New **Products**





Digimatic Scale Units Linear Scales

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Digimatic Scale Units/Linear Scales

ABSOLUTE Digimatic Scale Units



Linear Scales



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ABSOLUTE Digimatic Scale Units

Designed to accurately capture positional coordinates along an axis

SD ABSOLUTE Digimatic Scale Units SERIES 572



ABSOLUTE

- **SD** Series facilitates mounting on jigs, tools, and small machine tools to enable accurate positioning.
- Built-in absolute scale including the ABS point does not require a zero-set every time the power is turned on. In addition, reliability has improved thanks to elimination of overspeed errors.
- Horizontal or vertical display according to the scale mounting direction.
- The dust resistance and the environmental resistance of the display has improved. The **SD-G** Series offers dust/water protection level IP66.
- Long battery life for easier maintenance.
- EC counters are available as external display units.
- Equipped with an output port to transfer measurement data, allowing implementation in control systems and gaging systems.

Functions

- ABS (Absolute) measurement function
- INC (Incremental) measurement function
- Zero-setting function
- Presetting function (2 preset values can be set. Not available for SD-G, SD-AX, SD-D, SDV-D)
- Double reading function (Available only for **SD-F** or **SDV-F**)
- Direction switch function (Available only for **SD-E**, **SDV-E**)
- Hold function*
- Measurement value composition error alarm
- Low battery alarm
- Output function
- * To activate the hold function when using SD-AX, SD-D or SDV-D models, an optional hold unit is required. Simultaneous activation with the output function is not available.
- **SD-G** models are also available to special order. Note: These units use 1.5 V silver oxide cells for the power supply. Therefore, when the units are directly fixed to the frame of a machine tool that requires a high voltage, malfunctions such as display digit fluctuations and errors may occur. Countermeasure examples are described in the user manuals provided.



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Refer to the ABSOLUTE DIGIMATIC SCALE UNITS Brochure (**E4316**) for more details.

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System Diagram



[Display units]

Single-function type with high dust/water resistance



- with the external output function. *3 Connecting of **SD** Series and **DP-1VA LOGGER/MUX-10F/IT-016U** is also available without passing through the **EC** counter.
- In this case, connect these units and **SD** Series with the cables used for connection with the **EC** counter.

ABSOLUTE Digimatic Scale Units

Designed to accurately capture positional coordinates along an axis

ABSOLUTE Digimatic Scale Units SERIES 572

SPECIFICATIONS

Туре	Unit spec.	Order No.	Model	Range	Resolution	Accuracy	Repeatability	Response speed*2	Battery life
		572-600	SD-10G	100 mm					
Horizontal single-	Metric	572-601	SD-15G	150 mm	0.01 mm	0.03 mm			
		572-602	SD-20G	200 mm					Approx 12,000 hours
(Mater proof type)		572-613	SD-4" /10G	100 mm/4 in]		Approx. 15,000 nours
(water-proof type) Met	Metric/Inch	572-614	SD-6" /15G	150 mm/6 in	0.0005 in/0.01 mm	in/0.01 mm 0.03 mm/0.001 in			
		572-615	SD-8" /20G	200 mm/8 in					
		572-200-30	SD-10AX	100 mm					
	Metric	572-201-30	SD-15AX	150 mm	0.01 mm	0.03 mm			Approx. 18,000 hours
		5/2-202-30	SD-20AX	200 mm		0.04	-		A 20.000 l
Horizontal single-		5/2-203-10	SD-30D	300 mm		0.04 mm	-		Approx. 20,000 nours
function type		572-210-30		100 mm/4 m		0.02 mm/0.001 in			Approx 19 000 hours
	Metric/Inch	572-211-50		200 mm/8 in	0.0005 in/0.01 mm	0.05 11111/0.001 111			Approx. 16,000 nours
		572-212-30	50-0 AA	300 mm/12 in		0.04 mm/0.002 in	-		Approx 20.000 hours
		572-460	SD-10F	100 mm		0.04 1111/ 0.002 11			Approx. 20,000 110013
		572-461	SD-15E	150 mm		0.03 mm	0.01 mm		
		572-462	SD-20E	200 mm					
	Matria	572-463	SD-30E	300 mm	0.01 mm	0.04 mm	1		
	wetric	572-464	SD-45E	450 mm	0.01 mm	0.04 mm			
		572-465	SD-60E	600 mm		0.05 mm			
		572-466	SD-80E	800 mm		0.06 mm	-		
Horizontal multi-		572-467	SD-100E	1000 mm		0.07 mm	-		Approx 5 000 hours
function type		572-470	SD-4" E	100 mm/4 in		0.02 /0.004 -			Approxi 5/000 Hours
		5/2-4/1	SD-6" E	150 mm/6 in		0.03 mm/0.001 in			
		5/2-4/2	5D-8 E	200 mm/12 in			-		
	Metric/Inch	572-475	SD-12 E	450 mm/18 in	0.0005 in/0.01 mm	0.04 mm/0.002 in			
		572-475	SD-24" F	600 mm/24 in		0.05 mm/0.002 in	-		
		572-475	SD-32" F	800 mm/32 in		0.06 mm/0.0025 in	-		
		572-477	SD-40" E	1000 mm/40 in		0.07 mm/0.0025 in	1		
		572-480-10*1	SD-10F	100 mm					
		572-481-10*1	SD-15F	150 mm		0.03 mm			
		572-482-10*1	SD-20F	200 mm					
	Motric	572-483-10*1	SD-30F	300 mm	0.01 mm	0.04 mm]		
	weuld	572-484-10*1	SD-45F	450 mm	0.01 11111	0.04 11111		0.01 mm	
Horizontal multi-		572-485-10*1	SD-60F	600 mm		0.05 mm			
function type		572-486-10*1	SD-80F	800 mm		0.06 mm	0.01 mm		
(equipped with		5/2-48/-10*1	SD-100F	1000 mm		0.07 mm	(Radius indication,		Approx, 5,000 hours
double reading		572-490-10*1	SD-4" F	100 mm/4 in		0.02 mm/0.001 in	not diameter)		· · · ·
function)		572-491-10**		150 mm/8 in		0.03 mm/0.001 m			
,		572-492-10*1	SD-0 F	200 mm/12 in			Unlimited		
	Metric/Inch	572-493-10 572-494-10*1	SD-12 F	450 mm/18 in	0.0005 in/0.01 mm	0.04 mm/0.002 in			
		572-495-10*1	SD-24" F	600 mm/24 in		0.05 mm/0.002 in		Unlimited	
		572-496-10*1	SD-32" F	800 mm/32 in		0.06 mm/0.0025 in			
		572-497-10*1	SD-40" F	1000 mm/40 in		0.07 mm/0.0025 in			
		572-300-10	SDV-10D	100 mm				1	
	Matria	572-301-10	SDV-15D	150 mm	0.01 mana	0.03 mm			
	wetric	572-302-10	SDV-20D	200 mm	0.01 mm				Approx 20.000 hours
Vertical single-		572-303-10	SDV-30D	300 mm		0.04 mm			
function type		572-310-10	SD-4" D	100 mm/4 in					Approx. 20,000 110013
	Metric/Inch	572-311-10	SD-6" D	150 mm/6 in	0.0005 in/0.01 mm	0.03 mm/0.001 in			
		5/2-312-10	SD-8" D	200 mm/8 in		0.04 mm (0.002 in	-		
		5/2-313-10	SD-12" D	300 mm/12 in		0.04 mm/0.002 in	-		
	-	572-561	SDV-10E	150 mm		0.03 mm			
		572-562	SDV-70E	200 mm		0.05 11111			
		572-563	SDV-30E	300 mm				0.01 mm	
	Metric	572-564	SDV-45E	450 mm	0.01 mm	0.04 mm	0.01 mm		
		572-565	SDV-60E	600 mm		0.05 mm]		
		572-566	SDV-80E	800 mm		0.06 mm			
Vertical multi-		572-567	SDV-100E	1000 mm		0.07 mm			Approx 5 000 hours
function type		572-570	SDV-4" E	100 mm/4 in		0.00 (0.000)			, ippion: 5,000 moul3
		572-571	SDV-6" E	150 mm/6 in		0.03 mm/0.001 in			
		5/2-5/2	SDV-8" E	200 mm/8 in			-		
	Metric/Inch	5/2-5/3	SDV-12" E	300 mm/12 in	0.0005 in/0.01 mm	0.04 mm/0.002 in			
		572-574	SDV-10 E	430 mm/24 in		0.05 mm/0.002 in	-		
		572-575	SDV-24 E	800 mm/32 in		0.05 mm/0.0025 in	-		
		572-577	SDV-40" E	1000 mm/40 in		0.07 mm/0.0025 in	1		
		572-580-10*1	SDV-10F	100 mm		0.0020111			
		572-581-10*1	SDV-15F	150 mm		0.03 mm			
		572-582-10*1	SDV-20F	200 mm					
	Metric	572-583-10*1	SDV-30F	300 mm	0.01 mm	0.04 mm			
Vertical multi- function type (equipped with	wedle	572-584-10*1	SDV-45F	450 mm	0.01 1111	0.04 11111			
		572-585-10*1	SDV-60F	600 mm		0.05 mm	-		
		572-586-10*1	SDV-80F	800 mm		0.06 mm	0.01 mm		
		5/2-587-10*1	SDV-100F	1000 mm		0.07 mm	(Radius indication.		Approx. 5,000 hours
double reading		572-590-10*1	SDV-4" F	100 mm/4 in		0.02 mm /0.001 in	not diameter)		
function)		572-591-10*1		200 mm/9 in		0.05 mm/0.001 m			
		572-592-10*1	SDV-8 F	200 mm/12 in			-		
	Metric/Inch	572-595-10*1	SDV-12 F	450 mm/18 in	0.0005 in/0.01 mm	0.04 mm/0.002 in			
		572-595-10*1	SDV-24" F	600 mm/24 in		0.05 mm/0.002 in	1		
		572-596-10*1	SDV-32" F	800 mm/32 in		0.06 mm/0.0025 in			
			572-597-10*1	SDV-40" F	1000 mm/40 in		0.07 mm/0.0025 in	1	

*1 Available to special order *2 High slider speed does not cause data errors. Position feedback and output data may not be used while the slider is moving.









SDV-E (to 300 mm)/SDV-F (to 300 mm)







SD-E (450 to 1000 mm)/SD-F (450 to 1000 mm)



SDV-E (450 to 1000 mm)/SDV-F (450 to 1000 mm)



*1 Refer to the dimension table for details of the depth including the screw on the rear of the display.

*2 Mounting screw hole: 2×No.5-40 UNC (Inch type, Inch/Metric switching type)/2×M3×0.5 (Metric type) Screwed depth on the rear side of display unit: under 2 mm

*3 Mounting screw hole: 4×No.5-40 UNC (Inch type, Inch/Metric switching type)/4×M3×0.5 (Metric type) Screwed depth on the rear side of display unit: under 2 mm

SPECIFICATIONS

Madal	Range	Dimensions (mm)				Depth including the screw			
IVIOdel	(mm)	L1	L2	t	G	Н	on the rear of the display	iviass (g)	
	100	209	185	_	_	_		390	
SD-G	150	259	235	—	_	_		410	
	200	311	287	—	—	—		430	
	100	209	185	—	—	—]	235	
SD-AX	150	259	235	—	—	—		255	
	200	311	287	—	_	_	Less than 2 mm	275	
SD-30D	300	444	420	—	—	—]	370	
	100	244	220	—	_	_		250	
	150	294	270	—	—	—		280	
	200	344	320	—	—	—		310	
SD-E	300	444	420	_	_	_		370	
SD-F	D-F 450 594 570		14.6		760				
	600	774	750	0 0	23.2	14.0	Loss than 2 mm	900	
	800	974	950	10	27.2	10.0	Less trian 3 mm	1710	
	1000	1174	1150	10	27.2	18.0		2040	
	100	244	220	_	_	_		250	
	150	294	270	_	_	_]	280	
304-0	200	344	320	_	_	_		310	
	300	444	420	—	_	_	Loss than 2 mm	370	
	100	244	220	_	_	_		250	
	150	294	270	_	_	_		280	
	200	344	320	_	_	_		310	
SDV-E	300	444	420	_	_	_]	370	
SDV-F	450	594	570	c	12.2	14.6		760	
	600	774	750	Ø	Z3.Z	14.0	Loss than 2 mm	900	
	800	974	950	10	27.2	10 6	Less trian 2 mm	1710	
-	1000	1174	1150	1 10	27.2	27.2	10.0	5.0	2040



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Refer to the ABSOLUTE DIGIMATIC SCALE UNITS Brochure (E4316) for more details.

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Designed to accurately capture positional coordinates along an axis

Linear Scale System Diagram





An inspection certificate is supplied as standard. Refer to page U-11 for details.

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



SPECIFICATIONS

Model	AT103		
Effective range	100 to 6000 mm		
Accuracy (20 °C)	Effective range 100 to 3000 mm: (5 + 5L₀/1000) μm Effective range 3250 to 6000 mm: (5 + 8L₀/1000) 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 + 3Lo/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 + 2Lo/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. Lo=Effective range (mm)

AT103		Effective range*	Signal cable length
Order No.	Model	Lo (mm)	(m)
539-111-30	AT103-100	100 (4 in)	
539-112-30	AT103-150	150 (6 in)	7
539-113-30	AT103-200	200 (8 in)	7
539-114-30	AT103-250	250 (10 in)	7
539-115-30	AT103-300	300 (12 in)	7
539-116-30	AT103-350	350 (14 in)	1
539-117-30	AT103-400	400 (16 in)	
539-118-30	AT103-450	450 (18 in)	3
539-119-30	AT103-500	500 (20 in)	
539-121-30	AT103-600	600 (24 in)	
539-123-30	AT103-700	700 (28 in)	
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)	5
539-133-30	AT103-1600	1600 (64 in)	
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)	7
539-141-30	AT103-2800	2800 (112 in)	_
539-142-30	AT103-3000	3000 (120 in)	
539-143-30	AT103-3250	3250 (130 in)	_
539-144-30	AT103-3500	3500 (140 in)	_
539-145-30	AT103-3750	3/50 (150 in)	- 10
539-146-30	AT103-4000	4000 (160 in)	_
539-147-30	AT103-4250	4250 (170 in)	_
539-148-30	A1103-4500	4500 (180 in)	
539-149-30	AT103-4750	4/50 (190 in)	_
539-150-30	AT103-5000	5000 (200 IN)	-
539-151-30	AT103-5250	5250 (2 IU IN)	15
539-152-30	AT103-5500	5500 (220 IN)	-
539-155-30	AT 103-5/50	5/50 (230 III)	-
539-154-30	ATT03-6000	6000 (240 IN)	

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



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



Designed to accurately capture positional coordinates along an axis

Linear Scales AT113 SERIES 539 — Slim Type



SPECIFICATIONS

Model	AT113
Effective range	100 to 1500 mm
Accuracy (20 °C)	(5 + 5L₀/1000) 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 + 3Lo/1000) μm is also available to special order. Note 2: Ultra-high precision model AT113S (2 + 2Lo/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. Lo=Effective range (mm)

AT113		Effective range	Signal cable length
Order No.	Model	Lo (mm)	(m)
539-201-30	AT113-100	100 (4 in)	
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)	2
539-208-30	AT113-450	450 (18 in)	2
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)	
539-218-30	AT113-1100	1100 (44 in)	
539-219-30	AT113-1200	1200 (48 in)	5
539-220-30	AT113-1300	1300 (52 in)	
539-221-30	AT113-1400	1400 (56 in)	
539-222-30	AT113-1500	1500 (60 in)	



An inspection certificate is supplied as standard. Refer to page U-11 for details.

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



Mitutoyo

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



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- This is a slim, sealed, 2-phase, squarewave 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 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 + 3Lo/1000) μm Lo=effective range (mm)		
	(2 + 2L₀/1000) µm (L₀≤500 mm)		
Output signal	Two 90° phase-shifted square-wave signals		
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.





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



Designed to accurately capture positional coordinates along an axis

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



SPECIFICATIONS

	High rigidity type	High accuracy type	
Model	ABS AT13 (A)-S	ABS AT13 🗆 🗆 (A)-H	
Detection method	Photoelectric type linear encoder		
Resolution	0.001/0.05 µm		
Maximum response speed	3 m/s		
Maximum effective measuring length	2.2 m	1 m	
Accuracy (20 °C)*1	(3 + 3Lo/1000)µm	(2 + 2Lo/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. Lo=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 Effective range Type of the scale unit Interface specifications S: High rigidity type Model Applicable system H: High accuracy type FANUC CORPORATION ABS AT135 Serial *a*i Interface Mitsubishi Electric Corporation ABS AT134 MDS-D/MDS-DH Series Mitsubishi Electric Corporation ABS AT134 A MELSERVO servo amplifier MR-J4 Series ABS AT130 A Mitutoyo ENSIS

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

Note 2: ABS AT13 Transmission method Nothing: Full duplex communication **7**: 0.001 µm A: Half-duplex communication

4: 0.01 μm **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)	



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Outstanding resistance to contamination compared to conventional optical types by using a new detection principle (inhouse 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.



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

H-11



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- 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.



Mitutoyo

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





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 length Lo=140 to 2040 mm: 3 + 5Lo/1000 (µm) Effective length Lo=2240 to 3040 mm: 5 + 5Lo/1000 (µm)
Expansion coefficient	≈8x10 ⁻⁶ /K
Vibration resistance	≤196 m/s ² (20 G) (55 to 2000 Hz)
Shock resistance	Effective length L₀=140 to 2040 mm: ≤ 343 m/s² (35 G) Effective length L₀=2240 to 3040 mm: ≤ 294 m/s² (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.

<u>ABS AT1103</u> - <u>0000</u>			
	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	



Designed to accurately capture positional coordinates along an axis



SPECIFICATIONS

Model	ABS AT715			
Detection method	Electromagn	etic induction		
Minimum resolution	0.001 mm (Changeable by paramete	0.001 mm to 0.01 mm (Changeable by parameter on the KA-200 counter)		
Effective range	100 to 3	3000 mm		
Accuracy (20 °C)	±5 μm (Lo: 100 to 500 mm), ±7 μm (Lo: 600 Lo=Effective	±5 μm (Lo: 100 to 500 mm), ±7 μm (Lo: 600 to 1800 mm), ±10 μm (Lo: 2000 to 3000 mm) Lo=Effective range (mm)		
Maximum response speed	50 m	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.			
	Length	Order No.		
Extension cable (optional)	2 m 5 m 7 m	09AAB674A 09AAB674B 09AAB674C		
Connectable counter	KA-200 Counter			

AT	715	Effective range	Signal cable length
Order No.	Model	Lo (mm)	(m)
539-801	ABS AT715-100	100 (4 in)	
539-802	ABS AT715-150	150 (6 in)	
539-803	ABS AT715-200	200 (8 in)	
539-804	ABS AT715-250	250 (10 in)	
539-805	ABS AT715-300	300 (12 in)	
539-806	ABS AT715-350	350 (14 in)	
539-807	ABS AT715-400	400 (16 in)	2 6
539-808	ABS AT715-450	450 (18 in)	5.5
539-809	ABS AT715-500	500 (20 in)	
539-811	ABS AT715-600	600 (24 in)	
539-813	ABS AT715-700	700 (28 in)	
539-814	ABS AT715-750	750 (30 in)	
539-815	ABS AT715-800	800 (32 in)	
539-816	ABS AT715-900	900 (36 in)	
539-817	ABS AT715-1000	1000 (40 in)	
539-818	ABS AT715-1100	1100 (44 in)	
539-819	ABS AT715-1200	1200 (48 in)	
539-820	ABS AT715-1300	1300 (52 in)	
539-821	ABS AT715-1400	1400 (56 in)	
539-822	ABS AT715-1500	1500 (60 in)	5
539-823	ABS AT715-1600	1600 (64 in)	
539-824	ABS AT715-1700	1700 (68 in)	
539-825	ABS AT715-1800	1800 (72 in)	
539-860	ABS AT715-2000	2000 (80 in)	
539-861	ABS AT715-2200	2200 (88 in)	
539-862	ABS AT715-2400	2400 (96 in)	
539-863	ABS AT715-2500	2500 (100 in)	
539-864	ABS AT715-2600	2600 (104 in)	7*
539-865	ABS AT715-2800	2800 (112 in)	
539-866	ABS AT715-3000	3000 (120 in)	

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



ABSOLUTE[™]



An inspection certificate is supplied as standard. Refer to page U-11 for details.

- 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.



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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	AC100 to 240 V, 50/60 Hz		
Dimensions	300 (W) ×70 (D) ×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.



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







Η

Designed to accurately capture positional coordinates along an axis

Туре

High performance 835 III I

Linear scale counter

FUNCTIONS

Function		KA-200 Counter
Zero-setting	ZERO	•
Preset	P.SET	•
Resolution setting	0.000 5 / 0.1	•
Measurement direction setting	←	•
mm/inch conversion	mm/E	•
Diameter display	DIA	•
Scale reference point setting*1	▼ SET	•
1/2 calculation	1/2	•
Coordinate system switching	\odot "	•
Bolt-hole circle machining	\oplus	•*2
Pitch machining	- 1- A-A-	•
Zero approach machining (INC mode)		•
Addition of 2-axis data	Z1+Z2	•* ³
Linearity error compensation	۲ <u>۲</u>	•
Pitch error compensation		•* ¹
Smoothing	[°] ₂ 1234 [″] ₈	•
Memory backup	5675	•
Expansion/contraction coefficient setting	•	_
Lower digit blanking out	123 🚳	•
External zero-setting	ZERO SET IN PUT	▲ * ⁴
RS-232C output	RS-232C OUTPUT	▲ * ⁴
USB output	USB	▲ * ⁵
Limit signal output	LIMIT OUTPUT	_
Error message	Error	•

e: 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 autorit by code out unit and fact switch

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



Scale Units and Display Counters

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



An inspection certificate is supplied as standard. Refer to page U-11 for 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 1Vp-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	Reflective photoelectric linear encoder		
Output signal	 ST36A: 2Vp-p sinusoidal signals ST36B: 2-phase square-wave signals, Alarm reset input ST36C: 2-phase square-wave signals, 2-phase sinusoidal signals ST36D: 1Vp-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)		
*4 =====			
* Ettocfivo rango	() CCURDOV		

*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



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



Designed to accurately capture positional coordinates along an axis

Linear Scales ST46-EZA SERIES 579 — Compact Type





SPECIFICATIONS

Model	ST46-EZA		
Detection method	Reflective photoelectric linear encoder		
Scale type	Glass	Metal tape	
Main scale grating pitch	20	μm	
Output signal	Type B: 2-phase square-wave signals, refer Type C: 2-phase square-wave signals, refer	rence point pulse, external reset input. rence point pulse, 2-phase sinusoidal signals.	
Effective range	10 to 3	000 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: ±5 μm Effective range 1100 to 3000 mm: ±5 μm/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	C ± 5%	
Operating temperature (humidity) range	ge 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)		

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An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Glass and metal tape versions are available.
- 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.
- Self-diagnosis function with USB connectivity facilitates signal strength checking and parameter setup.
- I/F circuit integrated in connector shell reduces volume to 60 % 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.



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

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An inspection certificate is supplied as standard. Refer to page U-11 for 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) × 28 mm (D) ×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)



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

Linear Scales ABS ST700 SERIES 579 — General-purpose Type



SPECIFICATIONS

Model	ABS S	ST700
Scale type	Scale	base
Resolution	0.1	μm
Detection method	Electromagnetic induct	ion ABS linear encoder
Max. effective range	100 to 3000 mm	3200 to 6000 mm
Accuracy (20 °C)	5 + (5L/1000) µm L=Effective range (mm)	3 + (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	e 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.

Interface specification*1-

- 0:Supports Mitutoyo ENSIS high-speed serial interface ABS ST708A, ST708AL
- 4: Supports Mitsubishi Electric Corporation, high-speed serial interface ABS ST748A, ST748AL, ABS ST748, ST748L
- 5: Supports FANUC CORPORATION, high-speed serial interface ABS ST758, ST758L
- 7:Supports Panasonic Corporation, high-speed serial interface ABS ST778A, ST778AL
- 8:Supports YASKAWA Electric Corporation, high-speed serial interface ABS 51788A, ST788AL
- Head cable outlet A: Scale base type direction R: Right side L : Left side Effective range: 100 to 6000 mm $\boldsymbol{U}: \text{Upper side}$ Nothing: 100 to 3000 mm D: Lower side L: 3200 to 6000 mm Transmission method A: 2-wire system Nothing: 4-wire system Detection head form and resolution 8: Form: 50 (W)×28 (D)×11 (H) mm
 - Resolution: 0.1 µm
 - 9: 0.05 µm resolution (to special order)

Available Interfaces*1

FANUC CORPORATION, FANUC α i Series CNC
Mitsubishi Electric Corporation, MITSUBISHI CNC Drive Unit MDS Series
Mitsubishi Electric Corporation, MELSERVO Servo Amplifier MR-J4 Series, MR-J3 Series
YASKAWA Electric Corporation, SERVOPACK Σ -7 Series, Σ -V Series
Panasonic Corporation, MINAS A5 Series, MINAS A6 Series
Mitutoyo ENSIS ⁺² Nikki Denso Co., Ltd. VPH/VC II/VPS Series Servoland Corporation SVF Series PMAC Japan Co., Ltd. Power-UMAC, Power-Clipper, Power-Brick Series

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*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.



Designed to accurately capture positional coordinates along an axis

Linear Scales ABS ST1300 SERIES 579





An inspection certificate is supplied as standard. Refer to page U-11 for details.

- Effective length: 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 reflection type linear encoder			
Scale type	Double-end mounting	Double-end mounting Center mounting Double-sided tape mounting		
Maximum effective length	12000 mm	6000 mm	300	0 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)	\pm 5 µm (1 m or less), \pm	5 µm/m (1.1 m or more)
Maximum response speed		8 m/s or less		
Expansion coefficient	≈10x10 ⁻⁶ /K* ⁵ ≈10x10 ⁻⁶ /K ≈10x10 ⁻⁶ /K* ²			0 ⁻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 (RH 20 to 70 %, non-condensing) 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)			

Storage temperature (humidity) range

*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.

Absolute type

Series name

ABS ST135

Mitutoyo ENSIS*2

ABS ST13 4 1 A - 1200 D

Scale mount D: Double-end mounting E: Double-sided tape mounting : Center mounting (With system parameters) Separate Type ABSOLUTE Linear Scale G: Center mounting (Without system parameters) Interface specification*1 Effective range: 10 to 12000 mm 0: Supports Mitutoyo ENSIS high-speed serial interface ABS ST130 A Transmission method 4: Supports Mitsubishi Electric Corporation, high-speed serial interface A: When 0, 4, 7, or 8 is selected in the interface specification listed on the left ABS ST134 A 5: Supports FANUC CORPORATION, high-speed serial interface Nothing: When 5 is selected in the interface specification listed on the left 7: Supports Panasonic Corporation, high-speed serial interface Resolution ABS ST137 A 1: Resolution 0.01 um 8: Supports YASKAWA Electric Corporation, high-speed serial interface 2: Resolution 0.001 µm ABS ST138 A Available Interfaces^{*1}



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Scale Systems

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

*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.

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FANUC CORPORATION, FANUC *a* i Series CNC

Mitsubishi Electric Corporation, MELSERVO Servo Amplifier MR-J4 Series YASKAWA Electric Corporation, SERVOPACK Σ -7 Series, Σ -V Series Panasonic Corporation, MINAS A5 Series, MINAS A6 Series

Pulse signal interface unit PSU-200 SERIES 539

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.

• The **PSU-200** splits the sinusoidal signal



Order No.	539-005
Model	PSU-200
Number of axes	1
Input	Input connector DA-155-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

Serial signal interface unit PSU-251/252 SERIES 539



SPECIFICATIONS

Order No.	539-006	539-007
Model	PSU-251	PSU-252
Number of axes	ſ	
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: $5 \text{ VDC} \pm 5\%$ External power supply: $5 \text{ VDC} \pm 5\%$ 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	

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

• **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.



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 μ m 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 μ m 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:

Error = Value indicated by Laser length measuring machine - 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 below.

(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: $E = (\alpha + \beta L) \mu m$. 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 $(3 + \frac{3L}{1000}) \mu m$ 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: $e = \pm \frac{E}{2}$ (µm). 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 μ m, interpolated values can generate a resolution of 1 μ m. 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.



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