Mitutoyo

Mitutoyo Quality

Digital Scale and DRO Systems

Scale Units and Display Counters
Linear Scale DRO Systems

Catalog No.E13000(7)

Accurate, yet Affordable, DRO System from Mitutoyo

Mitutoyo's Linear Scale System tightly couples linear scale units with dedicated Digital Readout (DRO) units to offer accurate detection and display of axial displacement for machine tools and measuring equipment. The Linear Scale System can be configured to best meet your specific application, whether it be machining or measuring, just by choosing a suitable combination of scale unit and display unit. The Linear Scale System has superior ease-of-use and is reliable, both of which are features that can dramatically improve machining accuracy and efficiency.

Features of the Linear Scale System

1. Digital counter value display allows quick and accurate readout of displacement. Working efficiency thus greatly improved.
2. Zero-setting or presetting possible at any position. Versatile functions eliminate calculations or complicated key operations for positioning.
3. Various external output features allow output of current display values or various data to external devices such as PCs or sequencers. Easy data processing can be performed.

Detection principle of linear scales

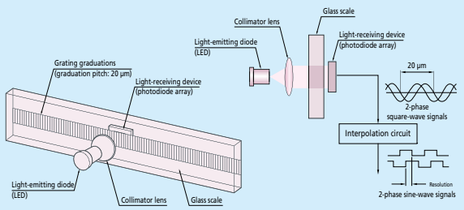
■ OVERVIEW

● The assembly-type Linear Scale (AT) is a scale protected by a frame. Our product line-up now fully covers both incremental/absolute systems for table position control of machine tools.

■ FEATURES

1. Excellent environment resistance, vibration resistance and shock resistance.
2. Requires no signal adjustment and easy-to-install.
3. A high degree of freedom for detection head mounting.
4. Solid and simple structure.

Operating Principle of AT103/AT113 Models

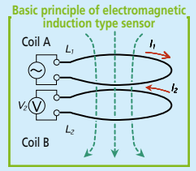


The assembly-type Linear Scale® uses a highly accurate glass scale grating pitch of 20 µm as the basic standard of length.
The grating is irradiated with parallel light generated with a Light-Emitting Diode (LED) and collimator lens. The parallel light transmitted through the grating generates an interference pattern with the same pitch as that of a grating on the photodiode array of the light-receiving device. The receiver output signal is 2-phase sinusoidal with a wavelength of 20 µm, identical to the pitch of the grating graduations, and is electrically converted to 2-phase square-wave signals by the interpolation circuit. The much smaller working resolution is achieved by detecting the cyclic variation in light intensity incident on the receiver array, as the scale is displaced in a measuring direction, and interpolating accordingly to output a corresponding displacement value.

Detecting Principle Added to AT715

The Absolute system-type linear scale AT715 employs a unique, Mitutoyo-proprietary, electromagnetic induction principle that is highly resistant to environmental contamination. Achievement of a true absolute scale with a resolution of 1 µm, thanks to a multi-track configuration, enables the user to obtain absolute positional information from the scale immediately power is applied to the counter.

Basic principle of electromagnetic induction type sensor



- If time-varying current I_1 is applied to coil A, a magnetic flux is generated inside the coil.
- A current I_2 is induced in coil B that tends to oppose the build-up of the magnetic flux.

The magnetic permeability between the coils will not vary whether the medium is air, water, or oil.

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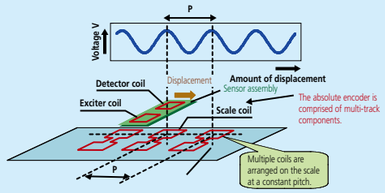
The electromagnetic induction type sensor has excellent water resistance and oil resistance.

Operating Principle of Electromagnetic Induction Type Encoder



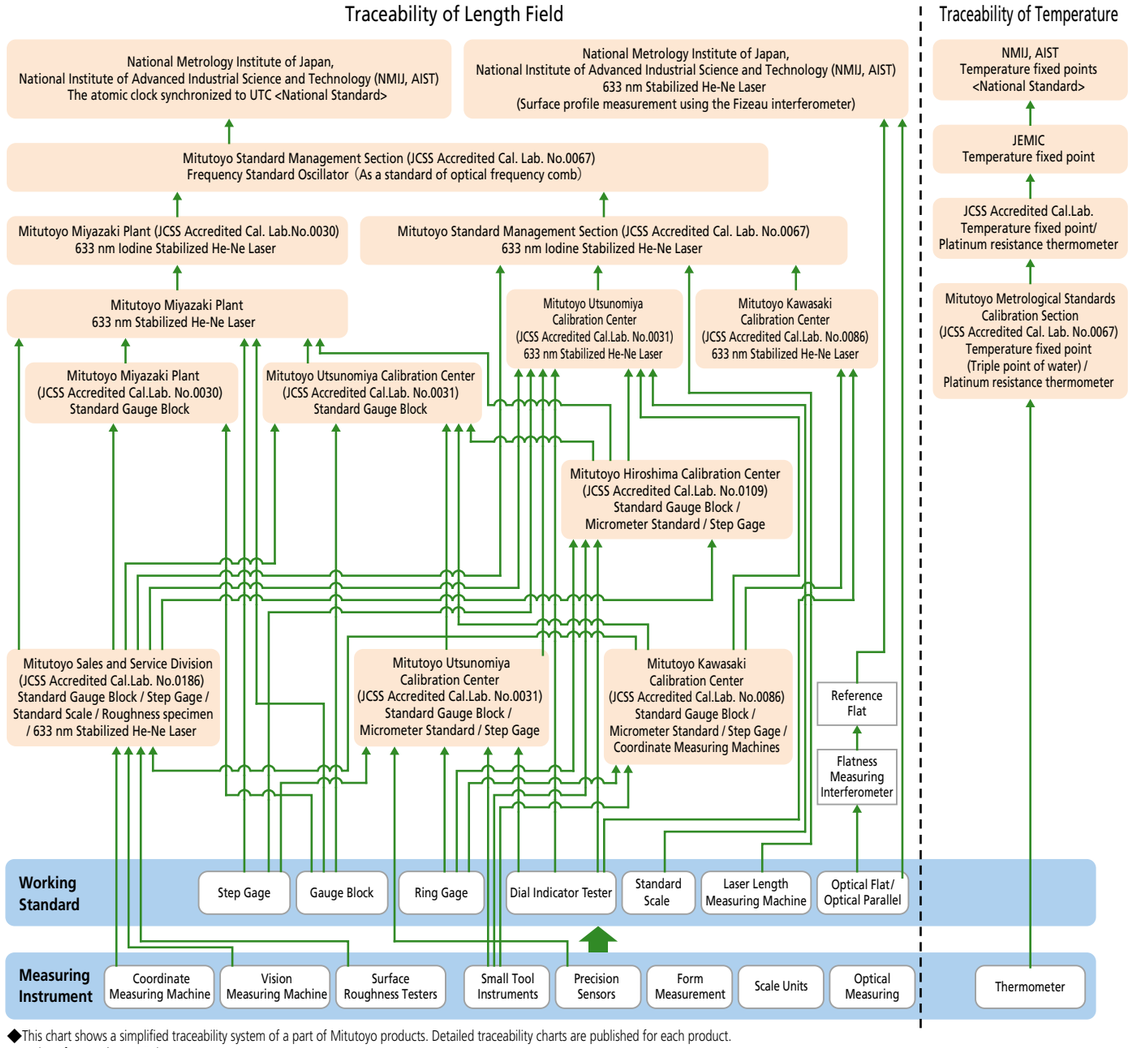
Note 1: Export to EU Member Countries
When you intend to export this product to any of the EU member countries, you may be required to provide User's Manual(s) in English and the EU Declaration of Conformity in English (under certain circumstances, User's Manual(s) in the destination country's official language and the EU Declaration of Conformity in the destination country's official language). For detailed information, please contact Mitutoyo in advance.

Note 2: The WEEE Directive
The WEEE Directive*1 is a directive that mandates appropriate collection and recycling of electrical and electronic equipment waste. The purpose of this directive is to increase the reuse and recycling of these products, and seeks eco-friendly product design. To differentiate between equipment waste and household waste, a crossed-out wheeled-bin symbol is marked on a product. We will promote eco-friendly design for our products.
*1 WEEE Directive: Directive 2012/19/EU of the European Parliament and of the Council on waste electrical and electronic equipment.

Mitutoyo Linear Scales are traceable to the national standard

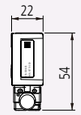
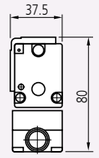
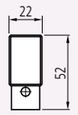
Traceability of Mitutoyo Standards

Mitutoyo ensures and maintains traceability of various types of precision measuring instruments by holding standards of length and other physical quantities that are directly traceable to the national standards for use in calibrating the working standards used for the calibration of measuring instrument products supplied to industry.

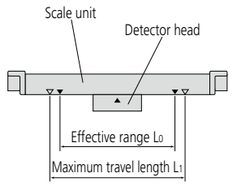


◆This chart shows a simplified traceability system of a part of Mitutoyo products. Detailed traceability charts are published for each product.
(As of November, 2024)

For the latest information, please refer to our website. **https://www.mitutoyo.co.jp**

Model		AT715 ABSOLUTE and High Environmental Resistance Type	AT103 Standard-size Type	AT113 Slim Type
				
Sectional dimensions		 Section size 22 × 54 mm	 Section size 37.5 × 80 mm*1	 Section size 22 × 52 mm
Measurement method		Electromagnetic induction system	Photoelectric: Transparent linear encoder Light source: LED Receptor: Phototransistor	
Output wave form		—	2-phase sine curves with a phase difference of 90°	
Effective range*2		100 - 3000 mm	1600 - 6000 mm	100 - 1500 mm
Accuracy (20 °C)*3		± 5 μm (100 to 500 mm*) ± 7 μm (600 to 1800 mm*) ± 10 μm (2000 to 3000 mm*) *effective measurement length	AT103, AT113: (5+5L0/1000) μm L0: Effective range High-accuracy type*4 is (3+3L0/1000) μm Super high-accuracy type*5 is (2+2L0/1000) μm	
Maximum response speed		50 m/min	120 m/min*6	
Scale reference point		—	At every 50 mm interval	
Linear expansion coefficient		—	(8 ± 1) × 10⁻⁶/K	
Power supply		5 VDC ± 5 %	5 VDC ± 5 %	
Max. current consumption		70 mA	70 mA	60 mA
Operating/Storage temperature		0 to 45 °C/-20 to 70 °C		
Operating/Storage temperature (relative humidity)		0 to 50 °C/-20 to 70 °C	0 to 45 °C/-20 to 70 °C	
Head cable length		—	—	0.3 m
Dust/water protection level		IP67	—	
Sliding force		5 N or less	5 N or less	
Signal cable*7		Standard accessory (refer to individual specifications for the length)		
Extension cable*8 (optional) (Conduit type)	Length	Code No.	Code No.	
	2 m	09AAB674A	09AAA033A	
	5 m	09AAB674B	09AAA033B	
	7 m	09AAB674C	09AAA033C	

*1: 37.5 × 95.5 mm for the AT103-3250 or larger models.
*2: Make sure that the linear scale's maximum travel distance (L1) is greater than the maximum travel distance of the machine when selecting a linear scale size. Also, since the assured accuracy is limited within the effective range (L_0), select a linear scale size with this in mind.
*3: (5+8L_0/1000) μm for the AT103-3250 or larger models.
*4: It is possible to manufacture 1600 - 2000 mm for type F of the AT103; 100 - 1500 mm for type F of the AT113.
*5: It is possible to manufacture 100 - 500 mm for type S of the AT113.
*6: 50 m/min for the AT103-3250 or larger models.
*7: Vinyl-coated type signal cable and extension cable are available on request.
*8: The maximum extension length of AT715 is 15 m in total.



Scale unit

ABSOLUTE and High Environmental Resistance Type Scale Unit

AT715

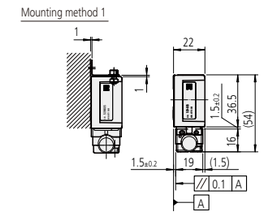
Absolute scale unit with excellent resistance to harsh environments

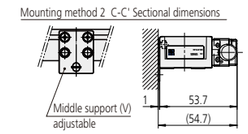
Reference dimensions for mounting

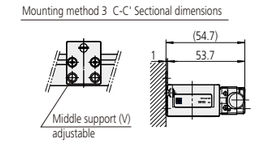
Effective range 100 – 3000 mm

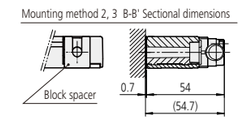
ABSOLUTE™ IP67

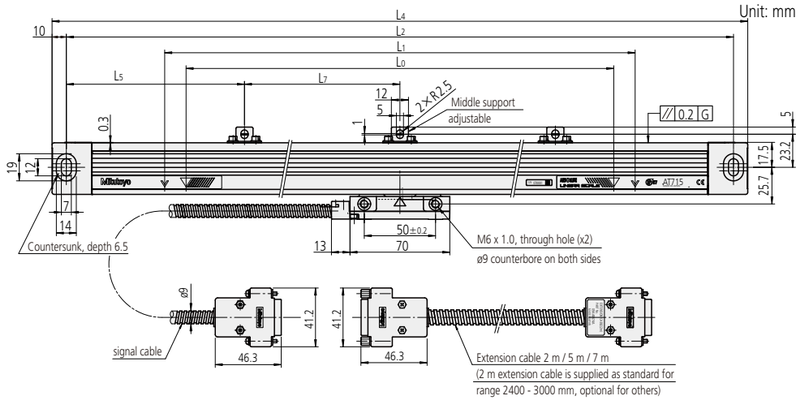
Unit: mm



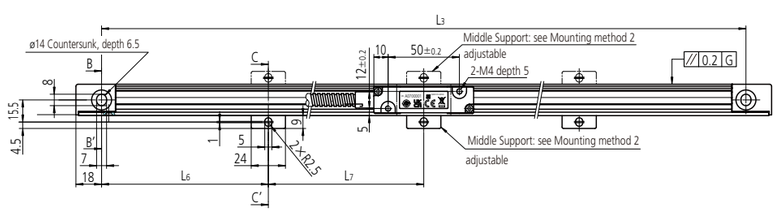








G: Machine guide



AT715		Effective range L0 (mm)	Maximum travel length L1 (mm)	Mounting hole pitch L2 (mm)	Mounting hole pitch L3 (mm)	Overall length L4 (mm)	Middle support positions L5 (mm)	Middle support positions L6 (mm)	Middle support positions L7 (mm)	Signal cable length (m)
Code No.	**Model**									
539-801N	**AT715-100**	100 (4 in)	120 (4.72 in)	258 (10.16 in)	242 (9.53 in)	278 (10.94 in)				
539-802N	**AT715-150**	150 (6 in)	170 (6.69 in)	308 (12.13 in)	292 (11.50 in)	328 (12.91 in)				
539-803N	**AT715-200**	200 (8 in)	220 (8.66 in)	358 (14.09 in)	342 (13.46 in)	378 (14.88 in)				
539-804N	**AT715-250**	250 (10 in)	270 (10.63 in)	408 (16.06 in)	392 (15.43 in)	428 (16.85 in)				
539-805N	**AT715-300**	300 (12 in)	330 (12.99 in)	468 (18.43 in)	452 (17.80 in)	488 (19.21 in)				
539-806N	**AT715-350**	350 (14 in)	380 (14.96 in)	518 (20.39 in)	502 (19.76 in)	538 (21.18 in)				
539-807N	**AT715-400**	400 (16 in)	430 (16.93 in)	568 (22.36 in)	552 (21.73 in)	588 (23.15 in)				
539-808N	**AT715-450**	450 (18 in)	480 (18.90 in)	618 (24.33 in)	602 (23.70 in)	638 (25.12 in)				
539-809N	**AT715-500**	500 (20 in)	540 (21.26 in)	678 (26.69 in)	662 (26.06 in)	698 (27.48 in)	339 (13.35 in)	331 (13.03 in)		
539-811N	**AT715-600**	600 (24 in)	640 (25.20 in)	778 (30.63 in)	762 (30.00 in)	798 (31.42 in)	389 (15.31 in)	381 (15.00 in)		
539-813N	**AT715-700**	700 (28 in)	740 (29.13 in)	878 (34.57 in)	862 (33.94 in)	898 (35.35 in)	439 (17.28 in)	431 (16.97 in)		
539-814N	**AT715-750**	750 (30 in)	780 (30.71 in)	918 (36.14 in)	902 (35.51 in)	938 (36.93 in)	459 (18.07 in)	451 (17.76 in)		
539-815N	**AT715-800**	800 (32 in)	840 (33.07 in)	978 (38.50 in)	962 (37.87 in)	998 (39.29 in)	489 (19.25 in)	481 (18.94 in)		
539-816N	**AT715-900**	900 (36 in)	940 (37.01 in)	1078 (42.44 in)	1062 (41.81 in)	1098 (43.23 in)	539 (21.22 in)	531 (20.91 in)		
539-817N	**AT715-1000**	1000 (40 in)	1040 (40.94 in)	1178 (46.38 in)	1162 (45.75 in)	1198 (47.17 in)	589 (23.19 in)	581 (22.87 in)		
539-818N	**AT715-1100**	1100 (44 in)	1140 (44.88 in)	1278 (50.31 in)	1262 (49.69 in)	1298 (51.10 in)	424 (16.69 in)	416 (16.38 in)	430 (16.93 in)	
539-819N	**AT715-1200**	1200 (48 in)	1240 (48.82 in)	1378 (54.25 in)	1362 (53.62 in)	1398 (55.04 in)	459 (18.07 in)	451 (17.76 in)	460 (18.11 in)	
539-820N	**AT715-1300**	1300 (52 in)	1340 (52.76 in)	1478 (58.19 in)	1462 (57.56 in)	1498 (58.98 in)	494 (19.45 in)	486 (19.13 in)	490 (19.29 in)	
539-821N	**AT715-1400**	1400 (56 in)	1440 (56.69 in)	1578 (62.13 in)	1562 (61.50 in)	1598 (62.91 in)	524 (20.63 in)	516 (20.31 in)	530 (20.87 in)	
539-822N	**AT715-1500**	1500 (60 in)	1540 (60.63 in)	1678 (66.06 in)	1662 (65.43 in)	1698 (66.85 in)	559 (22.01 in)	551 (21.69 in)	560 (22.05 in)	
539-823N	**AT715-1600**	1600 (64 in)	1640 (64.57 in)	1778 (70.00 in)	1762 (69.37 in)	1798 (70.79 in)	459 (18.07 in)	451 (17.76 in)	430 (16.93 in)	
539-824N	**AT715-1700**	1700 (68 in)	1740 (68.50 in)	1878 (73.94 in)	1862 (73.31 in)	1898 (74.72 in)	479 (18.86 in)	471 (18.54 in)	460 (18.11 in)	
539-825N	**AT715-1800**	1800 (72 in)	1840 (72.44 in)	1978 (77.87 in)	1962 (77.24 in)	1998 (78.66 in)	459 (18.07 in)	451 (17.76 in)	530 (20.87 in)	
539-860N	**AT715-2000**	2000 (80 in)	2040 (80.31 in)	2178 (85.75 in)	2162 (85.12 in)	2198 (86.54 in)	539 (21.22 in)	531 (20.91 in)	550 (21.65 in)	
539-861N	**AT715-2200**	2200 (88 in)	2240 (88.19 in)	2378 (93.62 in)	2362 (92.99 in)	2398 (94.41 in)	469 (18.46 in)	461 (18.15 in)	480 (18.90 in)	
539-862N	**AT715-2400**	2400 (96 in)	2440 (96.06 in)	2578 (101.50 in)	2562 (100.87 in)	2598 (102.28 in)	509 (20.04 in)	501 (19.72 in)	520 (20.47 in)	
539-863N	**AT715-2500**	2500 (100 in)	2540 (100.00 in)	2678 (105.43 in)	2662 (104.80 in)	2698 (106.22 in)	529 (20.83 in)	521 (20.51 in)	540 (21.26 in)	
539-864N	**AT715-2600**	2600 (104 in)	2640 (103.94 in)	2778 (109.37 in)	2762 (108.74 in)	2798 (110.16 in)	549 (21.61 in)	541 (21.30 in)	560 (22.05 in)	
539-865N	**AT715-2800**	2800 (112 in)	2840 (111.81 in)	2978 (117.24 in)	2962 (116.61 in)	2998 (118.03 in)	489 (19.25 in)	481 (18.94 in)	500 (19.69 in)	
539-866N	**AT715-3000**	3000 (120 in)	3040 (119.68 in)	3178 (125.12 in)	3162 (124.49 in)	3198 (125.91 in)	529 (20.83 in)	521 (20.51 in)	530 (20.87 in)	

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* Combination of a 5 m signal cable and a 2 m extension cable