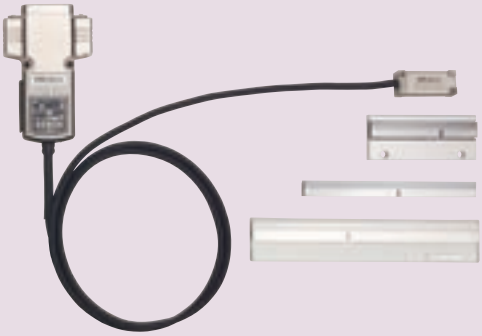
New Products

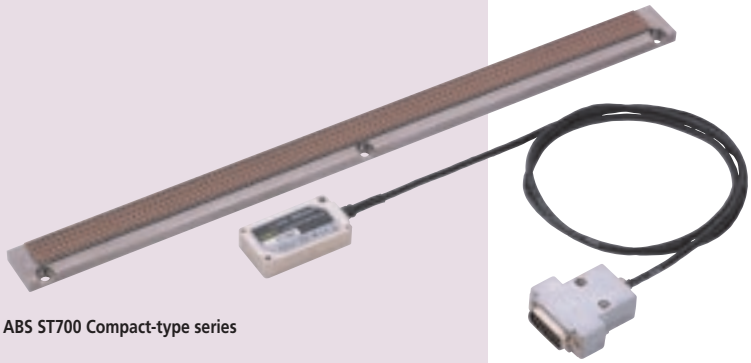


ST46-EZA Glass Linear Scales

Assembly Type Scale Unit for Incremental Systems

ST46-EZA series

Refer to page H-25 for details.

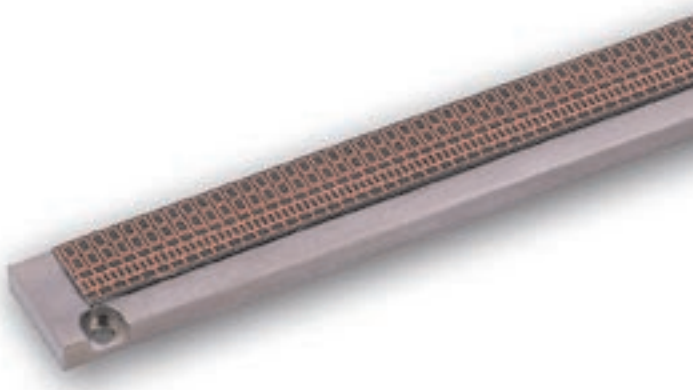


ABS ST700 Compact-type series

Separate Type Scale Unit for Absolute Systems

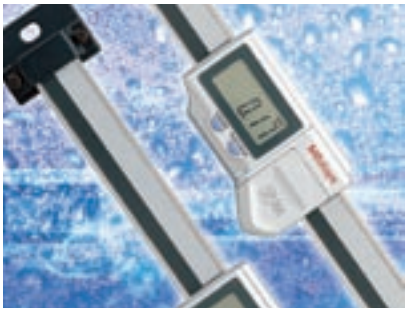
ABS ST700 Compact-type series

Refer to page H-26 for details.



Digimatic Scale Units/Linear Scales

ABSOLUTE Digimatic Scale Units



Linear Scales

Linear Scales

2D Image Correlation Encoder

2D Image Correlation Encoder

INDEX

ABSOLUTE Digimatic Scale Units

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

SD ABSOLUTE Digimatic Scale Units
SERIES 572

IP66

Horizontal single-function type (Water-proof type)
572-602 SD-20G

Horizontal single-function type
572-202-20 SD-20DX

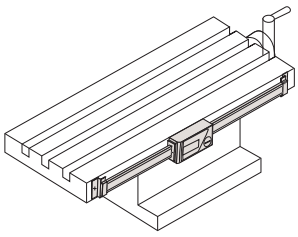
Horizontal multi-function type
572-461 SD-15E

Vertical single-function type
572-303-10 SDV-30D

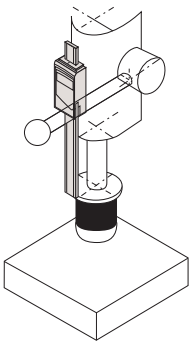
Vertical multi-function type
572-561 SDV-15E

Applications

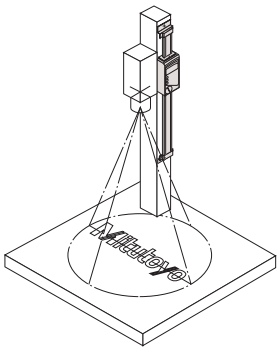
Machine table position



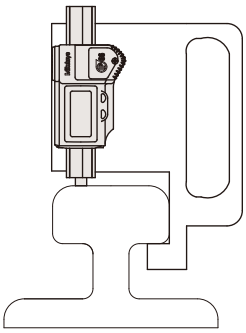
Drilling machine stroke position



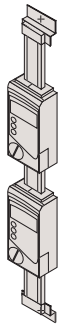
Focus setting on optical instruments



Special applications



As a measurement jig for outdoor use (SD-G)



Detector head mechanism

Please contact Mitutoyo for other special orders.

ABSOLUTE™ (Refer to page IX for details.)

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page IX for details.

- **SD** series facilitates mounting on jigs, tools, and small machine tools to enable accurate positioning.
- Built-in absolute scale including the ABS point requires no 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.
  This allows 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-D**, **SDV-D**)
- Double reading function (Available only for **SD-F** or **SDV-F**)
- Direction switch function
  Not available for **SD-G**, **SD-D**, **SDV-D**, **SD-F**, **SDV-F**)
- Hold function*
- Measurement value composition error alarm
- Low battery alarm
- Output function

* To activate the hold function when using **SD-D** or **SDV-D**, an optional hold unit is required. Simultaneous activation with the output function is not available. **SD-G** are also available to special order.

* These units use 1.5V 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, malfunction such as display digit fluctuations and errors may occur. The countermeasure examples are described in the user manuals provided.

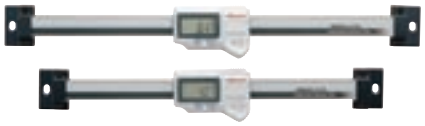
Refer to the ABSOLUTE DIGIMATIC SCALE UNITS (Catalog No.E4316) for more details.

System Diagram

[Scale units]

Single-function type with high dust/water resistance

SD-G



Single-function type

SD-D (Horizontal)

SDV-D (Vertical)

Multi-function type

SD-E (Horizontal)

SDV-E (Vertical)

Multi-function type

SD-F (Horizontal)

SDV-F (Vertical)

*2

[Display units]

EC Counter*3

Refer to page G-21 for details.

Tolerance judgment output*1

*3

Digimatic mini-processor
DP-1VR
No.264-504

Palm-sized printer for printing and statistical analysis

*3

Multiplexer
MUX-10F
No.264-002

Interface unit for the RS-232C conversion and output RS-232C output

RS-232C output

*3

Input Tool (USB keyboard signal conversion model)
IT-012U
No.264-012-10

USB Interface unit that converts and transfers data into spreadsheets

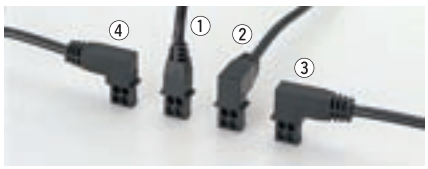
USB keyboard signal conversion

* Connection to an RS-232C conversion type (**IT-007R**) or a PS/2 keyboard signal conversion type (**IT-005D**) input tool is also available.

Connecting cable with the water-proof type output switch*2 1m : **No.05CZA624** 2m : **No.05CZA625**

Connecting cable with the output switch 1m : **No.959149** 2m : **No.959150**

Connecting cable with the output switch



① 1m : **No.905338** 2m : **No.905409**
② 1m : **No.905689** 2m : **No.905690**
③ 1m : **No.905691** 2m : **No.905692**
④ 1m : **No.905693** 2m : **No.905694**

Connecting cable 1m : **No.936937** 2m : **No.965014**

* 1: Select the tolerance judgment output or digimatic output when setting the parameters.
* 2: Connecting cable with the water-proof type output switch can be used only for **SD-G** or Water-proof Digital Caliper **CD-15/20/30PM** equipped with external output function.
* 3: Connecting of **SD** series and **DP-1VR/MUX-10F/IT-012U** is also available without passing through the EC counter.
In this case, connect these units and **SD** series with the cables used for the connection with the **EC** counter.

Mitutoyo

ABSOLUTE Digimatic Scale Units

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

ABSOLUTE Digimatic Scale Units
SERIES 572

SPECIFICATIONS

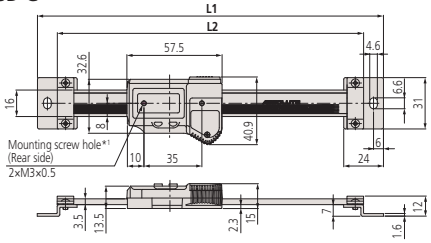
Type	Unit spec.	Order No.	Model	Range	Resolution	Accuracy	Repeatability	Battery life
Horizontal single-function type (Water-proof type)	Metric	**572-600**	**SD-10G**	0-100mm	0.01mm	0.03mm	0.01mm	Approx. 13000 hours
		572-601	**SD-15G**	0-150mm				
		572-602	**SD-20G**	0-200mm				
	Inch	**572-610**	**SD-4"G**	0-4"	0.0005"	.001"		
		572-611	**SD-6"G**	0-6"				
		572-612	**SD-8"G**	0-8"				
	Metric/Inch	**572-613**	**SD-4"/10G**	0-100mm/0-4"	0.0005"/0.01mm	0.03mm/.001"		
		572-614	**SD-6"/15G**	0-150mm/0-6"				
		572-615	**SD-8"/20G**	0-200mm/0-8"				
Horizontal single-function type	Metric	**572-200-20**	**SD-10DX**	0-100mm	0.01mm	0.03mm		Approx. 20000 hours
		572-201-20	**SD-15DX**	0-150mm				
		572-202-20	**SD-20DX**	0-200mm				
		572-203-10	**SD-30D**	0-300mm		0.04mm		
	Metric/Inch	**572-210-20**	**SD-4"DX**	0-100mm/0-4"	0.0005"/0.01mm	0.03mm/.001"		
		572-211-20	**SD-6"DX**	0-150mm/0-6"				
		572-212-20	**SD-8"DX**	0-200mm/0-8"				
		572-213-10	**SD-12"D**	0-300mm/0-12"		0.04mm/.002"		
Horizontal multi-function type	Metric	**572-460**	**SD-10E**	0-100mm	0.01mm	0.03mm		Approx. 5000 hours
		572-461	**SD-15E**	0-150mm				
		572-462	**SD-20E**	0-200mm				
		572-463	**SD-30E**	0-300mm		0.04mm		
		572-464	**SD-45E**	0-450mm				
		572-465	**SD-60E**	0-600mm		0.05mm		
		572-466	**SD-80E**	0-800mm		0.06mm		
		572-467	**SD-100E**	0-1000mm		0.07mm		
	Metric/Inch	**572-470**	**SD-4"E**	0-100mm/0-4"	0.0005"/0.01mm	0.03mm/.001"		
		572-471	**SD-6"E**	0-150mm/0-6"				
		572-472	**SD-8"E**	0-200mm/0-8"				
		572-473	**SD-12"E**	0-300mm/0-12"		0.04mm/.002"		
		572-474	**SD-18"E**	0-450mm/0-18"				
		572-475	**SD-24"E**	0-600mm/0-24"		0.05mm/.002"		
		572-476	**SD-32"E**	0-800mm/0-32"		0.06mm/.0025"		
		572-477	**SD-40"E**	0-1000mm/0-40"		0.07mm/.0025"		
Horizontal multi-function type (equipped with double reading function)	Metric	**572-480-10***	**SD-10F**	0-100mm	0.01mm	0.03mm	0.01mm	Approx. 5000 hours
		572-481-10*	**SD-15F**	0-150mm				
		572-482-10*	**SD-20F**	0-200mm				
		572-483-10*	**SD-30F**	0-300mm		0.04mm		
		572-484-10*	**SD-45F**	0-450mm				
		572-485-10*	**SD-60F**	0-600mm		0.05mm		
		572-486-10*	**SD-80F**	0-800mm		0.06mm		
		572-487-10*	**SD-100F**	0-1000mm		0.07mm		
	Metric/Inch	**572-490-10***	**SD-4"F**	0-100mm/0-4"	0.0005"/0.01mm	0.03mm/.001"		
		572-491-10*	**SD-6"F**	0-150mm/0-6"				
		572-492-10*	**SD-8"F**	0-200mm/0-8"				
		572-493-10*	**SD-12"F**	0-300mm/0-12"		0.04mm/.002"		
		572-494-10*	**SD-18"F**	0-450mm/0-18"				
		572-495-10*	**SD-24"F**	0-600mm/0-24"		0.05mm/.002"		
		572-496-10*	**SD-32"F**	0-800mm/0-32"		0.06mm/.0025"		
		572-497-10*	**SD-40"F**	0-1000mm/0-40"		0.07mm/.0025"		
Vertical single-function type	Metric	**572-300-10**	**SDV-10D**	0-100mm	0.01mm	0.03mm		Approx.20000 hours
		572-301-10	**SDV-15D**	0-150mm				
		572-302-10	**SDV-20D**	0-200mm				
		572-303-10	**SDV-30D**	0-300mm		0.04mm		
	Metric/Inch	**572-310-10**	**SD-4"D**	0-100mm/0-4"	0.0005"/0.01mm	0.03mm/.001"		
		572-311-10	**SD-6"D**	0-150mm/0-6"				
		572-312-10	**SD-8"D**	0-200mm/0-8"				
		572-313-10	**SD-12"D**	0-300mm/0-12"		0.04mm/.002"		
Vertical multi-function type	Metric	**572-560**	**SDV-10E**	0-100mm	0.01mm	0.03mm		Approx.5000 hours
		572-561	**SDV-15E**	0-150mm				
		572-562	**SDV-20E**	0-200mm				
		572-563	**SDV-30E**	0-300mm		0.04mm		
		572-564	**SDV-45E**	0-450mm				
		572-565	**SDV-60E**	0-600mm		0.05mm		
		572-566	**SDV-80E**	0-800mm		0.06mm		
		572-567	**SDV-100E**	0-1000mm		0.07mm		
	Metric/Inch	**572-570**	**SDV-4"E**	0-100mm/0-4"	0.0005"/0.01mm	0.03mm/.001"		
		572-571	**SDV-6"E**	0-150mm/0-6"				
		572-572	**SDV-8"E**	0-200mm/0-8"				
		572-573	**SDV-12"E**	0-300mm/0-12"		0.04mm/.002"		
		572-574	**SDV-18"E**	0-450mm/0-18"				
		572-575	**SDV-24"E**	0-600mm/0-24"		0.05mm/.002"		
		572-576	**SDV-32"E**	0-800mm/0-32"		0.06mm/.0025"		
		572-577	**SDV-40"E**	0-1000mm/0-40"		0.07mm/.0025"		
Vertical multi-function type (equipped with double reading function)	Metric	**572-580-10***	**SDV-10F**	0-100mm	0.01mm	0.03mm		Approx.5000 hours
		572-581-10*	**SDV-15F**	0-150mm				
		572-582-10*	**SDV-20F**	0-200mm				
		572-583-10*	**SDV-30F**	0-300mm		0.04mm		
		572-584-10*	**SDV-45F**	0-450mm				
		572-585-10*	**SDV-60F**	0-600mm		0.05mm		
		572-586-10*	**SDV-80F**	0-800mm		0.06mm		
		572-587-10*	**SDV-100F**	0-1000mm		0.07mm		
	Metric/Inch	**572-590-10***	**SDV-4"F**	0-100mm/0-4"	0.0005"/0.01mm	0.03mm/.001"		
		572-591-10*	**SDV-6"F**	0-150mm/0-6"				
		572-592-10*	**SDV-8"F**	0-200mm/0-8"				
		572-593-10*	**SDV-12"F**	0-300mm/0-12"		0.04mm/.002"		
		572-594-10*	**SDV-18"F**	0-450mm/0-18"				
		572-595-10*	**SDV-24"F**	0-600mm/0-24"		0.05mm/.002"		
		572-596-10*	**SDV-32"F**	0-800mm/0-32"		0.06mm/.0025"		
		572-597-10*	**SDV-40"F**	0-1000mm/0-40"		0.07mm/.0025"		

* Available to special order
Note: Response speed is unlimited

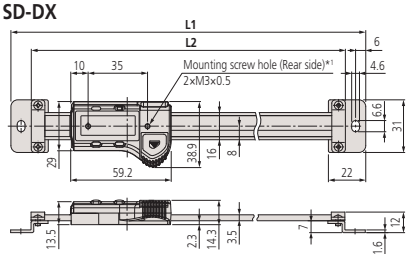
DIMENSIONS

Unit: mm

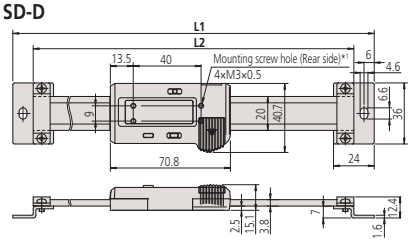
SD-G



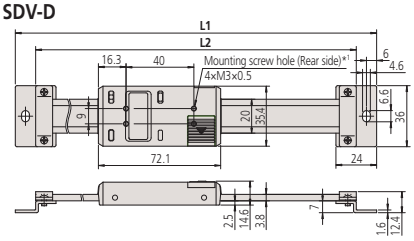
SD-DX



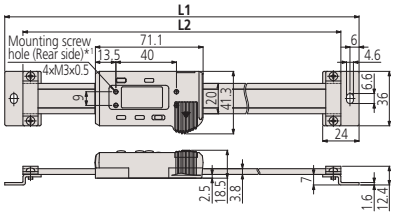
SD-D



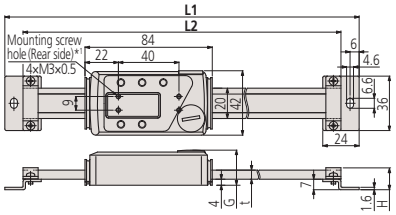
SDV-D



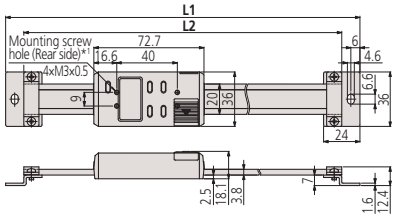
SD-E (to 300mm) / **SD-F** (to 300mm)



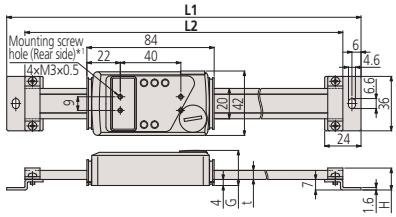
SD-E (450 to 1000mm) / **SD-F** (450 to 1000mm)



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



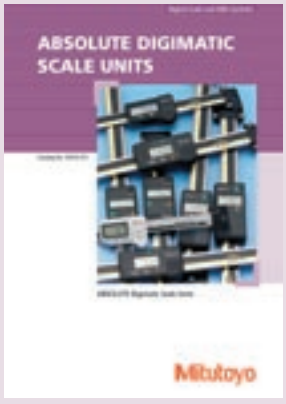
SDV-E (450 to 1000mm) / **SDV-F** (450 to 1000mm)



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

SPECIFICATIONS

Model	Range (mm)	Dimensions(mm)					Depth including the screw on the rear of the display	Mass (g)
		L1	**L2**	t	G	H		
SD-G	100	209	185	—	—	—	Less than 2mm	390
	150	259	235	—	—	—		410
	200	311	287	—	—	—		430
SD-DX	100	209	185	—	—	—		230
	150	259	235	—	—	—		250
	200	311	287	—	—	—		270
SD-30D	300	444	420	—	—	—		370
SD-E **SD-F**	100	244	220	—	—	—		250
	150	294	270	—	—	—		280
	200	344	320	—	—	—		310
	300	444	420	—	—	—		370
	450	594	570	6	23.2	14.6	Less than 3mm	760
	600	774	750					900
	800	974	950	10	27.2	18.6		1710
	1000	1174	1150					2040
SDV-D	100	244	220	—	—	—	Less than 2mm	250
	150	294	270	—	—	—		280
	200	344	320	—	—	—		310
	300	444	420	—	—	—		370
SDV-E **SDV-F**	100	244	220	—	—	—		250
	150	294	270	—	—	—		280
	200	344	320	—	—	—		310
	300	444	420	—	—	—		370
	450	594	570	6	23.2	14.6	Less than 3mm	760
	600	774	750					900
	800	974	950	10	27.2	18.6		1710
	1000	1174	1150					2040



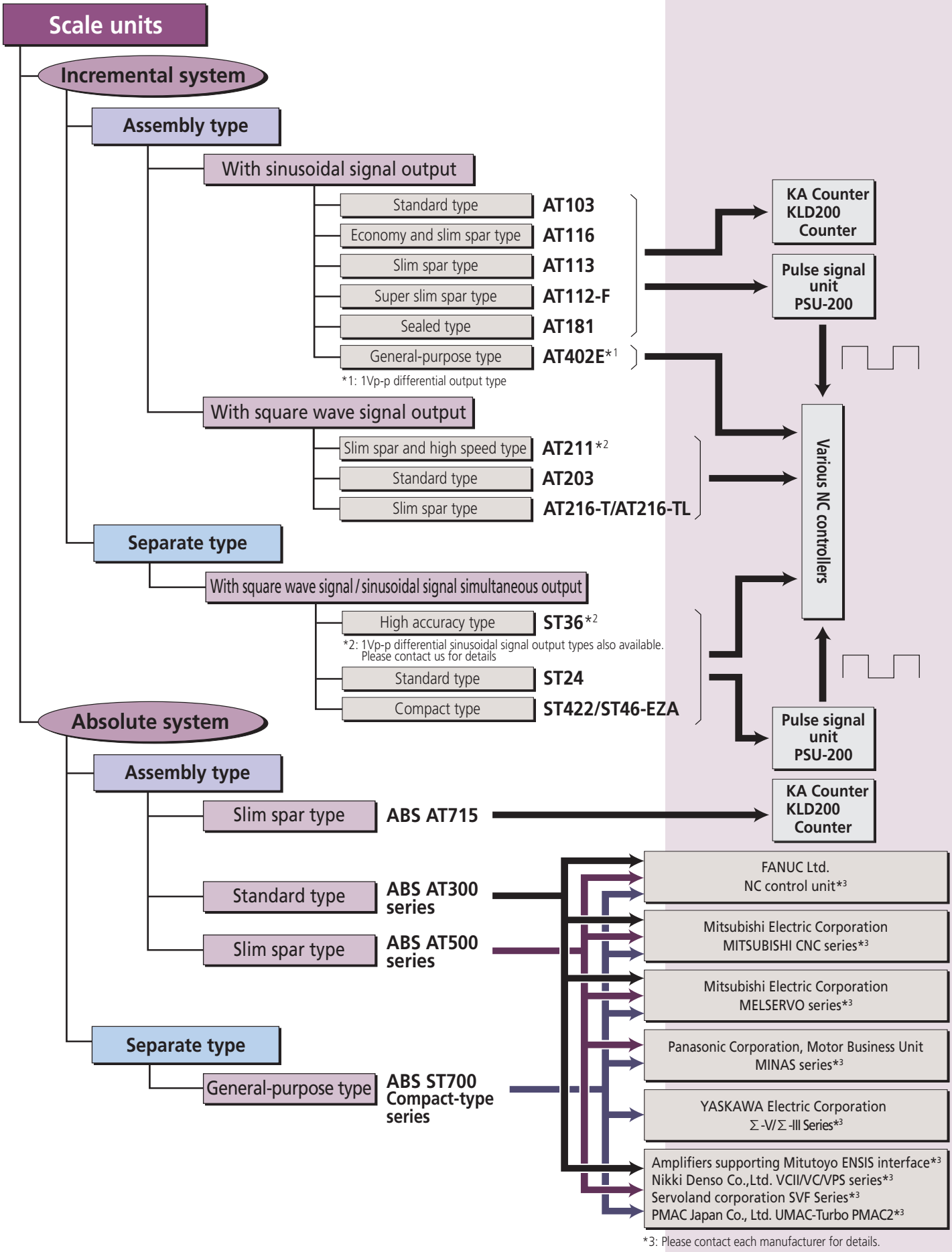
Refer to the ABSOLUTE DIGIMATIC SCALE UNITS (Catalog No.E4316) for more details.

Mitutoyo

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

Linear Scale System Diagram



*3: Please contact each manufacturer for details.

An inspection certificate is supplied as standard.
Refer to page IX for details.

Linear Scales AT103
SERIES 539 — Standard Type

- A wide variety of measuring ranges are available in this standard type scale unit.
- Connectable to the **KA** counter, **KLD** counter, or **PSU-200**.

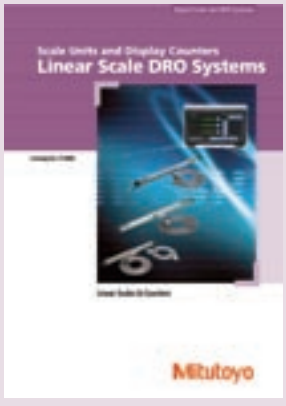
SPECIFICATIONS

Model	AT103
Effective range	100 to 6000mm (42 models)
Accuracy (20°C)	Effective range 100 to 3000: (5+5L0/1000)µm Effective range 3250 to 6000: (5+8L0/1000)µm
Output signal	Two 90° phase-shifted sinusoidal signals
Maximum response speed	120m/min (50m/min when the effective measuring length is 3250 to 6000mm)
Signal output pitch	20µm
Scale reference point	Output in 50mm pitch
Protection Level	IP53
Operating temperature	0 to 45°C

* High precision model **AT103F** (JIS Class 0, (3+3L0/1000)µm) is also available to special order for the effective range of 100 to 2000mm.
* Ultrahigh precision model **AT103S** (2+2L0/1000)µm is also available to special order for the effective range of 100 to 500mm.
* The indication accuracy does not include quantizing error. L0: Effective range (mm)

AT103		Effective range L0 (mm)	Signal cable length (m)
Order No.	Model		
539-111-30	**AT103-100**	100 (4")	3
539-112-30	**AT103-150**	150 (6")	
539-113-30	**AT103-200**	200 (8")	
539-114-30	**AT103-250**	250 (10")	
539-115-30	**AT103-300**	300 (12")	
539-116-30	**AT103-350**	350 (14")	
539-117-30	**AT103-400**	400 (16")	
539-118-30	**AT103-450**	450 (18")	
539-119-30	**AT103-500**	500 (20")	
539-121-30	**AT103-600**	600 (24")	
539-123-30	**AT103-700**	700 (28")	
539-124-30	**AT103-750**	750 (30")	
539-125-30	**AT103-800**	800 (32")	
539-126-30	**AT103-900**	900 (36")	
539-127-30	**AT103-1000**	1000 (40")	5
539-128-30	**AT103-1100**	1100 (44")	
539-129-30	**AT103-1200**	1200 (48")	
539-130-30	**AT103-1300**	1300 (52")	
539-131-30	**AT103-1400**	1400 (56")	
539-132-30	**AT103-1500**	1500 (60")	
539-133-30	**AT103-1600**	1600 (64")	
539-134-30	**AT103-1700**	1700 (68")	
539-135-30	**AT103-1800**	1800 (72")	
539-136-30	**AT103-2000**	2000 (80")	
539-137-30	**AT103-2200**	2200 (88")	
539-138-30	**AT103-2400**	2400 (96")	7
539-139-30	**AT103-2500**	2500 (100")	
539-140-30	**AT103-2600**	2600 (104")	
539-141-30	**AT103-2800**	2800 (112")	
539-142-30	**AT103-3000**	3000 (120")	
539-143-30	**AT103-3250**	3250 (130")	10
539-144-30	**AT103-3500**	3500 (140")	
539-145-30	**AT103-3750**	3750 (150")	
539-146-30	**AT103-4000**	4000 (160")	
539-147-30	**AT103-4250**	4250 (170")	
539-148-30	**AT103-4500**	4500 (180")	
539-149-30	**AT103-4750**	4750 (190")	15
539-150-30	**AT103-5000**	5000 (200")	
539-151-30	**AT103-5250**	5250 (210")	
539-152-30	**AT103-5500**	5500 (220")	
539-153-30	**AT103-5750**	5750 (230")	
539-154-30	**AT103-6000**	6000 (240")	

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



Refer to the Linear Scale DRO Systems (Catalog No.E13000) for more details.

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

Linear Scales AT116
SERIES 539 — Economy and Slim Spar Type

- Suitable for milling machines, XY tables, jigs, etc.
- Dimensionally compatible with **AT113** linear scale units.

An inspection certificate is supplied as standard.
Refer to page IX for details.

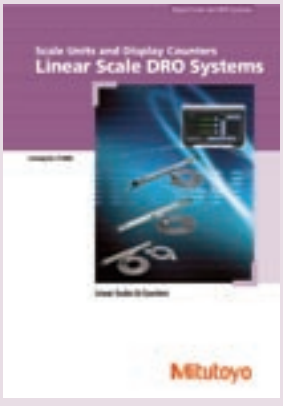
H

SPECIFICATIONS

Model	AT116
Effective range	100 to 1500mm (20 models)
Accuracy (20°C)	(5+5L0/1000)µm
Output signal	Two 90° phase-shifted sinusoidal signals
Maximum response speed	50m/min
Signal output pitch	20µm
Scale reference point	Output in 50mm pitch
Protection Level	IP53
Operating temperature	0 to 45°C

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

AT116		Effective range L0 (mm)	Signal cable length (m)
Order No.	Model		
539-271-30	**AT116-100**	100 (4")	3.5
539-272-30	**AT116-150**	150 (6")	
539-273-30	**AT116-200**	200 (8")	
539-274-30	**AT116-250**	250 (10")	
539-275-30	**AT116-300**	300 (12")	
539-276-30	**AT116-350**	350 (14")	
539-277-30	**AT116-400**	400 (16")	
539-278-30	**AT116-450**	450 (18")	
539-279-30	**AT116-500**	500 (20")	
539-281-30	**AT116-600**	600 (24")	
539-283-30	**AT116-700**	700 (28")	
539-284-30	**AT116-750**	750 (30")	
539-285-30	**AT116-800**	800 (32")	
539-286-30	**AT116-900**	900 (36")	
539-287-30	**AT116-1000**	1000 (40")	5
539-288-30	**AT116-1100**	1100 (44")	
539-289-30	**AT116-1200**	1200 (48")	
539-290-30	**AT116-1300**	1300 (52")	
539-291-30	**AT116-1400**	1400 (56")	
539-292-30	**AT116-1500**	1500 (60")	



Refer to the Linear Scale DRO Systems (Catalog No.E13000) for more details.

An inspection certificate is supplied as standard.
Refer to page IX for details.

Linear Scales AT113
SERIES 539 — Slim Spar Type

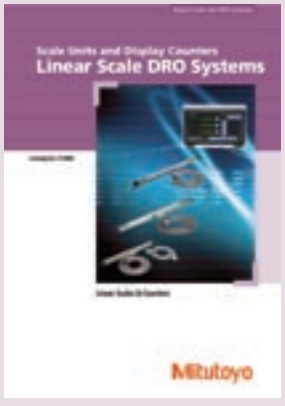
- Slim spar type with unit sectional dimensions of 22×35mmmm.
- Connectable to the **KA** counter, **KLD** counter, or **PSU-200**.

SPECIFICATIONS

Model	AT113
Effective range	100 to 1500mm (20 models)
Accuracy (20°C)	(5+5L0/1000)µm
Output signal	Two 90° phase-shifted sinusoidal signals
Maximum response speed	120m/min
Signal output pitch	20µm
Scale reference point	Output in 50mm pitch
Protection Level	IP53
Operating temperature	0 to 45°C

* High precision model **AT113F** (JIS Class 0, 3+3L0/1000)µm is also available to special order.
* Ultrahigh precision model **AT113S** (2+2L0/1000)µm is also available to special order for the effective range 100 to 500mm.
* The indication accuracy does not include quantizing error. L0: Effective range (mm)

AT113		Effective range L0 (mm)	Signal cable length (m)
Order No.	Model		
539-201-30	**AT113-100**	100 (4")	3
539-202-30	**AT113-150**	150 (6")	
539-203-30	**AT113-200**	200 (8")	
539-204-30	**AT113-250**	250 (10")	
539-205-30	**AT113-300**	300 (12")	
539-206-30	**AT113-350**	350 (14")	
539-207-30	**AT113-400**	400 (16")	
539-208-30	**AT113-450**	450 (18")	
539-209-30	**AT113-500**	500 (20")	
539-211-30	**AT113-600**	600 (24")	
539-213-30	**AT113-700**	700 (28")	
539-214-30	**AT113-750**	750 (30")	
539-215-30	**AT113-800**	800 (32")	
539-216-30	**AT113-900**	900 (36")	
539-217-30	**AT113-1000**	1000 (40")	5
539-218-30	**AT113-1100**	1100 (44")	
539-219-30	**AT113-1200**	1200 (48")	
539-220-30	**AT113-1300**	1300 (52")	
539-221-30	**AT113-1400**	1400 (56")	
539-222-30	**AT113-1500**	1500 (60")	



Refer to the Linear Scale DRO Systems (Catalog No.E13000) for more details.

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

Linear Scales AT112-F
SERIES 539 — Super Slim Spar Type

An inspection certificate is supplied as standard.
Refer to page IX for details.

- Super slim spar type with unit sectional dimensions of 15.4×30mm.
- Connectable to the **KA** counter, **KLD** counter, or **PSU-200**.

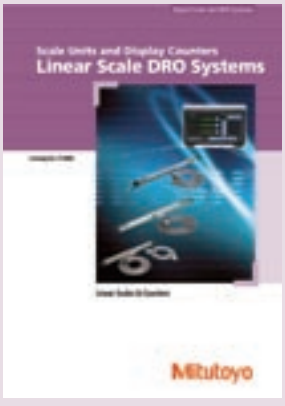
H

SPECIFICATIONS

Model	AT112-F
Effective range	50 to 1020mm (19 models)
Accuracy (20°C)	(3+3L0/1000)µm
Output signal	Two 90° phase-shifted sinusoidal signals
Maximum response speed	50m/min
Signal output pitch	20µm
Scale reference point	Output in 50mm pitch*1
Protection Level	IP53
Operating temperature	0 to 45°C

* Ultra-high precision model **AT112S** (2+2L0/1000)µm is also available to special order for the effective range 50 to 320mm.
* The indication accuracy does not include quantizing error. L0: Effective range (mm)
*1: Models whose effective range is 50mm or 70mm: Center point
Models whose effective range is 120mm or more: 50mm pitch starting at a point 35mm from the "▼" mark on the left seen from the front.

AT112-F		Effective range L0 (mm)	Signal cable length (m)
Order No.	Model		
539-251-10	**AT112-50F**	50 (1.5")	3
539-252-10	**AT112-70F**	70 (2.5")	
539-253-10	**AT112-120F**	120 (4.5")	
539-254-10	**AT112-170F**	170 (6.5")	
539-255-10	**AT112-220F**	220 (8.5")	
539-256-10	**AT112-270F**	270 (10.5")	
539-257-10	**AT112-320F**	320 (12.5")	
539-258-10	**AT112-370F**	370 (14.5")	
539-259-10	**AT112-420F**	420 (16.5")	
539-260-10	**AT112-470F**	470 (18.5")	
539-261-10	**AT112-520F**	520 (20")	
539-262-10	**AT112-570F**	570 (22")	
539-263-10	**AT112-620F**	620 (24")	
539-264-10	**AT112-670F**	670 (26")	
539-265-10	**AT112-720F**	720 (28")	
539-266-10	**AT112-770F**	770 (30")	
539-267-10	**AT112-820F**	820 (32")	
539-268-10	**AT112-920F**	920 (36")	
539-269-10	**AT112-1020F**	1020 (40")	



Refer to the Linear Scale DRO Systems (Catalog No.E13000) for more details.

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard.
Refer to page IX for details.

Linear Scales AT181
SERIES 539 — Sealed Type

- Plunger type in the fully sealed structure.
- Connectable to the **KA** counter, **KLD** counter, or **PSU-200**.

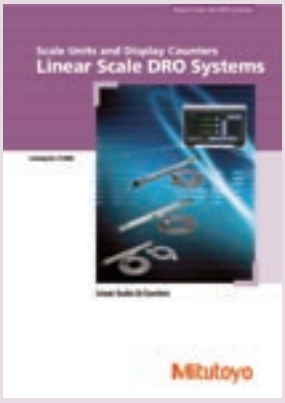
SPECIFICATIONS

Model	AT181
Effective range	100 to 600mm (11 models)
Accuracy (20°C)	(5+5L0/1000)µm
Output signal	Two 90° phase-shifted sinusoidal signals
Maximum response speed	50m/min
Signal output pitch	20µm
Scale reference point	Output in 50mm pitch
Protection Level	IP54
Operating temperature	0 to 45°C

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

AT112-F		Effective range	Signal cable length
Order No.	Model	L0 (mm)	(m)
539-301	**AT181-100**	100 (4")	3
539-302	**AT181-150**	150 (6")	
539-303	**AT181-200**	200 (8")	
539-304	**AT181-250**	250 (10")	
539-305	**AT181-300**	300 (12")	
539-306	**AT181-350**	350 (14")	
539-307	**AT181-400**	400 (16")	
539-308	**AT181-450**	450 (18")	
539-309	**AT181-500**	500 (20")	
539-300	**AT181-550**	550 (22")	
539-311	**AT181-600**	600 (24")	

* These units are made-to-order.



Refer to the Linear Scale DRO Systems (Catalog No.E13000) for more details.

Mitutoyo

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

Linear Scales AT402E
SERIES 539 — General-purpose Type

- Ideal for machine tools for heavy cutting as well as linear motors.
- Has multi-point elastic fixing for excellent vibration resistance (200m/s^2), shock resistance (400m/s^2), and temperature characteristics.
- The Absolute Interval Code allows for a simplified, low-cost ABS system.

PROPRIETARY INSPECTION CERTIFICATE

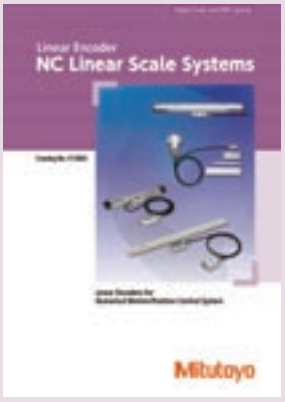
An inspection certificate is supplied as standard.
Refer to page IX for details.

SPECIFICATIONS

Model	AT402E
Effective range	140 to 3040mm (24 models)
Accuracy (20°C)	Effective range: 140 to 540mm: ±2µm Effective range: 640 to 940mm: ±3µm Effective range: 1040 to 3040mm: ±3µm/m
Output signal	Signal: 1Vp-p differential sinusoidal signal Differential reference point pulse: **Absolute Interval Code** compatible
Maximum response speed	120m/min (With sinusoidal signal amplitude of –3dB)
Signal output pitch	20µm
Protection Level	IP53
Operating temperature	0 to 45°C
Cable configuration	Type A: 3m flying lead cable Type B: 3m cable with European CNC connectors Type C: 3m cable with FANUC connectors

AT112-F		Effective range	Signal cable length
Order No.	Model	L_0 (mm)	(m)
539-371-□□	**AT402E-140**	140 (5.6")	3
539-373-□□	**AT402E-240**	240 (9.6")	
539-374-□□	**AT402E-340**	340 (13.6")	
539-375-□□	**AT402E-440**	440 (17.6")	
539-376-□□	**AT402E-540**	540 (21.6")	
539-377-□□	**AT402E-640**	640 (25.6")	
539-378-□□	**AT402E-740**	740 (29.6")	
539-379-□□	**AT402E-840**	840 (33.6")	
539-380-□□	**AT402E-940**	940 (37.6")	
539-381-□□	**AT402E-1040**	1040 (41.6")	
539-382-□□	**AT402E-1140**	1140 (45.6")	
539-383-□□	**AT402E-1240**	1240 (49.6")	
539-384-□□	**AT402E-1340**	1340 (53.6")	
539-385-□□	**AT402E-1440**	1440 (57.6")	
539-386-□□	**AT402E-1540**	1540 (61.6")	
539-387-□□	**AT402E-1640**	1640 (65.6")	
539-388-□□	**AT402E-1740**	1740 (69.6")	
539-389-□□	**AT402E-1840**	1840 (73.6")	
539-390-□□	**AT402E-2040**	2040 (81.6")	
539-391-□□	**AT402E-2240**	2240 (89.6")	
539-392-□□	**AT402E-2440**	2440 (97.6")	
539-393-□□	**AT402E-2640**	2640 (105.6")	
539-394-□□	**AT402E-2840**	2840 (113.6")	
539-395-□□	**AT402E-3040**	3040 (121.6")	

* The indication of " □□ " in the code numbers will be **01** for Type A, **02** for Type B, and **03** for Type C.



Refer to the NC Linear Scale Systems (Catalog No.E13005) for more details.

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard.
Refer to page IX for details.

Linear Scales AT203
SERIES 539 — Standard Type

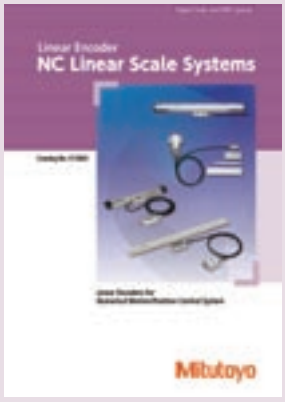
- The travel length of the linear scale is output with 2-phase square wave signals, which can be used as a feedback signal for NC machine tools.
- The pulse signal unit (PSU) is no longer needed, and the **AT203** can be directly connected to the NC machine tool.

SPECIFICATIONS

Model	AT203
Effective range	100 to 6000mm (42 models)
Accuracy (20°C)	Effective range: 100 to 1500mm (3+3L0/1000)µm Effective range: 1600 to 3000mm (5+5L0/1000)µm Effective range: 3250 to 6000mm (5+8L0/1000)µm
Output signal	Two 90° phase-shifted square wave signals
Maximum response speed	120m/min (50m/min when the effective range is 3250 to 6000mm)
Resolution	0.1/0.5/1µm (Switchable by the DIP switches)
Scale reference point	Output in 50mm pitch
Protection Level	IP53
Operating temperature	0°C to 45°C

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

AT203		Effective range L0 (mm)	Signal cable length (m)
Order No.	Model		
539-411-30	**AT203-100**	100 (4")	5
539-412-30	**AT203-150**	150 (6")	
539-413-30	**AT203-200**	200 (8")	
539-414-30	**AT203-250**	250 (10")	
539-415-30	**AT203-300**	300 (12")	
539-416-30	**AT203-350**	350 (14")	
539-417-30	**AT203-400**	400 (16")	
539-418-30	**AT203-450**	450 (18")	
539-419-30	**AT203-500**	500 (20")	
539-421-30	**AT203-600**	600 (24")	
539-423-30	**AT203-700**	700 (28")	
539-424-30	**AT203-750**	750 (30")	
539-425-30	**AT203-800**	800 (32")	
539-426-30	**AT203-900**	900 (36")	
539-427-30	**AT203-1000**	1000 (40")	
539-428-30	**AT203-1100**	1100 (44")	
539-429-30	**AT203-1200**	1200 (48")	
539-430-30	**AT203-1300**	1300 (52")	
539-431-30	**AT203-1400**	1400 (56")	
539-432-30	**AT203-1500**	1500 (60")	
539-433-30	**AT203-1600**	1600 (64")	
539-434-30	**AT203-1700**	1700 (68")	
539-435-30	**AT203-1800**	1800 (72")	
539-436-30	**AT203-2000**	2000 (80")	
539-437-30	**AT203-2200**	2200 (88")	
539-438-30	**AT203-2400**	2400 (96")	
539-439-30	**AT203-2500**	2500 (100")	
539-440-30	**AT203-2600**	2600 (104")	
539-441-30	**AT203-2800**	2800 (112")	
539-442-30	**AT203-3000**	3000 (120")	
539-443-30	**AT203-3250**	3250 (130")	
539-444-30	**AT203-3500**	3500 (140")	
539-445-30	**AT203-3750**	3750 (150")	
539-446-30	**AT203-4000**	4000 (160")	
539-447-30	**AT203-4250**	4250 (170")	
539-448-30	**AT203-4500**	4500 (180")	
539-449-30	**AT203-4750**	4750 (190")	
539-450-30	**AT203-5000**	5000 (200")	
539-451-30	**AT203-5250**	5250 (210")	
539-452-30	**AT203-5500**	5500 (220")	
539-453-30	**AT203-5750**	5750 (230")	
539-454-30	**AT203-6000**	6000 (240")	



Refer to the NC Linear Scale Systems (Catalog No.E13005) for more details.

Mitutoyo

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

Linear Scales AT216-T / AT216-TL
SERIES 539 — Slim Sealed Type

An inspection certificate is supplied as standard.
Refer to page IX for details.

- Slim, sealed type incremental linear scales suitable for feedback systems in NC machine tools.
- Direct connection with NC machine tools is possible.

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SPECIFICATIONS

Model	AT216-T	AT216-TL
Effective range	100 to 1500mm (20 models)	
Resolution	5µm	1µm
Accuracy (20°C)	(5+5L0/1000)µm	
Output signal	Two 90° phase-shifted sinusoidal signals	
Maximum response speed	48m/min	50m/min
Signal output pitch	20µm	
Scale reference point	Output in 50mm pitch	
Protection Level	IP53	
Operating temperature	0 to 45°C	

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

AT216-T		Effective range	Signal cable length
Order No.	Model	L0 (mm)	(m)
529-431-3	**AT216-100T**	100 (4")	5
529-432-3	**AT216-150T**	150 (6")	
529-433-3	**AT216-200T**	200 (8")	
529-434-3	**AT216-250T**	250 (10")	
529-435-3	**AT216-300T**	300 (12")	
529-436-3	**AT216-350T**	350 (14")	
529-437-3	**AT216-400T**	400 (16")	
529-438-3	**AT216-450T**	450 (18")	
529-439-3	**AT216-500T**	500 (20")	
529-441-3	**AT216-600T**	600 (24")	
529-443-3	**AT216-700T**	700 (28")	
529-444-3	**AT216-750T**	750 (30")	
529-445-3	**AT216-800T**	800 (32")	
529-446-3	**AT216-900T**	900 (36")	
529-447-3	**AT216-1000T**	1000 (40")	
529-448-3	**AT216-1100T**	1100 (44")	
529-449-3	**AT216-1200T**	1200 (48")	
529-450-3	**AT216-1300T**	1300 (52")	
529-451-3	**AT216-1400T**	1400 (56")	
529-452-3	**AT216-1500T**	1500 (60")	

AT216-TL		Effective range	Signal cable length
Order No.	Model	L0 (mm)	(m)
529-461-3	**AT216-100TL**	100 (4")	5
529-462-3	**AT216-150TL**	150 (6")	
529-463-3	**AT216-200TL**	200 (8")	
529-464-3	**AT216-250TL**	250 (10")	
529-465-3	**AT216-300TL**	300 (12")	
529-466-3	**AT216-350TL**	350 (14")	
529-467-3	**AT216-400TL**	400 (16")	
529-468-3	**AT216-450TL**	450 (18")	
529-469-3	**AT216-500TL**	500 (20")	
529-471-3	**AT216-600TL**	600 (24")	
529-473-3	**AT216-700TL**	700 (28")	
529-474-3	**AT216-750TL**	750 (30")	
529-475-3	**AT216-800TL**	800 (32")	
529-476-3	**AT216-900TL**	900 (36")	
529-477-3	**AT216-1000TL**	1000 (40")	
529-478-3	**AT216-1100TL**	1100 (44")	
529-479-3	**AT216-1200TL**	1200 (48")	
529-480-3	**AT216-1300TL**	1300 (52")	
529-481-3	**AT216-1400TL**	1400 (56")	
529-482-3	**AT216-1500TL**	1500 (60")	

An inspection certificate is supplied as standard.
Refer to page IX for details.

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

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

Common specification

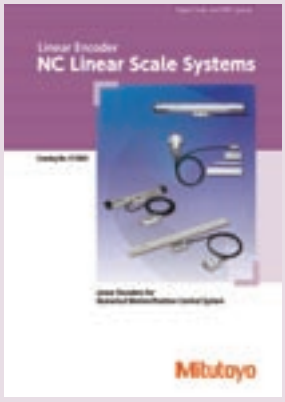
Model	AT211
Effective range*	100 to 1500mm (20 models)
Accuracy (20°C)*	(3+3L0/1000)µm L0: effective range (mm)
	(2+2L0/1000)µm (L0≤500mm)
Output signal	Two 90° phase-shifted square wave signals
Maximum response speed*	5.4 to 120m/min (varies depending on the resolution or minimum edge interval)
Resolution*	0.1/ 0.2/ 0.5/ 1.0/ 2.5/ 5.0µm
Scale reference point*	50mm/ Center point/ Left edge point/ Right edge point
Protection Level	IP53
Operating temperature	0 to 45°C

* Desired specification is selectable.

Meaning of Model No.

AT211 - 0100 A 1 S - P 1 - A B

- 0100 — Effective range: 100 to 1500mm
- A — Mounting method: Multipoint mounting/Double-end mounting
- 1 — Scale reference point: 50mm/ Center point/ Left edge point/ Right edge point
- S — Indication accuracy: (3+3L0/1000)µm / (2+2L0/1000)µm
- P — Resolution/ Minimum edge-to-edge interval: 0.1 to 5µm / 125 to 1000ns, 22 types
- 1 — Direction: PA/PB phase
- A — Head cable: 0.3 to 9m, 9 types
- B — Signal cable: 3 to 7m / None, 10 types

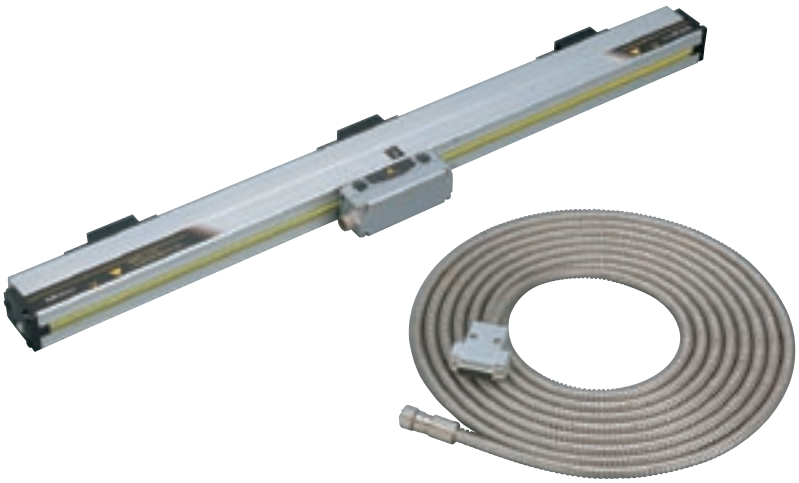


Refer to the NC Linear Scale Systems (Catalog No.E13005) for more details.

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

Linear Scales ABS AT300
SERIES 539 — Standard Type



ABSOLUTE™ (Refer to page IX for details.)

PROPRIETARY INSPECTION CERTIFICATE

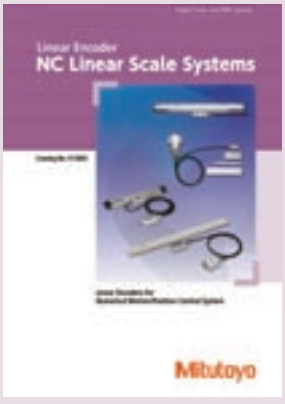
An inspection certificate is supplied as standard. Refer to page IX for details.

- ABSOLUTE linear encoder incorporates both our unique electrostatic capacity and photoelectric technology.
  *Refer to page H-30 "Quick Guide to Precision Measuring Instruments" for details of the principle of the absolute linear scale.
- Drastically reduced power consumption since there are no backup batteries.
- Easy operation because no recalibration is required at startup or after a power failure.
- Suitable for position feedback in machinery requiring high-accuracy, high-speed control.
- Improved environmental resistance against mechanical vibration and noise.

SPECIFICATIONS

Model	ABS AT353	ABS AT343	ABS AT343A	ABS AT303	ABS AT303A
Applicable system	FANUC Ltd. NC Control unit	Mitsubishi Electric Corporation MITSUBISHI CNC series	Mitsubishi Electric Corporation MR-J3	Amplifiers supporting Mitutoyo ENSIS interface	
Resolution	0.05µm				
Maximum response speed	120m/min				
Effective range	100 to 3000mm				
Accuracy (20°C)*	(3+3L₀/1000)µm, (5+5L₀/1000)µm when the effective range is 1600mm or more				

* The indication accuracy does not include quantizing error. L₀: Effective range (mm)
* A wide variety of special orders are available.



Refer to the NC Linear Scale Systems (Catalog No.E13005) for more details.

ABSOLUTE™ (Refer to page IX for details.)

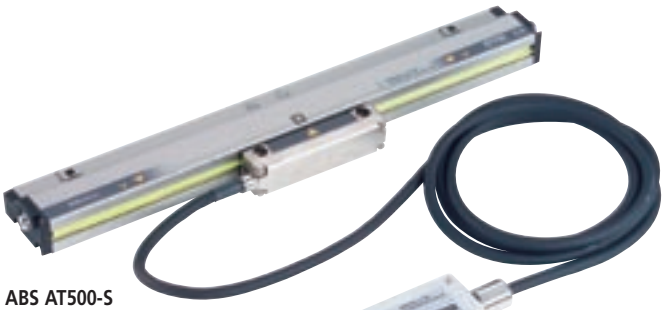
PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard.
Refer to page IX for details.

- Slim shape is suitable for space-saving designs.
- The high rigidity **ABS AT500-S** series has vibration resistance, shock resistance and temperature control, the **ABS AT500-H** series offers excellent temperature control and high accuracy.
- Scale alarm display LED allows for easy maintenance.
- Supports the interfaces of various manufacturers allowing a variety of system configurations.

Refer to the NC Linear Scale Systems (Catalog No.E13005) for more details.

Linear Scales ABS AT500
SERIES 539 — Slim Spar Type



ABS AT500-S

ABS AT500-H

SPECIFICATIONS

	High rigidity type	High accuracy type	
Model	**ABS AT500-SC**	**ABS AT500-HC**	**ABS AT500-HL/HR**
Resolution	0.005µm*1/0.05µm		
Maximum response speed	150m/min (72m/min for the H series whose resolution is 0.005µm)		
Effective range	100 to 2200mm	100 to 1000mm	100 to 350mm
Accuracy (20°C)*2	(3+3L0/1000)µm	(2+2L0/1000)µm	
Reference point of expansion influenced by the temperature fluctuation	Center of the effective measuring length		Edge of the effective measuring length HL: "+" side of the absolute value HR: "−" side of the absolute value

*1: The exact value is 0.0048828125µm since the 20µm signal is divided by 4096.
*2: The indication accuracy does not include quantizing error. L0: Effective range (mm)

Meaning of Model No.

ABS AT5□□□ - □□□ - □□

Resolution/Applicable system

Effective range

Model	Resolution	Applicable system
ABS AT553	0.05µm	FANUC Ltd. NC Control unit
ABS AT555	0.005µm	
ABS AT543	0.05µm	Mitsubishi Electric Corporation MITSUBISHI CNC series
ABS AT545	0.005µm	
ABS AT543A	0.05µm	Mitsubishi Electric Corporation MELSERVO series
ABS AT545A	0.005µm	
ABS AT573A	0.05µm	Panasonic Corporation, Motor Business Unit MINAS series*1
ABS AT503	0.05µm	Amplifiers supporting Mitutoyo ENSIS interface*1 (Nikki Denso Co., Ltd., Servoland corporation, PMAC Japan Co., Ltd.)
ABS AT503A		
ABS AT505	0.005µm	
ABS AT505A		

Reference point of expansion on the scale unit influenced by temperature fluctuation*
C: Center of the effective range
L: "+" side of the absolute value
R: "−" side of the absolute value
* "**L**" or "**R**" is marked only for the high accuracy type.

Type of the scale unit
S: High rigidity type
H: High accuracy type

Note: "Reference point of expansion"
The scale unit expands or contracts influenced by the temperature fluctuation.
The mechanical reference point of expansion is defined as the reference point.

*ABS AT5 □□□
Transmission method
Nothing: Full duplex communication
A: Half-duplex communication

*1: Please contact each manufacturer for details.

Mitutoyo

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

Linear Scales ABS AT715
SERIES 539 — Slim Spar Type

ABSOLUTE™ (Refer to page IX for details.)

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page IX for details.

- Electromagnetic induction principle means scales are unaffected by contamination
- Absolute scales have eliminated the need for origin restoration, also drastically reduces power consumption.

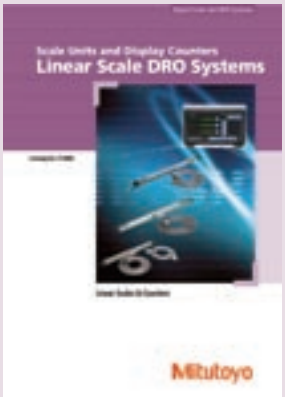
H

SPECIFICATIONS

Model	ABS AT715	
Detection method	Electromagnetic induction	
Minimum resolution	0.001mm to 0.01mm (Changeable by parameter on the **KA/KLD200** counter)	
Effective range	100 to 3000mm	
Accuracy (20°C)	±5µm (Lo: 100 to 500mm), ±7µm (Lo: 600 to 1800mm), ±10µm (Lo: 2000 to 3000mm) Lo: Effective range (mm)	
Maximum response speed	50m/min	
Protection level	IP67	
Sliding force	5N or less	
Signal cable	Standard Accessories Refer to the dimension table shown below for the length.	
Extension cable (optional)	Length	Order No.
	2m 5m 7m	**09AAB674A** **09AAB674B** **09AAB674C**
Connectable counter	**KA** Counter/ **KLD200** Counter	

AT715		Effective range Lo (mm)	Signal cable length (m)
Order No.	Model		
539-801	**ABS AT715-100**	100 (4")	3.5
539-802	**ABS AT715-150**	150 (6")	
539-803	**ABS AT715-200**	200 (8")	
539-804	**ABS AT715-250**	250 (10")	
539-805	**ABS AT715-300**	300 (12")	
539-806	**ABS AT715-350**	350 (14")	
539-807	**ABS AT715-400**	400 (16")	
539-808	**ABS AT715-450**	450 (18")	
539-809	**ABS AT715-500**	500 (20")	
539-811	**ABS AT715-600**	600 (24")	
539-813	**ABS AT715-700**	700 (28")	
539-814	**ABS AT715-750**	750 (30")	
539-815	**ABS AT715-800**	800 (32")	
539-816	**ABS AT715-900**	900 (36")	
539-817	**ABS AT715-1000**	1000 (40")	5
539-818	**ABS AT715-1100**	1100 (44")	
539-819	**ABS AT715-1200**	1200 (48")	
539-820	**ABS AT715-1300**	1300 (52")	
539-821	**ABS AT715-1400**	1400 (56")	
539-822	**ABS AT715-1500**	1500 (60")	
539-823	**ABS AT715-1600**	1600 (64")	
539-824	**ABS AT715-1700**	1700 (68")	
539-825	**ABS AT715-1800**	1800 (72")	
539-860	**ABS AT715-2000**	2000 (80")	
539-861	**ABS AT715-2200**	2200 (88")	
539-862	**ABS AT715-2400**	2400 (96")	7*1
539-863	**ABS AT715-2500**	2500 (100")	
539-864	**ABS AT715-2600**	2600 (104")	
539-865	**ABS AT715-2800**	2800 (112")	
539-866	**ABS AT715-3000**	3000 (120")	

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



Refer to the Linear Scale DRO Systems (Catalog No.E13000) for more details.

KA Counter
SERIES 174 — Standard Type

- High performance, low cost 2 or 3 axis counter.
- The KA counter has both mill and lathe functions, as well as standard functions.
- RS-232 interface (optional) is available as an external interface.
- Now lighter and takes less space.

174-173
KA-12

Optional Accessories

- RS-232C interface unit: **No.09CAB217**
- Touch signal probe (shank dia.: 20mm): **No.938140**
- Touch signal probe (shank dia.: 32mm): **No.935094**

SPECIFICATIONS

Order No.	**174-173**□	**174-175**□
Model	**KA-12**[*1]	**KA-13**
Number of axes to be displayed	1 axis/ 2 axes[*1]	3 axes
Resolution	(Changeable according to the parameter) When **AT100** series is connected: 0.05 to 0.0001mm[*2] When **AT715** is connnected: 0.01 to 0.001mm	
Display	7-segment LCD/ 7 digit	
Power supply voltage	100V-240V AC, 50/60Hz	
Dimensions	260 (W)×80 (D)×168 (H) mm	
Output (optional)	RS-232C	
Mass	1.25kg	1.33kg

*1: **KA-12** is available for 1 axis/ 2 axes. Number of axes is changeable according to the parameter.
*2: Count range when the minimum reading is 0.0005mm/0.0001mm: 9999.99999 to –999.99999
□: 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.

KLD200 Counter
SERIES 174 — Special Purpose Type with Limit Signal Output

- Counter designed to signal when a linear scale displacement value and a preset limit value coincide.
- Two types of limit settings are available: 2-step (**KLD-212**) and 4-step (**KLD-214**).

174-147
KLD-214

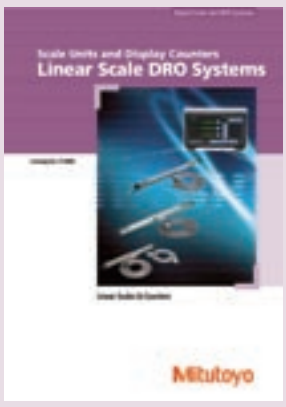
Optional Accessories

- External zero-set box (1 axis): **No.936551**
- External load box (1 axis, for the RS-232C output): **No.937326**

SPECIFICATIONS

Order No.	**174-146**□	**174-147**□
Model	**KLD-212**	**KLD-214**
Number of axes to be displayed	1 axis	
Number of limit values to be set	2	4
Resolution	(Changeable according to the parameter) When **AT100** series is connected: 0.05 to 0.0001mm When **AT715** is connected: 0.01 to 0.001mm	
Output	RS-232C (provided as standard)	
Display	7-segment LCD/ 7 digit[*1]	
Power supply voltage	100V-240V AC, 50/60Hz	
Power consumption	25 VA	
Operating temperature/ humidity range	0 to 45°C/ 20 to 80%	
Dimensions	332 (W)×163 (D)×204 (H) mm	
Mass	3.0kg	3.1kg

*1: Count range when the minimum reading is 0.001mm: 99999.999 to –9999.999
Count range when the minimum reading is 0.005mm: 99999.995 to –9999.995
□: 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 (Catalog No.E13000) for more details.

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

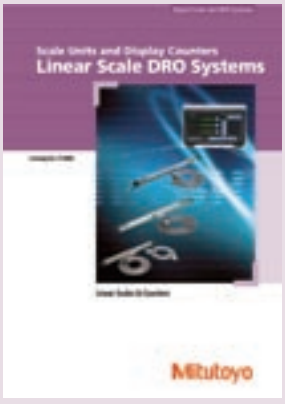
Linear scale counter

H

FUNCTIONS

Type / Function	High performance  **KA** Counter	Limit signal output  **KLD** Counter
Zero-setting	Available	Available
Preset	Available	Available
Minimum reading selection	Available	Available
Measurement direction setting	Available	Available
mm/inch conversion	Available	Available
Diameter display	Available	Available
Memorization/Reproduction of the scale reference point*1	Available	Available
1/2 calculation	Available	Available
ABS/INC coordinate selection	Available	—
Bolt-hole circle machining	Available*2	—
Pitch machining	Available	—
Zero approach machining	Available	—
2-axis arithmetic addition display	Available*3	—
Linearity error compensation	Available	Available
Smoothing	Available	Available
Memory backup	Available	Available
Expansion/contraction coefficient setting	—	Available
Lower digit blanking out	Available	Available
External zero-setting	●*4	Available
RS-232C output	●	Available
Limit signal output	—	Available
Error messages and remedies	Available	Available

Available (Provided as standard) ● : Option
*1: Available only when AT100 series is connected
*2: Not available when displaying 1 axis.
*3: Available only for the 3-axis counter (**KA-13**)
*4: Available by using the RS232C code out unit (**09CAB217**)



Refer to the Linear Scale DRO Systems (Catalog No.E13000) for more details.

An inspection certificate is supplied as standard.
Refer to page IX for details.

Linear Scales ST36
SERIES 579 — High Accuracy Type

- Outputs two-phase sinusoidal wave signal, two-phase pulse signal, and 1Vp-p at 4µm pitch.
- High accuracy type, 0.5µm class (effective range up to 300mm)
- Has a thinner detector head (thickness 11.5mm).
- The maximum effective measurement range of 3000mm enables use on large machines.
- 4 different types available for each signal output specification.
- LED display function for indicating signal errors.
- 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.

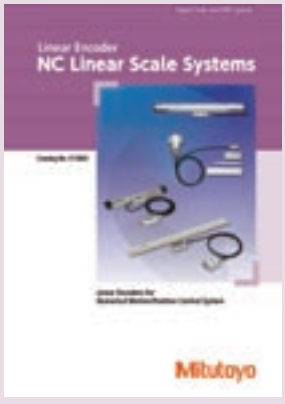
SPECIFICATIONS

Model	ST36
Detection method	Reflective photoelectlic linear encoder
Output signal	**ST36A**: 2-phase 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	8µm
Signal output pitch	4µm
Effective range	10 to 3000mm
Accuracy (20°C)*1	±0.5µm, ±1µm, ±2µm(/m)
Maximum response speed*2	1200mm/s
Scale reference point	Center point (10 to 80mm) 50mm pitch (100 to 3000mm)
Power supply voltage	DC5V ±5%
Operating temperature/ humidity range	0 to 40°C/ 20 to 80% (no condensation)
Storage temperature/ humidity range	–20 to 60°C/ 20 to 80% (no condensation)
Head cable length	1m (high-flex connecting cable)

*1:

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

*2: Maximum response speed when the sinusoidal signals are output



Refer to the NC Linear Scale Systems (Catalog No.E13005) for more details.

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

Linear Scales ST24
SERIES 579 — Standard Type

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard.
Refer to page IX for details.

- Outputs 2-phase square and sinusoidal wave signals at 10µm pitch.
- Has a thinner detector head (thickness 11mm).
- The maximum effective measurement range of 3000mm enables use on large machines.
- 2 different types available for each signal output specification
- LED display function for indicating signal errors.

H

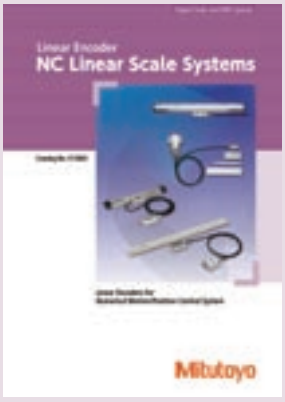
SPECIFICATIONS

Model	ST24
Detection method	Reflective photoelectlic linear encoder
Output signal	**ST24B**: 2-phase square wave signals, Alarm reset input **ST24C**: 2-phase square wave signals, 2-phase sinusoidal signals
Main scale grating pitch	20µm
Signal output pitch	10µm
Effective range	10 to 3000mm
Accuracy (20°C)*1	±1µm, ±2µm, ±3µm(/m)
Maximum response speed*2	1200mm/s
Scale reference point	Center point (10 to 80mm) 50mm pitch (100 to 3000mm)
Power supply voltage	DC5V ±5%
Operating temperature/ humidity range	0 to 40°C/ 20 to 80% (no condensation)
Storage temperature/ humidity range	–20 to 60°C/ 20 to 80% (no condensation)
Head cable length	1m (high-flex connecting cable)

*1:

Effective range	Accuracy
300mm or less	±1µm
500mm or less	±2µm
1000mm or less	±3µm
3000mm or less	±3µm/m

*2: Maximum response speed when the sinusoidal signals are output



Refer to the NC Linear Scale Systems (Catalog No.E13005) for more details.

An inspection certificate is supplied as standard.
Refer to page IX for details.

Linear Scales ST422
SERIES 579 — Compact Type

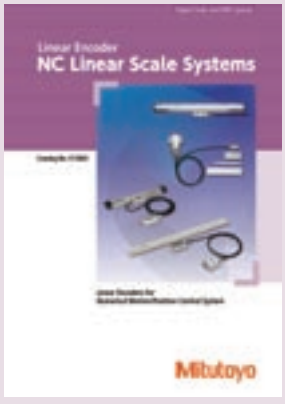
- The maximum response speed is 5000mm/s. (When resolution is 1µm and the minimum edge interval is 125ns)
- Ultra-compact detector control unit allows use in applications where space-saving design is important.
- The maximum effective measurement length of 3000mm enables use on large machines.
- Simultaneous output of 2-phase square wave signals (maximum resolution: 0.2µm) and 2-phase sinusoidal wave signals (main signal: 40µm) is available.
- LED display function for indicating signal errors.
- Equipped with scale reference point output.

SPECIFICATIONS

Model	ST422
Detection method	Reflective photoelectlic linear encoder
Output signal	2-phase sinusoidal signals, 2-phase square wave signals
Main scale grating pitch	40µm
Signal output pitch	40µm
Effective range	10 to 3000mm
Accuracy (20°C)*1	±1µm, ±2µm, ±3µm(/m)
Resolution	0.2µm/ 0.5µm/ 1µm/ 5µm (Selectable with internal switch)
Scale reference point	Center point (10 to 75mm)/ 50mm pitch (100mm or more)
Maximum response speed	5000mm/s (varies depending on the setting)
Minimum edge-to-edge interval	125ns/ 250ns/ 500ns/ 1µs (selectable with internal switch)
Operating temperature/ humidity range	0 to 40°C, RH 20 to 80% (no condensation)
Storage temperature/ humidity range	–20 to 60°C, RH 20 to 80% (no condensation)
Head cable length	1m

*1:

Effective range	Accuracy
300mm or less	±1µm
500mm or less	±2µm
1000mm or less	±3µm
3000mm or less	±3µm/m

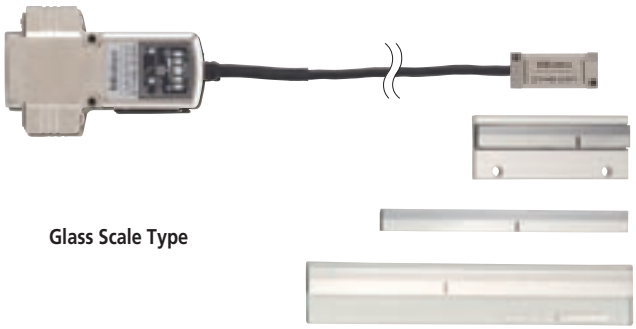


Refer to the NC Linear Scale Systems (Catalog No.E13005) for more details.

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

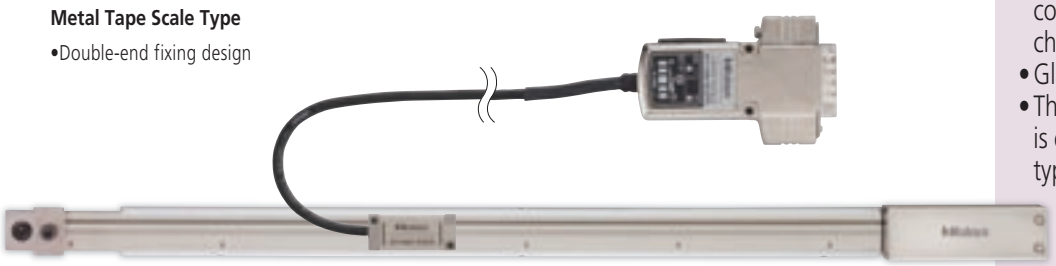
Linear Scales ST46-EZA
SERIES 579 — Compact Type



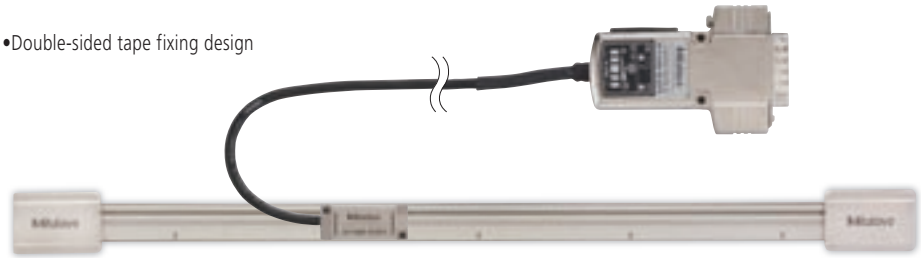
Glass Scale Type

Metal Tape Scale Type

•Double-end fixing design



•Double-sided tape fixing design



PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard.
Refer to page IX for details.

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

SPECIFICATIONS

Model	ST46-EZA	
Detection method	Reflective photoelectlic linear encoder	
Scale type	Glass	Metal tape
Main scale grating pitch	20μm	
Output signal	Type B: 2-phase square wave signals, reference point pulse, external reset input. Type C: 2-phase square wave signals, reference point pulse, 2-phase sinusoidal signals.	
Effective range	10 to 3000mm	
Accuracy (20°C)	Effective range 10 to 300mm: ±1μm Effective range 350 to 500mm: ±2μm Effective range 600 to 1000mm: ±3μm Effective range 1100 to 3000mm: ±3μm/m	Effective range 10 to 1000mm: ±5μm Effective range 1100 to 3000mm: ±5μm/m (The above accuracy applies to individual scales. For double-end fixing designs, perform point-to-point correction after ensuring the metal tape is tensioned correctly.)
Maximum response speed	2.6m/s (With sinusoidal signal amplitude of -3dB)	
Scale reference point	50mm pitch, 10 to 80mm: Center point	
Power supply voltage	5VDC±5%	
Operating temperature/ humidity range	0 to 40°C, RH 20 to 80% (no condensation)	
Storage temperature/ humidity range	–20 to 60°C, RH 20 to 80% (no condensation)	

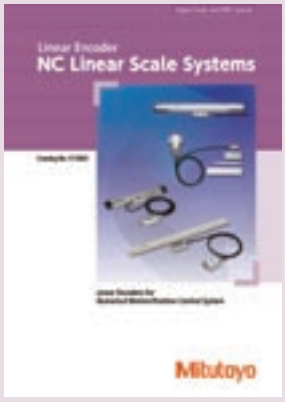
Refer to the ST46-EZA Series (Catalog No.E13008) for more details.

ABSOLUTE™ (Refer to page IX for details.)

PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard. Refer to page IX for details.

- Absolute measurement with exposed 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: 50mm (W) × 28mm (D) × 11mm (H)
- Cable outlets can be in four directions, with mounting holes on the top and sides
- Accuracy (5+5L/1000)µm, glass scale: (3+3L/1000)µm (previous models: (8+5L/1000)µm)
  L: Effective range (mm)
- Compatible with servo amplifiers from a range of companies (high-speed serial interfaces)



Refer to the NC Linear Scale Systems (Catalog No.E13005) for more details.

Linear Scales ABS ST700
SERIES 579 — General-purpose Type

Scale base type

Glass scale type

SPECIFICATIONS

Model	ABS ST700	
Scale type	Scale base type	Glass scale type
Resolution	0.1µm (0.05µm to special order)	
Detection method	Electromagnetic induction ABS linear encoder	
Max. effective range	6000mm	1100mm
Accuracy (20°C)	5+(5L/1000)µm L: Effective range (mm)	3+(3L/1000)µm L: Effective range (mm)
Maximum response speed	5m/s	
Linear expansion coefficient	(12.0±1.5)×10^{-6}/°C (When the material of the mounting components is steel or equivalent)	(8±1.0)×10^{-6}/°C
Power supply voltage	5V±10% (at the detection head) (Ripple + spike noise component should be less than 100mV.)	
Operating temperature/ humidity range	0 to 50°C, RH 20 to 80%	
Storage temperature/ humidity range	–20 to 70°C, RH 20 to 80%	

Meaning of Model No.

ABS ST7 0 8 A L - 100 A - R

Absolute type

Series name
Separate Type ABSOLUTE Linear Scale
ABS ST700 Compact-type series (Effective range ≤ 3m)
ABS ST700 Compact-type series (3.2m ≤ Effective range ≤ 6m)

Interface specification[*1]
0: Supports Mitutoyo ENSIS high-speed interface
ABS ST708A, **ST708AL**
4: Supports Mitsubishi Electric Corporation high-speed serial interface
ABS ST748, **ST748AL**, **ABS ST748**, **ST748L**
5: Supports FANUC Ltd. high-speed serial interface
ABS ST758, **ST758L**
7: Supports Panasonic Corporation, Motor Business Unit high-speed serial interface
ABS ST778A, **ST778AL**
8: Supports YASKAWA Electric Corporation high-speed serial interface
ABS ST788A, **ST788AL**

Detection head form and resolution
8: Form: 50mm (W)×28mm (D)×11mm (H)
Resolution: 0.1µm
9: 0.05µm resolution (to special orders)

Transmission method
A: 2-wire system
Nothing: 4-wire system

Nothing: 100mm to 3000mm
L: 3200mm to 6000mm

Effective range: 100mm to 6000mm

A: Scale base type
C: Glass scale type

Head cable outlet direction
R: Right side
L: Left side
U: Upper side
D: Lower side

Available Interfaces[*1]

FANUC Ltd. FS-i Series, Power Mate i Series
Mitsubishi Electric Corporation MELSERVO MR-J4/MR-J3 Series
Mitsubishi Electric Corporation CNC Series, MDS-D/MDS-DH Series
YASKAWA Electric Corporation Σ-V, Σ-III Series
Panasonic Corporation, Motor Business Unit MINAS-A5, A5L, A5N, A5NL, MINAS-A4, A4P, A4N, A4NL Series
Mitutoyo ENSIS[*2] Nikki Denso Co.,Ltd. VCII/VC/VPS series Servoland Corporation SVF Series PMAC Japan Co. Ltd. UMAC-Turbo PMAC2

*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.

Mitutoyo

Linear Scale

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment

Pulse signal interface unit PSU-200 SERIES 539

- 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.

SPECIFICATIONS

Order No.	**539-005**
Model	**PSU-200**
Number of axes	1 axis
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 splits	4, 8, 10, 20, 40, 80, 100, 200 (Selectable with the switch)
Function	Setting the number of slits, 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 (photocoupler), switching directions
Power supply voltage	5VDC ±5%
Current consumption	200mA
Storage temperature range	–20°C to 70°C
Operating temperature range	0°C to 40°C
Dimensions	160(W)×100(D)×28(H)mm
Mass	Approx. 620g

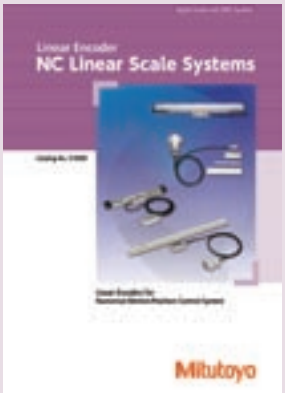
Serial signal interface unit PSU-200 SERIES 539

- **PSU251** series is a serial signal interface unit for incremental linear scales.
- The interface outputs serial data equivalent to 400 divisions from the signal (sinusoidal).
- The PSU-251 can be connected to Mitsubishi Electric Corporation's MR-J4/ MR-J3 series servo amplifier.
- The PSU-252 can be connected to Panasonic Corporation, Motor business unit's MINAS series servo amplifier.
- Since this unit is connected to incremental linear scales, the reference point should be passed through to determine the absolute position.

SPECIFICATIONS

Order No.	**539-006**	**539-007**
Model	**PSU-251**	**PSU-252**
Number of axes	1 axis	1 axis
Input	2-phase sinusoidal signals and standard voltage, reference signal, scale alarm signal. Maximum input frequency: 500kHz	
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 splits	400 splits	
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: 5VDC±5% External power supply: 5VDC±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	150mA (not including the scale)	
Operating temperature range	0°C to 40°C	
Storage temperature range	–20°C to 70°C	
Dimension	110(W)×60(D)×27.5(H)	
Mass	Approx. 315g	

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



Refer to the NC Linear Scale Systems (Catalog No.E13005) for more details.

An inspection certificate is supplied as standard.
Refer to page IX for details.

2D Image Correlation Encoder
SERIES 549

- Applies the image correlation of a speckle pattern.
- Simultaneous, non-contact measurement of X-Y position.
- Nano-resolution measurement.
- Suitable for applications such as stage position repeatability.
- Capable of measuring slight deformations and flex of parts.

SPECIFICATIONS

Order No.	**549-701**
Model	**MICSYS-SA1**
Detection method	Laser speckle image correlation
Effective range	±100μm (2D)
Resolution	1 nm
Accuracy (20°C)	±100 nm
Data update period	20Hz

Refer to the MICSYS (Catalog No.E13001) for more details.

Tests for Evaluating Linear Scales

1. Testing within the service temperature range
Confirms that there is no performance abnormality of a unit within the service temperature range and that data output is according to the standard.

2. Temperature cycle (dynamic characteristics) test
Confirms that there is no performance abnormality of a unit during temperature cycling while operating and that data output is according to the standard.

3. Vibration test (Sweep test)
Confirms that there is no performance abnormality of a unit while subject to vibrations of a frequency ranging from 30Hz to 300Hz with a maximum acceleration of 29.42m/s^2.

4. Vibration test (Acceleration test)
Confirms that there is no performance abnormality of a unit subject to vibrations at a specific, non-resonant frequency. (Approx. 98.07m/s^2)

5. Noise test
The noise test conforms to EMC Directive EN61326-1+A1:1998.

6. Package drop test
This test conforms to JIS Z 0200 (Heavy duty material drop test)

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 (RS422A compatible) is used as an I/F to the NC controller in the linear scale system.

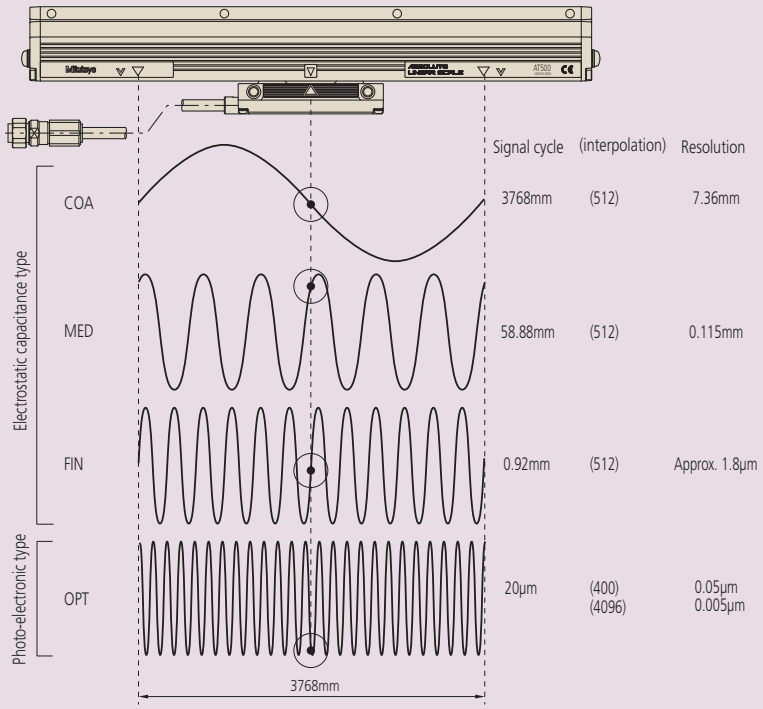
BCD
A notation of expressing the numerals 0 through 9 for each digit of a decimal number by means of four-bit binary sequence. Data transmission is one-way output by means of TTL or open collector.

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 +5V.

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 20ºC. 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 20µm 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 (1µm for example).

Principle of the Absolute Linear Scale (Example: ABS AT300, 500-S/H)

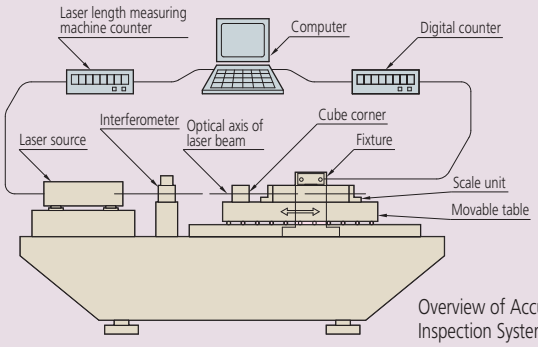


Upon supply of power to a linear scale, position readings from three capacitance-type sub-scales (COArse, MEDium and FINe) and one from a photoelectric sub-scale (OPTical) are taken. These sub-scales use such a combination of pitches, and are so positioned relative to each other, that the readings at any one position form a unique set and allow a microprocessor to calculate the position of the read head on the scale to a resolution of 0.05µm (0.005µm).

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.



Overview of Accuracy Inspection System

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

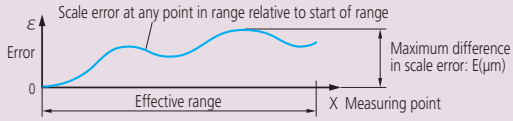
Error = Value indicated by laser inspection system
– Corresponding value indicated by the linear scale

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

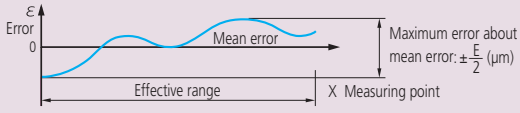
This method simply specifies the maximum error minus the minimum error from the accuracy graph, as shown below. It is of the form: $E = (\alpha + \beta L)$µm. L is the effective range (mm), and α and β are factors specified for each model.

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



(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.

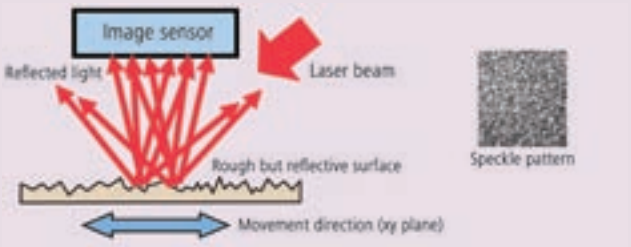


A linear scale detects displacement based on graduations of constant pitch. Two-phase sinusoidal signals with the same pitch as the graduations are obtained by detecting the graduations. Interpolating these signals in the electrical circuit makes it possible to read a value smaller than the graduations by generating pulse signals that correspond to the desired resolution. For example, if the graduation pitch is 20µm, interpolated values can generate a resolution of 1µm. 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.

Image correlation and the MICSYS two-dimensional encoder

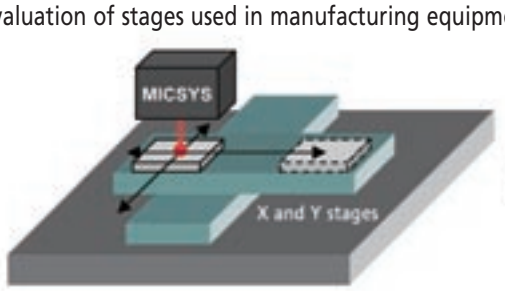
Principle of measurement

When an optically rough surface is irradiated with a laser beam, reflected coherent light scattering from the surface creates visible interference in the form of a speckle pattern. As the object moves in the XY plane, the speckle pattern also moves in response. Displacement of the object can be calculated by comparing, through image correlation, the speckle images obtained before and after movement, and this is the principle used in the highly accurate MICSYS measuring system.

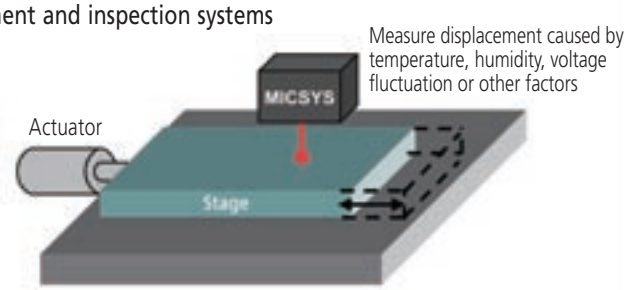


Applications

1. Evaluation of stages used in manufacturing equipment and inspection systems

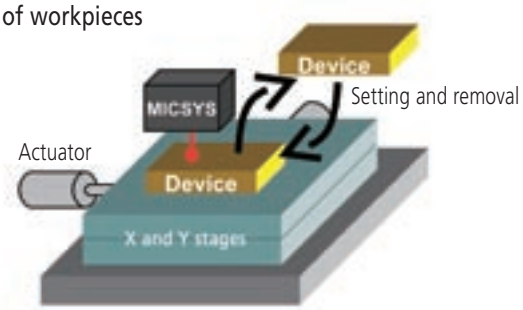


a) Evaluation of position repeatability

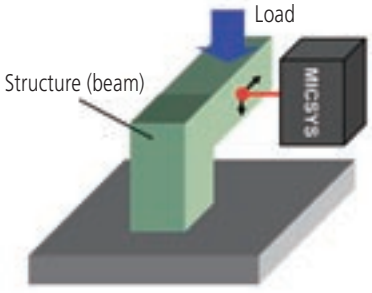


b) Evaluation of standstill stability and drift

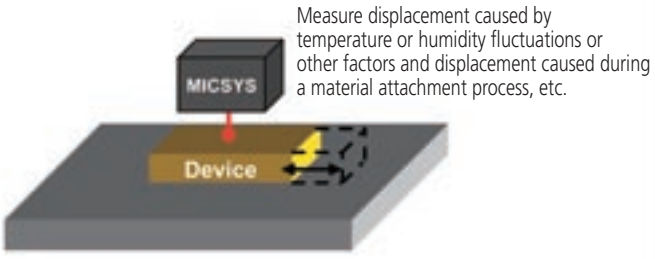
2. Highly accurate positioning of workpieces



3. Measurement of minute displacement



a) Measurement of minute displacement of a structure



b) Measurement of minute displacement of a workpiece