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1. PRELIMINARY REMARKS

Before proceeding with the installation of the product, read carefully the following instructions.

During machining, remove any accumulation of swarfs, dusts, etc. that does not allow the free sliding of the movable parts.

The use of a protection cover is recommended to prevent any damage from falling tools or material.

i Verify that all the tools used for mounting are strictly demagnetized.

2. RESISTANCE TO CHEMICAL AGENTS

LOW-IMPACT AGENTS

Formic acid, lactic acid, formaldehyde 40%, glycerine 93°C, hexane, isooctane, linseed oil, cotton oil, soybean oil, mineral oil.

MEDIUM-IMPACT AGENTS

Acetylene, acetone, acetic acid, oleic acid, stearic acid 70°C, seawater, ammonia, gasoline, ether isopropyl, petroleum, vapour.

STRONG-IMPACT AGENTS

Nitric acid, benzene, dimethylbenzene, tetraethyl furan, nitrobenzene, solvent, toluene, carbon tetrachloride, turpentine, trichloroethylene.

3. FIXING OF MAGNETIC BAND CSMA

i During mounting, the magnetic band has to be adequately centered on the measuring length.

The magnetic band can be fixed on any kind of non-magnetic surface. For a better protection of the magnetic band from shavings, liquids, powder, etc., we recommend the use of the protective cover PS (2), or of the aluminium support AP (see the picture in the right of the page).

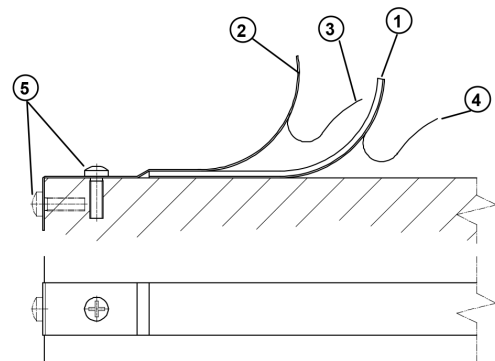
The best gluing temperature is between 20 °C and 30 °C. It is not advisable to perform the operation at temperatures below 10 °C.

In case the magnetic band has been stocked at a lower or higher temperature than the machine, it is advisable to wait some hours before gluing it, to stabilize the magnetic

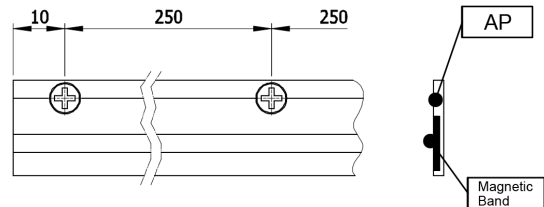
band. The adhesion of glued parts is completed after at least 48 hours.

To glue the magnetic band, proceed as follows:

- > Clean carefully the fixing surface from oil, grease or any kind of dirt, using trace-free solvents.
- > Raise few centimeters of the adhesive protection (4) and place the magnetic band properly, exerting a light pressure on the initial adhesive zone.
- > Proceed with the magnetic band fixing, removing progressively the adhesive protection and exerting a uniform pressure. If possible, use a small manual roller.
- > Proceed as above to glue the stainless steel cover tape on the magnetic band, after having accurately cleaned the surface.
- > Use the exceeding part of the protective cover tape for its mechanical fixing and ground connection, by means of screws M3x8 (5).



RECOMMENDED FIXING OF SUPPORT AP



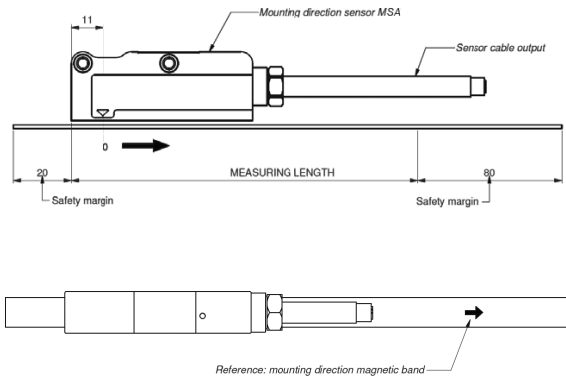
! It is not possible to use the AP support if the magnetic band is already protected by the PS cover.

4. MSA SENSOR MOUNTING

i Before turning on the MSA sensor, make sure it is properly mounted.

Use the two M4 threaded holes to fix the magnetic sensor. As an alternative, they can be used as through holes for TCEI M3x18 screws. For the zero reference definition and the sensor and magnetic band mounting, refer to the picture below.

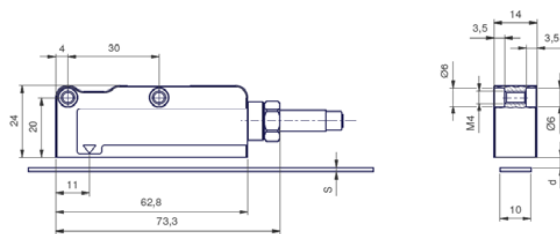
Once the mechanical mounting has been concluded, place the power supply cable and manually cover the entire measuring length to make sure that both the sensor and the cable are able to move without interferences.



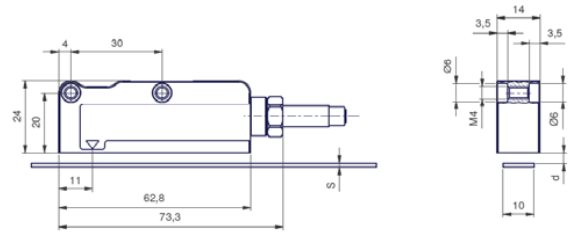
Check the respect of the alignment tolerances and the distance between sensor and magnetic band along the entire measuring length. Any positioning error must be corrected.

Spacer blocks or supporting arms should be adequately sized and made rigid to exclude any flexion or vibration that could compromise the system's accuracy.

DIMENSIONS AND DRILLING DIAGRAM

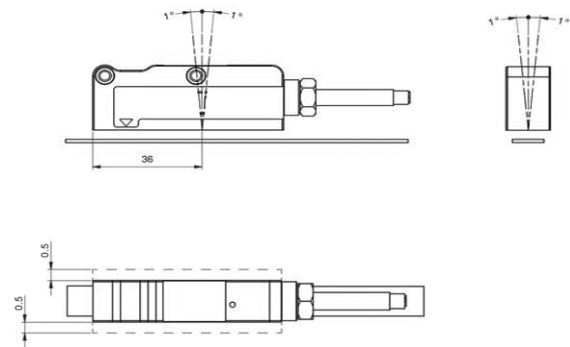


	CSMA	CSMA + PS	CSMA + AP
S (mm)	1.3	1.6	2.1
d (mm)	0.3 ÷ 1	0.7 MAX	0.2 MAX



	CSMA	CSMA + PS	CSMA + AP
S (mm)	1.3	1.6	2.1
d (mm)	0.3 ÷ 1	0.7 MAX	0.2 MAX

ALIGNMENT TOLERANCES



5. CABLES AND ELECTRICAL CONNECTIONS

+ Analog Output + Serial Output

The MSA absolute magnetic scale is supplied with a 10-wire shielded cable, Ø = 6.2 mm, PUR external sheath.

Inside the cable, a further shield for the twisted pair of the analog signals (SIN, COS) is present.

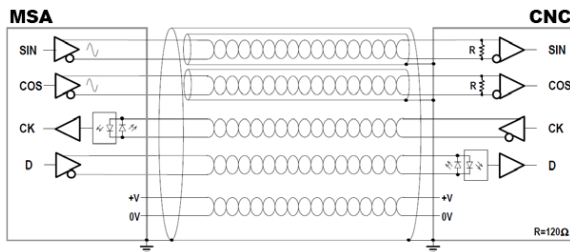
Conductors section:

- > Supply: 0.29 mm²
- > Signals: 0.10 mm²

i The cable's bending radius should not be lower than 70 mm.

The following output signals are available:

SIGNALS	CONDUCTOR COLOR
+ V	Red
0 V	Blue
A	Green
\tilde{A}	Orange
B	White
\tilde{B}	Light-blue
CK	Brown
CK-	Yellow
D	Pink
D-	Grey
SCH	Shield



Serial Output

The MSA absolute magnetic scale is supplied with a 6-wire shielded cable, $\varnothing = 7$ mm, PVC external sheath, with low friction coefficient, oilresistant, and suitable for continuous movements.

Conductors section:

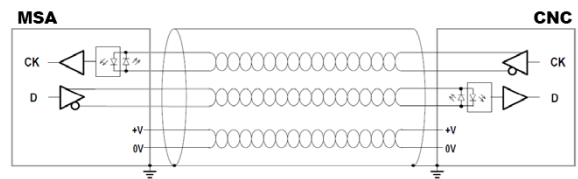
- > Supply: 0.25 mm²
- > Signals: 0.25 mm²

i The cable's bending radius should not be lower than 70 mm.

The following output signals are available:

SIGNALS	CONDUCTOR COLOR
+ V	Brown
0 V	White
CK	Green
CK-	Yellow
D	Pink
D-	Grey
SCH	Shield

Complying to DIN 47100.



Avoid locating the cable next to any device that may cause electromagnetic interferences (motors, solenoid valves, inverters).

If interferences are detected, act directly on the source of disturb using EMC filters.

If cable extensions are needed, it is necessary to use shielded cables with a section of at least 0.5 mm² for power supply and 0.25 mm² for signals.

The cable capacity should be: $C \leq 90 - 100$ pF/m

SSI			
Cable length	≤ 3 m	≤ 20 m	≤ 50 m
Clock frequency	1.2 MHz	0.4 MHz	0.2 MHz

BiSS			
Cable length	≤ 2 m	≤ 20 m	≤ 50 m
Clock frequency	2 MHz	1 MHz	0.4 MHz

The scale is supplied with a standard 2-m long cable, suitable for continuous movements, but longer lengths can be required.

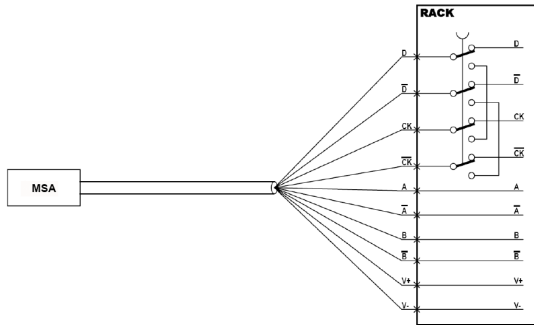
Ensuring a minimum power supply of 5 V to the sensor, the maximum cable length can be extended to 50 m.

i In case of cable extension, it is necessary to guarantee:

- > The electrical connection between the body of the connectors and the cables shield.
- > A minimum power supply voltage of 5 V to the sensor.

6. POSITION RESET

If the appropriate configuration interface is not available, to set a new zero position it is necessary to connect the serial line wires, as indicated in the picture below.



- i The sensor should be powered off during connections.
- i Make sure the sensor is perfectly still.
- i When the reset operation is done, you will see the sensor light flickers

Place the sensor in the desired position, press the button, power the sensor and wait one second before releasing the button.

Once this operation has been concluded, the sensor will send position values based on the new zero reference.

7. LED SIGNALLING

Sensor MSA is equipped with a LED that signals the correct functioning of the reading system.

When the LED is turned on, the sensor is correctly reading the absolute position. The turned off LED, instead, indicates the presence of an anomaly that causes a wrong reading of the absolute position. Possible causes of a wrong reading are:

- > External magnetic field that alters the sensor's reading.
- > Misalignment of the sensor.
- > Damaged magnetic band.

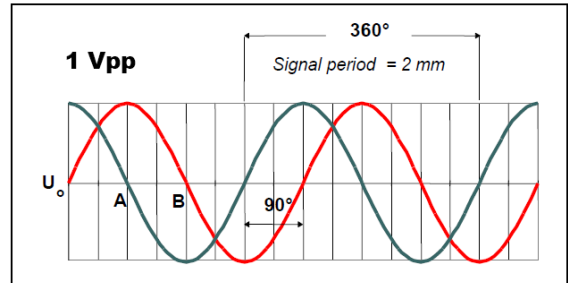
To restore the proper functioning of the system:

- > Verify the absence of external magnetic fields.
- > Verify the proper installation of the sensor and correct any misalignment.
- > Try to move the sensor in a different reading area.

If the LED remains turned off even after performing these operations, please contact the Manufacturer.

8. OUTPUT SIGNALS

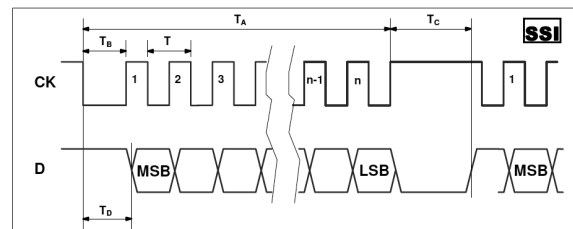
+ 1 Vpp Incremental Signals



Signals	A, \tilde{A} , B, \tilde{B}
Signals amplitude	0.6 ÷ 1.2 Vpp typical 1Vpp
Reference voltage U_o	≈ 2.5 V
A and B phase displacement	90° ± 10° electrical
Max. frequency (at 300 m/min)	2.5 kHz

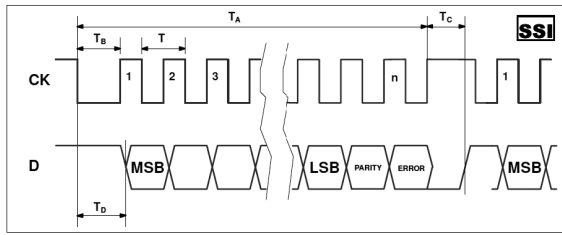
The signal amplitudes are referred to differential measurement on 120 Ω impedance.

+ Serial Signals - SSI

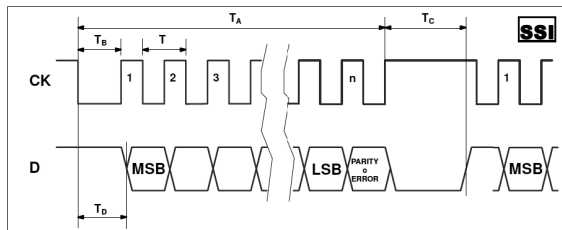


Interface	SSI (Synchronous Serial Interface) Binary - Gray
Data signals level	EIA RS 485
Clock signals level	3 V minimum Δ
Clock frequency	0.1 ÷ 1.2 MHz*
n	Position bit
T	0.833 ÷ 10 μs
TA	Clock sequence
Tb	> 0.4 μs
Tc	12 ÷ 45 μs
Td	0.6 ÷ 7.2 μs

(*) The maximum frequency is guaranteed with a cable length up to 2 m.



Interface	SSI (Synchronous Serial Interface) Binary
n	Position bit + Parity + Error



Interface	SSI (Synchronous Serial Interface) Binary
n	Position bit + Parity Position bit + Error

PARAMETERS FOR SSI PROTOCOL

Position bit

The number of bit transmitted is determined by the resolution required.

The value is transmitted with sign.

Reading resolution

Resolution	N° of position bit
1 µm	28 bit
5 µm	24 bit
10 µm	24 bit
50 µm	24 bit
100 µm	20 bit
500 µm	20 bit

Optional bit

> **Parity:** an additional bit for odd parity or even parity is transmitted.

> **Error:** it signals an error in reading the absolute position.

- Error bit =1 absolute position ok
- Error bit =0 absolute position wrong

Code

The code used for the transmission of the position is in binary or Gray format.

In case the Gray format is used, it is not possible to have the optional bit in the transmitted frame.

Refresh time

At the end of T_C period, the sensor provides a new position.

If a new position is not required, the sensor refreshes its position every 25 µs.

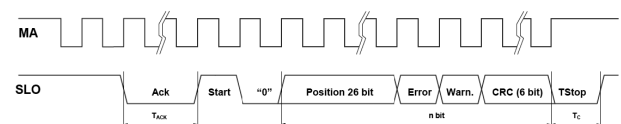
SSI timeout

In case of error/interruption of the serial line, the sensor goes back in the "ready" status after a period of 1600 µs.

Position error condition

In case of wrong absolute position, the status of the error bit, if enabled, is at 0 and a position value equal to 0 is transmitted. If the error bit is not enabled, the sensor will force the D signal low.

+ Serial Signals - BiSS C



Interface	BiSS C unidirectional
Parity	NO
Data signals level	EIA RS 485
Clock signals level	3 V minimum Δ
Clock frequency	0.1 ÷ 2 MHz*
n	26 + 2 + 6 bit
T _{ACK}	< 6 µs
T _C	12 ÷ 45 µs

(*) The maximum frequency is guaranteed with a cable length up to 2 m.

PARAMETERS FOR BiSS C UNIDIRECTIONAL PROTOCOL

Position bit

The position bit corresponds to the number of bit transmitted.

The value is transmitted with sign.

Reading resolution

Resolution	N° of position bit
1 µm	26 bit
5 µm	26 bit
10 µm	26 bit
50 µm	26 bit
100 µm	26 bit
500 µm	26 bit

Error

It signals an error in the absolute position reading.

- Error bit =1 absolute position ok
- Error bit =0 absolute position wrong

Warning

It signals a reading difficulty.

- Warning bit =1 reading ok
- Warning bit =0 difficulty in reading

Refresh time

At the end of Tc period, the sensor provides a new position.

If a new position is not required, the sensor refreshes its position every 25 µs.

BiSS timeout

In case of error/interruption of the serial line, the sensor goes back in the “ready” status after a period of 1600 µs.

CRC6 polynomial

CRC at 6 bit inverted, with polynomial 0x43, MSB as first bit of the frame.

After maintenance, verify the mounting tolerances and adjust any eventual misalignment.

10. WARRANTY TERMS

MSA scale is guaranteed against manufacturing faults for a period of twenty-four months from the date of purchase. Any repair must take place at the Manufacturer’s premises and the Customer shall arrange the delivery of the product, at its own risk and expense.

The Manufacturer is released from any claim against damages due to the non-observance of these instructions or mounting tolerances which causes the annulment of the warranty terms.

The warranty does not provide for repairing and/or replacement of those parts that have been damaged by negligence or misuse, improper installation or maintenance, maintenance performed by unauthorized personnel, transport or any other circumstance that excludes a manufacturing fault of the product.

Similarly, the warranty does not apply if serial numbers or any data identifying the product are cancelled or altered in any way, and if product modifications are introduced without the written authorization of the Manufacturer.

The Manufacturer declines any responsibility for damages to people or properties deriving from the use of the product, including any loss of profit or any other direct, indirect or incidental loss.

11. DISPOSAL

*Waste electrical and electronic equipment (WEEE)
European Council Directive (2012/19/EU)*



The use of the WEEE Symbol indicates that this product may not be treated as household waste.

If this product is disposed correctly, you will help to protect the environment.

For more detailed information about the recycling of this product, please contact your local authority, your household waste disposal service provider or the retailer where you purchased the product.

This information regards only European customers, according to 2012/19/EU European Parliament Directive.

For other countries, please refer to local law requirements.

9. USE AND MAINTENANCE

MSA scales do not require any particular maintenance and the correct use guarantees quality and good operation.

During machining, remove any accumulation of dirt that does not allow the free sliding of the movable parts.

Any discrepancy should be reported to the Manufacturer for repairing or replacement of defective parts.

12. TECHNICAL FEATURES - SENSOR

MSA	
Pole pitch	2+2 mm
Incremental signal	sine wave 1 Vpp (optional)
Resolution 1 Vpp	up to 1 µm*
Repeatability	±1 increment
Signal period	2 mm
Serial interface	SSI – BiSS
Resolution absolute position	500 - 100 - 50 - 10 - 5 - 1 µm
Accuracy	±15 µm
Measuring length ML	up to 30.000 mm
Max. traversing speed	300 m/min**
Vibration resistance (EN 60068-2-6)	200 m/s ² [55 ÷ 2000 Hz]
Protection class (EN 60529)	IP 67
Operating temperature	0°C ÷ 50°C
Storage temperature	-20°C ÷ 70°C
Relative humidity	100%
Power supply	5 ÷ 28 Vdc ÷ 5%
Current consumption	150 mA _{MAX} (with R = 120 Ω)
Max. cable length	20 m***
Electrical connections	see related table
Electrical protections	inversion of polarity and short circuits
Weight	80 g

(*) Depending on CNC division factor.

(**) With a 1 µm resolution, the maximum traversing speed becomes 90 m/min.

(***) Ensuring a minimum power supply of 5 V to the sensor, the maximum cable length can be extended to 50 m.

i Without prior notice, the products may be subject to modifications that the Manufacturer reserves to introduce as deemed necessary for their improvement.