



OTV
Precision Sensing



OTV AL200

Absolute Magnetic Encoder System

Product Manual — Linear Displacement Sensor



1. Product Overview

The AL200 is a true absolute magnetic grid encoder system designed for a wide range of automated motion control applications. It serves as a high-precision position and velocity feedback unit for linear motion axes. The encoder features IP67 epoxy potting for reliable, stable operation in harsh industrial environments.

Key Applications

Direct Drive: Linear motors, voice coil actuators

Semiconductor: Wafer handling, pick-and-place, inspection

Lithium Battery: Electrode winding, stacking, slitting

Medical & Laser: Precision positioning stages, scanning systems

3C & New Energy: Automated assembly, testing, inspection

CNC & Traditional: Machine tools, general automation equipment

2. Features & Advantages

True Dual-Track Absolute Magnetic Encoder: Genuine dual-code-track absolute encoding: one incremental track (2 mm pole pitch) + one absolute binary-coded track

High-Speed Operation: Velocity up to 5 m/s with low latency and fast response time

Rugged Design & Superior EMC: Stainless steel encoder body; shielded high-flex PUR cable; excellent electromagnetic compatibility

IP67 Epoxy Resin Potted: Fully sealed against dust and water immersion; reliable in harsh environments

Multi-Protocol Support: BiSS-C, SSI, Tamagawa, Panasonic, RS-485 serial communication protocols

Large Measurement Range: Cycle encoding length 16,384 mm; max measurement length 16.3 m

Ultra-High Resolution: Down to 0.1 μ m resolution

Fast Startup: Absolute position available within 350 ms after power-up; no homing required

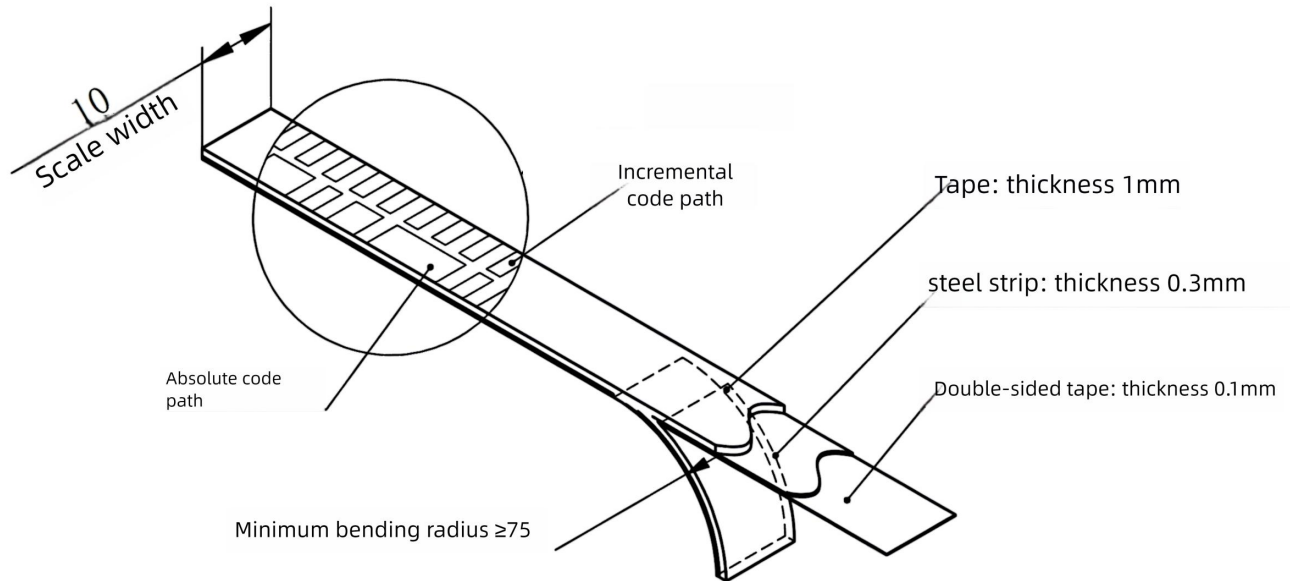
The AL200 provides accurate absolute physical position information within 350 ms of power-up. Its non-contact, wear-free measurement principle combined with robust internal safety algorithms ensures extremely stable and reliable operation.

3. Dual-Track Magnetic Scale Structure & Dimensions

The magnetic scale consists of two code tracks:

Track	Type	Pole Pitch	Function
Incremental Track	Uniform, regularly-spaced poles	2 mm	High-precision position interpolation
Absolute Track	Binary-coded pattern	—	Absolute position encoding over 16,384 mm cycle

NOTE: The encoder must be oriented correctly relative to the dual-track direction of the magnetic scale. The scale's printed markings indicate orientation. The encoder's effective sensing area is 4.1 x 10 mm centered on the bottom of the encoder head.



4. Encoder Structure & Orientation Guide

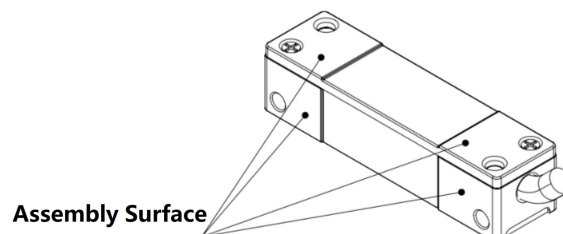
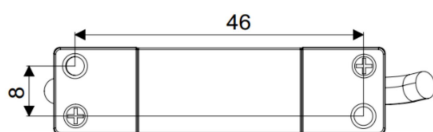
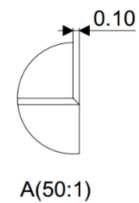
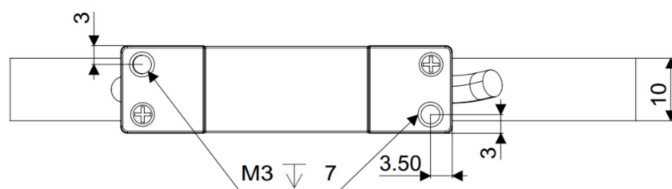
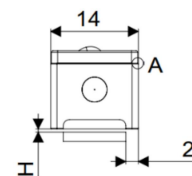
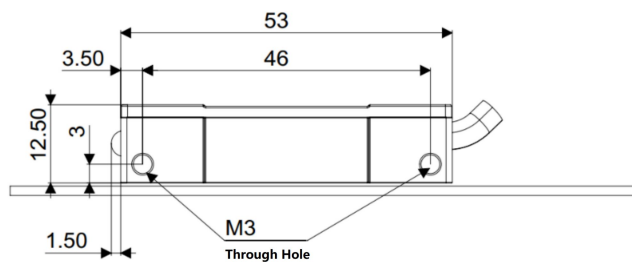
Key orientation features:

Incremental sensing window (light black printed window) — must align with the incremental track on the magnetic scale

Absolute sensing window — reads the binary-coded absolute track

During assembly, the light black printed window must be on the same side as the incremental magnetic scale track

NOTE: Installation tip: Cable exit on the left, incremental track on the bottom — easier to insert spacer gauge during setup.





5. Storage & Handling Precautions

Minimum bend radius of magnetic scale during handling: > 60 mm

Each encoder readhead is individually packaged in an anti-static ESD bag

Store in a clean, dry environment; avoid exposure to strong magnetic fields

Do not stack heavy items on top of packaged encoders or magnetic scales

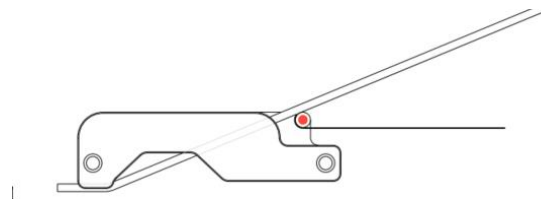
6. Installation Instructions

6.1 Installation Spacing

The encoder-to-scale gap must be maintained at 0.2 – 0.6 mm across the entire measurement length. A plastic spacer gauge (feeler gauge) of 0.3 mm thickness is recommended for optimal installation.

6.2 Installation Procedure

1. Clean the mounting surface thoroughly.
2. Apply the magnetic scale using the scale applicator tool for guided alignment — ensure correct orientation per the printed direction markings.

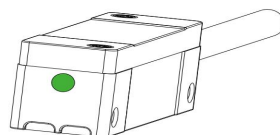


Encoder scale assembly tool

3. Insert the plastic spacer gauge (0.2–0.6 mm) between the encoder and the scale.
4. Ensure the encoder, spacer, and scale are in full, firm contact.
5. Align the encoder so its incremental sensing window matches the incremental track side of the scale.
6. Center the encoder laterally over the scale.

6.3 LED Verification After Installation

WARNING: The encoder LED indicator must be GREEN at all positions along the entire measurement length. After installation, move the encoder at least 10 mm along the scale to verify LED status. Red to Green = correct installation. If not green at any position, the system will not function correctly.



7. Installation Tolerances

Parameter	Tolerance
Operating Gap (Readhead to Scale)	0.2 – 0.6 mm



Longitudinal Tilt Angle	±0.5°
Alignment Yaw Angle	±1°
Lateral Offset	±0.2 mm
Side Roll Angle	±0.5°

WARNING: The encoder-to-scale gap must be strictly maintained throughout the entire measurement range. Any contact friction or excessive gap will cause measurement errors or system failure.

7.1 External Magnetic Field Sensitivity

The AL200 absolute encoder system is sensitive to external magnetic fields:

Field Strength	Effect
< 1 mT	May reduce system accuracy
> 1 mT	May cause system malfunction or erroneous absolute position output
> 25 mT	IRREVERSIBLE damage to magnetic scale; replacement required

8. Cable Installation & Bend Radius

Parameter	Specification
Cable Type	Black, PUR high-flex, UL AWM, drag-chain compatible, tinned copper braid shielded, RoHS
Conductors	8 cores (4 twisted pairs)
Outer Diameter	5.0 ± 0.15 mm
Wire AWG	4 x 2 x 0.05 mm ² (red/gray, white/blue, brown/yellow, green/black)
Bend Radius – Fixed	35 mm
Bend Radius – Free Movement	69 mm
Bend Radius – Continuous Flex	83 mm
Cable Weight	31 g/m
Torsion	Continuous torsion not permitted

9. System Specifications

9.1 Mechanical & Performance Parameters

Parameter	Value
Pole Width (Incremental Track)	2 mm
Maximum Measurement Length	16 m
Absolute Encoding Cycle Length	16,384 mm
System Accuracy	±20 µm/m to ±40 µm/m
Repeatability	< 2 µm (at 0.2 mm installation gap)
Unidirectional Repeatability	< 1 µm
Resolution	Down to 0.1 µm
Maximum Velocity	5 m/s
Encoder Body Material	Stainless Steel
Encoder Weight	105 g (readhead with 0.5 m cable, DB9 connector)

9.2 Electrical Parameters

Parameter	Value
Supply Voltage	4.75 V to 5.5 V DC (at connector), reverse polarity protected
Power Consumption	< 200 mA (5 V supply, 10 m cable length, no load)
Startup Time	< 350 ms (power-up to valid data)
Position Data Latency	< 62.5 µs

9.3 Environmental Parameters

Parameter	Value
Operating Temperature	-10°C to +55°C
Storage Temperature	-20°C to +85°C
Vibration (55–2000 Hz)	300 m/s ² (IEC 60068-2-6:2007)
Shock (11 ms)	300 m/s ² (IEC 60068-2-27:2008)
Humidity	100% RH (condensation permitted)
EMC Immunity	EN IEC 61000-6-2:2019



EMC Emissions	EN IEC 61000-6-4:2019
Environmental Sealing	IP67 (IEC 60529:1992+A2:2013)
Permissible External Magnetic Field	< 1 mT (operating)

10. Electrical Connections & Pinouts

Wire Color Code & Signal Assignments (OD: 5.0 mm PUR cable, 8-core)

Wire Color	BiSS-C Signal	SSI Signal	Panasonic/Tamagawa	DB9 Pin	DB15 Pin
Red	+5V	+5V	+5V	5	7,8
Gray	0V	0V	0V	9	2,9
White	SLO+	DATA+	PS	4	14
Blue	SLO-	DATA-	/PS	8	6
Brown	MA+	CLK+	—	3	13
Yellow	MA-	CLK-	—	7	5
Green	485_A	485_A	—	2	12
Black	485_B	485_B	—	6	4
Braid (Shield)	Shield	Shield	Shield	Shell	Shell

11. LED Status Indicator & Diagnostics

The LED indicator on the encoder displays the internal status and is used for installation alignment and diagnostics.

LED State	Status	Description
Green (Solid)	Normal Operation	Position data valid; system functioning correctly
Orange (Solid)	Warning	Position data valid but signal strength at critical threshold
Red (Solid)	Error	Position data invalid. Causes: excessive gap, incorrect orientation, scale demagnetization/damage
Slow Flash	Power On / No Comms	Power supplied but communication with controller not yet established
Orange (Solid)	PC Software Mode	Connected to PC software for calibration and parameter configuration
Orange to Green	Initialization Done	Power-up initialization completed successfully
Red to Orange (Flash)	Motion Error	Error detected during motion; stopped, awaiting handling
Red to Green (Flash)	RS-485 Mode Entry	Power-up into RS-485 mode; R-Y-G sequence repeats 3 times then enters running state

WARNING: During installation, move encoder at least 10 mm along scale to observe LED. Red to Green = correct. After install, LED must remain GREEN across entire travel range.

12. Accessories

Accessory	Description	Purpose
Magnetic Viewer Card	Magnetic field visualization film	Visual inspection of scale tracks for damage/errors
Scale Hold-Down Clamps	Mechanical clamps	Secure magnetic scale ends to mounting surface
Feeler Gauge Set	0.1–0.6 mm plastic spacers	Precise encoder-to-scale gap (0.3 mm recommended)
Scale Applicator Tool	10 mm guide channel tool	Guided alignment for precise magnetic scale application

13. Absolute Magnetic Scale — Technical Specifications

Parameter	Value
Product Model	AL200
Encoding Type	Absolute encoding, dual-track system
Incremental Track Pole Pitch	2 mm
Maximum Length	16 m
Accuracy Grade	±20 um/m - ±40 um/m



Linear Thermal Expansion Coefficient	$\alpha \approx 16 \times 10^{-6} / \text{K}$
Minimum Bend Radius	> 60 mm
Magnetic Material	NBR-bonded elastic ferrite
Operating / Storage Temperature	-20°C to +70°C