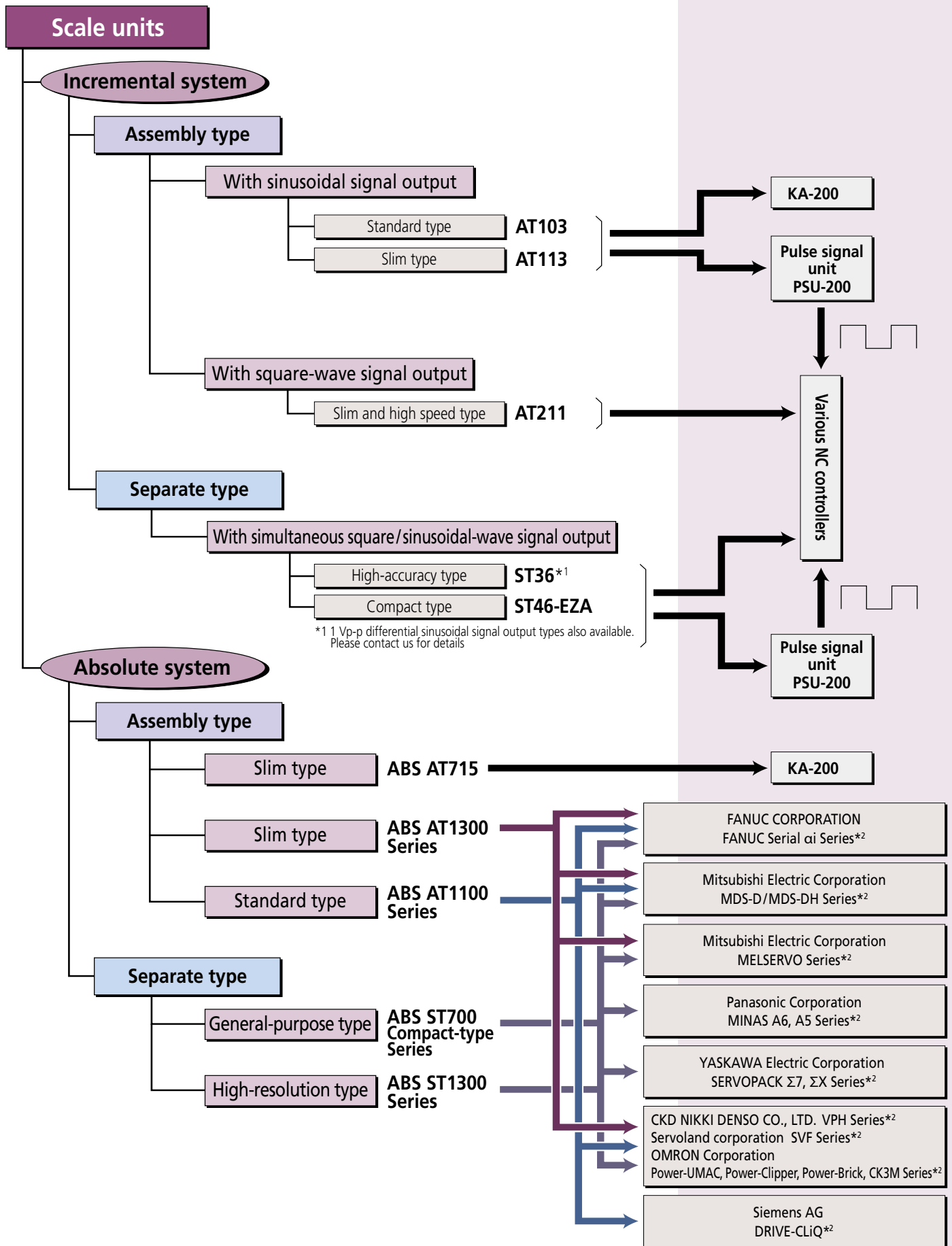


Linear Scales

Linear Scale System Diagram





- A wide choice of measuring range is available in this standard type scale unit.
- Connectable to the **KA-200** counter or **PSU-200**.

Linear Scales AT103
SERIES 539 — Standard Type



SPECIFICATIONS

Model	AT103
Effective range	100 to 6000 mm
Accuracy (20 °C)	Effective range 100 to 3000 mm: (5 + 5L ₀ /1000) μm Effective range 3250 to 6000 mm: (5 + 8L ₀ /1000) μm
Output signal	Two 90° phase-shifted sinusoidal signals
Maximum response speed	120 m/min (50 m/min when the effective measuring length is 3250 to 6000 mm)
Signal output pitch	20 μm
Scale reference point	Output in 50 mm pitch
Operating temperature	0 to 45 °C

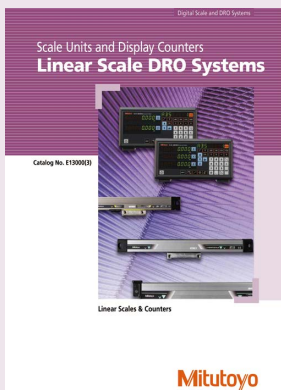
Note 1: High precision model **AT103F** (JIS Class 0, (3 + 3L₀/1000) μm) is also available to special order for the effective range of 100 to 2000 mm.

Note 2: Ultra-high precision model **AT103S** (2 + 2L₀/1000) μm is also available to special order for the effective range of 100 to 500 mm.

Note 3: The indication accuracy does not include quantizing error. L₀=Effective range (mm)

AT103		Effective range* L ₀ (mm)	Signal cable length (m)
Order No.	Model		
539-111-30	AT103-100	100 (4 in)	3
539-112-30	AT103-150	150 (6 in)	
539-113-30	AT103-200	200 (8 in)	
539-114-30	AT103-250	250 (10 in)	
539-115-30	AT103-300	300 (12 in)	
539-116-30	AT103-350	350 (14 in)	
539-117-30	AT103-400	400 (16 in)	
539-118-30	AT103-450	450 (18 in)	
539-119-30	AT103-500	500 (20 in)	
539-121-30	AT103-600	600 (24 in)	
539-123-30	AT103-700	700 (28 in)	5
539-124-30	AT103-750	750 (30 in)	
539-125-30	AT103-800	800 (32 in)	
539-126-30	AT103-900	900 (36 in)	
539-127-30	AT103-1000	1000 (40 in)	
539-128-30	AT103-1100	1100 (44 in)	
539-129-30	AT103-1200	1200 (48 in)	
539-130-30	AT103-1300	1300 (52 in)	
539-131-30	AT103-1400	1400 (56 in)	
539-132-30	AT103-1500	1500 (60 in)	
539-133-30	AT103-1600	1600 (64 in)	7
539-134-30	AT103-1700	1700 (68 in)	
539-135-30	AT103-1800	1800 (72 in)	
539-136-30	AT103-2000	2000 (80 in)	
539-137-30	AT103-2200	2200 (88 in)	
539-138-30	AT103-2400	2400 (96 in)	
539-139-30	AT103-2500	2500 (100 in)	
539-140-30	AT103-2600	2600 (104 in)	
539-141-30	AT103-2800	2800 (112 in)	
539-142-30	AT103-3000	3000 (120 in)	
539-143-30	AT103-3250	3250 (130 in)	10
539-144-30	AT103-3500	3500 (140 in)	
539-145-30	AT103-3750	3750 (150 in)	
539-146-30	AT103-4000	4000 (160 in)	
539-147-30	AT103-4250	4250 (170 in)	
539-148-30	AT103-4500	4500 (180 in)	
539-149-30	AT103-4750	4750 (190 in)	
539-150-30	AT103-5000	5000 (200 in)	
539-151-30	AT103-5250	5250 (210 in)	
539-152-30	AT103-5500	5500 (220 in)	
539-153-30	AT103-5750	5750 (230 in)	15
539-154-30	AT103-6000	6000 (240 in)	

* Models for the effective range 3250 mm or more are made-to-order.



Refer to the Linear Scale DRO Systems Brochure (**E13000**) for more details.

Linear Scales

Linear Scales AT113 SERIES 539 — Slim Type



- Slim type with unit sectional dimensions of 22×35 mm.
- Connectable to the **KA-200** counter or **PSU-200**.

SPECIFICATIONS

Model	AT113
Effective range	100 to 1500 mm
Accuracy (20 °C)	(5 + 5L ₀ /1000) μm
Output signal	Two 90° phase-shifted sinusoidal signals
Maximum response speed	120 m/min
Signal output pitch	20 μm
Scale reference point	Output in 50 mm pitch
Operating temperature	0 to 45 °C

Note 1: High precision model **AT113F** (JIS Class 0, 3 + 3L₀/1000) μm is also available to special order.

Note 2: Ultra-high precision model **AT113S** (2 + 2L₀/1000) μm is also available to special order for the effective range 100 to 500 mm.

Note 3: The indication accuracy does not include quantizing error. L₀=Effective range (mm)

AT113		Effective range L ₀ (mm)	Signal cable length (m)
Order No.	Model		
539-201-30	AT113-100	100 (4 in)	3
539-202-30	AT113-150	150 (6 in)	
539-203-30	AT113-200	200 (8 in)	
539-204-30	AT113-250	250 (10 in)	
539-205-30	AT113-300	300 (12 in)	
539-206-30	AT113-350	350 (14 in)	
539-207-30	AT113-400	400 (16 in)	
539-208-30	AT113-450	450 (18 in)	
539-209-30	AT113-500	500 (20 in)	
539-211-30	AT113-600	600 (24 in)	
539-213-30	AT113-700	700 (28 in)	
539-214-30	AT113-750	750 (30 in)	
539-215-30	AT113-800	800 (32 in)	
539-216-30	AT113-900	900 (36 in)	
539-217-30	AT113-1000	1000 (40 in)	5
539-218-30	AT113-1100	1100 (44 in)	
539-219-30	AT113-1200	1200 (48 in)	
539-220-30	AT113-1300	1300 (52 in)	
539-221-30	AT113-1400	1400 (56 in)	
539-222-30	AT113-1500	1500 (60 in)	



Refer to the Linear Scale DRO Systems Brochure (**E13000**) for more details.



- This is a slim, sealed, 2-phase, square-wave scale that can be directly connected to a control unit.
- Scale alarm LED enables easy maintenance.
- A wide range of specifications to best suit your application.
- Suitable for the control (positioning and speed) of semiconductor manufacturing systems and NC machine tools.

**Linear Scales AT211-A (Multipoint mounting)
AT211-B (Double-end mounting)
SERIES 539 — Slim and high speed Type**

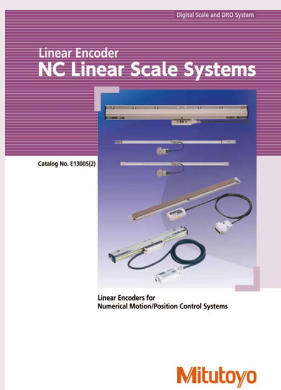
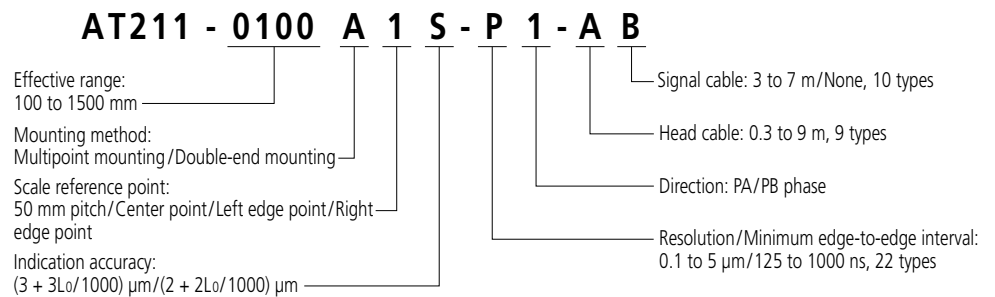


Common specification

Model	AT211
Effective range*	100 to 1500 mm
Accuracy (20 °C)*	(3 + 3L ₀ /1000) μm L ₀ =effective range (mm) (2 + 2L ₀ /1000) μm (L ₀ ≤500 mm)
Output signal	2-phase square-wave signals (RS-422A compatible)
Maximum response speed*	5.4 to 120 m/min (varies depending on the resolution or minimum edge interval)
Resolution*	0.1/0.2/0.5/1.0/2.5/5.0 μm
Scale reference point*	50 mm pitch/Center point/Left-edge point/Right-edge point
Operating temperature	0 to 45 °C

* Desired specification is selectable.

Meaning of Model No.



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.

Linear Scales



Linear Scales ABS AT1300 — Slim Type Assembly Type Scale Unit for Absolute Systems



ABS AT1300-S



ABS AT1300-H

SPECIFICATIONS

Model	High rigidity type	High accuracy type
	ABS AT13□□(A)-S	ABS AT13□□(A)-H
Detection method	Optical	
Resolution	0.001/0.01/0.05 μm	
Maximum response speed	3 m/s	
Maximum effective measuring length	2.2 m	1 m
Accuracy (20 °C)*1	(3 + 3L _o /1000) μm	(2 + 2L _o /1000) μm
Reference point*2	Center of the effective measuring length	
Operating temperature (humidity) range	0 to 50 °C (RH 20 to 80%, non-condensing)	
Storage temperature (humidity) range	-20 to 70 °C (RH 20 to 80%, non-condensing)	

*1 The indication accuracy does not include quantizing error. L_o=Effective range (mm)

*2 Scale is mechanically fixed at this point, therefore expansion caused by temperature fluctuations are relative to this point.

Meaning of Model No.

ABS AT13□□□ - □□□□ - □

Interface specifications

Effective range

Type of the scale unit

S : High rigidity type
H : High accuracy type

Model	Applicable system
ABS AT135□	FANUC CORPORATION Serial αi Interface
ABS AT134□	Mitsubishi Electric Corporation MDS-D/MDS-DH Series
ABS AT134□A	Mitsubishi Electric Corporation MELSERVO servo amplifier MR-J5 Series, MR-J4 Series
ABS AT138□A	YASKAWA Electric Corporation SERVOPACK Σ7, ΣX Series
ABS AT130□A	Mitutoyo ENSIS

Note 1: Be sure to contact each manufacturer for details of the applicable systems.

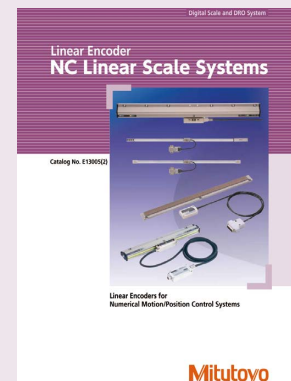
Note 2: ABS AT13□□□

Resolution Transmission method
7: 0.001 μm Nothing: Full duplex communication
4: 0.01 μm A: Half-duplex communication
3: 0.05 μm

Signal cable specifications (optional)

Items	Specifications
Cable length	1 m, 2 m, 3 m, 4 m, 5 m, 6 m, 7 m, 8 m, 9 m, 12 m
Cable material	PVC sheath (ø6.5 mm), High-flex connecting cable (No metal conduit)
I/O output connector	Flying lead specifications FANUC specifications Mitsubishi specifications D-sub specifications (Alarm display LED mounted)

- Outstanding resistance to contamination compared to conventional optical types by using a new detection principle (in-house testing result).
- Features a new coolant-proof design incorporating a high-performance rubber seal to provide higher reliability in the harsh factory environment.
- Delivers high accuracy and the outstanding resolution of 0.001 μm, the best-in-class in absolute scales.
- Allows space-saving design thanks to a slim form. (AT500-S and AT500-H are compatible with each other in installation.)
- Supports the interfaces of various manufacturers allowing a variety of system configurations.



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.

Linear Scales ABS AT1100 Assembly Type Scale Unit for Absolute Systems

- Features a new coolant-proof design incorporating a high-performance rubber seal to provide higher reliability in the harsh factory environment.
- The 0.4 mm air gap between the sensors is approximately four times wider than the conventional optical or magnetic sensors. Therefore, the chance of foreign objects lodging in this gap is lower. This air gap is the world's largest in this class of scale used on machine tools.
- The de facto standard multi-point fixing method for the frame is adopted, resulting in high vibration/shock-resistance.
- Due to an improvement in the signal processing technique for the electromagnetic induction ABSOLUTE linear encoder, the repeatability is six times better than our conventional model.
- Being compatible with the high-speed serial interface of each company, a direct connection to the NC controller is possible.



ABS AT1100

SPECIFICATIONS

Model	ABS AT11□3(A)
Detection method	Electromagnetic induction
Mounting method	Frame multipoint
Effective range	140 to 3040 mm
Resolution	0.05 μm
Maximum response speed	3 m/s
Accuracy (20 °C)	Effective range L ₀ =140 to 2040 mm: 3 + 5L ₀ /1000 (μm) Effective range L ₀ =2240 to 3040 mm: 5 + 5L ₀ /1000 (μm)
Expansion coefficient	≈8×10 ⁻⁶ /K
Vibration resistance	≤196 m/s ² (20 G) (55 to 2000 Hz)
Shock resistance	Effective range L ₀ =140 to 2040 mm: ≤ 343 m/s ² (35 G) Effective range L ₀ =2240 to 3040 mm: ≤ 294 m/s ² (30 G) (1/2 sin 11 ms)
Power supply voltage	ABS AT1153/1143/1103A: 5 VDC ± 10% ABS AT1123: DC24 V (Conforming to DRIVE-CLiQ)
Maximum current consumption	AT1153: 300 mA (Max.) AT1143: 290 mA (Max.) AT1123: 140 mA (Max.) AT1103A: 300 mA (Max.)
Operational temperature (humidity) ranges	0 to 50 °C (RH 20 to 80%, non-condensing)
Storage temperature (humidity) ranges	-20 to 70 °C (RH 20 to 80%, non-condensing)

Meaning of Model No.

ABS AT11□3 - □□□□
Effective range

Interface specifications

Model	Applicable system
ABS AT1153	FANUC CORPORATION Serial ai Interface
ABS AT1143	Mitsubishi Electric Corporation MDS-D/MDS-DH Series
ABS AT1123	Siemens AG DRIVE-CLiQ
ABS AT1103A	Mitutoyo ENSIS

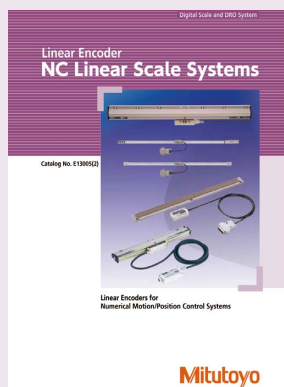
Note 1: Please contact each manufacturer for details of the applicable systems.

Note 2: ABS AT11□3□

- Transmission method
- Nothing: Full duplex communication
- A: Half-duplex communication

Signal cable specifications (optional)

Items	Specifications
Cable length	1 m, 3 m, 6 m, 9 m, 12 m
Cable material	PVC sheath ø6.5 Without conduit, High-flex specification with conduit PUR sheath ø6.5 Without conduit
I/O output connector	Flying lead specifications FANUC specifications Mitsubishi specifications Mitutoyo standard specifications Siemens specifications M12 connector specifications



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.

Linear Scales

Linear Scales ABS AT715 SERIES 539 — Slim Type



SPECIFICATIONS

Model	ABS AT715	
Detection method	Electromagnetic induction	
Minimum resolution	0.001 mm to 0.01 mm (Changeable by parameter on the KA-200 counter)	
Effective range	100 to 3000 mm	
Accuracy (20 °C)	±5 μm (L ₀ : 100 to 500 mm), ±7 μm (L ₀ : 600 to 1800 mm), ±10 μm (L ₀ : 2000 to 3000 mm) L ₀ =Effective range (mm)	
Maximum response speed	50 m/min	
Protection level	IP67	
Sliding force	5 N or less	
Signal cable	Standard Accessories Refer to the dimension table shown below for the length.	
Extension cable (optional)	Length	Order No.
	2 m	09AAB674A
	5 m	09AAB674B
7 m	09AAB674C	
Connectable counter	KA-200 Counter	

AT715		Effective range L ₀ (mm)	Signal cable length (m)	
Order No.	Model			
539-801R	ABS AT715-100	100 (4 in)	3.5	
539-802R	ABS AT715-150	150 (6 in)		
539-803R	ABS AT715-200	200 (8 in)		
539-804R	ABS AT715-250	250 (10 in)		
539-805R	ABS AT715-300	300 (12 in)		
539-806R	ABS AT715-350	350 (14 in)		
539-807R	ABS AT715-400	400 (16 in)		
539-808R	ABS AT715-450	450 (18 in)		
539-809R	ABS AT715-500	500 (20 in)		
539-811R	ABS AT715-600	600 (24 in)		
539-813R	ABS AT715-700	700 (28 in)		
539-814R	ABS AT715-750	750 (30 in)		
539-815R	ABS AT715-800	800 (32 in)		
539-816R	ABS AT715-900	900 (36 in)		
539-817R	ABS AT715-1000	1000 (40 in)		5
539-818R	ABS AT715-1100	1100 (44 in)		
539-819R	ABS AT715-1200	1200 (48 in)		
539-820R	ABS AT715-1300	1300 (52 in)		
539-821R	ABS AT715-1400	1400 (56 in)		
539-822R	ABS AT715-1500	1500 (60 in)		
539-823R	ABS AT715-1600	1600 (64 in)		
539-824R	ABS AT715-1700	1700 (68 in)		
539-825R	ABS AT715-1800	1800 (72 in)		
539-860R	ABS AT715-2000	2000 (80 in)	7*	
539-861R	ABS AT715-2200	2200 (88 in)		
539-862R	ABS AT715-2400	2400 (96 in)		
539-863R	ABS AT715-2500	2500 (100 in)		
539-864R	ABS AT715-2600	2600 (104 in)		
539-865R	ABS AT715-2800	2800 (112 in)		
539-866R	ABS AT715-3000	3000 (120 in)		

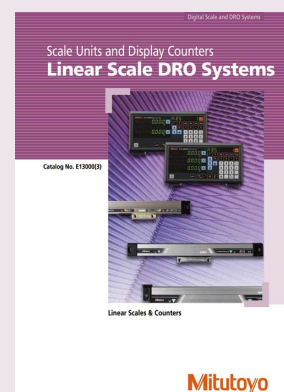
* Combination of a 5 m signal cable and a 2 m extension cable

ABSOLUTE™



IP67

- The electromagnetic induction principle adopted means Absolute system-type linear scales are highly resistant to environmental contamination.
- Absolute scales have eliminated the need for origin restoration, also drastically reducing power consumption.



Refer to the Linear Scale DRO Systems Brochure (E13000) for more details.

KA-200 Counter SERIES 174 — Standard Type

- **KA-200** counter is high-performance unit that can be used as "standard counter" or "lathe counter".
- Downsizing and weight saving have been realized.
- The RS-232C interface enables connection to a PC or printer.

Optional Accessory

- Code out unit: **06AET993**

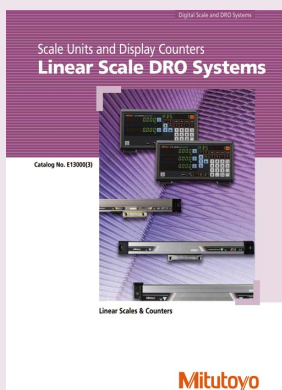


174-183
KA-212

SPECIFICATIONS

Order No.	174-183 □	174-185 □
Model	KA-212	KA-213
Number of axes to be displayed	2	3
Resolution	(Changeable according to the parameter) When AT100 is connected: 0.05 to 0.0001 mm When AT715 is connected: 0.01 to 0.001 mm	
Display/digit	Main display: 9 digits including sign Sub display: 8 digits	
Power supply voltage	AC 100 to 240 V, 50/60 Hz	
Dimensions	300 (W) x 70 (D) x 167 (H) mm	
Output (optional)	RS-232C	
Mass	1.25 kg	1.3 kg

□: To denote your AC power cable add the following suffixes to the order No. :
A for UL/CSA, D for CEE, DC for CCC, E for BS, K for KC, C and No suffix are required for PSE.



Refer to the Linear Scale DRO Systems Brochure (**E13000**) for more details.

Linear Scales

Linear scale counter

FUNCTIONS

Function		Type	High performance
		 KA-200 Counter	
Zero-setting		●	
Preset		●	
Resolution setting		●	
Measurement direction setting		●	
mm/inch conversion		●	
Diameter display		●	
Scale reference point setting*1		●	
1/2 calculation		●	
Coordinate system switching		●	
Bolt-hole circle machining		●*2	
Pitch machining		●	
Zero approach machining (INC mode)		●	
Addition of 2-axis data		●*3	
Linearity error compensation		●	
Pitch error compensation		●*1	
Smoothing		●	
Memory backup		●	
Expansion/contraction coefficient setting		—	
Lower digit blanking out		●	
External zero-setting		▲*4	
RS-232C output		▲*4	
USB output		▲*5	
Limit signal output		—	
Error message		●	

●: Standard function, ▲: Optional function, —: Not available

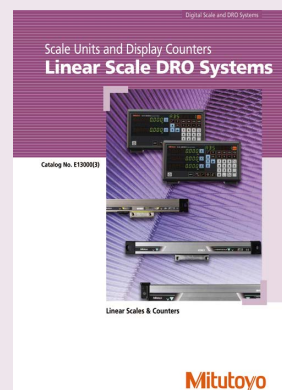
*1 Only available when connecting with **AT100** Series.

*2 Not available in single-axis use

*3 Only available for 3-axis model (**KA-213**)

*4 Code out unit (**06AET993**) is required.

*5 Text can be output by code out unit and foot switch



Refer to the Linear Scale DRO Systems Brochure (**E13000**) for more details.



- Outputs 2-phase sinusoidal wave signals at 4 μm pitch.
- The maximum effective measuring length is 3000 mm when the resolution is 0.01/0.02/0.05/0.1 μm (2-phase square-wave is output).
- Compact detector head enables space saving design.
- Along with the output specifications of 2-phase sinusoidal wave and 2-phase square-wave, the output specification of 1 Vp-p wave is also available.
- Equipped with the function to display signal errors on the LED.

Linear Scales ST36 SERIES 579 — High Accuracy Type

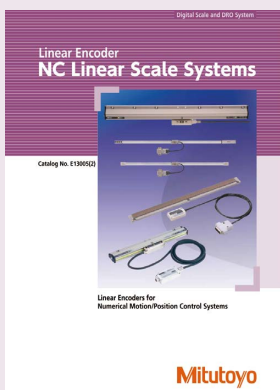


SPECIFICATIONS

Model	ST36
Detection method	Optical
Output signal	ST36A: 2 Vp-p sinusoidal signals ST36B: 2-phase square-wave signals (RS-422A compatible), Alarm reset input ST36C: 2-phase square-wave signals (RS-422A compatible), 2-phase sinusoidal signals ST36D: 1 Vp-p differential sinusoidal signals
Main scale grating pitch	8 μm
Signal output pitch	4 μm
Effective range	10 to 3000 mm
Accuracy (20 °C)*1	±0.5 μm, ±1 μm, ±2 μm/m
Maximum response speed*2	1200 mm/s
Scale reference point	10 to 80 mm: 1 center point; 100 to 300 mm: 50 mm pitch
Power supply voltage	5 VDC ± 5%
Operating temperature (humidity) range	0 to 40 °C (20 to 80% RH, non-condensing)
Storage temperature (humidity) range	-20 to 60 °C (20 to 80% RH, non-condensing)
Head cable length	1 m (high-flex connecting cable)

*1	Effective range	Accuracy
	300 mm or less	±0.5 μm
	500 mm or less	±1 μm
	1000 mm or less	±2 μm
	3000 mm or less	±2 μm/m

*2 Maximum response speed when sinusoidal signals are output



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.

Linear Scales

Linear Scales ST46-EZA SERIES 579 — Compact Type

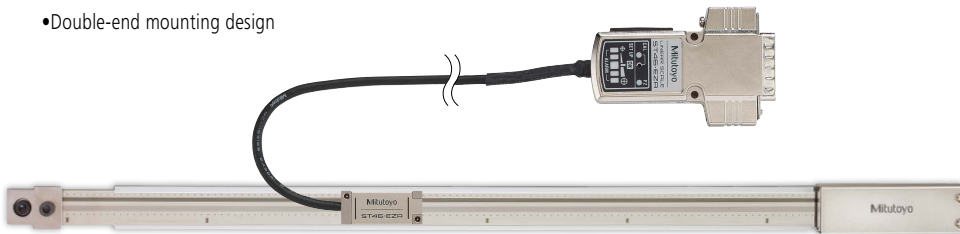


Glass Scale Type

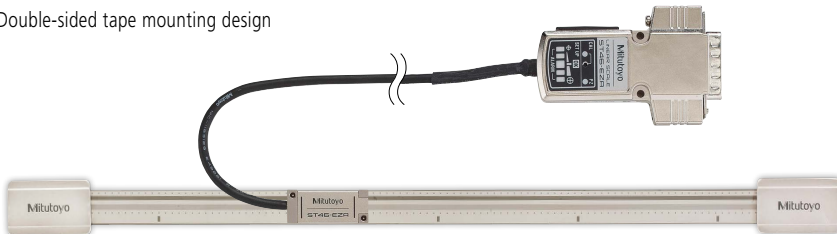


Metal Tape Scale Type

- Double-end mounting design



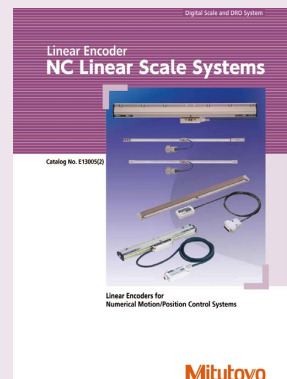
- Double-sided tape mounting design



- Includes an automatic adjusting function for the signal (EZA function) at the push of a button.
- Detector head mounting and signal adjustment possible without oscilloscope or PC.
- A setup indicator for checking signal strength is included.
- When connected with a PC it is possible to check signal strength and set parameter (Optional application program required).
- I/F circuit integrated in connector shell reduces volume to compared to conventional interface.
- The thickness of the detector head is only 7.5 mm. The metal tape scale type has a mounting surface area of 12.5 by 9.325 mm, allowing use in applications where a space-saving design is important.
- Glass and metal tape versions are available.

SPECIFICATIONS

Model	ST46-EZA	
Detection method	Optical	
Scale type	Glass	Metal tape
Main scale grating pitch	20 μ m	
Output signal	Type B: 2-phase square-wave signals (RS-422A compatible), reference point pulse, external reset input. Type C: 2-phase square-wave signals (RS-422A compatible), reference point pulse, 2-phase sinusoidal signals.	
Effective range	10 to 3000 mm	
Accuracy (20 °C)	Effective range 10 to 300 mm: $\pm 1 \mu$ m Effective range 350 to 500 mm: $\pm 2 \mu$ m Effective range 600 to 1000 mm: $\pm 3 \mu$ m Effective range 1100 to 3000 mm: $\pm 3 \mu$ m/m	Effective range 10 to 1000 mm: $\pm 5 \mu$ m Effective range 1100 to 3000 mm: $\pm 5 \mu$ m/m (The above accuracy applies to individual scales. For double-end mounting designs, perform point-to-point correction after ensuring the metal tape is tensioned correctly.)
Maximum response speed	2.6 m/s (at the point where the sinusoidal signal amplitude has decreased by 3 dB)	
Scale reference point	10 to 80 mm: 1 center point; 100 to 300 mm: 50 mm pitch	
Power supply voltage	5 VDC \pm 5%	
Operating temperature (humidity) range	0 to 40 °C (RH 20 to 80%, non-condensing)	
Storage temperature (humidity) range	-20 to 60 °C (RH 20 to 80%, non-condensing)	
Head cable length	1 m (high-flex connecting cable)	



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.

- Absolute measurement with separate type scales
- Non-contact detection is optimal for high speed and high acceleration devices such as linear motors
- Electromagnetic induction principle means scales are unaffected by water and oil contamination
- The detector head is approximately 1/3 the previous model size: 50 mm (W) x 28 mm (D) x 11 mm (H)
- Cable outlets can be in four directions, with mounting holes on the top and sides
- Compatible with servo amplifiers from a range of companies (high-speed serial interfaces)

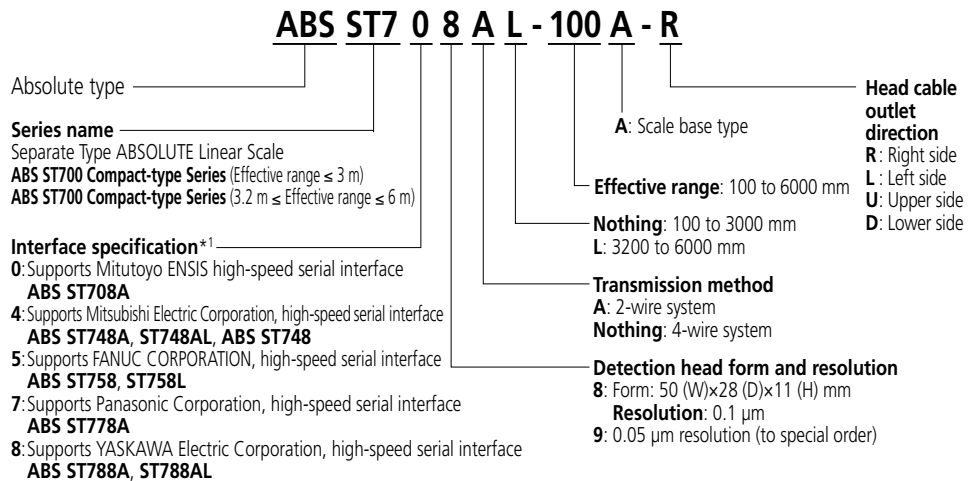
Linear Scales ABS ST700 SERIES 579 — General-purpose Type



SPECIFICATIONS

Model	ABS ST700	
Scale type	Scale base	
Resolution	0.1 μm	
Detection method	Electromagnetic induction	
Max. effective range	100 to 3000 mm	3200 to 6000 mm
Accuracy (20 °C)	5 + (5L/1000) μm L=Effective range (mm)	5 + (5L/1000) μm L=Effective range (mm)
Maximum response speed	5 m/s	
Power supply voltage	5 VDC ± 10% (at the detection head) (Ripple+spike noise component should be less than 100 mV)	
Maximum current consumption	270 mA	
Head cable length	1 m (high-flex connecting cable)	
Maximum cable length	29 m (including the head cable length)	
Operating temperature (humidity) range	0 to 50 °C (RH 20 to 80%, non-condensing)	0 to 50 °C (RH 20 to 70%, non-condensing)
Storage temperature (humidity) range	-20 to 70 °C (RH 20 to 80%, non-condensing)	-20 to 60 °C (RH 20 to 70%, non-condensing)

Meaning of Model No.

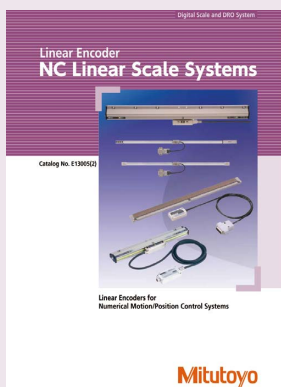


Available Interfaces*1

FANUC CORPORATION, FANUC Serial αi Series
Mitsubishi Electric Corporation, MDS-D/MDS-DH Series
Mitsubishi Electric Corporation, MELSERVO Series Servo Amplifier MR-J5 Series, MR-J4 Series, MR-J3 Series
YASKAWA Electric Corporation, SERVOPACK Σ7, ΣX Series
Panasonic Corporation, MINAS A6, A5 Series
Mitutoyo ENSIS*2
CKD NIKKI DENSO CO., LTD. VPH Series
Servoland Corporation SVF Series
OMRON Corporation Power-UMAC, Power-Clipper, Power-Brick, CK3M Series

*1 Be sure to contact each manufacturer for details of the applicable systems (availability of connection).

*2 ENSIS is a registered trademark of Mitutoyo Corporation.



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.

Linear Scales

ABSOLUTE™

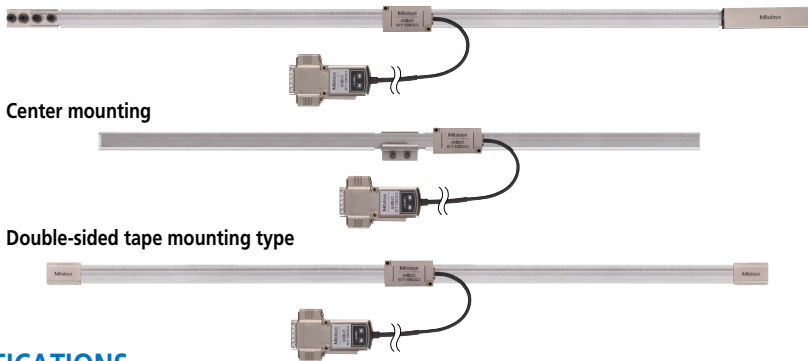


Linear Scales ABS ST1300 SERIES 579

Double-end mounting type

Center mounting

Double-sided tape mounting type



- Effective range: 12 m, Maximum response speed: 8 m/s, Resolution: 1 nm
- Various interfaces are supported.
- A new detection method has improved robustness in regards to contamination resistance and gap tolerance (in-house testing result).
- Can be mounted using double-sided tape or screws (on both sides or at the center of the unit).
- Signal check program enables integrity check and maintenance.

SPECIFICATIONS

Model	ABS ST1300		
Detection method	Optical		
Scale type	Double-end mounting	Center mounting	Double-sided tape mounting
Maximum effective range	12000 mm	6000 mm	3000 mm
Fixing part material	—	—	Equivalent to iron Other than equivalent to iron
Accuracy (20 °C)	±5 μm (1 m or less), ±5 μm/m (1.1 m or more)*4	With system parameters: ±5 μm (1 m or less), ±5 μm/m (1.1 m or more) Without system parameters: ±10 μm (1 m or less), ±10 μm/m (1.1 m or more)	±5 μm (1 m or less), ±5 μm/m (1.1 m or more)
Maximum response speed	8 m/s or less		
Expansion coefficient	≈10×10 ⁻⁶ /K*5	≈10×10 ⁻⁶ /K	≈10×10 ⁻⁶ /K*2
Power supply	5 VDC ± 10%		
Maximum current consumption	270 mA or 250 mA (depends on interface)		
Cable length	1 m (high-flex connecting cable)		
Maximum cable length	29 m (including head cable)		
Usable temperature (humidity) range	0 to 50 °C (RH 20 to 70%, non-condensing)		0 to 50 °C*1 (RH 20 to 70%*3, non-condensing) When mounting: ±10 °C
Storage temperature (humidity) range	-20 to 70 °C (RH 20 to 70%, non-condensing)		

*1 Double-sided tape fixing type, careful for the condition of operating temperature range, in case that the sealing surface material is except for Fe equivalent.

*2 Thermal expansion coefficient occasionally change, as the difference between scale material's and sealing surface material's is excessive.

*3 Double-sided tape fixing type, the accuracy compensation occasionally change, in case that the sealing surface material is except for Fe equivalent and stored in environment over operating temperature range. Imaging these conditions, double-end fixing type is adopted.

*4 Tension fix is adopted to be stable the temperature property. Because scale tension is longer 250 μm/m, the accuracy compensation is needed over the system.

*5 Thermal expansion coefficient after mounted conform to expansion/contraction of mounted surface by changing outer temperature (Double-end fixing type).

Note: For details on specification, mounting procedure, and adjustments, refer to the corresponding brochure and operation manual.

Meaning of Model No.

ABS ST13 4 1 A - 1200 D

Absolute type

Series name

Separate Type ABSOLUTE Linear Scale

Interface specification*1

0: Supports Mitutoyo ENSIS high-speed serial interface

ABS ST130□A

4: Supports Mitsubishi Electric Corporation, high-speed serial interface

ABS ST134□A

5: Supports FANUC CORPORATION, high-speed serial interface

ABS ST135□

7: Supports Panasonic Corporation, high-speed serial interface

ABS ST137□A

8: Supports YASKAWA Electric Corporation, high-speed serial interface

ABS ST138□A

Scale mount

D: Double-end mounting

E: Double-sided tape mounting

F: Center mounting (With system parameters)

G: Center mounting (Without system parameters)

Effective range: 10 to 12000 mm

Transmission method

A: Half-duplex method

Nothing: Full duplex method or Half-duplex method/Half-duplex method

Resolution

1: Resolution 0.01 μm

2: Resolution 0.001 μm

Available Interfaces*1

FANUC CORPORATION, FANUC Serial αi Series

Mitsubishi Electric Corporation, MELSERVO Series Servo Amplifier MR-J5 Series, MR-J4 Series

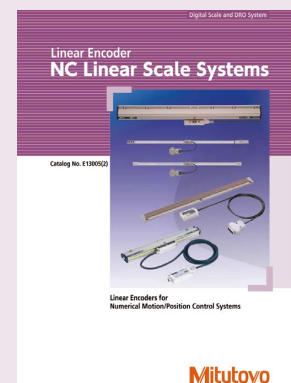
YASKAWA Electric Corporation, SERVOPACK Σ7, ΣX Series

Panasonic Corporation, MINAS A6, A5 Series

Mitutoyo ENSIS*2

*1 Be sure to contact each manufacturer for details of the applicable systems (availability of connection).

*2 ENSIS is a registered trademark of Mitutoyo Corporation.



Refer to the NC Linear Scale Systems Brochure (E13005) for more details.

- The **PSU-200** splits the sinusoidal signal output by Mitutoyo linear scales into a minimum of four and a maximum of 200 divisions, and converts the signal to a square-wave signal so that NC feedback systems, measurement control devices, etc., can be used with linear scales in order to achieve highly accurate positioning.

**Pulse signal interface unit PSU-200
SERIES 539**



SPECIFICATIONS

Order No.	539-005
Model	PSU-200
Number of axes	1
Input	Input connector DA-15S-N (JAE) or equivalent Input signal: 2-phase sinusoidal and the reference voltage, Reference point, Scale alarm
Output	Output connector: MR-20RMA (HONDA TSUSHIN KOGYO CO., LTD.) Output signal: 2-phase square-wave signals (PA, PB), reference point (PZ), Alarm, Alarm reset, Photo-coupler
Number of divisions	4, 8, 10, 20, 40, 80, 100, 200 (Selectable by switch)
Function	Setting the number of divisions, setting the minimum edge interval, and maximum response speed. Detection of broken wires or short circuits and abnormalities (alarm), detection of signal errors (alarm). Power supply voltage low alarm (warning light only), switching between high-impedance mode and alarm signal output mode. Reference position detection light, hysteresis width settings (directly linked to No. of divisions), external alarm reset input (Photo-coupler)
Power supply voltage	5 VDC ± 5%
Current consumption	200 mA
Operating temperature range	0 to 50 °C
Storage temperature range	-20 to 70 °C
Dimensions	160 (W) × 100 (D) × 28 (H) mm
Mass	Approx. 620 g

- **PSU-251** Series is a serial signal interface unit for incremental linear scales.

The interface outputs serial data equivalent to 400 divisions from the sinusoidal signal (according to EIA Standard **RS-422-A**)

- The **PSU-251** can be connected to Mitsubishi Electric Corporation's MR-J4/MR-J3 Series servo amplifier.
- Since this unit is connected to incremental linear scales, the reference point should be passed through to determine the absolute position.

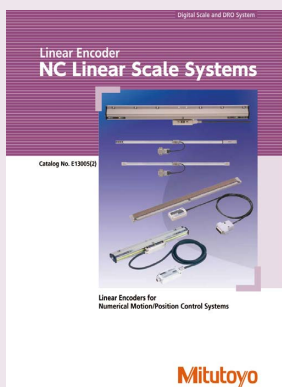
**Serial signal interface unit PSU-251/252
SERIES 539**



SPECIFICATIONS

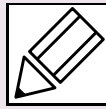
Order No.	539-006	539-007
Model	PSU-251	PSU-252
Number of axes	1	
Input	2-phase sinusoidal signals and standard voltage, reference signal, scale alarm signal. Maximum input frequency: 500 kHz	
Output	Mitsubishi Electric Corporation MR-J4/MR-J3 Series High-speed serial data*	Panasonic Corporation Motor Business Unit MINAS-A5, A5L, A5N, A5NL Series* MINAS-A4, A4P, A4N, A4NL Series*
Number of divisions	400	
Function	Alarm detection: Broken wires, short circuits in the scale and abnormalities. Alarm output: Status data is output through serial communication and the PWR light blinks. Also, the PWR light turns on.	
Power supply voltage	Power supply from the servo amplifier: 5 VDC ± 5% External power supply: 5 VDC ± 5% Power supply is selected with the shorting link for the terminal block used to supply external power. To choose a servo amplifier or external power supply, please refer to the servo amplifier power specifications (in particular, the maximum supplied current) and the power supply specifications of the scale that is used.	
Current consumption	150 mA (not including the scale)	
Operating temperature range	0 °C to 40 °C	
Storage temperature range	-20 °C to 70 °C	

* Please contact each manufacturer for details of the applicable systems.



Refer to the NC Linear Scale Systems Brochure (**E13005**) for more details.

Quick Guide to Precision Measuring Instruments



Linear Scales

Glossary

Absolute system

A measurement mode in which every point measurement is made relative to a fixed origin point.

Incremental system

A measurement mode in which every point measurement is made relative to a certain stored reference point.

Origin offset

A function that enables the origin point of a coordinate system to be translated to another point offset from the fixed origin point. For this function to work, a system needs a permanently stored origin point.

Restoring the origin point

A function that stops each axis of a machine accurately in position specific to the machine while slowing it with the aid of integrated limit switches.

Sequence control

A type of control that sequentially performs control steps according to a prescribed order.

Numerical control

A way of controlling the movements of a machine by encoded commands created and implemented with the aid of a computer (CNC). A sequence of commands typically forms a 'part program' that instructs a machine to perform a complete operation on a workpiece.

Binary output

Refers to output of data in binary form (ones and zeros) that represent numbers as integer powers of 2.

RS-232C

An interface standard that uses an asynchronous method of serial transmission of data over an unbalanced transmission line for data exchange between transmitters located relatively close to each other. It is a means of communication mainly used for connecting a personal computer with peripherals.

Line driver output

This output features fast operating speeds of several tens to several hundreds of nanoseconds and a relatively long transmission distance of several hundreds of meters. A differential-voltmeter line driver (RS-422A compatible) is used as an I/F to the NC controller in the linear scale system.

BCD

A notation of expressing the numerals 0 through 9 for each digit of a decimal number by means of four-bit binary sequence. Data transmission is one-way output by means of TTL or open collector.

RS-422

An interface standard that uses serial transmission of bits in differential form over a balanced transmission line. RS-422 is superior in its data transmission characteristics and in its capability of operating with only a single power supply of 5 VDC.

Accuracy

The accuracy specification of a scale is given in terms of the maximum error to be expected between the indicated and true positions at any point, within the range of that scale, at a temperature of 20 °C. Since there is no international standard defined for scale units, each manufacturer has a specific way of specifying accuracy. The accuracy specifications given in our catalog have been determined using laser interferometry.

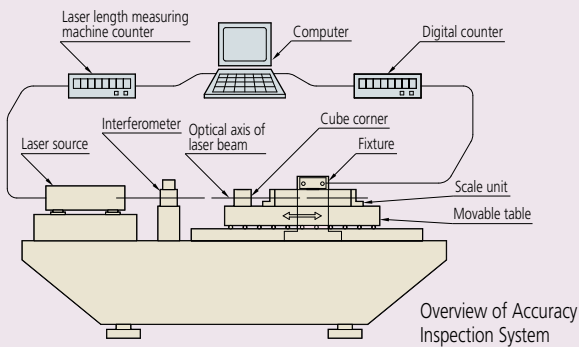
Narrow range accuracy

Scale gratings on a scale unit normally adopt 20 μm pitch though it varies according to the kind of scale. The narrow range accuracy refers to the accuracy determined by measuring one pitch of each grating at the limit of resolution (1 μm for example).

Specifying Linear Scale Accuracy

Positional Indication accuracy

The accuracy of a linear scale is determined by comparing the positional value indicated by the linear scale with the corresponding value from a laser length measuring machine at regular intervals using the accuracy inspection system as shown in the figure below. As the temperature of the inspection environment is 20 °C, the accuracy of the scale applies only in an environment at this temperature. Other inspection temperatures may be used to comply with internal standards.



The accuracy of the scale at each point is defined in terms of an error value that is calculated using the following formula:

$$\text{Error} = \text{Value indicated by Laser length measuring machine} - \text{Corresponding value indicated by the linear scale}$$

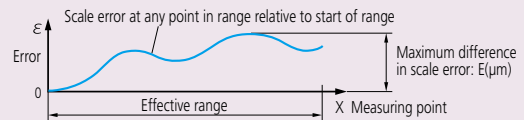
A graph in which the error at each point in the effective positioning range is plotted is called an accuracy diagram.

There are two methods used to specify the accuracy of a scale, unbalanced or balanced, described the right.

(1) Unbalanced accuracy specification - maximum minus minimum error

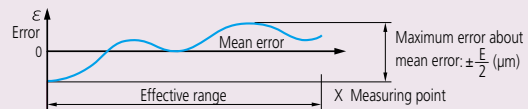
This method simply specifies the maximum error minus the minimum error from the accuracy graph, as shown below. It is of the form: $E = (\alpha + \beta L) \mu\text{m}$. L is the effective range (mm), and α and β are factors specified for each model.

For example, if a particular type of scale has an accuracy specification of $(3 + \frac{3L}{1000}) \mu\text{m}$ and an effective range of 1000 mm, E is 6 μm .



(2) Balanced accuracy specification - plus and minus about the mean error

This method specifies the maximum error relative to the mean error from the accuracy graph. It is of the form: $e = \pm \frac{E}{2} (\mu\text{m})$. This is mainly used in separate-type (retrofit) scale unit specifications.



A linear scale detects displacement based on graduations of constant pitch. Two-phase sinusoidal signals with the same pitch as the graduations are obtained by detecting the graduations. Interpolating these signals in the electrical circuit makes it possible to read a value smaller than the graduations by generating pulse signals that correspond to the desired resolution. For example, if the graduation pitch is 20 μm , interpolated values can generate a resolution of 1 μm . The accuracy of this processing is not error-free and is called interpolation accuracy. The linear scale's overall positional accuracy specification depends both on the pitch error of the graduations and interpolation accuracy.