Starrett®

SR160 SURFACE ROUGHNESS TESTER
USER MANUAL

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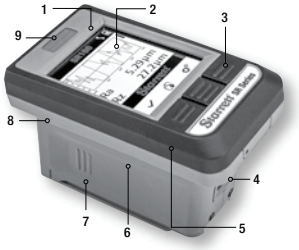
COMPONENTS



1. **BLUETOOTH TECHNOLOGY -** Quick, reliable communication between traverse and display/control unit.
   - **TECNOLOGÍA BLUETOOTH** - Comunicación rápida y confiable entre el mecanismo transversal y la pantalla/unidad de control.
   - **TECHNOLOGIE BLUETOOTH** - Communication rapide et fiable entre l'unité d'avance et l'unité d'affichage/de mesure.
   - **TECNOLOGIA BLUETOOTH** - Comunicação rápida e confiável entre a unidade móvel e a unidade de exibição/controle.
   - 蓝牙技术 - 移动部件与显示/控制部件之间快速、可靠通信。
   - **BLUETOOTH-TECHNOLOGIE** - Schnelle, zuverlässige Datenübertragung zwischen Linearvorschubgerät und Display/Steuergerät.
   - **TECNOLOGIA BLUETOOTH** - Comunicazione rapida e affidabile tra l'unità trasversale e l'unità di visualizzazione/controllo.
2. **PROFILE GRAPH -** Clear detailed graph showing measurement area - excellent for visually identifying defects.
   - **GRÁFICO DE PERFILES** - Gráfico claro y detallado que muestra el área de medición - excelente para identificar defectos visualmente.
   - **GRAPHIQUE DE PROFIL** - Graphique détaillé clair représentant la zone de mesure - excellent pour l'identification visuelle des défauts.
   - **GRÁFICO DE PERFIL** - Gráfico claro e detalhado indicando a área medida: excelente para a identificação visual de defeitos.
   - 轮廓图 - 清楚、详细显示被测区域的图形,出色的肉眼识别缺陷功能。
   - **PROFILDIAGRAMM** - Klares, detailliertes Diagramm zeigt die Messfäche – ausgezeichnet zum visuellen Identifizieren von Mängeln.
   - **GRAFICO DEL PROFILO** - Chiaro grafico dettagliato che mostra l'area di misurazione - eccellente per l'identificazione visiva dei difetti.

COMPONENTS

3. **SIMPLE 3-BUTTON NAVIGATION -** Instant access to menu option settings.
   - **NAVEGACIÓN SIMPLE CON 3 BOTONES** - Acceso instantáneo a los ajustes de opciones del menú.
   - **NAVIGATION SIMPLE À 3 TOUCHES** - Accès instantané aux réglages des options de menu.
   - **NAVEGAÇÃO SIMPLES COM UTILIZAÇÃO DE 3 BOTÕES** - Acesso imediato às configurações de opção do menu.
   - 简单 3 键导航 - 即时访问菜单选项设置。
   - EINFACHE 3-TASTEN-NAVIGATION Schneller Zugriff auf die Menüoptionseinstellungen.
   - **NAVIGAZIONE SEMPLICE CON 3 TASTI** Accesso immediato alle impostazioni dei menu.

4. **USB MINI CHARGING PORT -** Charge from mains or any standard USB charging port.
   - **MINIPUERTO DE CARGA USB** - Carga desde la alimentación principal o cualquier puerto de carga USB estándar.
   - **PORT MINI USB POUR LA RECHARGE** - Recharge sur le secteur ou sur tout port USB standard de recharge.
   - **PORTA DE CARREGAMENTO MINI USB** - A bateria pode ser carregada pela alimentação principal ou por qualquer porta USB padrão.
   - USB 迷你充电接口 - 从电源或任何 USB 标准充电接口充电。
   - **USB MINI-LADEANSCHLUSS** - Laden an einer Steckdose oder an einem standardmäßigen USB-Ladeanschluss.
   - **PORTA MINI USB PER LA CARICA** - Può essere caricato tramite qualsiasi porta USB standard o tramite adattatore CA.

5. **RUBBERIZED MOLDING -** Enhanced durability and improved grip provides unbeatable protection in harsh shop floor environments.
   - **MOLDURAS DE CAUCHO** - La durabilidad realzada y el mejor agarre proporciona una protección inigualable en entornos exigentes de taller.
   - **MOULAGE CAOUTCHOUTÉ** - La meilleure prise en main constitue une protection imbattable dans les environnements d'atelier difficiles, pour une durée de vie prolongée.
   - **GUARNIÇÃO DE BORRACHA** - Maior durabilidade e aderência oferecem proteção inigualável nos ambientes hostis do chão de fábrica.
   - 橡胶成型 - 增强耐用性, 改良握柄, 为恶劣工作环境提供最佳保护。
   - **GUMMIERTE BLENDE** - Verbesserte Langlebigkeit und besserer Griff sorgen für ausgezeichneten Schutz in der Werkstatt.
   - **INVOLUCRO IN GOMMA** - La maggiore durata e un'impugnatura migliore forniscono una protezione senza pari in ambienti industriali ostili.

6. **LI-POLY BATTERY -** Most advanced rechargeable battery technology for unrivalled reliability and battery life.
   - **BATERÍA DE LI-POLI** - La tecnología más avanzada de baterías recargables para una confiabilidad y una vida útil de la batería inigualadas.
   - **BATTERIE LI-POLY** - La technologie de batterie rechargeable la plus avancée pour une fiabilité et une durée de vie inégalées de la batterie.
   - **BATERIA DE POLÍMERO DE LÍTIO** - A mais avançada tecnologia de baterias recarregáveis para oferecer vida útil e confiabilidade incomparáveis.
   - 锂聚合电池 - 先进的充电电池技术, 最佳可靠性和电池续航时间。
   - **LI-POLY-AKKU** - Die fortschrittlichste Akkutechnologie für höchste Zuverlässigkeit und lange Akkulebensdauer.
   - **BATTERIA AI POLIMERI DI LITIO (LI-POLY)** - La batteria ricaricabile più avanzata per un'affidabilità e una durata senza pari.

7. **DIAMOND STYLUS AND PIEZOELECTRIC PICK-UP -** The hard wearing, robust piezoelectric pick-up stylus with diamond tip assures very reliable measurement.
   - **ESTILETE DE DIAMANTE Y DISPOSITIVO PIEZOELÉCTRICO DE RECOGIDA** - El robusto y duradero estilete piezoeléctrico de recogida con punta de diamante asegura una medición muy confiable.
   - **PALPEUR EN DIAMANT ET CAPTEUR PIÉZO-ÉLECTRIQUE** - Le capteur piézo-électrique robuste et résistant à l'usure à palpeur en diamant garantit une mesure très fiable.
   - **AGULHA DE DIAMANTE E SENSOR PIEZOELÉTRICO** - Sensor piezoelétrico robusto e resistente e agulha com ponta de diamante asseguram medidas altamente confiáveis.
   - 金刚石触针和压电传感 - 坚固耐磨的压电传感触针, 金刚石触针尖, 确保测量可靠性。
   - **DIAMANT-STYLUS UND PIEZOELEKTRISCHER TASTER** - Der robuste, verschleißbeständige piezoelektrische Taster mit Diamantspitze gewährleistet extrem zuverlässige Messungen.
   - **STILO IN DIAMANTE E PICK-UP PIEZOELETTRICO** - Stilo con pick-up piezoelettrico robusto e a lunga durata con punta in diamante per una misurazione molto affidabile.

8. **SEPARATES -** The SR160 splits into a display/control unit and traverse unit via a slide and lock mechanism.
   - **COMPONENTES SEPARADOS** - El SR160 se divide en una pantalla/unidad de control y una unidad transversal por medio de un mecanismo de deslizamiento y bloqueo.
   - **EN DEUX PARTIES** - Le SR160 se sépare en une unité d'affichage/de mesure et une unité d'avance à l'aide d'un mécanisme à emboîtement.
   - **SEPARAÇÃO** - Com seu mecanismo de deslizamento e trava, o SR160 pode ser separado em duas unidades: uma unidade móvel e uma unidade de exibição/controle.
   - 分体式 - SR160 由滑动和固定机构分隔成显示/控制部件和移动部件。
   - **AUSEINANDERNEHMBAR** - Das Modell SR160 lässt sich anhand eines Gleit- und Arretiermechanismus in das Display/Steuergerät und das Linearvorschubgerät trennen.
   - **SEPARABILE** - L'SR160 si separa in unità di visualizzazione/controllo e unità trasversale con un meccanismo di scorrimento e blocco.

9. **MEASURE -** Tactile measurement button great for challenging orientations.
   - **MEDICIÓN** - Botón táctil de medición, ideal para orientaciones complejas.
   - **MESURE** - Touche de mesure tactile très pratique pour les orientations difficiles.
   - **MEDIDAS** - Botão de medição tátil, excelente para dificuldades de orientação.
   - 测量 - 触控测量键极为适用于测量难度高的方向。
   - **MESSEN** - Taktile Messtaste für anspruchsvolle Ausrichtungen.
   - **MISURAZIONE** - Tasto per la misurazione tattile utile per gli orientamenti più complessi.

COMPONENTS

FAST AND RELIABLE

Simply press the measurement button and in a few seconds a full set of traceable measurement results including a detailed profile graph is displayed.

RÁPIDO Y CONFIABLE

Simplemente pulse el botón de medición y en unos pocos segundos aparecerá un conjunto completo de resultados rastreables de medición, incluido un gráfico detallado del perfil.

RAPIDE ET FIABLE

Appuyez simplement sur la touche de mesure et, en quelques secondes, un ensemble complet de résultats de mesure traçables s'affiche, dont un graphique détaillé du profil.

RÁPIDO E CONFIÁVEL

Basta pressionar o botão de medição e, em poucos segundos, aparecerá um conjunto completo de medições rastreáveis, incluindo a exibição de um gráfico de perfil detalhado.

快速、可靠

只需按测量键，数秒内即可显示出一组完整、可追溯的测量结果，包含详细的轮廓图。

SCHNELL UND ZUVERLÄSSIG

Drücken Sie einfach die Messtaste und nach einigen Sekunden wird ein Satz nachverfolgbarer Messergebnisse mit einem detaillierten Profildiagramm angezeigt.

VELOCE E AFFIDABILE

Premere semplicemente il tasto di misurazione e in alcuni secondi vengono visualizzati i risultati tracciabili compreso un grafico dettagliato del profilo.

BUILT TO LAST, BY DESIGN

Impact resistant rubberized moldings surround a recessed, Mylar protected high durability screen making the unit robust.

CONSTRUIDO PARA DURAR, POR DISEÑO

Las molduras de caucho, resistentes al impacto, que rodean una pantalla empotrada, de alta durabilidad, protegida por Mylar permiten que la unidad sea robusta.

CONÇU POUR DURER

La robustesse de l'unité est assurée par un moulage caoutchouté antichoc accueillant un écran haute durabilité en retrait et muni d'une protection en Mylar.

PROJETADO E CONSTRUÍDO PARA DURAR

Guarnições de borracha resistente ao impacto contornam uma tela reentrante de alta durabilidade protegida com Mylar, dando resistência à unidade.

精心设计，长久使用

嵌入式、高耐用屏幕，带 Mylar 保护膜，周围包覆耐冲击橡胶，使部件更坚固。

DESIGN FÜR LANGFRISTIGEN EINSATZ

Die stoßfeste, gummierte Blende um das mit Mylar geschützte langlebige Display sorgen für ein robustes Gerät.

PROGETTATO E FATTO PER DURARE

L'involucro in gomma resistente agli urti circonda il robusto schermo incassato, con protezione in Mylar, e rende l'unità più resistente.

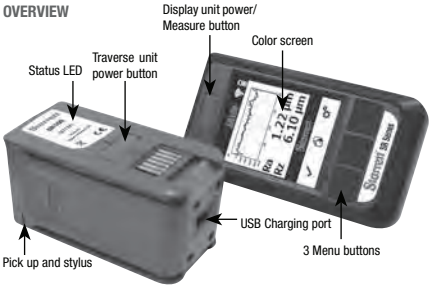
SR160 SURFACE ROUGHNESS TESTER

THIS IS A STARRETT USER GUIDE FOR THE SR160 SURFACE ROUGHNESS TESTER.

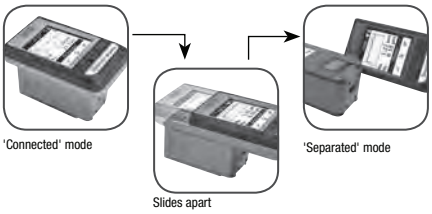
ALL SPECIFICATIONS IN THIS DOCUMENT ARE CORRECT AT TIME OF PRODUCTION AND ARE SUBJECT TO CHANGE. PLEASE CONTACT STARRETT FOR FURTHER INFORMATION.

USING THE INSTRUMENT

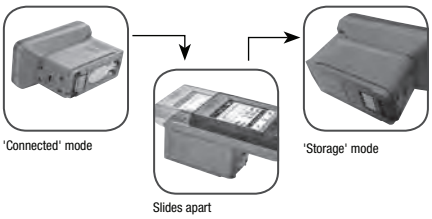
OVERVIEW



SR160 OPERATION MODE



SR160 STORAGE MODE



FUNCTION BUTTONS

UNIT POWER/MEASURE BUTTON - SEPARATED MODE

POWER

- Both the display unit and the traverse unit will need to be powered On/Off individually. There is no specific order of preference. Hold the red power button for 3 seconds or more to switch Off/On.

MEASURE

- Press the red button on the display unit for < 3 seconds

UNIT POWER/MEASURE BUTTON - CONNECTED MODE

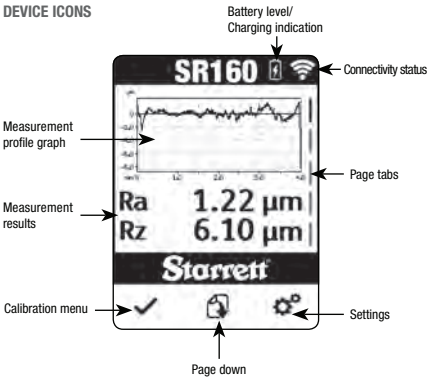
POWER

- Both the display unit and the traverse unit can be switched on in Connected mode configuration when the only the display unit power button is pressed. However, to power OFF, both traverse and display unit will need to be powered off individually. Hold the red power button for 3 seconds or more to switch OFF/ON.

MEASURE

- Press the red button on the display unit for < 3 seconds

DEVICE ICONS

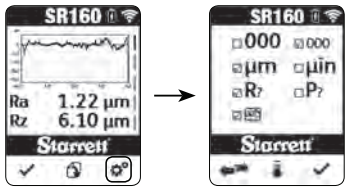


MENU

FONT SIZE (LARGE/SMALL)

Press the settings button to enter the settings menu.

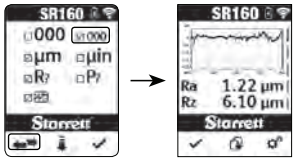
Select the size of font to use in displaying the measurement results. There are two size options available to choose from – Large and Small. Press the ⬅➡ to toggle between the 2 options. Press the check button to accept the setting and exit the settings menu.



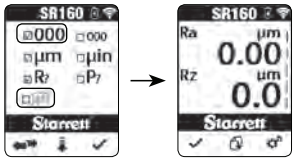
NOTE

The large style font cannot be used together with the profile graph option. When the large font is selected, the profile graph option is automatically set to 'no graph' (greyed out).

SMALL FONT

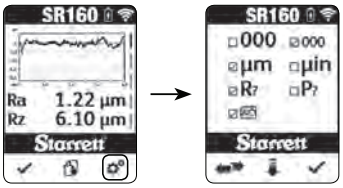


LARGE FONT



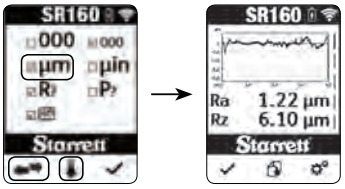
UNITS (µM/µIN)

Press the settings button to enter the settings menu.

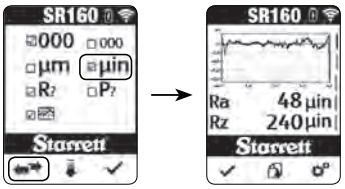


Press the down arrow button to scroll down to the units selection line.
Press the ⬅➡ to toggle between the 2 options – µm (Metric) or µin (English).
Press the check button to accept the setting and exit the settings menu.

Metric units (µm)

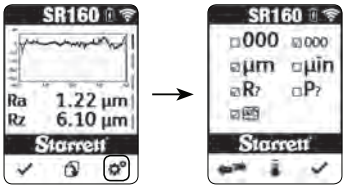


English units (µin)



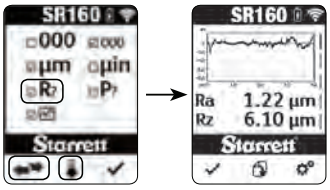
PARAMETERS (R?/P?)

Press the settings button to enter the settings menu.

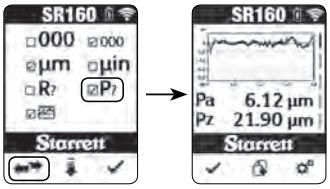


Press the down arrow button to scroll down to the Parameter setting line. Press the ⬅➡ to toggle between the two ISO 4287 parameter options available to display – Roughness (R) or Primary (P). Press the check button to accept the setting and exit the settings menu. Either selection will display all the parameters available for that particular option on the results screen.

ISO 4287 Roughness parameters (R)

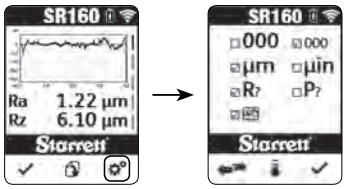


ISO 4287 Primary parameters (P)



PROFILE GRAPH (ON/OFF)

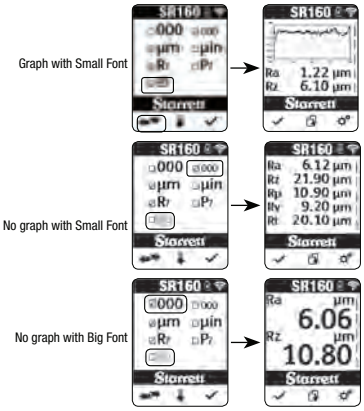
Press the settings button to enter the settings menu.



Press the down arrow button to scroll down to the Graph option line. Press the ⬅➡ to toggle between the option of displaying or not displaying the graph on the results screen. Press the check button to accept the setting and exit the settings menu.

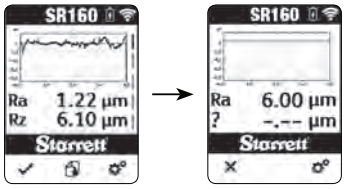
NOTE

For the graph option to be selected, the Small font option must be used.

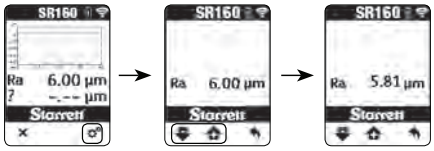


CALIBRATION

Press the calibration button to enter the calibration menu.



In the calibration screen, the default or last saved calibration Ra value will be displayed. To change this calibration value, press the settings icon. Then use the up (+) and down (-) buttons to adjust the calibration Ra value to the desired number. Press the back button to accept the value and return to the calibration screen.

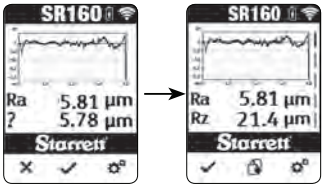


Place the SR160 on the calibration standard provided with the unit (or any other certified standard). Press the measure button to take a measurement on the calibration standard.

The measured Ra value will be displayed at the end of the measurement. To accept and complete the calibration, press the check button.

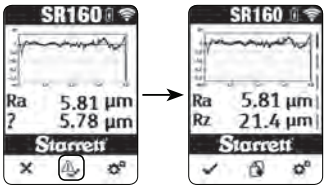
At any time, press the cross (x) button to exit the calibration menu.

Calibration complete



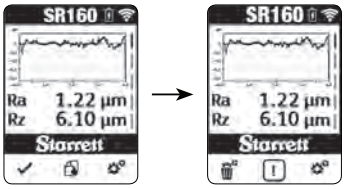
If calibration is more than 10% then a warning is shown.

Calibration complete



FACTORY RESET

To reset the SR160 to factory settings, hold the settings button for about 3 seconds.

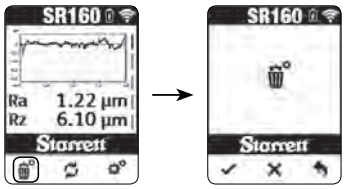


Press the delete settings button.

In the reset screen, press the check button to do a factory reset or the cross(x) button to exit and return to the main results screen.

Press the back arrow at any time to exit and return to the results screen.

In the factory reset menu, the battery percentages of both the display unit and the traverse unit will be displayed along with their Bluetooth address.

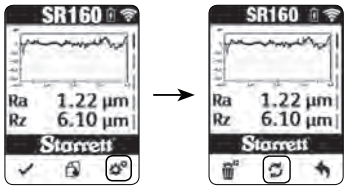


The factory reset function works only when the SR160 is paired (either via Bluetooth or in connected mode).

TEST MODE

Test Mode is initiated when the settings button is held for 3 seconds and the test mode icon is pressed. This is for internal service and diagnostic purposes and should NOT be used by the customer.

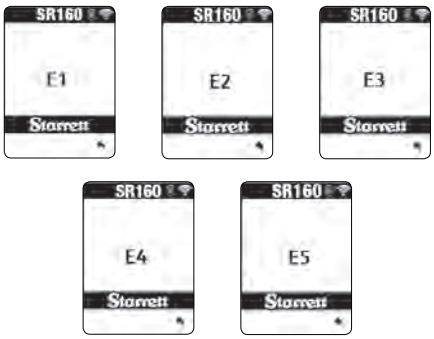
If at any time the test mode is inadvertently activated, switch off the unit completely and switch back on to return the unit to normal operation.



ERROR CODES

The following are the error codes associated with the SR160 and their meanings:

- E1 ➔ Motor sensor failure
- E2 ➔ Motor sensor misaligned
- E3 ➔ Motor speed failure
- E4 ➔ Traverse unit settings lost, returned to default
- E5 ➔ Display unit settings lost, returned to default



If any errors occur and are displayed, use the back button to continue.

SR160 OVERVIEW

WHAT IT DOES

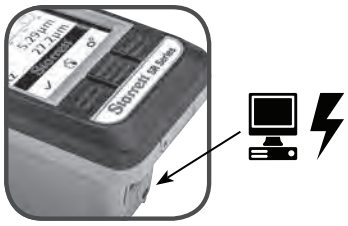
The SR160 is a superior portable surface roughness tester that measures multiple roughness parameters with a 1-button click. Roughness measurement parameters such as Ra, Rz, Rp, Rv and Rt are displayed on a brightly lit intuitive 2.4" LCD color display. Its rechargeable battery operation makes it a convenient way of performing fast, easy and precise on-the-spot measurements in almost any environment and surface.

HOW IT DOES IT

The hard-wearing diamond stylus is drawn across the part with a precision motorized traverse mechanism to ensure that the correct horizontal distance is travelled. Vertical movement of the stylus is detected by a high quality piezo-electric pick-up as it travels across peaks and valleys which converts mechanical movement into electrical signals. The electrical signal is digitized and sent to a microprocessor for instant calculation of surface parameters using standardized algorithms.

UKAS CALIBRATION AND TESTING

The mini USB port can be used for charging with the included mains charger (or with any standard USB charger).



KEEPING IT SIMPLE

The surface roughness testing philosophy keeps the process simple. It is the perfect tool for any inspector to check surface roughness even in the most demanding applications.

- Incoming inspections
- Final inspection before shipment
- Process control on the production line
- Checking large components or structures

STANDARDS AND TRACEABILITY

The reference standard supplied can be used both to calibrate the instrument and check for stylus wear to ensure the most accurate results are always being achieved.

MEASUREMENT	BEST CAPABILITY
Roughness standards (Ra)	±(2% + 0.004µm)
Workpiece or component surface texture (Ra)	±3% of measured value per trace

ENGLISH

INSTANT ON

By utilizing Instant On technology these instruments are ready to measure in less than 5 seconds from switching on!

IN SITU MEASUREMENTS

Monitor wear and roughness changes in situ during product's life. E.g. monitoring changes in turbine blade roughness as an early warning sign for defects and efficiency losses.

USER-FRIENDLY, NOT USER-HOSTILE!

The SR160 is a simple and easy-to-use as any Smart Phone. Users have the advantage of the intuitive quick access 3-button menu and its crisp 2.4" daylight readable industrial color LCD screen.

BLUETOOTH CONNECTIVITY

This next generation bluetooth technology boasts super efficient connectivity allowing wireless communication between the display unit and traverse unit.

BUILT FOR POWER…

Powered by heavy duty reliable Li-Poly technology, the SR160 operates 24/7 with over 2000 measurements from a single charge.

PARAMETERS

PARAMETERS AVAILABLE: ISO 4287 ROUGHNESS*				
Rt	Rp	Rv	Rz	Ra
Total profile height	Maximum profile peak height	Maximum profile valley depth	Maximum height of the profile	Arithmetic mean deviation
Other parameters include: Rsk, Rku, Rq, Rz1max				

*Includes primary parameters

SR160 ACCESSORIES

PORTABLE HYBRID SOLAR RECHARGEABLE POWER BANK*

Portable power bank for charging the SR160 on the go. Can be charged by USB, mains AC or sunlight.

COMPACT PORTABLE CARRY BAG

Helps secure the SR160 and prevent accidental drops especially for applications involving measuring at heights.

USB CHARGER

Mini USB charger 5V 1A 110-240 VAC 50/60 Hz with international adapters.

HARD TRANSPORT CASE*

Air and water tight case that provides the SR160 with extra protection for safe storage and/or transportation.

CALIBRATION STANDARD

For calibrating and checking the SR160 instrument.

- Ra 229µin (5.81µm)

MAGNETIC BASE*

Lightweight compact base specially designed to allow for measurements in multiple orientations including upside down on metallic surfaces.

* Not supplied as standard with SR160

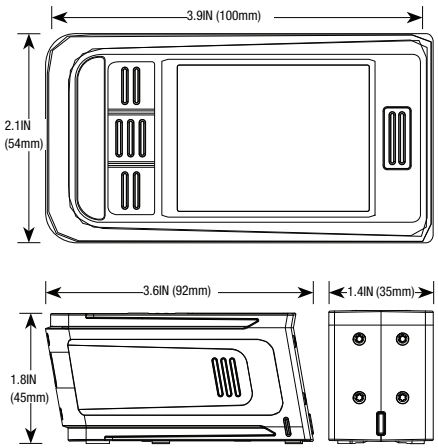
INSTRUMENT PERFORMANCE		
GAGE	Resolution	0.4µin (0.01µm)
MEASUREMENT	Range (Ra)	Up to 1600µin (40µm)
	Range (Rz, Rv, Rp, Rt)	Up to 7800µin (199µm)
	Repeatability	2% of value + noise
	Accuracy	5% of reading + 4µin (0.1µm)
	Noise	4µin (0.1µm)
CALIBRATION	Process	Automatic software calibration
	Standard	Able to calculate to ISO 4287 Roughness Standards
PARAMETERS	Standards	ISO 4287
	ISO 4287 (Roughness)	Ra, Rz, Rp, Rv, Rt, Rz1max, Rsk, Rq, Rku
	ISO (Primary)	Pa, Pz, Pp, Pv, Pt

TECHNICAL		
DATA OUTPUT	On-Screen	Up to 5 results per page, selectable on-screen graph
BATTERY	Charger	Mini USB 5V 1A 110-240VAC 50/60 Hz
	Charging Time	4 hours
POWER	Battery Life	>10,000 measurements per charge
	Standby Time	5,000 hours
	Instant On	Max 5 sec from standby to ready to measure
	Auto-Sleep Function	5 minutes

INSTRUMENT CAPABILITY		
PICK-UP ASSEMBLY	Pick-Up Type	Piezoelectric
	Stylus Type	Diamond, Radius 200µin (5µm)
GAGE	Gage Force	200mg
	Measurement Type	Skidded
FILTER	Filter Type	Gaussian
	Filter Cut-Off	0.8mm
TRAVERSE	Traverse Length	0.2in (5mm)
	Traverse Speed	0.08in/sec (2mm/sec)
DISPLAY	Units	µin/µm

ENVIRONMENTAL/PHYSICAL		
PHYSICAL SPECIFICATIONS	Weight Including Pick-Up	14oz (0.4kg)
	Power Source	Li-Poly rechargeable battery
OPERATING CONDITIONS	Temperature	41 - 104°F (5 -40°C)
	Humidity	0 - 80% non-condensing
STORAGE	Temperature	32 - 122°F (0 - 50°C)
	Humidity	0 - 80% non-condensing

SR160 DIMENSIONS



WHAT IS A SKID?

The SR160 is a skidded device. The skid guides the pick-up along the workpiece, with the workpiece itself forming the datum for measurement. This method usually eases set-up by reducing the need for leveling. It also reduces the effects of vibration due to a much smaller measuring loop.

The skid is an integral part of the gauge and has a radius large enough to prevent movement in and out the roughness characteristics of the surface. The stylus and the skid are independent in their height (Z) movement but move together in the measurement direction. Surface deviations are recorded as the difference between the stylus and the skid movement in the Z direction.

The skid will act as a mechanical filter, taking out much of the general form of the component. Also, wavelengths greater than the diameter of the skid will not register.

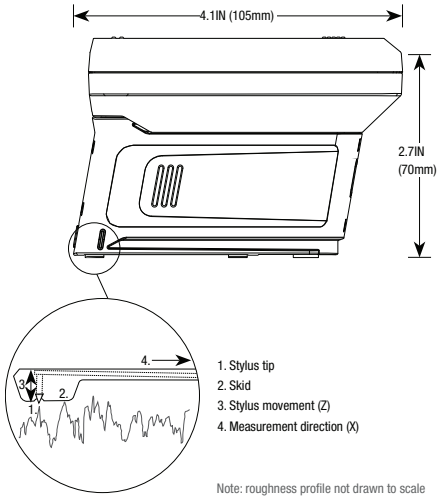
ENGLISH

HOW MUCH DIFFERENCE DOES THE STYLUS TIP SIZE MAKE?

These instruments use a 200µin (5µm) stylus tip radius. This suits their purpose as a portable tool for checking roughness in three ways:

- **Durability** – It is less likely to be damaged even when subjected to mishandling.
- **Maintenance** – It is easier to remove dirt and oil that collects on the tip during use.
- **Suitability** – It acts as a filter to remove the highest surface frequencies that are more reliably measured in a controlled environment.

Other Starrett instruments use a stylus with a tip radius of 80µin (2µm). This smaller radius coupled with an inductive gage head having low contact force enables analysis of even the smallest surface imperfections.



1. Stylus tip
2. Skid
3. Stylus movement (Z)
4. Measurement direction (X)

Note: roughness profile not drawn to scale

QUICK START GUIDE