lika

Smart encoders & actuators

Incremental and absolute linear encoders 2016
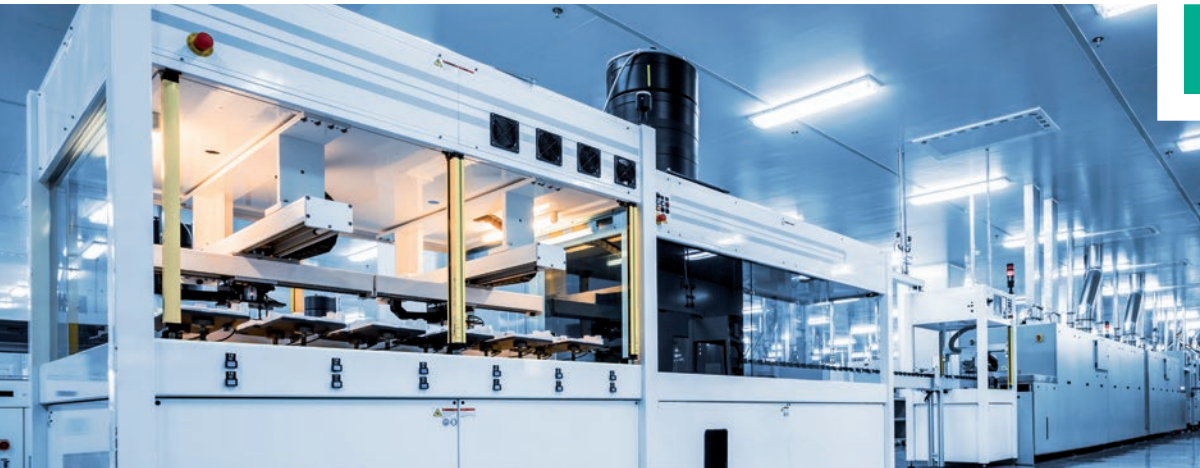
ROTAPULS
Incremental rotary encoders

ROTACOD
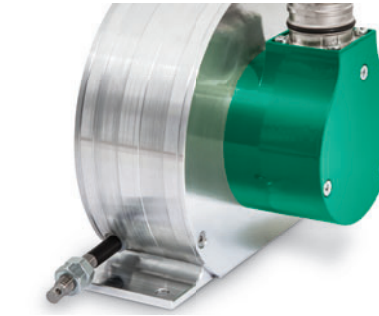Absolute rotary & Fieldbus encoders

ROTAMAG
Rotary Magnetic encoder &
Encoder modules
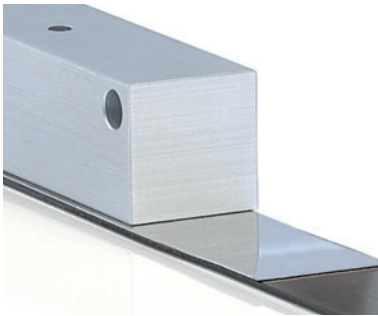
LINEPULS – LINECOD
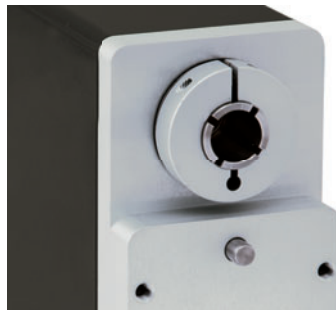Linear Absolute & Incremental encoders

DRAW-WIRE
Draw-wire encoders & potentiometers

COUPLINGS
Flexible & Transmission couplings

POSICONTROL
Displays & Signal converters
Encoder Interfaces

DRIVECOD
Rotary Actuators & Positioning units

30th

**30 YEARS
YOUNG
1982.2012**

An international family company, corporate profile

Lika Electronic stands for encoders and position measuring systems. Since its inception in 1982, Lika Electronic develops and manufactures *incremental and absolute, optical and magnetic, rotary and linear encoders, incremental & absolute sensors, linear and rotary incremental & absolute magnetic measurement systems, rotary actuators, displays, signal converters and encoder interfaces.*

Starting as a family-owned business, thanks to its technical competence and comprehensive know-how in the automation industry along with the high quality standards and the skill in providing solutions that target specific customer needs, over the years **Lika Electronic has grown becoming a forward thinking innovative and global company** and has become one of the leading manufacturers of optical encoders and magnetic measurement systems in Europe and worldwide.
Many key features include the extensive technical engineering skills , in-depth knowledge and expertise in digital and analogical electronic design as well as the proven daily practice in co-operation with universities, research institutions and customers in order to **develop and provide advanced electronic equipment and high-tech materials & devices tailored to specific customer and market requirements**. Moreover software development and mechanical & optical components design are entirely performed within the company. Often production machinery and tools are often engineered and built internally to satisfy specific needs and performances.

Every day Lika Electronic is committed to being a step ahead and always at the forefront of innovation, looking to the future with the enthusiasm that steers the company towards new opportunities *without giving up the strength of being an international family company.*

Lika Electronic is certified for compliance with ISO 9001:2000 quality management system and is now committed to adopt an environmental management system complying with ISO 14001:2004 requirements. All Lika's products are designed and manufactured to fully meet the requirements of CE, RoHS and REACH directives, most of them are UL and CSA compliant too. ATEX certified solutions suitable to be integrated into potential explosive environments and hazardous areas are also available.

Global presence, make us closer to the customer

Every day, everywhere Lika Electronic works in close contact with its customers to build strong, long-lasting relationships and support them at all times in each day-to-day requirement. Lika's actions focus on customers' needs with daily challenges to develop reliable and cutting edge solutions *Continuous innovation, outstanding expertise, overall quality, prompt action and maximum flexibility* are the fundamental values that Lika Electronic is truly proud of offering its customers when working together.

The Rosetta space mission

Lika is proud to be part of the international team of companies that, under the guide of the **European Space Agency (ESA)** has allowed to achieve this historic result. Visit our website for full information.

Lika Electronic operates all over the world providing a widespread and efficient global distribution network, offering unrivalled technical support and excellent customer service. At the present time the export share is approximately 60% of the turnover in more than 50 countries.

2000 ROSETTA space probe project gets under way in co-operation with CISAS.	**2002** Production in antistatic environment (ESD). DRIVECOD & POSICONTROL product ranges are launched in the market.	**2007** Lika Electronic celebrates its 25th anniversary.	**2012** 30th anniversary: "30 new products for our 30 years" event launched.	**2015** Certificate ISO 14001:2004

2000	**2004**	**2008**	**2012**	**2015**

| **1998**
First 16-bit resolution single-turn absolute encoder engineered for installation in aerostatic probes developed by Florence University. | **2004**
Arianne 5 rocket successfully launched: Rosetta probe fits Lika encoders. | **2008**
ALMA project: giant array of 12-m radio telescopes equipped with special custom-made Lika encoders. | **2010**
Lika introduces the innovative range of heavy-duty products dedicated to steel & iron industry and wind mills.

2013
Lika South East Asia founded in Thailand. |

Environmental policies at Lika Electronic

Besides a daily investment in materials research, electronics improvement and software development, day after day also environmental values have become an unavoidable commitment in each choice and strategy of the company. For this purpose, even though discretionary, conscious about the importance of the human health, the environmental protection and the preservation of natural resources, since 2006 Lika Electronic has decided to fully comply with the directive **2002/95/EC, usually referred to as RoHS**, i.e. Restriction of Hazardous Substances Directive (it has been replaced by the new "RoHS2" Directive 2011/65/EU recently).
Two years later Lika Electronic has adhered to stringent directive 1907/2006/EC, usually referred to as REACH, banning the chemical substances reported in ECHA's Candidate List and in authorized list. Now Lika Electronic is committed to adopt an environmental management system complying with ISO 14001:2004 requirements in order to promote a responsible environmental policy among employees, suppliers and customers as well.
Dedication to corporate responsibility has led the company to implement a real "green" investment for environmental sustainability: Lika Electronic is equipped with a photovoltaic system consisting of 260 PV modules for a maximum power output of about 65 kW which prevents the emission of approximately 40 tonnes of CO_2 per year.

Express service

Lika Electronic provides high flexibility and faster action as all design and production processes are carried out in-house.
For this reason we are able to translate any needs into customized solutions in very short time. Fast manufacturing service is available and intended to ensure production within **three working days** only. The service is subject to availability of all parts at our premises.

Customer service & assistance

Production and manufacturing processes from design to after-sales are constantly monitored and improved to ensure optimized, fast, resilient and cost-effective service. Thus you can trust in a dependable and on-time service -from production to delivery. Furthermore Lika Electronic is able to translate the customers' specific requirements and needs into customized solutions in very short time, both for small and large batches. A repairs workshop also operates within Lika's facilities where expert and thorough personnel provide fast and effective repair service and guarantee reduced times and costs. Lika's team is dynamic, professional and customer-focused and has relevant experience and technical competence. Whether you need troubleshooting assistance or business advice we provide outstanding and responsive technical support and excellent customer service. English, Italian, German, French and Spanish are fluently spoken. Offices and phone lines are open Monday to Friday 8am – 5pm CET.

Catalogues, user manuals and website

As a part of Lika's ongoing commitment to provide the highest level of support to make customers' job easier, a full set of technical and commercial documentation is easily available in the Downloads section of our corporate website and upon request.
Catalogues, brochures, datasheets, user's manuals and installation guides are offered in the most common languages. The general catalogue is a hands-on reference guide useful to describe the whole products portfolio and is available in more than 10 languages.
Series-specific and thematic catalogues provide detailed product information and technical specifications that can help you always make the right choice.

Quality policies at Lika Electronic

Quality policy has always been of highest priority for Lika Electronic.

Lika is every day committed to develop and manufacture products that are recognized by customers and the industry for their high quality and performances.

Quality policy statement has been established since 1997 when Lika Electronic was first certified to ISO 9001:1994. **Nowadays Lika Electronic is certified to ISO 9001:2008 compliant quality management system**. It attests that Lika Electronic places *the utmost importance in the quality, safety and reliability of its products and every day aims at ensuring the full satisfaction of customer's needs.*

This is achieved by continuously developing new products that implement the most advanced technologies and can easily meet customers and markets requirements; by enhancing both internal and suppliers' processes for continual improvement of the system and the assurance of conformity; and by always meeting the regulations and complying early with future standards. All production and manufacturing processes as well as company management activities are involved in quality assurance and enhancement: from purchasing to goods receipt, from manufacturing to technical, from sales to account departments.

With the same purpose and even if not binding with this directive, Lika Electronic is committed to comply with **Directive 1907/2006/EC, usually referred to as REACH.** REACH is the European Community Regulation on chemicals and their safe use. It deals with the Registration, Evaluation, Authorization and Restriction of Chemical substances. The law entered into force on 1st June 2007.

The aim of REACH is to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances and progressive substitution of the most dangerous chemicals when suitable alternatives have been identified.

All Lika encoders are **CE compliant** and fully meet the requirements of the EMC European Directives as well as the recent Directive 2011/65/EU (RoHS2).

All Lika encoders comply with the **Directive 2002/95/EC, usually referred to as RoHS, i.e. Restriction of Hazardous Substances Directive, since 2006.**

The RoHS directive aims to restrict certain dangerous substances commonly used in electronic equipment.

Any RoHS compliant component is attested to be free from the presence of Lead (Pb), Cadmium (Cd), Mercury (Hg), Hexavalent chromium (Hex-Cr), Polybrominated biphenyls (PBB) and Polybrominated diphenyl ethers (PBDE).

This means that in all Lika products maximum concentrations of the afore-mentioned substances are under the restrictive limits permitted by this Directive.

July 2011 the new Directive 2011/65/EU, sometimes referred to as RoHS2, was published by the European Commission. The main point to consider is that the RoHS directive is now a CE-marking Directive. This means that compliance with RoHS Directive is required in order to place the CE mark on any product.

Lika Electronic declares that all products are here and now RoHS2 compliant and therefore they are allowed to bear the CE mark.

WEEE and end-of-life disposal information

Directive 2012/19/UE (as previous 2002/96/EC) is intended, as a first priority, to prevent waste electric and electronic equipment (hence the acronym WEEE) from being introduced into the unsorted waste stream; and in addition to promote reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste.

Furthermore it encourages the "ecological" design and production of electrical and electronic equipment which take into account and facilitate dismantling and recovery, in particular the re-use and recycling of WEEE, their components and materials.

Extended producer and user responsibility for separate collection is the precondition to ensure specific treatment and recycling of WEEE and is necessary to achieve the chosen level of protection of human health and the environment.

Products manufactured by Lika Electronic are not covered by WEEE directive currently as they do not fall under the categories coming within the scope of the Directive.

WEEE directive applies to standalone products; our products cannot function entirely on their own, they are always integrated into larger systems and come as part of complex equipment. Anyway, electric and electronic equipment may contain materials, components and substances which can be dangerous to the environment and harmful to human health if not disposed properly.

So you should not dispose of electrical and electronic equipment as unsorted municipal waste.

Please we advise you to dispose of waste so as to reduce environmental impact and increase re-use, recycling and recovering of WEEE.

For this reason the symbol of the crossed-out wheelie bin appears in the documentation of all our products.

For customers who wish to send us back Lika products at the end of their life, we are willing to recycle and dispose of them in compliance with Directives and regulations in force.

Product label

Each device is fitted with its own product label applied to the enclosure.

All important data such as product name, order code, serial number, … is printed on the label.

Please have this data to hand when you call to help us deal with your enquiry quicker.

The label is applied at the end of the manufacturing process and after passing all conformance and quality tests. Each device is individually checked and tested by expert and thorough personnel having relevant experience and technical competence.

Thus the label certifies that the product has been subjected to rigorous testing throughout its development and production in order to assess its safety, performance and conformity to Lika's quality standards.

Linear encoders

Linear encoders are measuring systems that generate signals in response to a linear motion.
They are specifically designed to convert a linear motion into either analogue/digital electrical signals or a digital code in order to determine the change in position.
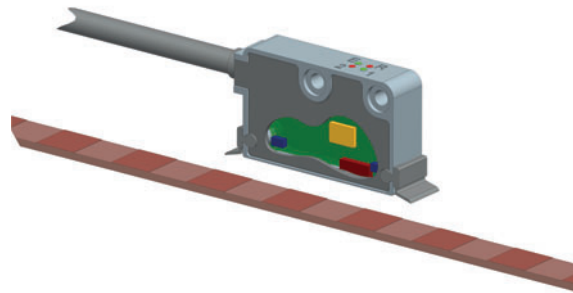
They basically consist of a **readhead** (oxtherwise referred to as **sensing head** hereinafter) and an active measurement scale, namely a **magnetic tape** (sometimes a passive measurement tape could be used in specific applications -for instance a ferromagnetic toothed structure. For any information on such dedicated measuring systems see on page 23).
The readhead encompasses MR magneto-resistive sensors/Hall sensors (see on page 12) and the converting/translation circuitry (see on page 12). The readhead is paired with a magnetic tape that encodes the incremental/absolute position information.
When the sensing head is moved along the tape without contact, it reads the sequence of North-South poles and converts the encoded datum position into an analogue/digital signal or a digital code.
Thus the linear encoder is able to provide the motion controller with information concerning travel, position, displacement, direction, velocity and acceleration.
Linear encoders offer great advantages. **The magnetic sensing technology is non-contact and frictionless**; the use of miniaturized sensor modules and circuitries allow for very compact and slim enclosures; the operation without mobile mechanical elements minimize the risks of errors and failures (no bearings are used!). In addition they can be easily protected against contaminants using methods such as tropicalization, conformal coating, encapsulating or varnishing thus easily achieving the highest IP ratings (IP67 to IP69K).

Linear encoders from Lika Electronic have minimal dimensions and provide high immunity to interferences and most contaminants. Since they detect change in the magnetic field, they are insensitive to external influences such as light, dust, moisture, oil, grease, water jets and a variety of chemical agents.
They work without contact and ensure virtually wear & maintenance-free operation.
Furthermore they are able to offer high reliability, enduring service and long operating life even in demanding conditions and under dirt, shocks, vibrations, temperature fluctuations and significant mechanical stresses.

Linear sensors are claimed to reliably operate in the most aggressive and harshest industrial environments and ideally suited for applications where small size, high robustness and fine resolution are mandatory.

Among the typical applications are:
- motion systems, direct drives and linear motors;
- electronic and semiconductors assembly systems, PCB assembly equipment and wire bonders;
- product handling equipment, robotics, pick-and-place lines;
- machining tools (boring machines, lathes, cutting and bending machines ...);
- telescopic systems and hydraulic pistons (outriggers, stabilizing slides, telescopic cranes, booms of mobile equipment ...);
- valve actuators;
- utility vehicles and industrial trucks;
- forklifts, scissor lifts and loading platforms;
- medical technology applications such as examination tables, X-ray machines, dentist's chairs and laboratory testing devices;
- electro-medical and metrology instruments;
- printing machines, presses and converting machineries;
- textile, wood, metal and stone working machineries.

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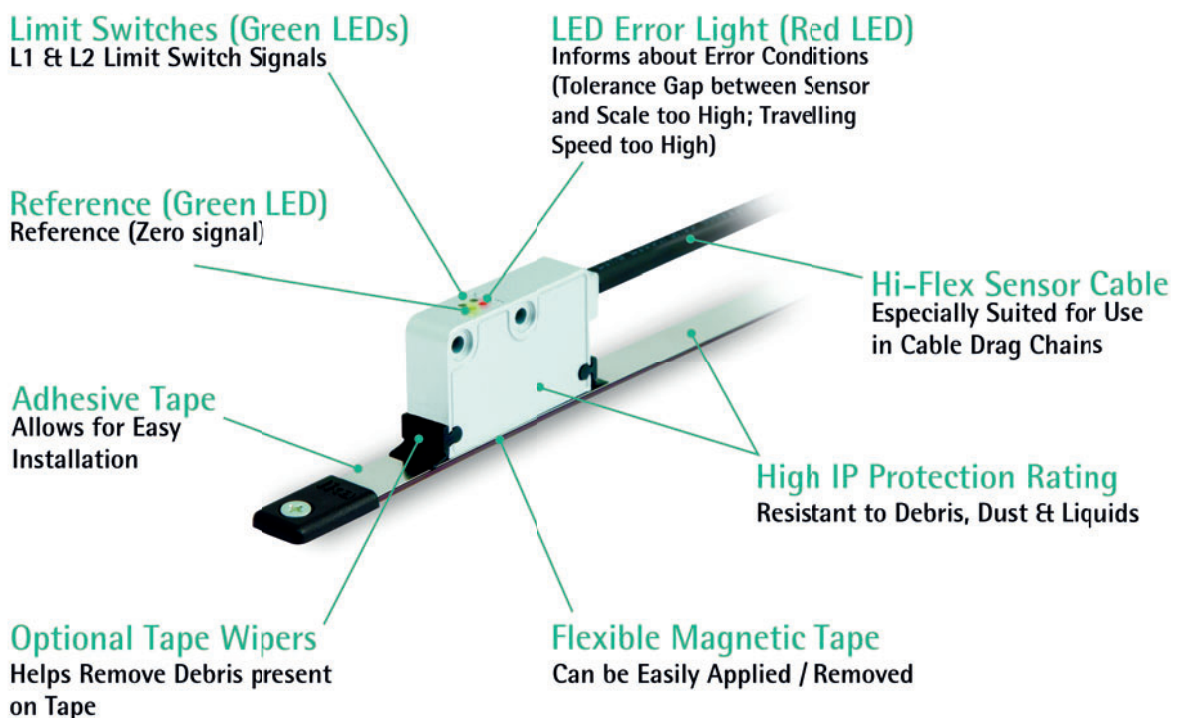Linear encoders can be **incremental or absolute.**
Incremental linear encoders produce square waves signals or sinusoidal signals and can provide travel, position and displacement information. Positional information is cyclical, thus relative and ambiguous; this means that you can gather whether the axis is moving and the direction of the movement; yet you cannot get information about its absolute position. To compensate for this glitch the homing operation is always required at the beginning of the process to determine the absolute position of the system (detection of the zero point; then it requires counting of cycles to maintain absolute position within the travel range). For such reason most incremental linear encoders can produce Index and/or Reference mark pulses providing a datum position along the tape for use at power-up or following a loss of power. For detailed information on incremental linear encoders refer to page 24.

Incremental encoder

An absolute linear encoder is designed to output the absolute position information in response to motion along a linear path. It relies on a unique code pattern encoded on the tape, so it can provide a unique and unambiguous position within the travel range without requiring knowledge of any previous position. The major advantage is that you can always gather exactly the position of the axis. For instance, in case of power loss or failure, then at power-up the absolute encoder will be able to output the current position of the axis precisely. This means that no homing operation is required to determine the current position. An absolute encoder provides the motion controller with either analogue signals or a digital code information. The digital information can be in pure Binary or Gray code format. Customarily the absolute encoder encompasses serial (SSI, BiSS) output circuits, but it can also afford analogue and fieldbus interfaces.
For detailed information on absolute linear encoders refer to page 34.

Absolute encoder

At a glance: Linear Encoder typical features

Limit Switches (Green LEDs)
L1 & L2 Limit Switch Signals

LED Error Light (Red LED)
Informs about Error Conditions
(Tolerance Gap between Sensor
and Scale too High; Travelling
Speed too High)

Reference (Green LED)
Reference (Zero signal)

Hi-Flex Sensor Cable
Especially Suited for Use
in Cable Drag Chains

Adhesive Tape
Allows for Easy
Installation

High IP Protection Rating
Resistant to Debris, Dust & Liquids

Optional Tape Wipers
Helps Remove Debris present
on Tape

Flexible Magnetic Tape
Can be Easily Applied / Removed

The magnetic tape is the carrier of the incremental and absolute encoded position information.

Magnetic tape
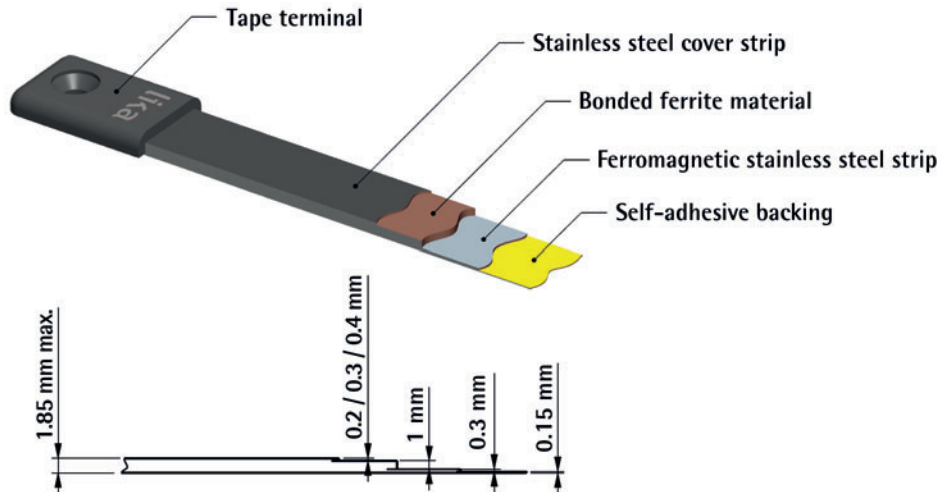
It is primarily made up of a **bonded ferrite material** where the datum position is coded. During the encoding process, the sensitive material is magnetized to obtain either a systematic sequence of North-South poles with alternating magnetic field having the same pole pitch dimension (incremental version) or a coded sequence of North-South poles generating an absolute pattern (absolute version).
Sometimes the absolute encoders are paired with a double-track magnetic tape encompassing both the absolute pattern and an incremental poles track for speed feedback.
The bonded ferrite layer is mounted on a **ferromagnetic stainless steel strip** in order to be self-supporting, have both robustness and flexibility and shield the encoded material from the magnetic fields that may influence from the bottom.
A **cover strip** in stainless steel can be supplied on request to be stuck on the sensitive surface and protect it from scratching and contaminants (see the magnetic tape's order code). The tape can be easily applied/removed via a **self-adhesive backing (liner)** pre-applied under the stainless steel strip. The tape is insensitive to light, dust, fingerprints, moisture, oil, grease, water, many chemical agents; thus it can be mounted in the most aggressive industrial environments.

In specific encoders that require the sensing head to be guided by a track profile (see the SMIG and SMAG series), the magnetic tape is inserted in an aluminium track section. On demand the measurement tape can be protected using an aluminium profile (order code PS1-x). Furthermore it can be fitted with plastic terminals to protect the ends and prevent them from peeling off (order codes **KIT LKM-1439 and KIT LKM-1440**).
For availability and additional information see the section "Accessories" on page 119.

For specific applications Lika Electronic is able to provide incremental modular encoders for toothed-wheels and racks. In such measurement systems a ferromagnetic toothed structure is used as a passive measurement scape instead of the active measurement tape with magnetized poles described above. For more information about such applications see on page 23.

Passive scale

Tape dimensions

There are two types of magnetic tapes for incremental encoders: **MT**x tapes and **MTS**x tapes. MT tapes are 10 mm wide while MTS tapes are 5 mm wide.

As in an incremental measuring system the tape has a systematic sequence of North and South poles recurring indefinitely, there is virtually no limit to its measuring length (see on page 14). Standard incremental tapes up to 100 m long can be supplied, they can be cut to length accorwding to application requirements. You are required to indicate the desired size under the option LENGTH in the order code.

The magnetic tapes for absolute encoders, **MTA**x type tapes, are 10 or 20 mm wide, according to models.

An absolute tape encompasses a coded sequence of **North-South poles** generating a pseudo-random absolute pattern, so there is a limit to the number of information it can provide as well as to its overall length. The max. measuring length of the absolute encoders is indicated in the datasheet under the section "Mechanical specifications". Unless otherwise indicated, any absolute tape section shorter than the max. measuring length can be supplied on request.

When you need to order the tape please calculate its length as follows:
length of the travel to be measured + length of the sensing head + two safety sections at both ends each one being min. 1-pole pitch long + additionally 1 cm at both ends if you mount the optional tape terminals.
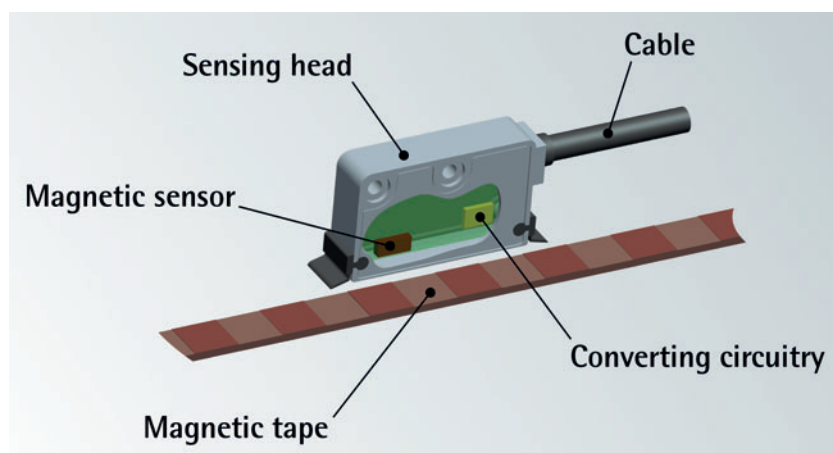
Magnetic sensors

The magnetic sensors (MR magneto-resistive sensors or Hall sensors) are located inside the readhead and designed to translate the information from the magnetic field generated by the North-South poles of the tape into an electrical signal.

In an incremental encoder the magnetic sine waves are converted into two separate sine-cosine signals phase-shifted by 90 electrical degrees.

While in an absolute encoder the sequence of coded poles is converted into an absolute serial signal. The signals are processed and optimized by the converting circuitry before being output. The sensing elements are designed and arranged in order to minimize the effects of the external static magnetic fields.

Converting circuitry

The converting circuitry (otherwise referred to as translation circuitry) is designed to collect the signals from the magnetic sensor and convert them into standard output signals.

Signal conditioning processes allow to obtain signals that are optimized for the subsequent controller and the different environmental conditions.

Using interpolation techniques further allows to interpolate the signals, that is to convert the signals to a higher sampling rate (upsampling). In this way it is possible to provide enhanced measuring resolutions to output.

The converter can provide the following output signals or information to the subsequent controller:
- square wave signals phase-shifted by 90 electrical degrees;
- sine-cosine signals phase-shifted by 90 electrical degrees;
- absolute information via serial SSI and BiSS interfaces;
- absolute information via fieldbus interfaces;
- current and voltage analogue signals.

Cables

Linear sensors are equipped with **high-flex cables** especially suited for use in cable drag chains and tested for more than 1 million cycles. Furthermore they are expressly designed for high speeds up to 10 m/s and accelerations up to 6 m/s². They are halogen free and resistant to oil, hydrolysis and abrasion. For more details please refer to page 118.
When choosing an encoder model, please consider the noise and the cable length that could affect the system and reduce its performances. Longer cable lengths are more susceptible to noise. It is crucial to use proper cable lengths to ensure that the system operates correctly. We recommend shielded, twisted-pair cables to be used. For more information on the cable lengths recommended for each interface please refer to the specific sections.

Pole pitch

The magnetic tape is magnetized in order to have a sequence of North and South poles along the path. The poles allow the magnetic sensor passing along the tape to detect the changes in the magnetic field, that is to sense each small shift in the position and so to output a signal in response to motion.
The **pole pitch** is the distance between two consecutive poles and is expressed in millimetres.

In an **incremental measuring system** the tape has a systematic sequence of North and South poles. The pole pitch depends on the magnetization process and tapes with a variety of pole pitches can be supplied. **MT10** magnetic tape, for instance, provides **1.0-mm pole pitches**, while **MTS25** magnetic tape provides **2.5-mm pole pitches**. The smaller the pole pitch, the higher the resolution and the quality of the positional information.
The incremental pole pitches can be 1, 2, 2.5, 3.2, 4 and 5 mm long, according to models.

In an **absolute measuring system**, the absolute coding pole pitch depends on the physical characteristics of the sensor array deployed in the sensing head. The smaller is the distance between the sensors in the array, the smaller is the pole pitch. In an absolute measuring system the tape has a sequence of alternating magnetic fields, but they have different dimensions (more than one either North or South pole could follow in the sequence).

You must always pair the encoder with the right pole pitch tape.
For instance, the **SME1 linear encoder must be compulsorily paired with the MT10 tape**. If otherwise, the sensor cannot work.

Resolution

The resolution can be defined in several ways. **It is the ability to provide the information over a defined space**; otherwise it is the spacing between two consecutive discrete points, i.e. the sequence of information. The more discrete points are used and the smaller the distance between these points, the higher will be the resolution of the measurement system and the quality of its information.
When referring to an incremental linear encoder, the resolution (otherwise referred to as "measuring step" or "measuring increment") is the distance between two following edges of A and B channels. It results from the pole pitch of the magnetic tape and the interpolation factor. It is indicated by using a metric length such as millimetres (mm) or microns (μm). Digital linear incremental encoders interpolate the analogue sine/cosine signals by an interpolation factor in order to sub-divide the tape period, so providing a higher measurement resolution. The output of the interpolation process results in quadrature squarewaves – the distance between the edges of the A and B channels being the resolution of the encoder. Unlike what is stated in rotary encoders, **the resolution indicated in this catalogue for the linear incremental encoders is always to be intended after quadruplication**, as shown in the Figure.
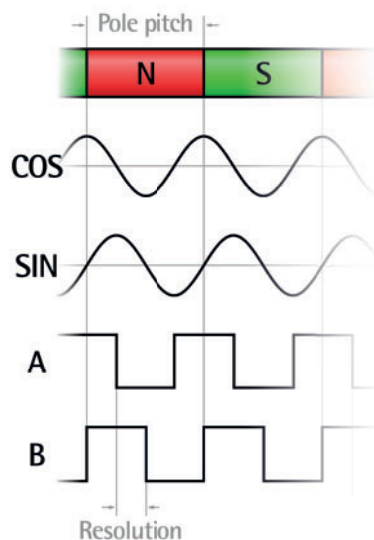
In an **absolute encoder** the resolution can be defined as the smallest change in the underlying physical quantity that produces a response in the measurement, the response being the absolute information that is provided to output.

The measuring length can be defined as the overall active section (path) in the tape that encodes the position.

An **incremental tape** has a systematic sequence of North and South poles recurring indefinitely, so there is virtually no limit to its measuring length and the tape can be shortened at will according to needs.

In an **absolute tape** the max. measuring length depends on some characteristics of both the encoder and the tape such as the number of Hall sensors in the array and the pole pitch.
So there is a limit to the overall path. The max. measuring length of the absolute encoders is indicated in the datasheet under the section "Mechanical specifications".
Unless otherwise indicated, any absolute tape section shorter than the max. measuring length can be supplied on request.

The number of information that the encoder is able to provide to output depends on its measuring length and resolution.
It results from the following calculation:

$$\text{Max. No of Information} = \frac{\text{Max. measuring length}}{\text{Resolution}}$$

Let's suppose we need to connect the following linear encoder: **SMAX–BG–100.**
Its resolution is **0.1 mm** (see the order code). The max. measuring length of the SMAX linear encoder on the MTAX tape is **600 mm** (see the order code).
The encoder will provide the following max. number of information:

$$\text{Max. No of Information} = \frac{600}{0.1} = 6{,}000$$

If you mount only half the tape (300 mm), then the number of information provided by the encoder will be down to half (3,000 information).

In an absolute encoder it can be translated into a bit value. To know the number of bits needed for the position information, then you must "round up" the result to the next highest power of 2, that is: $6{,}000 = 2^{13}$ (8192). Thus the number of bits is "13" and the encoder will provide max. 6,000 information in the range 0 ... 8191. So customarily if you set a zero along the path, when the encoder moves back and cross the zero, the value immediately after 0 will be $2^{\text{number of bits}} - 1$ (i.e. 8,191 in the example above).

Sometimes you may be required to convert the pulses/information from the linear encoder in order to know the linear space travelled by the encoder; to convert the value into a metric measuring unit then you must multiply the number of detected pulses (or information) by the resolution.

Example 1
SME22-Y-2-50-...
resolution = 50 µm
detected pulses = 123
position value = 123 * 50 = 6150 µm = 6.15 mm

Example 2
SME22-Y-2-1-...
resolution = 1 µm
detected pulses = 1569
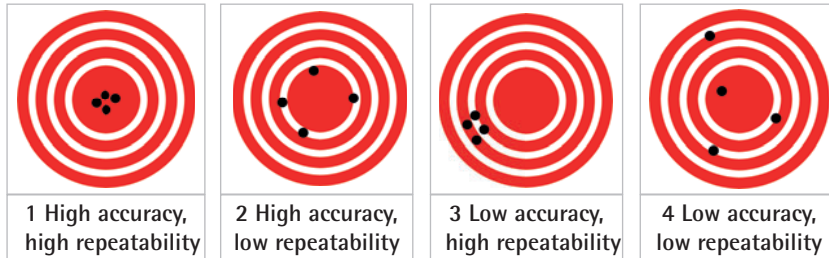position value = 1569 * 1 = 1569 µm = 1.569 mm

Measuring length

Max. number of information

Conversion into a metric measuring unit

The terms "accuracy" and "repeatability" are in straight relation between each other and are often used as synonyms. Actually, their meaning is very different.

Accuracy

| 1 High accuracy, high repeatability | 2 High accuracy, low repeatability | 3 Low accuracy, high repeatability | 4 Low accuracy, low repeatability |

As you can easily understand from the Figures, a measurement system can provide high accuracy but low repeatability (2), high repeatability but low accuracy (3), neither (4), or both (1). Many factors can affect both accuracy and repeatability:
- the characteristics of the magnetic tape;
- the characteristics of the sensor;
- the characteristics of the overall application where the measurement system is integrated (mechanical alignment, etc.);
- the environmental conditions.

The accuracy of the magnetic tape is indicated by μm/m in the datasheets.
The accuracy value represents the maximum deviation of inaccuracy inside any section of 1 m of the measurement range. The accuracy class is listed as ± xx μm, where xx = number of μm/m. Since most of the tapes can be supplied with different accuracy classes, it has to be indicated under the option **ACCURACY CLASS** in the order code.

The system (sensor) accuracy refers to the error within the single pole and depends mainly on the sensing elements and the electronics. It is expressed in μm.

Repeatability is the ability of the measurement system to provide consistent information under the same -unchanged- conditions or under different -changed- conditions.
The standard deviation is expressed in increments.

Repeatability

Most of Lika Electronic linear encoders are equipped with **LEDs** intended for diagnostic purposes. They are meant to show visually the operating or fault status of the device and the interface as well as to help the user during installation and set up.
They also signal the activation of Reference and Limit Switch marks, when available.

Diagnostic LEDs

Specific models include additional rubber cleaning wipers to be mounted on the sensing head (order code **KIT WIPERS**). They are designed for debris removal from the magnetic tape surface ensuring a clear path of motion.

Cleaning wipers

Diagnostic LEDs

Optional cleaning wipers
Order code: KIT WIPERS
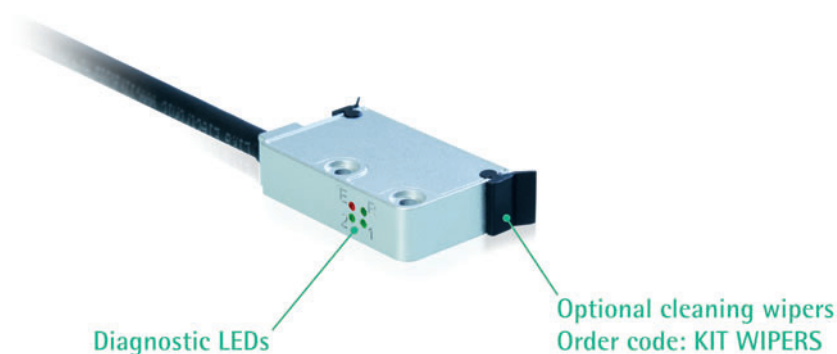
Mechanical and environmental information

The accuracy of a linear encoder system largely depends also on mechanical alignment, thus the installers ability to maintain all mounting parameters within the tolerance values specified in the technical documentation is vital for proper operation.

As stated, a linear encoder basically consists of a sensing head and a magnetic tape.

One of these encoder assembly component parts is mounted on a fixed support while the other is secured to the moving structure of the application. In a customary installation, the magnetic tape is applied to a fixed support, while the sensing head is fastened to the moving unit. But sometimes, for instance in the measurement systems having a rigid track profile such as SMIG and SMAG encoders, we could have the reading head fastened to a fixed support while the magnetic tape is kept free to move.

In both cases, the relation between the reading head and the tape is critical and must be preserved along the whole axis travel. Thus, mounting the two component parts parallel to the axis of travel for all planes within specified tolerances will yield best results.

Great care is required when mounting a linear encoder because all the alignment dimensions can seriously affect the proper operation of the measuring system.

The Figure below shows the critical features that must be assessed and taken into the greatest consideration during installation.

Make sure that the gap D between the sensing head and the magnetic tape is always **within the tolerance values indicated** in the specific documentation along the whole axis travel. The same considerations concern the gap you have to comply with when installing the sensing head and the external Reference magnet and/or the external limit switch magnets.

Check the parallelism and planarity specifications for all the measuring system component units: sensing head, magnetic tape, reference external magnet, limit switch external magnets. Always comply with the tolerances concerning roll, tilt, yaw and lateral deviation. Alignment specifications depend on the characteristics of each specific encoder model, so they are expressly provided with installation literature.

Install the measurement system providing protection means against waste, especially swarf as turnings, chips or filings; should this not be possible, please make sure that adequate cleaning measures (as for instance brushes, scrapers, jets of compressed air, etc.) are in place in order to prevent the reading head and the magnetic tape from jamming. Optional rubber cleaning wipers can be supplied in specific models (see on page 15).

Distance from the scale

D

Roll

Lateral deviation

Tilt

Yaw
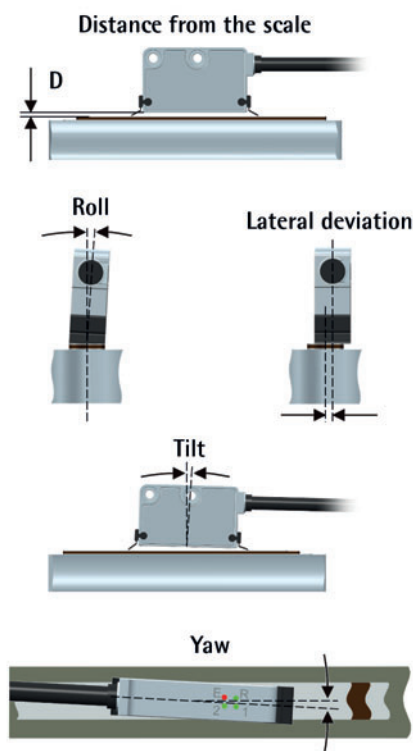
The magnetic tape must be mounted evenly on the application surface ensuring that it is perfectly levelled and free of bumps. The adhesion of the tape to the bonding surface depends on a variety of factors such as the cleaning, the temperature at application, the roughness of the materials and the smoothness of the bonding surface. To obtain optimum and safe adhesion, the bonding surfaces must be well unified, clean and dry. The ideal application temperature range is +21°C to +38°C (+70°F to +100°F). Do not wind the tape with the magnetized side facing outwards. Do not twist or bend the magnetic tape.

For the recommended tape length in relation to the travel to be measured please see the section "Tape dimensions" on page 12.

Both the magnetic sensor and the tape are sensitive to magnetic fields and may be damaged even permanently if exposed to a powerful magnetic field generated by magnetic tools or linear motors. Please use precautionary procedures during installation in order to avoid performance degradation or loss of functionality. Always keep the measuring system a safe distance from devices producing strong magnetic fields.

Orientation

The orientation of the sensing head over the magnetic tape must be compulsorily observed and is always indicated in the technical documentation.

Please note that the orientation does not affect the operation of an **incremental encoder**: the encoder works properly regardless of the mounting direction of the measuring system parts.
However check the cable outlet and operate the sensor accordingly to have a standard counting direction. In an incremental encoder **the standard counting direction** is achieved when the sensor moves according to the installation instructions so that the rising edge of the signal A leads the rising edge of the signal B; and on the contrary, the reverse counting direction is achieved when the sensor moves in the reverse of the standard direction so that the rising edge of the signal B leads the rising edge of the signal A.
Refer to the specific "User's guide".

On the contrary the correct installation of both the sensor and the tape is mandatory in an **absolute encoder**: the absolute measuring system cannot work if it is not mounted as indicated in the technical documentation.
An arrow printed on the upper surface of the absolute tape is intended to help direct the sensing head properly in accordance with the mounting instructions: **please always check the cable outlet as well as the direction of the arrow printed on the tape.**
In an absolute system the arrow further indicates the standard counting direction.
The standard counting direction means that the count increases when the sensor moves as indicated by the arrow (provided that the sensor is mounted properly). Please always note down the direction of the arrow on the tape before applying the cover strip!
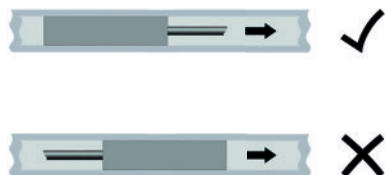
For further information on the standard counting direction please refer to the section "A and B channels (bi-directional output, single ended output)" on page 24 (incremental encoders) and to the section "Counting direction input" on page 41 (absolute encoders).

Operating temperature

To guarantee the encoder reliability over time and a proper working, the operating temperature range indicated under the section "Environmental specifications" in the datasheet has to be fulfilled carefully. When operating, the encoder can reach the range of temperature indicated in the datasheet. Within the stated range of temperature the encoder meets the performance specifications listed in the datasheet.
The minimum and maximum temperature values have been measured in compliance with the standards CEI IEC 68-2-1 and CEI IEC 68-2-2.
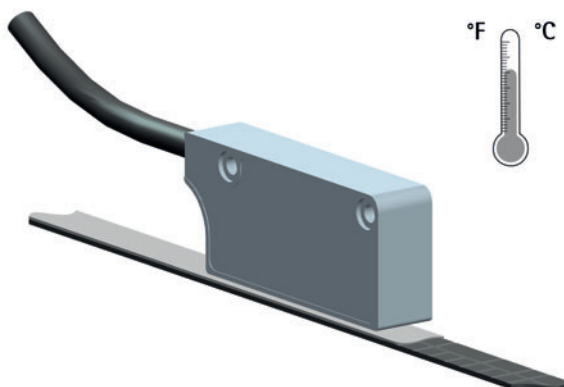
Shock

This is the **maximum shock acceleration** that the encoder is able to withstand without inducing a mechanical weakness and losing the performances specified in the datasheet. Shock test is performed in compliance with the international standard IEC EN 60068-2-27. Maximum values are permissible providing that the encoder is installed properly, following carefully the instructions given in the technical documentation and complying with the mounting tolerances indicated by the manufacturer. Any mechanical shock and vibration exceeding the stated values may cause damage to the encoder. Please further consider that an encoder is a delicate electronic equipment, for this reason it should not be subjected to excessive mechanical shock and vibration during both installation and operation.

Vibration

This is the **maximum sustained vibration** that the encoder is able to withstand without inducing a mechanical weakness and losing the performances specified in the datasheet. Vibration test is performed in compliance with the international standard IEC EN 60068-2-6. Maximum values are permissible providing that the encoder is installed properly, following carefully the instructions given in the technical documentation and complying with the mounting tolerances indicated by the manufacturer. Any mechanical shock and vibration exceeding the stated values may cause damage to the encoder. Please further consider that an encoder is a delicate electronic equipment, for this reason it should not be subjected to excessive mechanical shock and vibration during both installation and operation.

Short-circuit protection

Most of the outputs (refer to the section "Output circuits") **are protected against short-circuit.** Short-circuit protection is intended to keep the encoder electronics safe from accidental and temporary connection of one or more outputs either to 0Vdc, to +Vdc or to each other, provided that the power voltage is connected properly. If such a situation arises, no damage is caused to the circuitry, nevertheless it is compulsory to re-establish immediately the proper connection. Refer to the "Protection" information in the "Electrical Specifications" of the datasheet.

Reverse polarity protection

Most of the Lika encoder versions (except some +5Vdc power supply versions; refer to the section "Output circuits") implement the reverse polarity protection to prevent the internal electronics from being damaged in case the polarity is accidentally reversed on the connection. Refer to the "Protection" information in the "Electrical Specifications" of the datasheet.

IP code

IP –International Protection– code as defined in the international standard IEC 60529 classifies the degrees of protection from solid objects and accidental contacts as well as from liquids provided by the enclosures of any electrical equipment. The protection rate is defined by the IP abbreviation followed by a two-digit number. **The first digit indicates** the level of protection of the enclosure against particles and solid objects; while **the second digit** indicates the level of protection against liquids. IP ratings are summarized in the table below.

IP first digit – Protection against solid objects		IP second digit – Protection against liquids	
0	No protection	0	No protection
1	Protected against solid objects 50 mm (2") or greater	1	Protected against vertically dripping water
2	Protected against solid objects 12 mm (0.47") or greater	2	Protected against vertically dripping water, when tilted 15 degrees
3	Protected against solid objects 2.5 mm (0.1") or greater	3	Protected against water spraying at an angle up to 60 degrees
4	Protected against solid objects 1 mm (0.04") or greater	4	Protected against water splashing from any direction
5	Protected against dust limited ingress	5	Protected against jets of water from any directions
6	Totally protected against dust	6	Protected against powerful jets of water from any directions
		7	Protected against immersion between a depth of 150 mm (6") and 1000 mm (40")
		8	Protected against continuous submersion

For instance, if a product provides IP67-rated protection, this means that it is totally protected against dust -first digit: 6- and protected against immersion between a depth of 150 mm (6") and 1000 mm (40") -second digit: 7.

The **IP69K protection rate** is not defined in the international standard IEC 60529 but in the German standard DIN 40050-9 which was originally intended to concern the road vehicles and nowadays is generally and widely considered as an integration of the IEC 60529 rating system. The IP69K protection rate applies to equipment able to withstand high-pressure and high-temperature wash down and even steam cleaning applications.
Selected products with IP69K protection rate are available on request.

The **United States National Electrical Manufacturers Association (NEMA)** also publishes protection ratings for enclosures similar to the IP rating system. However, it also dictates other product features not addressed by IP codes, such as corrosion resistance.
Thus, while it is possible to map NEMA ratings that satisfy or exceed the IP code criteria, it is not possible to map IP codes to NEMA enclosure ratings, as the IP code does not mandate the additional requirements. The table below indicates the minimum NEMA rating that satisfies or exceeds a given IP code, but can only be used in that way, not to map IP to NEMA.

IP69K

NEMA ratings and IP equivalency chart

NEMA enclosure rating	IP Code
1	IP10
2	IP11
3	IP54
3R	IP14
3S	IP54
4	IP56
4X	IP56
5	IP52
6	IP67
6P	IP67
12 and 12K	IP52
13	IP54

Encoder options and accessories

Linear encoders are offered in a comprehensive range of choices and options to perfectly suit specific needs in a good many industries and applications. In addition Lika Electronic is able to provide a wide variety of accessories such as cordsets, connectors, reference and limit switch marks, cleaning wipers, tape terminals, protection profiles, displays, signal converters and encoder interfaces.

Cordset

Connectors

Reference and Limit swith marks

Cleaning wipers

Tape terminals

Protection profiles

Position displays

Converters

Signal interfaces

Products by category, products by application

Lika Electronic measuring systems are research-driven and designed to set the standards. They all apply the latest state-of-the-art technologies and aim at meeting early the ever-changing requirements of customers and markets. Dependability, high quality and innovative strength are part of each one of them. Encoders and sensors, actuators and interfaces, they only fit selected advanced components and are inspected individually before delivery, ensuring they can operate safely and reliably throughout the lifetime of any application. Nevertheless these basic properties need to be carefully balanced as not all are suitable for specific requirements in the same manner. Lika products are practice-based and customer-oriented and are born out of proven experience and expertise. For this reason Lika Electronic can offer a wide products portfolio devised for any application and operating environment. And this is why the products in this catalogue are divided into three main categories according to their specialized application, they are listed hereafter.

General application and position measurement encoders category is the most versatile and is intended to target the products for the widest requirements of the industrial market. Because of the huge variety of use possibilities, general application encoders need to be highly flexible and even multi-purpose, thus they offer several features in a full range of industrial network connections; furthermore they must strike a careful balance between providing adequate protection against industrial conditions and ensuring good speeds and accuracies as well as absolute safe signal transmissions. General application products boast a rugged design and high-protection standards with immunity to dirt, debris and environmental factors and are able to handle shock and vibration impacts as well as temperature fluctuations. The wide range of general application encoders further includes economical solutions intended for applications where high resolutions are not a primary concern.

General application and position measurement encoders are offered in several versions providing:
- Incremental and absolute information
- fieldbus interfaces
- high IP protection rate

Application:
- packaging machinery
- metal cutting machines
- woodworking machinery
- stone & marbles cutting machinery
- glass machinery
- mechanical engineering
- robotics and product handling equipment

General application and position measurement encoders

Recommended types	
Incremental:	SMK, SMP, SME51, SME52, SMIG
Absolute:	SMAG, SMAX, SMAZ, SMA5
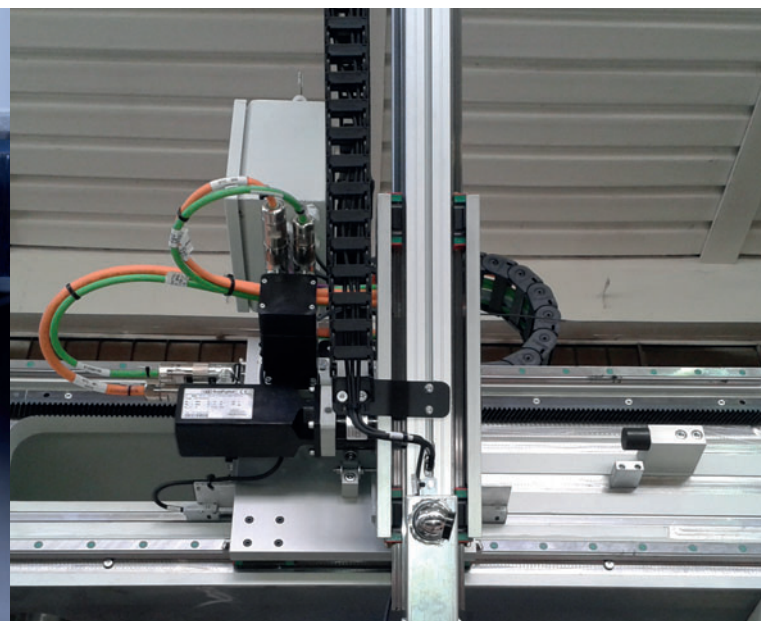
Feedback encoders are specifically designed for positional feedback in linear motors and high dynamic and precision motion systems.
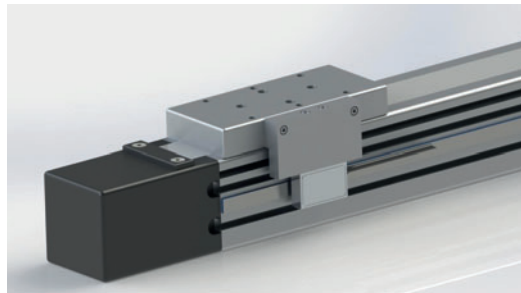
Thus they encompass standard interfaces suited to both communication and data exchange and mechanical installation in order to meet the requirements of a wide range of feedback applications. Developed to meet critical requirements although IP protection rate is not necessarily high, they are able to handle high temperatures and speeds and boast excellent accuracy and the safest signal transmission.

Feedback encoders are offered in several versions providing:
- Incremental and absolute information
- additional incremental/absolute tracks
- highest resolutions
- increased accuracy at highest speeds

Application:
- linear motors
- linear motion applications
- linear guideways, carriages, slides, positioning tables
- plotters, ink-jet printers

Motion control / feedback encoders

Recommended types	
Incremental:	SMP, SME11, SME12, SMS11 SMS12, SMSR, SMI
Absolute:	SMA1, SMA2

The harshest and most critical environments affected by oil, grease, dirt, the finest of dust particles, moisture, water jets, wash down cleaning, high pressure steam, common chemical agents as well as severe temperature fluctuations require **rugged and high protection level encoders. Heavy-duty encoders** are designed for the toughest applications and built to last. They are robust and capable of withstanding both highest mechanical stresses and extreme shock and vibration levels. Reliable design, sturdy construction, selected components, appropriate surface treatments and coatings and hermetically sealed housing are key features for dependable enduring service. Furthermore they are designed to offer outstanding reliability and absolute safety, with little or no maintenance. Usually they are devised for applications that demand high accuracy, therefore they encompass superior features.

Heavy-duty encoders are offered in several versions providing:
- Incremental and absolute information
- fieldbus interfaces
- large mounting tolerances
- high IP protection rate
- guided sensor versions

Application:
- wood, paper and metal working industries
- stone & marbles working machinery
- plastic working machinery
- ore mills, steel mills and metallurgic plants
- die casting industry
- shipbuilding
- aerospace industry
- utility vehicles and mobile equipment
- wind power plants
- marine industry and off-shore plants
- harbour equipment
- cranes, hoists and lifting equipment

Heavy-duty encoders

Recommended types	
Incremental:	SMH, SMK, SMX, SMIG
Absolute:	SMAG, SMAX, SMAZ

Lika Electronic is everyday committed to expanding its application specific product range. For such reason a variety of products and solutions are dedicated to suit individual industry needs. Here follows a cross-section of encoders tailored to specialized applications. For more information and special requirements please contact Lika Electronic.

Gear/tooth sensors

SMG is the incremental modular encoder specifically designed to sense a variety of ferromagnetic toothed structures which are used as a passive measurement scale with different pitches in both rotary and linear installations such as **toothed-wheels and racks.**
So it is typically intended for speed and position feedback in industrial applications up to 100,000 RPM such as HSC (High Speed Cutting) spindles of lathes and mills, machine tools and CNC machining centres; assembly equipment, industrial robots and manipulators, welding equipment, torque motors and drive systems in general. The sensor is available with different pitches to accommodate several modules **(typically M0.3 and M0.5).** Standard ferromagnetic wheels and racks with optional module versions can be provided; customized wheels and application solutions with diameters, modules and tooth profiles on request are further available to meet specific requirements. SMG provides either AB digital signals through Push-Pull or Line Driver (with /AB inverted signals) output circuits or sine-cosine signals through 1Vpp output circuit. An additional Reference signal is available on request.
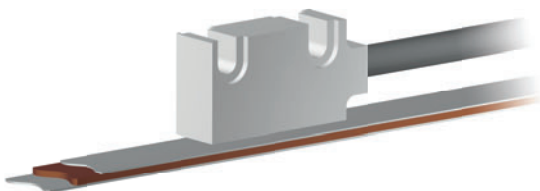
Vacuum encoders

SMB UHV is the incremental or absolute encoder suitable for both rotary and linear position feedback in **UHV applications where vacuum pressure is as low as 10^{-7} torr.**
SMB UHV is the first encoder encompassing the <u>magnetic technology</u> instead of the customary optical scanning for such use in **vacuum chambers.**

The benefits:
- appreciable 50% cost reduction;
- non-contact, maintenance-free and reliable operation;
- complete insensitivity to use under high vacuum;
- larger mounting tolerances which prevent the need for further adjustments after installation and set up.

Each component and material of SMB UHV has been especially designed and tested for use in vacuum chambers **in order to reduce outgassing and contamination**: sensing head enclosure and substrate in stainless steel, appropriate surface treatments and coatings, special adhesives, Kapton wires are among the design cares taken to meet the demanding requirements of such critical environment. Because of the use in limited space, also the readhead footprint has been shrunk to a minimum.

Typical applications under ultra high vacuum include electronics and semi-conductor industry, pick & place robots & manipulators, biomedical instruments, measuring equipment.

Incremental linear encoders

An incremental linear encoder uses a readhead fitted with MR magneto-resistive sensors and a magnetic tape to produce square waves signals or sinusoidal signals to output.
As the North-South poles positional information encoded on the tape is cyclical, that is relative and ambiguous, this means that you can gather whether the axis is moving and the direction of the movement when the magnetic sensor passes along the tape; yet you cannot have information about its absolute position; for such reason you need a calibration point for measuring reference.

A channel (uni-directional output)

Incremental encoders seldom provide only one A output channel (uni-directional pulses). They can be used uniquely when the information on the direction of motion is not required. All Lika encoders are dual channel encoders at least.

A and B channels (bi-directional output, single ended output)

The whole range of Lika incremental encoders provides A and B output channels at least (bi-directional pulses, also referred to as quadrature).
A and B channels supply square waves or cosine-sine signals phase-shifted by 90 electrical degrees. Thanks to this signal displacement, we can determine the direction of the motion. In fact when the rising edge of the signal A leads the rising edge of the signal B, the sensor is moving in the **standard counting direction**; and on the contrary, when the rising edge of the signal B leads the rising edge of the signal A, the sensor is moving in the reverse counting direction. This is right provided that the sensor is mounted properly and according to the installation literature. For further information on mounting and orienting the tape and the sensor please refer to the section "Mechanical and environmental information" on page 16 and to the section "Orientation" on page 17.
In the Figure the digital signals with inverted signals are represented after an interpolation factor 4x.
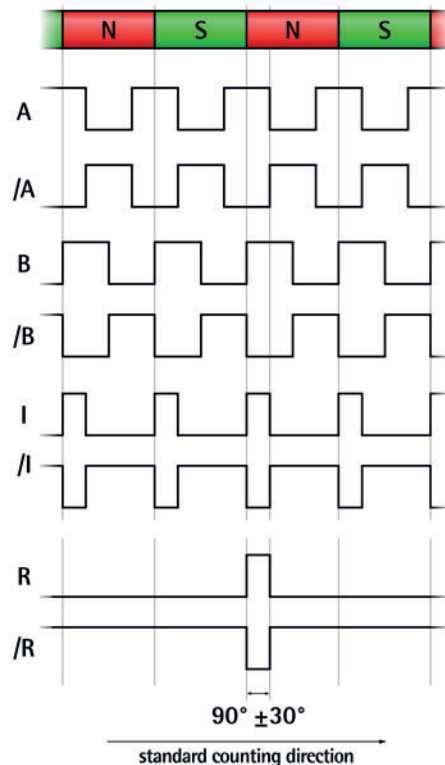
Inverted signals (complementary or differential outputs)

When noisy electrical environment conditions or long cable lengths could lead to unsafe communication, A and B as well as Index and Reference signals should be paired with **inverted signals** (/ABO, typically referred to as A NOT, B NOT and 0 NOT).
They are typically generated by inverting the electrical output (for instance, when A signal goes HIGH, /A signal goes LOW and vice versa).
Inverted signals allow pulses to be filtered in order to have clean signals.
Noisy pulses (missed or extra pulses) affect both normal and complementary signals in the same way and thus they can be easily detected and trimmed.

See the Figure: the extra pulse (in red) which affects both channels A and /A can be easily trimmed by the differential receiver to obtain a clean signal. Inverted signals are always available with RS-422 and sine wave output circuits and optionally with Push-Pull circuits (YC order code only).
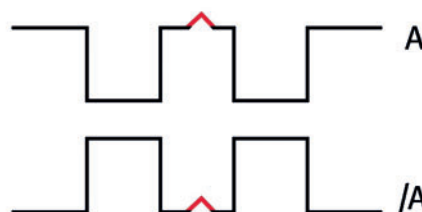
Index pulse (I and K output signals)

Most incremental linear encoders produce **Index pulses.** They provide datum positions along the tape for use at power-up or following a loss of power.

The periodic Index pulses (codes I or K) are customarily synchronized with A and B channels and provided once per pole (see the "Pole pitch" on page 13). They are always sent at the same position inside the pole, thus the distance between two Index pulses is the pole pitch. The amplitude of the Index signals depends on the output circuit: digital incremental encoders provide I code Index signals, they have an amplitude of either 0V +5V or +10V +30V. Sine-cosine incremental encoders can provide either I or K code Index signals (see the order code). I code Index signals have an amplitude according to RS422, while K code Index signals have an amplitude of 1Vpp. Also the duration of the Index signals varies depending on the output circuit (see the Figures): it is 90° ±30° for Push-Pull and Line Driver outputs; it can be either 70° ±10° (SMS series) or 180° ±1° (K code of SMSR) for the sine-cosine output. Index signals can be provided with inverted signals.

Please note that the Index pulse characteristics and duration may vary in specific models, so always refer to each individual user's guide for complete information.

Digital encoders

Sine-cosine encoders
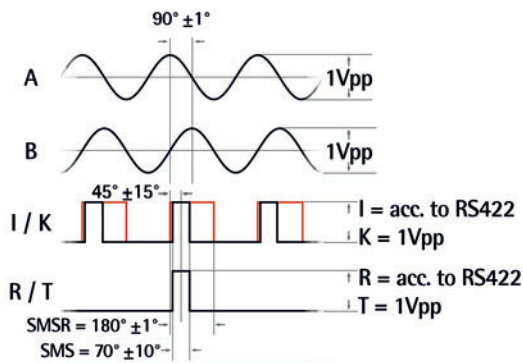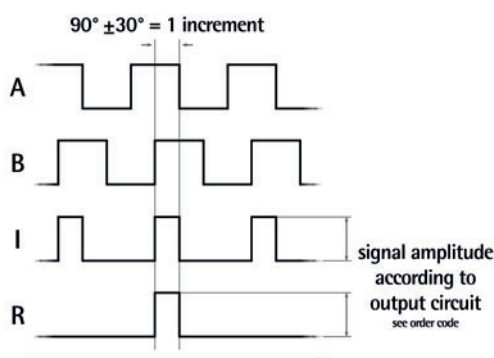
An external sensor (for instance, an inductive proximity switch) can be paired with an Index signal to obtain a reference point on the tape. The characteristics of the used sensor are not of great importance to the measuring system, in particular its accuracy does not affect directly the detection accuracy of the reference point. Anyway you must ensure that the switching hysteresis of the external sensor is smaller than the length of one pole pitch on the tape. In this way the external sensor can be related to the single Index signal unambiguously.

Please note that if the measuring system is fitted with the Reference mark (see the section "Reference mark pulse (R and T output signals)" on page 26, then the Index pulse is not supplied.
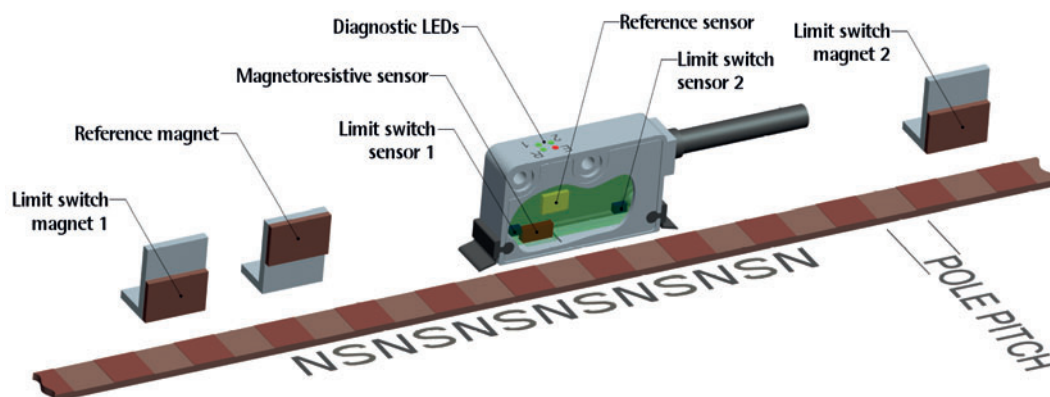
Some incremental linear encoders produce a **Reference mark pulse (code R or code T)** once per travel.
It provides a datum position along the tape for use at power-up or following a loss of power. An integral Reference sensor is designed to detect the external Reference magnet (order code **LKM-1309/X** where X is the pole pitch corresponding to the one of the matched tape).

The external Reference magnet is placed next to the tape at the preferred location to mark a relevant position in the travel (for instance, the home position, otherwise referred to as calibration point). The amplitude of the Reference signal depends on the output circuit (see the Figure under the "Index pulse" point in the previous page): digital incremental encoders provide a R code Reference signal, it has an amplitude of either 0V +5V or +10V +30V.
Sine-cosine incremental encoders can provide either a R or a T code Reference signal (see the order code).
R code Reference signal has an amplitude according to RS-422, while T code Reference signal has an amplitude of 1Vpp. Also the duration of the Reference signal varies depending on the output circuit: it is 90° ±30° for Push-Pull and Line Driver outputs; it is 70° ±10° for the sine-cosine output.
As soon as the external magnet is detected an integral LED lights up. Please note that the LED switching on does not mean that the Reference pulse is output in the same time: the Reference pulse is usually synchronized with A and B channels within the South pole and has its own duration. Thus, it may be not output yet or be already output while the LED is lit. The Reference pulse can be provided with inverted signal.

Reference mark pulse (R and T output signals)

SME models

SMS models
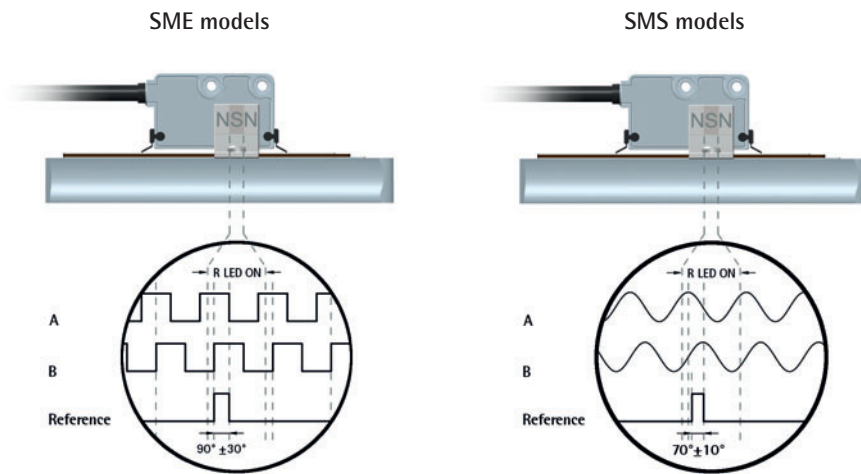
Please note that **the Reference pulse is supplied as an alternative to the Index pulse**: if the measuring system is fitted with the Reference mark pulse, the Index pulse cannot be supplied.
The series available with the external Reference mark pulse on demand are: **SME11, SME12, SME21, SME22, SME51, SME52, SMS11, SMS12, SMS21.**

Some linear encoders include built-in limit switch sensors designed to detect two external limit switch magnets (order code LKM-1309/LS). The two sensors are activated by different external magnets, thus it is possible to distinguish between the opposite ends in the travel. The external limit switch magnets have to be installed at the preferred location along the tape to mark the end limits of the travel. In this way at power-up or during operation the controller can determine whether the encoder is at an end-of-travel and in which direction to drive the axis.
The signals of the limit switches LS1 and LS2 are output through open collector type circuit and have Imax = 50 mA. **The limit switch signal is normally at logic level HIGH (+Vdc)** and switches to logic level LOW (0Vdc) as soon as the external magnet is detected.
The signal is kept at logic level LOW (0Vdc) as long as the sensor is within the active area of the external magnet. Integral LEDs light up as soon as the external magnets are detected.

The series available with external limit switches on demand are: **SME12, SME22, SME52, SMS12.**

Limit switches
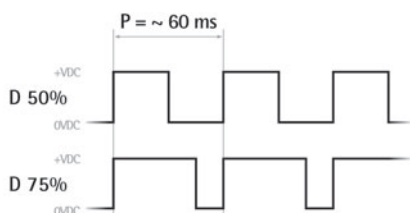
PWM error output (on request)
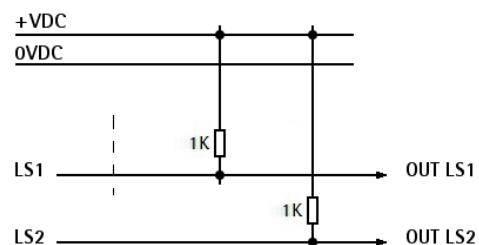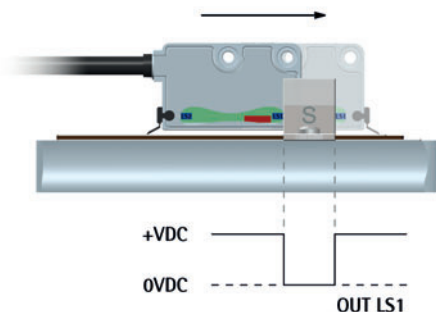
SMEx1 linear encoders can be equipped with an additional PWM error output to signal fault and error conditions to a PLC or a controller. The electronics generates a pulse-width modulated (PWM) waveform signal with four different duty cycles. When the encoder falls into error mode the diagnostic PWM signal is output. The duty cycle of the signal will depend on what caused the encoder to enter the error mode. A frequency error -that's to say: when the encoder is travelling too fast along the tape- will cause a 50% duty cycle to be generated. A distance error -i.e. when the specified mounting tolerances are not met- will cause the diagnostic feedback signal to be at 75% duty cycle. Internal electronics error conditions will cause a 100% duty cycle to be generated, so the signal will be at high logic level solidly. On the contrary a low logic level (0% duty cycle) will indicate that no error is active.

PWM error output characteristics

Output signal	Meaning
Duty cycle D 0% LOW (0Vdc)	No error is active.
Duty cycle D 50%	Frequency error: the sensor is travelling too fast.
Duty cycle D 75%	Distance error: specified mounting tolerances are not met.
Duty cycle D 100% HIGH (+Vdc)	Internal error.

The series available with PWM error output on demand are: **SME11, SME21, SME51.**

Edge distance

The edge distance feature only applies to the incremental digital signals and has to be selected under the option EDGE DISTANCE in the order code. It can be defined as the **minimum spacing time** between two following signal edges at output. The value is expressed in μsec and calculated referring to all edges. When choosing the resolution of the encoder and its related minimum edge distance, consider attentively also both the travel speed of the application and the max. frequency that the subsequent electronics is able to evaluate.
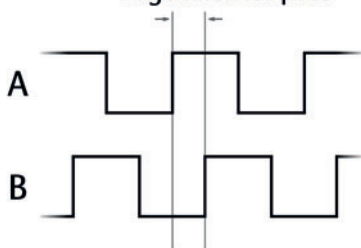
Unexpected situation with high travel speed to be considered are:
• micro-vibrations;
• heavy accelerations and decelerations.

Signals will be output at the highest speed (see the edge distance value charts) when the sensor comes to a standstill exactly on a graduation mark, resulting in a frequent change of the output signal by +/- 1 increment.

Please note that the minimum edge distance value is in relation with the max. speed value. For slower speeds the effective edge distance is necessarily greater.

Also the **max. mechanical travel speed** indicated in the datasheet has always to be considered attentively. It attests a mechanical permissible limit of the unit.

Edge distances reference tables

SMB series		Maximum speed (m/s)								Sensor type
Min. edge distance	Order code	H	J	A	B	C	D	E	F	
	μsec	0.3	0.5	1.0	2.0	4.0	8.0	16.0	25.0	
Max. counting frequency	kHz	3,333	2,000	1,000	500	250	125	62.5	40	
Resolution (μm)	5	11.7	7.0	3.5	1.7	0.9	0.4	0.2	0.1	SMB5
	10	23.3	14.0	7.0	3.3	1.7	0.9	0.5	0.3	SMB2, SMB5

SME series		Maximum speed (m/s)								Sensor type
Min. edge distance	Order code	H	J	A	B	C	D	E	F	
	μsec	0.3	0.5	1.0	2.0	4.0	8.0	16.0	25.0	
Max. counting frequency	kHz	3,333	2,000	1,000	500	250	125	62.5	40	
Resolution (μm)	0.5	1.2	0.7	0.3	0.2	0.1	0.04	0.02	0.01	SME11, SME12
	1	2.3	1.4	0.7	0.3	0.2	0.1	0.05	0.03	SME11, SME12 SME21, SME22
	2	4.7	2.8	1.4	0.7	0.3	0.2	0.1	0.06	SME11, SME12 SME21, SME22
	5	11.7	7.0	3.5	1.7	0.9	0.4	0.2	0.1	SME11, SME12 SME51, SME52
	10	11.7	7.0	3.5	1.7	0.9	0.4	0.2	0.1	SME11, SME12
	10	23.3	14.0	7.0	3.3	1.7	0.9	0.5	0.3	SME21, SME22 SME51, SME52
	25	25.0	25.0	17.5	8.3	4.4	2.2	1.1	0.7	SME51, SME52
	50	14.6	8.74	4.4	2.1	1.1	0.5	0.3	0.2	SME21, SME22
	50	25.0	25.0	17.5	8.3	4.4	2.2	1.1	0.7	SME51, SME52

SMG series						Sensor type
Pulses/tooth	1	8	16	32	100	
Min. edge distance (μsec)	0.5	0.5	0.5	0.5	0.5	
Max. counting frequency (kHz)	2,000	2,000	2,000	2,000	2,000	
Maximum speed (m/s)	300.0	36.0	18.0	9.0	3.0	SMG03
	500.0	64.0	32.0	16.0	5.0	SMG05

SMI2

Resolution (µm)	2	2.5	4	5	8	10	16	20
Maximum speed (m/s)	0.9	1.1	1.7	2.1	3.4	4.3	6.9	8.6
Min. edge distance (µsec)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Max. counting frequency (kHz)	500	500	500	500	500	500	500	500

SMI5

Resolution (µm)	5	6.2	10	12.5	20	25	40	50
Maximum speed (m/s)	2.1	2.7	4.3	5.4	8.6	10.7	17.2	21.5
Min. edge distance (µsec)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Max. counting frequency (kHz)	500	500	500	500	500	500	500	500

SMK

Resolution (µm)	10	25	50	100	500	1,000
Maximum speed (m/s)	1.5	2.0	2.0	2.0	5.0	5.0
Min. edge distance (µsec)	2.0	2.0	2.0	50.0	50.0	50.0
Max. counting frequency (kHz)	500	500	500	20	20	20

SMH

Resolution (µm)	100	250	500	1,000
Maximum speed (m/s)	4.2	25.0	25.0	25.0
Min. edge distance (µsec)	2.0	2.0	2.0	2.0
Max. counting frequency (kHz)	500	500	500	500

SML

Resolution (µm)	100
Maximum speed (m/s)	25.0
Min. edge distance (µsec)	2.0
Max. counting frequency (kHz)	500

SMP

Resolution (µm)	12.5	25	50	62.5	125	250
Maximum speed (m/s)	10.0	17.5	17.5	17.5	17.5	17.5
Min. edge distance (µsec)	1.0	1.0	1.0	1.0	1.0	1.0
Max. counting frequency (kHz)	1,000	1,000	1,000	1,000	1,000	1,000

SMA2 AB
incremental signals

Resolution (µm)	1	2	5	10	50
Maximum speed (m/s)	1.4	2.8	7	7	7
Min. edge distance (µsec)*	0.25	0.25	0.25	0.25	0.25
Max. counting frequency (kHz)	580	580	580	350	73

*Max. counting frequency 4 MHz

Incremental output circuits

Several output circuit types are available to incremental encoders. As most control units only use digital signals (square wave signals), therefore the sinusoidal signals have often to be digitized before being issued to output.

The choice of the output circuit depends on some considerations, for instance the type of input the controller is expecting and the required cable length.

Push-Pull electronics bases on a 7272 circuit and provides square-waves signals phase-shifted by 90 electrical degrees. It is a general-purpose circuit capable of either sourcing or sinking current up to 80 mA (peak) per output and suitable for most motion control equipment. When the output is in logic state high, current will source to the downstream electronic equipment. When the output is in logic state low, current will sink from the load. Push-Pull output can optionally provide also inverted signals (code YC, see "Inverted signals complementary or differential outputs" on page 24). Customarily encoders with Push-Pull output circuit are operated at 10 to 30Vdc (typically 12Vdc or 24Vdc).

Advantages: high compatibility, suitable for interface connections even with NPN or PNP inputs circuits, inverted signals allow use with longer cables.

Disadvantages: medium interference immunity, needs external filters for noise reduction.

Push-Pull / HTL (codes Y and YC)

Power supply (Vin)	Max. output current	Peak output current	Typical rising/falling edge time	Vout low @40mA	Vout high @40mA
+10 +30 Vdc	40 mA	80 mA	550 ns / 470 ns	≤ 0.5 Vdc	(Vin−1.25) Vdc

Thermal protection	Short-circuit protection	Inverted signals	Max. cable length
●	-	YC order code only	30 m / 100 ft (AB0) 180 m / 590 ft (AB0, /AB0)

Recommended input circuit (Y order code)
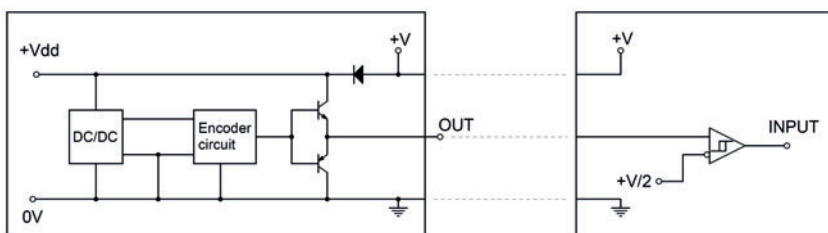
Recommended input circuit (YC order code)

Line Driver (RS422) / TTL (code L)
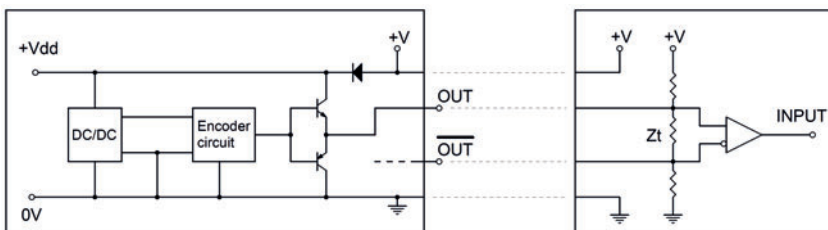
Differential Line Driver output bases on a 26LS31 circuit. It is a sourcing output circuit highly recommended when noisy electrical environment conditions or long cable lengths could lead to unsafe communication. Line Driver electronics provides square-wave AB0 signals and inverted /AB0 signals (see "Inverted signals complementary or differential outputs" on page 24). In fact noisy pulses (missed or extra pulses) that affect both normal and inverted signals in the same way can be easily detected and trimmed by the differential line receiver. The encoder is operated at 5Vdc ± 5% and complies with the EIA RS-422 standard.

Advantages: high interference immunity, long run of cables.
Disadvantages: requires Line Receiver for optimal performance.

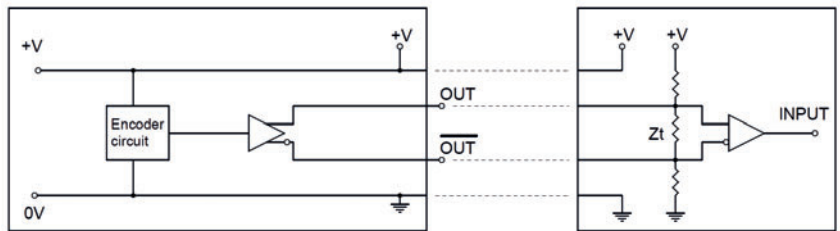| Power supply (Vin)	Max. output current	Peak output current	Typical rising/falling edge time	Vout low @40mA	Vout high @40mA
+5 Vdc	20 mA	-	60 ns / 30 ns	≤ 0.5 Vdc	≥ 2.5 Vdc

Thermal protection	Short-circuit protection	Inverted signals	Max. cable length
-	-	●	150 m / 495 ft

Recommended input circuit

Universal circuit
Push-Pull + Line Driver / HTL + TTL (code H)

This is a Push-Pull-based output circuit compatible with Line Driver, designed by Lika Electronic in the late nineties and now widely recognized as a standard by all encoder manufacturers. To ensure compatibility with Line Receiver inputs, Universal circuit is always provided with complementary signals.

Advantages: high compatibility, advantages of both Push-Pull and/or Line Driver output circuits, allows for reduction of models in stock.

Disadvantages: same as Push-Pull and/or Line Driver.

Power supply (Vin)	Max. output current	Peak output current	Typical rising/falling edge time	Vout low @40mA	Vout high @40mA
+5 +30 Vdc	40 mA	80 mA	550 ns / 470 ns	≤ 0.4 Vdc	(Vin – 1.25) Vdc

Thermal protection	Short-circuit protection	Inverted signals	Max. cable length
●	●	●	180 m / 590 ft

Recommended input circuit

1Vpp output circuit provides sinusoidal analogue signals phase-shifted by 90 electrical degrees (sine and cosine) for external interpolation. Sinusoidal signals have an amplitude of typically 0.5 Vpp (peak-to-peak) and a 2.5V offset.

1Vpp output level results from differential signals detection. The frequency of the output signals is in direct ratio to the travel speed of the device.

Sinusoidal signals can be highly interpolated by the following electronics in order to increase the resolution. In this way the transmission frequency along the cable is significantly reduced.

A (cosine) and B (sine) signals (standard code sequence) plus 0 signal are shown in the Figure.

Advantages: sinusoidal signals can be highly interpolated, thus increasing the resolution and reducing the transmission frequency over long cables.

Disadvantages: needs electronics for interpolation.

1Vpp sin/cos (code V)

Power supply (Vin)	Max. output current	Peak output current	Thermal protection	Short–circuit protection	Inverted signals	Max. cable length
+5Vdc	40 mA	80 mA	-	-	●	50 m / 165 ft

Recommended input circuit
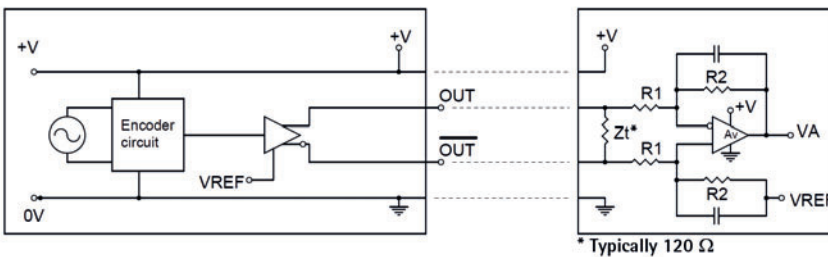
$V_{REF} = 2.5V \pm 0.5V$ $\qquad V_A = 1Vpp * Av$ $\qquad Av = R2/R1$
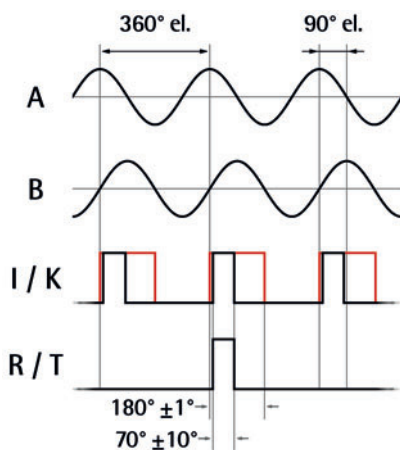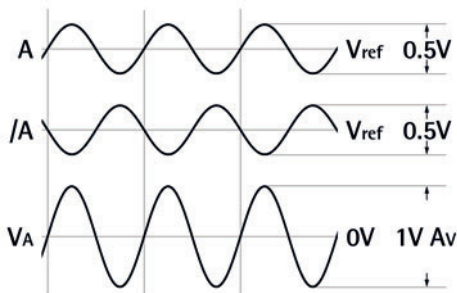
We highly recommend the cable lengths reported in the following tables to be fulfilled strictly.
Please note that data listed below may vary due to the following factors:
• the supply voltage of the encoder;
• the quality of the cable;
• the electrical noise coming from the ground connection;
• the features of the controller connected to the encoder;
• the ambient temperature.

For the afore-mentioned reasons the recommended cable lengths could be shorter depending on each specific application.

Cable lengths

Maximum cable lengths in relation to frequencies

Output circuit	Max. cable length m / ft	Max. counting frequency
Y **Push–Pull (ABO signals)**	2 m / 7 ft	2 MHz
	5 m / 17 ft	1 MHz
	10 m / 35 ft	400 kHz
	20 m / 65 ft	200 kHz
	30 m / 100 ft	100 kHz

Output circuit	Max. cable length m / ft	Max. counting frequency
YC **Push–Pull (ABO, /ABO signals)** **H, ABO /ABO** **PP/LD universal circuit**	6 m / 20 ft	2 MHz
	15 m / 50 ft	1 MHz
	60 m / 200 ft	400 kHz
	120 m / 395 ft	200 kHz
	180 m / 590 ft	100 kHz

Output circuit	Max. cable length m / ft	Max. counting frequency
L **Line Driver (RS422)**	10 m / 35 ft	2 MHz
	25 m / 85 ft	1 MHz
	50 m / 165 ft	400 kHz
	100 m / 330 ft	200 kHz
	150 m / 495 ft	100 kHz

At ambient temperature (23°C)

Max. counting frequency = frequency A, B x4
Please always consider also the set minimum edge distance and the maximum speed allowed (see the values in the tables under the "Edge distance" section on page 27).
Line Driver: please always consider the voltage drop over wires. Refer also to the "Cable specifications" on page 118 to estimate the voltage drop.

Please note that the higher the resolution and the maximum travel speed of the encoder, the higher the counting frequency.
There is a straight relation between the counting frequency and the signal distortion.
The longer is the cable in fact, the greater is its capacitance; and the capacitance affects the signal quality causing the higher frequencies to be "filtered" so distorting the signal.
Please always refer to the maximum counting frequency value indicated in the product datasheet; consider also the relation between the counting frequency and the maximum permissible speed indicated in the tables on page 28.
Please always check both the max. permissible speed and the counting frequency in order to be sure that they comply with the characteristics of your mechanical system and the following electronics and with the run of the cables. For the max. permissible speed and counting frequency refer to the tables in the section "Edge distance" on page 27.

Absolute linear encoders

An **absolute linear encoder** is designed to output the absolute position information in response to motion along a linear path.

It relies on a magnetic reading principle and a unique code pattern encoded on the tape, so it can provide a unique and unambiguous position within the travel range without requiring knowledge of any previous position. It follows that you can always gather exactly the position of the axis. For instance, in case of power loss or failure, then at power-up the absolute encoder will be able to output the current position of the axis precisely. This means that no homing or calibration operation is required to determine the current position.

The absolute position datum is calculated by processing the information from a Hall sensor array / magneto-resistive sensor through the translation circuitry and the interpolation electronics.

In specific models the encoder can further provide an incremental signal for speed feedback in addition to the absolute value.

In an absolute measuring system, the absolute coding pole pitch depends on the physical characteristics of the sensor array deployed in the sensing head.

An absolute encoder provides the motion controller with either analogue signals or a digital code information. The digital information can be in pure Binary or Gray code format.

Customarily the absolute encoder encompasses serial (SSI, BiSS) output circuits, but it can also afford analogue and fieldbus interfaces.
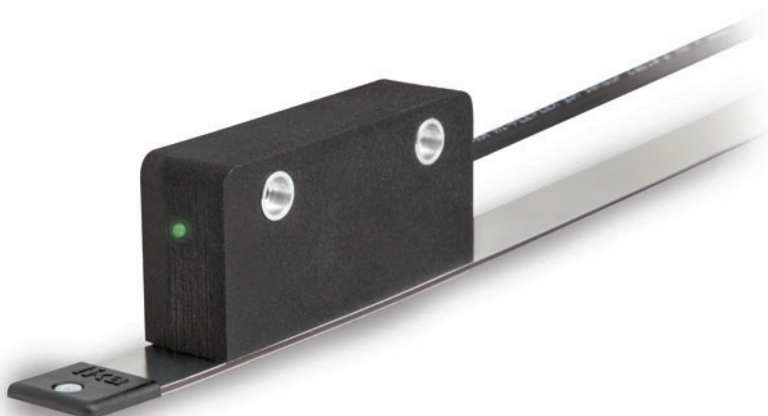
The absolute encoders provide the absolute position information in a code format.
The output information can be represented in Binary or Gray code.

Binary code

In the base-2 number system only two digits are used: 0 and 1.
For this reason it is the base of data processing in computing and electronic systems where 0 and 1 can be represented, electronically, as states "off" and "on".
Binary code represents the information through the base-2 number system.
It is very efficient, but has a great disadvantage from the point of view of the measuring equipment: more than one digit at a time often changes in consecutive positions.
Because of the variations caused by gate delays, line impedances, etc. transitions do not occur simultaneously and this could result in erroneous readings and therefore lead to significant measuring errors.
Consider, for instance, the following sequence:

Decimal	0	1	2	3	4	5	6	7
Binary (4 digits)	0000	0001	0010	0011	0100	0101	0110	0111
Gray (4 digits)	0000	0001	0011	0010	0110	0111	0101	0100

From position 1 to 2 (decimal), the last two digits both change in the binary representation ($0 \rightarrow 1$; $1 \rightarrow 0$). The same happens from position 3 to 4, where the last three digits all change ($0 \rightarrow 1$; $1 \rightarrow 0$; $1 \rightarrow 0$). During operation, a sensing error of the detection elements could result in a positioning command error. For instance, let's suppose the following wrong sequence: $0001 \rightarrow 0011 \rightarrow 0010$ (position $1 \rightarrow 3 \rightarrow 2$ instead of $1 \rightarrow 2 \rightarrow 3$).
Motion controller would command position 1, then position 3 and then a reverse motion to position 2. Anyway please consider that Lika encoders are designed to always ensure that only consecutive position values are transmitted.

Binary code 4-bit representation (high logic level is represented in black)
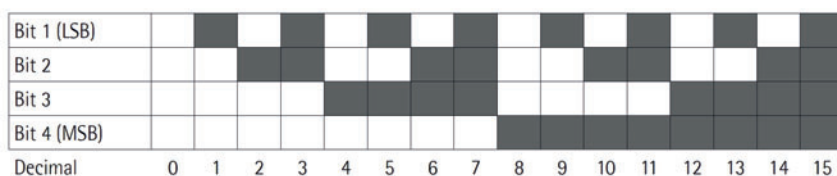
As Binary code, also Gray code, patented by Bell Laboratories researcher Frank Gray in 1947, represents the information through the base-2 number system; but the binary strings are ordered so that two successive values differ in only one bit at a time (see the table under the "Binary code" point). This is a safer method than Binary code, because any sequence where more than one bit changes at a time can be easily and immediately detected by the control unit. Anyway, the maximum error is always the LSB value.

Gray code

Gray code 4-bit representation (high logic level is represented in black)
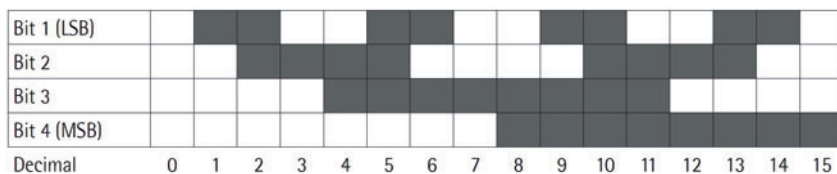
The absolute position information can be provided to the following control via a wide variety of output circuits (interfaces).

Typically, we can distinguish between electrical interfaces (serial and analogue interfaces) and fieldbus interfaces.

The absolute linear encoders are customarily fitted with serial (SSI, BiSS, RS-485) output circuits, the analogue circuit is more seldom used. The electrical interfaces are simple, cost-effective and easily fulfil the requirements of most industrial applications. Nevertheless in the last years fieldbus interfaces are rapidly gaining ground worldwide because of their compatibility in more complex installations.

Fieldbus technology in fact permits to improve performances thanks to complete device interface (bi-directional data transmission, enhanced programmability, diagnostic information, etc.), achieve communication transparency, simplify and standardize installations allowing several devices to be simply connected in the same network.

In addition the use of standardised bus cables provides a simplified and safe connectivity thus saving time and money whilst reducing the risk of errors.

To meet the industry's request for fieldbus and Ethernet networks and communication protocols, Lika Electronic has designed the range of **IF55 gateways.** They are specifically engineered to **interface SSI serial encoders** and integrate them easily into **conventional fieldbus and industrial Ethernet networks.**

For complete information please refer to the section "IF55 converter series" on page 47.

SSI (the acronym for *Synchronous Serial Interface*) **is a synchronous point-to-point serial interface engineered for unidirectional data transmission between one Master and one Slave.** Developed in the first eighties of the last century, it is based on the RS-422 serial standard. Its most peculiar feature is that data transmission is achieved by synchronizing both the Master and the Slave devices to a common clock signal generated by the controller; in this way the output information is clocked out at each controller request. Furthermore only two pairs of twisted wires are used for data and clock signals, thus a six-wire cable is required.

The main advantages in comparison with competing parallel or asynchronous data transmissions are:
- less conductors are required for transmission;
- less electronic components;
- possibility of insulating the circuits galvanically by means of optocouplers;
- high data transmission frequency;
- hardware interface independent of the resolution of the absolute encoder.

Furthermore the differential transmission increases the noise immunity and decreases the noise emissions. It allows multiplexing from several encoders, thus process controls are more reliable with simplified line design and easier data management.

In addition, SSI encoders can be easily integrated into conventional fieldbus or industrial Ethernet networks using IF55 converters (see on page 47).

Data transmission is carried out as follows.
At the first falling edge of the clock signal (1, the logic level changes from high to low) the absolute position value is stored while at the following rising edge (2) the transmission of data information begins starting from the MSB.
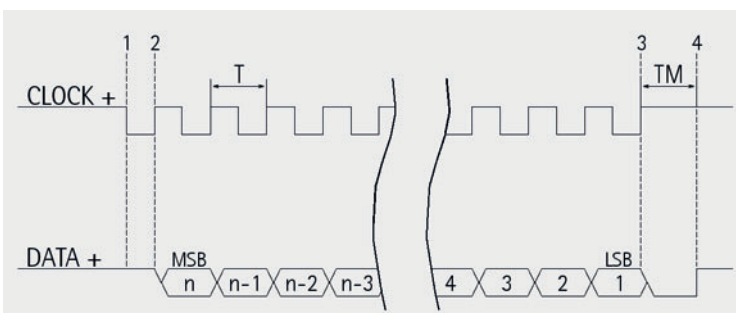
At each change of the clock signal and at each subsequent rising edge (2) one bit is clocked out at a time, up to LSB, so completing the data word transmission.

The cycle ends at the last rising edge of the clock signal (3). This means that up to n + 1 rising edges of the clock signals are required for each data word transmission (where n is the bit resolution); for instance, a 13-bit encoder needs minimum 14 clock edges.

If the number of clocks is greater than the number of bits of the data word, then the system will send a zero (low logic level signal) at each additional clock, zeros will either lead (LSB ALIGNED protocol) or follow (MSB ALIGNED protocol) or lead and/or follow the data word (TREE FORMAT protocol).

After the period TM monoflop time, having a typical duration of 16 µsec, calculated from the end of the clock signal transmission, the encoder is ready for the next transmission and therefore the data signal is switched high.

SSI interface has a frequency of data transmission ranging between 100 kHz and 2 MHz.
The clock frequency (baud rate) depends on the length of the cable and must comply with the technical information reported in the following table:

Max. cable length m [ft] @	400 [1310]	200 [655]	100 [330]	75 [245]	60 [200]	30 [100]	15 [50]
Clock frequency [kHz]	100	200	300	400	500	900	1800

At ambient temperature (23°C)

The clock signal has a typical logic level of 5V, the same as the output signal which has customarily a logic level of 5V in compliance with the RS-422 standard.
The output code can be either Binary or Gray.

SSI at a glance:

Number of stations	Setting the nodes	Setting the baud rate	Transmission rate	Cable length	Cable
–	–	–	Up to 2Mbit/s	Up to 400 m	Lika M8 type cable

At ambient temperature (23°C)

"LSB right aligned" protocol allows to right align the bits, the transmission begins from MSB (most significant bit) to LSB (least significant bit); LSB is then sent at the last clock cycle. The word has an overall length of 25 bits. If the number of clock signals is higher than the data bits, then unused bits are forced to low logic level (0) and lead the data word. So, if the device needs 20 bits to provide the position information, then unused bits (from 21 to 25) are set to 0 (zero).

"LSB RIGHT ALIGNED" protocol

LSB RIGHT ALIGNED protocol scheme (BA- and GA- output circuit codes)

LINECOD
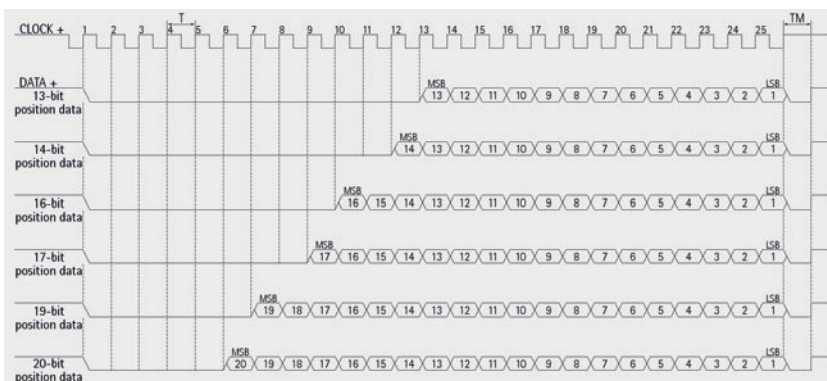
"MSB left aligned" protocol allows to left align the bits, beginning from MSB to LSB; MSB is then sent at the first clock cycle. If the number of clock signals is higher than the data bits, then unused bits are forced to low logic level (0) and follow the data word.

The number of clocks to be sent to the encoder must equal the number of data bits at least, anyway it can be higher, as stated previously. The great advantage of this protocol over the LSB RIGHT ALIGNED format is that data can be transmitted with a minimum time loss and the TM monoflop time can immediately follow the data bits without any additional clock signal. In specific encoders the SSI word can further provide an error bit and the parity bit. The error bit follows the position information and is intended to communicate the normal ("1" high logic level) or fault ("0" low logic level) state of the Slave. Parity bit is an optional function used for checking in a very basic way whether errors occur during transmission (for further information refer to page 41).

"MSB LEFT ALIGNED" protocol

MSB LEFT ALIGNED protocol scheme (BG-, GG- and G1- output circuit codes)
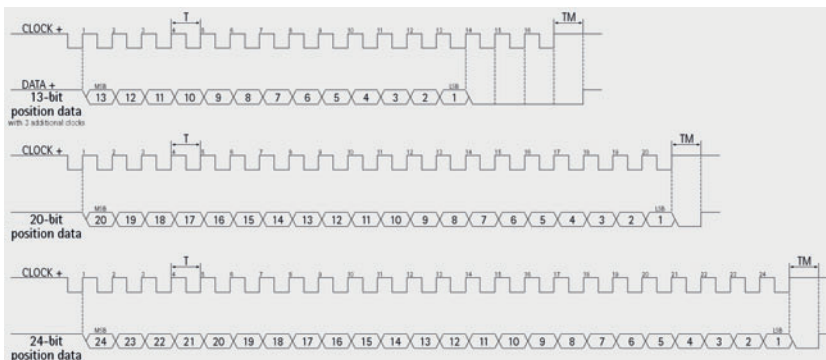
Advantages: simple, efficient and cost-effective, less conductors, less electronic components, transmission rate up to 2 Mbit/s, circuit can be galvanically insulated by means of optocouplers, increased noise immunity, long cable runs, SSI encoders can be easily integrated into conventional fieldbus or industrial Ethernet networks using IF55 converters (see on page 47).

Disadvantages: point-to-point architecture, transmission speed lower than in competing parallel interface.

Recommended input circuit
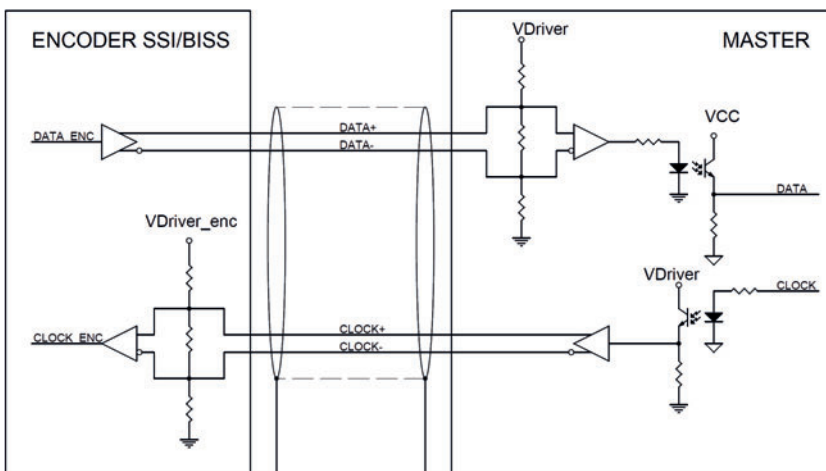
SSI cable length
For max. cable lengths refer to the section "Cable lengths" on page 44.

BiSS is a digital, bidirectional, serial and synchronous interface expressly developed and released in 2002 for sensors and actuators.
Nowadays it has become widely popular in several industrial sectors that require high operating speeds and improved robustness against EMC interference, while simultaneously reducing costs.
It is hardware compatible with SSI interface but offers additional features and options such as multi-slave networking (up to 8 Slaves), higher frequency of data transmission up to 10 MHz, diagnostic information. BiSS safeguards communication between position encoders or measuring devices and industrial controls such as a drive control and is able to transfer measurement values coming from up to 8 Slaves simultaneously, if necessary.
Lika Electronic implements both B-mode ("I8" order code) **and C-mode** ("I7" order code) **versions of the BiSS protocol.**
For 1 to 8 subscribers (Slaves) the Master interface provides a clock signal for both the simultaneous acquirement of all position information and the following synchronous serial data transmission. Only four unidirectional RS-422 data lines are required; minimum Slave electronics are incorporated into ICs (integrated circuits). When the Master sends a clock pulse on the MA line, then the Slave sends the reply directly on the return SLO line with the stored position data. Commands and parameters can be swapped on a PWM pulse form; this is, however, not necessary to start the BiSS protocol. Within each data cycle the Master learns and compensates for line delays, thus permitting clock rates up to 10 Mbit/s even using cables up to 1000 m long. Changes which may occur in line conditions, for example during cable drag, are corrected. The precision of the synchronization among several position encoders and along various axes is less than 1 microsecond; furthermore the signal delay registered by the Master is clearly accessible to the control unit, thus allowing further optimization. The BiSS protocol classifies each subscriber under one of the following data sections: sensor data, actuator data, register data and multi-cycle data. These data sections can boast various configurations in order to customize and optimize access and transmission performances and in this way they fulfil the requirements of a large variety of sensor applications. A bidirectional parameter communication for device configuration - available also for parameters referred to as OEM - is customarily available in the register data section.
Data that changes slowly, such as sensor temperatures, is allocated to the multi-cycle data section; while data that changes quickly is allocated to the sensor data section.
Thus control cycle times shorter than 10 µs are not a problem, even for data words up to 64-bit long. In fact there is enough space in the protocol for redundancy and this space is customarily used to implement a CRC (Cyclic Redundancy Check). Framed by just one start and one stop bit, sensor data is transmitted at the highest core data rate; a single multi-cycle data bit is optional.
The individual user's freedom of design for specific devices is not curbed by the necessity of keeping solutions compatible with other BiSS products and this results in cutting down on unnecessary additional costs. A BiSS subscriber is defined in its entirety by just a few parameters; an XML device description file supplied with the sensor makes it easier and faster to set up the unit with a control system. If the subsequent controller does not have a BiSS input yet, BiSS devices can be switched over to SSI mode.
Any further information on the BiSS interface is available at **www.biss-interface.com**.

Advantages: simple, efficient and cost-effective, full digital, bi-directional and synchronous, less conductors, less electronic components, higher frequency of data transmission up to 10 MHz, long cable runs.
Disadvantages: transmission speed lower than in competing parallel interface.

Max. cable length m [ft]	1000 [3280]	500 [1640]	200 [655]	100 [330]	60 [200]	25 [80]	10 [35]
Frequency	100 kHz	200 kHz	500 kHz	1 MHz	2 MHz	5 MHz	10 MHz

At ambient temperature (23°C)

Among the parameters available: position readout, scaling function, preset and offset values, counting direction, output code.

BiSS at a glance:

Number of stations	Setting the nodes	Setting the baud rate	Transmission rate	Cable length	Cable
-	-	-	Up to 10Mbit/s	Up to 1000 m	Lika T12 and M8 type cable

Lika absolute encoders with BiSS B-mode are always Slave devices and comply with the "BiSS B-mode interface" and the "Standard encoder profile".
They support a point-to-point configuration, thus they have to be installed in "single Master – single Slave" networks (not in "single Master – multi Slave" networks).
MA (CLOCK) and SLO (DATA) signal levels comply with the "EIA standard RS-422".
The BiSS B-mode protocol implemented in Lika absolute encoders uses two types of data transmission protocols:
- **Register Mode:** this is used to read data from or write data to the registers of the Slave.
- **Sensor Mode:** this is used to transfer process data from the Slave device to the Master device.

Lika absolute encoders with **BiSS C-mode** are always Slave devices and comply with the "BiSS C-mode interface" and the "Standard encoder profile". They support a point-to-point configuration, thus they have to be installed in "single Master – single Slave" networks (not in "single Master – multi Slave" networks).
MA (CLOCK) and SLO (DATA) signal levels comply with the "EIA standard RS-422".
The BiSS C-mode protocol implemented in Lika absolute encoders uses two types of data transmission protocols:
- **Single Cycle Data (SCD):** it is the primary data transmission protocol. It is used to send process data from the Slave to the Master.
- **Control Data (CD):** transmission of a single bit following the SCD data. It is used to read or write data into the registers of the Slave.

BiSS B-mode (I8 order code)

BiSS C-mode
(continuous mode, I7 order code)
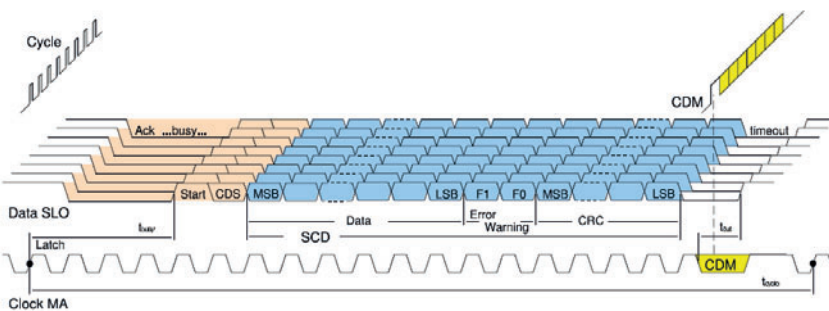
Recommended input circuit
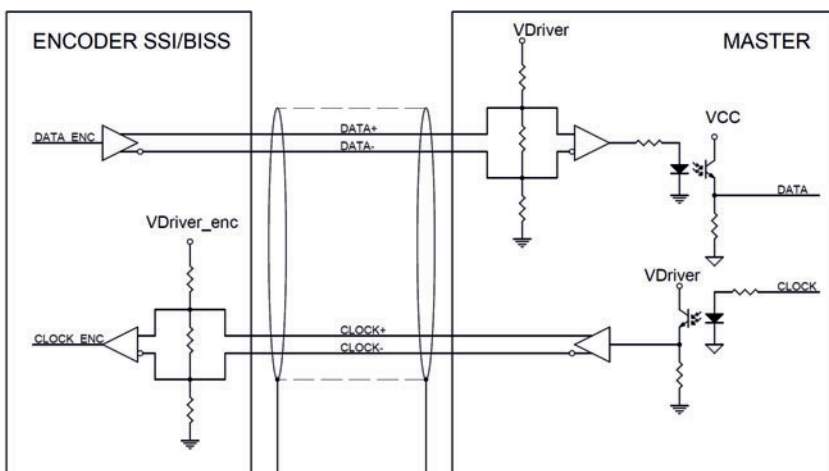
BiSS cable length
For max. cable lengths refer to the section "Cable lengths" on page 44.

Using the **Zero setting / Preset function,** the output value can be set either to zero (reset) or to a desired value (preset) via an external signal issued by a PLC or other controller device. When the internal microprocessor receives the signal it resets or presets the output information. This can be very useful, for example, for synchronizing the encoder readout with the 0 mechanical position of the axis you need to measure. To set the zero (or the preset), the Zero setting/Preset signal must be connected to +Vdc for 100 µs at least; then it must be disconnected. In normal conditions its voltage must be at 0Vdc.
The Zero setting/Preset operation must be performed after having set the Counting direction. We suggest setting the zero/Preset when the encoder is in stop.
Please note that a zero setting operation is compulsorily required after having installed the sensor on the magnetic tape. The zero setting operation is further needed every time either the sensor or the tape are replaced in an existing system.

Zero setting / Preset input

The **counting direction** circuit allows to reverse the counting direction. In other words it allows the count up when the sensor moves in reverse of the standard direction.
The standard counting direction is to be intended with sensor moving as indicated by the arrow in the upper face of the magnetic tape (provided that the sensing head is mounted properly). Connect the counting direction input to 0Vdc to have an increasing count when the sensor moves as indicated by the arrow in the tape; connect the counting direction input to +Vdc to have an increasing count when the sensor moves in reverse of the standard direction, i.e. in the opposite direction to the one shown by the arrow in the tape.
Connect the Counting direction input to 0Vdc if not used.

Counting direction input

In specific SSI models an error bit is provided at output. It is intended to communicate the normal or fault status of the encoder.
"1":   correct status (no active error)
"0":   an error is active when the following conditions typically occur:
 • reading error: the sensor is not able to read the tape correctly; among the possible causes are: the tape is not installed properly (for instance: the tape is mounted contrariwise to the sensor; or it is mounted upside down); the tape magnetic surface is damaged somewhere; the sensor is not working properly;
 • frequency error: the sensor is travelling too fast over the tape.
Refer to the specific encoder's documentation for the position of the error bit in the frame and its proper meaning.

Error bit

The parity bit is an optional function used for checking in a very basic way whether errors occur during transmission. It is the simplest form of error detecting code and offers the advantage that only one bit is required for error detection. On the other hand it only indicates that a parity error occurred in the transmission and there is no way to determine which particular bit is corrupted. Furthermore the parity bit is only guaranteed to detect an odd number of bit errors. If an even number of bits have errors, the parity bit records the correct number of ones, even though the data is corrupt. It can be either even or odd. Lika encoders provide an ODD parity bit. Thus the sum of the bits having logic level 1 in the character has to be odd.
Refer to the specific encoder's documentation for the position of the parity bit in the frame.

Parity bit

Analogue electronics is especially used for position and provides a continuously variable unique signal, namely a voltage or current signal, instead of a two-level discrete representation of the information (digital signal). Its choice and use depend on the specific application, 4-20mA current output is nearly the standard in several fields.

In the linear encoders, the digital information is converted into current or voltage analogue signals before being issued to the subsequent electronics. The following voltage and current analogue signal outputs are available from Lika Electronic: 0 to 10V (AV2 order code), 4 to 20mA (AI1 order code).

Analogue linear encoders implement the TEACH IN procedure which allows to greatly ease the configuration by simply defining the axis travel directly on the site and by setting the start and stop reference points of the measuring range. The travel is defined in either an ascending or a descending ramp: with ascending ramp the initial position of the travel is the minimum value of the output range and the final position is the maximum value of the output range; with descending ramp the initial position of the travel is the maximum value of the output range and the final position is the minimum value of the output range.

Beyond the travel limits the current/voltage signal level is kept at the minimum/maximum value in the range. The set output range (the overall information to be output) is defined over the travel of the specific application and is comprised between the ends of the axis.

The following table shows the maximum cable lengths for both voltage and current analogue outputs.

Max. cable length m [ft] @	Voltage analogue	Current analogue
	100 m [328 ft] with 1 MΩ max. load	150 m [490 ft]

At ambient temperature (23°C), Venc = 20V

Advantages: current signals are better suited to transmission over long cable runs, voltage electronics interface directly with D/A and A/D converters and analogue multiplexing devices.

Disadvantages: more susceptible to noise than digital circuits, affected by EMI.

Recommended input circuits

Voltage analogue encoder
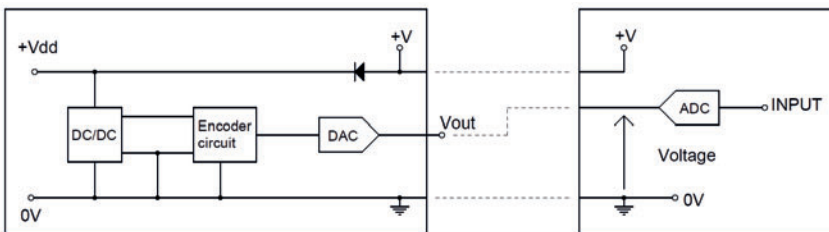
Current analogue encoder
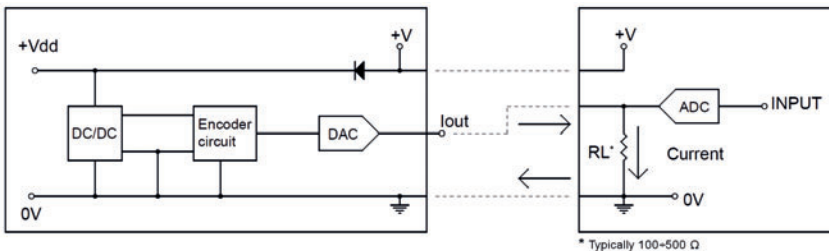
Analogue interface cable length
For max. cable lengths refer to the section "Cable lengths" on page 44.

Analogue output

The TEACH-IN function allows to easily and intuitively set by means of the START ► and STOP ■ input signals both the furthermost points in the travel of an axis, then the available analogue range will be scaled automatically within the set limits.
To execute the TEACH-IN procedure you must proceed as follows:
- move the sensor to the START position in the travel of your application;
- switch the START input to HIGH logic level +Vdc for 3 seconds at least; in this point the encoder will provide the minimum current / voltage level available in the range;
- now move the sensor to the END position in the travel of your application;
- switch the STOP input to HIGH logic level +Vdc for 3 seconds at least; in this point the encoder will provide the maximum current / voltage level available in the range.
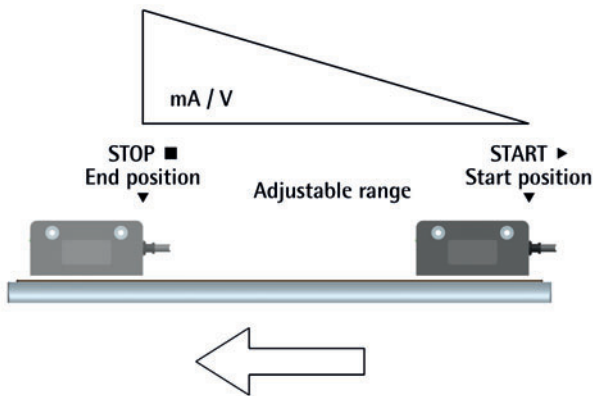
TEACH-IN function (START ► and STOP ■ inputs)

The FAULT output is only available for AI1 current analogue output and is intended to signal an error condition such as a circuit break.
To connect the Fault signal please refer to the examples in the sections hereafter: "Fault output connected to a PLC input" and "Fault output connected to a relay".
Please pay attention to the value of the R2 resistor (Figure 1 and Figure 2).

Fault output

No encoder error = transistor ON (conducting)
Encoder error = transistor OFF (open)

Imax = 50 mA
R1 = 47 Ω

$$R2 = \left(\frac{Vdc}{I}\right) - R1$$

Fault output connected to a PLC input
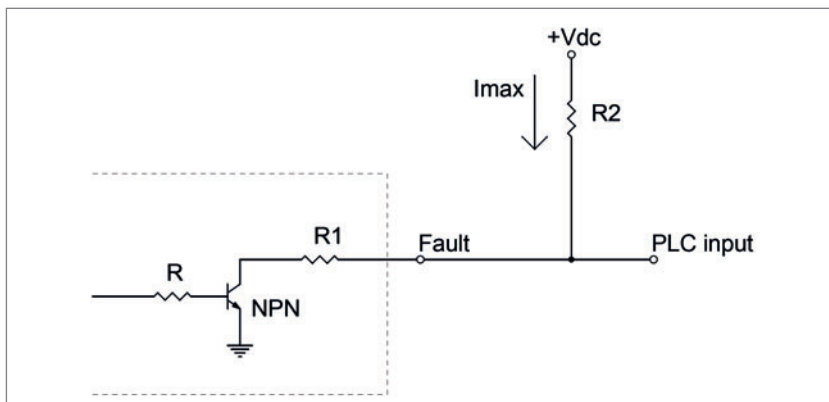
No encoder error = PLC input Low (0Vdc)
Encoder error = PLC input High (+Vdc)

Example
Vdc = +24V
R1 = 47Ω

$$R2 = \left(\frac{Vdc}{I}\right) - R1$$

I = 4.7 mA
R2 = 5 kΩ

Figure 1

Fault output connected to a relay
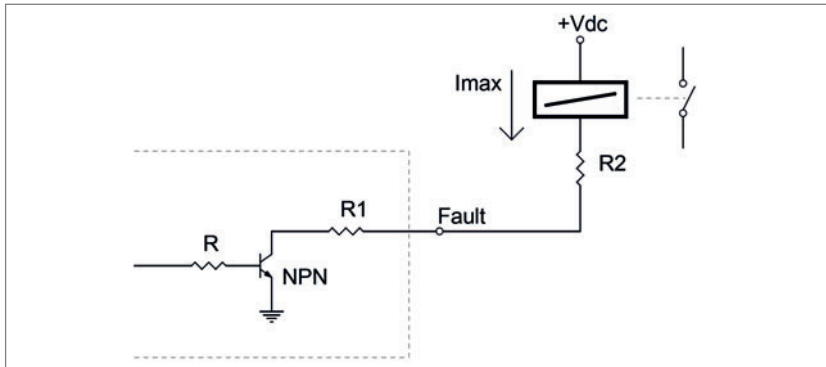
Figure 2

> **No encoder error = coil energized**
> **Encoder error = coil de-energized**
>
> Example
> Vdc = +24V
> R1 = 47Ω
>
> $$R2 = \left(\frac{Vdc}{I}\right) - R1$$
>
> I = 30 mA (current needed to energize a small relay coil)
> R2 = 750 Ω

Cable lengths

We highly recommend the cable lengths reported in the following tables to be fulfilled strictly. Tests have been carried out by connecting the encoder to the Lika LD200 universal position display through a DS3486 line receiver complying with the EIA standards.
Data listed below may vary due to the following factors:
* the electrical noise coming from the power supply line;
* the electrical noise coming from the encoder earthing connection;
* the features of the controller connected to the encoder;
* the ambient temperature.

Maximum cable lengths in relation to frequencies.

Interface / output circuit	Max. cable length @	Frequency
SSI (RS-422)	400 m / 1310 ft	100 kHz
	75 m / 245 ft	400 kHz
BiSS	1000 m / 3280 ft	100 kHz
	60 m / 200 ft	2 MHz

	Max. cable length	
Analogue output	Voltage analogue	100 m / 328 ft with 1 MΩ max. load
	Current analogue	150 m / 490 ft

At ambient temperature (23°C)

Please note that the higher the resolution and the maximum travel speed of the encoder, the higher the counting frequency. There is a straight relation between the counting frequency and the signal distortion. The longer is the cable in fact, the greater is its capacitance; and the capacitance affects the signal quality causing the higher frequencies to be "filtered" so distorting the signal. Please always refer to the maximum counting frequency value indicated in the product datasheet.

Modbus RTU is a serial communication open protocol developed in the seventies of the last century by Modicon. It is now widely used in the industry and has become a standard for device-to-device communication in several industrial automation systems.

The development and update of Modbus protocol is managed by the Modbus Organization (www.modbus.org), formed of independent users and suppliers of Modbus compliant devices. Modbus RTU allows for communication between up to 247 nodes in a true multi-drop network over a serial EIA-485 physical layer. The Modbus Serial Line protocol is a Master – Slaves protocol. Lika encoders are Slave devices and implement the Modbus application protocol (level 7 of OSI model) and the "Modbus over Serial Line" protocol (levels 1 & 2 of OSI model). Only one Master is connected to the bus and one or several Slave nodes can also be connected to the same serial bus. A Modbus communication is always initiated by the Master. The Slave nodes will never transmit data without receiving a request from the Master node. MODBUS RTU messages (registers) are simple data strings with 16-bit CRC (Cyclic Redundant Checksum for error checking). The simplicity of these messages is meant to ensure reliability. Modbus interface does not need any configuration file to be installed.

Layer 7	Application layer	Modbus Application Protocol
Layers 3-6	not used	
Layer 2	Data Link layer	Serial line Master / Slave
Layer 1	Physical layer	EIA/TIA-232 EIA/TIA-485
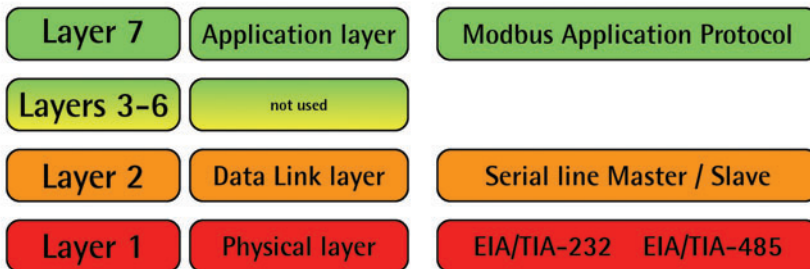
The main reasons behind such large implementation and diffusion of the Modbus interface are:
- Modbus bases on RS-485/RS-232 serial communication which is well established and universally supported;
- it is basic yet complete, flexible and most of all reliable;
- it is really simple to implement and easy-to-use;
- it is significantly more inexpensive to deploy than other industrial fieldbus protocols and requires less resources;
- it is open and can be used royalty-free.

Among the parameters available: position readout, counting direction, scaling function, preset and offset values, errors register and diagnostic information.
Encoders are fitted with diagnostic LED.

Modbus at a glance

Number of stations	Setting the nodes	Setting the baud rate	Transmission rate	Cable length	Cable
Up to 247	Software	Software	Up to 115.2 Kbit/s	Up to 1000 m/ 3300 ft	Cable / M12 connectors

First developed in the automotive industrial sector, **CANbus (Controller Area Network) serial bus system** has thereafter established itself in a variety of industrial applications, in particular where noisy electrical environment conditions could lead to unsafe communication.

International Organization for Standardization (ISO) has established the CAN standard in ISO 11898, developing the protocol over the first two layers of the ISO/OSI (Open Systems Interconnection) reference model; while all the other protocol layers are the network designer's choice. Unlike other protocols that define all ISO/OSI layers, developers intentionally limited the CAN specifications so manufacturers are free to choose a specific implementation of the higher protocol layers; for this reason other CAN-based protocols have been developed at higher layers as CANopen and DeviceNet or other proprietary protocols.

CANbus standard and CANopen communication protocol are administered by CAN in Automation (www.can-cia.org). CANopen is widely used in Europe.
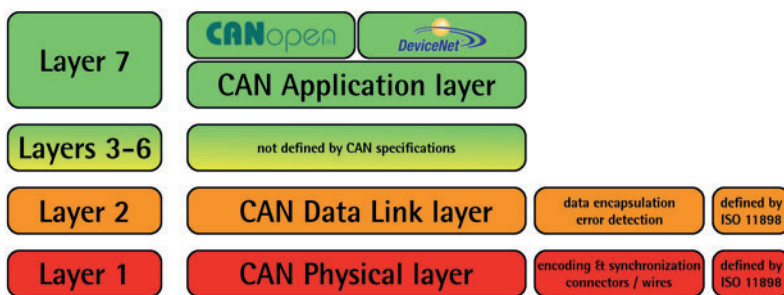
CANopen is a CAN-based communication protocol which implements the higher layers of the ISO/OSI (Open Systems Interconnection) reference model. Its technology development and standardization are entrusted to CiA (CAN in Automation).

CANopen is a Single Master - Multi Slave communication protocol. Master device is able to detect all the Slaves connected to the network thanks to the EDS (Electronic Datasheet) configuration file which is provided by the device manufacturer. The EDS file contains the complete list of all the working parameters of the Slave device and information for configuring the communication between the Master and the Slave.

In the CANopen network, the Master device must be addressed to 0, while the Slave nodes have address between 1 and 127. Maximum transmission rate is up to 1Mbit/s.

The following table shows the maximum transmission rates in relation to permissible line length.

Baud rate [Kbit/s]	10	20	62.25	125	250	500	800	1000
Max. cable length	5000 m 16400 ft	2500 m 8200 ft	1000 m 3300 ft	500 m 1650 ft	250 m 820 ft	100 m 330 ft	50 m 165 ft	30 m 100 ft

Lika encoders with CANopen interface comply with the "Device Profile for encoders" Class 2 established in the "CIA Draft Standard 301" and the "CIA Draft Standard 406" publications.

Lika devices with CANopen support the CANopen network management (NMT) slave state machine (Initialization state, Pre-operational state, Operational state, Stopped state) and use COBs (Communication Objects), in particular: NMT (Network Management) messages to issue state machine change commands (i.e. to start and stop the devices) and detect remote device boot-ups and error conditions; PDO (Process Data Object) messages to process real time data (transmission of process data in real time); and SDO (Service Data Object) messages to set and read values from the "Object dictionary" of the remote device. Furthermore they implement some standard objects such as the synchronization object (SYNC) and the Nodeguarding. Among the parameters available: position readout, counting direction, scaling function, preset and offset values, two min. and max. software limit switches, errors register and diagnostic information. Encoders can be fitted with diagnostic LEDs and bus termination resistance.

CANopen at a glance

Number of stations	Setting the nodes	Setting the baud rate	Transmission rate	Cable length	Cable
Up to 127	Dip switches or software	Dip switches or software	Up to 1Mbit/s	Up to 5000 m/ 16400 ft	Standard CANopen/ M12 connectors

IF55 converter series

The range of **IF55 gateways** from Lika Electronic is specially designed to interface **SSI serial encoders**, both linear and rotary, and integrate them easily into conventional fieldbus or **industrial Ethernet networks.**
IF55 converters are available for CANopen, Profibus-DP and EtherCAT networks.
You can connect any linear encoder fitted with SSI serial interface (and singleturn / multi-turn rotary encoders as well). There is no need to change the hardware or software of the encoder as the configuration is set via the controller of each specific bus by entering few simple parameters.
The encoder is configured as a Slave device and is able to communicate in the bus line or industrial network in a complete and efficient manner:
- Slave encoder with CANopen interface complying with the "Device Profile for enco-ders" Class 2;
- Slave encoder with Profibus-DP interface configurable as a Class 1 or Class 2 device;
- Slave encoder with EtherCAT interface complying with ETG.1000 specifications and supporting CoE (CANopen over EtherCAT) and FoE (for firmware upgrade) protocols as well as the EtherCAT State Machine.

IF55 modules use connection cables and connectors that meet the specifications of each protocol. Thanks to IF55 converters any existing SSI serial interface encoder can be conver-ted and used further in a more modern and integrated communication system instead of being discarded during a plant retrofit project. Furthermore it is finally possible to install the smallest encoders in tight spaces not giving up the bus or Ethernet technology.
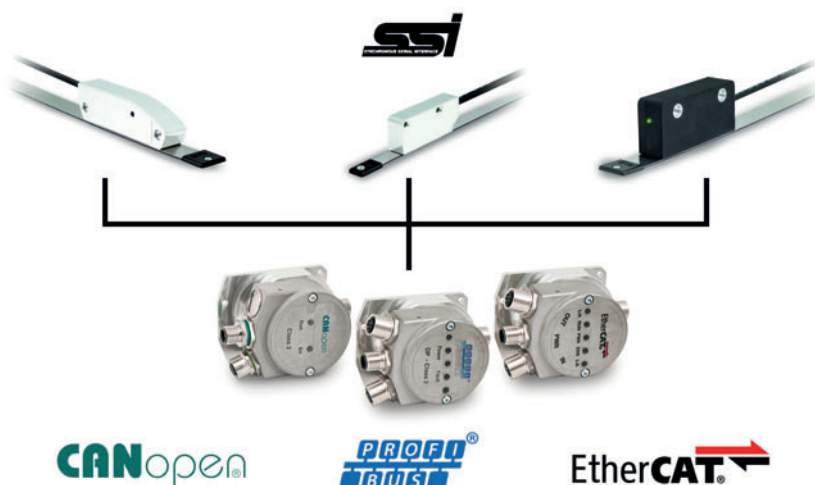
EtherCAT (Ethernet for Control Automation Technology) is an open Ethernet-based fieldbus system which applies Ethernet features to fieldbus technology.
Its development and administrative management are entrusted to the EtherCAT Technology Group (ETG) (www.ethercat.org). EtherCAT bus is simply a single large Ethernet "device" which receives and sends Ethernet telegrams (standard Ethernet dataframes in accordance with IEEE 802.3).
However, the "device" does not contain an Ethernet controller, but one Master and some Slaves. Moreover any control with a commercially available Ethernet controller should be able to be used as an EtherCAT Master: standard structural components such as Ethernet switches in fact should be usable for EtherCAT. Telegrams are processed directly "on the fly". While the telegrams (delayed by only a few bits) are already passed on, the Slave recognizes relevant commands and executes them accordingly. Processing is done within the hardware and is therefore independent of the response times of any microprocessors that may be connected. Flexible topology variants arbitrarily extendable namely Line, Star, Tree, Daisy Chain + Drop Lines are possible, even in the same network. Slave configuration can be done both via XML configuration file (EtherCAT Slave Information ESI) provided by the device manufacturer and by loading data directly from EEPROM (Slave Information Interface SII). The number of devices which can be installed in the EtherCAT network is virtually unlimited, while up to 65,535 nodes can be connected for each segment.
The transmission rate is 100 Mbit/s with full-duplex communication (Fast Ethernet).

Lika encoders with EtherCAT interface are Slave devices and support the CANopen Over EtherCAT (CoE) protocol for data transfer; in particular they comply with the "Device Profile for encoders" Class 2 established in the "CIA Draft Standard 301" and the "CIA Draft Standard 406" publications for CANopen; furthermore they comply with the EtherCAT standard established in ETG.1000 protocol conformance. As CANopen communication protocol, also EtherCAT uses PDOs and SDOs. PDO (Process Data Object) messages are used to process real time data (transmission of process data in real time, bus cycle time of 62 μs only, the faster in the market); while SDO (Service Data Object) messages are used to set and read values from the "Object dictionary" of the remote device. The following transmission modes are available: FreeRun: asynchronous mode, encoder position is sampled directly from EtherCAT frame sent by the Master; position update is performed by an internal timer of the controller every 100 microseconds; Synchronous with SM3: data is sampled and then copied into Sync Manager buffer as soon as the previous data are read by the Master (SM event); in this way new sampled data is synchronous with Master readings; Synchronous with DC: data is sampled and then copied into Sync Manager buffer simultaneously at SYNC0 event generated by the ESC capture/compare unit. Furthermore, Lika devices support the ESM (EtherCAT State Machine) with Init state, Pre-operational state, Safe-Operational state and Operational state; they also implement the FOE (File Access over EtherCAT) protocol for firmware update. Among the parameters available: position readout, counting direction, scaling function, preset and offset values, errors register and diagnostic information.
They are fitted with diagnostic LEDs and do not need any bus termination resistance.

EtherCAT at a glance

Number of stations	Setting the nodes	Setting the baud rate	Transmission rate	Cable length	Cable
Virtually unlimited	Software, automatic	-	100 Mbit/s full duplex	Up to 100 m / 330 ft	Standard EtherCAT / M12 connectors

Profibus (a portmanteau word of PROcess FIeld BUS) is a standard digital com-munication system for fieldbus widely used in automation industry for exchanging control data and I/O signals.

Its technology development and administrative management are entrusted to the Profibus International organization (PI) (www.profibus.com).

Profibus complies with the European Fieldbus Standard EN 50170 which allows a standardized development. It is the most popular fieldbus protocol in Europe.

Profibus communication protocol is built in accordance with the ISO/OSI (Open Systems Interconnection) reference model and developed on the four Physical (1), Data Link (2), Application (7) and User layers.

A Profibus network supports up to 126 stations and transmission rates up to 12Mbit/s. Serial communication is always used.

Profibus is a Multi-Master – Multi-Slave system with cyclic or acyclic access. Master device is able to detect all the Slaves connected to the network thanks to the GSD (General Station Description) configuration files which are provided by the device manufacturers (they are often called GSE, GSI, etc. depending on their language). GSD file is a readable ASCII text file and contains both general and device-specific information needful for communication. Furthermore each of the entries describes a feature that is supported by the Profibus device.
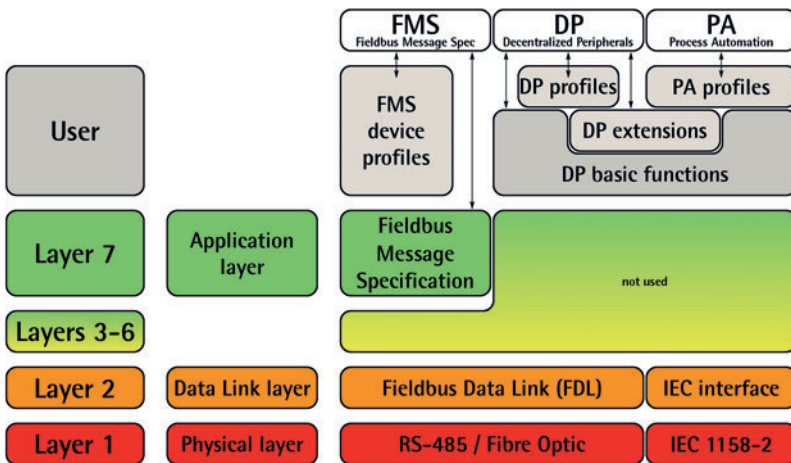
Profibus protocol supports a Master-Slave access method where the Master controls the communication on the bus and is the only allowed to issue messages without external request; while the Slave is a passive peripheral device and is only enabled to reply to explicit requests from the Master.

In conjunction with Master-Slave access method, token passing procedure is implemented allowing the Master devices to take control of the bus alternately. This procedure is intended to ensure that each Master keeps the token ownership for equal and regular time slices.

Time slice assigned to each Master for managing the network depends on the number of active nodes in the bus and the token hold time. In this way token is passed periodically from node to node around the network in a defined, recurring sequence (logical ring).

RS-485 is the most commonly used transmission technology for PROFIBUS; it is simple, easy-to-use and cost-effective. It is primarily used for tasks that require high transmission rates. RS-485 transmission technology uses shielded twisted pair copper cables with one conductor pair. A Profibus system that is to accommodate more than 32 stations must be divided into several bus segments. These individual bus segments with up to 32 stations each one are connected to each other by repeaters (also referred to as line amplifiers).

The following table shows the maximum transmission rates in relation to permissible line length.

Baud rate [Kbit/s]	9.6	19.2	93.75	187.5	500	1500	12000
Max. cable length	1200 m 4000 ft	1200 m 4000 ft	1200 m 4000 ft	1000 m 3300 ft	400 m 1300 ft	200 m 660 ft	100 m 330 ft

Lika linear encoders with Profibus interface implement Profibus DP (Decentralized Peripherals) communication protocol and can be set as Class 1 or Class 2 devices.
Encoder class has to be set at device configuration.
Class 1 provides the basic functionalities of DP such as:
- position readout;
- setting of the counting direction;
- setting of the preset value;
- 16-byte reduced diagnostic information.

Class 2 supports extended enhancements in addition to functionalities of Class 1:
- scaling function;
- 63-byte extended diagnostic information.

Thanks to Profibus DP, encoders can be coupled reducing costs and increasing performances; furthermore they fulfil each configuration, parametrization and diagnostic requirement. Among the parameters available: position readout, counting direction, scaling function, preset value. Encoders are fitted with diagnostic LEDs and bus termination resistance.

Profibus at a glance

Number of stations	Setting the nodes	Setting the baud rate	Transmission rate	Cable length	Cable
Up to 126	Dip switches	Software	Up to 12Mbit/s	Up to 1200 m 4000 ft	Standard Profibus M12 connectors

Setting the node number and the transmission rate for LIKA encoders

	Modbus	CANopen	Profibus	EtherCAT
Node number IP address	Software	Dip switches or software	Dip switches	Software, automatic
Baud rate	Software	Dip switches or software	Software	-

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Product	Page	Dimensions (mm)	Connection connector	Connection cable	Resolution max. (µm)	Travel speed max. (m/s)	Push-Pull	Line Driver	1Vpp	Reference	Limit switches	Power supply (Vdc)	Operating temperature °C (°F) min. – max.	Protection max.
SME51 Linear encoder for position measurement with up to 2 mm gap.	70	40 x 25 x 10	•	•	5	16	•	•		•		+5 +10 +30	-25 +85 (-13 +185)	IP67
SME52 Version with integrated reference and limit switches.	72	40 x 25 x 10		•	5	16	•	•		•	•	+5 +10 +30	-25 +85 (-13 +185)	IP67
SME21 Linear encoder for position measurement with up to 1 mm gap.	74	40 x 25 x 10	•	•	1	16	•	•		•		+5 +10 +30	-25 +85 (-13 +185)	IP67
SME22 Version with integrated reference and limit switches.	76	40 x 25 x 10		•	1	16	•	•		•	•	+5 +10 +30	-25 +85 (-13 +185)	IP67
SMP Encoder with lateral sensing for linear guides.	102	40 x 20 x 10	•	•	12,5	16	•	•				+5 +10 +30	-25 +85 (-13 +185)	IP67
SMB2 – SMB5 Miniature sensing head with external signal converter.	86	25 x 15 x 8,5		•	50	16	•	•				+5 +10 +30	-25 +85 (-13 +185)	IP68
SMK – SML – SMH Robust sensors for standard application.	96 98	40 x 25 x 10		•	10 100	2,5 10	•	•				+5 +10 +30	-25 +85 (-13 +185)	IP67
SMIG Guided incremental sensor.	100	80 x 48 x 28	•	•	5	1	•	•				+5 +10 +30	-25 +85 (-13 +185)	IP67
SMX2 – SMX5 Incremental speed & position sensor for rings & tapes.	94	M10 x 30		•	5 mm (1.25) 2 mm (0.5)	30 (7,5 kHz)	•	•				+5 +30	-10 +70 (+14 +158)	IP67

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	Page	Dimensions (mm)	Connection		Resolution max. (µm)	Travel speed max. (m/s)	SSI	BiSS	Push–Pull	Line Driver	1Vpp	Reference	Limit switches	Power supply (Vdc)	Operating temperature °C (°F) min. – max.	Protection max.
			connector	cable												
SMI2 – SMI5 Encoder with resolution selector & dynamic signal calibration.	88	25 x 15 x 8,5	•		50	16			•	•				+5 +10 +30	-25 +85 (-13 +185)	IP68
SMS11 Sine/cosine encoder for linear motors.	82	40 x 25 x 10	•	•	1000	16					•	•		+5	-25 +85 (-13 +185)	IP67
SMS12 Version with integrated reference & limit switches.	84	40 x 25 x 10	•	•	1000	16					•	•	•	+5	-25 +85 (-13 +185)	IP67
SMSR Miniature sine/cosine sensor for linear motors & pick-place applications.	90	25 x 15 x 8,5	•	•	1000	10					•			+5	-25 +85 (-13 +185)	IP68
SME11 High performance encoder for linear motors.	78	40 x 25 x 10	•	•	0,5	16			•	•		•		+5 +10 +30	-25 +85 (-13 +185)	IP67
SME12 Version with integrated reference & limit switches.	80	40 x 25 x 10	•	•	0,5	16			•	•		•	•	+5 +10 +30	-25 +85 (-13 +185)	IP67
SMA1 BiSS INTERFACE Absolute encoder with additional sine/cosine output.	110	85 x 21 x 20		•	5	5	•	•						+10 +30	-25 +85 (-13 +185)	IP67
SMA2 BiSS INTERFACE High performance absolute encoder with additional incremental track.	106	62 x 25 x 14	•	•	1	10	•	•						+10 +30	-25 +85 (-13 +185)	IP67

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	Page	Dimensions (mm)	Connection		Resolution max. (µm)	Measurement length max. (mm)	SSI	BiSS	Modbus RS485	Profibus	CANopen / CANlift	Analogue	Power supply (Vdc)	Operating temp. °C (°F) min. – max.	Protection max.
			connector	cable											
SMA5 Standard encoder for position measurement.	108	65 x 20 x 20	•	•	5	5,1	•						+10 +30	-25 +85 (-13 +185)	IP67
SMA2 BiSS INTERFACE High performance absolute encoder with additional incremental track.	106	62 x 25 x 14	•	•	1	8,2	•	•					+10 +30	-25 +85 (-13 +185)	IP67
SMAG Guided encoder for linear positioning.	112	80 x 48 x 28	•	•	5	0,6	•				•		+10 +30	-25 +85 (-13 +185)	IP65
SMAX Low-cost encoder with programmable resolution.	114	80 x 40 x 22	•	•	100	0,6	•		•			•	+10 +30	-25 +85 (-13 +185)	IP68
SMAZ Low-cost encoder with programmable resolution.	114	80 x 40 x 22	•	•	100	1,2	•		•			•	+10 +30	-25 +85 (-13 +185)	IP69K

LINEPULS • LINECOD Accessories

Standard incremental magnetic tapes **MT50, MT40, MT32, MT25, MT20 and MT10** are available up to 100 m length.
Versions with reduced width **MTS50 and MTS20**, available up to 30 m.
Standard absolute magnetic tapes **MTA5, MTA2, MTA1, MTAL, MTAX and MTAZ** are available up to max. 8,2 m length.

Tape terminals for incremental and absolute tapes.
(Terminals included with tape rolls. Additional terminals may be ordered separately).
KIT LKM-1440 for 10 mm width tapes, series MTxx and MTA2.
KIT LKM-1439 for 20 mm width tapes series MTAx (excluding MTA2).
(Each KIT contains 10 terminals with mounting screws).
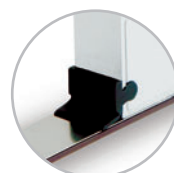
KIT WIPERS for incremental sensors.
Kit of 10 rubber wipers for series SME and SMS.

lika	Housing ø (mm)	Shaft max. ø (mm)	Shaft rotational speed max. (rpm)	Connection connector	Connection cable	Resolution max. (PPR or Bit)	Power supply (Vdc)	NPN	PNP	1Vpp	Push–Pull	Line Driver	SSI	Operating temperature °C (°F) min. – max.	Protection max.
IM30 – IM31 – IM56 Incremental encoder module for motor feedback.	30÷56	○ 8	3000	•		2048	+5	•				•		-40 +85 (-40 +185)	IP20
MIK36 Shaftless incremental encoder. Waterproof design.	36	○ 10	30000		•	2048	+5 +10 +30	•			•	•		-25 +85 (-13 +185)	IP68
SGSM – SGSD Magnetic ring encoder. Single & redundant version.	-	○ 50	6000		•	1024	+5 +10 +30				•	•		-40 +85 (-40 +185)	IP68
SMG Bearingless feedback encoder for spindle motors.	-	○ 100	50000	•	•	>25000	+5			•		•		-25 +85 (-13 +185)	IP68
SMRI Incremental ring encoder. Several ring sizes available.	-	○ 250	25000	•	•	90000	+5 +10 +30				•	•		-25 +85 (-13 +185)	IP68
SGHM Incremental ring encoder for integration into gearmotors.	-	○ 50	12000	•		16384	+5 +10 +30				•	•		-25 +85 (-13 +185)	IP65
MSK36 – MMK36 Shaftless absolute encoder. Single & multiturn. Waterproof design.	36	○ 10	12000	•	•	13 12 x 16	+5 +10 +30						•	-25 +85 (-13 +185)	IP68
SMRA Absolute bearingless ring encoder.	-	○ 380	15000	•	•	14	+10 +30						•	-25 +85 (-13 +185)	IP68
SMLA Sensor for absolute measuring of curved axes up tp 360°.	-	-	15000		•	14	+10 +30						•	-25 +85 (-13 +185)	IP68
SMR5H Sensor for incremental measuring of internal curved axes.	-	-	25000		•	5 µm	+5 +10 +30				•	•		-25 +85 (-13 +185)	IP67

	Housing ø (mm)	Shaft max. ø (mm)	Shaft rotational speed max. (rpm)	Resolution max. (PPR)	NPN	PNP	1Vpp	Push-Pull	Line Driver	Universal circuit	Operating temp. °C (°F) min. – max.	Protection max.
I28 — Miniature light-duty encoder.	28	● 5	3000	2048	•			•	•	•	-20 +70 (-4 +158)	IP54
MI36 – MC36 — Compact magnetic encoder.	36	● 6 ○ 6	12000	2048	•			•	•		-25 +85 (-13 +185)	IP67
I40 – I41 — Compact shaft encoder.	40	● 8	6000	5000	•	•		•	•	•	-25 +85 (-13 +185)	IP66
CK46 – CK41 — Compact blind hollow shaft encoder.	41	○ 6	6000	5000	•	•		•	•	•	-25 +85 (-13 +185)	IP65
I58 – I58S — Industrial grade shaft encoder.	58	● 12	12000	10000	•	•	•	•	•	•	-40 +100 (-40 +212)	IP65
C58 – C59 – C60 — Industrial grade through hollow shaft encoder.	58	○ 15	6000	5000				•	•	•	-40 +100 (-40 +212)	IP65
C58A – C58R — Industrial grade through hollow shaft encoder. Front or back collar fixing.	58	○ 15	6000	5000				•	•	•	-40 +100 (-40 +212)	IP65
CK58 – CK59 – CK60 — Industrial grade blind hollow shaft encoder.	58	○ 15	6000	10000	•	•	•	•	•	•	-40 +100 (-40 +212)	IP65
MC58 – MC59 – MC60 — Magnetic through hollow shaft encoder.	58	○ 15	6000	10000				•	•	•	-25 +85 (-13 +185)	IP67
I65 – IT65 — Industrial grade shaft encoder with MIL connector.	65	● 12	6000	10000	•	•		•	•	•	-40 +100 (-40 +212)	IP66

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		Housing ø (mm)	Shaft max. ø (mm)	Shaft rotational speed max. (rpm)	Resolution max. (PPR or Bit)	NPN / Push–Pull	SSI	BiSS	Modbus / RS485	Additional incremental track	Analogue output	Operating temp. °C (°F) min. – max.	Protection max.
	MS36 – MSC36 MM36 – MMC36 Compact magnetic encoder. Single & multiturn version.	36	● 6 ○ 6	12000	13 12 x 16		•					-20 +85 (-4 +185)	IP67
	AS36 – ASC36 AM36 – AMC36 Compact shaft & hollow shaft endoder. High resolution.	36	● 6 ○ 6	6000	20 20 x 16		•	•				-40 +100 (-40 +212)	IP65
	ES58 – ES58S – ESC58 EM58 – EM58S – EMC58 Industrial grade encoders. Shaft & blind hollow shaft versions.	58	● 12 ○ 15	12000	13 13 x 14	•	•		•	•		-40 +100 (-40 +212)	IP67
	HS58 – HS58S – HSC58 HM58 – HM58S – HMC58 Industrial grade high resolution encoders. Shaft & blind hollow shaft versions.	58	● 12 ○ 15	6000	19 + 2048 PPR 16 x 14 + 2048 PPR	•	•	•		•		-40 +100 (-40 +212)	IP65
	HSCT – HMCT Industrial grade high resolution encoders. Through hollow shaft.	58	○ 15	6000	18 16 x 12 + 2048 PPR	•	•	•		•		-25 +85 (-13 +185)	IP65
	MM58 – MM58S – MMC58 Magnetic multiturn encoders. Shaft & through hollow shaft versions.	58	● 12 ○ 15	12000	12 x 16		•					-20 +85 (-4 +185)	IP67
	AS58 A – AM58 A Industrial grade encoders with precise analogue output.	58	● 12 ○ 15	6000	12 tot. 16						•	-20 +85 (-14 +185)	IP65
	AST6 – AMT6 Industrial grade encoders with square flange.	65	● 12	6000	18 16 x 14	•	•			•		-25 +85 (-13 +185)	IP65
	AM9 – AMC9 Multiturn encoders with shaft & through hollow shaft. Low profile housing.	88	● 10 ○ 15	6000	13 x 12		•					-40 +100 (-40 +212)	IP65

ROTAPULS • ROTACOD programmable encoders

		Housing ø (mm)	Shaft max. ø (mm)	Shaft rotational speed max. (rpm)	Resolution max. (PPR or Bit)	NPN / Push-Pull	Line Driver	Universal circuit	SSI	BiSS	Analogue output	Operating temperature °C (°F) min. – max.	Protection max.
	IP58 – IP58S – CKP58 High resolution incremental encoder. Shaft & blind hollow shaft versions.	58	● 12 ○ 15	12000	65536			•				-25 +85 (-13 +185)	IP65
	IQ58 – IQ58S – CKQ58 Standard incremental encoder. Shaft & blind hollow shaft versions.	58	● 12 ○ 15	12000	16384			•				-40 +100 (-40 +212)	IP65
	HM58 P – HM58S P HMC58 P Absolute multiturn encoder. Possibility of resolution teach-in.	58	● 12 ○ 15	12000	18 x 14	•			•			-40 +100 (-40 +212)	IP67
	EM58 TA – EM58S TA EMC58 TA Absolute encoder with programmable analogue output. Teach-in buttons.	58	● 12 ○ 15	12000	12 x 14						•	-25 +85 (-13 +185)	IP67
	EM58 PA – EM58S PA EMC58 PA Fully programmable absolute encoder with analogue output.	58	● 12 ○ 15	12000	12 x 14						•	-25 +85 (-13 +185)	IP67

ROTACOD absolute encoders with fieldbus interface

	Housing ø (mm)	Shaft max. ø (mm)	Shaft rotational speed max. (rpm)	Connection cap with PG	Connection cap with M12 connectors	Resolution max. (bits)	CANopen	CANopen LIFT	Profibus–DP	DeviceNet	EtherCAT	Profinet	Powerlink	Operating temperature °C (°F) min. – max.	Protection max.
AS58 PB – AM58 PB AS58 CB – AM58 CB — Standard encoders with Profibus & CANopen interface. PG & M12 connections.	58	● 12 ○ 15	6000	•	•	13 13 x 12	•		•					-25 +85 (-13 +185)	IP65
HS58 FB – HM58 FB — High resolution encoders with Fieldbus interface. PG & M12 connections.	58	● 12 ○ 15	6000	•	•	18 16 x 14	•	•	•	•				-25 +85 (-13 +185)	IP65
AS58 – AM58 CANopen — CANopen encoder with single output (point-to-point). Shaft & blind hollow shaft.	58	● 12 ○ 15	6000			18 16 x 14	•	•						-25 +85 (-13 +185)	IP65
EM58 PT – HS58 PT HM58 PT — Standard & high resolution encoders with Profinet interface.	58	● 12 ○ 15	6000	–	•	13 x 14 18 16 x 14						•		-25 +85 (-13 +185)	IP65
EM58 EC – HS58 EC HM58 EC — Standard & high resolution encoders with EtherCAT interface.	58	● 12 ○ 15	6000	–	•	13 x 14 18 16 x 14					•			-25 +85 (-13 +185)	IP65
EM58 PL – HS58 PL HM58 PL — Standard & high resolution encoders with Powerlink interface.	58	● 12 ○ 15	6000	–	•	13 x 14 18 16 x 14							•	-25 +85 (-13 +185)	IP65

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ETHERNET POWERLINK

EtherCAT

PROFIBUS PROCESS FIELD BUS

PROFINET INDUSTRIAL ETHERNET

DeviceNet

BiSS INTERFACE

Modbus

CANopen

CANopen LIFT cia

ROTAPULS encoders for motor feedback applications

lika	Housing ø (mm)	Shaft max. ø (mm)	Shaft rotational speed max. (rpm)	Resolution max. (PPR)	NPN	PNP	1Vpp	Push–Pull	Line Driver	Universal circuit	Operating temperature °C (°F) min. – max.	Protection max.
C50 Compact & reliable through hollow shaft encoder. High operating temperature.	50	○ 10	6000	8192	•	•					-40 +100 (-40 +212)	IP65
CB50 Encoder with UVW commutation signals.	50	○ 10	6000	2500/ 8 poles				•	•		-20 +100 (-4 +212)	IP20
CB59 – CB60 Sine/Cosine encoder with absolute C-D track. Hollow & taper shaft.	58	● 1:10 ○ 15	12000	2048/ 1 sin/cos			•				-20 +100 (-4 +212)	IP40
C80 Through hollow shaft for lift motors.	80	○ 30	6000	4096				•	•	•	-40 +100 (-40 +212)	IP65
C81 Robust through hollow shaft encoder.	80	○ 44	3000	4096			•	•	•	•	-40 +100 (-40 +212)	IP65
C82 Through hollow shaft for lift motors.	80	○ 44	3000	8192				•	•	•	-40 +100 (-40 +212)	IP65
SMG Gearwheel encoder for high speed spindle motors.	-	-	50000	>25000		•			•		-25 +85	IP68

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		Housing ø (mm)	Shaft max. ø (mm)	Shaft rotational speed max. (rpm)	Resolution max. (PPR or Bit)	NPN / Push–Pull	SSI	BiSS	Profibus–DP / CANopen	Add. incremental track	Analogue output	Operating temp. °C (°F) max.	Protection max.
XC77 ⟨Ex⟩	Incremental ATEX encoder. Ex II 2 GD, Ex d IIC T6 Gb, Ex tb IIIC T85°C Db. Zone 1, 2, 21, 22.	77	○ 14	6000	10000	•						-25 +85 (-13 +185)	IP66
XAC77 ⟨Ex⟩	Absolute ATEX encoder. Ex II 2 GD, Ex d IIC T6 Gb, Ex tb IIIC T85°C Db. Zone 1, 2, 21, 22.	77	○ 14	6000	18 16 x 14	•	•	•		•	•	-25 +85 (-13 +185)	IP65
I58 – CK58 ⟨Ex⟩	Incremental ATEX encoder. Ex II 3G Ex nA IIB T4 Gc, Ex II 3D Ex tc IIIC T105° Dc. Zone 2, 22.	58	● 12 ○ 15	12000 6000	10000	•						-40 +100 (-40 +212)	IP65
XAC77 PB – CB ⟨Ex⟩	Profibus & CANopen ATEX encoder. Point-to-point communication.	77	○ 14	6000	18 16 x 14				•			-25 +85 (-13 +185)	IP66

ROTAPULS • ROTACOD Accessories

Flexible couplings

Complete range of encoder and transmission couplings

- Flexible or rigid
- Zero-backlash
- Electrically insulated
- Vibration absorbing

- High torque & stiffness versions
- Grub screw or collar fixing
- Versions with keyway
- Stainless steel versions

Mounting and Connection accessories

Mounting accessories for encoders and electrical connections

- Spring loaded brackets
- Mounting bells and adapter flanges
- Fixing clamps, Reducing sleeves
- Connectors
- Cordets

Metric wheels and Gears

Metric wheels with 200 and 500 mm circumference

- Aluminum or Rubber surface
- Metric wheel encoders (IR65 series on request)
- Rack and pinions (for ICS series)

ROTAPULS • ROTACOD heavy-duty encoders & with stainless-steel housing

lika

	Housing ø (mm)	Shaft max. ø (mm)	Shaft rotational speed max. (rpm)	Resolution max. (PPR or Bit)	NPN / PNP	1Vpp	Universal circuit	Push–Pull	Line Driver	SSI	CANopen	Profibus–DP	DeviceNet	Analogue output	Operating temperature °C (°F) min. – max.	Protection max.
I58SK — Industrial stainless steel incremental encoder. Food industry.	58	● 12	12000	10000	•	•	•	•	•						-40 +100 (-40 +212)	IP65
MI36K – MC36K — Compact magnetic encoder in stainless steel. Food industry.	36	● 6	12000	2048	•			•	•						-25 +85 (-13 +185)	IP67
C100 – C101 — Hollow shaft feedback encoder. Single & redundant version. Windturbines.	100	○ 1 : 17 ○ 16	6000	2500 2048			•	•	•						-40 +100 (-40 +212)	IP65
I115 – I116 — Solid shaft feedback encoder. Single & redundant version. Windturbines, Steelmills.	115	● 11	6000	5000	•		•	•	•						-40 +100 (-40 +212)	IP66
ICS — Spring-loaded movable shaft for linear measurements with pinions & gears.	172x80 x53	● 12	6000	2500	•		•	•	•						-25 +85 (-13 +185)	IP65
AM58 K — Absolute stainless steel encoder. Profibus & CANopen interfaces. Food industry.	58	● 12	6000	13 x 12							•	•			-25 +85 (-13 +185)	IP67
MH58S — Robust absolute encoder. Windturbines, Mobile equipment, Steelmills.	58	● 10	6000	12 x 12						•				•	-40 +85 (-13 +185)	IP67
XAC77 FB — Absolute fieldbus hollow shaft encoder with connection cap.	77	○ 14	6000	18 16 x 14							•	•	•		-25 +85 (-13 +185)	IP66

ROTAPULS • ROTACOD specialty encoders & OEM versions

lika

		Housing ø (mm)	Shaft max. ø (mm)	Shaft rotational speed max. (rpm)	Resolution max. (PPR or Bit)	NPN	PNP	1 Vpp	Push–Pull	Line Driver	Universal circuit	Analogue output	Operating temperature °C (°F)min. – max.	Protection max.
	I70 Pulley encoder for timing belt systems.	54	-	3600	500				•				-20 +85 (-4 +185)	IP65
	CH59 Ultra high resolution incremental encoder. Flat design, through hollow shaft.	58	○ 12	6000	204800					•			-25 +85 (-13 +185)	IP42
	IR01 Wheel-encoder with mounting kit. Linear & conveyor belt measurements.	-	-	3000	2500				•	•	•		-25 +85 (-13 +185)	IP65
	I105 High resolution non-interpolated incremental encoder.	105	● 10	6000	18000				•	•	•		-25 +85 (-13 +185)	IP65
	ASR58 – AMR58 Absolute encoder with integrated cam switch programmer. Packaging machines.	58	● 12	6000	12 12 x 18		•					•	-25 +85 (-13 +185)	IP65
	IT68 Incremental encoder for tool machines.	65	● 15	6000	10000	•	•		•	•	•		-40 +100 (-40 +212)	IP66

DRAW WIRE incremental & absolute wire encoders

lika

	Measurement length max. (mm)	Stroke per turn (mm)	Measuring speed max. (m/sec)	Sensor integrated	Sensor external	Potentiometer Analogue	Incremental encoder	Absolute encoder	Fieldbus encoder	Atex encoder
SFP — Compact wire-potentiometer with ohmic or analogue output.	2000	100	2	•		•				
SFE — Compact wire- encoder with incremental output.	2000	100	2	•			•			
SFE-5000, SFE-10000 — Programmable incremental wire-encoder, 5 & 10m length.	10000	200		•			•			
SFA — Compact wire-encoder with absolute output.	2000	100	2	•				•		
SFA-5000, SFA-10000 — Absolute wire-encoder, 5 & 10m length	10000	200		•				•		
SFA-5000 TA, SFA-10000 TA — Wire-encoder with analogue output & teach-in buttons. 5 & 10m length.	10000	200		•		•				
SF-I, SF-A — Draw-wire units for incremental & absolute encoders, 5 & 6,8m length.	6800	200 204,8	2,5		•	•	•	•	•	
SAK-10000, SAK-15000 SBK-20000, SBK-30000 SBK-40000, SBK-50000 — Robust draw-wire units with reinforced winding mechanism.	50000	500	10		•	•	•	•	•	•

lika

		Dimensions (mm)	Hollow shaft ø (mm)	Shaft rotational speed max. (rpm)	Nominal torque (Nm)	Max. torque (Nm)	Motor brake	Power supply (Vdc)	RS232 service Modbus	CANopen	Profibus	Modbus RS485	EtherCAT	Operating temperature °C (°F) min. – max.	Protection max.
	RD1A Rotary actuator with absolute multiturn encoder & jog buttons.	59 x 112 x 125	14	240 120 60	1,2 2,4 5	3 6 12		24	•	•	•	•	•	0 +60 (32 +140)	IP65
	RD12A Version with integrated motor brake.	59 x 142 x 125	14	240 120 60	1,2 2,4 5	3 6 12	•	24	•	•	•	•		0 +60 (32 +140)	IP65
	RD5 Compact actuator with absolute multiturn encoder.	48,3 x 88 x 127	14	60	5	12		24	•	•	•			0 +60 (32 +140)	IP54
	RD53 Version with integrated motor brake.	48,3 x 88 x 139	14	60	5	12	•	24	•	•	•			0 +60 (32 +140)	IP54
	RD4 High torque rotary actuator with absolute encoder.	65 x 153 x 160	20	94 62	10 15	20 30		24	•	•	•			0 +60 (32 +140)	IP65

LDT10 Touch screen controller for rotary actuators

Description	Master controller for up to 16 RD units with Modbus interface.
Screen	TFT LCD 7.0 inch, touchscreen.
General specs	Dimension 205 x 151 x 33 mm. Power supply 24 Vdc, 15W. Full parameter setting and command of RD units. Editing & storage of recipes. Cordsets & connection cables to RD units available.

lika	Display	Display mode			Dimensions (mm)	Input				Counting frequency max. (kHz)	Interface RS232 / RS485	Power supply	Output max.
		linear	angular	mm/inch		AB0	SSI	1Vpp	Magnetic sensor				
LD120 Compact LED position display for SMx magnetic sensors.	LED 5 digit	•	•	•	72 x 36 x 62				•	–	•	+10 +30	–
LD112 Compact LCD battery powered position display with SM25 sensor.	LCD 6 digit	•	•	•	72 x 48 x 31				•	–		battery	–
LD111 – LD141 Version without housing for OEM applications.	LCD 6 digit	•	•	•	61 x 39 x 23 87 x 60,5 x 47				•	–		battery	–
LD140 – LD142 Standard LCD battery display for SM25 sensors. LD142 directly connected sensor.	LCD 6 digit	•	•	•	96 x 72 x 47				•	–	•	battery	–
LD200 Universal LED display with multiple encoder input.	LED 8 digit	•	•	•	96 x 48 x 49	•	•	•	•	500	•	24 Vdc	3 x 24V @ 23mA
LD250 Multifunction LED display for absolute encoders.	LED 6 digit	•		•	96 x 48 x 141		•			–	•	24 Vdc 115/230 Vac	0/4 - 20mA 0...±10Vdc
LD300 Multifunction LED display for incremental encoders.	LED 6 digit	•		•	96 x 48 x 141	•				100	•	24 Vdc 115/230 Vac	0/4 - 20mA 0...±10Vdc

	Description	Input	Output	Service interface	Functions
IF10	Universal incremental encoder signal splitter, converter & cross switch. DIN rail mounting.	2 inputs HTL or TTL / RS422	2 outputs HTL or TTL / RS422		Adjustable inputs and outputs signal levels (can be mixed) Contactless switch-over Up to 1 MHz input frequency
IF20	Signal level converter for incremental encoder. DIN rail mounting.	HTL or TTL / RS422	HTL or TTL / RS422		Output voltage according to remote voltage Input/Output galvanically separated AB quadrature to UP/DOWN conversion
IF30	Sine/Cosine signal interpolator. DIN rail mounting.	1Vpp	HTL (AB0) or RS422 (AB0 /AB0)		Adjustable interpolation rate up to x50 Adjustable pulse divider Filtering functions
IF50	Incremental signal to Analogue converter and to RS232/RS485. DIN rail mounting.	HTL or TTL / RS422	± 10 V 0- 20 mA 4 - 20 mA	RS232 RS485	Signal linearization Scaling factor Teach-in function
IF51	Absolute SSI to Analogue converter and to RS232/RS485. DIN rail mounting.	SSI (up to 25 bit)	± 10 V 0- 20 mA 4 - 20 mA	RS232 RS485	Bit blanking function Signal linearization Scaling factor
IF52	Absolute SSI to Bit parallel converter and to RS232. DIN rail mounting.	SSI (up to 25 bit)	Push-Pull	RS232	Signal linearization Scaling factor
IF55	Robust gateway for linear and rotary encoders. From SSI to EtherCAT, Profibus, CANopen.	SSI (up to 25 bit)	EtherCAT Profibus CANopen		Scaling factor Velocity output
IFS10 *SIL3 Functional Safety PLe*	Safety monitor for speed, standstill and counting direction.	1Vpp, RS422 HTL	Secure relay 4 - 20 mA	RS232 USB	Integrated splitter function 4 redundant outputs Upper & lower speed limits Pre alarm function
IF60 – IF61 IF62 – IF63	Fibre-optic signal converters for incremental and absolute encoders. IF60/IF62 transmitter. IF61/IF63 receiver.	HTL or TTL / RS422 SSI	Optical signal		Safe signal transmission up to 1500 m Suitable for explosive areas and environments with extremly high electromagnetic fields

LINEPULS
Magnetic tape

lika

CE   RoHS   IP67

- Flexible magnetic tape with adhesive tape
- Incremental coding
- Cover strip available on request
- Resistant to debris, liquids and oils
- Standard rolls up to 100 m
- MT10, MT20, MT25, MT32, MT40, MT50 series
- MTS20, MTS50 series
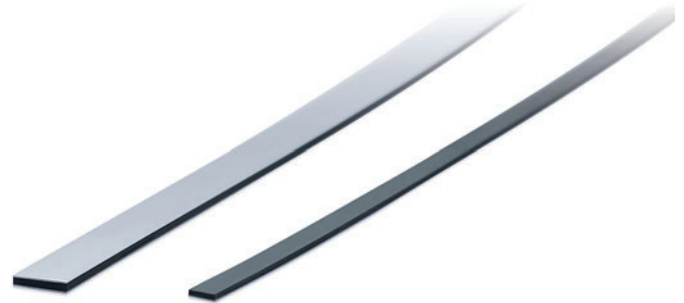
MTxx

ENVIRONMENTAL SPECIFICATIONS	
Protection:	IP67
Operating temperature range:	-20°C +70°C (-4°F +158°F)
Storage temperature range:	-40°C +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Material:	plastoferrite and stainless steel
Accuracy class:	see order code
Thermal expansion coefficient:	$16 * 10^{-6}/K$
Length:	MT max. 100 m, MTS max. 30 m
Polar pitch:	MT/MTS50 : 5,0 mm, MT40 : 4,0 mm, MT32 : 3,2 mm MT/MTS20 : 2,0 mm, MT25 : 2,5 mm, MT10 : 1,0 mm

CHEMICAL RESISTANCE INFORMATION			
Acetone	●●	Mineral / Motor oil	●
Acetylene	●●	Petrol	●●
Antifreeze (Glacial acetic acid)	●	Seawater	●●
Benzene	●●●	Steam heat	●
Heptane	●●●	Thinner	●●●
Kerosene	●	Turpentine	●●
Ketone	●●●		

● No effect or low effect   ●● Low to Medium effect   ●●● Strong effect

ACCESSORIES	
KIT PS1-1,0:	Protection profile (10 pcs)
KIT LKM-1440:	Tape terminals (10 pcs)

MT

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Carrier with adhesive strip
5	Adhesive tape

MTS

I	Plastoferrite tape
2	Carrier with adhesive strip
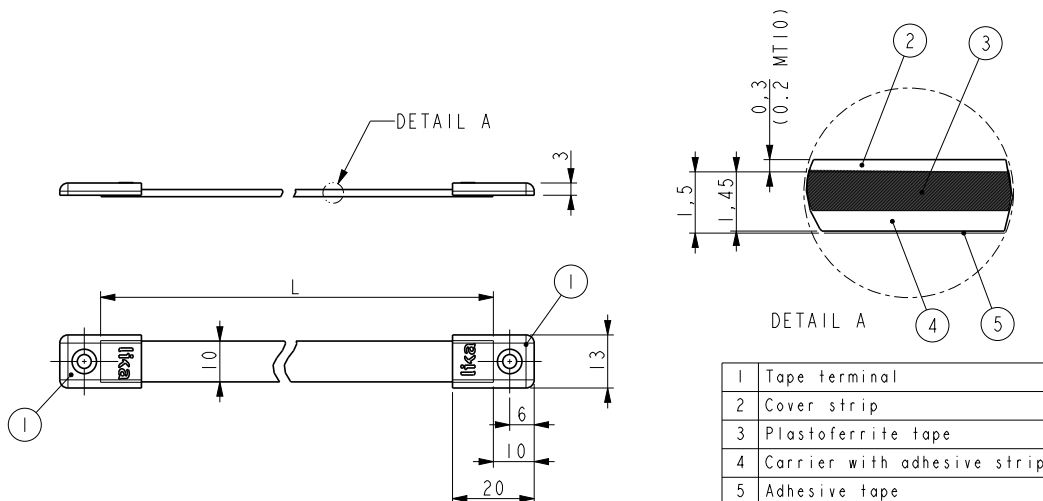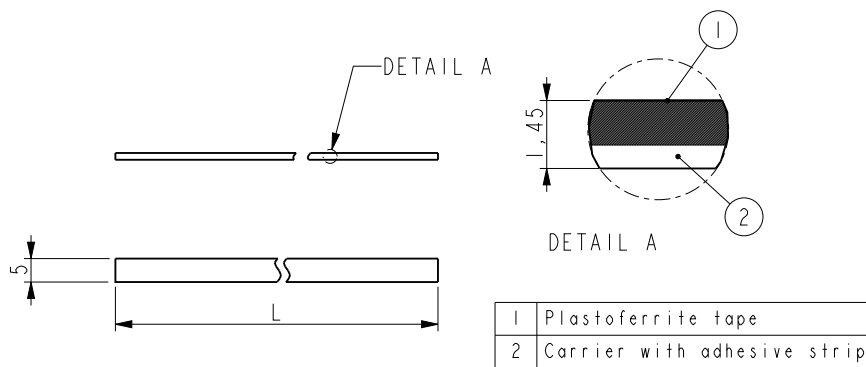
Order code

MT50 MT40 MT32	MT25 MT20 MT10	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	–	/Sxxx ⓓ

ⓐ LENGTH		ⓑ ACCURACY CLASS	ⓒ COVER STRIP
1 = 1,0 m	**20 =** 20,0 m	**100 =** ±85 µm/m	**0 =** not supplied
2 = 2,0 m	**30 =** 30,0 m	**50 =** ±35 µm/m (up to 30 m)	**1 =** supplied
4 = 4,0 m	**50 =** 50,0 m	**10 =** ±8 µm/m (up to 10 m)	
10 = 10,0 m	**100 =** 100,0 m		

ⓓ CUSTOM VERSION

Order code

MTS50 MTS20	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	–	/Sxxx ⓓ

ⓐ LENGTH	ⓑ ACCURACY CLASS	ⓒ COVER STRIP
1 = 1,0 m	**100 =** ±85 µm/m	**0 =** not supplied
2 = 2,0 m	**50 =** ±35 µm/m	
4 = 4,0 m		
10 = 10,0 m		
20 = 20,0 m		
30 = 30,0 m		

ⓓ CUSTOM VERSION

Specifications subject to changes without prior notice

LINEPULS
Linear encoder with integrated converter

lika

Series	SME51

- Standard encoder for linear position measurement
- Gap clearance up to 2 mm
- Lika hi-flex sensor cable for drag cable chains
- Status LED for clearance and gap error
- Optional reference mark LKM1309/5 to be installed along the magnetic tape
- Optional tape cleaning wipers
- Error output available on request (see on page 27)

SME51

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M8, 2,0 m or M12 8 pin inline plug
Gap between sensor/tape (without cover strip):	0,1 ÷ 2,0 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	0,05 / 0,025 / 0,01 / 0,005 mm
Sensor accuracy:	±15 µm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB0 /AB0
Counting frequency:	acc. to edge distance setting
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	70 mA max.
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3
Option:	Error signal output (PWM)

ACCESSORIES	
MT50:	Magnetic tape
LKM-1309/5:	Reference pole support
KIT LKM-1440:	Set of tape terminals
KIT WIPERS:	Wipers for SMExx/SMSxx (10 pcs)
KIT PS1-1,0:	Protection profile (10 pcs)
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 meters with M12 conn.

Edge distance selection

Order code	Edge distance (µsec)	Max. counting frequency (kHz)	Resolution (µm) vs. max. possible speed (m/s)			
			5	10	25	50
H	0,3	3333	11,67	23,34	25,00	25,00
J	0,5	2000	7,00	14,00	25,00	25,00
A	1	1000	3,50	7,00	17,50	17,50
B	2	500	1,67	3,34	8,35	8,35
C	4	250	0,88	1,75	4,38	4,38

A	Reference sensor "R"
B	Dust wipers
C	Diagnostic LEDS
	E: Gap/Speed error (red)
	R: Reference detection (green)
	1: Led 1
	2: Led 2

SME51

LKM-1309/5
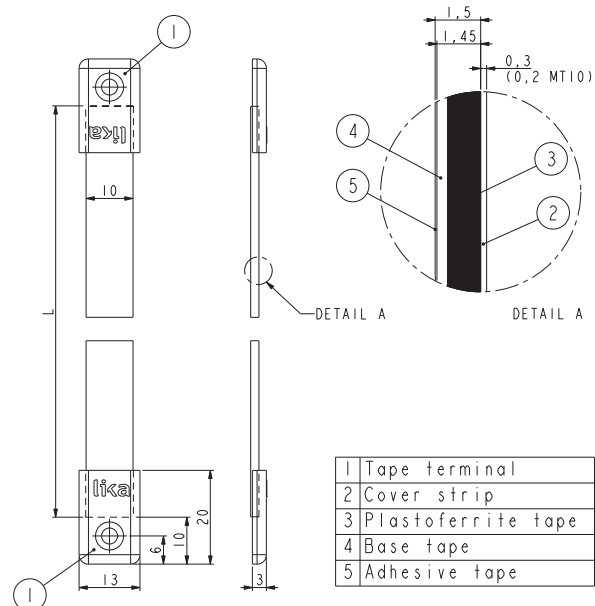
1	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

MT50

Order code – Sensor

SME51	–	XX ⓐ	–	X ⓑ	–	XX ⓒ	–	X ⓓ	–	XX ⓔ	–	X ⓕ	/Sxxx ⓖ

ⓐ OUTPUT CIRCUITS
Y = Push-Pull (AB)
YC = Push-Pull (AB, /AB)
L = Line Driver (AB, /AB)

ⓑ POWER SUPPLY
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (Y and YC output circuit)

ⓒ RESOLUTION
50 = 0,05 mm (50 µm)
25 = 0,025 mm (25 µm)
10 = 0,01 mm (10 µm)
5 = 0,005 mm (5 µm)

ⓓ INDEX
N = without
I = every 5 mm
R = unique reference signal

ⓔ CONNECTIONS
L2 = cable output 2 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 inline plug
M2 = 2 m cable + M12 inline plug

ⓕ EDGE DISTANCE *(see edge distance selection)*
H = 0,3 µs
J = 0,5 µs
A = 1 µs
B = 2 µs *(standard value)*
C = 4 µs

ⓖ CUSTOM VERSION

Order code – Magnetic tape

MT50	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	–	/Sxxx ⓓ

ⓐ LENGTH
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m
50 = 50,0 m
100 = 100,0 m

ⓑ ACCURACY CLASS
100 = ±85 µm/m
50 = ±35 µm/m (up to 30 m)
10 = ±8 µm/m (up to 10 m)

ⓒ COVER STRIP
0 = not supplied
1 = supplied

ⓓ CUSTOM VERSION

LINEPULS
Linear encoder with integrated converter

lika

Series	SME52

- Standard encoder for linear position measurement
- Two integrated limit switch sensors
- Gap clearance up to 2.0 mm
- Lika hi-flex sensor cable for drag cable chains
- Status LED for clearance and gap error
- Reference and limit switch marks to be installed along the magnetic tape
- Optional tape cleaning wipers

SME52

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M10, 2,0 m
Gap between sensor/tape (without cover strip):	0,1 ÷ 2,0 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	0,05 / 0,025 / 0,01 / 0,005 mm
Sensor accuracy:	±15 μm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB0 /AB0 + LS1, LS2 (o.c. 50 mA)
Counting frequency:	acc. to edge distance setting
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	80 mA max.
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MT50:	Magnetic tape
LKM-1309/5:	Reference pole support
LKM-1309/LS	Limit switch support
KIT LKM-1440:	Set of tape terminals
KIT WIPERS:	Wipers for SMExx/SMSxx (10 pcs)
KIT PS1-1,0:	Protection profile (10 pcs)

Edge distance selection

Order code	Edge distance (μsec)	Max. counting frequency (kHz)	Resolution (μm) vs. max. possible speed (m/s)			
			5	10	25	50
H	0,3	3333	11,67	23,34	25,00	25,00
J	0,5	2000	7,00	14,00	25,00	25,00
A	1	1000	3,50	7,00	17,50	17,50
B	2	500	1,67	3,34	8,35	8,35
C	4	250	0,88	1,75	4,38	4,38

A	Reference sensor "R"
B	Dust wipers
C	Limit switch sensors
D	Diagnostic LEDS
	E: Gap/Speed error (red)
	R: Reference detection (green)
	I: Limit switch (green)
	2: Limit switch (green)

E	Tape position on LKM1309/LS

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

SME52   **LKM-1309/5 • LKM-1309/LS**   **MT50**

Order code – Sensor

SME52	–	XX	–	X	–	XX	–	X	–	XX	–	X	/Sxxx
		ⓐ		ⓑ		ⓒ		ⓓ		ⓔ		ⓕ	ⓖ

ⓐ OUTPUT CIRCUITS
Y = Push-Pull (AB)
YC = Push-Pull (AB, /AB)
L = Line Driver (AB, /AB)

ⓑ POWER SUPPLY
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (Y and YC output circuit)

ⓒ RESOLUTION
50 = 0,05 mm (50 μm)
25 = 0,025 mm (25 μm)
10 = 0,01 mm (10 μm)
5 = 0,005 mm (5 μm)

ⓓ INDEX
R = unique reference signal

ⓔ CONNECTIONS
L2 = cable output 2 m
L5 = cable output 5 m
Lx = cable output x m

ⓕ EDGE DISTANCE *(see edge distance selection)*
H = 0,3 μs
J = 0,5 μs
A = 1 μs
B = 2 μs *(standard value)*
C = 4 μs

ⓖ CUSTOM VERSION

Order code – Magnetic tape

MT50	–	XXX	–	XXX	–	X	–	/Sxxx
		ⓐ		ⓑ		ⓒ		ⓓ

ⓐ LENGTH
1 = 1,0 m   20 = 20,0 m
2 = 2,0 m   30 = 30,0 m
4 = 4,0 m   50 = 50,0 m
10 = 10,0 m   100 = 100,0 m

ⓑ ACCURACY CLASS
100 = ±85 μm/m
50 = ±35 μm/m (up to 30 m)
10 = ±8 μm/m (up to 10 m)

ⓒ COVER STRIP
0 = not supplied
1 = supplied

ⓓ CUSTOM VERSION

LINEPULS
Linear encoder with integrated converter

lika

Series	SME21

- High resolution encoder for linear measurements
- High speed and protection degree
- Speed proportional output signals (real-time)
- Resolution up to 1 μm
- Optional reference mark LKM1309/2 to be installed along the magnetic tape
- Optional tape cleaning wipers
- Error output available on request (see on page 27)

SME21

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

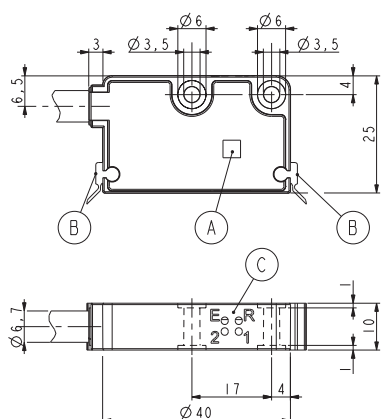| MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M8, 2,0 m or M12 8 pin inline plug
Gap between sensor/tape (without cover strip):	0,1 ÷ 1,0 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	0,05 / 0,01 / 0,002 / 0,001 mm
Sensor accuracy:	±15 μm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB0 /AB0
Counting frequency:	acc. to edge distance setting
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	70 mA max.
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3
Option:	Error signal output (PWM)

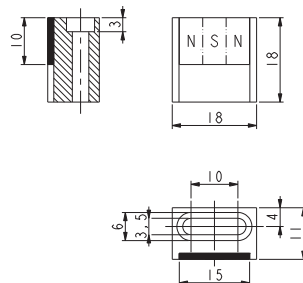| ACCESSORIES	
MT20:	Magnetic tape
LKM-1309/2:	Reference pole support
KIT LKM-1440:	Set of tape terminals (10 pcs)
KIT WIPERS:	Wipers for SMExx/SMSxx (10 pcs)
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 meters with M12 conn.

Edge distance selection

Order code	Edge distance (μsec)	Max. counting frequency (kHz)	Resolution (μm) vs. max. possible speed (m/s)			
			1	2	10	50
H	0,3	3333	2,33	4,67	23,34	14,58
J	0,5	2000	1,40	2,80	14,00	8,74
A	1	1000	0,70	1,40	7,00	4,38
B	2	500	0,33	0,67	3,34	2,08
C	4	250	0,18	0,35	1,75	1,09

A	Reference sensor "R"
B	Dust wipers
C	Diagnostic LEDS
	E: Gap/Speed error (red)
	R: Reference detection (green)
	1: Led 1
	2: Led 2

SME21

LKM-1309/2
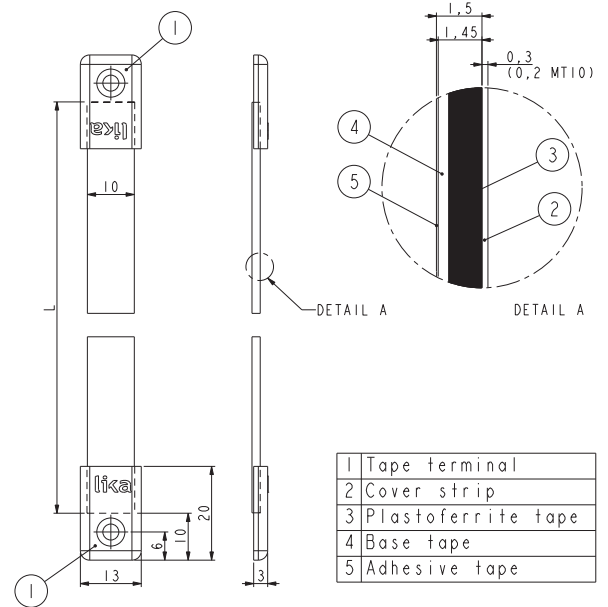
1	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

MT20

Order code – Sensor

SME21	-	XX (a)	-	X (b)	-	XX (c)	-	X (d)	-	XX (e)	-	X (f)	/Sxxx (g)

ⓐ **OUTPUT CIRCUITS**
Y = Push-Pull (AB)
YC = Push-Pull (AB, /AB)
L = Line Driver (AB, /AB)

ⓑ **POWER SUPPLY**
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (Y and YC output circuit)

ⓒ **RESOLUTION**
50 = 0,05 mm (50 μm)
10 = 0,01 mm (10 μm)
2 = 0,002 mm (2 μm)
1 = 0,001 mm (1 μm)

ⓓ **INDEX**
N = without
I = every 2 mm
R = unique reference signal

ⓔ **CONNECTIONS**
L2 = cable output 2 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 inline plug
M2 = 2 m cable + M12 inline plug

ⓕ **EDGE DISTANCE** *(see edge distance selection)*
H = 0,3 μs
J = 0,5 μs
A = 1 μs
B = 2 μs *(standard value)*
C = 4 μs

ⓖ **CUSTOM VERSION**

Order code – Magnetic tape

MT20	–	XXX (a)	–	XXX (b)	–	X (c)	–	/Sxxx (d)

ⓐ **LENGTH**
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m
50 = 50,0 m
100 = 100,0 m

ⓑ **ACCURACY CLASS**
100 = ±85 μm/m
50 = ±35 μm/m (up to 30 m)
10 = ±8 μm/m (up to 10 m)

ⓒ **COVER STRIP**
0 = not supplied
1 = supplied

ⓓ **CUSTOM VERSION**

LINEPULS
Linear encoder with integrated converter

lika

Series	SME22

- Two integrated limit switch sensors
- High resolution encoder for linear measurements
- High speed and protection degree
- Speed proportional output signals
- Resolution up to 1 µm
- Reference and limit switch marks to be installed along the magnetic tape
- Optional tape cleaning wipers

SME22

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

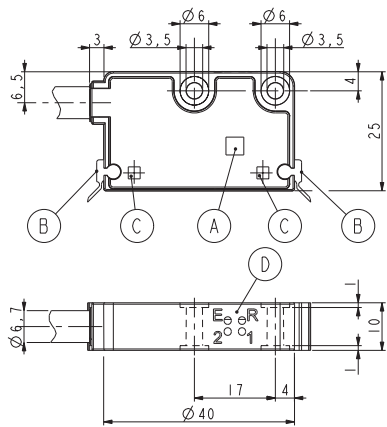| MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M10, 2,0 m
Gap between sensor/tape (without cover strip):	0,1 ÷ 1,0 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	0,05 / 0,01 / 0,002 / 0,001 mm
Sensor accuracy:	±15 µm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB0 /AB0 + LS1, LS2 (o.c. 50 mA)
Counting frequency:	acc. to edge distance setting
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	80 mA max.
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

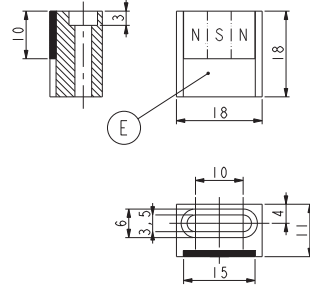| ACCESSORIES	
MT20:	Magnetic tape
LKM-1309/2:	Reference pole support
LKM-1309/LS	Limit switch support
KIT LKM-1440:	Set of tape terminals (10 pcs)
KIT WIPERS:	Wipers for SMExx/SMSxx (10 pcs)

Edge distance selection

Order code	Edge distance (µsec)	Max. counting frequency (kHz)	Resolution (µm) vs. max. possible speed (m/s)			
			1	2	10	50
H	0,3	3333	2,33	4,67	23,34	14,58
J	0,5	2000	1,40	2,80	14,00	8,74
A	1	1000	0,70	1,40	7,00	4,38
B	2	500	0,33	0,67	3,34	2,08
C	4	250	0,18	0,35	1,75	1,09

A	Reference sensor "R"
B	Dust wipers
C	Limit switch sensors
D	Diagnostic LEDS
	E: Gap/Speed error (red)
	R: Reference detection (green)
	I: Limit switch (green)
	2: Limit switch (green)

| E | Tape position on LKMI309/LS |

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

SME22   LKM-1309/2 • LKM-1309/LS   MT20

Order code – Sensor

| SME22 | – | XX (a) | – | X (b) | – | XX (c) | – | X (d) | – | XX (e) | – | X (f) | /Sxxx (g) |

(a) OUTPUT CIRCUITS
Y = Push-Pull (AB)
YC = Push-Pull (AB, /AB)
L = Line Driver (AB, /AB)

(b) POWER SUPPLY
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (Y and YC output circuit)

(c) RESOLUTION
50 = 0,05 mm (50 µm)
10 = 0,01 mm (10 µm)
2 = 0,002 mm (2 µm)
1 = 0,001 mm (1 µm)

(d) INDEX
R = unique reference signal

(e) CONNECTIONS
L2 = cable output 2 m
L5 = cable output 5 m
Lx = cable output x m

(f) EDGE DISTANCE *(see edge distance selection)*
H = 0,3 µs
J = 0,5 µs
A = 1 µs
B = 2 µs *(standard value)*
C = 4 µs

(g) CUSTOM VERSION

Order code – Magnetic tape

| MT20 | – | XXX (a) | – | XXX (b) | – | X (c) | – | /Sxxx (d) |

(a) LENGTH
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m
50 = 50,0 m
100 = 100,0 m

(b) ACCURACY CLASS
100 = ±85 µm/m
50 = ±35 µm/m (up to 30 m)
10 = ±8 µm/m (up to 10 m)

(c) COVER STRIP
0 = not supplied
1 = supplied

(d) CUSTOM VERSION

Specifications subject to changes without prior notice

LINEPULS

Linear encoder with integrated converter

lika

Series	SME11

- High performance encoder for linear motors
- Lika hi-flex sensor cable
- Status LED for clearance error
- Optional tape cleaning wipers
- Error output signal available on request

SME11

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

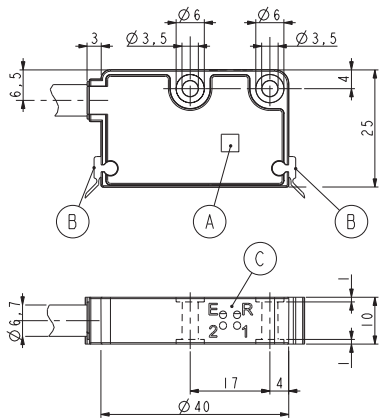| MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M8, 2,0 m or M12 8 pin inline plug
Gap between sensor/tape (without cover strip):	0,1 ÷ 0,5 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	0,01 / 0,005 / 0,002 / 0,0005 mm
Sensor accuracy:	±15 µm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB0 /AB0
Counting frequency:	acc. to edge distance setting
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	70 mA max.
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

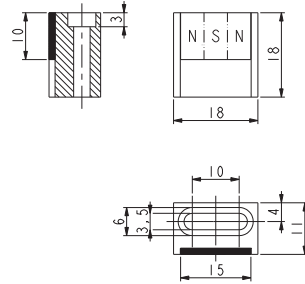| ACCESSORIES	
MT10:	Magnetic tape
LKM-1309/1:	Reference pole support
KIT LKM-1440:	Set of tape terminals (10 pcs)
KIT WIPERS:	Wipers for SMExx/SMSxx (10 pcs)
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 meters with M12 conn.

Edge distance selection

Order code	Edge distance (µsec)	Max. counting frequency (kHz)	Resolution (µm) vs. max. possible speed (m/s)				
			0,5	1	2	5	10
H	0,3	3333	1,17	2,33	4,67	11,67	11,67
J	0,5	2000	0,70	1,40	2,80	7,00	7,00
A	1	1000	0,35	0,70	1,40	3,50	3,50
B	2	500	0,17	0,33	0,67	1,67	1,67
C	4	250	0,09	0,18	0,35	0,88	0,88

A	Reference sensor "R"
B	Dust wipers
C	Diagnostic LEDS
	E: Gap/Speed error (red)
	R: Reference detection (green)
	1: Led 1
	2: Led 2

SME11

LKM-1309/1
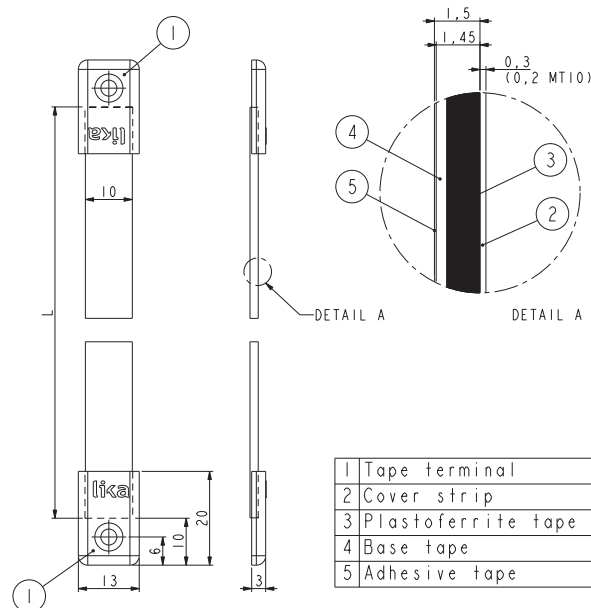
1	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

MT10

Order code – Sensor

| SME11 | – | XX (a) | – | X (b) | – | XX (c) | – | X (d) | – | XX (e) | – | X (f) | /Sxxx (g) |

(a) OUTPUT CIRCUITS
Y = Push-Pull (AB)
YC = Push-Pull (AB, /AB)
L = Line Driver (AB, /AB)

(b) POWER SUPPLY
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (Y and YC output circuit)

(c) RESOLUTION
10 = 0,01 mm (10 µm)
5 = 0,005 mm (5 µm)
2 = 0,002 mm (2 µm)
1 = 0,001 mm (1 µm)
05 = 0,0005 mm (0,5 µm)

(d) INDEX
N = without
I = every 1 mm
R = unique reference signal

(e) CONNECTIONS
L2 = cable output 2 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 inline plug
M2 = 2 m cable + M12 inline plug

(f) EDGE DISTANCE *(see edge distance selection)*
H = 0,3 µs
J = 0,5 µs
A = 1 µs
B = 2 µs *(standard value)*
C = 4 µs

(g) CUSTOM VERSION

Order code – Magnetic tape

| MT10 | – | XXX (a) | – | XXX (b) | – | X (c) | – | /Sxxx (d) |

(a) LENGTH
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m
50 = 50,0 m
100 = 100,0 m

(b) ACCURACY CLASS
100 = ±85 µm/m
50 = ±35 µm/m (up to 30 m)
10 = ±8 µm/m (up to 10 m)

(c) COVER STRIP
0 = not supplied
1 = supplied

(d) CUSTOM VERSION

LINEPULS
Linear encoder with integrated converter

lika

Series	SME12

- 2 integrated limit switch sensors
- High performance encoder for linear motors
- Lika hi-flex sensor cable
- Status LED for clearance error
- Reference and limit switch marks to be installed along the magnetic tape
- Resolution up to 0,5 µm
- Optional tape cleaning wipers

SME12

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

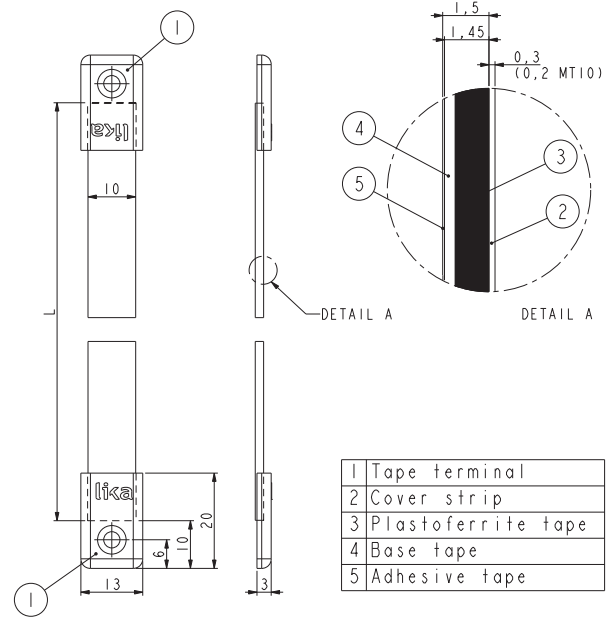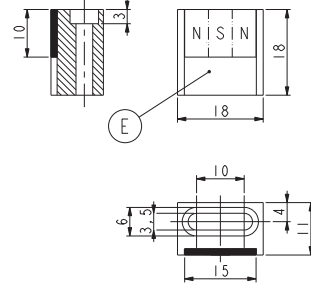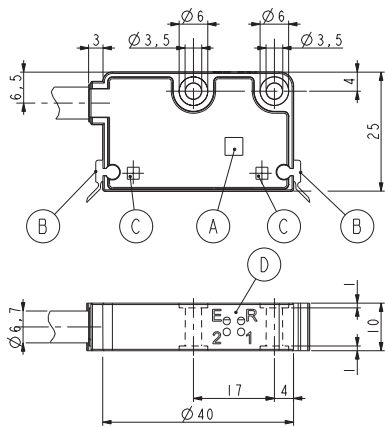| MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M10, 2,0 m
Gap between sensor/tape (without cover strip):	0,1 ÷ 0,5 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	0,01 / 0,005 / 0,002 / 0,001 / 0,0005 mm
Sensor accuracy:	±15 µm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB0 /AB0 + LS1, LS2 (o.c. 50 mA)
Counting frequency:	acc. to edge distance setting
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	80 mA max.
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MT10:	Magnetic tape
LKM-1309/1:	Reference pole support
LKM-1309/LS	Limit switch support
KIT LKM-1440:	Set of tape terminals (10 pcs)
KIT WIPERS:	Wipers for SMExx/SMSxx (10 pcs)

Edge distance selection

Order code	Edge distance (µsec)	Max. counting frequency (kHz)	Resolution (µm) vs. max. possible speed (m/s)				
			0,5	1	2	5	10
H	0,3	3333	1,17	2,33	4,67	11,67	11,67
J	0,5	2000	0,70	1,40	2,80	7,00	7,00
A	1	1000	0,35	0,70	1,40	3,50	3,50
B	2	500	0,17	0,33	0,67	1,67	1,67
C	4	250	0,09	0,18	0,35	0,88	0,88

A	Reference sensor "R"
B	Dust wipers
C	Limit switch sensors
D	Diagnostic LEDS
	E: Gap/Speed error (red)
	R: Reference detection (green)
	I: Limit switch (green)
	2: Limit switch (green)

E	Tape position on LKM1309/LS

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

SME12   **LKM-1309/1 • LKM-1309/LS**   **MT10**

Order code – Sensor

SME12	–	XX ⓐ	–	X ⓑ	–	XX ⓒ	–	X ⓓ	–	XX ⓔ	–	X ⓕ	/Sxxx ⓖ

ⓐ OUTPUT CIRCUITS
Y = Push-Pull (AB)
YC = Push-Pull (AB, /AB)
L = Line Driver (AB, /AB)

ⓑ POWER SUPPLY
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (Y and YC output circuit)

ⓒ RESOLUTION
10 = 0,01 mm (10 μm)
5 = 0,005 mm (5 μm)
2 = 0,002 mm (2 μm)
1 = 0,001 mm (1 μm)
05 = 0,0005 mm (0,5 μm)

ⓓ INDEX
R = unique reference signal

ⓔ CONNECTIONS
L2 = cable output 2 m
L5 = cable output 5 m
Lx = cable output x m

ⓕ EDGE DISTANCE *(see edge distance selection)*
H = 0,3 μs
J = 0,5 μs
A = 1 μs
B = 2 μs *(standard value)*
C = 4 μs

ⓖ CUSTOM VERSION

Order code – Magnetic tape

MT10	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	–	/Sxxx ⓓ

ⓐ LENGTH
1 = 1,0 m   **20 =** 20,0 m
2 = 2,0 m   **30 =** 30,0 m
4 = 4,0 m   **50 =** 50,0 m
10 = 10,0 m   **100 =** 100,0 m

ⓑ ACCURACY CLASS
100 = ±85 μm/m
50 = ±35 μm/m (up to 30 m)
10 = ±8 μm/m (up to 10 m)

ⓒ COVER STRIP
0 = not supplied
1 = supplied

ⓓ CUSTOM VERSION

LINEPULS
Linear encoder with SIN/COS output

lika

Series	SMS11 • SMS21

- Magnetic encoder for linear and torque motors
- Sine-Cosine 1Vpp real-time output
- Unaffected by dust, debris or liquids, IP67
- Status LED for clearance error and A, B signals
- Optional tape cleaning wipers
- Lika Hi-flex cable
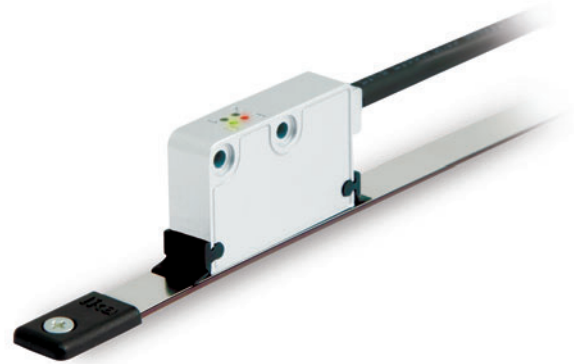
SMS11 • SMS21

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M8, 2,0 m or M12 8 pin inline plug
Gap between sensor/tape (without cover strip):	SMS11: 0,1 ÷ 0,5 mm
	SMS21: 0,1 ÷ 1,0 mm
Travel speed (mechanical):	16 m/s max.
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	SMS11: 1000 µm
	SMS21: 2000 µm
Sensor accuracy:	max. 1% of period length
Repeat accuracy:	±1 increment
Output circuits:	1Vpp
Output signals:	sine/cosine, AB0 /AB0
Counting frequency:	8 kHz max.
Power supply:	+5Vdc ±5%
Power consumption:	70 mA
Protection:	against short-circuit
EMC:	acc. to EN 61000-6-2 level 3

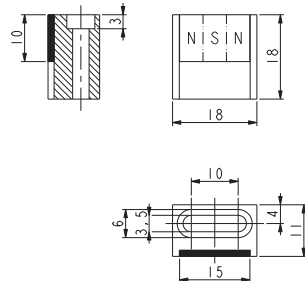| ACCESSORIES	
MT10:	Magnetic tape for SMS11
MT20:	Magnetic tape for SMS21
LKM-1309/1:	Reference pole support for SMS11
LKM-1309/2:	Reference pole support for SMS21
KIT LKM-1440:	Set of tape terminals (10 pcs)
KIT WIPERS:	Wipers for SMExx/SMSxx (10 pcs)
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 meters with M12 conn.
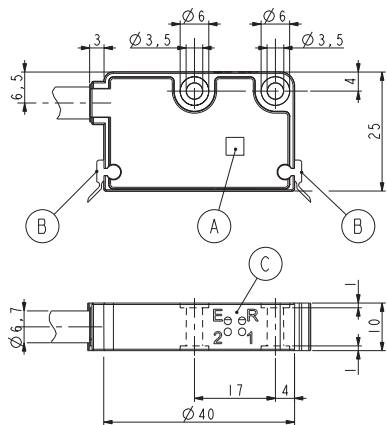
SMS11 • SMS21

A	Reference sensor "R"
B	Dust wipers
C	Diagnostic LEDS

E: Gap/Speed error (red)
R: Reference detection (green)
1: Output A (green)
2: Output B (green)

LKM-1309/1 • LKM-1309/2

MT10

1	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape
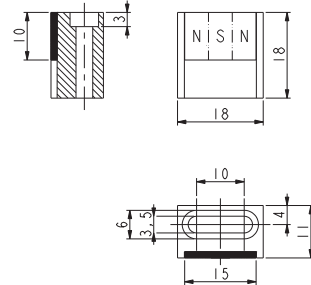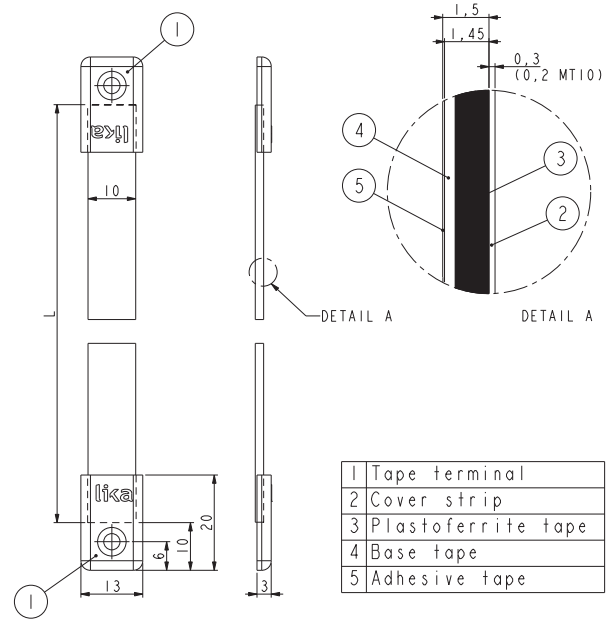
Order code – Sensor

| SMS11 SMS21 | – | X (a) | – | X (b) | – | X (c) | – | XXX (d) | /Sxxx (e) |

(a) OUTPUT CIRCUIT
V = 1 Vpp sine/cosine

(b) POWER SUPPLY
1 = +5Vdc ±5%

(c) INDEX
N = without
I = every 1 or 2 mm (RS422 level)
R = unique reference signal (RS422 level)
K = every 1 or 2 mm (1Vpp level)
T = unique reference signal (1Vpp level)

(d) CONNECTIONS
L2 = cable output 2 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 inline plug
M2 = 2 m cable + M12 inline plug

(e) CUSTOM VERSION

Order code – Magnetic tape

| MT10 MT20 | – | XXX (a) | – | XXX (b) | – | X (c) | – | /Sxxx (d) |

(a) LENGTH
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m
50 = 50,0 m
100 = 100,0 m

(b) ACCURACY CLASS
100 = ±85 µm/m
50 = ±35 µm/m (up to 30 m)
10 = ±8 µm/m (up to 10 m)

(c) COVER STRIP
0 = not supplied
1 = supplied

(d) CUSTOM VERSION

Series	SMS12

- 2 integrated limit switch sensors
- Magnetic encoder for linear motors
- Sine-cosine 1Vpp real-time output
- Unaffected by dust, debris or liquids, IP67
- Status LED for clearance error and A, B signals
- Reference and limit switch marks to be installed along the magnetic tape
- Optional tape cleaning wipers

SMS12

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

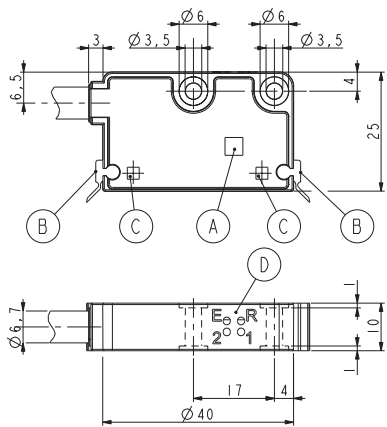| MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M10, 2,0 m
Gap between sensor/tape (without cover strip):	0,1 ÷ 0,5 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	1000 µm
Sensor accuracy:	max. 1% of period length
Repeat accuracy:	±1 increment
Output circuits:	1Vpp
Output signals:	sine/cosine, AB0 /AB0 + LS1, LS2 (o.c. 50 mA)
Counting frequency:	8 kHz
Power supply:	+5Vdc ±5%
Power consumption:	80 mA
Protection:	against short-circuit
EMC:	acc. to EN 61000-6-2 level 3

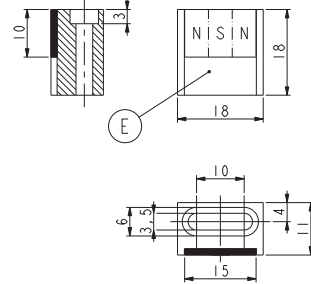| ACCESSORIES	
MT10:	Magnetic tape
LKM-1309/1:	Reference pole support
LKM-1309/LS	Limit switch support
KIT LKM-1440:	Set of tape terminals (10 pcs)
KIT WIPERS:	Wipers for SMExx/SMSxx (10 pcs)

A	Reference sensor "R"
B	Dust wipers
C	Limit switch sensors
D	Diagnostic LEDS
	E: Gap/Speed error (red)
	R: Reference detection (green)
	I: Limit switch (green)
	2: Limit switch (green)

E	Tape position on LKM1309/LS

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

SMS12   **LKM-1309/1 • LKM-1309/LS**   **MT10**

Order code – Sensor

SMS12	–	X ⓐ	–	X ⓑ	–	X ⓒ	–	XX ⓓ	/Sxxx ⓔ

ⓐ OUTPUT CIRCUITS	ⓒ INDEX	ⓓ CONNECTIONS
V = sin/cos 1Vpp	R = unique reference signal (RS422 level)	L2 = cable output 2 m
	T = unique reference signal (1Vpp level)	L5 = cable output 5 m
ⓑ POWER SUPPLY		Lx = cable output x m
1 = +5Vdc ±5%		
		ⓔ CUSTOM VERSION

Order code – Magnetic tape

MT10	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	–	/Sxxx ⓓ

ⓐ LENGTH		ⓑ ACCURACY CLASS	ⓒ COVER STRIP
1 = 1,0 m	20 = 20,0 m	100 = ±85 µm/m	0 = not supplied
2 = 2,0 m	30 = 30,0 m	50 = ±35 µm/m (up to 30 m)	1 = supplied
4 = 4,0 m	50 = 50,0 m	10 = ±8 µm/m (up to 10 m)	
10 = 10,0 m	100 = 100,0 m		ⓓ CUSTOM VERSION

Specifications subject to changes without prior notice

LINEPULS
Linear encoders with external converter

lika

IP67   CE   RoHS

- Compact encoders with in-line external interpolator
- IP67 protection
- Resolution up to 5 μm
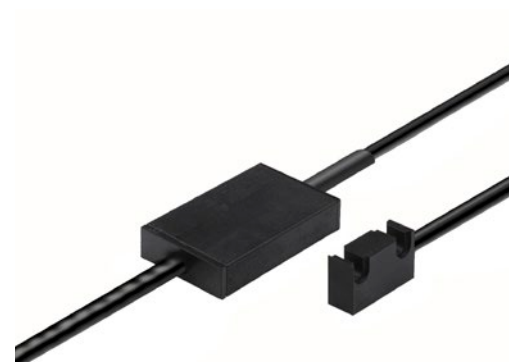
SMB2 • SMB5

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

| MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M8, 2,0 m
Gap between sensor/tape (without cover strip):	SMB2: 0,1 ÷ 1,0 mm
	SMB5: 0,1 ÷ 2,0 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	0,01 / 0,005 mm
Sensor accuracy:	±15 μm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB0 /AB0
Counting frequency:	acc. to edge distance setting
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	70 mA
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MT20:	Magnetic tape for SMB2
MT50:	Magnetic tape for SMB5
KIT PS1-1,0:	Protection profile (10 pcs)
KIT LKM-1440:	Set of tape terminals (10 pcs)

Edge distance selection

Order code	Edge distance (μsec)	Max. counting frequency (kHz)	Resolution (μm) vs. max. possible speed (m/s)	
			5	10
H	0,3	3.333	11,67	23,34
J	0,5	2.000	7,00	14,00
A	1	1.000	3,50	7,00
B	2	500	1,67	3,34
C	4	250	0,88	1,75

SMB2 • SMB5   MT20 • MT50

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

Order code – Sensor

SMB2 SMB5	–	X ⓐ	–	XX ⓑ	–	X ⓒ	–	XX ⓓ	–	XX ⓔ	–	XX ⓕ	–	X ⓖ	/Sxxx ⓔ

ⓐ SENSOR
R = rectangular
C = circular

ⓑ OUTPUT CIRCUITS
Y = Push-Pull (AB)
YC = Push-Pull (AB, /AB)
L = Line Driver (AB, /AB)

ⓒ POWER SUPPLY
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (Y and YC output circuit)

ⓓ RESOLUTION
10 = 0,01 mm
5 = 0,005 mm (only SMB5)
(others on request)

ⓔ CONNECTIONS
0,5 = cable length between sensor and converter 0,5 m
(others on request)

ⓕ CONNECTIONS
L2 = cable output 2 m
L5 = cable output 5 m
Lx = cable output x m

ⓖ EDGE DISTANCE *(see edge distance selection)*
H = 0,3 µs
J = 0,5 µs
A = 1 µs
B = 2 µs *(standard value)*
C = 4 µs

ⓗ CUSTOM VERSION

Order code – Magnetic tape

MT20 MT50	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	–	/Sxxx ⓓ

ⓐ LENGTH
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m
50 = 50,0 m
100 = 100,0 m

ⓑ ACCURACY CLASS
100 = ±85 µm/m
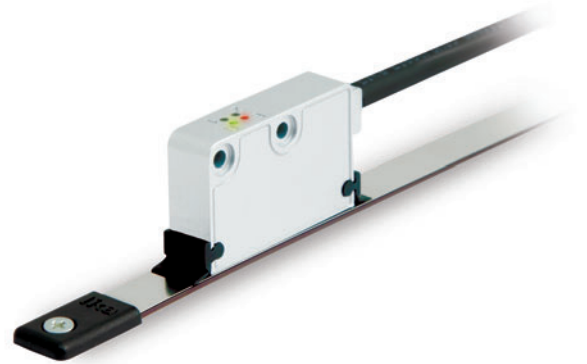50 = ±35 µm/m (up to 30 m)
10 = ±8 µm/m (up to 10 m)

ⓒ COVER STRIP
0 = not supplied
1 = supplied

ⓓ CUSTOM VERSION

LINEPULS

Linear encoder with resolution selector

lika

Series	SMI2 • SMI5

- Resolution selector from 50 to 2 µm
- Compact reading head with IP68 protection
- Power-on and error LEDs
- Automatic output signal performance control
- Ideal for linear motors and pick & place axes

SMI2 • SMI5

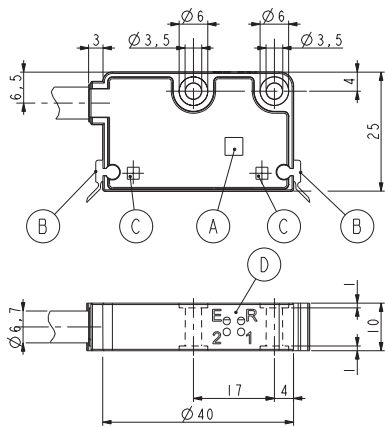| ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP68 (sensor head), IP65 (connector)
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	sensor: die cast aluminium, UNI EN AC-46100 connector: Macromelt OM646-EN
Electrical connections:	Lika Hi-flex cable M6 + DSub 9 pin inline plug
Gap between sensor/tape (without cover strip):	SMI2: 0,1 ÷ 1,0 mm SMI5: 0,1 ÷ 2,0 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	SMI2: 0,002 ÷ 0,02 mm SMI5: 0,005 ÷ 0,05 mm
Sensor accuracy:	±1 increment (after auto-calibration)
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB0 /AB0
Counting frequency:	500 kHz max. (others on request)
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	80 mA
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MT50:	Magnetic tape for SMI5
MT20:	Magnetic tape for SMI2
KIT LKM-1440:	Set of tape terminals (10 pcs)
EDE9P:	9 pin DSub mating connector

Edge distance SMI5

Order code	Edge distance (µsec)	Max. counting frequency (kHz)	Resolution (µm) vs. max. possible speed (m/s)							
			5	6,25	10	12,5	20	25	40	50
B	2	500	2,15	2,69	4,30	5,38	8,60	10,75	17,20	21,50

Edge distance SMI2

Order code	Edge distance (µsec)	Max. counting frequency (kHz)	Resolution (µm) vs. max. possible speed (m/s)							
			2	2,5	4	5	8	10	16	20
B	2	500	0,86	1,08	1,72	2,15	3,44	4,30	6,88	8,60

SMI2 • SMI5

MT20 • MT50

1	Tape terminal							
2	Cover strip							
3	Plastoferrite tape							
4	Carrier with adhesive strip							
5	Adhesive tape							
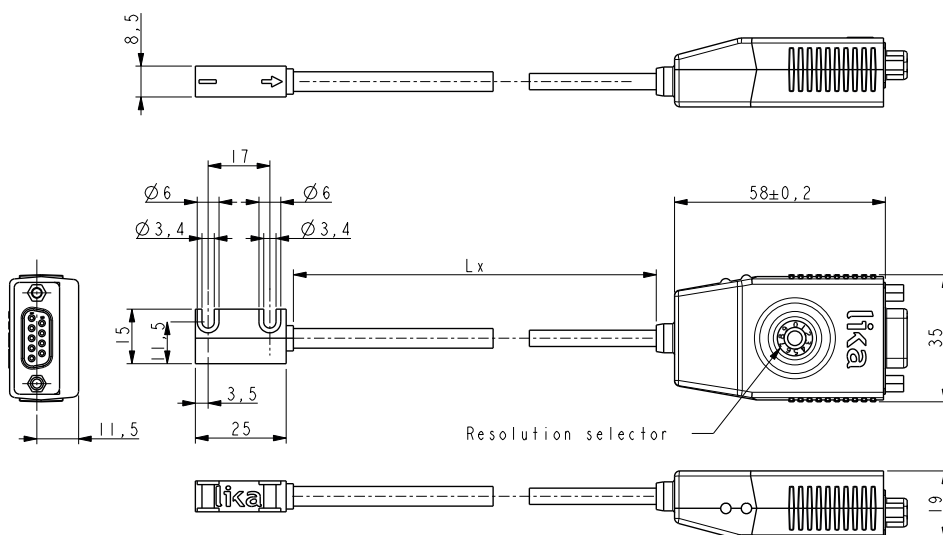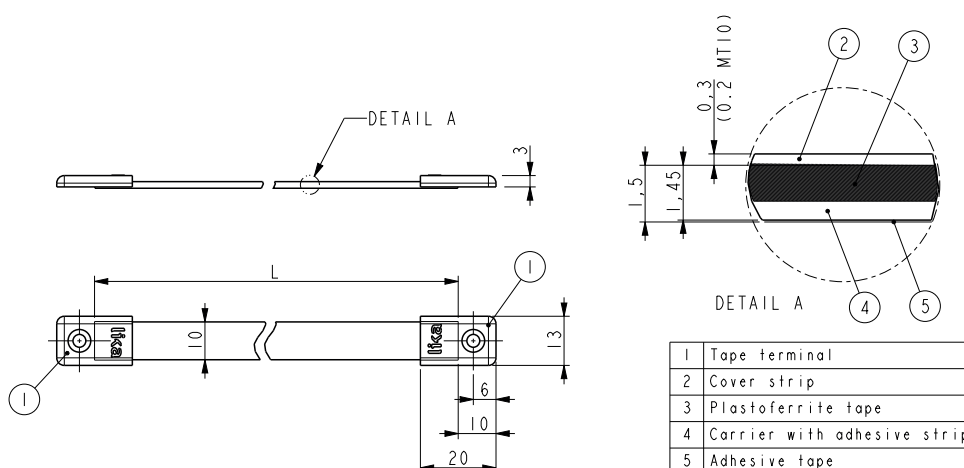
Order code – Sensor

SMI2 SMI5	–	R ⓐ	–	XX–X ⓑ	–	XX ⓒ	–	XX ⓓ

ⓐ **R =** rectangular sensor

ⓑ **OUTPUT CIRCUITS**

YC–2 = Push-Pull, 10 ÷ 30Vdc (AB0 /AB0)
L–1 = Line Driver (RS422), +5Vdc ±5% (AB0 /AB0)

ⓒ **CABLE LENGTH**

0.5 = 0,5 m
1 = 1 m
2 = 2 m
3 = 3 m
5 = 5 m

ⓓ **EDGE DISTANCE**

B = 2 μs (500 kHz) - standard

on request:
K = 0,125 μs (8 MHz)
H = 0,25 μs (4 MHz)
J = 0,5 μs (2 MHz)
A = 1 μs (1 MHz)

Order code – Magnetic tape

MT20 MT50	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	–	/Sxxx ⓓ

ⓐ **LENGTH**

1 = 1,0 m	**20 =** 20,0 m
2 = 2,0 m	**30 =** 30,0 m
4 = 4,0 m	**50 =** 50,0 m
10 = 10,0 m	**100 =** 100,0 m

ⓑ **ACCURACY CLASS**

100 = ±85 μm/m
50 = ±35 μm/m (up to 30 m)
10 = ±8 μm/m (up to 10 m)

ⓒ **COVER STRIP**

0 = not supplied
1 = supplied

ⓓ **CUSTOM VERSION**

LINEPULS

Miniature linear encoder with SIN/COS output

lika

Series	SMSR • SMSR2 • SMSR5

- Miniature encoder for linear motor and pick & place applications
- Real-time 1Vpp sine/cosine
- High performance output signals
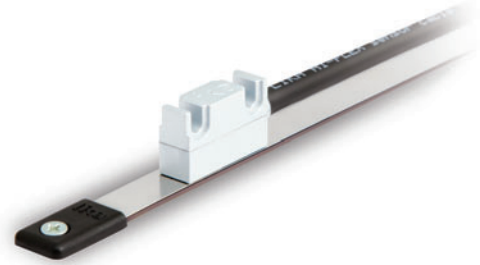
SMSR • SMSR2 • SMSR5

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP68
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

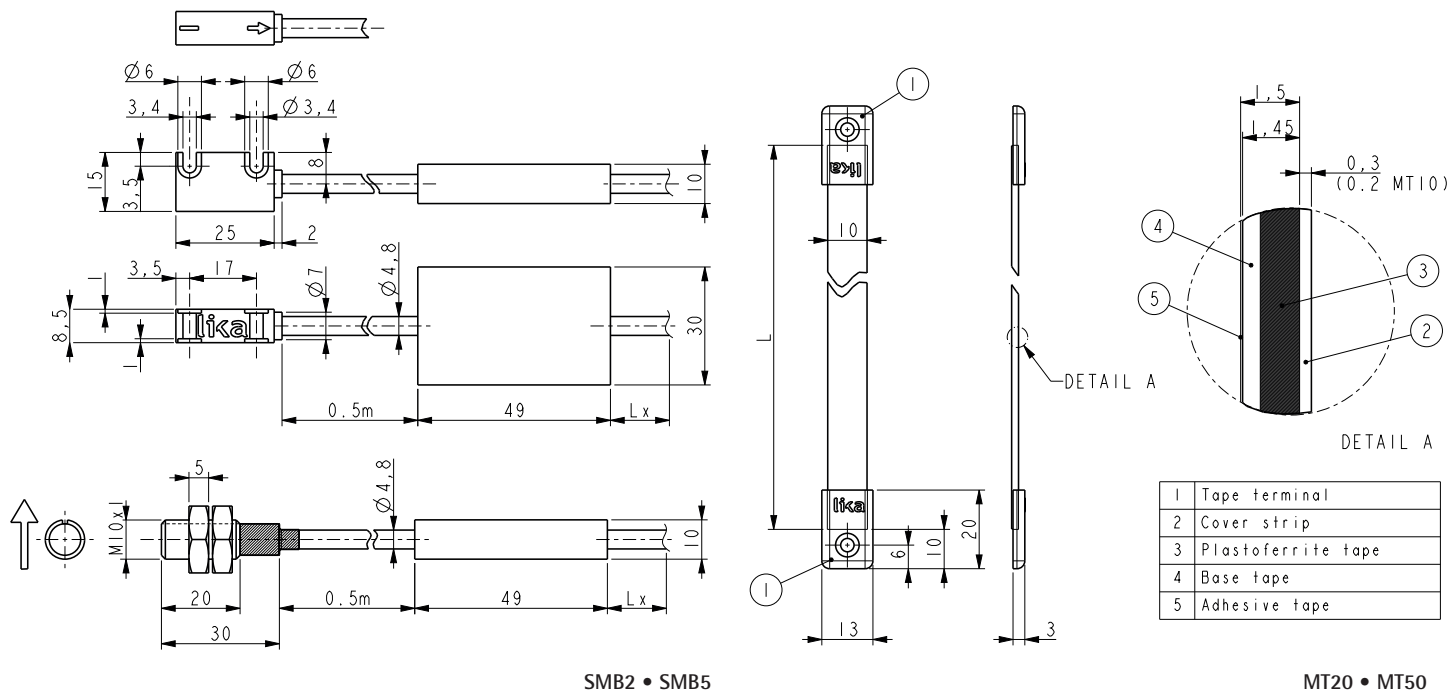| MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M8 2,0 m or M12 8 pin inline plug
Gap between sensor/tape (without cover strip):	SMSR: 0,1 ÷ 0,5 mm
	SMSR2: 0,1 ÷ 1,0 mm
	SMSR5: 0,1 ÷ 2,0 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	SMSR: 1000 µm
	SMSR2: 2000 µm
	SMSR5: 5000 µm
Sensor accuracy:	max. 1% of period length
Repeat accuracy:	±1 increment
Output circuits:	1Vpp
Output signals:	sine/cosine, AB0 /AB0
Counting frequency:	8 kHz max.
Power supply:	+5Vdc ±5%
Power consumption:	25 mA typ., 50 mA max.
Protection:	against short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MT10:	Magnetic tape for SMSR
MT20:	Magnetic tape for SMSR2
MT50:	Magnetic tape for SMSR5
KIT LKM-1440:	Set of tape terminals (10 pcs)
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 meters with M12 conn.

SMSR
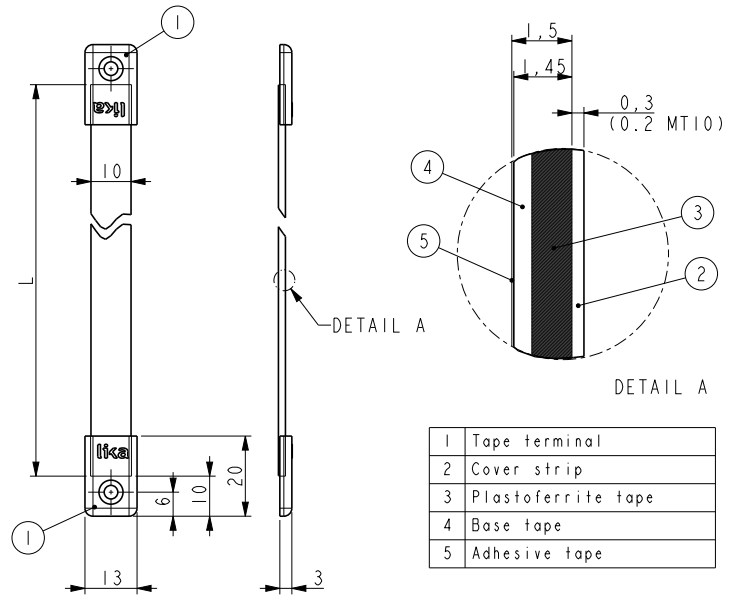
MT10

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

DETAIL A

Order code – Sensor

SMSR SMSR2 SMSR5	–	X ⓐ	–	X ⓑ	–	X ⓒ	–	XXX ⓓ	/Sxxx ⓔ

ⓐ OUTPUT CIRCUIT
V = 1 Vpp sine/cosine

ⓑ POWER SUPPLY
1 = +5Vdc ±5%

ⓒ INDEX
N = without
K = every 1, 2 or 5 mm (1Vpp level)

ⓓ CONNECTIONS
L2 = cable output 2 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 inline plug
M2 = 2 m cable + M12 inline plug

ⓔ CUSTOM VERSION

Order code – Magnetic tape

MT10 MT20 MT50	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	–	/Sxxx ⓓ

ⓐ LENGTH
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m
50 = 50,0 m
100 = 100,0 m

ⓑ ACCURACY CLASS
100 = ±85 µm/m
50 = ±35 µm/m (up to 30 m)
10 = ±8 µm/m (up to 10 m)

ⓒ COVER STRIP
0 = not supplied
1 = supplied

ⓓ CUSTOM VERSION

Specifications subject to changes without prior notice

LINEPULS
High–speed gear sensor

lika

- High speed gear and tooth sensor
- Position & speed feedback
- Compact design with IP68 protection
- Easy & precise alignment thanks to keyway
- Available for modules 0,3 and 0,5 & 1, 2, 3 mm tooth structures

SMG

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP68
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M8 0,3 m or M12 8 pin inline plug
Gap between sensor/target:	SMG03: 0,19 mm max.
	SMG05: 0,31 mm max.
Travel speed (mechanical):	max 16 m/s
Measurement length:	Target length -1 mm each side

ELECTRICAL SPECIFICATIONS	
Interpolation factor:	up to 100 (only digital output)
Repeat accuracy:	±1 increment
Output circuits:	1Vpp sine/cosine, Line Driver, Push-Pull
Output signals:	AB0 /AB0
Counting frequency:	2000 kHz max.
Power supply:	+5Vdc ±5%
Power consumption:	25 mA typ., 50 mA max.
Protection:	against short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 meters with M12 conn.

Edge distance SMG05

Edge distance (μsec)	Max. counting frequency (kHz)	Resolution (μm) vs. max. possible speed (m/s)				
		100	32	16	8	1
0,5	2.000	5,00	16,00	32,00	64,00	500,00

Edge distance SMG03

Edge distance (μsec)	Max. counting frequency (kHz)	Resolution (μm) vs. max. possible speed (m/s)				
		100	32	16	8	1
0,5	2.000	3,00	9,00	18,00	36,00	300,00

SMG

Toothed-structure with module/pitch M0.3, M0.5, 1, 2, 3
(contact Lika for further information)

Order code

SMG03 SMG05	–	X ⓐ	–	X ⓑ	–	XXX ⓒ	–	XX ⓓ	–	XXX ⓔ	/Sxxx ⓕ

ⓐ **OUTPUT CIRCUIT**
Y = Push-Pull (AB)
L = Line Driver (AB /AB)
V = 1 Vpp sine/cosine (*)

ⓑ **POWER SUPPLY**
1 = +5Vdc ±5%

ⓒ **INTERPOLATION**
1 = 1 pulse/tooth
8 = 8 pulse/tooth
16 = 16 pulse/tooth
32 = 32 pulse/tooth
100 = 100 pulse/tooth

(*)*with output V only interpolation "1"*

ⓓ **INDEX**
N = without
R = with reference type R
Z = with reference type Z

ⓔ **CONNECTIONS**
0,3 = cable output 0,3 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 8 pin inline connector

ⓕ **CUSTOM VERSION**

Series	SMX2 • SMX5

- Heavy-duty magnetic sensor
- Quadrature output, AB signals
- Universal output circuit (Push-Pull & Line Driver)
- M10 steel case
- Gap clearance up to 3.0 mm
- Position & speed measurement
- Suitable for linear or rotary applications

SMX2 • SMX5

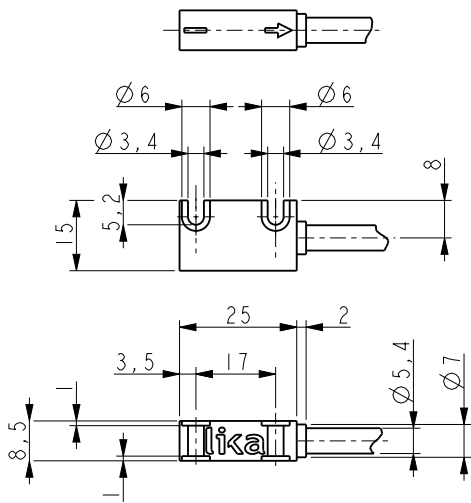| ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	stainless steel
Electrical connections:	Lika Hi-flex cable M6, 1,0 m
Gap between sensor/tape (without cover strip):	SMX2: 0,1 ÷ 2,0 mm
	SMX5: 0,1 ÷ 3,0 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	SMX2: 1 mm
	SMX5: 2.5 mm
Repeat accuracy:	±1 increment
Output circuits:	Universal output circuit (PP/LD)
Output signals:	AB /AB
Counting frequency:	30 kHz
Power supply:	+5Vdc +30Vdc
Power consumption:	50 mA max.
Protection:	against inversion of polarity and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MT50:	Magnetic tape for SMX5
MT20:	Magnetic tape for SMX2
MRI:	Magnetic rings
KIT LKM-1440:	Set of tape terminals (10 pcs)

CODE	COLOR
SMX2	BLACK
SMX5	RED

SMX2 • SMX5

DETAIL A

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Carrier with adhesive strip
5	Adhesive tape
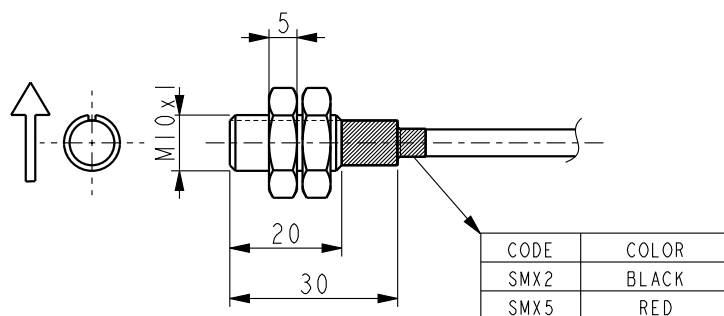
MT50 • MT20

Order code – Sensor

SMX2 SMX5	–	C ⓐ	–	X ⓑ	–	X ⓒ	–	XXX ⓓ	/Sxxx ⓔ

ⓐ **C =** circular sensor

ⓑ **OUTPUT CIRCUITS**
H = PP/LD universal circuit

ⓒ **POWER SUPPLY**
4 = +5Vdc ±30Vdc

ⓓ **CONNECTIONS**
L2 = cable output 2 m
L5 = cable output 5 m
Lx = cable output x m

ⓔ **CUSTOM VERSION**

Order code – Magnetic tape

MT20 MT50	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	–	/Sxxx ⓓ

ⓐ **LENGTH**
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m
50 = 50,0 m
100 = 100,0 m

ⓑ **ACCURACY CLASS**
100 = ±85 µm/m

ⓒ **COVER STRIP**
0 = not supplied
1 = supplied

ⓓ **CUSTOM VERSION**

LINEPULS
Linear encoder with integrated converter

lika

Series	SMK

- Robust linear encoder for position measurement
- Large mounting tolerance with gap clearance up to 4.0 mm
- IP67 protection
- Resolution up to 0.01 mm
- Special resolutions possible

SMK

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M8 2,0 m or M12 8 pin inline plug
Gap between sensor/tape (without cover strip):	0,1 ÷ 4,0 mm
Travel speed (mechanical):	max 2,5 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	1 / 0,5 / 0,1 / 0,05 / 0,025 / 0,01 mm
Sensor accuracy:	±25 µm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB0 /AB0
Counting frequency:	20 kHz max.
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	70 mA max.
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MT50:	Magnetic tape
KIT PS1-1,0:	Protection profile (10 pcs)
KIT LKM-1440:	Set of tape terminals (10 pcs)
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 meters with M12 conn.

SMK

MT50

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape
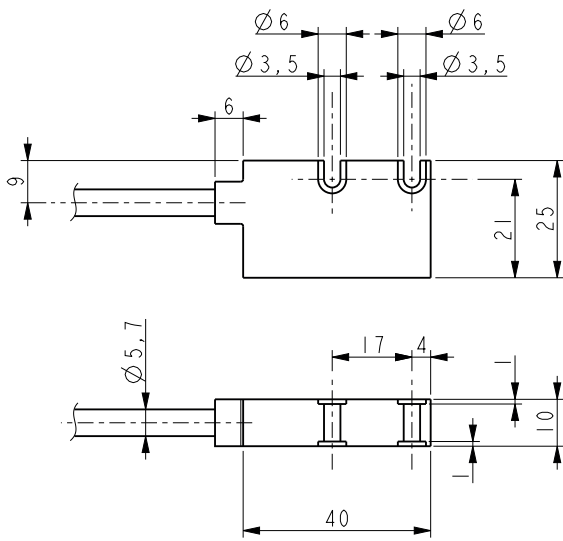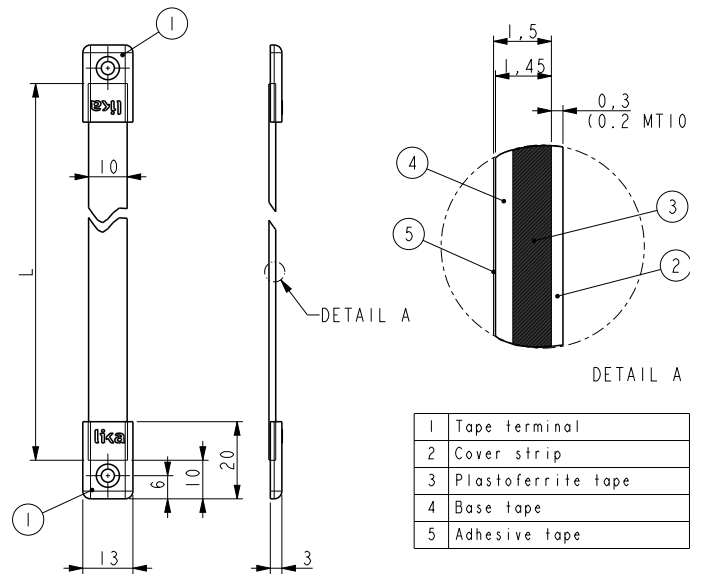
Order code – Sensor

SMK	–	XX ⓐ	–	X ⓑ	–	XXXX ⓒ	–	X ⓓ	–	XX ⓔ	–	/Sxxx ⓕ

ⓐ OUTPUT CIRCUITS
Y = Push-Pull (AB)
YC = Push-Pull (AB, /AB)
L = Line Driver (AB, /AB)

ⓑ POWER SUPPLY
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (Y and YC output circuit)

ⓒ RESOLUTION
1000 = 1 mm
500 = 0,5 mm
100 = 0,1 mm
50 = 0,05 mm
25 = 0,025 mm
10 = 0,01 mm

ⓓ INDEX
N = without
I = every 5 mm

ⓔ CONNECTIONS
L2 = cable output 2 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 inline plug
M2 = 2 m cable + M12 inline plug

ⓕ CUSTOM VERSION

Order code – Magnetic tape

MT50	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	–	/Sxxx ⓓ

ⓐ LENGTH
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m
50 = 50,0 m
100 = 100,0 m

ⓑ ACCURACY CLASS
100 = ±85 µm/m

ⓒ COVER STRIP
0 = not supplied
1 = supplied

ⓓ CUSTOM VERSION

LINEPULS
Linear encoder with integrated converter

lika

Series	SML • SMH

- Robust linear encoder for position measurement
- Gap clearance up to 2.0 mm
- IP67 protection
- Resolution up to 0.1 mm
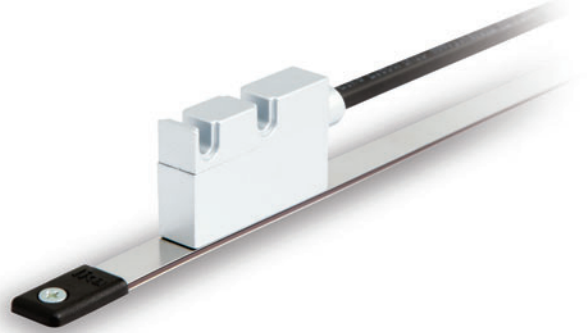
SML • SMH

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

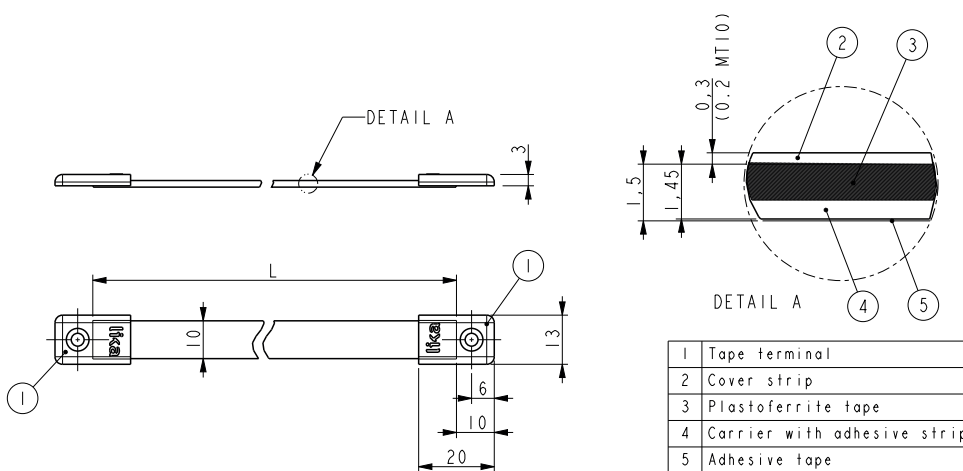| MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M8 2,0 m or M12 8 pin inline plug
Gap between sensor/tape (without cover strip):	0,1 ÷ 2,0 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	0,1 / 0,25 / 0,5 / 1 mm
Sensor accuracy:	±25 µm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Counting frequency:	500 kHz max.
Output signals:	AB0 /AB0
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	70 mA max.
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MT32:	Magnetic tape for SML
MT40:	Magnetic tape for SMH
KIT PS1-1,0:	Protection profile (10 pcs)
KIT LKM-1440:	Set of tape terminals (10 pcs)
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 meters with M12 conn.
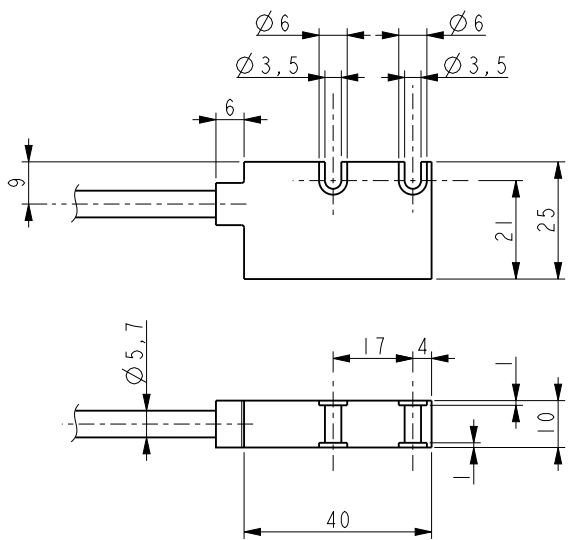
SML • SMH
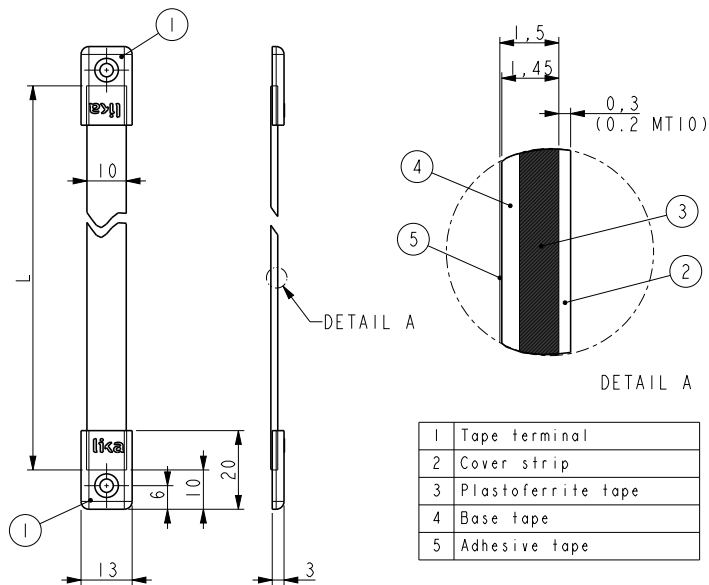
MT32 • MT40

1	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

Order code – Sensor

SML SMH	–	XX ⓐ	–	X ⓑ	–	XXXX ⓒ	–	XXX ⓓ	–	XX ⓔ	/Sxxx ⓕ

ⓐ OUTPUT CIRCUITS
Y = Push-Pull (AB)
YC = Push-Pull (AB, /AB)
L = Line Driver (AB, /AB)

ⓑ POWER SUPPLY
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (Y and YC output circuit)

ⓒ RESOLUTION
1000 = 1 mm (SMH)
500 = 0,5 mm (SMH)
250 = 0,25 mm (SMH)
100 = 0,1 mm (SML, SMH)

ⓓ INDEX
N = without
I = every 3,2 mm (SML)
      every 4,0 mm (SMH)

ⓔ CONNECTIONS
L2 = cable output 2 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 inline plug
M2 = 2 m cable + M12 inline plug

ⓕ CUSTOM VERSION

Order code – Magnetic tape

MT32 MT40	–	XX ⓐ	–	XXX ⓑ	–	X ⓒ	/Sxxx ⓓ

ⓐ LENGTH
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m

ⓑ ACCURACY CLASS
100 = ±85 µm/m

ⓒ COVER STRIP
0 = not supplied
1 = supplied

ⓓ CUSTOM VERSION

Specifications subject to changes without prior notice

LINEPULS
Guided incremental linear encoder

lika

Series	**SMIG**

- Guided incremental encoder
- No mechanical alignment necessary
- Easy installation
- One side fixing of profile
- Unaffected by dust, debris or liquids
- Resolution up to 5 µm

SMIG • MTIG

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP65
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)
Option:	Protection IP67 (sealed circuits)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Material:	Sensor: Nylon 6FC 30%, Profile: aluminium
Electrical connections:	Lika Hi-flex cable M8 2,0 m or M12 8 pin inline plug
Travel speed (mechanical):	0,5 m/s typ., 1 m/s max.
Measurement length:	Profile length -80 mm

ELECTRICAL SPECIFICATIONS	
Resolution:	0,05 / 0,025 / 0,01 / 0,005 mm
System accuracy (SMIG + MTIG):	±50 µm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB0 /AB0
Counting frequency:	500 kHz
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	70 mA max.
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MTIG:	Magnetic profile
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 meters with M12 conn.
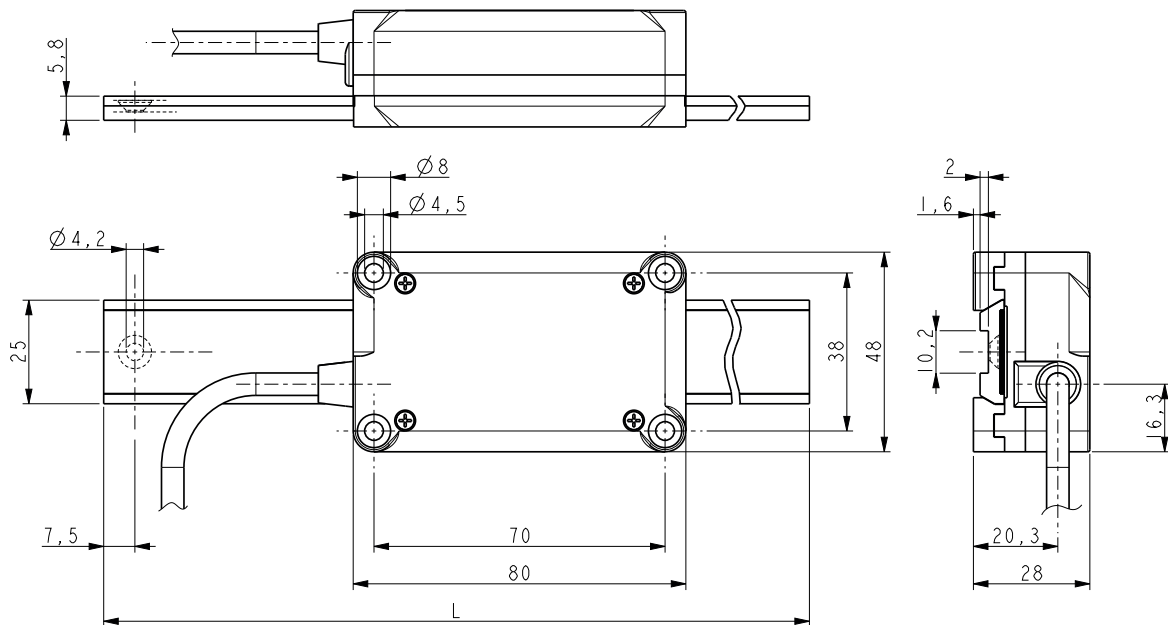
SMIG • MTIG

Order code – Sensor

SMIG	–	XX ⓐ	–	X ⓑ	–	XX ⓒ	–	X ⓓ	–	X ⓔ	–	XXX ⓕ	/Sxxx ⓖ

ⓐ OUTPUT CIRCUITS
YC = Push-Pull (ABI, /ABI)
L = Line Driver (ABI, /ABI)

ⓑ POWER SUPPLY
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (YC output circuit)

ⓒ RESOLUTION
50 = 0,05 mm
25 = 0,025 mm
10 = 0,01 mm
5 = 0,005 mm

ⓓ INDEX
N = without
I = every 5 mm

ⓔ PROTECTION
– = IP65 (standard)
J = IP67 (with sealed circuit)

ⓕ CONNECTIONS
L2 = cable output 2 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 inline plug
M2 = 2 m cable + M12 inline plug

ⓖ CUSTOM VERSION

Order code – Magnetic profile

MTIG	–	XXX ⓐ	–	XX ⓑ	–	X ⓒ	/Sxxx ⓓ

ⓐ PROFILE LENGTH
195 = 195 mm (ML = 105 mm)
220 = 220 mm (ML = 140 mm)
240 = 240 mm (ML = 160 mm)
300 = 300 mm (ML = 220 mm)
370 = 370 mm (ML = 290 mm)
650 = 650 mm (ML = 570 mm)

ⓑ ACCURACY CLASS
50 = ± 50μm (SMIG+MTIG)

ⓒ COVER STRIP
1 = supplied

ⓓ CUSTOM VERSION

LINEPULS
Linear encoder with integrated converter

lika

Series	SMP

- Linear encoder with lateral tape detection
- Space saving installation on linear guides
- Resolution up to 0,0125 mm
- Lika hi-flex sensor cable
- Easy installation and alignment

SMP

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C ÷ +85°C (-13°F +185°F)
Storage temperature range:	-40°C ÷ +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	die cast aluminium, UNI EN AC-46100
Electrical connections:	Lika Hi-flex cable M8 2,0 m or M12 8 pin inline plug
Gap between sensor/tape (without cover strip):	0,1 ÷ 2,0 mm
Travel speed (mechanical):	max 16 m/s
Measurement length:	Tape length -5 mm each side

ELECTRICAL SPECIFICATIONS	
Resolution:	0,25 / 0,125 / 0,0625 / 0,05 / 0,025 / 0,0125 mm
Sensor accuracy:	±15 µm max.
Repeat accuracy:	±1 increment
Output circuits:	Line Driver, Push-Pull
Output signals:	AB /AB
Counting frequency:	1000 kHz max.
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	70 mA max.
Protection:	against inversion of polarity (except 5Vdc version) and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MT50:	Magnetic tape
KIT LKM-1440:	Set of tape terminals (10 pcs)
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	Cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	Cordset 10 meters with M12 conn.

POSITION OF ACTIVE SENSOR

M3x5
M3x5

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

DETAIL A
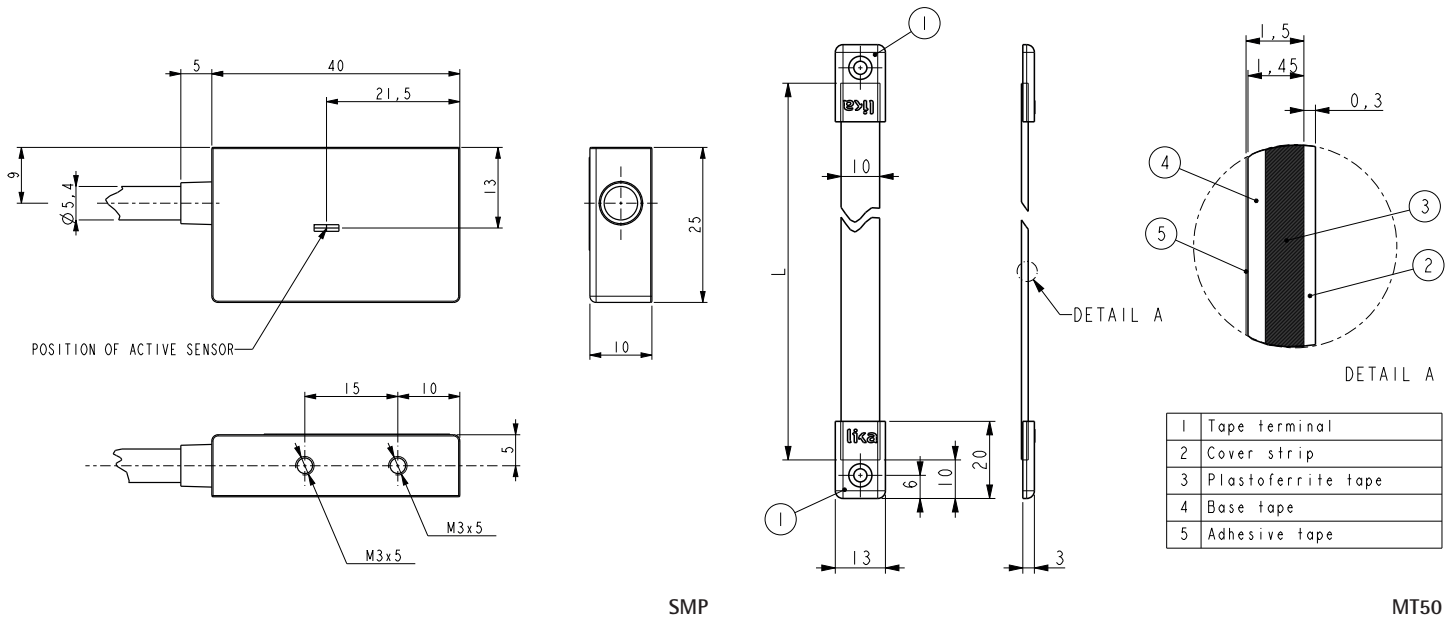
SMP

MT50

Order code – Sensor

SMP	–	XX ⓐ	–	X ⓑ	–	XXXX ⓒ	–	X ⓓ	–	XX ⓔ	–	X ⓕ	/Sxxx ⓖ

ⓐ OUTPUT CIRCUITS
Y = Push-Pull (AB)
YC = Push-Pull (AB, /AB)
L = Line Driver (AB, /AB)

ⓑ POWER SUPPLY
1 = +5Vdc ±5% (L output circuit)
2 = +10Vdc ÷ +30Vdc (Y and YC output circuit)

ⓒ RESOLUTION
250 = 0,25 mm (250 µm)
125 = 0,125 mm (125 µm)
62/5 = 0,0625 mm (62,5 µm)
50 = 0,05 mm (50 µm)
25 = 0,025 mm (25 µm)
12/5 = 0,0125 mm (12,5 µm)

ⓓ INDEX
N = without

ⓔ CONNECTIONS
L2 = cable output 2 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 inline plug
M2 = 2 m cable + M12 inline plug

ⓕ EDGE DISTANCE
A = 1 µs

ⓖ CUSTOM VERSION

Order code – Magnetic tape

MT50	–	XXX ⓐ	–	XXX ⓑ	–	X ⓒ	/Sxxx ⓓ

ⓐ LENGTH
1 = 1,0 m
2 = 2,0 m
4 = 4,0 m
10 = 10,0 m
20 = 20,0 m
30 = 30,0 m
50 = 50,0 m
100 = 100,0 m

ⓑ ACCURACY CLASS
100 = ±85 µm/m
50 = ±35 µm/m (up to 30 m)
10 = ±8 µm/m (up to 10 m)

ⓒ COVER STRIP
0 = not supplied
1 = supplied

ⓓ CUSTOM VERSION

Series	MTAx

- Flexible magnetic scale with adhesive tape
- Absolute coding
- Cover strip available on request
- Resistant to debris, liquids and oils
- MTA1, MTA2, MTA5, MTAX, MTAZ series

CE RoHS IP67

MTAx

ENVIRONMENTAL SPECIFICATIONS	
Protection:	IP67
Operating temperature range:	-40°C +120°C (-40°F +248°F)
Storage temperature range:	-40°C +120°C (-40°F +248°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Material:	plastoferrite and stainless steel
Accuracy class:	see order code
Thermal expansion coefficient:	$16 * 10^{-6}/K$
Length:	see order code

CHEMICAL RESISTANCE INFORMATION			
Acetone	••	Mineral / Motor oil	•
Acetylene	••	Petrol	••
Antifreeze (Glacial acetic acid)	•	Seawater	••
Benzene	•••	Steam heat	•
Heptane	•••	Thinner	•••
Kerosene	•	Turpentine	••
Ketone	•••		
• No effect or low effect •• Low to Medium effect ••• Strong effect			

ACCESSORIES	
KIT LKM-1440:	set of tape terminals (10 pcs)
KIT LKM-1439:	set of tape terminals (10 pcs)

MTAx

Series	L1	L2	Tape terminals
MTA1, MTA5	20 mm	23 mm	KIT LKM-1439
MTAX, MTAZ	20 mm	23 mm	KIT LKM-1439
MTA2	10 mm	13 mm	KIT LKM-1440

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape
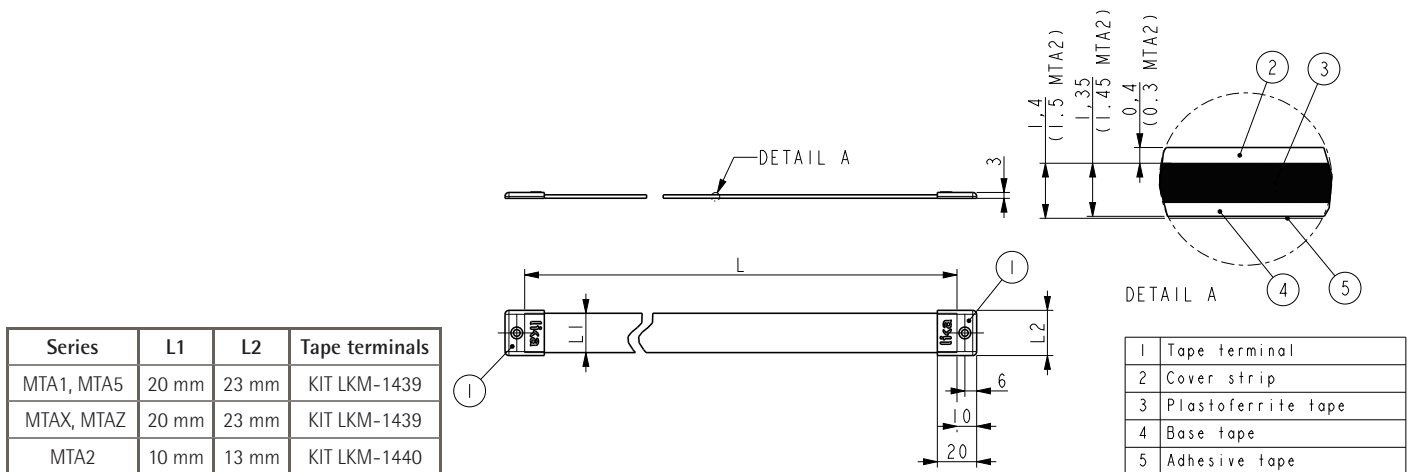
Order code

MTA1 MTA5	–	XX (a)	–	XX (b)	–	X (c)	–	/Sxxx (d)

(a) LENGTH		(b) ACCURACY CLASS	(c) COVER STRIP
0,1 = 0,1 m	1,5 = 1,5 m	50 = ±35 µm/m (up to 30 m)	0 = not supplied
0,2 = 0,2 m	… = …		1 = supplied (only MTA5)
… = …	4,5 = 4,5 m		
0,5 = 0,5 m	5,1 m		(d) CUSTOM VERSION
1,0 = 1,0 m			

Order code

MTA2	–	XX (a)	–	XX (b)	–	X (c)	–	/Sxxx (d)

(a) TAPE LENGTH		(b) ACCURACY CLASS	(c) COVER STRIP
1 = 1 m	5 = 5 m	40 = ±40 µm/m	0 = not supplied
2 = 2 m	6 = 6 m		1 = supplied
3 = 3 m	7 = 7 m		
4 = 4 m	8,2 = 8,2 m		(d) CUSTOM VERSION

Order code

MTAX – XXX MTAZ – XXXX (a)	–	XX (b)	–	X (c)

(a) TAPE LENGTH (measuring length)	(b) ACCURACY CLASS	(c) COVER STRIP
MTAX–280 = 280 mm (ML = 200)	50 = ± 35µm/m	0 = not supplied
MTAX–380 = 380 mm (ML = 300)		1 = supplied
MTAX–680 = 680 mm (ML = 600)		
MTAZ–1330 = 1330 mm (ML = 1250)	Product combination: SMAX + MTAX, SMAZ + MTAZ	

LINECOD
High performance absolute linear encoder

Series **SMA2**

CE RoHS

BiSS INTERFACE | SSi SYNCHRONOUS SERIAL INTERFACE | IP67

- BiSS & SSI interface
- Resolution up to 1 µm
- Additional incremental output for speed feedback
- Error bit output
- Measuring length up to 8,1 m
- Large mounting tolerances
- Unaffected by dust, debris or liquids with IP67

SMA2

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C +85°C (-13°F +185°F)
Storage temperature range:	-40°C +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	anticorodal, UNI EN AW-6082
Electrical connection:	Lika Hi-flex cable M8 2,0 m or M12 8 pin inline plug
Gap between sensor/tape:	0,1 ÷ 0,6 mm
Travel speed (mechanical):	10 m/s max.
Measurement length:	8165 mm max. Measurement length = tape length - 55 mm

ELECTRICAL SPECIFICATIONS	
Resolution:	50, 10, 5, 2, 1 µm
Sensor accuracy:	±2 µm max.
Repeat accuracy:	±1 increment
Output circuits:	absolute: SSI, BiSS-C incremental: NPN o.c. (AB)
Position refresh (absolute):	33 µs
Counting frequency (incremental):	see table 1
Power supply:	+5Vdc ±5%
Power consumption:	1 W max.
Protection:	against short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MTA2:	Magnetic tape
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset with 5 m cable
EC-M12F8-LK-M8-10:	cordset with 10 m cable
KIT LKM-1440:	Set of tape terminals (10 pcs)

Resolution code	Max. travel speed (m/s) (*)	Max. counting frequency of AB (kHz)
50	7	73
10	7	350
5	7	580
2	2.8	580
1	1.4	580

(*) min. edge distance = 0,25 µs (4MHz). Double speed possible with reduced sensor accuracy (± 4µm)

SMA2

MTA2

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape
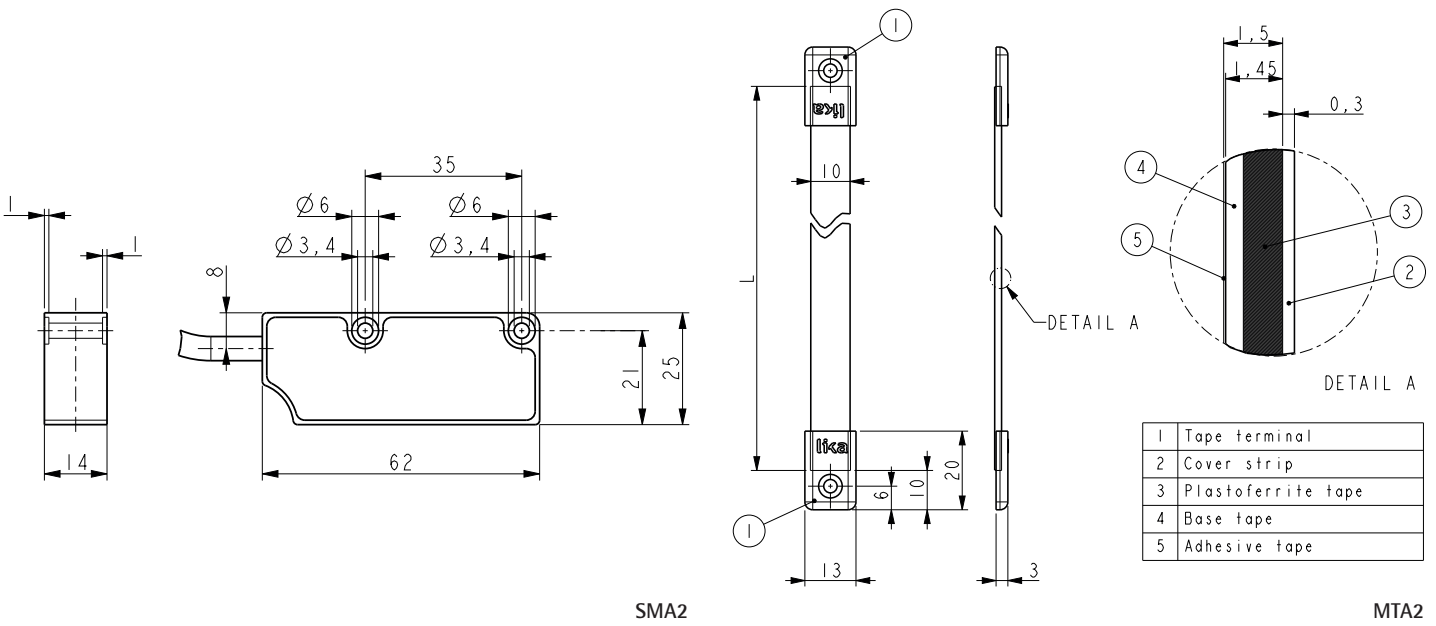
Order code – Sensor

SMA2	–	XXX ⓐ	–	XX ⓑ	–	XXX ⓒ	/Sxxx ⓓ

ⓐ OUTPUT CIRCUIT	ⓑ RESOLUTION	ⓒ CONNECTIONS
GG1 = SSI, Gray MSB aligned, +5Vdc ±5% **G11 =** SSI, Gray MSB aligned + AB incremental, +5Vdc ±5% **BG1 =** SSI, Binary MSB aligned, +5Vdc ±5% **SC1 =** BiSS-C interface + AB incremental, +5Vdc ±5%	**50 =** 50 µm **10 =** 10 µm **5 =** 5 µm **2 =** 2 µm **1 =** 1 µm	**L2 =** cable output 2 m **Lx =** cable output x m **M0,5 =** 0,5 m cable + M12 8 pin inline plug **M2 =** 2 m cable + M12 8 pin inline plug
		ⓓ CUSTOM VERSION

Order code – Magnetic tape

MTA2	–	XX ⓐ	–	XX ⓑ	–	X ⓒ	/Sxxx ⓓ

ⓐ TAPE LENGTH		ⓑ ACCURACY CLASS	ⓒ COVER STRIP
1 = 1 m **2 =** 2 m **3 =** 3 m **4 =** 4 m	**5 =** 5 m **6 =** 6 m **7 =** 7 m **8,2 =** 8,2 m	**40 =** ±40 µm	**0 =** not supplied **1 =** supplied
			ⓓ CUSTOM VERSION

Specifications subject to changes without prior notice

LINECOD
Absolute linear encoder

lika

Series	SMA5

SSI · IP67 · CE · RoHS

- Compact absolute linear encoder with SSI interface
- Measurement lenght up to 5 m
- Mounting tolerances with airgap up to 1 mm
- Resolution from 100 to 5 μm
- Diagnostic LED for clearance/gap error
  (Error bit available on request)
- Unaffected by dust, debris or liquids

SMA5

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C +85°C (-13°F +185°F)
Storage temperature range:	-40°C +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	anticorodal, UNI EN AW-6082
Electrical connection:	Lika Hi-flex cable M8 2,0 m or M12 8 pin inline plug
Gap between sensor/tape:	0,1 ÷ 1,0 mm
Travel speed (mechanical):	5 m/s max.
Measurement length:	5,05 m max.
	Measurement length = tape length - 65 mm

ELECTRICAL SPECIFICATIONS	
Resolution:	100, 50, 10, 5 μm
Sensor accuracy:	±20 μm max.
Repeat accuracy:	±1 increment
Output circuits:	SSI
Position refresh:	250 μs
Power supply:	+10Vdc ÷ +30Vdc
Power consumption:	1 W max.
Protection:	against inversion of polarity and short-circuit
EMC:	acc. to EN 61000-6-2 level 3
Functions:	Zero setting, Counting direction
Options:	Power supply +5Vdc ±5%
	Error bit + Parity bit output

ACCESSORIES	
MTA5:	Magnetic tape
E-M12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset with 5 m cable
EC-M12F8-LK-M8-10:	cordset with 10 m cable
KIT LKM-1439:	Set of tape terminals (10 pcs)

SMA5

MTA5

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

Order code – Sensor

| SMA5 | – | XX ⓐ | – | XXX ⓑ | – | XXX ⓒ | /Sxxx ⓓ |

ⓐ OUTPUT CIRCUIT
GA = Gray, SSI LSB aligned

ⓑ RESOLUTION
100 = 0,1 mm
50 = 0,05 mm
10 = 0,01 mm
5 = 0,005 mm

ⓒ CONNECTIONS
L2 = cable output 2 m
Lx = cable output x m
M0,5 = 0,5 m cable + M12 8 pin inline plug
M2 = 2 m cable + M12 8 pin inline plug

ⓓ CUSTOM VERSION

Order code – Magnetic tape

| MTA5 | – | XX ⓐ | – | XX ⓑ | – | X ⓒ | /Sxxx ⓓ |

ⓐ TAPE LENGTH
0,1 = 0,1 m   **1 =** 1 m
0,2 = 0,2 m   **1,5 =** 1,5 m
... = ...   **... =** ...
0,5 = 0,5 m   **5,1 =** 5,1 m

ⓑ ACCURACY CLASS
50 = ±35 µm

ⓒ COVER STRIP
0 = not supplied
1 = supplied

ⓓ CUSTOM VERSION

LINECOD

Absolute linear encoder for feedback applications

lika

BiSS INTERFACE | SSI SYNCHRONOUS SERIAL INTERFACE | IP67

Series	SMA1

- Compact absolute linear encoder
- BiSS-B, BiSS-C or SSI interface
- Additional 1Vpp incremental output (sin/cos)
- Resolution programmable up to 5 µm
- Diagnostic LED for clearance/gap error
- Unaffected by dust, debris or liquids

SMA1

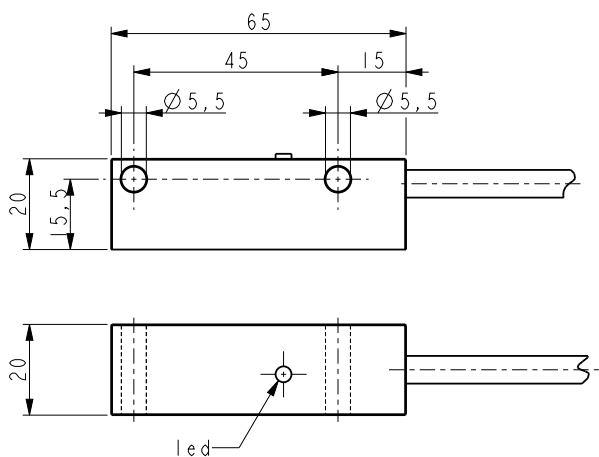| ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP67
Operating temperature range:	-25°C +85°C (-13°F +185°F)
Storage temperature range:	-40°C +100°C (-40°F +212°F)

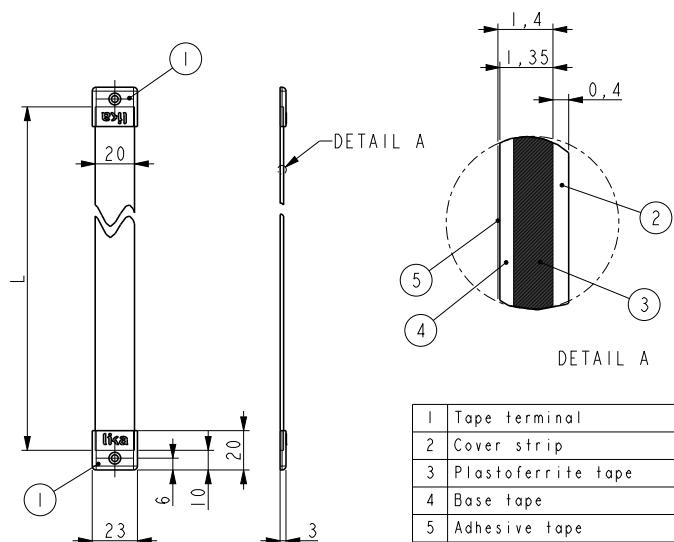| MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	anticorodal, UNI EN AW-6082
Electrical connection:	Lika Hi-flex cable T12 2,0 m
Gap between sensor/tape:	0,1 ÷ 0,3 mm
Travel speed (mechanical):	5 m/s max.
Measurement length:	5,03 m max.
	Measurement length = tape length - 85 mm

ELECTRICAL SPECIFICATIONS	
Resolution:	absolute: 5 µm
	incremental: sin/cos 1000 µm
Sensor accuracy:	±20 µm max.
Repeat accuracy:	±1 increment
Output circuits:	absolute: BiSS-B, BiSS-C, SSI
	incremental: sin/cos 1Vpp (AB)
Position refresh (absolute):	170 µs
Counting frequency (incremental):	8 kHz
Power supply:	+5Vdc ±5%, +10Vdc ÷ +30Vdc
Power consumption:	1,5 W max.
Protection:	against inversion of polarity and short-circuit
EMC:	acc. to EN 61000-6-2 level 3

ACCESSORIES	
MTA1:	Magnetic tape
KIT LKM-1439:	Set of tape terminals (10 pcs)
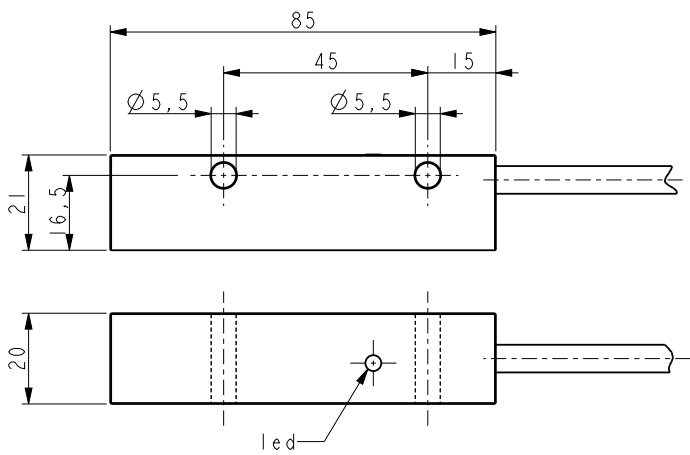
SMA1
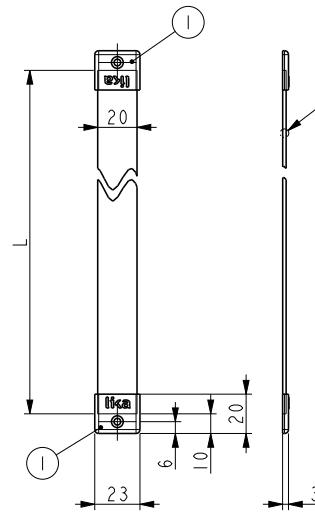
MTA1
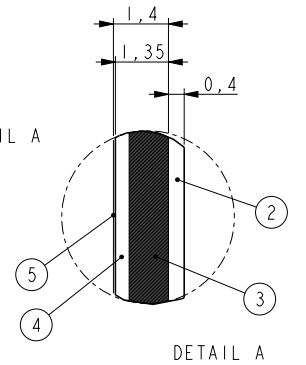
I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

Order code – Sensor

SMA1	–	XXX ⓐ	–	X ⓑ	–	XX ⓒ	/Sxxx ⓓ

ⓐ OUTPUT CIRCUIT	ⓑ RESOLUTION	ⓒ CONNECTIONS
SC1 = BiSS-C + AB sin/cos, +5Vdc ±5%	**5 =** 0,005 mm	**L2 =** cable output 2 m
SC2 = BiSS-C + AB sin/cos, +10Vdc +30Vdc		**L5 =** cable output 5 m
SB1 = BiSS-B + AB sin/cos, +5Vdc ±5%		**Lx =** cable output x m
SB2 = BiSS-B + AB sin/cos, +10Vdc +30Vdc		
GA2 = SSI LSB aligned, Gray, +10Vdc +30Vdc		ⓓ CUSTOM VERSION

Order code – Magnetic tape

MTA1	–	XX ⓐ	–	XX ⓑ	–	X ⓒ	/Sxxx ⓓ

ⓐ TAPE LENGTH		ⓑ ACCURACY CLASS	ⓒ COVER STRIP
0,1 = 0,1 m	**1 =** 1 m	**50 =** ±35 µm	**0 =** not supplied
0,2 = 0,2 m	**1,5 =** 1,5 m		
… = …	**… =** …		
0,5 = 0,5 m	**5,1 =** 5,1 m		ⓓ CUSTOM VERSION

Specifications subject to changes without prior notice

LINECOD
Guided absolute linear encoder

lika

CE RoHS IP67

CANopen SSI

- Guided measurement system
- Absolute sensing without referencing
- CANopen & SSI interface
- Resolution up to 5 µm
- Measurement length from 115 to 570 mm
- Easy installation with 1 fixing point
- Non-linear movement possible
- Unaffected by dust, debris or liquids

SMAG

| ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP65
Operating temperature range:	-25°C +85°C (-13°F +185°F)
Storage temperature range:	-40°C +100°C (-40°F +212°F)
Options:	Protection IP67 (sealed circuits)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	Sensor: Nylon 6FC 30%, Profile: aluminium
Electrical connection:	Lika Hi-flex cable M8 2,0 m or M12 8 pin inline plug
Travel speed (mechanical):	typ. 0,5 m/s - max. 1m/s
Measurement length:	Measurement length = profile length - 80 mm

| ELECTRICAL SPECIFICATIONS	
Resolution:	CANopen: 5 µm (programmable) SSI: 100, 50, 10, 5 µm
Sensor accuracy:	±15 µm max.
Repeat accuracy:	±1 increment
Output circuits:	CANopen, SSI
Power supply:	+10Vdc ÷ +30Vdc
Power consumption:	1 W max.
Protection:	against inversion of polarity and short-circuit
EMC:	acc. to EN 61000-6-2 level 3
Functions:	Zero setting, Counting direction

ACCESSORIES	
MTAG:	Magnetic profile
EM12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 meters with M12 conn.
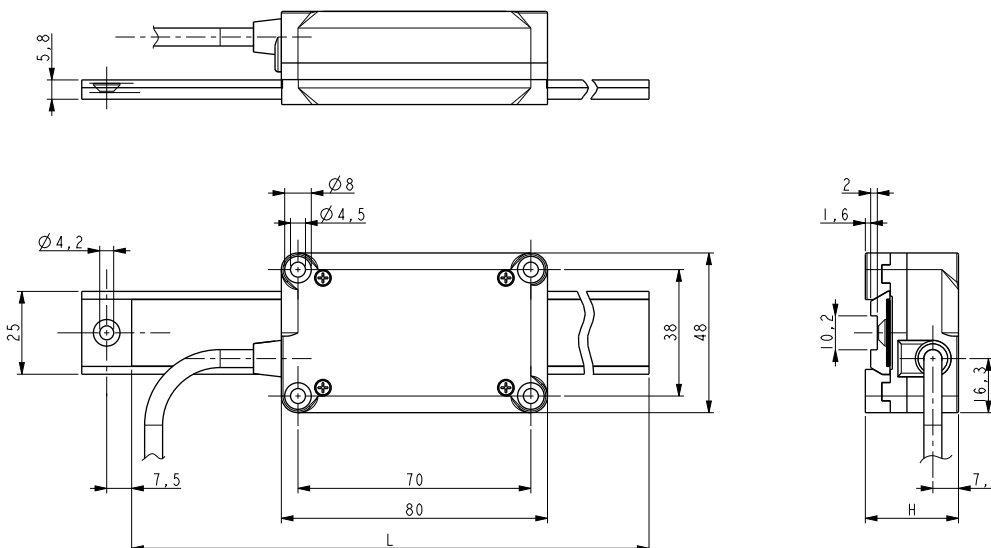
Series	L	H
SMAG - CB	see profile length	35 mm
SMAG - GA	see profile length	28 mm

SMAG

Order code – CANopen version

SMAG	–	XX ⓐ	–	X ⓑ	–	XX ⓒ	/Sxxx ⓓ

ⓐ OUTPUT CIRCUIT	ⓑ RESOLUTION	ⓒ CONNECTIONS
CB = CANopen interface	**5 =** 0,005 mm	**L2 =** cable output 2 m
		L5 = cable output 5 m
		Lx = cable output x m
		ⓓ CUSTOM VERSION

Order code – SSI version

SMAG	–	XX ⓐ	–	XXX ⓑ	–	X ⓒ	–	XX ⓓ	/Sxxx ⓔ

ⓐ OUTPUT CIRCUIT	ⓑ RESOLUTION	ⓓ CONNECTIONS
GA = Gray, SSI, LSB alligned	**100 =** 0,1 mm	**L2 =** cable output 2 m
	50 = 0,05 mm	**L5 =** cable output 5 m
	10 = 0,01 mm	**Lx =** cable output x m
	5 = 0,005 mm	**M0,5 =** cable output 0,5 m with M12 8 pin conn.
		M2 = cable output 2 m with M12 8 pin connector
	ⓒ PROTECTION	
	– = IP65 (standard)	
	J = IP67 (with sealed circuit)	**ⓔ CUSTOM VERSION**

Order code – Profile

MTAG	–	XXX ⓐ	–	XX ⓑ	–	X ⓒ	/Sxxx ⓓ

ⓐ PROFILE LENGTH		ⓑ ACCURACY CLASS	ⓒ COVER STRIP
		35	**1 =** supplied
195 = 195 mm (ML = 115mm)	**300 =** 300 mm (ML = 220mm)		
220 = 220 mm (ML = 140mm)	**370 =** 370 mm (ML = 290mm)		
240 = 240 mm (ML = 160mm)	**650 =** 650 mm (ML = 570mm)		**ⓓ CUSTOM VERSION**

Specifications subject to changes without prior notice

lika

CE RoHS

Modbus SSI IP68

- Cost effective non-contacting absolute encoder
- IP68 protection degree for harsh environments, IP69K on request
- Modbus/RS485, SSI & Analogue output
- Programmable resolution
- Self-diagnostics on tape distance & integrity
- Measuring length up to 1250 mm
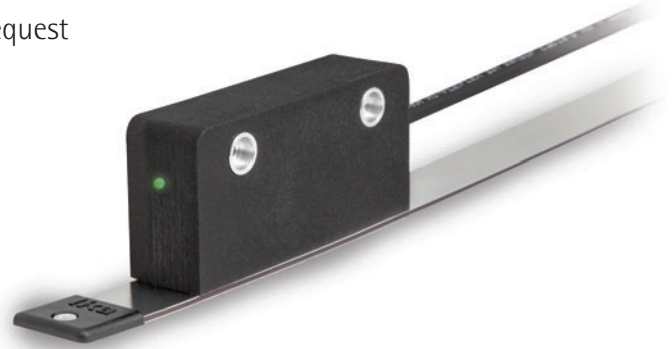
SMAX • SMAZ

ENVIRONMENTAL SPECIFICATIONS	
Shock:	250 g, 6 ms acc. to CEI EN 60068-2-27
Vibrations:	10 g, 5-2000 Hz acc. to CEI EN 60068-2-6
Protection:	IP68
Operating temperature range:	-25°C +85°C (-13°F +185°F)
Storage temperature range:	-40°C +100°C (-40°F +212°F)

MECHANICAL SPECIFICATIONS	
Dimensions:	see drawing
Housing material:	Macromelt OM 646-EN
Electrical connection:	Lika Hi-flex cable M8 1,0 m or M12 8 pin inline plug
Gap between sensor/tape:	0.1 ÷ 2.0 mm
Travel speed (mechanical):	5 m/s max.
Measurement length:	SMAX: 600 mm max., SMAZ: 1250 mm max. Measurement length = tape length - 80 mm
Options:	• additional cable

ELECTRICAL SPECIFICATIONS	
Resolution:	programmable or fix 1.25, 1.0, 0.5, 0.1 mm
Sensor accuracy:	±2 µm max.
Repeat accuracy:	±1 increment
Output circuits:	analogue 4-20mA, 0-10V, Modbus/RS485, SSI
Position refresh:	100 µs
Power supply:	Modbus, SSI: +10Vdc +30Vdc Analogue output: +13Vdc +30Vdc
Power consumption:	1 W max.
Protection:	against inversion of polarity and short-circuit (except AI1 and AV2 circuits)
EMC:	acc. to EN 61000-6-2 level 3
Functions:	SSI: zero setting, counting direction Modbus: preset , counting direction, scaling, baud-rate Analogue: Teach-in of output range

ACCESSORIES	
MTAX:	Magnetic tape for SMAX
MTAZ:	Magnetic tape for SMAZ
KIT LKM-1439:	Set of tape terminals (10 pcs)
EM12F8:	M12 8 pin mating connector
EC-M12F8-LK-M8-5:	cordset 5 meters with M12 conn.
EC-M12F8-LK-M8-10:	cordset 10 m. with M12 conn.

SMAX • SMAZ

MTAX • MTAZ

I	Tape terminal
2	Cover strip
3	Plastoferrite tape
4	Base tape
5	Adhesive tape

DETAIL A
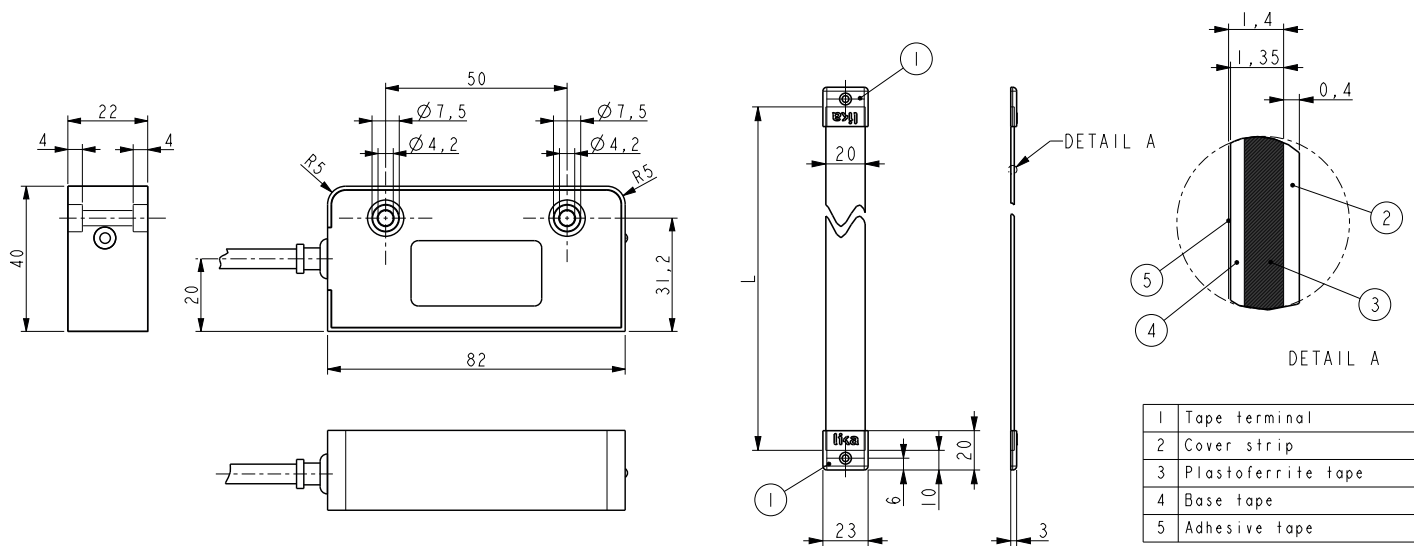
Order code sensor – SSI output

SMAX SMAZ	–	XX ⓐ	–	XXXX ⓑ	–	XXX ⓒ	/Sxxx ⓓ

ⓐ OUTPUT CIRCUITS	ⓑ RESOLUTION	ⓒ CONNECTIONS
BG = Binary, SSI MSB aligned	**1250 =** 1,25 mm	**L1 =** cable output 1 m (standard)
GG = Gray, SSI MSB aligned	**1000 =** 1,0 mm	**Lx** = cable output x m
	500 = 0,5 mm	**M0,5 =** 0,5 m cable + M12 8 pin inline plug
	100 = 0,1 mm	**M2** = 2 m cable + M12 8 pin inline plug
		ⓓ CUSTOM VERSION

Order code sensor – Modbus/RS485, Analogue output

SMAX SMAZ	–	XXX ⓐ	–	XXX ⓑ	–	XXX ⓒ	/Sxxx ⓓ

ⓐ OUTPUT CIRCUITS	ⓑ RESOLUTION	ⓒ CONNECTIONS
MB = Modbus/RS485	**PRG =** programmable	**L1 =** cable output 1 m (standard)
AI1 = 4-20 mA (10 bit)		**Lx** = cable output x m
AV2 = 0-10V (10 bit)		**M0,5 =** 0,5 m cable + M12 8 pin inline plug
		M2 = 2 m cable + M12 8 pin inline plug
		ⓓ CUSTOM VERSION

Order code – Magnetic tape

MTAX – XXX MTAZ – XXXX ⓐ	–	XX ⓑ	–	X ⓒ

ⓐ TAPE LENGTH (measuring length)	ⓑ ACCURACY CLASS	ⓒ COVER STRIP
MTAX–280 = 280 mm (ML = 200)	**50 =** ± 35µm/m	**0 =** not supplied
MTAX–380 = 380 mm (ML = 300)		**1 =** supplied
MTAX–680 = 680 mm (ML = 600)		
MTAZ–1330 = 1330 mm (ML = 1250)	**Product combination: SMAX + MTAX, SMAZ + MTAZ**	

Specifications subject to changes without prior notice

SME11, SME21, SME51, SMP, SMIG, SMK, SML, SMH, SMS11, SMS21, SMSR, SMG

Signals	M12 8-pin	M8 cable
0Vdc	1	Black
+Vdc	2	Red
A	3	Yellow
/A	4	Blue
B	5	Green
/B	6	Orange
0*	7	White
/0*	8	Grey
Shield	Case	Shield

*: 0, /0 signals not available for SMP

SME12, SME22, SME52, SMS12

Signals	M10 cable
0Vdc	Black
+Vdc	Red
A	Yellow
/A	Blue
B	Green
/B	Orange
0	White
/0	Grey
LS1	Brown
LS2	Violet
Shield	Shield

SMI2, SMI5

Function	DSub 9-pin
A	1
/A	2
0Vdc	3
B	4
/B	5
0	6
/0	7
+Vdc	8
0Vdc	9
Shield	Case

SMX2, SMX5

Signals	M6 cable
0Vdc	Black
+5Vdc +30Vdc	Red
A	Yellow
/A	Orange
B	Green
/B	Brown
Shield	Shield

Picture (example)	Cable type	Order code
	M6 6 x 0.14 mm² (26 AWG), TPU	Lika Hi Flex sensor cable type M6
	M8 2 x 0.22 + 6 x 0.14 mm² (24/26 AWG), TPU	Lika Hi Flex sensor cable type M8
	M10 2 x 0.22 mm² + 8 x 0.14 mm² (24/26 AWG), TPU	Lika Hi Flex sensor cable type M10

Connector type	Picture	Frontal view	Mating connector	Dimensions
M12 8-pin plug Male, A coding IEC 61076-2-101 reference standard			E-M12F8	
DSub 9-pin connector Female IEC 60807 reference standard			EDE 9P	

SMA1

Signals	T12 cable
0Vdc	White / Green
+Vdc	Brown / Green
Clock IN +	Violet
Clock IN -	Yellow
Data OUT +	Grey
Data OUT -	Pink
A	Green
/A	Brown
B	Red
/B	Black
not connected	White
not connected	Blue
Shield	Shield

SMA2

Signals	M12 8-pin	M8 cable
0Vdc	1	Black
+5Vdc ±5%	2	Red
Clock IN +	3	Yellow
Clock IN -	4	Blue
Data OUT +	5	Green
Data OUT -	6	Orange
A*	7	White
B*	8	Grey
Shield	Case	Shield

*only with additional incremental track

SMA5

Signals	M8 cable
0Vdc	Black
+10Vdc +30Vdc	Red
Clock IN +	Yellow
Clock IN -	Blue
Data OUT +	Green
Data OUT -	Orange
Counting direction	Grey
Zero setting	White
Shield	Shield

CANopen SMAG / SSI

Signals	T6 cable
0Vdc	White
+10Vdc +30Vdc	Brown
CAN_L (BUS IN)	Green
CAN_H (BUS IN)	Yellow
CAN_L (BUS OUT)	Grey
CAN_H (BUS OUT)	Pink

Signals	M12 8-pin	M8 cable
0Vdc	1	Black
+10Vdc +30Vdc	2	Red
Clock IN +	3	Yellow
Clock IN -	4	Blue
Data OUT +	5	Green
Data OUT -	6	Orange
Zero setting	7	White
Counting direction	8	Grey
Shield	Case	Shield

SMAX, SMAZ

SSI signals	Modbus signals	Analogue signals AI1	Analogue signals AV2	M12 8-pin	M8 cable
0Vdc	0Vdc	0Vdc Power Supply		1	Black
+10Vdc +30Vdc	+10Vdc +30Vdc	+13Vdc +30Vdc		2	Red
Clock IN +	A_RS485 IN	0Vdc analogue		3	Yellow
Clock IN -	B_RS485 IN	START		4	Blue
Data OUT +	A_RS485 OUT	+Iout	+Vout	5	Green
Data OUT -	B_RS485 OUT	STOP		6	Orange
Zero setting	n.c	n.c.		7	White
Counting direction	n.c.	FAULT	n.c.	8	Grey
Shield	Shield	Shield		Case	Shield
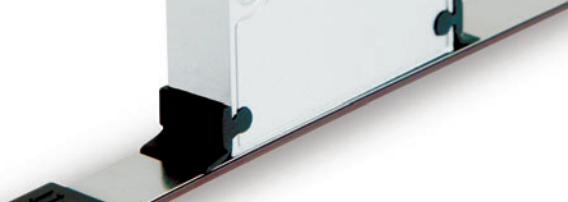
Picture (example)	Cable type	Order code
	T6 3 x 2 x 0.25mm² (24AWG), PVC	Lika Bus cable T6
	M8 2 x 0.22 mm² + 6 x 0.14 mm² (24/26 AWG), TPU	Lika Hi-Flex sensor cable type M8
	T12 4 x 0.25 mm² + 4 x 2 x 0.14 mm² (24/26 AWG), TPU	Lika Hi-Flex sensor cable type T12

Connector type	Picture	Frontal view	Mating connector	Dimensions
M12 8-pin plug Male, A coding IEC 61076-2-101 reference standard			E-M12F8	Ø 20 53,5

Order code Cable type	Description	Notes
M6 Incremental encoders	Cross section: 6 x 0.14 mm² (26 AWG) Jacket: TPU, extraflexible Shield: tinned copper braid, coverage ≥85% External diameter: 4.5 mm ±0.2 mm Min. bend radius: external diameter x 7.5 Operating temperature: -50 +90°C fix / -40 +90°C dyn. Conductor resistance: <148 Ω/km	RoHS compliant Ref. standard UL1581 Halogen free Oil, hydrolysis, abrasion resistant Suitable for cable drag chains 10 m/s max. speed 4 m/s² max. acceleration ≥ 1,000,000 cycles
M8 Incremental encoders Absolute encoders	Cross section: 2 x 0.22 mm² + 6 x 0.14 mm² (24/26 AWG) Jacket: TPU, extraflexible Shield: tinned copper braid, coverage ≥85% External diameter: 5.3 ÷ 5.6 mm Min. bend radius: external diameter x 7.5 Operating temperature: -50 +90°C fix / -40 +90°C dyn. Conductor resistance: <90 Ω/km (0.22), <148 Ω/km (0.14)	RoHS compliant Ref. standard UL1581 Halogen free Oil, hydrolisys, abrasion resistant Suitable for cable drag chains 10 m/s max. speed 6 m/s² max. acceleration ≥ 1000000 cycles
M10 Incremental encoders	Cross section: 2 x 0.22 mm² + 8 x 0.14 mm² (24/26 AWG) Jacket: TPU, extraflexible Shield: tinned copper braid, coverage ≥85% External diameter: 5.7 mm ±0.2 mm Min. bend radius: external diameter x 7.5 Operating temperature: -50°C +90°C fix / -40°C +90°C dyn. Conductor resistance: <90 Ω/km (0.22), <148 Ω/km (0.14)	RoHS compliant Ref. standard UL1581 Halogen free Oil, hydrolysis, abrasion resistant Suitable for cable drag chains 10 m/s max. speed 6 m/s² max. acceleration ≥ 1,000,000 cycles
T6 Absolute encoders	Cross section: 3 x 2 x 0.25 mm² (24 AWG) Jacket: flame retardant PVC Shield: tinned copper braid External diameter: 5.7 mm Min. bend radius: external diameter x 10 fix Operating temperature: -20°C +75°C Conductor resistance: <79 Ω/km	RoHS and LVD compliant Ref. standard DIN47100
T12 Incremental encoders Absolute encoders	Cross section: 4 x 0.25 mm² + 4 x 2 x 0.14 mm² (24/26 AWG) Jacket: TPU, extraflexible Shield: tinned copper braid, coverage ≥85% External diameter: 6.1 mm ±0.1 mm Min. bend radius: external diameter x 7.5 Operating temperature: -50°C +90°C fix / -40°C +90°C dyn. Conductor resistance: <90 Ω/km (0.25), <148 Ω/km (0.14)	RoHS compliant Ref. standard UL1581 Halogen free Oil, hydrolysis, abrasion resistant Suitable for cable drag chains 10 m/s max. speed 6 m/s² max. acceleration ≥ 1,000,000 cycles

Cables having bending radius indicated with "flexible" can be used in low speed moving installations, while cables indicated with bending radius "dynamic" can be used in high speed and acceleration installations.

FREQUENT FLEXING   RIGID CONFIGURATION

Picture	Description
	Aluminium profile for MT50, MT40 or MT32 Protects against mechanical impacts & very harsh environments Additional fixing to adhesive tape **KIT PS1-1,0** = 1 set of 10 profiles
	Standard incremental magnetic tapes **MT50, MT40, MT32, MT25, MT20 and MT10** are available up to 100 m length. Versions with reduced width **MTS50 and MTS20**, available up to 30 m. Standard absolute magnetic tapes **MTA5, MTA2, MTA1, MTAL, MTAX and MTAZ** are available up to max. 8,1 m length.
	Tape terminals for incremental and absolute tapes. *(Terminals included with tape rolls. Additional terminals can be ordered separately).* **KIT LKM-1440** for 10 mm width tapes, series MTxx and MTA2. **KIT LKM-1439** for 20 mm width tapes series MTAx (excluding MTA2). *(Each KIT contains 10 terminals with mounting screws).*
	KIT wipers for SMEx and SMS series. *(Each KIT contains 10 rubber wipers).*

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