

LA12 Absolute Magnetic Encoder System with Mitsubishi, Yaskawa and Fanuc Serial Communications

LA12 is a true absolute magnetic encoder system designed for motion control applications as a position and velocity control loop feedback element. The encoder readhead is sealed to IP67 providing reliable and robust operation with high resolution.

TRUE
ABSOLUTE
SYSTEM

ROBUST
DESIGN

LOW
LATENCY



Features and benefits

- ▶ True absolute system
- ▶ Fanuc, Mitsubishi and Yaskawa serial communication protocols (Half-Duplex, RS-485)
- ▶ Suitable for highly dynamic control loops
- ▶ Robust design and great EMC compatibility
- ▶ IP67 sealing
- ▶ Speeds up to 7 m/s
- ▶ Axis lengths up to 16.3 m
- ▶ Resolutions up to ~0.244 μ m



MACHINE TOOL



LINEAR MOTOR



ASSEMBLY LINES



INDUSTRIAL AUTOMATION



IN SMALL SIZE

General information

The LA12 encoder system provides true-absolute position information immediately after power-up over the two-wire communication protocol. The LA12 is extremely reliable due to the non-contact, wear-free measuring principle and the built-in safety algorithm.

The measuring standard is a magnetic scale that is magnetised with two tracks. The incremental track is magnetised with north/south 2 mm poles and the absolute track with a pseudo-random binary sequence.

The readhead consists of a Hall sensor array that reads the absolute track and an AMR sensor that reads the incremental track. The raw data is merged by the interpolator and the microcontroller unit. The position information is additionally processed in the FPGA, which enables low latency and short response time. Diagnostic information is available via the selected communication protocol and the multicolor status LED.

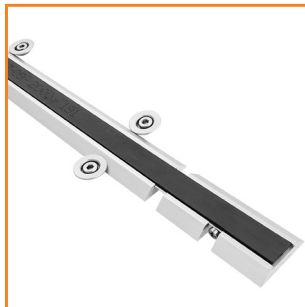
The readhead is connected to the outside world via a robust, highly flexible cable with various connection options. Due to the robust design of the readhead and the cable, the system ensures great electromagnetic compatibility (EMC).

Choose your LA12 system

The LA12 system provides a flexible and reliable solution for industrial measurement applications. The AS10 magnetic scale allows measurement lengths up to 16.3 m and can be optionally protected with stainless steel foil for increased durability. Installation is simplified by the TRS track system, which ensures precise alignment, improved mounting accuracy, and consistent positioning. For demanding environments, the SAS10 stainless steel carrier offers excellent thermal stability and accuracy up to $\pm 5 \mu\text{m/m}$, while the fully welded cover option provides additional protection against aggressive conditions.



AS10 magnetic scale



TRS track system (AS10)



SAS10 fully welded or exposed

Further information

For detailed documentation, compatible scales (ASD01) and 3D models, refer to the [LA12](#) product page or [RLS Media center](#).

Storage and handling

Storage temperature



-20 °C to +85 °C

Operating temperature

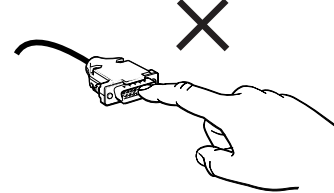
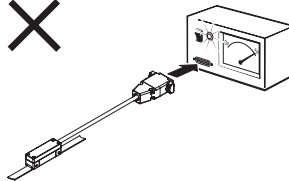
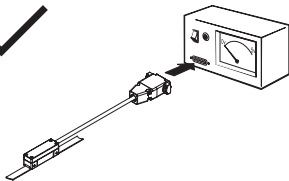


0 °C to +55 °C

Humidity

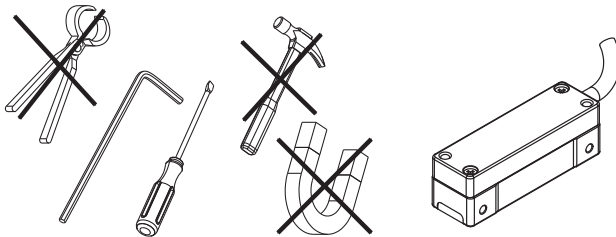


100 % condensing



Readhead is ESD sensitive - handle with care.

Do not touch electronic circuit, wires or sensor area without proper ESD protection or outside of ESD controlled environment.



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

Operational conditions

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

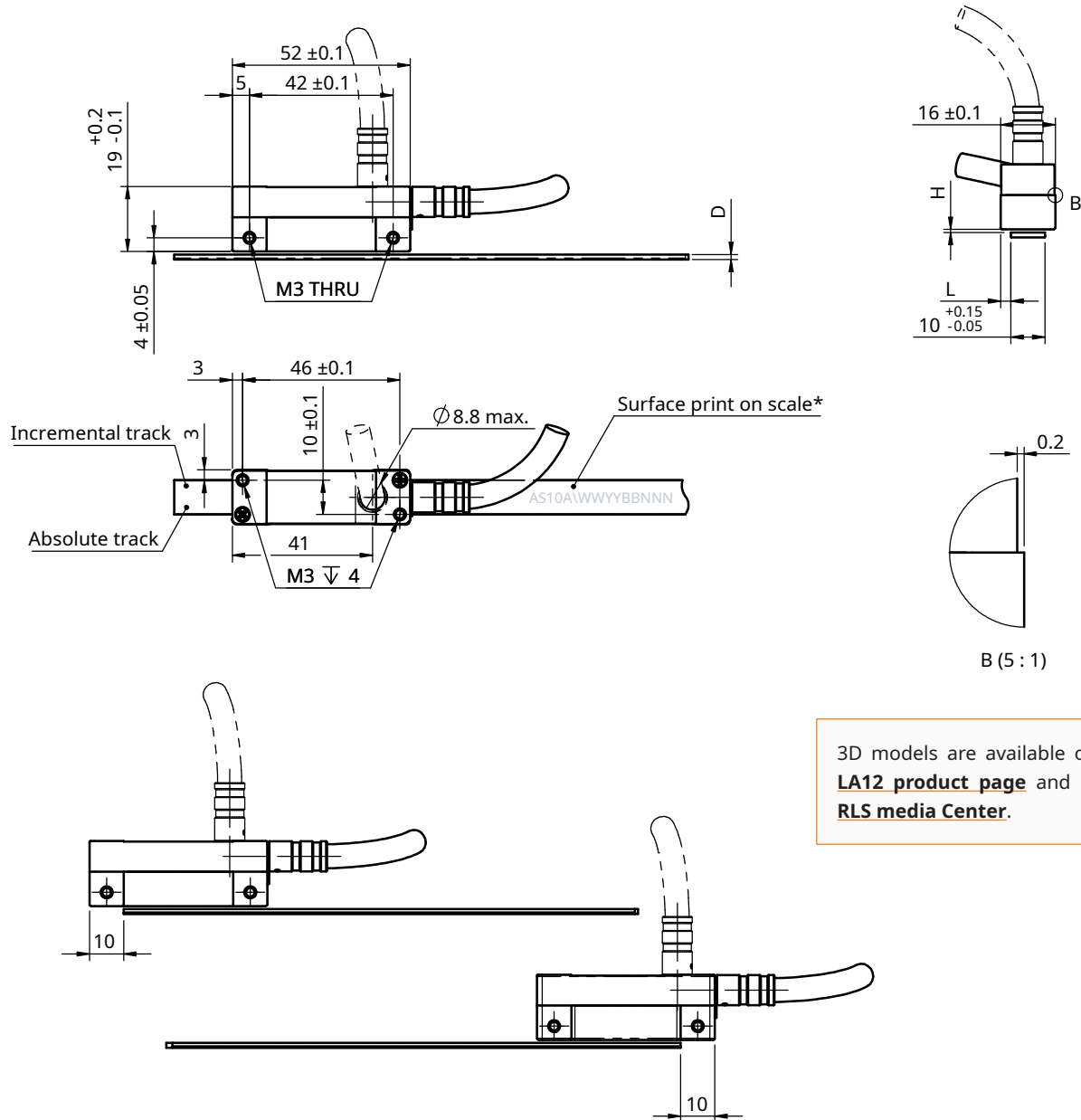
Effects of external magnetic fields

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

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

Dimension drawing

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



3D models are available on the **LA12 product page** and in the **RLS media Center**.

Installation instructions

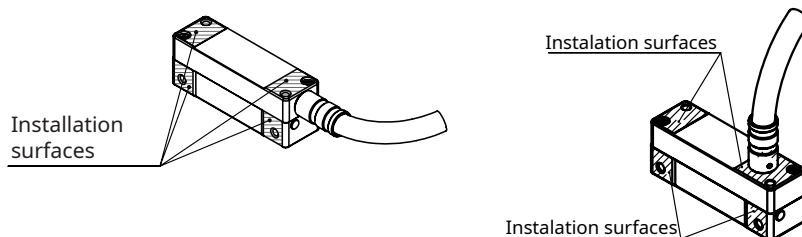
The magnetic encoder system must be installed and mounted in strict compliance with the installation dimensions and tolerances given on **page 4** and in the ASD01 at **RLS Media center**. Contact between the readhead and magnetic scale must be avoided over the entire measuring range.

Installation procedure

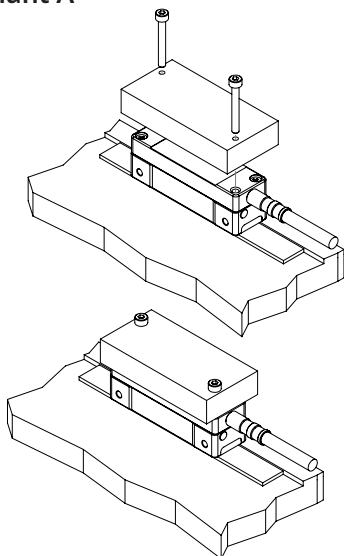
The readhead LED must be green at all measuring length positions. Otherwise, the installation will not be performed correctly. To facilitate installation, the 0.1 mm to 0.6 mm thick plastic spacer (shim) can be used. For optimal installation, the recommended thickness of the shim is 0.2 mm.

1. Mount the magnetic scale.
2. Place the plastic shim and the readhead on the magnetic scale.
3. Ensure that the readhead, shim and magnetic scale are in full contact.
4. Ensure that the orientation and alignment of the readhead relative to the magnetic scale is as shown in the ASD01 at **RLS Media center**. The print on the scale can be used to determine the orientation.

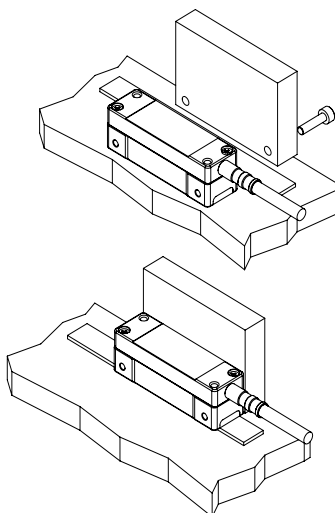
Improper mounting of the magnetic scale and readhead can impair the function of the magnetic encoder system and lead to total failure.



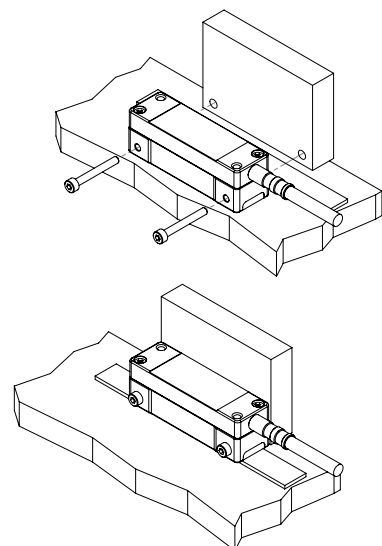
Variant A



Variant B



Variant C



Technical specifications

System data

Pole length	2 mm		
Maximum measuring length	AS10: 16.3 m SAS10: 1.288 m		
System accuracy	±20 µm/m to ±40 µm/m For more information about accuracy of AS10 or SAS10 magnetic scale please refer to ASD01 available at RLS Media center .		
Hysteresis	< 2 µm at 0.2 mm ride height		
Unidirectional repeatability	< 1 µm		
Resolutions	Part number	Resolution	Max. speed
Fanuc interface	8D0	0.25 µm	2 m/s
Mitsubishi interface	1D0	2 µm	7 m/s
	2D0	1 µm	7 m/s
	11B	0.9765625 µm	7 m/s
	12B	0.48828125 µm	4 m/s
	13B	0.244140625 µm	2 m/s
Yaskawa interface	11B	0.9765625 µm	7 m/s
	12B	0.48828125 µm	4 m/s
	13B	0.244140625 µm	2 m/s

Electrical data

Power supply	From 4.75 V to 5.5 V (on the connector), reverse polarity protection
Current consumption	< 250 mA (at 5 V power supply and 15 m cable length, without load)
Set-up time after power-on	< 1 s (the encoder will start responding according to the communication protocol after set-up time has passed)
Position latency *	< 1 µs

* Delay caused by the sensor, interpolator and data processing.

Mechanical data

Material	Readhead: Aluminium (Eloxal - anodised)
Mass	86 g (readhead with 1 m cable, no connector)

Environmental data

Temperature	Operating	0 °C to +55 °C
	Storage	-20 °C to +85 °C
Vibrations (55 Hz to 2000 Hz)	300 m/s ² (IEC 60068-2-6:2007)	
Shocks (11 ms)	300 m/s ² (IEC 60068-2-6:2007)	
Humidity	100 % (condensation permitted)	
EMC Immunity	EN IEC 61000-6-2:2019	
EMC Emission	EN IEC 61000-6-4:2019	
Environmental sealing	IP67 (according to IEC 60529:1992+A2:2013)	
External magnetic field during operation	<0.5 mT	

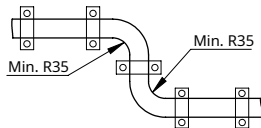
Cable

Cable type	Green colour, PUR high flex cable, UL AWM recognised, drag-chain compatible, tinned braided shield. RoHS approved.
Number of wires	6
Outer diameter	6.9 ±0.3 mm
Wires AWG	Green/Yellow/Blue/Pink 2 × 2 × 0.2 mm ² + Red/Black 2 × 0.38 mm ²
Cable bending radius *	Fixed installation: 35 mm, free movement: 69 mm, for continuous flexing: 83 mm
Mass	61 g/m
Torsion	Continuous torsion not allowed

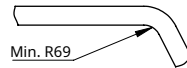
* Please see the chapter [Cable bending radius](#).

Cable bending radius

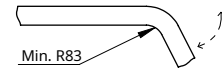
Fixed laying application



Flexible application



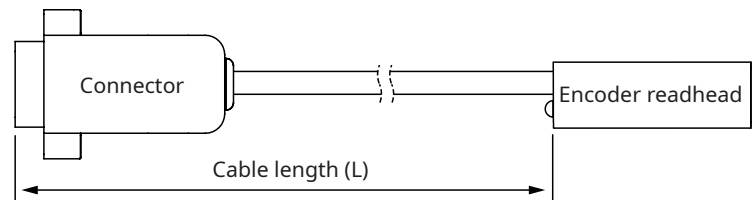
Continuously flexible application



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

Cable tolerances

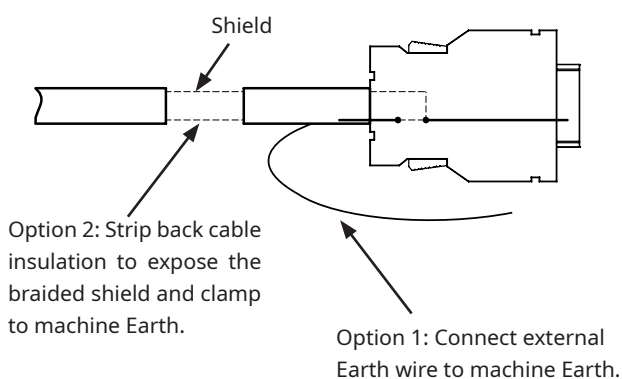
Cable length L [m]	Tolerance [mm]
≤ 2	+30/-0
2 < L ≤ 7	+40/-0
10 < L ≤ 15	+50/-0



Connecting the cable screen

The following arrangement should be applied to FANUC versions only.

The cable is supplied with the shield connected to pin 16 inside the connector, making the required connection to the FANUC equipment. The shield must also be connected to machine Earth, either by using the external Earth wire provided, or by cutting back the cable insulation to expose the shield and clamping that to machine Earth.

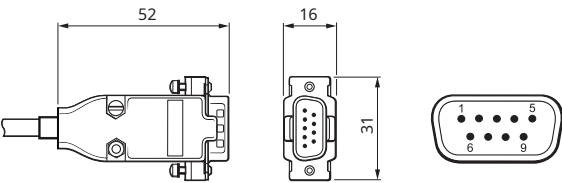


Electrical connections

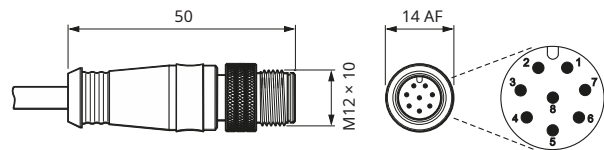
Pinout

Function	Signal	Wire colour	9 pin D type plug (option A)	10-way Mitsubishi (option C)	20-way Fanuc (option V)	M12 8-way (option W)	6-way Yaskawa (option Y)
Power	Vdd	Red	5	1	9, 20	2	1
	GND	Black	9	2	12, 14	5, 8	2
Serial communication	MR	Green	2	3	5	3	5
	MRR	Yellow	3	4	6	4	6
Reserved	-	Blue	6	-	-	7	-
	-	Pink	7	-	-	6	-
Shield	Shield	Shield	Case	Case	External shield, pin 16	Case	Case

9-way D-type connector

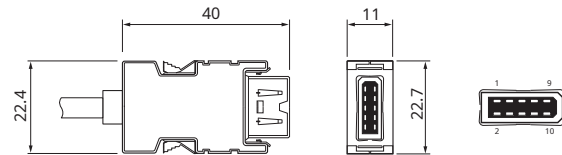


M12 8-way sealed connector (male type) *

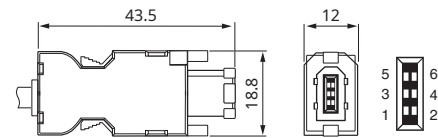


* Depending on availability. Available with overmoulded or metal housing connector version.

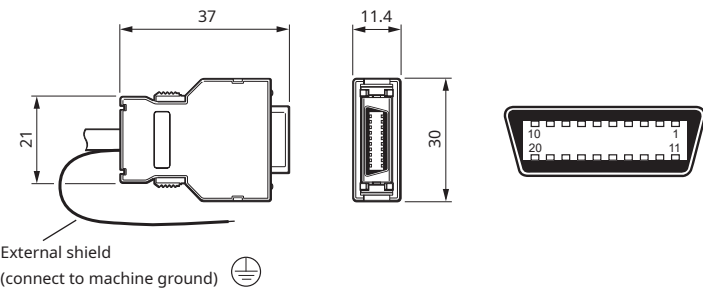
10-way Mitsubishi connector (MOLEX 54599-1019)



6-way Yaskawa connector

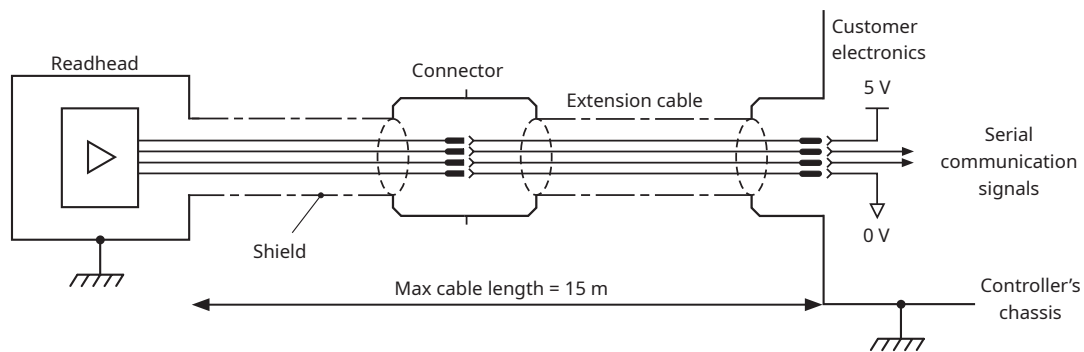


20-way Fanuc connector



Shield connection

Figure below shows a recommended shield termination in order to ensure electromagnetic compatibility.

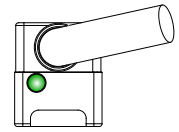


Housing of the encoder is galvanically connected with the housing of the connector. The encoder system must be correctly integrated to achieve EMC compliance. In particular, attention to shielding arrangements is essential.

Status indicator LED

After installing the AS10 magnetic scale, the readhead can be easily adjusted on the machine using the LED setup indicator. The LED indicator shows the internal status of the encoder and is used for encoder installation and diagnostics.

Slow flashing LED indicates that power is being supplied to the encoder, but communication between the encoder and the controller has not yet been established. The error status has a higher priority than the warning status in the LED signaling. The LED signaling may differ from the encoder status signaled by the controller.



LED Status	Status	Description
	Green	Normal operation Position data is valid.
	Orange	Warning Position data is valid. The internal temperature is near operational limits.
	Red	Error Position data is not valid. Possible causes: - The distance between the readhead and the magnetic scale is too large. - Signal lost. - The readhead is out of alignment with the magnetic scale or the magnetic scale is demagnetised. - Incorrect orientation of the readhead and the magnetic scale. - The internal temperature is out of the operational limits. - The encoder speed is out of operational limits.
	Fast red flashing	Error Position data is not valid. Internal system error.
	Slow red or green flashing	/ The communication has not been established.
	No light	No power supply /

During installation, the readhead must be moved for more than 10 mm above the magnetic scale to see the current encoder status on LED. The change from red to green color LED indicates a correctly installed encoder. After successful installation, perform a power off/on cycle.

The LED signal statuses listed in the table above do not indicate non-optimal installation of the readhead, e. g. an accuracy outside the specified range.

Troubleshooting

If the readhead reports an error during operation as a result of incorrect decoding of absolute position on the magnetic scale, this indicates a serious problem. Serious problems include incorrect installation or damaged magnetic scale. To determine the cause of the problem, proceed as follows:

- Verify that the installation matches the specification of the encoder for the orientation of the readhead relative to the scale (ride height, lateral offsets and yaw/pitch/roll tolerances)
- If possible, check the error location on the magnetic scale with the magnet viewer for the abnormal pattern in the magnetic code

Once the cause of the error has been identified, power cycle the readhead (OFF-ON) or move it at least 10 mm along the magnetic scale.

The same behaviour occurs if the application causes the readhead to lose overlap with the magnetic scale. When overlap is re-established from either side, the error will clear automatically after the readhead travels at least 10 mm over a valid position.

Output type

Fanuc

Interface type	Alpha-I, Type-6, 2-wire (one pair transmission)
Supported controllers *	• 30iB, 0i-D, F from its first version • Series 15i, 16i, etc. 90B1 series/following versions from K(11) • Series 30i, etc. 90D0, 90E0 series/following versions from P(16)

Mitsubishi

Interface type	2-wire RS-485 half-duplex
Supported controllers *	MR-J4 (140J at the end of the PN)
Compatible software version of the controller/servo	From version C3 onwards

Yaskawa

Interface type	Yaskawa Sigma-LINK, (2-wire, one pair transmission)
Supported controllers *	Sigma-7 (4 Mbps mode only) and Sigma-X/10 (4 Mbps mode only)

* Not all controllers are listed. Please contact the controller manufacturer to confirm product compatibility.

Part numbering

Readhead

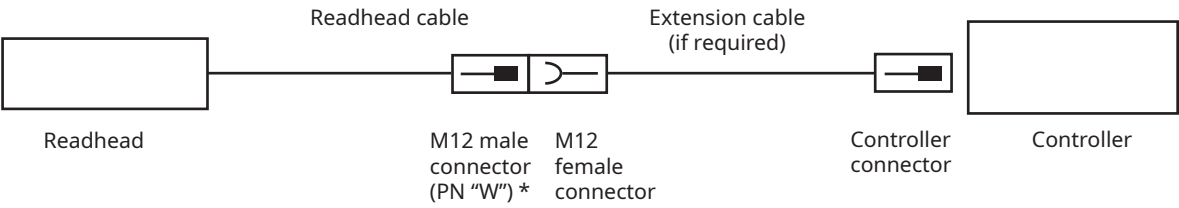
	LA12	MS	A	13B	A	A	50D	C	00
Communication interface									
FA - Fanuc interface									
MS - Mitsubishi interface									
YA - Yaskawa interface									
Communication interface variant									
A - Two-wire interface (half-duplex RS485)									
Resolution									
For FA:									
8D0 - 0.25 µm									
For YA:									
13B - 0.244140625 µm									
12B - 0.48828125 µm									
11B - 0.9765625 µm									
For MS:									
13B - 0.244140625 µm									
12B - 0.48828125 µm									
11B - 0.9765625 µm									
2D0 - 1 µm									
1D0 - 2 µm									
Minimum edge separation									
A - N/A									
Power supply									
A - 5 V (regardless of cable length up to 15 m)									
Cable length									
10D - 1 m									
20D - 2 m									
30D - 3 m									
40D - 4 m									
50D - 5 m									
70D - 7 m									
10M - 10 m									
12M - 12 m									
15M - 15 m									
Maximum cable length is 15 m. If extension cable is used, the readhead cable length + extension cable length must not exceed 15 m.									
Connector options									
A - 9 pin D type plug									
C - 10-way Mitsubishi (Molex 54599-1019)									
F - Flying leads (no connector)									
V - 20-way Fanuc connector									
W - Overmould/metal-housed M12 male *									
Y - 6-way Yaskawa									
* Depending on availability. Available with overmoulded or metal housing connector version. Overmoulded M12 connectors with cable lengths 2m, 5 m and 10 m are available from stock. Longer delivery times apply for other lengths with the overmoulded connector.									
Special requirements									
00 - No special requirements (standard)									
12 - Perpendicular cable outlet**									
** Only available for MS (Mitsubishi) communication output									

For the extension cable (Female M12 to dedicated connector), please [see page 14](#).

Table of available combinations

Series	Communication interface	Comm interface variant	Resolution	Minimum edge separation	Power supply	Cable length	Connector option	Special requirements
LA12	FA	A	8D0	A	A	10D / 20D / 30D / 40D / 50D / 70D / 10M / 12M / 15M	A / F / V / W	00 / 12
	MS		13B / 12B / 11B / 2D0 / 1D0				A / C / F / W	
	YA		13B / 12B / 11B				A / F / W / Y	

Extension cable



* Input of the extension cable is M12 female overmould connector. When using an extension cable the LA12 readhead must be ordered with M12 (PN "W") connector.

	EC	12000	A	V	00
Extension cable					
EC - Extension cable					
Cable length *					
04000 - 4 m					
05000 - 5 m					
07000 - 7 m					
10000 - 10 m					
12000 - 12 m					
15000 - 15 m					
DDDDD - Cable length in mm					
* Cable length 2 m, 5 m and 10 m available from stock. Longer delivery times apply for other lengths.					
Readhead compatibility					
A - LA12					
Output connector type					
V - FANUC connector					
Y - Yaskawa connector					
C - Mitsubishi connector					
F - Flying leads					
A - 9-pin D-type plug					
W - Overmould/metal-housed M12 male **					
** Depending on availability. Available with overmoulded or metal housing connector version.					
Special requirements					
00 - No special requirements (standard)					

Accessories



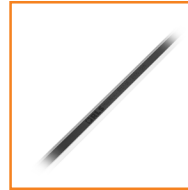
End clamp kit
LM10ECL00
(2 clamps + 2 fasteners)



Magnet viewer
MM0001



Track section, 1.00 m
TRS100A00
(1x fastener M3x10 included)



Track section, 2.00 m
TRS200A00
(1x fastener M3x10 included)



Fastener and washer
TRC00



Scale clamp with fasteners,
0.04 m
TRE004A00
(2x fastener M3x10 and 1x fastener
M2x4 included)



Extension cable
See **page 14** for more information.

Packaging

Each readhead is packed individually in an antistatic bag, according to ESD protection measures.

Head office

RLS Merilna tehnika d. o. o.

Poslovna cona Žeje pri Komendi
Pod vrbami 2
SI-1218 Komenda
Slovenia

T +386 1 5272100
E mail@rls.si

www.rls.si

Global support

Visit our [website](http://www.rls.si) to contact your nearest sales representative.

Document issues

Issue	Date	Page	Description
4	31. 1. 2023	4	Dimensions drawings amended
		8	Cable tolerances added
5	17. 5. 2023	8	Cable tolerances amended
		14	Accessories added
6	12. 2. 2024	11	Yaskawa output amended
		12	Readhead part numbering amended
		14	Part numbering for cable added
7	8. 10. 2025	4-5, 12-13	Perpendicular cable option added
8	2. 4. 2026	11	Yaskawa output amended

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