Datasheet:

3-axis Hall probe type HS/HM/HL for SENIS 3MH4 and 3MH2 digital teslameters and I3D low-noise analog magnetic field transducers

Integrated 3-axis Hall Probe with high spatial resolution

DESCRIPTION:

The new developed Hall probe type H for the SENIS 3MH4 and 3MH2 digital teslameters and I3D low-noise analog magnetic field transducers is a thin (0.75 mm) single-chip integrated 3-axis Hall probe that provides simultaneous analogue voltage outputs for all three (Bx, By and Bz) components of the measured magnetic flux density and for the probe temperature.

The H probes are available in 3 (three) different lengths:

1. Long (H**L**): 71 mm,
2. Medium (H**M**): 47 mm,
3. Small (H**S**): 8 mm.

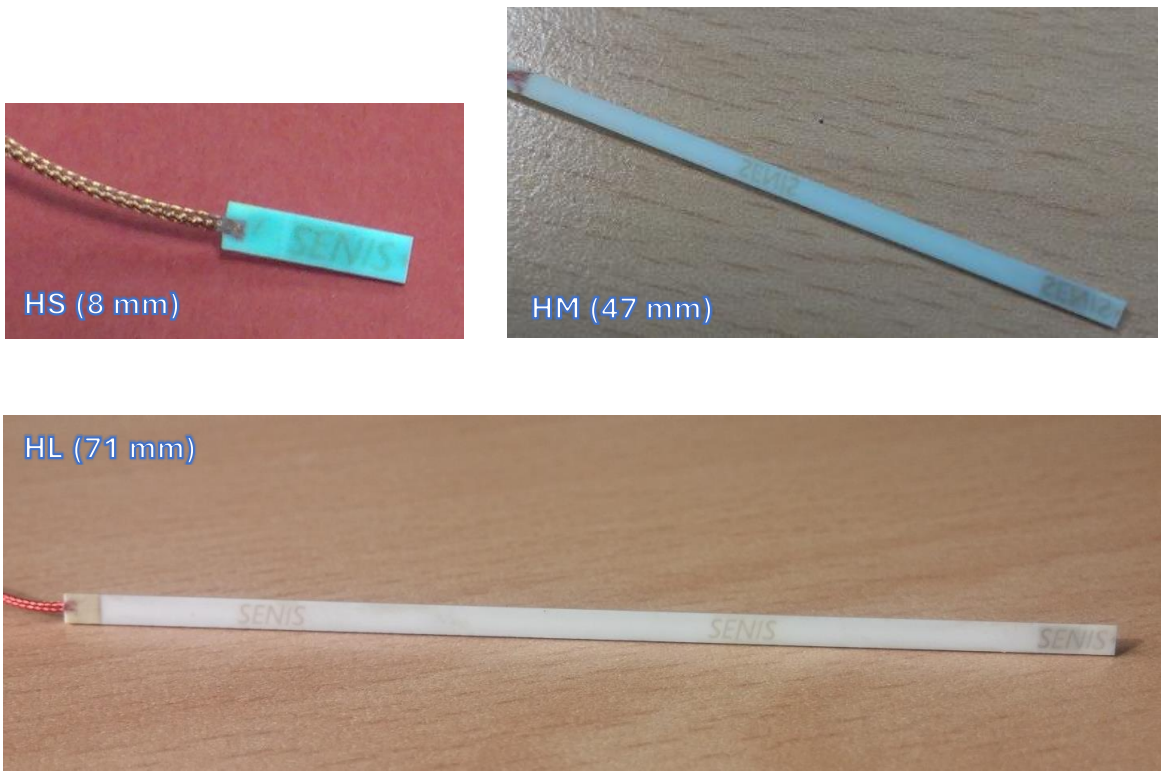


Figure 1: Photos of the 3-axis Hall probes type HS (length 8 mm), HM (length 47 mm) and HL (length 71 mm)

The probe contains a CMOS integrated circuit, which incorporates a group of 3 (three) mutually orthogonal Hall elements, biasing circuits, amplifiers and a temperature sensor.

The integrated Hall elements occupy very small area (100 x 100 μm^2), which provides very high spatial resolution of the probe.

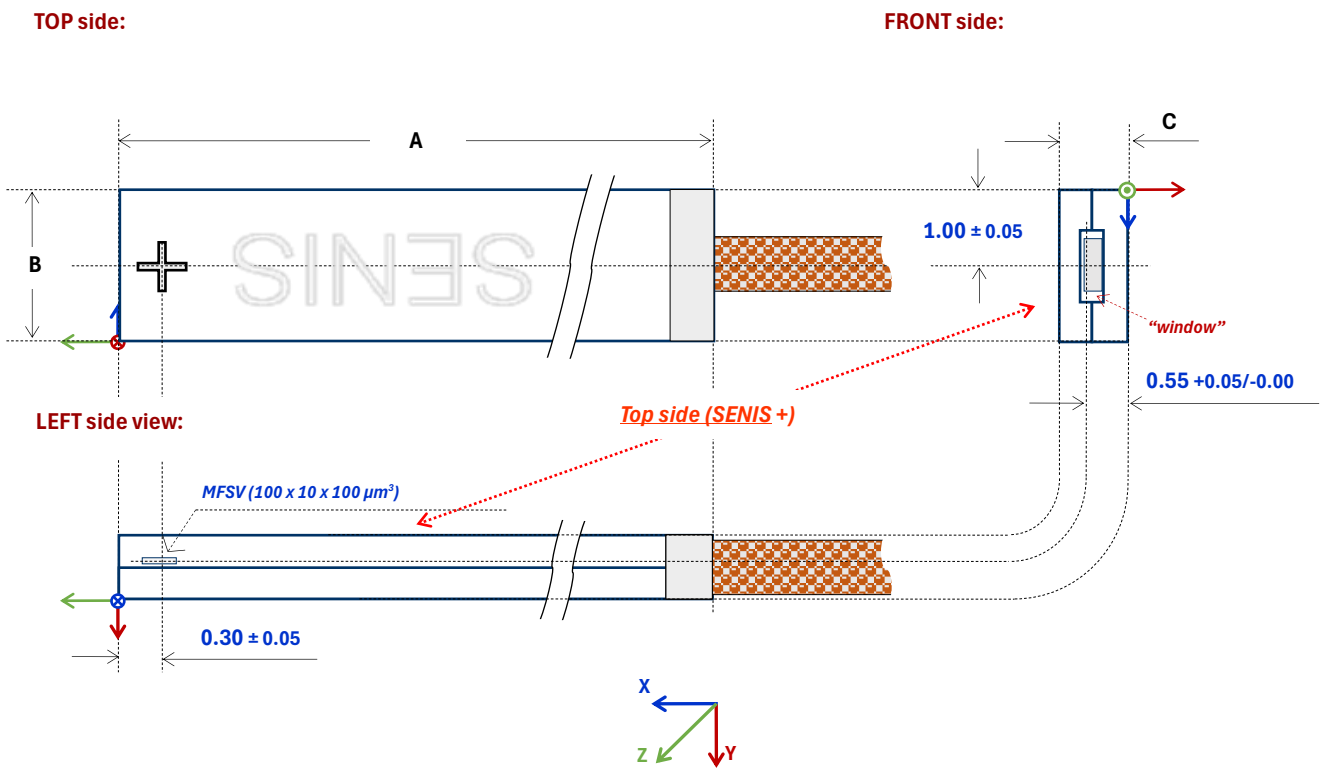
The CMOS IC technology enables very high precision in the fabrication of the vertical and horizontal Hall elements, which gives high angular accuracy between the three measurement axes of the probe (mutual orthogonality error is < 1°, measured with accuracy of better than 0.1° by the utilization of an improved calibration method).

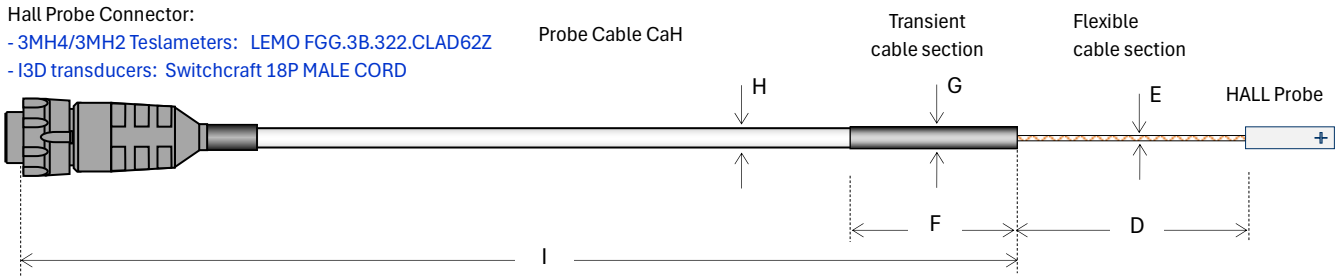
The sensor chip is embedded in the probe package made of alumina-ceramics (Al_2O_3) and it is connected to the flexible shielded cable. The reference ceramic plate on the bottom side of the probe housing allows for an appropriate alignment of the probe.

Key features of the Hall probe type H:

- Hall probe type H is a thin (0.75 mm) probe with protected silicon chip, available in 3 (three) different lengths: 71 mm (HL - long), 47 mm (HM - medium), and 8 mm (HS - small probe)
- Probe package is fully made of Al_2O_3 ceramic, with the chip and cable connecting pads directly printed on the ceramic substrate
- Integrated CMOS 3-axis (Bx, By, Bz) Hall Probe, of which one, two, or three channels are used
- Very low noise and offset fluctuations
- Very high spatial resolution: *By:* 30 x 5 x 30 μm^3 ; *Bx & Bz:* 100 x 10 x 100 μm^3
- High angular accuracy of the measurement axes: mutual orthogonality between the three measurement axes of the probe is < ±1°, determined with accuracy better than 0.1° by the application of an improved method
- Virtually no planar Hall Effect
- Negligible inductive loops on the Probe
- Integrated temperature sensor on the probe for temperature compensation
- Embedded EEPROM in the connector for the probes used with 3MH4 and 3MH2 digital teslameters, etc.

Hall probe and Cable - Mechanical specifications:





Part		Dimension (mm)	Part	Dimension (mm)
A	*HS*	8.0 ± 0.2	F	25 ± 2
	HM	47.0 ± 0.5	G	Ø 2.1 ± 0.2
	HL	71.0 +0.5/-0.0	H	Ø 1.7 ± 0.1
B		2.00 ± 0.05	I	Standard cable lengths: 2'000 ± 1 % 5'000 ± 1 % 10'000 ± 1 %
C		0.75 +0.05/-0.00		
D		50 ± 1		
E		Ø 0.8 ± 0.1		

Figure 2: Dimensions and tolerances of the H-module type I3D-03H**x**0**I**L (3-axis Hall probe type H**x**, where ***x*** denotes probe length) and cable CaH (***I*** – cable length in meters)

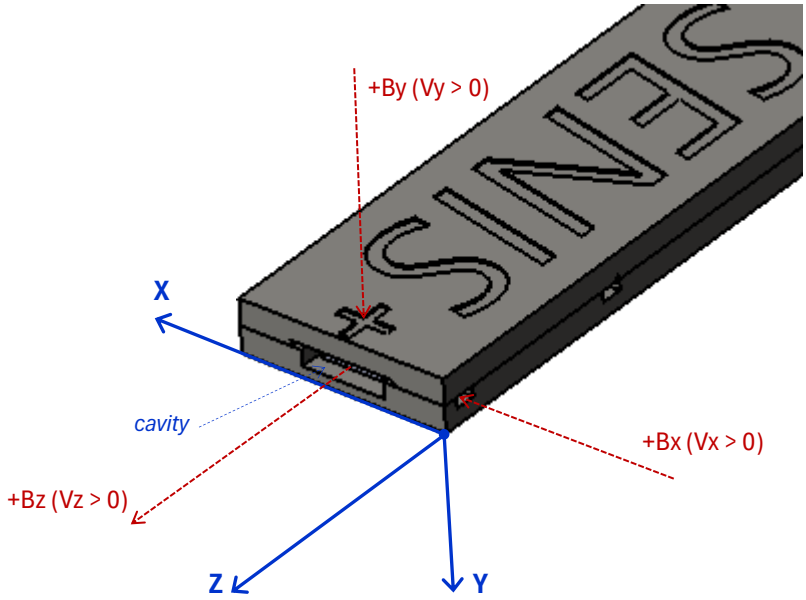


Figure 3: Reference Cartesian coordinate system (X, Y, Z) of the 3-axis Hall probe type H

Parameter				
Dimensions		**X (mm)**	**Y (mm)**	**Z (mm)**
Magnetic field sensitive volume (MFSV)		0.10	0.01	0.10
Position of the MFSV centre (Fig. 2 and 3)		1.00 ± 0.05	-0.55 -0.05/+0.00	-0.30 ± 0.05
External dimensions of the probe	*HS*	2.00 ± 0.05	0.75 +0.05/-0.00	8.00 ± 0.2
	HM			47.0 ± 0.5
	HL			71.0 +0.5/-0.0
Positioning accuracy				
Angular accuracy of the measurement axes		▪ < ±1° with respect to the reference surface		
		▪ Mutual orthogonality between the meas. axes: < ±1° (determined with an accuracy of better than 0.1° by the application of a well-improved measurement method)		
Cable properties				
Conductor:		Silver plated soft copper core, 7 x 44 AWG		
Insulation:		PFA (Perfluoro Alkoxy), diameter 0.30 mm		
Twisting:		15 x OD		
Shield:		Silver plated soft copper braid		
Jacket:		PFA (Perfluoroalkoxy)		
Service temperature:		-196 / +200 °C		
Linear resistance:		1.4 Ω/m		
Rated voltage:		150 Vac		
RoHS compliance:		Yes		
Cable length:		Standard: 2 m	Notation: I3D-03Hx02L	
NOTE: Various cable lengths are available upon request.		Optional: X m	Notation: I3D-03Hx0XL	

Installation Manual for the H probes:

NOTE: The H probes are fragile! Please handle it with a special care.

The Hall probes type HS, HM and HL are made of the two thin ceramic plates and can be easily broken (as a probe is longer, as mechanically more sensitive is).

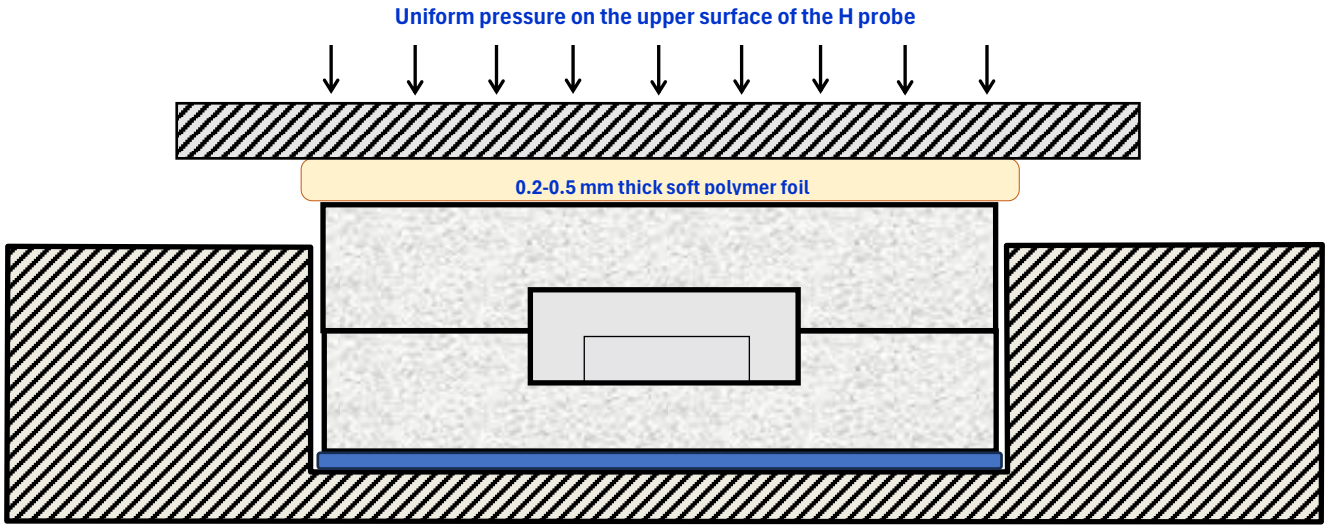
Therefore, avoid any mechanical contact of the probe tip with other objects! Moreover, avoid the immersion of the probe in any liquid, as well its exposure to moisture and aggressive gasses.

Considering that we deal with a high-precision device of very small dimensions, following precautions should help to avoid damage to the probe during installation and handling, and ensure that the accurate calibration of the device remains preserved:

- Always disconnect powering of the instrument before plugging/unplugging the Hall probe!

- Applied CMOS Hall sensor can be damaged by ESD. We strongly recommend that the probe be handled with appropriate ESD preventive precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure.
- Mounting of the Probe should be carried out by application of very low pressure to its head and the thin red cable.
- Do not apply more force than required to hold the probe in its place. Damage to either the ceramics package of the Hall sensor or thin wiring could destroy the Probe.
- If the probe head is clamped, the user needs to make sure that the environment surface in contact with the reference plane of the probe is flat and covers as much of the probe reference surface as possible.
- Do not apply more force than required to hold the probe in its mounting. Also, do not press the probe just in a single spot. Pressure on the probe should be uniformly distributed over its upper surface.

  To relax a stress while mounting or gluing the probe in a groove, it is recommended to press the probe by application of a flat 0.2-0.5 mm thick soft polymer or a rubber foil over the upper surface of the probe:

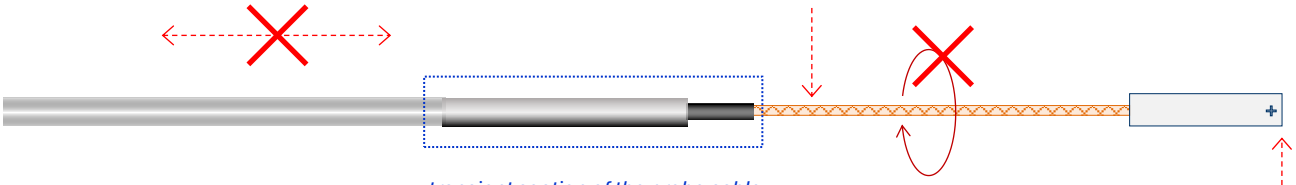


- In order to prevent rupture of the thin probe wiring, the user should fix and secure the probe cable in the proximity of the head. The thin red wire from the probe can be folded only with a special care. Strongly avoid loops or twisting of this section.

The following actions must be strictly avoided:

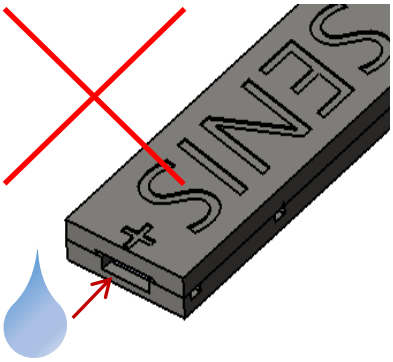
- pressing the thin red cable;
- contacts to any sharp edges;
- loops or twisting of the thin red part !

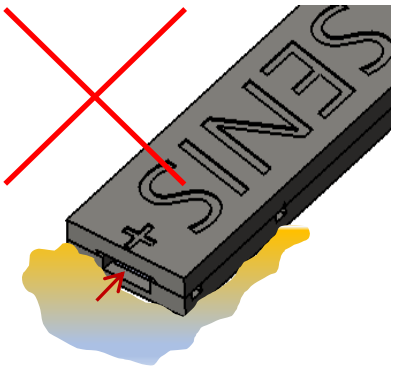
Do not push / pull the probe cable if the probe head is fixed !



transient section of the probe cable

Do not expose the front side of the probe to any liquid or gas !

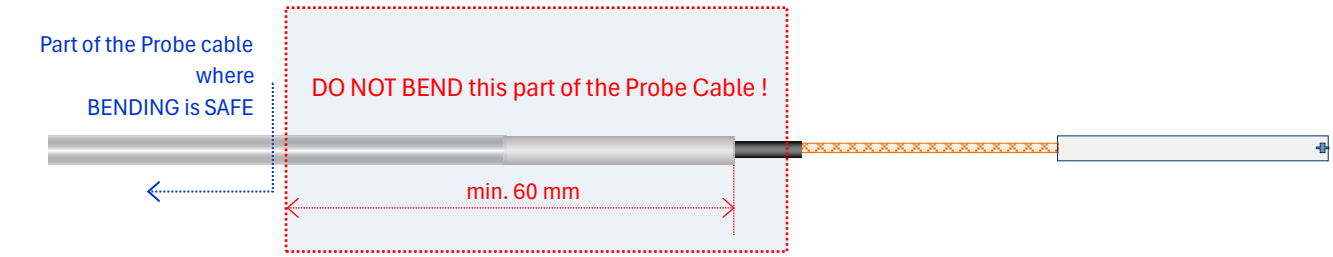




Strongly avoid contact of the FRONT side of the probe (with the cavity) with any liquid or a grain mass (such as a glue). Due to capillary effect, such matter could enter through the cavity into the interior of the probe and destroy or deteriorate the characteristics of the CMOS Hall sensor !

- Do not expose the thin red cable to the external sharp edges.
- Do not expose the probe to moisture and aggressive gasses.
- Avoid immersion of the probe in any liquid.
- Strongly avoid any high pressure, tightening and/or bending of the rigid (non-flexible) transient section between the thin (red) and thick (white) probe cables.

- Safe area for bending the thick (white) probe cable is illustrated on the following drawing:



- Keep the cable out of the way of foot traffic. Do not pinch the cable, or drop sharp or heavy objects on it.
- A severed cable cannot be re-joined without altering the probe performance, and requires factory repair and full re-calibration of the device.
- Example / proposal for a safe fixation of the HS/HM/HL probe on a probe holder: