14-3CE00	0.38	—	
Analog output 0 to 20 mA	1 NO, pnp	► 3RG61 14-3GF00	0.38	—	
	1 NC, pnp	3RG61 14-3GE00	0.38	—	
With swivel sensor					
Analog output 4 to 20 mA	1 NO, pnp	3RG61 24-3BF00	0.43	—	
	1 NC, pnp	3RG61 24-3BE00	0.43	—	
Analog output 0 to 20 mA	1 NO, pnp	3RG61 24-3CF00	0.43	—	
	1 NC, pnp	3RG61 24-3CE00	0.43	—	
Analog output 0 to 10 V	1 NO, pnp	3RG61 24-3GF00	0.43	—	
	1 NC, pnp	3RG61 24-3GE00	0.43	—	
Spherical sensor					
Analog output 4 to 20 mA	2 NO, pnp	—		3RG61 76-6BH00	
	2 NC, pnp	—		3RG61 76-6BG00	
Analog output 0 to 20 mA	2 NO, pnp	—		3RG61 76-6CH00	
	2 NC, pnp	—		3RG61 76-6CG00	
Analog output 0 to 10 V	2 NO, pnp	—		3RG61 76-6GH00	
	2 NC, pnp	—		3RG61 76-6GG00	

1) Parameters can be preset to non-standard values. A programming supplement will be charged in this case per Sonar-BERO.

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact range II

Selection and ordering data

K II

Housing M 30 × 1.5

Adjustable via potentiometers or using SONPROG ¹⁾

SONPROG

Operates as diffuse sensor or reflex sensor

Foreground and background suppression

Synchronization capability, multiplex operation

Solid-state outputs:

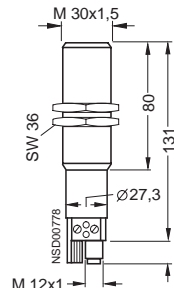
- 1 or 2 switching outputs
- Frequency output, suitable for connection to LOGO!

Electrical connection via M 12 connector, Type F

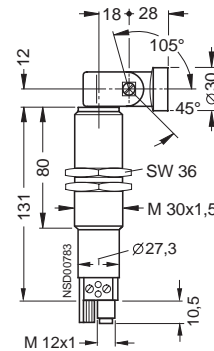
Temperature range:

- Operation –25 to 70 °C
- Storage –40 to 85 °C

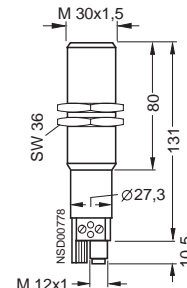
3RG 60 12–3..00



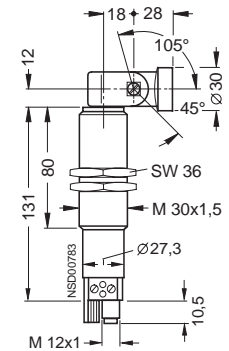
3RG 60 22–3..00



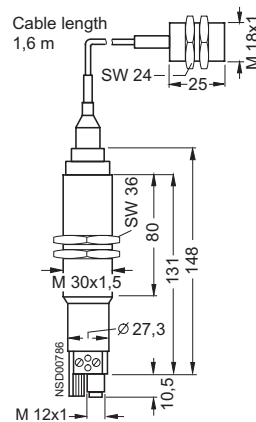
3RG 60 13–3..00



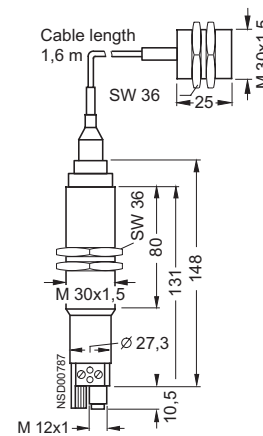
3RG 60 23–3..00



3RG 60 12–3..01



3RG 60 13–3..01



Sensing range	cm	6 to 30	20 to 130
Standard target	cm	1 × 1	2 × 2
Rated operational voltage (DC)	V	12 to 30 (± 10 % residual ripple included; for 12 to 20 V sensitivity reduced by 20 %)	
Rated operational current	mA	300	
No-load supply current I ₀	mA	< 50	
Switching frequency	Hz	8	4
Response time	ms	80	110
Power-up delay	ms	280	
Differential travel H	mm	10	10
Repeat accuracy R	mm	± 0.45	± 2
LED (switching state)		Yellow	
Ultrasonic frequency	kHz	400	200
Housing material		Brass, nickel-plated; converter cover CRAFTIN; converter coating Epoxy resin	
Degree of protection		IP 65; with separate sensor IP 68	
Weight, approx.	kg	0.21	0.21

		Order No.	Weight, approx.	Order No.	Weight, approx.
		Preferred type	kg	Preferred type	kg
1 switching output	1 NO, pnp	3RG60 12–3AF00	0.21	3RG60 13–3AF00	0.21
	1 NC, pnp	3RG60 12–3AE00	0.21	3RG60 13–3AE00	0.21
	2 NO, pnp	3RG60 12–3AH00	0.21	3RG60 13–3AH00	0.21
	2 NC, pnp	3RG60 12–3AG00	0.21	3RG60 13–3AG00	0.21
Frequency output 30 to 150 Hz, pnp suitable for LOGO!		3RG60 12–3RS00	0.21	–	
Frequency output 20 to 130 Hz, pnp suitable for LOGO!		–		3RG60 13–3RS00	0.21
With swivel sensor					
1 switching output	1 NO, pnp	3RG60 22–3AF00	0.28	3RG60 23–3AF00	0.28
	1 NC, pnp	3RG60 22–3AE00	0.28	3RG60 23–3AE00	0.28
With separate sensor					
1 switching output	1 NO, pnp	3RG60 12–3AF01	0.29	3RG60 13–3AF01	0.32
	1 NC, pnp	3RG60 12–3AE01	0.29	3RG60 13–3AE01	0.32

1) Parameters can be preset to non-standard values.
A programming supplement will be charged in this case per Sonar-BERO.

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact range II

Selection and ordering data

K II

Housing M 30 × 1.5

Adjustable via potentiometers or using SONPROG ¹⁾

SONPROG

Operates as diffuse sensor or reflex sensor

Foreground and background suppression

Synchronization capability, multiplex operation

Solid-state outputs:

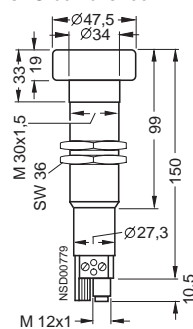
- 1 or 2 switching outputs
- Frequency output, suitable for connection to LOGO!

Electrical connection via M 12 connector, Type F

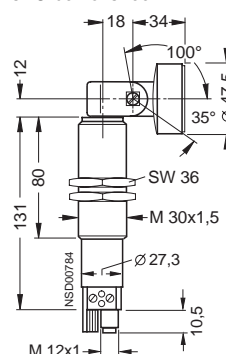
Temperature range:

- Operation –25 to 70 °C
- Storage –40 to 85 °C

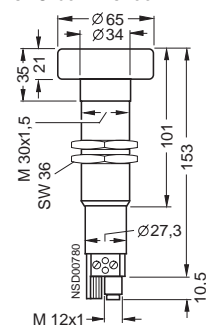
3RG 60 15–3..00



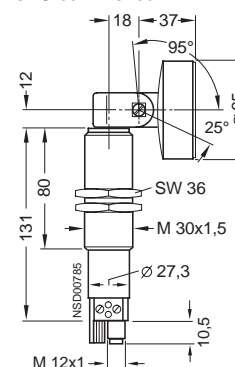
3RG 60 25–3..00



3RG 60 14–3..00



3RG 60 24–3..00



Sensing range	cm	40 to 300	60 to 600
Standard target	cm	5 × 5	10 × 10
Rated operational voltage (DC)	V	12 to 30 (± 10 % residual ripple included; for 12 to 20 V sensitivity reduced by 20 %)	
Rated operational current	mA	300	
No-load supply current I_0	mA	< 50	
Switching frequency	Hz	2	1
Response time	ms	200	400
Power-up delay	ms	280	
Differential travel H	mm	20	60
Repeat accuracy R	mm	± 5	± 9
LED (switching state)		Yellow	
Ultrasonic frequency	kHz	120	80
Housing material		Brass, nickel-plated; converter cover CRAFTIN; converter coating Epoxy resin	
Degree of protection		IP 65	
Weight, approx.	kg	0.34	0.38

		Order No.	Weight, approx.	Order No.	Weight, approx.
		Preferred type	kg	Preferred type	kg
1 switching output	1 NO, pnp	3RG60 15–3AF00	0.34	3RG60 14–3AF00	0.38
	1 NC, pnp	3RG60 15–3AE00	0.34	3RG60 14–3AE00	0.38
	2 NO, pnp	3RG60 15–3AH00	0.34	3RG60 14–3AH00	0.38
	2 NC, pnp	3RG60 15–3AG00	0.34	3RG60 14–3AG00	0.38
Frequency output 20 to 150 Hz, pnp suitable for LOGO!		3RG60 15–3RS00	0.34	–	
Frequency output 15 to 150 Hz, pnp suitable for LOGO!		–		3RG60 14–3RS00	0.38
With swivel sensor					
1 switching output	1 NO, pnp	3RG60 25–3AF00	0.36	3RG60 24–3AF00	0.43
	1 NC, pnp	3RG60 25–3AE00	0.36	3RG60 24–3AE00	0.43

¹⁾ Parameters can be preset to non-standard values.

A programming supplement will be charged in this case per Sonar-BERO.

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact range I

Selection and ordering data

K I

Housing M 30 × 1.5

Adjustable via potentiometer

Operates as diffuse sensor or reflex sensor

Solid-state output:

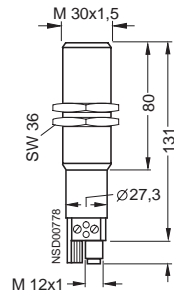
- Switching output

Electrical connection via M 12 connector, Type E, F

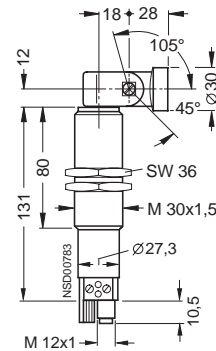
Temperature range:

- Operation –25 to 70 °C
- Storage –40 to 85 °C

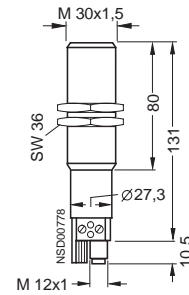
3RG 60 12–3..00



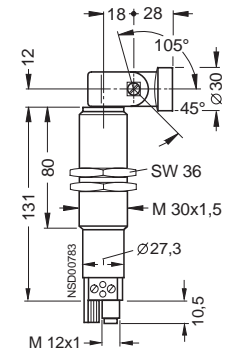
3RG 60 22–3..00



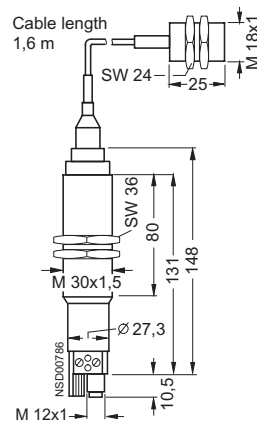
3RG 60 13–3..00



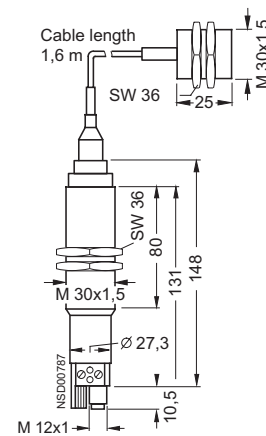
3RG 60 23–3..00



3RG 60 12–3..01



3RG 60 13–3..01



Sensing range	cm	6 to 30	20 to 130
Standard target	cm	1 × 1	2 × 2
Rated operational voltage (DC)	V	20 to 30 (± 10 % residual ripple included)	
Rated operational current	mA	300	
No-load supply current I_0	mA	< 50	
Switching frequency	Hz	10	4
Response time	ms	80	110
Power-up delay	ms	280	
Differential travel H	mm	10	10
Repeat accuracy R	mm	± 0.45	± 1.5
LED (switching state)		Yellow	
Ultrasonic frequency	kHz	400	200
Housing material		Brass, nickel-plated; converter cover CRAFTIN; converter coating Epoxy resin	
Degree of protection		IP 65; with separate sensor IP 68	
Weight, approx.	kg	0.21	0.21

Order No.		Weight, approx.	Order No.		Weight, approx.
Preferred type		kg	Preferred type		kg
▶ 3RG60 12–3AD00		0.21	▶ 3RG60 13–3AD00		0.21
3RG60 12–3AC00		0.21	3RG60 13–3AC00		0.21
3RG60 22–3AD00		0.28	3RG60 23–3AD00		0.28
3RG60 22–3AC00		0.28	3RG60 23–3AC00		0.28
3RG60 12–3AD01		0.29	3RG60 13–3AD01		0.32
3RG60 12–3AC01		0.29	3RG60 13–3AC01		0.32

With swivel sensor

1 switching output	1 NO, pnp
	1 NC, pnp

With separate sensor

1 switching output	1 NO, pnp
	1 NC, pnp

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact range I

Selection and ordering data

K I

Housing M 30 × 1.5

Adjustable via potentiometer

Operates as diffuse sensor or reflex sensor

Solid-state output:

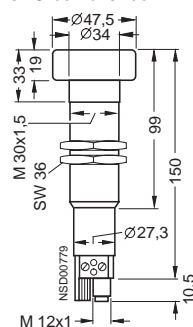
- Switching output

Electrical connection via M 12 connector, Type E, F

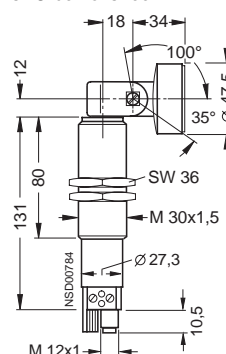
Temperature range:

- Operation –25 to 70 °C
- Storage –40 to 85 °C

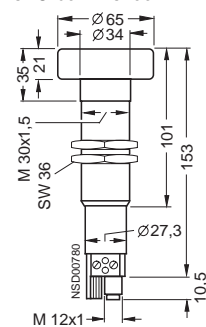
3RG 60 15–3..00



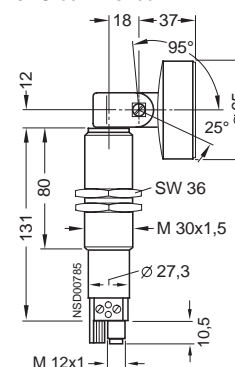
3RG 60 25–3..00



3RG 60 14–3..00



3RG 60 24–3..00



Sensing range	cm	40 to 300	60 to 600
Standard target	cm	5 × 5	10 × 10
Rated operational voltage (DC)	V	20 to 30 (± 10 % residual ripple included)	
Rated operational current	mA	300	
No-load supply rating I_0	mA	< 50	
Switching frequency	Hz	2	1
Response time	ms	200	400
Power-up delay	ms	280	
Differential travel H	mm	20	60
Repeat accuracy R	mm	± 5	± 9
LED (switching state)		Yellow	
Ultrasonic frequency	kHz	120	80
Housing material		Brass, nickel-plated; converter cover CRAFTIN; converter coating Epoxy resin	
Degree of protection		IP 65	
Weight, approx.	kg	0.34	0.38

		Order No.	Weight, approx.	Order No.	Weight, approx.
		Preferred type	kg	Preferred type	kg
1 switching output	1 NO, pnp	3RG60 15–3AD00	0.34	3RG60 14–3AD00	0.38
	1 NC, pnp	3RG60 15–3AC00	0.34	3RG60 14–3AC00	0.38
With swivel sensor					
1 switching output	1 NO, pnp	3RG60 25–3AD00	0.36	3RG60 24–3AD00	0.43
	1 NC, pnp	3RG60 25–3AC00	0.36	3RG60 24–3AC00	0.43

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact ranges M 18, M 18 S

Selection and ordering data

K M 18

Housing M 18 x 1

M 18 adjustable via potentiometers or using SONPROG ¹⁾

SONPROG

M 18 S adjustable via teach-in

Versions as diffuse sensor or reflex sensor

Foreground and background suppression

Synchronization capability, multiplex operation

Solid-state outputs:

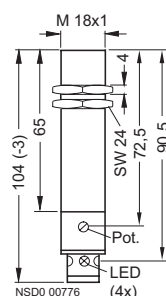
- Switching output
- Analog output (not for M 18 S)
- Frequency output

Electrical connection via M 12 connector, Type F

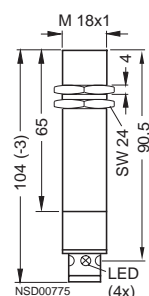
Temperature range:

- Operation -25 to 70 °C
- Storage -40 to 85 °C

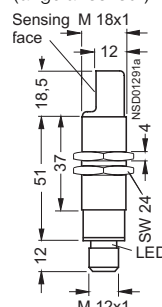
3RG 62 3.-3A.00



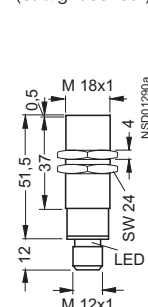
3RG 62 3.-3.S00



3RG64 2.
(angular sensor)



3RG64 3.
(straight sensor)



Type	cm	M 18	M 18 S	M 18	M 18 S
Sensing range		5 to 30	3 to 20	15 to 100	10 to 70
Standard target	cm	1 x 1	2 x 2	2 x 2	2 x 2
Rated operational voltage (DC)	V	10 to 30 (± 10 % residual ripple included; for 10 to 20 V sensitivity reduced by 20 %)	20 to 30 (± 10 % residual ripple included)	10 to 30 (± 10 % residual ripple included; for 10 to 20 V sensitivity reduced by 20 %)	20 to 30 (± 10 % residual ripple included)
Rated operational current	mA	150			
No-load supply current I ₀	mA	< 60	< 20	< 60	< 20
Switching frequency	Hz	5	10	4	5
Response time	ms	100	50	120	100
Power-up delay	ms	280	20	280	20
Differential travel H	mm	10		10	
Repeat accuracy R	mm	± 1	± 1 (freq. output ± 2.5)	± 2	± 1 (freq. output ± 2.5)
LED (switching state)		Yellow			
Ultrasonic frequency	kHz	400		200	
Housing material		Brass, nickel-plated; converter cover CRASTIN; converter coating Epoxy resin			
Degree of protection		IP 67			
Weight, approx.	kg	0.05		0.05	

Straight form M 18

Switching output	1 NO, pnp 1 NC, pnp
Analog output	4 to 20 mA 0 to 20 mA 0 to 10 V
Frequency output, suitable for LOGO!	250 to 1500 Hz 150 to 1000 Hz

Straight form M 18 S

Diffuse sensor	1 NO, pnp
Reflex sensor	1 NO, pnp
Frequency output	400 to 1600 Hz or 200 to 800 Hz 300 to 1400 Hz or 150 to 700 Hz

Angular form M 18 S

Diffuse sensor	1 NO, pnp
Reflex sensor	1 NO, pnp
Frequency output	400 to 1600 Hz or 200 to 800 Hz 300 to 1400 Hz or 150 to 700 Hz

Accessories

SONPROG interface unit,
100 to 240 V AC, 24 V DC

Order No.	Weight, approx.	Order No.	Weight, approx.
Preferred type	kg	Preferred type	kg
3RG62 32-3AB00	0.05	3RG62 33-3AB00	0.05
3RG62 32-3AA00	0.05	3RG62 33-3AA00	0.05
3RG62 32-3LS00	0.05	3RG62 33-3LS00	0.05
3RG62 32-3TS00	0.05	3RG62 33-3TS00	0.05
3RG62 32-3JS00	0.05	3RG62 33-3JS00	0.05
3RG62 32-3RS00	0.05	3RG62 33-3RS00	0.05
3RG64 32-3AB00	0.05	3RG64 33-3AB00	0.05
3RG64 32-3BB00	0.05	3RG64 33-3BB00	0.05
3RG64 32-3RS00	0.05	3RG64 33-3RS00	0.05
3RG64 22-3AB00	0.05	3RG64 23-3AB00	0.05
3RG64 22-3BB00	0.05	3RG64 23-3BB00	0.05
3RG64 22-3RS00	0.05	3RG64 23-3RS00	0.05
3RX4 000	0.5		

¹⁾ Parameters can be preset to non-standard values.
A programming supplement will be charged in this case per Sonar-BERO.

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact range 0

Selection and ordering data

K 0

Housing 65 × 88 × 30

Adjustable via potentiometer

Operates as diffuse sensor

Background suppression

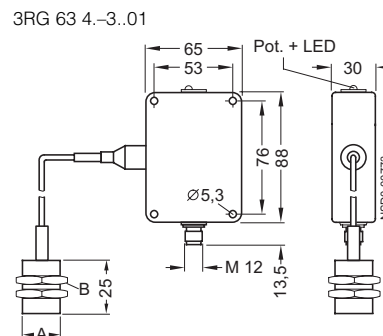
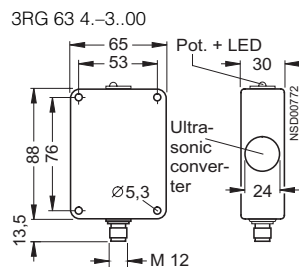
Solid-state outputs:

- Switching output
- Analog output

Electrical connection via M 12 connector, Type F

Temperature range:

- Operation 0 to 55 °C
- Storage -40 to 85 °C



Type	A	B
3RG63 42-3..01	M 18	SW 24
3RG63 43-3..01	M 30	SW 36

Sensing range	cm	6 to 30	20 to 100
Standard target	cm	1 × 1	2 × 2
Rated operational voltage (DC)	V	10 to 35 (± 10 % residual ripple included; for 10 to 18 V sensitivity reduced by 30 %)	
Rated operational current	mA	100	
No-load supply current I_0	mA	< 35	
Switching frequency	Hz	8	5
Response time	ms	70	90
Power-up delay	ms	7	
Differential travel H	mm	5	10
Repeat accuracy R	mm	± 0.45	± 1.5
LED (switching state)		Yellow	
Ultrasonic frequency	kHz	400	200
Housing material		CRASTIN; converter coating Epoxy resin	
Degree of protection		IP 65; with separate sensor IP 68	
Weight, approx.	kg	0.2	0.2

		Order No.	Weight, approx.	Order No.	Weight, approx.
		► Preferred type	kg	► Preferred type	kg
Switching output	1 NO, pnp	► 3RG63 42-3AB00	0.2	► 3RG63 43-3AB00	0.2
	1 NC, pnp	► 3RG63 42-3AA00	0.2	► 3RG63 43-3AA00	0.2
Analog output 0 to 10 V		► 3RG63 42-3JK00	0.2	► 3RG63 43-3JK00	0.2
With separate sensor					
Switching output	1 NO, pnp	3RG63 42-3AB01	0.3	3RG63 43-3AB01	0.3
	1 NC, pnp	3RG63 42-3AA01	0.3	3RG63 43-3AA01	0.3
Analog output 0 to 10 V		3RG63 42-3JK01	0.3	3RG63 43-3JK01	0.3

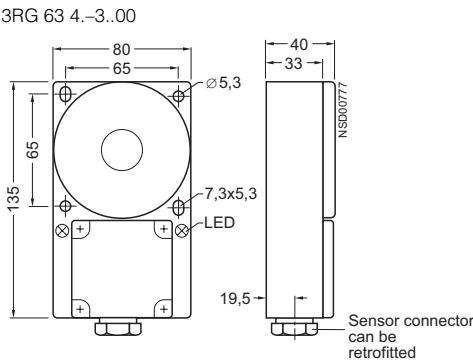
Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact form 3SG16

Selection and ordering data

KF

- Housing 80 × 130 × 40
Adjustable via plug-in jumpers
Operates as diffuse sensor or reflex sensor
Foreground and background suppression
Solid-state outputs:
• 2 switching outputs
Terminal compartment with screw-type terminals
Temperature range:
• Operation –25 to 70 °C
• Storage –40 to 85 °C



Sensing range	cm	20 to 100
Standard target	cm	2 × 2
Rated operational voltage (DC)	V	10 to 35 (± 10 % residual ripple included; for 10 to 18 V sensitivity reduced by 30 %)
No-load supply current I_0	mA	< 60
Switching output		
• Rated operational current	mA	150
• Voltage drop	V	2
• Off-state current	mA	0.01
Switching frequency	Hz	4
Response time	ms	120
Power-up delay	ms	280
Differential travel H	mm	10
Repeat accuracy R	mm	± 2
LED (switching state)		Yellow
Ultrasonic frequency	kHz	200
Housing material		CRASTIN; converter coating Epoxy resin
Degree of protection		IP 65
Weight, approx.	kg	0.39

	Order No.	Weight, approx.
	▶ Preferred type	kg
2 switching outputs	▶ 3SG16 67-1BJ87	0.39

Accessories	
Aligning unit	3SX6 287

2

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Compact form K 65

Selection and ordering data

K 65

Housing 65 × 120 × 30
Adjustable via teach-in or
SONPROG

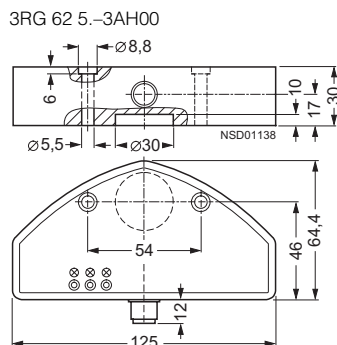
SONPROG

Operates as diffuse sensor or reflex
sensor

Solid-state outputs:
• 2 switching outputs

Electrical connection via M 12
connector, Type G

Temperature range:
• Operation –25 to 70 °C
• Storage –40 to 85 °C



Sensing range	cm	6 to 50	20 to 150	25 to 250
Standard target	cm	1 × 1	2 × 2	5 × 5
Rated operational voltage (DC)	V	20 to 30 (± 10 % residual ripple included)		
No-load supply current I_0	mA	< 60		
Switching output				
• Rated operational current	mA	150		
• Voltage drop	V	2		
• Switching output function S_{max}		NO		
• Switching output function S_{min}		NO/NC programmable		
Ultrasonic frequency	kHz	400	200	100
Measurement rate	ms	20	25	50
Switching limit				
• S_{max}	cm	8	25	35
• S_{min}	cm	45	140	230
Differential travel H				
• H_{max} (adjustable)	cm	2	5	10
• H_{min} (adjustable)	cm	10	10	20
LED (switching state)		2 × yellow		
LED (operation)		Green		
Housing material		CRASTIN; converter coating Epoxy resin		
Degree of protection		IP 65		
Weight, approx.	kg	0.5		

	Order No.	Order No.	Order No.
2 switching outputs 2 NO, pnp	3RG62 52-3AH00	3RG62 53-3AH00	3RG62 55-3AH00
Accessories			
SONPROG interface unit, 100 to 240 V AC, 24 V DC	3RX4 000		

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Sonar thru-beam sensor

Selection and ordering data

Sonar thru-beam sensor

Housing 40 × 40 × 19

3 measurement ranges can be set

Operates as thru-beam sensor
with emitter and receiver

Solid-state output:

- Switching output

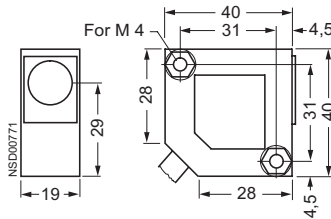
Connection:

- With 3 m cable
- With M 8 connector, Type B
- With M 12 connector, Type F

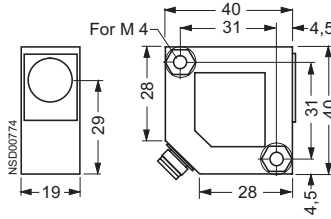
Temperature range:

- Operation 0 to 70 °C
- Storage -25 to 85 °C

3RG62 43-0..00



3RG62 43-3..00. 3RG62 43-7..00



Sensing range	cm	– (receiver)	5 to 150 (emitter)
Standard target	cm	2 × 2	
• Up to 40 cm	cm	1 × 1	
• Over 40 cm	cm		
Rated operational voltage (DC)	V	20 to 30 (± 10 % residual ripple included)	
Rated operational current	mA	100	–
No-load supply current I_0	mA	< 20	< 30
Switching frequency	Hz	200	–
• Up to 40 cm	Hz	150	–
• Up to 80 cm	Hz	100	–
• Up to 150 cm	Hz		–
Response time	ms	2	–
• Up to 40 cm	ms	1.5	–
• Up to 80 cm	ms	1	–
• Up to 150 cm	ms	< 40	–
Power-up delay	ms		
LED (status indication)		Green	
Ultrasonic frequency	kHz	–	200
Housing material		CRASTIN; converter coating Epoxy resin	
Degree of protection		IP 65	
Weight, approx.	kg	0.2	0.2

Receiver		Order No.	Weight, approx.	Order No.	Weight, approx.
Preferred type		kg	kg	kg	kg
With cable, 3 m, switching output	1 NO, pnp	▶ 3RG62 43-0PB00	0.2		
	1 NC, pnp	3RG62 43-0PA00	0.2		
With M 8 connector, 4-pole, switching output	1 NO, pnp	▶ 3RG62 43-7PB00	0.2		
	1 NC, pnp	3RG62 43-7PA00	0.2		
With M 12 connector, 4-pole, switching output	1 NO, pnp	▶ 3RG62 43-3PB00	0.2		
	1 NC, pnp	3RG62 43-3PA00	0.2		
Emitter					
With 3 m cable				▶ 3RG62 43-0NN00	0.2
With M 8 connector, 4-pole				3RG62 43-7NN00	0.2
With M 12 connector, 4-pole				▶ 3RG62 43-3NN00	0.2

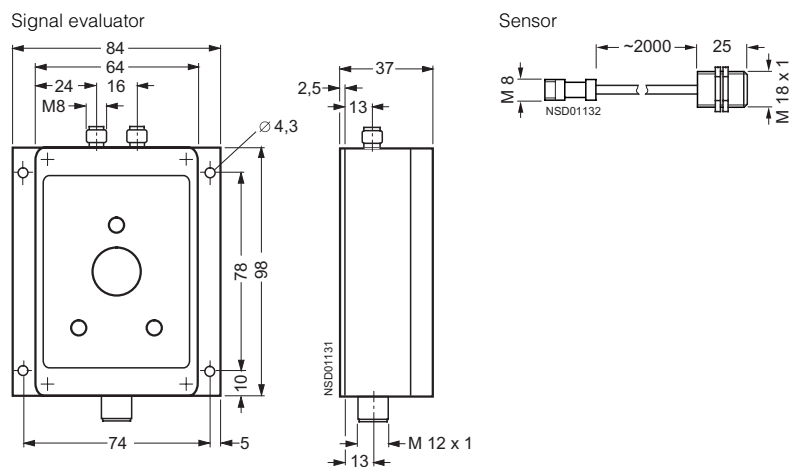
Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Double-layer sheet monitoring

Selection and ordering data

DK

Housing 84 × 98 × 37
 Adjustable via teach-in
 With 2 separate sensors
 Solid-state outputs:
 • 2 switching outputs
 Electrical connection via M 12 connector, Type G
 Temperature range:
 • Operation 0 to 65 °C
 • Storage -40 to 85 °C



Sensing range	mm	20 to 60
Material thickness (paper, card)	g	20 to 1100
Rated operational voltage (DC)	V	18 to 36 (± 10 % residual ripple included)
No-load supply current I_0	mA	< 75
Switching output		
• Rated operational current	mA	200
• Voltage drop at 200 mA	V	< 3
Switching frequency	Hz	100
Response time	ms	5
LED (switching state)		Red and yellow
Ultrasonic frequency	kHz	200
Housing material		
• Signal evaluator		Metal
• Sensor		Brass, nickel-plated; converter coating Epoxy resin
Degree of protection		IP 65
Weight, approx.	kg	0.5

	Order No.	Weight, approx.
		kg
2 switching outputs	2 NO, pnp	3RX2 210
		0.5

Selection and ordering data

B II

Signal evaluator

Adjustable via four keys
and a two-line LCD

Operates as diffuse sensor or reflex
sensor

Outputs:

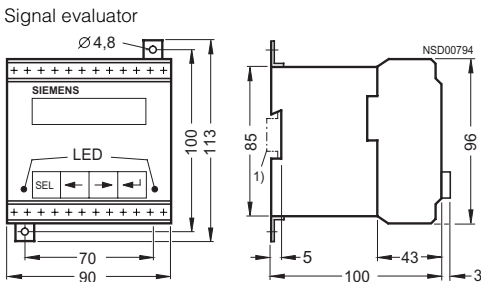
- 2 switching outputs
- 1 analog output
- 1 alarm output
- 1 relay output

Connections

- Screw terminals

Temperature range:

- Operation 0 to 55 °C
- Storage -10 to 70 °C

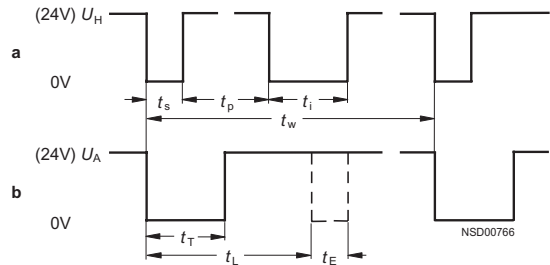


Rated operational voltage (DC)	V	20 to 30 (± 10 % residual ripple included)
No-load supply current I_0	mA	< 150
Switching output		
• Current I_0 /AC-12 at 230 V	A	3.0
• Current I_0 /DC-12 at 230 V	A	0.1
• Life at switching frequency of 5000/h		30 million operating cycles
Analog output		
• Range	mA	4 to 20
• Burden	Ω	0 to 500
• Max. voltage	V	10
• Resolution	bit	8
Switching frequency	Hz	Depending on sensor type
Response time	ms	Depending on sensor type
Display		LCD, 2 lines of 16 characters
Mounting		Screw fitting or snap-on fitting (standard mounting rail)
Cable to sensor		max. 100 m (shielded)
Housing material		CRASTIN
Degree of protection		IP 20
Weight, approx.	kg	0.6
Order No.		Weight, approx.
▶ Preferred type		kg
▶ 3RX2 110		0.6
Standard version		
Extended version		3RX2 110-1A 0.6

Time diagram

a: Input SEND, output TEMP

b: Output REC



Values depend on sensor type,
see following pages.

Sending pulse width t_s
Temperature pulse time t_p
Temperature pulse width t_i
Cycle time t_w

Sending deadtime t_T
Sound propagation time t_L
Echo duration t_E

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Modular range II

Selection and ordering data

B II

External sensors

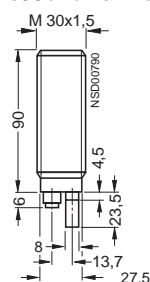
Connections

- M 12 connector

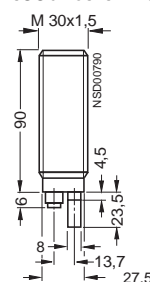
Temperature range:

- Operation 0 to 55 °C
- Storage -10 to 70 °C

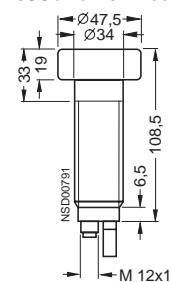
3SG61 52-3MM00



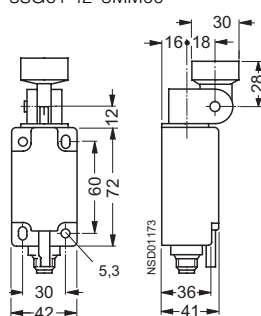
3SG61 53-3MM00



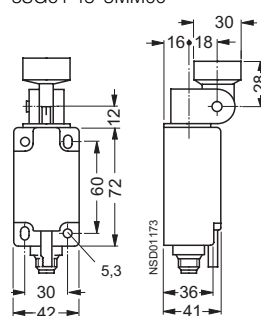
3SG61 52-3MM00



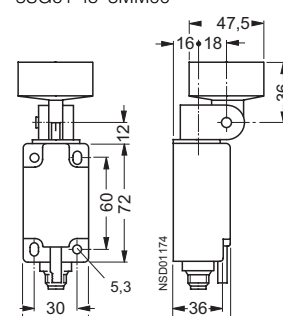
3SG61 42-3MM00



3SG61 43-3MM00



3SG61 45-3MM00



Sensing range	cm	6 to 30	20 to 130	40 to 300
Standard target	cm	1 x 1	2 x 2	5 x 5
Rated operational voltage (DC)	V	20 to 30 (±10 % residual ripple included)		
No-load supply current I_0	mA	< 30		
Switching frequency	Hz	1 to 20	1 to 10	1 to 4
Power-up delay	ms	< 50		
Differential travel H	mm	Adjustable		
Resolution	mm	1	1	10
Ultrasonic frequency	kHz	400	200	120
Sending pulse width t_s	µs	70 to 80	140 to 160	235 to 265
Temperature pulse time t_p	ms	9 to 12	18 to 24	30 to 40
Temperature pulse width t_i	µs	350 to 750		
Cycle time t_W	ms	> 13	> 25	> 50
Sending deadtime t_T	ms	< 0.35	< 1.17	< 2.33
Echo duration t_E	µs	40 to 400	100 to 800	100 to 800
Housing material		CRASTIN; converter coating Epoxy resin		
• 3RG61 4.		Brass, nickel-plated; converter cover CRASTIN; converter coating Epoxy resin		
• 3RG61 5.		IP 65		
Degree of protection				
Weight, approx.	kg	0.27	0.27	0.3
• 3RG61 4.	kg	0.21	0.21	0.3
• 3RG61 5.				
		Order No.	Order No.	Order No.
		► Preferred type	► Preferred type	► Preferred type
Cubic housing with a swivel sensor		► 3RG61 42-3MM00	► 3RG61 43-3MM00	► 3RG61 45-3MM00
Cylindrical housing M 30 x 1,5		3RG61 52-3MM00	3RG61 53-3MM00	3RG61 55-3MM00

Sonar-BERO 3RG6 Ultrasonic Proximity Switches

Modular range II

Selection and ordering data

B II

External sensors

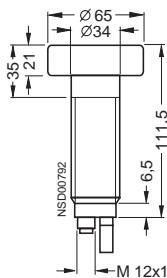
Connections

- M 12 connector

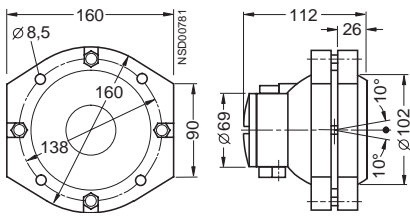
Temperature range:

- Operation 0 to 55 °C
- Storage -10 to 70 °C

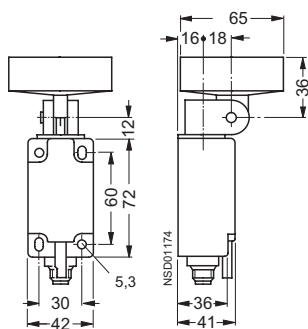
3SG61 54-3MM00



3SG61 74-6MM00,
3SG61 76-6MM00



3SG61 44-3MM00



Sensing range	cm	60 to 600	80 to 1000
Standard target	cm	10 × 10	20 × 20
Rated operational voltage (DC)	V	20 to 30 (±10 % residual ripple included)	
No-load supply current I_0	mA	< 30	
Switching frequency	Hz	1 to 3	1 to 2
Power-up delay	ms	< 50	
Differential travel H	mm	Adjustable	
Resolution	mm	10	10
Ultrasonic frequency	kHz	80	60
Sending pulse width t_s	μs	330 to 370	470 to 530
Temperature pulse time t_p	ms	45 to 60	60 to 80
Temperature pulse width t_t	μs	350 to 700	
Cycle time t_W	ms	> 95	> 130
Sending deadtime t_f	ms	< 3.5	< 4.66
Echo duration t_E	μs	200 to 5000	200 to 5000
Housing material		CRASTIN; converter coating Epoxy resin	
• 3RG61 4., 3RG61 7.		Brass, nickel-plated; converter cover CRASTIN; converter coating Epoxy resin	
• 3RG61 5.		IP 65	
Degree of protection			
Weight, approx.			
• 3RG61 4.	kg	0.39	—
• 3RG61 5.	kg	0.38	—
• 3RG61 7.	kg	1.85	1.9

	Order No.	Order No.
	Preferred type	
Cubic housing with a swivel sensor	3RG61 44-3MM00	—
Cylindrical housing M 30 × 1,5	3RG61 54-3MM00	—
Spherical housing	3RG61 74-6MM00	3RG61 76-6MM00