**MICROSONAR**
MS-100
MS-300
MS-800

## OPERATION

The **MICROSONAR** is a distance sensor, which uses ultrasonic measurement. It senses any object within it's measuring range that is in line with its centre line and has a perpendicular surface and good reflecting characteristics.
The sensor measures the distance by sensing the time-span of the echo return and it is fully temperature compensated.

USER'S MANUAL

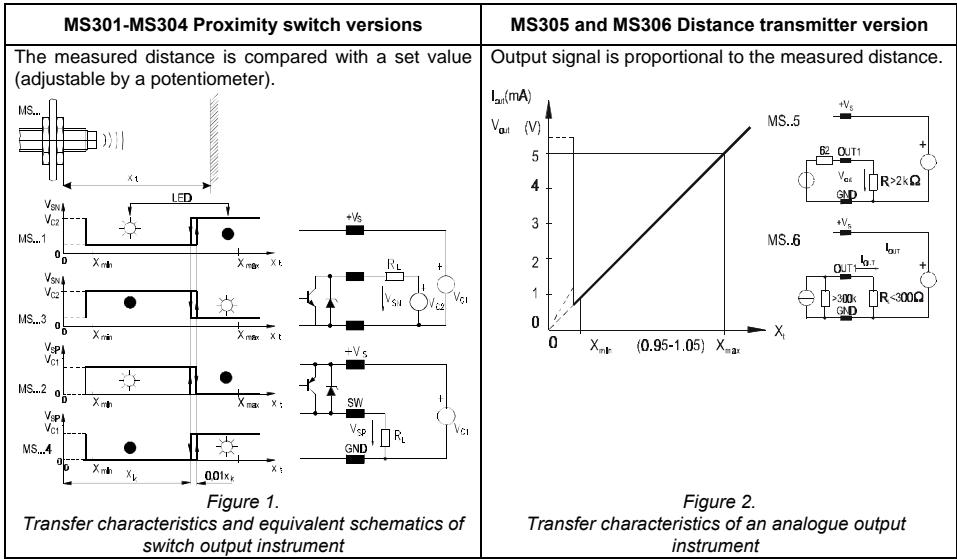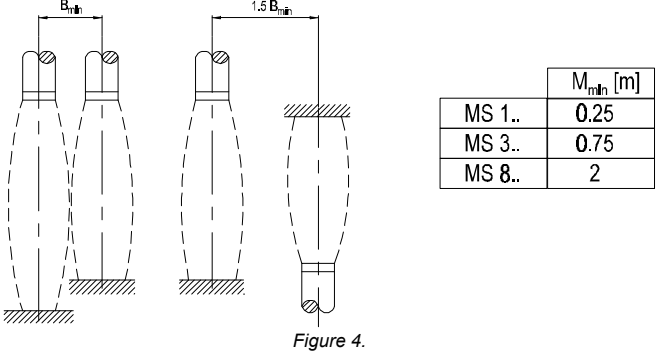| **MS301-MS304 Proximity switch versions** | **MS305 and MS306 Distance transmitter version** |
|---|---|
| The measured distance is compared with a set value (adjustable by a potentiometer). | Output signal is proportional to the measured distance. |
|  |  |
| *Figure 1.*<br>*Transfer characteristics and equivalent schematics of switch output instrument* | *Figure 2.*<br>*Transfer characteristics of an analogue output instrument* |

Figure 3. shows the reliable sensing limits of an object with surface perpendicular to the centre line of the instrument. In the same figure, we illustrated with a dashed line what distance the edges of any large obstructing object may approach the centre line, which may be in the zone between the reflecting surface and the sensor.

*Figure 3.*
*Sensing characteristics*
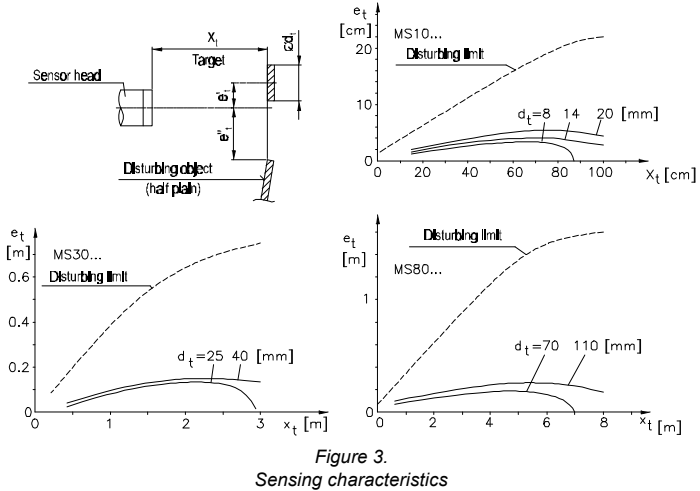
Ultrasound devices using identical frequency will interfere with each other. To avoid this, the devices should have at least the distance between them according to Figure 4.



| | $M_{min}$ [m] |
|---|---|
| MS 1.. | 0.25 |
| MS 3.. | 0.75 |
| MS 8.. | 2 |

*Figure 4.*
*Minimum distance between instruments working besides each other.*

In sensing moving objects the reaction time of the sensor is significant and depends on the ultrasound transmitting period ($T_p$).
The output switch should operate within $t < 1{,}25\, T_p$ time after the object appears in the sensing zone and switch again within $t < 1{,}25\, T_p$ period after the object passes out of the sensing zone.
The object passing through the sensing zone should stay within the sensing zone for at least $t > 2{,}2\, T_p$ time in order for it to be reliably sensed.

In case of badly reflecting surfaces or moving objects or in case of stronger wind, it can happen that some echos do not return to the sensor. In this case the switch shall switch to a condition for $T_p$ period of time, as if the object were outside the switching distance.

In the analogue output sensors (MS...5, MS...6) the $T_p$ measuring time interval is varying. In the case the dynamic behaviour of the sensor is characterised by the $T_b$ settling time, which is the settling of the output signal after a sudden change of the target distance (Figure 5.)

The impulse output increases the application possibilities of the instrument (Figure 6.). The output signal in the proximity switches is a $T_p$ period pulse, the width $T_i$ of which is proportional to the measured distance $T_i = x_t \cdot 5.81$ ms/m. The pulse width is not compensated by temperature.
The impulse of analogue output sensors is a rectangular signal with a time of $T_p = 1.9\, T_i$. The period time is temperature compensated.
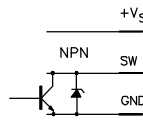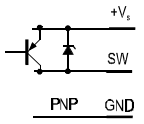


*Figure 5.*
*Settling of the analogue output signal*
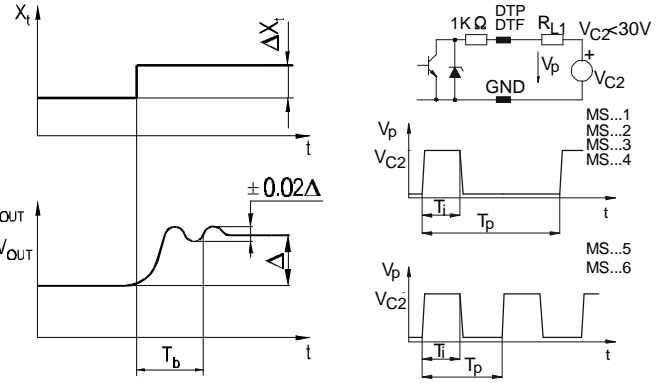


$T_i$ = Time proportional with distance,
$T_p$ = Burst period
*Figure 6. - Pulse output*

# TECHNICAL DATA

| Type | | MS101-MS104 | MS105-MS106 | MS301-MS304 | MS305-MS306 | MS801-MS804 | MS805-MS806 |
|---|---|---|---|---|---|---|---|
| Range | $X_{min}$(m) | 0.2 | | 0.3 | | 0.5 | |
| | $X_{max}$(m) | 1.0 | | 3.0 | | 8.0 | |
| Ultrasonic freq. | | 160 kHz | | 60 kHz | | 40 kHz | |
| Full beam angle | | 5° | | | | | |
| Burst period | | 25 ms | Changing | 75 ms | Changing | 200 ms | Changing |
| Switching time | | <32 ms | - | <95 ms | - | <250 ms | - |
| Settling time | | - | 125 ms | - | 375 ms | - | 1000 ms |
| Reproducibility | | ±0.5% | ±2 mm | ±0.5% | ± 6 mm | ±0.5% | ±5 mm |
| Linearity | | - | ±8 mm | - | ±25 mm | - | ±50 mm |
| Temperature coefficient | | 0.03% / °C | | | | | |
| Outputs | | see Table 1. Output variations | | | | | |
| Hysteresis | | 1% | - | 1% | - | 1% | - |
| Polarity & short circuit protection | | yes | | | | | |
| Operating voltage | | 10,8 V ... 26,4 V DC | | | | | |
| Current cons., @12 V (mA) | | < 30 | < 50 | < 28 | < 38 | < 26 | < 36 |
| Current cons., @24 V (mA) | | < 32 | < 65 | < 32 | < 58 | < 32 | < 55 |
| Mechanical protection | | IP 65 | | | | | |
| Ambient temperature | | -10...+60°C | | | | | |
| Housing | | Brass, Nickel plated  polypropylene | | | | | |
| Mass | | appr. 0.2 kg | | appr. 0.45 kg | | appr. 0.85 kg | |

| Type | MS101 MS301 MS801 | MS103 MS303 MS803 | MS102 MS302 MS802 | MS104 MS304 MS804 | MS105 MS305 MS805 | MS106 MS306 MS806 |
|---|---|---|---|---|---|---|
| Output | NPN | PNP | NPN | PNP | - | - |
| Switching condition | **t < k** | **t > k** | **t < k** | **t > k** | - | - |
| Switching voltage | max. 30 V DC | | | | - | - |
| Switching current | max. 120 mA | | | | - | - |
| Output voltage residue at max. current | <2.5 V | | | | - | - |
| Analogue output adjustable by (±5%) | - | | | | 0...5 V | 0...5 mA |
| Permissible load | - | | | | > 2 kΩ | < 300Ω |

*t = target distance     k = set switching distance*

*Table 1. Output variations*

## ACCESSORIES

2 pcs.    Mounting nuts
1 pc.    User's manual

## DIMENSIONS



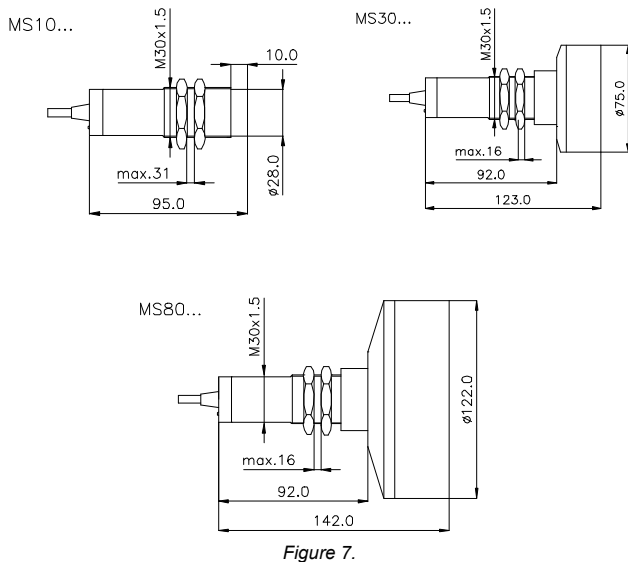*Figure 7.*

# INSTALLATION

The instrument can be fixed in a 31 mm diameter hole. The sensor head must not be used as an attachment surface.
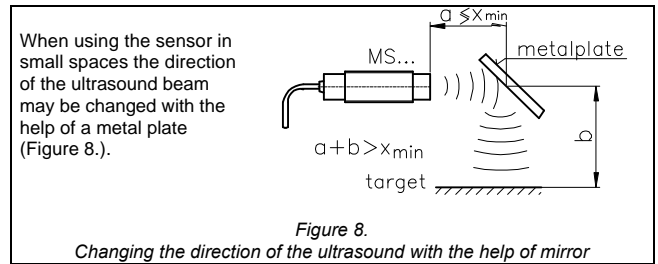
When using the sensor in small spaces the direction of the ultrasound beam may be changed with the help of a metal plate (Figure 8.).



*Figure 8.*
*Changing the direction of the ultrasound with the help of mirror*

# CALIBRATION

| Type | Designation | Colour of cable |
|---|---|---|
| MS..1 MS..2 MS..3 MS..4 | +$V_S$ | brown |
| | SW (OUT1) (Switch output, See Figure 1.) | green (black) |
| | DTP (OUT2) (Puls output) | white |
| | GND | shield (blue) |
| MS..5 MS..6 | +$V_S$ | brown |
| | $I_{out}$, $V_{out}$ (OUT1) (Distance proportional output) | green (black) |
| | DTF (OUT2) (Puls output) | white |
| | GND | shield (blue) |

*Table 2.*
*Electric connection*

During the installing, use the precautions commonly used to avoid ESD (Ex.: before wiring, touch the shielding of the cable).
The instrument is ready for operation once it is properly connected and the voltage is switched on.

**Switch output versions – setting the switching distance:**
1). Place the target object or any other flat surface to the required switching distance.
2). Rotate the potentiometer while observing the LED status (Figure 1.) for desired operation.

**Analogue output versions – calibration of distance measurement accuracy:**
The distance proportional output signal can be offset by +/-5%.
Use the potentiometer beside the cable outlet.

# MAINTENANCE AND REPAIR

The device does not require routine maintenance. In some instances, however, the probe may need occasional cleaning to remove surface deposits. Avoid cleaning with abrasive tools. Repairs during or beyond the guarantee period are carried out solely by the manufacturer.

# STORAGE CONDITIONS

Ambient temperature:  -20°C...+60°C

# WARRANTY

All Nivelco products are warranted free of defects in materials or workmanship for a period of 2 (two) years from the date of purchase.
All repairs under guarantee are carried out at the Manufacturer's premises. Models returned to the manufacturer will not be handled unless they are cleaned and desinfected.
The Purchaser is liable for costs of dismantling and re-installation as well as transport costs.
Nivelco shall not be liable for misapplication, labour claims, direct or consequential damage or expense arising from the installation or use of equipment.