

Compact Roundness Measurement **ROUNDTEST RA-220**

Bulletin No. 1977



Compact roundness tester equipped with a wide range of analysis features and capable of flexibly accommodating a variety of workpieces

Mitutoyo

Powerful Analysis Performance in a Compact Body Roundtest RA-220

Compact manual machine for measuring roundness and cylindrical form including cylindricity measurement

- Multiple analyses through simple operation
- Fine adjustment on both X- and Z-axes
- Scaled Z-axis*
- Continuous ID and OD measurement*
- D.A.T function*
- Wide-range detector*
- High accuracy offered in a compact body (features high-accuracy air bearing)

* See page 4 for details.



Various types of Analysis

Type of Analysis	Measurement mode	Evaluation diagram	Type of Analysis	Measurement mode	Evaluation diagram
Roundness			Parallelism		
Flatness			Thickness variation	Radial	
Squariness	Relative to Axis		Axial		
	Relative to Plane		Radial		
Concentricity			Axial		
Coaxiality	Of section		Cylindricity		
	Of axis				

File save

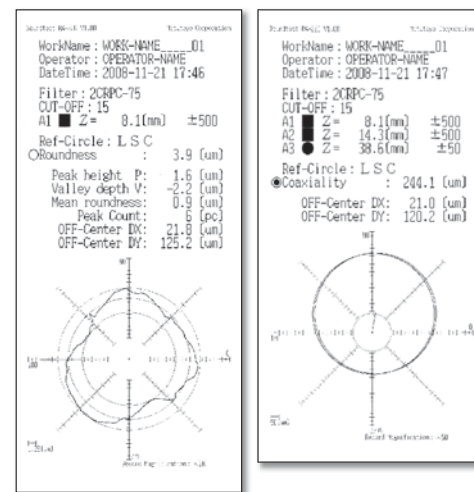
Save and access [Measurement files] and [Result files] in USB memory. Data can also be totaled using the data output function with commercial tabulation software.

High-grade thermal printer

Print measurement conditions, computation results, result graphs, comments, etc., to the thermal printer. Change development graphs and output items as desired.



Sample prints



Call up by one touch of a button

Four measurement files can be independently assigned to buttons.

One-touch recall Simple operation Prevention of operational errors



Easy-to-understand operation panel with large LCD

Operating panel that is read at a glance

Operating panel

Operating panel that is read at a glance

Analysis type

Selection buttons provide access to a wide variety of analysis types

Switching screen modes

Switch the display at the touch of a button, providing access to the Calibration, Centering and Leveling, Measurement and Result screens

Zero-setting button

No fine adjustment necessary for setting the measurement position



Black and white LCD screen

Easy-to-read screen displays essential information

Simple setup

Apply the current measurement setup in one go
Simple operation helps prevent operational errors

Log dial

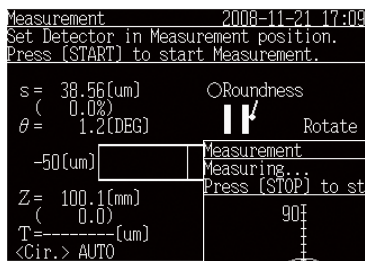
Make incremental changes to setup and other operations

Simple, interactive display screen

The large LCD screen with backlight shows easy-to-understand measurement results and graphs. Forms can be checked and notch processing can be set while observing the displayed graphs.

Measurement screen

- Set the position of the detector and measurement conditions here
- During measurement, graphs are displayed in real time



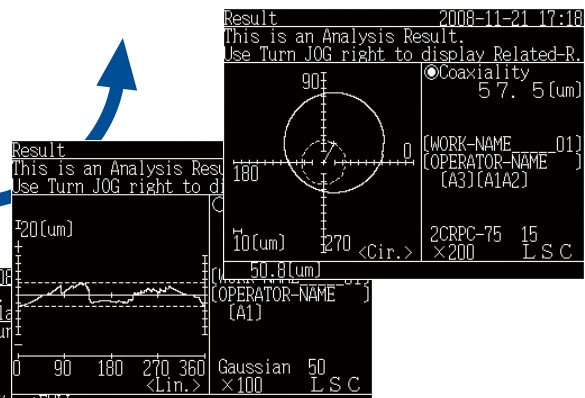
▲ Measurement screen



▲ Measurement in progress screen

Measurement results

- Filter, display magnification, etc., can be altered
- Besides circles, developed views can also be displayed



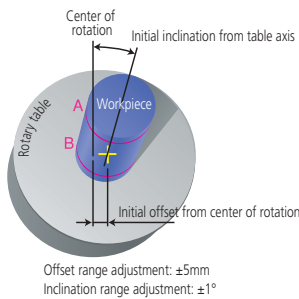
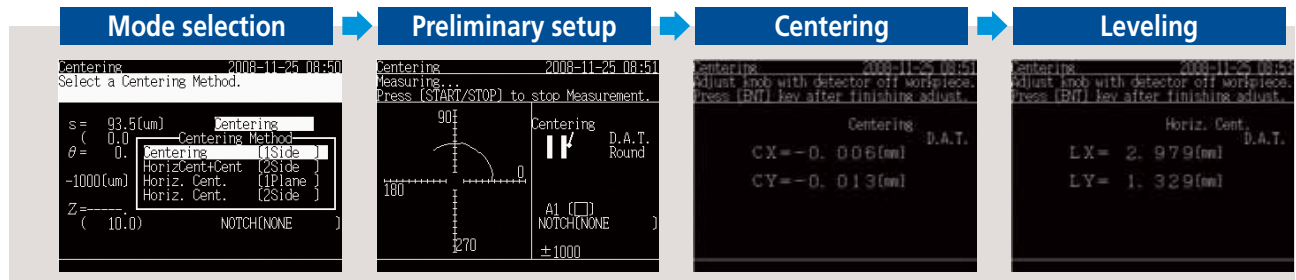
Result screen ▲

High-level functions promote greater efficiency

D.A.T function

Patent registered (in Japan)

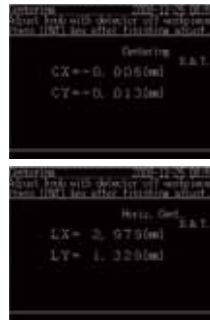
This instrument uses the D.A.T (Digital Adjustment Table) function available on more sophisticated models, and this provides powerful support for centering and leveling operations. To perform such operations, the user need only adjust the digital micrometer heads attached to the rotary table by the amounts indicated by the display. This function also supports notched workpieces.



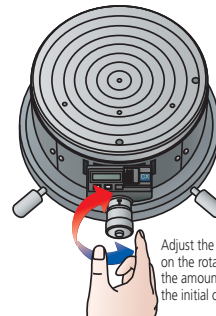
Offset range adjustment: $\pm 5\text{mm}$
Inclination range adjustment: $\pm 1^\circ$

Preliminary measurement

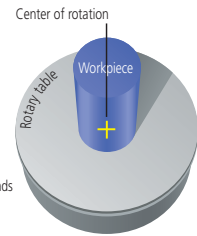
Two preliminary measurements are made at cross-sections [A] and [B]



Displays amount of offset/inclination



Simple adjustment



Centering/leveling complete

IN/OUT switchable wide-range detector

The range of this detector has been extended from that of a conventional lever head by as much as four times, and now provides a wide 2000 μm stroke. The detector can provide sufficient margin for centering and leveling jobs, or when measuring large differences. Moreover, the measuring direction can be switched between inside and outside diameters with a single touch of a button.



IN/OUT Switchable wide-range detector

Standard accessories that enhance measurement efficiency



Z-axis scale

This scale is useful when the measuring height position needs to be entered, such as when measuring coaxiality, etc.

X-axis stop

Allows the user to return the detector rapidly and easily to a fixed position in the X axis.

Continuous ID and OD measuring function

Patent registered (in Japan, USA, Germany, UK, France)

This function comes in very handy when outside and inside surfaces need to be measured repeatedly, for example, with respect to coaxiality, deviation in wall thickness, etc.



Making an inside-surface-related measurement

Making an outside-surface-related measurement

Specifications

■ Main unit

Model	RA-220	
Order No.	211-643A	
Turntable unit	Rotational accuracy: Radial	(0.04+6H/10000) μ m H: Measuring height (mm) JIS B7451-1997
	Rotational accuracy: Axial	(0.04+6X/10000) μ m X: Distance from the rotation center (mm)
	Rotation speed	6 rpm
	Effective table diameter	ϕ 6" (ϕ 150mm)
	Maximum loading weight	55lbs (25kg)
	Maximum probing diameter *1	ϕ 11" (280mm) (ϕ 14.96" (380mm): when detector holder is installed in reverse; in the vertical posture only; maximum measuring height is up to 2" (50 mm) from the table top)
	Maximum workpiece diameter	ϕ 18.5" (ϕ 470mm)
Vertical drive unit (Z-axis)	Parallelism to rotation center	0.5 μ m/100mm
	Straightness	Narrow range: 0.2 μ m/20mm Wide range: 0.5 μ m/100mm
	Vertical travel	11.02" (280mm) from the turntable top
	Maximum probing height *1	11.02" (280mm) from the turntable top
	Maximum probing depth	4" (100mm) (minimum ID: 30mm)
Radial drive unit (X-axis)	Horizontal travel	-1" ~ 5.5" (-25mm ~ 140mm)
Detector *2	Measuring force	70 ~ 100mN (\pm 30%)
	Standard stylus tip	Carbide ball, ϕ 1.6mm
	Measuring range	\pm 1000 μ m
	Measuring direction	IN/OUT switchable
Electronic unit	Measuring range	\pm 1000, \pm 100, \pm 10 μ m (3 steps)
	Recording magnification	\times 5, \times 10, \times 20, \times 50, \times 100, \times 200, \times 500, \times 1K, \times 2K, \times 5K, \times 10K, \times 20K, \times 50K, \times 100K, \times 200K (15 steps)
	Filter type	With phase-correction: 2CRPC75, 2CRPC50 Without phase-correction: 2CR75, 2CR50 Gaussian, Filter OFF
	Cutoff value	Low pass: 15 upr, 50 upr, 150 upr, 500 upr Band pass: 15-150 upr, 15-500 upr, 50-500 upr
	Number of measuring cross sections	1 to 5 cross sections : Roundness, Coaxiality, Flatness 1 to 3 cross sections : Radial runout, Squareness (axis reference) 2 cross sections: Concentricity, Thickness deviation, Parallelism 3 cross sections: Squareness (plane reference) 3 to 5 cross sections : Cylindricity
	Reference circle for roundness evaluation	Least square circle method (LSC), Minimum zone circle method (MZC), Maximum inscribed circle method (MIC), Maximum circumscribed circle method (MCC)
	Data analysis items	Roundness, Coaxiality, Concentricity, Flatness, Circular run-out (radial), Circular run-out (axial), Squareness (relative to axis), Squareness (relative to plane), Thickness deviation, Parallelism, Cylindricity
	Data output	USB, RS-232C, SPC
	Printer	Thermal line printer, External printer (option)
Others	Power supply	AC100 ~ 240V
	Power consumption	33W
	Specified air pressure	0.39MPa
	Air consumption	30L/min or over (Standard state)
	Mass	Main unit: 332 lbs (151kg) Air filter: 4.4 lbs (2kg)

*1: Use an auxiliary workpiece stand (option) when measuring a workpiece whose diameter is .78" (20mm) or less and whose height is .78" (20mm) or less from the top surface of the alignment table.

*2: The detector supports standard-length styli only. Long styli cannot be used.

■ Standard accessories

Order No.	Name of Parts	QTY	Remarks
211-016	Reference hemisphere	1	
350365	Calibration film	2	
12AAB681	Standard stylus	1	
938882	Battery	5	SR44: For Micrometerheads (D.A.T function), For ABS-SD scale (Z axis)
—	Printer paper (2), X-axis stop (1), Coupler(socket) (1), Hose band (1), Power cord (1), Philips screwdriver (1), Allen wrench(Nominal size:0.9mm) (1), Allen wrench(Nominal size:2mm) (2), Allen wrench(Nominal size:2.5mm) (1), Vinyl cover (1), Hanger bolt (4), User's manual (1)		

*Number in () shows quantity

■ Reference hemisphere

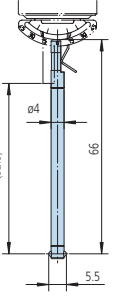
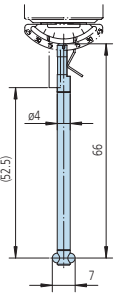
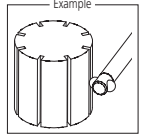
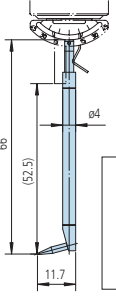
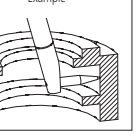
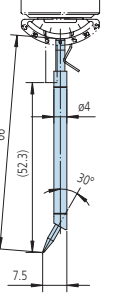
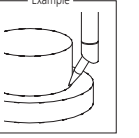
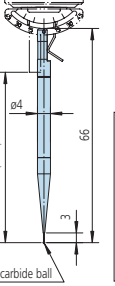
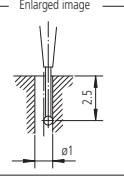
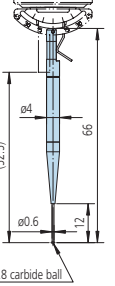
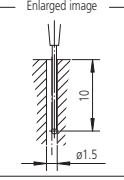
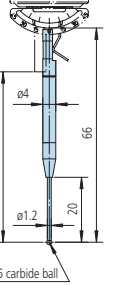
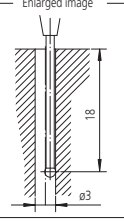
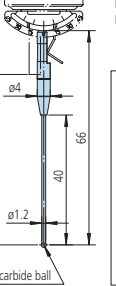
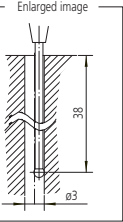
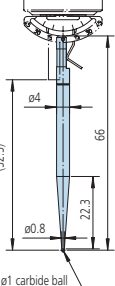
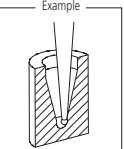
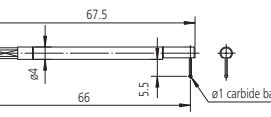

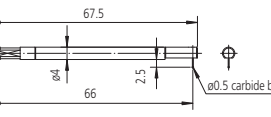
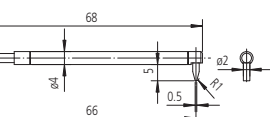
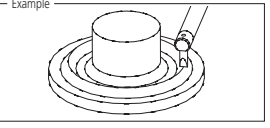
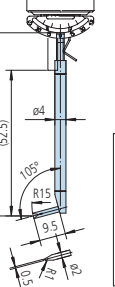
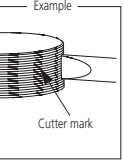
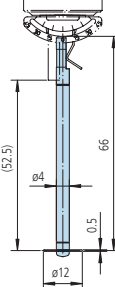
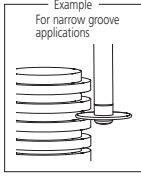
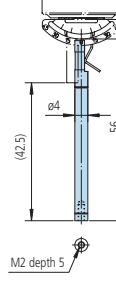
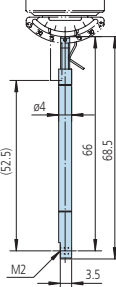
Order No. 211-016



Optional Accessories

Interchangeable Styli

Unit: mm

12AAB681 Standard stylus *Standard accessory (stylus tip: $\phi 1.6$ carbide ball)	12AAB682 Stylus for notched workpieces (stylus tip: $\phi 3$ carbide ball)	12AAB683 Stylus for grooves (stylus tip: R0.25 sapphire)	12AAB684 Stylus for corners (stylus tip: R0.25 sapphire)
 <p>For standard applications</p> <p>In ID measurement Dia.: ≥ 7.5mm, Depth: ≤ 50mm</p>	 <p>Useful for notched workpieces</p> 	 <p>For stepped applications</p> 	 <p>For inside-corner applications</p> 
12AAB687 Stylus for extra small holes (stylus tip: $\phi 0.5$ carbide ball)	12AAE859 Stylus for small holes (stylus tip: $\phi 0.8$ carbide ball)	12AAB674 Stylus for small and deep holes (stylus tip: $\phi 1.6$ carbide ball)	12AAE855 Stylus for small and deep holes (stylus tip: $\phi 1.6$ carbide ball)
 <p>For extra small hole applications Dia.: ≥ 1mm, Depth: ≤ 2.5mm</p>  <p>$\phi 0.5$ carbide ball</p>	 <p>For small hole applications Dia.: ≥ 1.5mm, Depth: ≤ 10mm</p>  <p>$\phi 0.8$ carbide ball</p>	 <p>For small and deep hole application: Dia.: ≥ 3mm, Depth: ≤ 18mm</p>  <p>$\phi 1.6$ carbide ball</p>	 <p>For small and deep hole application: Dia.: ≥ 3mm, Depth: ≤ 38mm</p>  <p>$\phi 1.6$ carbide ball</p>
12AAB686 Stylus for small holes (stylus tip: $\phi 1$ carbide ball)	12AAB696 Cranked stylus (stylus tip: $\phi 0.5$ carbide ball)	12AAB695 Cranked stylus (stylus tip: $\phi 1$ carbide ball)	12AAE856 Stylus for flat surface
 <p>For small hole applications</p>  <p>$\phi 1$ carbide ball</p>	 <p>For upper/lower surface in a narrow groove</p>  <p>Note: This stylus cannot be used for OD/ID measurement.</p>		 
12AAB685 Stylus for filtering asperities (machining marks)	12AAB694 Disk stylus	12AAB676 M2 tapped shank for CMM styli	12AAE857 M2 tapped shank for CMM styli
 <p>Filtering out the effects of asperities by tracing with R15 tipped stylus</p>  <p>Cutter mark</p>	 <p>Example for narrow groove applications</p> 	 <p>Compatible with CMM styli with M2 threaded shank</p> <p>M2 depth 5</p>	 <p>Compatible with CMM styli with M2 threaded shank</p>

□ portion shows stylus except for the cranked stylus and stylus for flat surface.
 * () dimension shows a distance from the tip end of stylus or the center of tip ball to the connecting surface of detector.
 * Customized special interchangeable styli are available on request. Please contact any Mitutoyo office for more information.

Centering chuck (knurled ring operated)

Provides good operability when measuring a small-diameter workpiece. The knurled ring allows the workpiece to be clamped easily.



Order No.	211-032
Holding range	OD with internal jaws 11–36 mm ID with internal jaws 16–69 mm OD with internal jaws 25–79 mm
External size (D x H)	ø 4.65" x 1.6" (118 x 41 mm)
Mass	2.6 lbs (1.2 kg)

Three-jaw chuck (key operated)

Useful where it is necessary to apply a higher clamping force to the workpiece than can be applied with the centering chuck.



Order No.	211-014
Holding range	OD with internal jaws 12–26 mm ID with internal jaws 25–68 mm OD with internal jaws 35–78 mm
External size (D x H)	ø 6.18" x 2.78" (157 x 70.6 mm)
Mass	8.4 lbs (3.8 kg)

Microchuck

For clamping a small workpiece, 1 mm or less in diameter, that cannot be held in the centering chuck.



Order No.	211-031
Holding range	OD: up to 1.5 mm
External size (D x H)	ø4.65" x 1.9" (118 x 48.5 mm)
Mass	1.32 lbs (0.6 kg)

Collet chuck

Provides high clamping repeatability due to the use of optional precision collets. (See table at right.)



Order No.	211-051
Part holding range	ø0.5–10 mm*2
Centering error	Within 50 µm*3
Mass	3 lbs (1.4 kg)

*2: Collets to match the workpiece size range are required for use with this chuck.

*3: When measured with ø5 mm pin gauge at measuring height of 30 mm.

Individual collets*4

These collets are for use with the collet chuck shown at left and are acquired to match the workpiece diameter range required.

Order No.	Part Holding Range (O.D.)
12AAH402	ø0.02"–0.04" (0.5–1.0mm)
12AAH403	ø0.04"–0.06" (1.0–1.5mm)
12AAH404	ø0.06"–0.08" (1.5–2.0mm)
12AAH405	ø0.08"–0.1" (2.0–2.5mm)
12AAH406	ø0.1"–0.12" (2.5–3.0mm)
12AAH407	ø0.12"–0.138" (3.0–3.5mm)
12AAH408	ø0.138"–0.157" (3.5–4.0mm)
12AAH409	ø0.157"–0.197" (4.0–5.0mm)
12AAH410	ø0.197"–0.236" (5.0–6.0mm)
12AAH411	ø0.236"–0.275" (6.0–7.0mm)
12AAH412	ø0.275"–0.315" (7.0–8.0mm)
12AAH413	ø0.315"–0.354" (8.0–9.0mm)
12AAH414	ø0.354"–0.394" (9.0–10.0mm)

*4: A collet cannot be mounted on the rotary table without a collet chuck.

*4: YCC10-** Class AA, made by Yukiwa Seiko Inc. or its equivalent.

Auxiliary stage for a short workpiece

Order No. **356038**



Magnification checking gage

Order No. **211-045**



Gage block set for calibration

Order No. **997090**



Vibration-damping stand bench-top type



Order No.	950-990
Vibration damping system	Preumatic type w/ self-leveling
External size	25" x 20" x 2" 610 x 508 x 51 mm
Max. loading mass	175 lbs (80 kg)



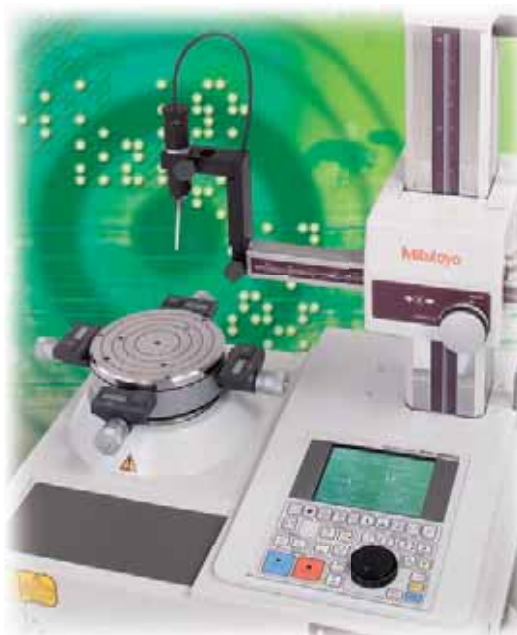
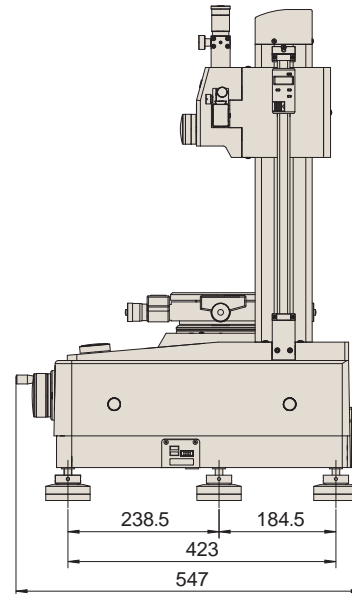
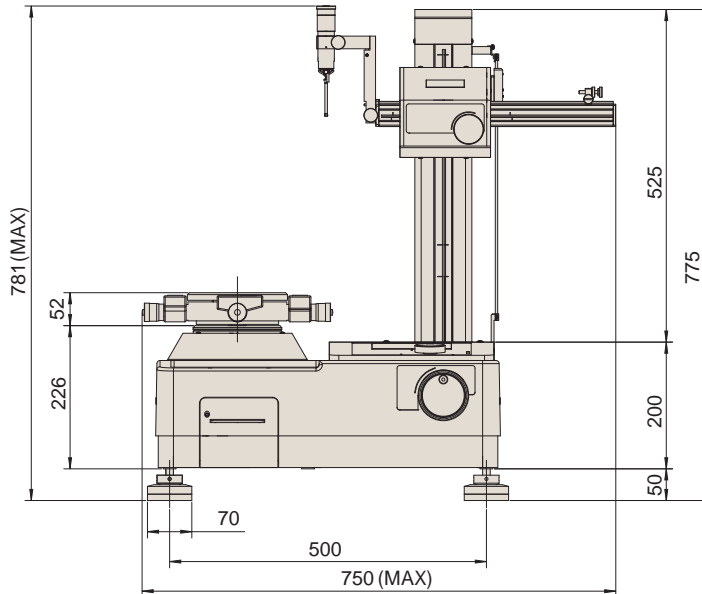
Cylindrical square

Order No.	350850
Straightness	0.5µm
Cylindricity	2µm
External size (D x H)	ø70 x 250mm
Mass	7.5kg

Dimensions

External dimensions

Unit: mm



- Coordinate Measuring Machines
- Vision Measuring Systems
- Form Measurement
- Optical Measuring
- Sensor Systems
- Testing Equipment and Seismometer
- Digital Scale and DRO Systems
- Small Tool Instruments and Data Management

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