HiLin™
High-accuracy Linear Magnetic Encoder

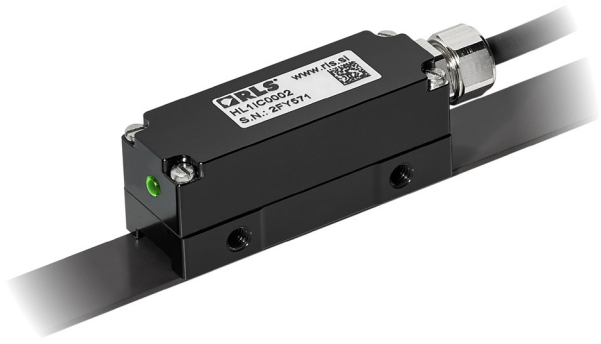
HIGH ACCURACY

ROBUST DESIGN

HIGH SPEED

The HiLin™ series is a family of high-accuracy magnetic linear incremental encoder systems designed for demanding industrial applications. The system consists of a compact, fully sealed readhead and a separate magnetic scale.

The system can provide high resolution while maintaining low hysteresis and low interpolation error. Stable signal performance is achieved within a nominal ride height of 0.2 ±0.1 mm, allowing reliable operation with practical installation tolerances.



Features and benefits

- Selectable resolutions down to 0.1 µm
- Unique, periodic or distance-coded reference mark
- Low hysteresis: ≤1 µm
- Low interpolation error (SDE): ±1.5 µm
- High speed: 25 m/s with 1 µm resolution
- Industry-standard digital incremental RS422 output
- Wide operating temperature range from –40 °C to +75 °C

LINEAR MOTOR | PRINTING TECHNOLOGY | SMT PICK AND PLACE | SERVO MECHANISMS | HARSH ENVIRONMENT

General information

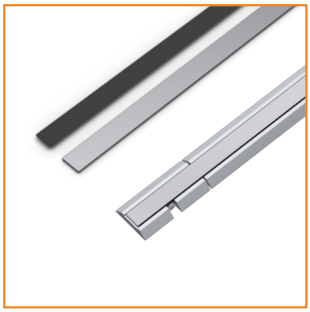
HiLin™ readheads provide an industry-standard digital RS422 output and are designed for reliable position feedback in demanding industrial environments. The readhead is fully sealed and feature high IP67 environmental protection, ensuring stable operation in the presence of particles, vapours, and liquids. Thanks to the detachable cable design, a damaged readhead or cable can be easily replaced, reducing downtime and maintenance costs.

The HiLin encoder system is based on a non-contact, frictionless measuring principle, eliminating the need for special guide or sealing systems. This enables a compact system design without compromising speed, robustness, or performance. As a result, HiLin encoders are well suited to a wide range of machines, such as lathes, EDM machines, laser or water jet cutting systems, grinding and milling machines, printers, and presses.

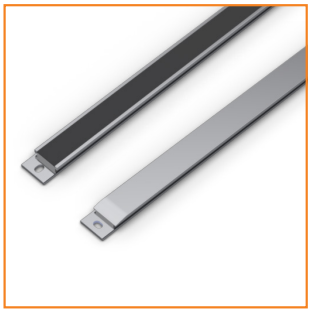
Choose your HiLin system

The HiLin system provides a cost-effective and versatile solution for general industrial measurement applications. The MS19/20 magnetic scale, optionally combined with cover foil and the TRS system, enables flexible installation and measurement lengths with accuracy up to ±10 µm/m. Its self-adhesive design and flexible magnetic scale with 2 mm or 2.032 mm pole length ensure easy integration with HiLin readheads.

For enhanced performance and durability, the HMS solid magnetic scale with a stainless steel carrier offers improved thermal stability and accuracy up to ±5 µm/m. The fully welded cover foil version provides additional protection, making it suitable for use in harsh and aggressive environments.



MS19/20 (optionally with cover foil and TRS system)



HMS solid magnetic scale or fully welded cover foil

Further information
For detailed documentation, compatible scales (MSD01) and 3D models, refer to the **HiLin** product page or **RLS Media center.**

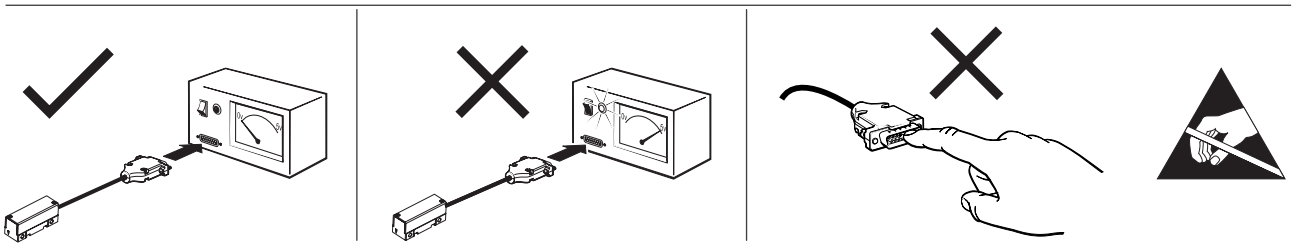
Storage and handling

Operating and storage temperature

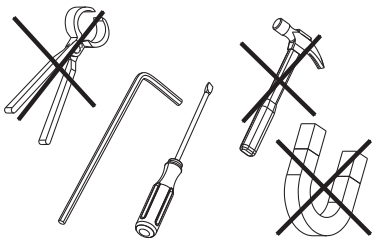
–40 °C to +75 °C

Humidity

With HMS: IP67 (according to IEC 60529)
With MS19/20:High resistance to humidity



Readhead is ESD sensitive - handle with care.
Do not touch electronic circuit, wires or sensor area without proper ESD protection or outside of ESD controlled environment.



This encoder system is a high performance measuring instrument and should be handled with the same care as any other precision instrument. The use of industrial tools during installation or contact with strong magnets, such as a magnetic base, is not recommended as there is a risk that parts of the system will be damaged and may not function to specifications as a result.

Operational conditions

The magnetic encoder system must be used in accordance with the specified degree of protection. The following factors must be taken into account: IP protection class, operating temperature, external magnetic field, mechanical load and EMC compatibility.

External magnetic fields

The magnetic encoder system is sensitive to the external magnetic fields. The magnitude of the influence on the magnetic encoder system depends on the magnitude and direction of the external magnetic field. In particular, the rapidly changing stray magnetic fields affect the encoder system and can alter its function. Magnetic field strength within 1 mT reduces the accuracy of the system. Field strengths greater than 1 mT will cause the system to malfunction and as a result the readhead will report an incorrect absolute position with the error status active.

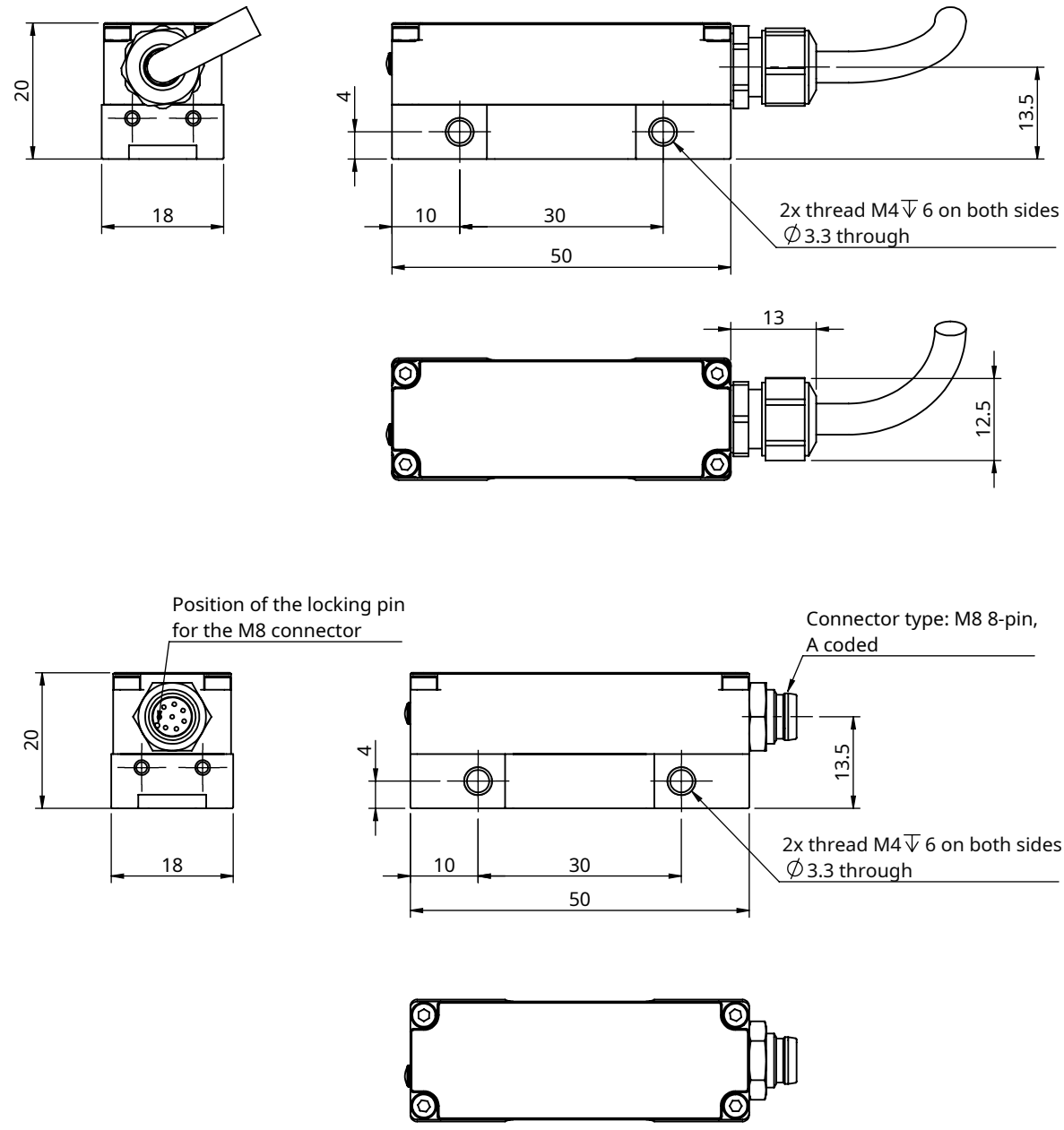
Magnetic field strengths of more than 25 mT cause irreversible damage to the magnetic scale and must be replaced.

Product identification and markings

The marking on the label contains a 18-digit part number, a 6-digit serial number and a QR code with a serial number.

Dimension drawing

Dimensions and tolerances are in mm. Dimensions without tolerance values are in accordance with ISO 2768-m.



General tolerances for linear dimensions according to ISO 2768-m			
Tolerance class	up to 6	6-30	30-120
m (medium)	±0.1	±0.2	±0.3

3D models are available on the **HiLin product page** and in the **RLS Media Center**.

Installation instructions

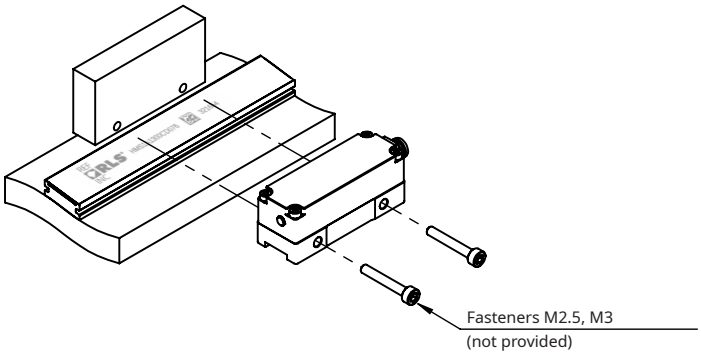
The magnetic encoder system must be installed and mounted in strict compliance with the installation dimensions and tolerances given on **page 5** and in MS incremental magnetic scales data sheet MSD01 available at **RLS Media center**. Mechanical contact between the readhead and magnetic scale must not occur over the entire measuring range.

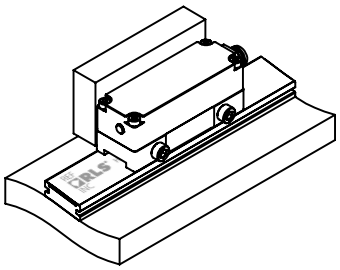
Installation procedure

The readhead LED must be green at all measuring length positions. Otherwise the installation is not performed correctly. To facilitate installation, the readhead is supplied with a 0.2 mm thick spacer.

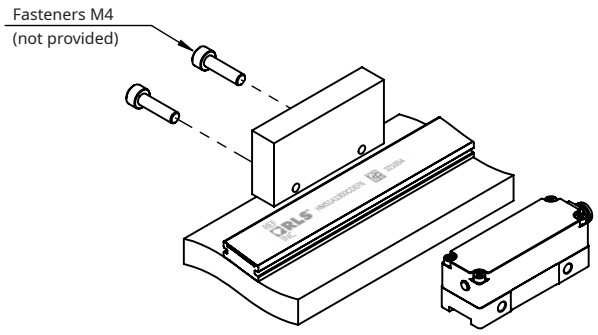
1. Mount the magnetic scale.
2. Place the spacer and the readhead on the magnetic scale.
3. Ensure that the readhead, spacer and magnetic scale are in full contact.
4. Before removing the spacer, tighten the readhead with M3 fasteners to the holder. For more information, refer to the **Table of recommended fastener tightening torques.**
5. Ensure that the readhead is correctly aligned. There is a triangular mark on the side of the reference sensor. The triangular mark on the readhead and the reference mark on the scale must be on the same side for the correct alingment.

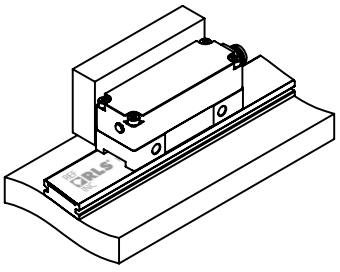
Variant A





Variant B

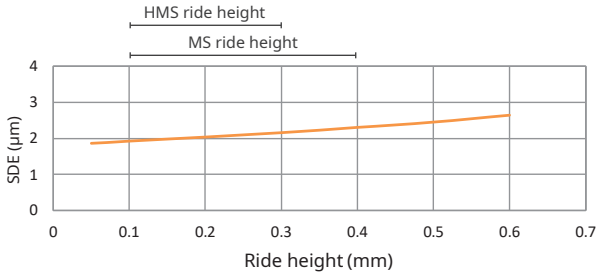




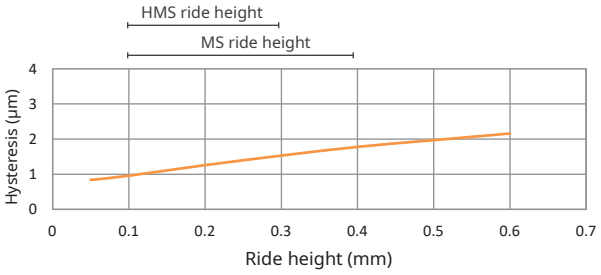
Technical specifications

System data

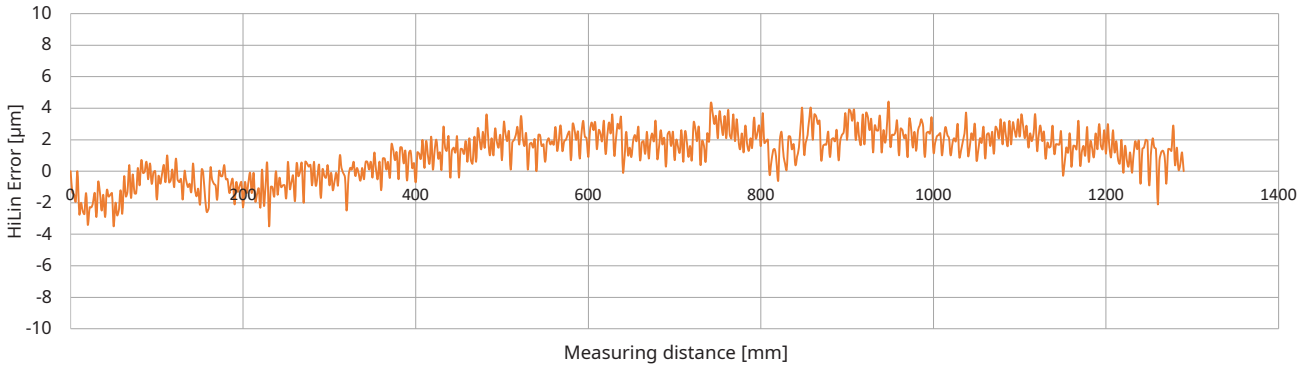
Reading type		Linear
Resolution		Up to 100 nm
Accuracy (at 20 °C)	MS19/MS20	±10 µm/m
	HMS	±5 µm/m
Hysteresis		≤1 µm
Unidirectional repeatability		±0.4 µm
Position latency		<20 µs
SDE	MS19/MS20	±2 µm
	HMS	±1.5 µm



Graph 1: Sub-divisional error (SDE) as a value of ride height



Graph 2: Hysteresis as a value of ride height



Graph 3: Accuracy error plot

All magnetic scales are magnetised at 20 °C.

Electrical data

Power supply		4.75 V to 12 V – voltage on readhead Reverse polarity and overvoltage protection (up to 15 V)
Reverse polarity protection		Yes
Start-up time		<1 s
Power consumption		<450 mA (with termination)
		<250 mA (without termination)
Communication standard		Differential line drive signal RS422 - A, B, Z
EMC Immunity		EN 61000-6-2
EMC Emission		EN 61000-6-4
ESD protection		HBM, max +/-2 kV

Mechanical data

Material		Aluminium (anodised)
Mass		32 g (with connector, without cable)
Readhead connector		M8, 8 pin, male

Environmental data

Operating and storage temperature		–40 °C to +75 °C
Vibrations (55 Hz to 2000 Hz)		400 m/s² (IEC 60068-2-6:2007)
Shocks (6 ms)		1000 m/s² (IEC 60068-2-6:2007)
Environmental sealing	Readhead	IP67 (according to IEC 60529)*
	MS19/MS20	Resistance to dirt and dust
	HMS	IP67 (according to IEC 60529)*
Maximum external magnetic field during operation		1 mT

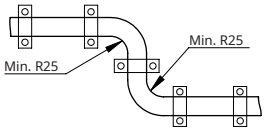
* IP protection is only guaranteed when suitable connector with same or higher IP is used.

Cable

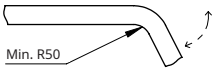
Number of wires	8 (2 × 26 AWG + 6 × 28 AWG)
Outer sheath	PUR
Outer diameter	Max. 4.5 mm
Cable bending radius (internal radius)	50 mm
Mass	33 kg/km
Continues flex cycle number	10 million bending cycles
Torsion	Continuous torsion not allowed
DC resistance at 20 °C	Max. 139.3 Ω/km
	Max. 226.7 Ω/km
Maximum cable length	10 m (including extensions)

Cable bending radius

Fixed laying application



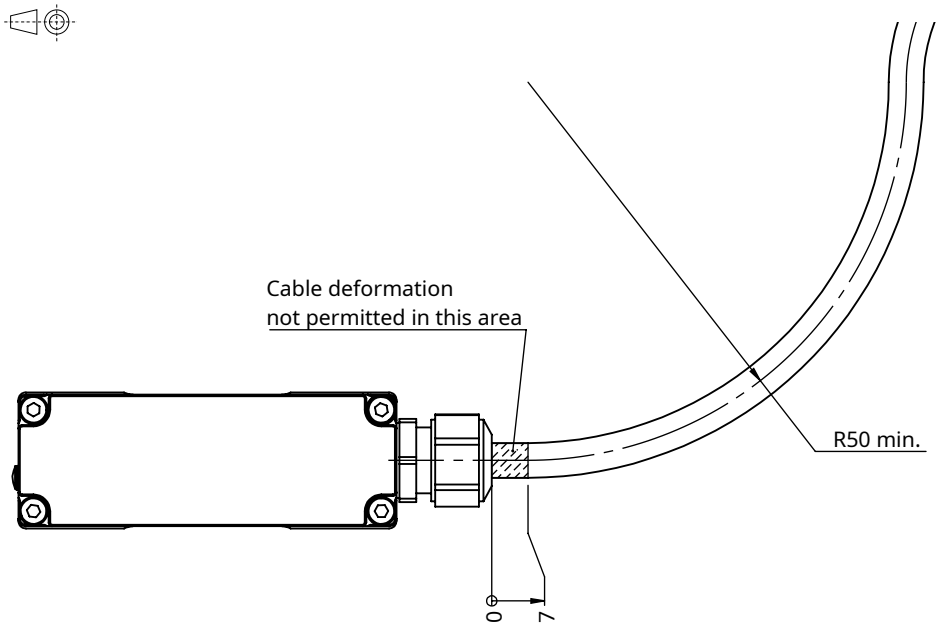
Continuously flexible application



The cable requires adequate strain relief to ensure its integrity and avoid lateral forces that could damage the cable entry. The bending radius of the cable also applies to the connector side.

Cable installation

Dimensions and tolerances are in mm. Dimensions without tolerance values are in accordance with ISO 2768-m.



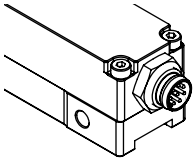
Electrical connections

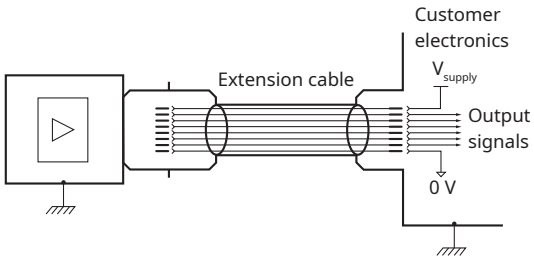
Pinout

Function	Signal	Readhead connector pinout, M8 8-pin	Flying leads (option F)	9 pin D type plug (option A)
Power	V_{cc}	2	Brown	5
	GND	8	White	9
Incremental / analogue signals	A	5	Green	4
	A–	6	Yellow	8
	B	7	Blue	3
	B–	1	Red	7
Reference signals	Z	3	Pink	2
	Z–	4	Grey	6
Shield	Outer	Case	–	Case

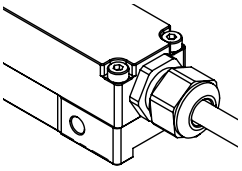
Shield connection

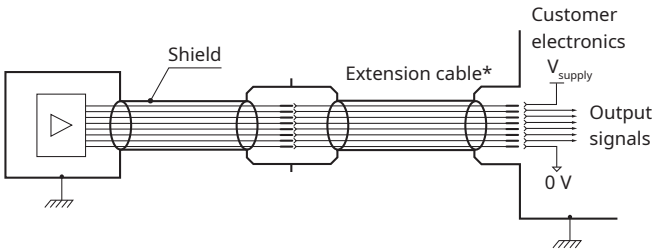
With connector on the readhead
(cable not provided)





With cable





* Extension cable is optional and not supplied by RLS.

The encoder housing is galvanically connected to the connector housing. For EMC compliance, proper shielding must be ensured. The cable outer shield should be connected to the connector housing.

Status indicator LED

After installing the magnetic scale, adjust the readhead using the LED setup indicator. The readhead must remain stable when passing the reference mark; any blinking indicates incorrect orientation relative to the magnetic scale.

LED Status		Status
●	**Green**	Good signal strength/correct set-up
●	**Red**	Poor signal strength. Possible reasons: • Incorrect readhead orientation. • Readhead installation out of tolerance. • Demagnetisation of measuring scale. • Insufficient power supply voltage.

The LED signal functions listed in the table above do not detect non-optimal installation, such as accuracy outside the specified range or improper position of the reference mark.

Output type

Digital output signals, RS422

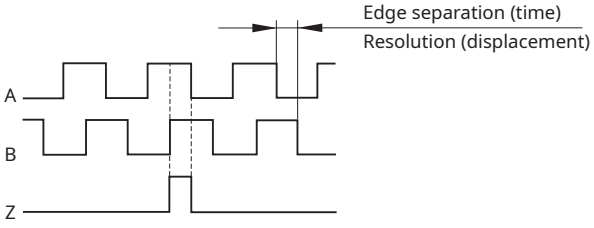
HLxIC

Specifications

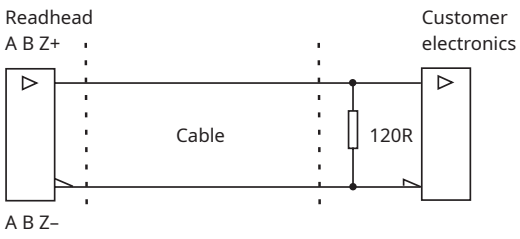
Power supply	4.75 V to 12 V – voltage on readhead Reverse polarity and overvoltage protection (up to 15 V)
Current consumption	<250 mA (without termination) <450 mA (with termination)
Voltage drop over cable	1.3 V (worst case; lowest supply voltage, maximum load, maximum cable length)
Power supply rise time	0.1 ms to 100 ms
Position latency	30 µs
Output signals	3 square-wave signals A, B, Z and their inverted signals A–, B–, Z–
Reference signal	1 or more square-wave pulse Z and its inverted pulse Z–
Signal level	Differential line driver compatible with EIA standard RS422
Permissible load	$Z_0 \geq 100\ \Omega$ between associated outputs Outputs are protected against short circuit Only one output shorted at a time
Alarm / Error signalisation	High impedance on output lines A, B, A–, B–, Z, Z–
Switching time (10 to 90 %)	145 ns

Timing diagram

Complementary signals not shown



Recommended signal termination



Part numbering

Readhead

HL 1 IC 04000 B A 10D A 00

Pole length

1 - 2 mm
2 - 2.032 mm (DPI)

Output type

IC - Incremental, RS422, 5 V

Interpolation factor (Resolution)

20000 - 0.10 µm (DPI 0.1016 µm)
10000 - 0.20 µm (DPI 0.2032 µm)
04000 - 0.50 µm (DPI 0.508 µm)
02000 - 1.00 µm (DPI 1.016 µm)
01000 - 2.00 µm (DPI 2.032 µm)
00400 - 5.00 µm (DPI 5.08 µm)

Customer selectable resolutions available.
For more options and resolution calculation details, see **HiLin FAQ website**.

Minimum edge separation (µs)

A - 0.031 (32 MHz)
B - 0.063 (16 MHz)
C - 0.091 (11 MHz)
D - 0.125 (8 MHz)
E - 0.156 (6.4 MHz)
F - 0.182 (5.5 MHz)
G - 0.217 (4.6 MHz)
H - 0.25 (4 MHz)
I - 0.278 (3.6 MHz)
J - 0.313 (3.2 MHz)
K - 0.345 (2.9 MHz)
L - 0.4 (2.5 MHz)
M - 0.435 (2.3 MHz)
N - 0.5 (2 MHz)
O - 0.556 (1.8 MHz)
P - 0.625 (1.6 MHz)
R - 0.714 (1.4 MHz)
S - 0.833 (1.2 MHz)
T - 1 (1 MHz)
U - 1.25 (0.8 MHz)
V - 1.667 (0.6 MHz)
W - 2.5 (0.4 MHz)
Z - 4 (0.25 MHz)

For more options please go to **RLS FAQ website**.

The customer's controller must support the selected edge separation time even if the encoder is used below the maximum speed.

Reference mark

A - With reference mark
B - Without reference mark
C - Periodic reference mark

Cable length

30C - 0.3 m
50C - 0.5 m
10D - 1 m
15D - 1.5 m
20D - 2 m
25D - 2.5 m
30D - 3 m
50D - 5 m
10M - 10 m
000 - No cable, connector only

Other cable lengths available per special request. Minimum cable length is 10 cm, maximum cable length is 10 m.

Connector

A - 9 pin D type plug
C - Connector only, M8, 8 pin, male
F - Flying lead, no connector

Special requirements

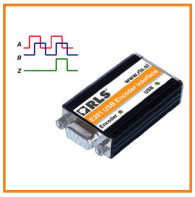
00 - No special requirements (standard)

Not all part number combinations are valid. Please refer to the available part numbers on next page.

Table of available combinations

Series	Pole length	Output type	Interpolation factor	Minimum edge separation	Reference mark	Cable length	Connector	Special requirements
HL	1 / 2	IC	xxxxx	x	A / B / C	xxC / xxD / 10M	A / F	00
						000	C	

Accessories



USB interface (for incremental output)
E201-9Q

Packaging

Each readhead is individually packaged in an antistatic bag, in accordance with ESD protection measures.

Head office

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Global support

Visit our **website** to contact your nearest sales representative.

Document issues

Issue	Date	Page	Description
15	25. 5. 2026	4	Product identification and markings added
		5, 6	Magnetic scale, HMS dimension and installation drawings moved to MSD01, Encoder assembly removed
		7-8	Technical specifications amended
		9	Cable specifications added
		11	Status indicator LED amended
		General	Document structure updated
16	2. 9. 2026	12	Minimum edge separation amended

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