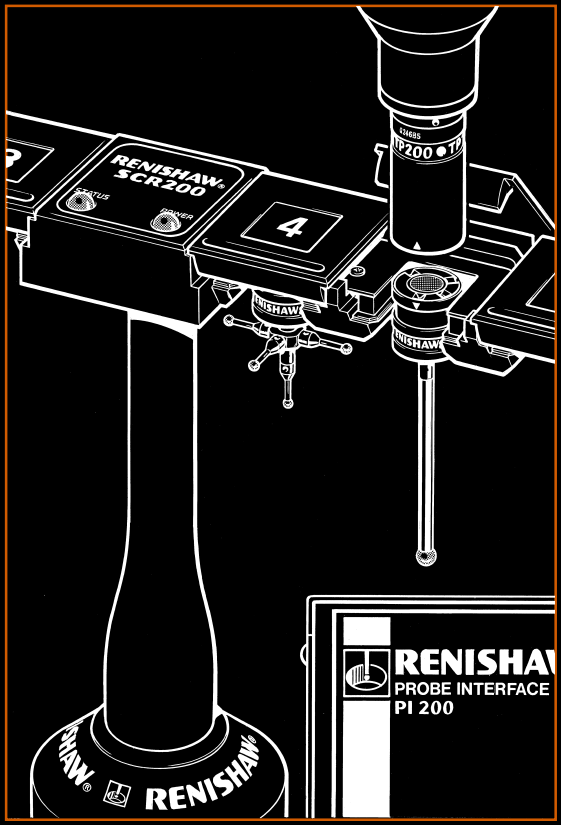
H-1000-5014-01-A



RENISHAW®

TP200 and SCR200
User's Guide

H-1000-5014-01-A

User's Guide

TP200
Precision touch-trigger probe
and
SCR200
Stylus change rack

CE

RENISHAW

Renishaw plc, New Mills, Wotton-under-Edge,
Gloucestershire GL12 8JR,
United Kingdom.

Telephone: (44) 1453 524524
Fax: (44) 1453 524901
Telex: 437120 RENMET G
e-mail: genenq@renishaw.co.uk
Internet: http://www.renishaw.com

Changes to specification
Renishaw plc may modify or change its products or specifications without notice and without obligation.

Warranty
Renishaw plc warrants its products provided they are installed as defined in the associated Renishaw documentation.

Consent must be obtained from Renishaw plc if non-Renishaw equipment (such as interfaces or cabling) is to be used or substituted. Failure to do this may invalidate the Renishaw warranty.

Patents
Aspects of the TP200 system and aspects of similar systems are the subjects of the following patents and patent applications.

EP 0068899	JP 1556462	US 4462162
EP 0142373	JP 187,808/1993	US 4651405
EP 0243766	JP 2,098,080	US 4813151
EP 0293036	JP 2,510,804	US 4817362
EP 0388993	JP 2,539,824	US 4916339
EP 0470234	JP 2,545,082	US 5,228,352
EP 0501710	JP 2,647,881	US 5,323,540
EP 0641427	JP 501,776/1994	US 5,327,657
EP 0750171	JP 503,652/1994	US 5,339,535
EP 242747 B	JP 506,706/1992	US 5,404,649
EP 279828 B	JP 507,145/1995	US 5,505,005
EP 548328 B		US 5,671,542
EP 566719 B		

GB

WARNINGS

In all applications involving the use of machine tools or CMMs, eye protection is recommended.

There are no user serviceable parts inside Renishaw's mains powered units. Return defective units to an authorised Renishaw Customer Service Centre.

Replace blown fuses with new components of the same type. Refer to the SAFETY section of the relevant product documentation.

For instructions regarding the safe cleaning of Renishaw products refer to the MAINTENANCE section of the relevant product documentation.

Remove power before performing any maintenance operations.

Refer to the machine supplier's operating instructions.

It is the machine supplier's responsibility to ensure that the user is made aware of any hazards involved in operation, including those mentioned in Renishaw product documentation, and to ensure that adequate guards and safety interlocks are provided.

Under certain circumstances the probe signal may falsely indicate a probe seated condition. Do not rely on probe signals to stop machine movement.

The expected method of providing an emergency stop for Renishaw products is to remove power.

F

AVERTISEMENTS

Le port de lunettes de protection est recommandé pour toute application sur machine-outil et MMC.

Aucune pièce des machines Renishaw alimentées sur secteur ne peut être réparée par l'utilisateur. Renvoyer toute machine défectueuse à un Centre Après Vente Renishaw agréé.

Remplacer les fusibles grillés par des composants neufs du même type. Consulter la section SECURITE de votre documentation.

Les conseils de nettoyage en toute sécurité des produits Renishaw figurent dans la section MAINTENANCE de votre documentation.

Mettre la machine hors tension avant d'entreprendre toute opération de maintenance.

Consulter le mode d'emploi du fournisseur de la machine.

Il incombe au fournisseur de la machine d'assurer que l'utilisateur prenne connaissance des dangers d'exploitation, y compris ceux décrits dans la documentation du produit Renishaw, et d'assurer que des protections et verrouillages de sûreté adéquats soient prévus.

Dans certains cas, il est possible que le signal du palpeur indique à tort l'état que le palpeur est au repos. Ne pas se fier aux signaux du palpeur qui ne garantissent pas toujours l'arrêt de la machine.

La procédure habituelle d'arrêt d'urgence des produits Renishaw est la mise hors tension.

D

ACHTUNG

Bei der Bedienung von Werkzeugmaschinen oder Koordinatenmeßanlagen ist Augenschutz empfohlen.

Die betriebenen Renishaw-Einheiten enthalten keine Teile, die vom Anwender gewartet werden können. Im Falle von Mängeln sind diese Geräte an Ihren Renishaw Kundendienst zu senden.

Durchgebrannte Sicherungen müssen mit gleichwertigen ersetzt werden. Beziehen Sie sich bitte auf die SICHERHEITS (SAFETY) in der Produktdokumentation.

Anleitungen über die sichere Reinigung von Renishaw-Produkten sind in Kapitel WARTUNG (MAINTENANCE) in der Produktdokumentation enthalten.

Bevor Wartungsarbeiten begonnen werden, muß erst die Stromversorgung getrennt werden.

Beziehen Sie sich auf die Wartungsanleitungen des Lieferanten.

Es obliegt dem Maschinenlieferanten, den Anwender über alle Gefahren, die sich aus dem Betrieb der Ausrüstung, einschließlich der, die in der Renishaw Produktdokumentation erwähnt sind, zu unterrichten und zu versichern, daß ausreichende Sicherheitsvorrichtungen und Verriegelungen eingebaut sind.

Unter gewissen Umständen könnte das Meßtastersignal falscherweise melden, daß der Meßtaster nicht ausgelenkt ist. Verlassen Sie sich nicht allein auf Sondensignale, um sich über Maschinenbewegungen zu informieren.

Renishaw-Produkte sollen im Notfall durch Trennen der Stromversorgung gestoppt werden.

I

AVVERTENZE

Si raccomanda di indossare occhiali di protezione in applicazioni che comportano macchine utensili e macchine per misurare a coordinate.

All'interno degli apparecchi Renishaw ad alimentazione di rete elettrica, non vi sono componenti adatti a interventi di manutenzione da parte dell'utente. In caso di guasto, rendere l'apparecchio a uno dei Centri di Assistenza Renishaw.

I fusibili bruciati dovranno essere sostituiti con quelli dello stesso tipo. Consultare la sezione SICUREZZA (SAFETY) della documentazione del prodotto.

Per le istruzioni relative alla pulizia dei prodotti Renishaw, fare riferimento alla sezione MANUTENZIONE (MAINTENANCE) della documentazione del prodotto.

Prima di effettuare qualsiasi intervento di manutenzione, isolare dall'alimentazione di rete.

Consultare le istruzioni d'uso del fabbricante della macchina.

Il fornitore della macchina ha la responsabilità di avvertire l'utente dei pericoli inerenti al funzionamento della stessa, compresi quelli riportati nelle istruzioni della Renishaw, e di mettere a disposizione i ripari di sicurezza e gli interruttori di esclusione.

E' possibile, in certe situazioni, che la sonda emetta erroneamente un segnale che la sonda è in posizione. Evitare di fare affidamento sugli impulsi trasmessi dalla sonda per arrestare la macchina.

Lo stop d'emergenza per i prodotti Renishaw è l'isolamento dall'alimentazione elettrica.

E

ADVERTANCIAS

Se recomienda usar protección para los ojos en todas las aplicaciones que implican el uso de máquinas herramientas y máquinas de medición de coordenadas.

Dentro de las unidades Renishaw que se enchufan a la red, no existen piezas que puedan ser mantenidas por el usuario. Las unidades defectuosas deben ser devueltas a un Centro de Servicio al Cliente Renishaw.

Sustituir los fusibles fundidos con componentes nuevos del mismo tipo. Remitirse a la sección titulada SEGURIDAD (SAFETY) en la documentación sobre el producto.

Para instrucciones sobre seguridad a la hora de limpiar los productos Renishaw, remitirse a la sección titulada MANTENIMIENTO (MAINTENANCE) en la documentación sobre el producto.

Quitar la corriente antes de emprender cualquier operación de mantenimiento.

Remitirse a las instrucciones de manejo del proveedor de la máquina.

Corresponde al proveedor de la máquina asegurar que el usuario esté consciente de cualquier peligro que implica el manejo de la máquina, incluyendo los que se mencionan en la documentación sobre los productos Renishaw y le corresponde también asegurarse de proporcionar dispositivos de protección y dispositivos de bloqueo de seguridad adecuados.

Bajo determinadas circunstancias la señal de la sonda puede indicar erroneamente que la sonda está asentada. No fiarse de las señales de la sonda para parar el movimiento de la máquina.

El método previsto para efectuar una parada de emergencia de los productos Renishaw es el de quitar la corriente.

P

AVISOS

Em todas as aplicações que envolvam a utilização de Máquinas-Ferramenta e CMMs, recomenda-se usar protecção para os olhos.

Não há peças que possam ser consertadas pelo utilizador dentro das unidades Renishaw alimentadas pela rede. Devolver unidades avariadas a um Centro de Atendimento a Clientes Renishaw.

Substituir fusíveis fundidos por novos componentes do mesmo tipo. Consultar a secção SEGURANÇA (SAFETY) da documentação do produto.

Para instruções relativas à limpeza segura de produtos Renishaw, consultar a secção MANUTENÇÃO (MAINTENANCE) da documentação do produto.

Desligar a alimentação antes de efectuar qualquer operação de manutenção.

Consultar as instruções de funcionamento do fornecedor da máquina.

É responsabilidade do fornecedor da máquina assegurar que o utilizador é consciencializado de quaisquer perigos envolvidos na operação, incluindo os mencionados na documentação do produto Renishaw e assegurar que são fornecidos resguardos e interbloqueios de segurança adequados.

Em certas circunstâncias, o sinal da sonda pode indicar falsamente uma condição de sonda assentada. Não confiar em sinais da sonda para parar o movimento da máquina.

O método esperado de proporcionar uma paragem de emergência para produtos Renishaw é desligar a alimentação.

DK

ADVARSLER

I alle tilfælde, hvor der anvendes værktøjs- og koordinatmålemaskiner, anbefales det at bære øjenbeskyttelse.

Der er ingen dele inde i Renishaw-enhederne, som sluttes til lysnettet, der kan efterses eller repareres af brugeren. Send alle defekte enheder til Renishaws kundeservicecenter.

Udskift sikringer, der er sprunget, med nye komponenter af samme type. Se i afsnittet SIKKERHED (SAFETY) i produktdokumentatione.

Se afsnittet VEDLIGEHOLDELSE (MAINTENANCE) i produktdokumentationen for at få instruktioner til sikker rengøring af Renishaw-produkter.

Afbryd strømforsyningen, før der foretages vedligeholdelse.

Se maskinleverandørens brugervejledning.

Det er maskinleverandørens ansvar at sikre, at brugeren er bekendt med eventuelle risici i forbindelse med driften, herunder de risici, som er nævnt i Renishaws produktdokumentation, og at sikre, at der er tilstrækkelig afskærmning og sikkerhedsblokeringer.

Under visse omstændigheder kan sondesignalet ved en fejl angive, at sonden står stille. Stol ikke på, at sondesignaler stopper maskinens bevægelse.

Den forventede metode til nødstop af Renishaw-produkter er afbrydelse strømforsyningen.

NL

WAARSUCHSWINGEN

Het dragen van oogbescherming wordt tijdens gebruik van Machinewerktuigen en CMM's aanbevolen.

De onderdelen van Renishaw units die op het net worden aangesloten kunnen niet door de gebruiker onderhouden of gerepareerd worden. U kunt defecte units naar een erkend Renishaw Klantenservice Centrum brengen of toezenden.

Doorgeslagen zekeringen met nieuwe componenten van hetzelfde type vervangen. U wordt verwezen naar het hoofdstuk VEILIGHEID (SAFETY) in de produktendocumentatie.

Voor het veilig reinigen van Renishaw produkten wordt verwezen naar het hoofdstuk ONDERHOUD (MAINTENANCE) in de produktendocumentatie.

Voordat u enig onderhoud verricht dient u de stroom uit te schakelen.

De bedieningsinstructies van de machineleverancier raadplegen.

De leverancier van de machine is ervoor verantwoordelijk dat de gebruiker op de hoogte wordt gesteld van de risico's die verbonden zijn aan bediening, waaronder de risico's die vermeldm worden in de produktendocumentatie van Renishaw. De leverancier dient er tevens voor te zorgen dat de gebruiker is voorzien van voldoende beveiligingen en veiligheidsgrendelinrichtingen.

Onder bepaalde omstandigheden kan het sondesignaal een onjuiste sondetoestand aangeven. Vertrouw niet op de sondesignalen voor het stoppen van de machinebeweging.

In geval van nood wordt er verwacht dat het Renishaw produkt wordt stopgezet door de stroom uit te schakelen.

SW

VARNING

Ögonskydd rekommenderas för alla tillämpningar som involverar bruket av maskinverktyg och CMM.

Det finns inga delar som användaren kan utföra underhåll på inuti Renishaws nätströmsdrivna enheter. Returnera defekta delar till ett auktoriserat Renishaw kundcentra.

Byt ut smälta säkringar med nya av samma typ. Se avsnittet SÄKERHET (SAFETY) i produktdokumentationen.

För instruktioner angående säker rengöring av Renishaws produkter, se avsnittet UNDERHÅLL (MAINTENANCE) i produktdokumentationen.

Koppla bort strömmen innan underhåll utförs.

Se maskintillverkarens bruksanvisning.

Maskinleverantören ansvarar för att användaren informeras om de risker som drift innebär, inklusive de som nämns i Renishaws produktdokumentation, samt att tillräckligt goda skydd och säkerhetsförreglingar tillhandahålls.

Under vissa omständigheter kan sondens signal falskt ange att en sond är monterad. Lita ej på sondsignaler för att stoppa maskinens rörelse.

Metoden för nödstopp för Renishaws produkter förutsätter att strömmen kopplas bort.

FIN

VAROITUKSIA

Kaikkia työstökoneita ja koordinoituja mittauskoneita (CMM) käytettäessä suositamme silmäsuojuksia.

Sähköverkkoon kytkettävät Renishaw-tuotteet eivät sisällä käyttäjän huollettavissa olevia osia. Vialliset osat tulee palauttaa valtuutetulle Renishaw-asiakaspalvelukeskukselle.

Vaihda palaneiden sulakkeiden tilalle samantyyppiset uudet sulakkeet. Lue tuoteselosteen TURVALLISUUTTA (SAFETY) koskeva osa.

Renishaw-tuotteiden turvalliset puhdistusohjeet löytyvät tuoteselosteen HUOLTOA (MAINTENANCE) koskevasta osasta.

Kytke pois sähköverkosta ennen huoltotoimenpiteitä.

Katso koneen toimittajalle tarkoitettuja käyttöhjeita.

Koneen toimittaja on velvollinen selittämään käyttäjälle mahdolliset käyttöön liittyvät vaarat, mukaan lukien Renishaw'n tuoteselosteessa mainitut vaarat. Toimittajan tulee myös varmistaa, että toimitus sisältää riittävän määrän suojia ja lukkoja.

Tietyissä olosuhteissa anturimerkki saattaa osoittaa virheellisesti, että kyseessä on anturiin liittyvä ongelma. Älä luota anturimerkkeihin koneen liikkeen pysäyttämiseksi.

Renishaw-tuotteiden hätäpysäytys tehdään tavallisesti kytkemällä sähkö pois.

GR

ΠΡΟΕΙΔΟΠΟΙΗΣΕΙΣ

Σ× όλ×⇓ τι⇓ ×ωαρμογ×⇓ ποψ σψν×πάγονται τη ξρήση ×ργαλ×ίϖν μηξανημάτϖν και ×φαρτημάτϖν CMM, σψνιστάται η ξρήση σψσκ×ψή⇓ προστασία⇓ τϖν ματιϖν.

Σ× μονάδ×⇓ τη⇓ Renishaw μ× σύνδ×ση μ× το ηλ×κτρικό ρ×ύμα δ×ν ψπάρξοψν ×φαρτήματα ποψ να ξρ×ιάζονται σψντήρηση από το ξρήστη. Τψξόν ×λαττϖματικ×⇓ μονάδ×⇓ ×πιστρ×ωονται σ× ×φοψσιοδοτημ×νο Κ×ντρο Εφψπηρ×τηση⇓ τϖν Π×λατϖν τη⇓ Renishaw.

Τψξόν ασωάλ×ι×⇓ ποψ καίονται πρ×π×ι να αντικαυιστούνται μ× ν××⇓ ασωάλ×ι×⇓ τοψ ίδιοψ τύποψ. Βλ×π×τ× το κ×ωάλαιο ΑΣΦΑΛΕΙΑ (SAFETY) οτο διαωϖτιστικό ψλικό τοψ προϊόντο⇓.

Για οδηγί×⇓ ποψ αωορούν τον ασωαλή καυαρισμό τϖν προϊόντϖν Renishaw, βλ×π×τ× το κ×ωάλαιο ΣΨΝΤΗΡΗΣΗ (MAINTENANCE) στο διαωϖτιστικό ψλικό τοψ προϊόντο⇓.

Αποσψνδ×στ× το μηξάνημα από το ηλ×κτρικό ρ×ύμα προτού ×πιξ×ιρήσ×τ× τψξόν ×ργασί×⇓ σψντήρηση⇓.

Βλ×π×τ× τι⇓ οδηγί×⇓ λ×ιτοψργία⇓ τοψ προμηυ×ψτή τοψ μηξανήματο⇓.

Αποτ×λ×ί ×ψυύνη τοψ προμηυ×ψτή τοψ μηξανήματο⇓ να ×φασωαλίσ×ι ότι ο ξρήστη⇓ ×ίναι ×νήμ×ρο⇓ τψξόν κινδύνϖν ποψ σψν×πάγ×ται η λ×ιτοψργία, σψμπ×ριλαμβανομ×νϖν και όσϖν αναω×ρονται στο διαωϖτιστικό ψλικό τοψ προϊόντο⇓ τη⇓ Renishaw. Είναι ×πίση⇓ ×ψυύνη τοψ να ×φασωαλίσ×ι ότι ψπάρξοψν τα απαιτούμ×να προστατ×ψτικά καλύμματα και σψνδ×σ×ι⇓ ασωαλ×ία⇓.

Ψπό ορισμ×ν×⇓ σψνυήκ×⇓ μπορ×ί το σήμα ανιξν×ψτή να δϖσ×ι ×σωαλμ×νη ×νδ×ιφη υ×ση⇓ τοψ ανιξν×ψτή. Μη βασίζ×στ× στα σήματα ανιξν×ψτή για υ×ση τη⇓ κίνηση⇓ τοψ μηξανήματο⇓ ×κτό⇓ λ×ιτοψργία⇓.

Η ×γκ×κριμ×νη μ×υοδο⇓ υ×σ×ϖ⇓ τϖν μηξανημάτϖν Renishaw ×κτό⇓ λ×ιτοψργία⇓ σ× π×ρίπτϖση ανάγκη⇓ ×ίναι η αποσύνδ×ση από το ηλ×κτρικό ρ×ύμα.

SAFETY

The PI200 interface unit must be connected to a supply incorporating a protective earth conductor via a three-core mains cable (line cord).

Electrical ratings

Supply voltage range	85V - 264V
Power frequency range	47Hz - 63Hz
Power consumption	10W
Fuse type	1A (T) HBC, 250V

Operating conditions

The **PI200 interface unit** is specified to operate under the following conditions which comply with (or exceed) those of standard BS EN 61010-1: 1993/A2: 1995.

Protection provided by enclosure	IP30
Altitude	Maximum 2000m
Operating temperature	0°C to 50°C
Storage temperature	-10°C to +70°C
Relative humidity	Maximum 80% RH up to +31°C, decreasing linearly to a maximum 50% at +40°C.
Transient overvoltage	Installation category II
Pollution degree	2

PRODUCT CARE

Your Renishaw probe and accessories are precision instruments. Please use and maintain the products in accordance with these instructions.

Please retain the transit box for storing the components when not in use.

Caution

The TP200 probe contains sensitive silicon strain sensors.

Permanent damage may be caused if the probe is dropped or subjected to severe shock as may be caused by misuse.

Contents

Table of contents

Introduction

The TP200 is a 13mm diameter touch-trigger probe with the facility to quickly change stylus configurations without the need for requalification. Electronic strain sensing techniques are used to improve on the form measuring accuracy and operating life that can be achieved with kinematic switching probes.

The TP200 probe is a two piece design comprising the **probe sensor** and a detachable **stylus module** that holds the stylus assembly.

The optional **SCR200 stylus change rack** provides storage for pre-qualified stylus assemblies and facilitates automatic stylus changing under measurement program control.

The probe and rack are powered by the dedicated **PI200 interface**, which performs signal processing and communicates with the CMM controller.

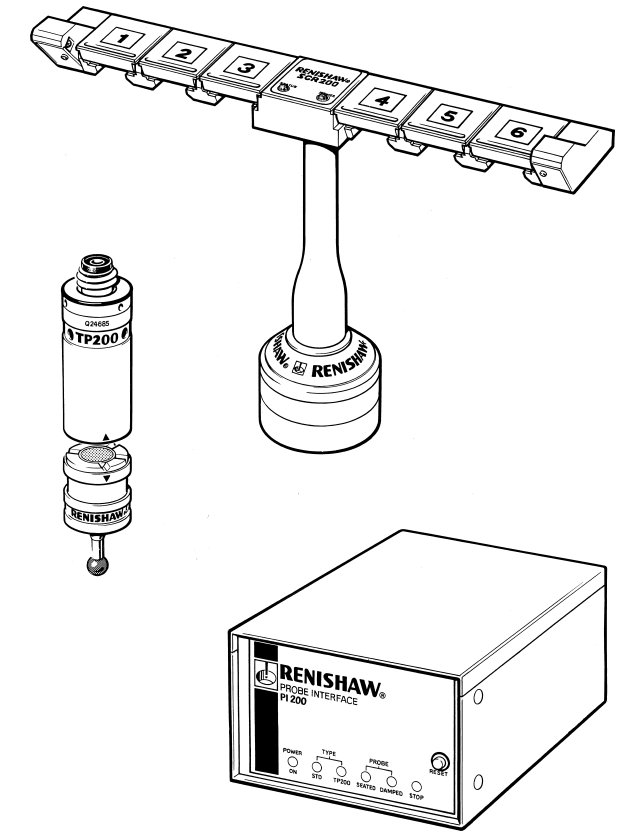


Figure 1 - The TP200 precision touch-trigger probe system

Product description

Probe sensor

The probe sensor body houses the strain sensing structure and electronic processing.

When the stylus contacts the workpiece, in a normal gauging move, the force applied to the stylus tip is transferred, through the stylus module and the coupling at the front of the sensor body, to the silicon strain sensors. A tip deflection of a few μm is sufficient to trigger the probe. The sensor signals are amplified and conditioned in a hybrid microcircuit electronic assembly. The sensor data and control signals are communicated between the probe and the PI200 interface over a normal pair of screened wires, allowing the TP200 system to be compatible with the majority of Renishaw probe heads and accessories.

The stylus module is located in position on the front of the sensor by a magnetically held, kinematic coupling. The coupling allows the stylus module to be removed and then replaced such that the stylus tip returns to a highly repeatable spatial position, eliminating the need for requalification.

Stylus module

The stylus module carries the M2 stylus mount and provides overtravel in the X, Y and +Z probe axes. Overtravel in the -Z probe axis is accommodated by separation of the module from the probe sensor body.

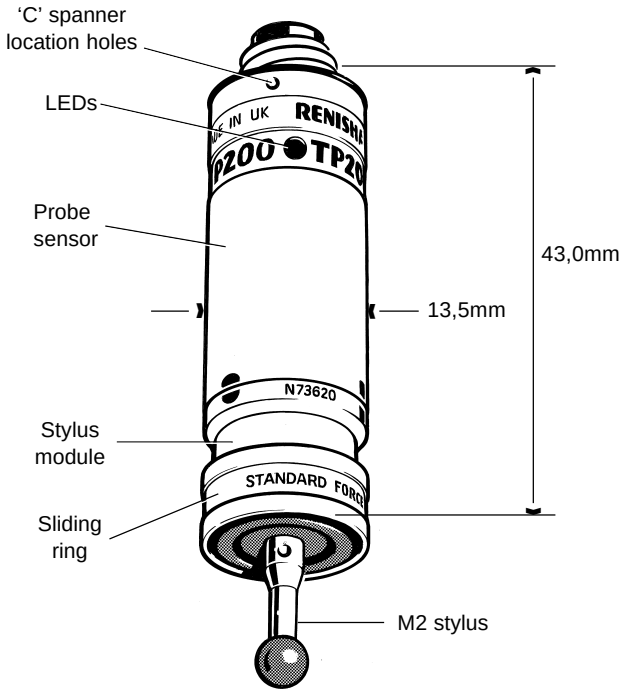


Figure 2 - The TP200 precision touch-trigger probe

The module houses the mating half of the magnetically held kinematic coupling (see Figure 6), which ensures repeatable positioning on the probe sensor. The coupling consists of 3 bearing points formed by the V grooves on the rear of the stylus module, which seat on 3 ball bearings located on the front of the probe sensor. The fourth V groove and semi-recessed ball form an alignment feature to ensure that the module has a unique orientation in the rotational axis. The module and stylus axis will be visibly misaligned if the coupling is not correctly seated.

Alignment symbols (see Figure 6) are provided to assist manual alignment.

The module cover forms a sliding ring (see Figure 2), which transfers excess force to the case of the sensor if the maximum Z axis overtravel distance is exceeded.

The stylus module is available in 2 overtravel force options. Standard force is suitable for the majority of applications and provides maximum stylus carrying capability. Low force is intended for use with small diameter stylus balls or where minimum force is essential.

PI200 interface

The PI200 interface unit powers and services the TP200 probe and up to two SCR200 stylus change racks. The PI200 will service kinematic switching probes (TP2, TP20, TP6), in addition to the TP200. The PI200 automatically recognises the probe type, determines the status of the probe and transmits probe trigger signals to the CMM controller.

When automatic stylus changing is performed using the SCR200 change rack, the PI200 inhibits probe triggering and resets the TP200 probe sensor to account for the loading effects of the new stylus assembly on the strain sensors. In the event of rack overtravel or error condition, the PI200 transmits signals to the CMM controller to stop CMM motion.

During high speed position moves (fast traverse), it is necessary to reduce probe sensitivity to prevent vibration causing unwanted triggers. The CMM controller automatically switches the PI200 into a low sensitivity mode, such that vibration triggers are prevented but a trigger is still issued, to stop CMM motion, if an unexpected collision occurs. This mode is known as ‘probe damped mode’ and is indicated by an LED on the PI200 front panel. Note that the probe cannot take accurate points when damped mode is selected.

The CMM manufacturer sets the configuration of the PI200 and it should not be necessary for the user to make adjustments except to operate the reset button, as explained later in this handbook.

SCR200 stylus change rack

The SCR200 holds and protects up to 6 stylus modules for automatic changing. The modules are magnetically held in the docking ports to allow the rack to be mounted in any orientation and to eliminate the need for high accuracy positioning. No special commands are necessary, as stylus changing requires only simple position moves to be programmed.

The SCR200 incorporates a system of infrared light beams and a Hall effect sensor to detect the presence of the probe and to signal the PI200 interface that stylus changing is in progress. A self-test mode checks operation of the light beams during power-up.
The rack is provided with an overtravel mechanism to reduce the possibility of damage should a collision occur. When the mechanism is deflected, STOP, SYNC and HALT signals are transmitted to the CMM controller to stop CMM motion. The overtravel mechanism is self-resetting. After a collision, the rack should return to its normal operating position and should not require re-datuming.

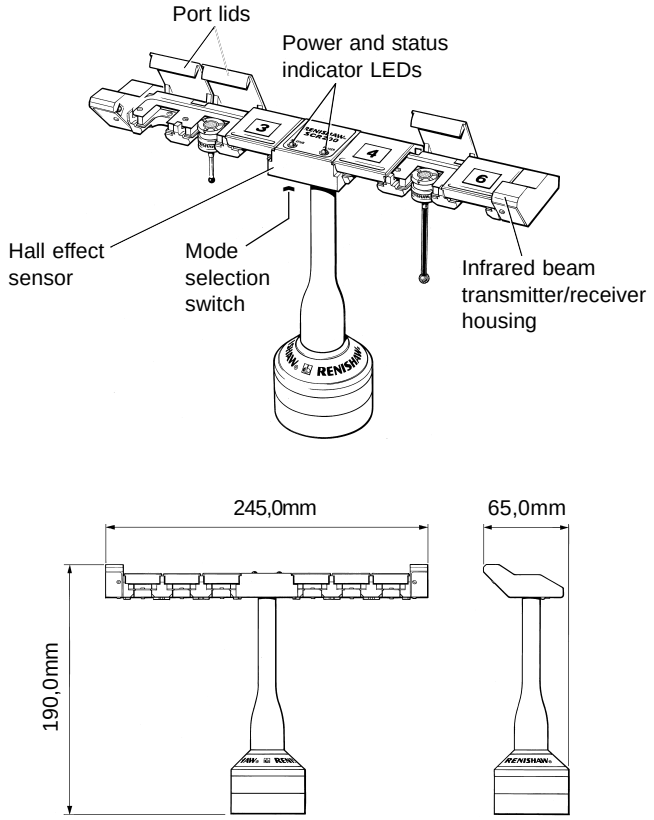


Figure 3 - The SCR200 stylus change rack

Part number summary

Probe kit - Standard force	**A-1207-0001**
Probe kit - Low force	**A-1207-0002**

Contents:

- TP200 sensor
- Stylus module
- Tools/cleaning kit
- Test certificate
- User's Guide

Stylus module - Standard force	**A-1207-0010**
Stylus module - Low force	**A-1207-0011**
Stylus change rack kit – Standard force	**A-1207-0030**
Stylus change rack kit – Low force	**A-1207-0070**

Contents:

- SCR200 rack
- Stylus modules (quantity 3)
- Mounting kit
- Datuming stylus

SCR200 cable – 5m long (PL63)	**A-1016-7630**
SCR200 cable – 10m long (PL64)	**A-1016-7631**
SCR200 cable – 20m long (PL65)	**A-1016-7632**
Dual SCR200 cable (PL97)	**A-1016-7660**
M12 location piece	**M-1371-0298**
Datum stylus (PS2R)	**A-5000-3603**
Replacements: -	
CK200 cleaning material	**A-1085-0016**
S1 'C' spanner	**A-1042-1486**
S9 double ended 'C' spanner	**A-1047-3932**
S7 stylus tool	**M-5000-3540**
hexagon key 1,5mm AF	**P-TL03-0150**

Installation procedure - TP200 probe

Mounting the probe sensor on the probe head

- Take great care not to drop the probe when installing.
  Mount the probe sensor on the probe head before fitting a stylus module.

Probe heads with M8 connector

- See Figure 4.
- Screw the threaded end of the probe sensor into the M8 connector, on the probe head, until it is finger-tight.
- Fit the S1 ‘C’ spanner (supplied) to the location holes and tighten by hand.
- The recommended tightening torque is 0.3Nm – 0.5Nm.

Probe heads with Renishaw Autojoint

- See Figure 5.
- Before fitting to the probe head, screw the probe sensor to a PAA series adaptor, as instructed above for M8 heads.
- Locate the adaptor on the probe head and lock the Autojoint using an S10 key.

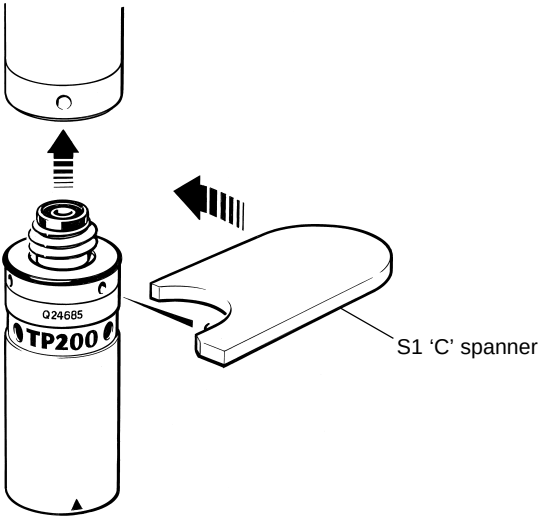


Figure 4 - Assembling the TP200 probe sensor to a M8 probe head

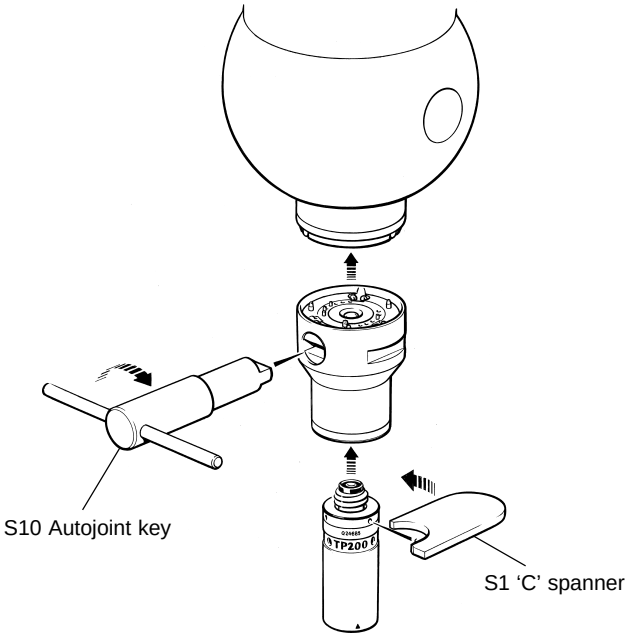


Figure 5 - Assembling the TP200 probe sensor to an Autojoint probe head

Assembling a stylus to a stylus module

- For a one-piece stylus, screw the stylus into the threaded mount on the module until finger-tight. Fit an S7 pin spanner (supplied) into the stylus cross-hole and tighten using finger pressure to achieve the recommended torque of between 0.05Nm and 0.15Nm. (Note the maximum permissible torque is 0.3Nm).

- Where an offset or star stylus arrangement is to be used, assemble the arrangement loosely and offer the module up to the probe sensor to check alignment. Adjust the alignment with the module removed and tighten as described above using one or two S7 pin spanners as necessary.

- Styli from the Renishaw GF (carbon fibre reinforced plastic) range must be tightened using the S20 tightening tool (supplied with the stylus kit). When tightening GF styli or extension pieces do not apply torque to the stylus stem. It may be necessary to use two S20 tools or S20 and S7 tools in combination to tighten adjacent threaded couplings. Refer to the instruction leaflet (H-1000-4003) provided with the stylus kit.

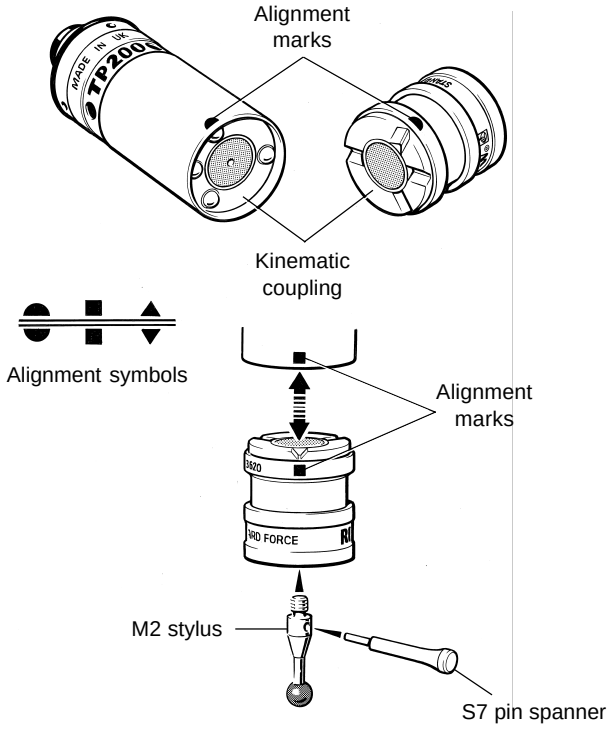


Figure 6 - Assembling a stylus to the stylus module and mounting the stylus module to the probe sensor

Mounting the stylus module to the probe sensor

- See Figure 6.

- Visually examine the mating faces of the stylus module and the probe sensor for dirt or other contamination. Clean if necessary using the CK200 cleaning material (supplied), (refer to the **'Maintenance'** section).

- Offer up the stylus module to the probe sensor ensuring that the alignment symbols are matched.
  Allow the stylus module to engage under the pull of the magnetic force.

- Reset the probe as described in the section **'Resetting the probe'**.

Resetting the probe

Press the RESET button, on the front panel of the PI200 interface, for 2 seconds to reset the probe sensor to the seated (armed) state.

CAUTION: Probe triggers are inhibited when the RESET button is pressed. Before pressing the button, the CMM must be stationary in manual mode with the probe stylus clear of the workpiece.

NOTE: When the TP200 is mounted on a PH9 or PH10 series motorised head, the action of unlocking and locking the head will perform the same function as the RESET button,

TP200 probe operation

The TP200 probe has 2 normal operating states, armed or triggered. The probe should be in the armed state except for the moments when the stylus is deflected against the workpiece.

Probe armed

When the probe is armed (sometimes called ‘seated’ or ‘reset’) the following PI200 front panel indicators will be ON:

- POWER ON
- TYPE - TP200
- PROBE - SEATED

Additionally, the probe head LED will be ON and the LEDs on the TP200 probe sensor body will be OFF. The probe LEDs may sometimes glow slightly, indicating a low level of background vibration.

Probe triggered

When the stylus touches the workpiece the LEDs on the probe sensor body turn ON brightly. The SEATED and probe head LEDs will turn OFF.

The probe should be allowed to remain in the triggered state only for the minimum time necessary to reverse the CMM motion and back-off from the workpiece.

If the probe remains in the triggered state for more than 10 seconds, drift of the stylus zero reference position will occur and the PI200 will emit an audible warning. Back-off the probe from the workpiece and refer to the section **'Resetting the probe'**.

Changing a stylus module manually

- Ensure the CMM will remain stationary, in a safe condition.
- Remove the stylus module and store safely.
- To fit another module, refer to the section **'Mounting the stylus module to the probe sensor'**.
- When using MH8 or MIH probe heads, unlock and relock the head before resetting the probe.
- Reset the probe, refer to the section **'Resetting the probe'**.

Operation with a manual probe head

After manually re-orientating the probe when using PH1, MH8 or MIH probe heads, reset the probe. Refer to the section **'Resetting the probe'**.

Stylus module selection

The Standard force module is satisfactory for the majority of applications and provides the maximum stylus carrying capability.

The low force module should be employed where the application necessitates the use of styli with ball diameters less than 1,0mm (particularly the PS29R, A-5000-7800), or where lower overtravel force will reduce the risk of marking or deflecting the surface of the workpiece.

Note that the overtravel force, in the X-Y axis, varies with both direction and displacement for a given stylus length. In the X-Y axis there is a pattern of 3 maximum and minimum force directions as illustrated in Figure 7.

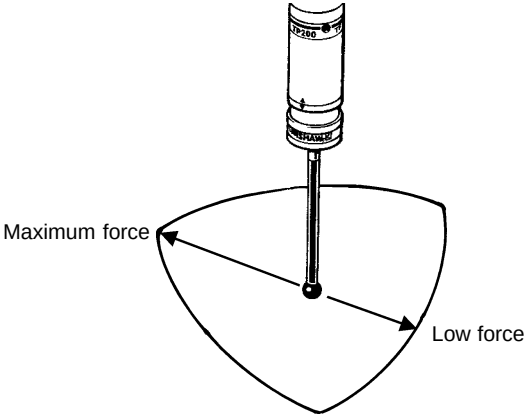


Figure 7 - Stylus force pattern

Stylus selection

To obtain the best performance apply the following considerations when selecting and fitting a stylus:

- Use the shortest possible stylus length.
- Minimise the mass of the stylus by using the types with ceramic or GF stems where possible. Refer to the Renishaw stylus catalogue for further information.
- Work within the recommended stylus limits.
- Ensure that stylus balls, threads and mating faces are kept clean.
- Tighten styli using only the tools provided.
- Use the stylus changing facility to optimise the styli for accuracy and feature access.
- Always qualify the styli at the gauging speed set for the part measurement program. If the speed is changed re-qualify the stylus tips.

Recommended stylus limits

The absolute maximum stylus carrying ability of the TP200 probe is determined by the mass of the stylus and the distance from the stylus holder to the centre of gravity. The limits are: -

Low force module – 3g at 20mm

Standard force module – 8g at 50mm

In practice the stylus carrying is restricted by CMM vibration level, probe orientation and CMM controller flexibility. The recommended limits are given in Figures 8 and 9.

It may be possible to exceed the recommended limits but the user is advised to conduct trials to establish the suitability for the application and the effect on measuring performance.

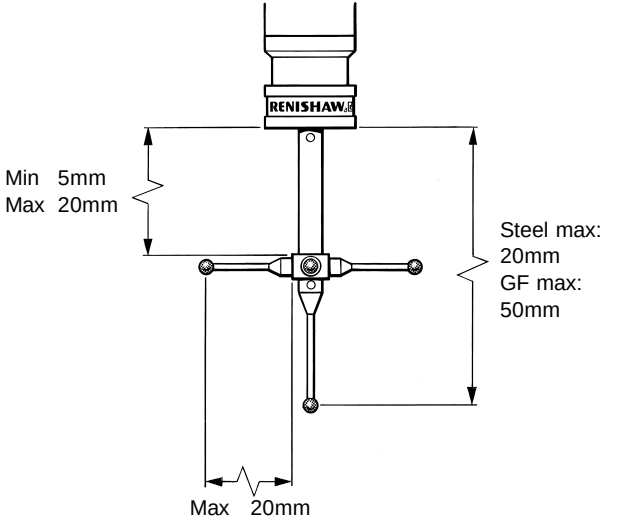


Figure 8 - Recommended stylus limits (Low force module)

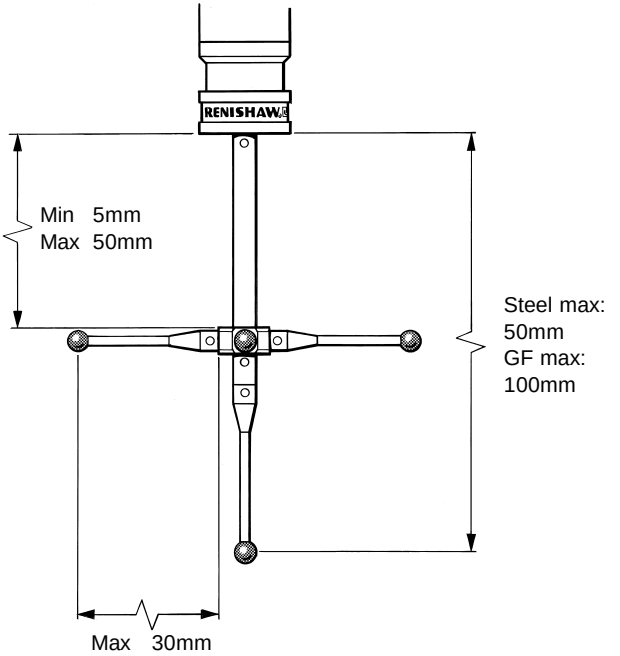


Figure 9 - Recommended stylus limits (Standard force module)

Trigger level

Under certain conditions, vibration may cause false ‘air’ triggers during gauging and it may be necessary to reduce the probe sensitivity. False triggers may occur when large or heavy stylus arrangements are used, or where there is floor transmission from nearby machinery or vehicles.

- Trigger level 1 - the highest sensitivity mode, provides the best measuring accuracy.
- Trigger level 2 – lower sensitivity to vibration but with a small loss of measuring accuracy.

The trigger level is selected by switch 10 on the rear panel of the PI200 interface:

- Level 1 - switch 10 DOWN
- Level 2 - switch 10 UP

NOTE: For versions of the PI200 prior to V9, the trigger level was adjusted by switch 11.

The trigger level selection does not affect sensitivity when the probe is in **damped mode**.

Please consult your CMM supplier before making any adjustment to the PI200 settings.

All stylus tips must be re-qualified after changing the trigger level.

Installation procedure - SCR200 rack

Mounting the SCR200 rack on the CMM

- See Figure 10.

- Place the location piece over a threaded insert at the desired location on the CMM table and screw down using a M8 or M10 bolt and hexagon key (supplied).

  A special location piece with integral bolt is available for M12 inserts.
  Part No. M-1371-0298
  Tighten the M12 location piece using a S1 ‘C’ spanner (supplied with the probe kit).

- Locate the base of the SCR200 rack over the location piece and partially tighten the fixing screw using the 1,5mm AF hexagon key (supplied).

- Before fully tightening the fixing screw, rotate the rack and align with the CMM axes as described in the following procedure.

NOTES: Your CMM supplier’s instructions will indicate the preferred method of alignment.

Alignment of the SCR200 with the CMM axes may be essential for some measurement programs or may be desirable for ease of programming.

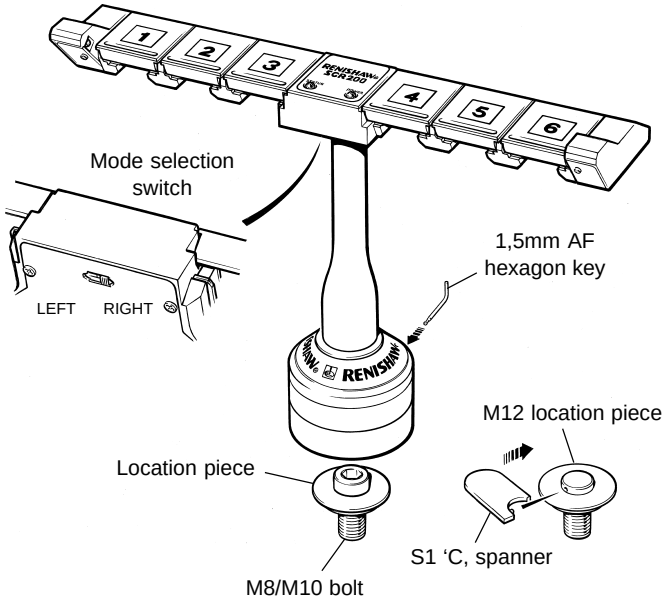


Figure 10 - Mounting the SCR200 rack to the CMM

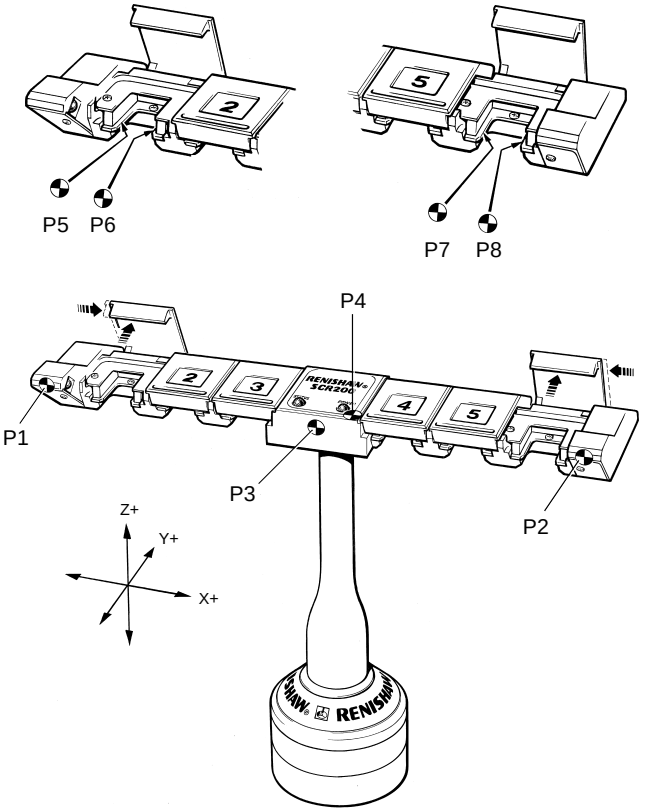


Figure 11 - Datuming the SCR200 rack

Aligning the SCR200 rack to the CMM axes

- Align the rack approximately, by eye.
- Take points P1 and P2 (see Figure 11).
- Carefully rotate the rack until the runout between points P1 and P2 is less than 0,2mm.
- Tighten the fixing screw using the 1,5mm AF hexagon key (supplied).

Datuming the SCR200 rack

Renishaw recommends that the PS2R stylus (supplied) is used to datum the SCR200 rack.

NOTE: For racks previously supplied with a PS35R stylus, the instructions are identical.

If a different stylus is used, the length (L) (minimum 20mm) and the ball radius (R) must be used to calculate offsets.

The following instructions assume uncompensated probing points are taken. Therefore, the target positions for stylus module changing are given in absolute machine co-ordinates. The X, Y, Z axis system refers to the rack axes indicated in Figure 11.

IMPORTANT
The SCR200 rack must NOT be connected to the PI200 interface when performing the datuming procedure.

- Remove the electrical connector before datuming the rack.

- Open the lids of ports 1 and 6 and latch in position by sliding towards the centre of the rack.

Establishing the docking depth (Y)

- Take point P3 (see Figure 11).

- The docking depth for all ports is:
  {Y = P3 + R (1mm) + 14,0mm}

Establishing the docking height (Z)

- Take point P4 on the top face (see Figure 11), ensuring that the point is not taken on the label.

- The docking height for all ports is:
  {Z = P4 – L (20mm) – R (1mm) – 18,6mm}.

Establishing the X-axis docking centres for Ports 1, 2 and 3 (X1, X2, X3)

- See Figure 11.

- Take points P5 and P6 using the stylus shank to gauge the edges of the module retention plate in port 1.

- The docking centre for port 1:
  {X1 = centre point P5/P6}

- The docking centre for port 2: **{X2 = X1 + 30mm}.**

- The docking centre for port 3: **{X3 = X1 + 60mm}.**

Establishing the X-axis docking centres for Ports 4, 5 and 6 (X4, X5, X6)

- See Figure 11.

- Take points P7 and P8 using the stylus shank to gauge the edges of the module retention plate in port 6.

- The docking centre for port 6 is:
  {centre point P7/P8 = X6}.

- The docking centre for port 4: **{X4 = X6 - 60mm}.**

- The docking centre for port 5: **{X5 = X6 - 30mm}.**

Summary of docking target co-ordinates

Port 1 = X1, Y, Z

Port 2 = X2, Y, Z

Port 3 = X3, Y, Z

Port 4 = X4, Y, Z

Port 5 = X5, Y, Z

Port 6 = X6, Y, Z

CAUTION:The constant Y value assumes the SCR200 is aligned to your CMM axes or is using its own co-ordinate system.

After datuming the rack

- Close the lids of ports 1 and 6.

- Select the operating mode (Tamper proof ON or OFF, refer to the **'Operating modes'** section).

- Connect the cable to the PI200 interface and observe the POWER and STATUS LEDs for correct indication.

- Refer to the section **'Loading stylus modules into the rack'.**

Electrical connection

Suitable cables for connection of the SCR200 rack to the PI200 interface are available from Renishaw in 3 standard lengths.

The cable part numbers are:

SCR200 cable	**5m long**	**(PL63)**	**A-1016-7630**
SCR200 cable	**10m long**	**(PL64)**	**A-1016-7631**
SCR200 cable	**20m long**	**(PL65)**	**A-1016-7632**

For applications requiring a second rack, a dual rack splitter cable is available.

The cable part number is:

Dual SCR200 cable	**(PL97)**	**A-1016-7660**

NOTE: 2 x standard rack cables of the correct length will be required in addition to the dual SCR200 adaptor cable, which must be installed at the PI200 end.

SCR200 rack operation

Operating modes

The SCR200 may be operated in either of 2 modes depending on the application requirements and whether the SCR200 is accessible in normal operation.

With TAMPER PROOF ON selected, the stylus change cycle is initiated by moving the probe across the face of the Hall sensor, for the rack to detect the presence of the probe before entering a docking port. In this mode, interruption of the light beams alone does not inhibit probe triggering and therefore the probe cannot be accidentally inhibited during normal operation. For example by placing fingers in the light beam or by operating a port lid.

With TAMPER PROOF OFF selected, direct entry to the rack ports is allowed. The light beams detect the probe entering a module docking port and inhibit probe triggers. In this mode faster stylus changing is possible but Renishaw recommend that it is used only in situations where access to the rack is restricted when the CMM is operating automatically.

To Select the operating mode

- Remove the electrical connector.
- Move the slide switch (see Figure 10): -

  LEFT for Tamper proof ON

  RIGHT for Tamper proof OFF
- Replace the electrical connector.

- Confirm that the POWER and STATUS lamps are indicating the correct mode.

Loading stylus modules into the rack
Renishaw recommend that the stylus modules are mounted to the probe sensor by hand and each tip qualified before loading into the rack.

The CMM should be used to load the stylus modules into the rack by following the procedure **'Storing a stylus module'**.

It is possible to load the rack by hand but care must be taken to ensure correct rotational alignment, as there is no warning if a module is incorrectly seated on the probe sensor and gross measurement errors will occur.

Power and status indicators

Two LED lamps are provided on the top face of the rack: -

POWER - green
STATUS - red

POWER	STATUS	SCR200 MODE
OFF	Flashing for 10s	Self-test, Tamper Proof ON
OFF	Flashing for 5s	Self-test, Tamper Proof OFF
ON	OFF	Rack idle, Tamper Proof ON
ON	ON	Rack idle, Tamper Proof OFF
ON	Flashing	Stylus changing
Flashing	Flashing	Self-test failed

Stylus changing procedure

Storing a stylus module - Tamper Proof ON.

See Figure 12.

Refer to the section **Datuming the SCR200 rack** for definitions of co-ordinates X(n), Y, Z.

1. Move to the START co-ordinates for activating the Hall sensor:
   {Xs, Ys, Z}
   where Xs = X1 + 82mm and
   Ys = P3 + R (1mm) - 7,5mm.

2. Move along the X- axis to:
   {Xs - 12mm}
   at a minimum speed of 5mm/s.

3. Move along the X axis to the centre line of the required vacant port (n):
   {X(n), Ys, Z}

NOTES: If the stylus assembly has an offset or star component projecting along the Y+ axis, it is permissible (after step 1) to move out along the Y- axis and exit the light beam for a maximum of 5s, to avoid a collision with the SCR200 leg or another stored stylus.

---

4. Move along the Y+ axis to the docking target co-ordinate for port (n):
   {X(n), Y, Z}

5. Move along the Z+ axis to the release co-ordinate:
   {X(n), Y, Zr}
   where Zr = Z + 3mm.

6. Move along the Y- axis to a co-ordinate clear of the port lid:
   {X(n), Ys, Zr}

Storing a stylus module - Tamper Proof OFF
Refer to the procedure for **Storing a stylus module - Tamper Proof ON**, omitting steps 1 and 2.

NOTE: It is not necessary to stop CMM motion at the start co-ordinates in this mode, provided that the port is entered along the Y+ axis at the specified X(n) and Z axis positions.

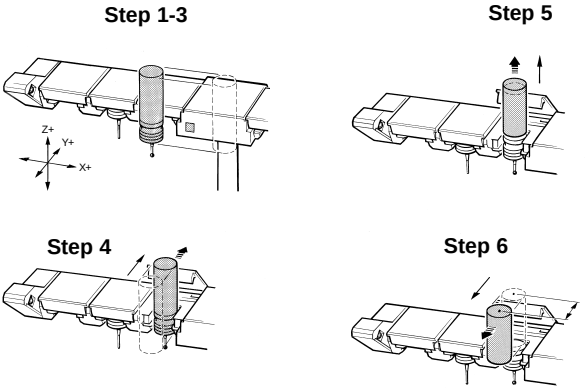


Figure 12 - Stylus changing procedure - storing a stylus module

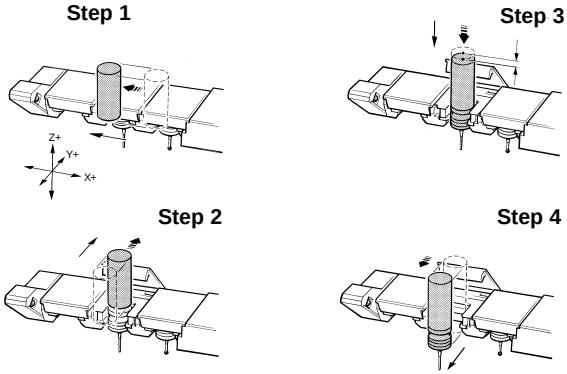


Figure 13 - Stylus changing procedure - picking up a stored stylus module

Picking up a stylus module

This procedure is applicable to both operating modes.

See Figure 13.

Refer to the section **'Datuming the SCR200 rack'** for definitions of co-ordinates X(n), Y, Z.

1. From the previous port co-ordinates:
   {X(n), Ys, Zr}
   Move along the X axis to the port (n) containing the required stylus module:
   {X(n), Ys, Zr}

2. Move along the Y+ axis to the port centre:
   {X(n), Y, Zr}

3. Move along the Z- axis to the docking target co-ordinate for port (n):
   {X(n), Y, Z}

4. Move along the Y- axis to a co-ordinate clear of the port lid:
   {X(n), Ys, Z}

Proceed with the part measurement program.

Specification

Measuring performance

The following data is derived from test rig measurements and may not represent the performance achievable on a CMM. Please contact your CMM supplier for overall system accuracy information.

NOTES: Tested with standard Renishaw M2 steel and GF styli. gauging speed 8mm/s.

Repeatability and XY (2D) form measurements as specified to Renishaw in-house test standards.

3D form measurements as specified to standard ASME B89.4.1-1997 for point-to-point probing.

1. Unidirectional repeatability (2σ µm)

Stylus length (mm)	Offset length (mm)	Trigger level	
		1 (µm)	2 (µm)
10		0,30	0,35
50		0,40	0,50
70		0,70	1,00
100		1,00	1,20
5	20	0,50	0,70
50	20	0,70	1,00

2. XY (2D) form measurement deviation

Stylus length (mm)	Offset length (mm)	Trigger level	
		1 (µm)	2 (µm)
10		±0,40	±0,50
50		±0,80	±0,90
70		±0,90	±1,50
100		±1,70	±2,00
5	20	±1,00	±1,20
50	20	±1,00	±1,20

3. XYZ (3D) form measurement deviation

Stylus length (mm)	Offset length (mm)	Trigger level	
		1 (µm)	2 (µm)
10		±0,65	±0,90
50		±1,00	±1,40
70		±2,00	±3,00
100		±4,00	±5,50
5	20	±1,50	±2,20
50	20	±3,00	±4,00

Repeatability of stylus change

Automatic change with SCR200	1,0µm max.
Manual change	2,0µm typical

Overtravel forces

Standard force module

Stylus length	XY Axis Low force (g)	XY Axis High force (g)	Z+ Axis (g)
20mm at typical overtravel	45	70	490
50mm at typical overtravel	20	40	490
50mm at max. overtravel	25	50	1500

Low force module

Stylus length	XY Axis Low force (g)	XY Axis High force (g)	Z+ Axis (g)
20mm at typical overtravel	20	30	160
50mm at typical overtravel	10	15	160
50mm at max. overtravel	15	25	450

Overtravel limits

XY axis	±14°
Z+ axis	4,4mm
Z- axis	4,0mm

Technical data

Trigger forces	2g (at 50mm stylus tip)
Gauging speed range	0,5mm/s - 80mm/s
Trigger rate	5 triggers/s max
Sense directions	6 way: ±X, ±Y, ±Z
Module life	>10 million triggers
Module pull-off force	800g - 1000g
Probe cable length	Max 50m x 0,22mm²
Probe cable resistance	Max 5Ω / conductor
Operating temperature range	+10°C to +40°C
Storage temperature range	-10°C to +70°C
Probe length	38mm
Probe diameter	13,5mm
Probe connector	M8 x 1,25 x 5mm
Stylus mount	M2 x 0,4mm
Sealing	IP30
Weight: sensor	15g
Weight: module	7g

Maintenance

TP200 probe and stylus module

The kinematic coupling mechanism, connecting the probe sensor to the stylus module, incorporates precision ball/V groove seatings. The coupling mechanism has been tested in a wide range of environments and is highly tolerant of non-metallic dust, but regular inspection and cleaning with the CK200 material (supplied) is recommended to ensure continued high performance.

Instructions for use are included with the cleaning material (Part No. A-1085-0016).

The user should determine the frequency of cleaning according to the conditions of use.

Stylus balls, threads and mating faces should be cleaned with a proprietary cleaning cloth or solvent.

Stylus modules that are not in use should be stored in spare ports in the SCR200 rack or in their transport boxes.

SCR200 rack

Periodic cleaning of the rack ports, lids and outer surfaces using a proprietary cleaning cloth, is recommended to prevent contamination of the modules.

Fault finding

Symptoms	**The CMM will not register a probe trigger, but the probe operates normally when the stylus is deflected by hand.**
PI200 indicators	'STOP' lamp ON. 'TP200 lamp ON. 'SEATED' LED operates normally.
Possible causes	The CMM controller or a Renishaw system has activated STOP signal. SCR200 overtravel mechanism is deflected.
Remedy	Check status of Renishaw motorised probe head or other systems. Clear obstruction and allow overtravel mechanism to reset.

Symptoms	**The probe fails to trigger and the probe LEDs glow only dimly when the stylus touches the workpiece, but the probe operates normally when the stylus is deflected by hand.**
PI200 indicators	'SEATED' LED ON.
Possible causes	The trigger speed is too slow. The stylus is too heavy.
Remedy	Probe normally to the workpiece surface. Increase gauging speed.

Symptoms	**The probe will not arm or the probe does not stay armed when the RESET button is released. The probe LEDs are always OFF.**
PI200 indicators	'STD' LED ON. 'SEATED' LED OFF.
Possible causes	Probe sensor faulty. Probe wiring open circuit.
Remedy	Remove probe and test by substitution. Check wiring from probe to PI200 interface.

Symptoms	**The probe will not arm or the probe does not stay armed when the RESET button is released. The probe LEDs are always ON.**
PI200 indicators	'TP200' LED ON 'SEATED' LED OFF.
Possible causes	Probe sensor faulty or damaged by collision.
Remedy	Remove probe and test by substitution.

Symptoms	**False ('air') triggers occur while the CMM is stationary and the probe LEDs flicker.**
PI200 indicators	'TP200' LED ON. 'SEATED' LED operates normally.
Possible causes	Probe sensor faulty. Probe loose in probe head. Excessive vibration from external source. Excessive vibration from CMM.
Remedy	Remove probe and test by substitution. Correctly tighten probe. Remove cause or isolate CMM. Check CMM air supply. Maintain CMM air bearing system.

Symptoms	**False ('air') triggers occur at gauging speed and the probe LEDs flicker.**
PI200 indicators	'DAMPED' LED is OFF. 'SEATED' LED operates normally.
Possible causes	Stylus is too large or heavy. Excessive vibration from CMM.
Remedy	Use stylus arrangements within recommendations. Check CMM air supply. Maintain CMM air bearing system.

Symptoms	**False ('air') triggers occur at traverse speed and the probe LEDs flicker.**
PI200 indicators	'DAMPED' LED is ON. 'SEATED' LED operates normally.
Possible causes	Stylus is too large or heavy. Excessive vibration from CMM. Traverse speed is too high.
Remedy	Use stylus arrangements within recommendations. Check CMM air supply. Maintain CMM air bearing system. Reduce traverse speed.

Symptoms	**The probe triggers during an SCR200 stylus change.**
PI200 indicators	'SEATED' LED operates normally.
Possible causes	The SCR200 is not connected to the PI200. Incorrect SCR200 operating mode.
Remedy	Check SCR200 indicator lamps. Re-connect cable.

Fault finding

Symptoms	**There is an unexpected loss of accuracy.**
PI200 indicators	'TP200' LED ON. 'SEATED' LED operates normally.
Possible causes	Stylus ball is damaged or dirty. Stylus is too large or heavy. The probe is loose or not correctly assembled. The kinematic coupling is damaged or dirty. The gauging speed has been changed. The trigger threshold has been changed.
Remedy	Inspect and clean stylus ball, or replace and re-qualify the stylus. Use stylus arrangements within recommendations. Check the stylus joints. Ensure the module is correctly seated and the probe is tight in the probe head. Inspect and clean the kinematic coupling. Re-qualify stylus tips.

Symptoms	**Deflection alarm active.**
PI200 indicators	Audible indicator ON.
Possible causes	The stylus is or was deflected for >10s. Stylus module was changed manually.
Remedy	Move the stylus clear of any obstruction and press the RESET button.

Accessories

High performance styli

For applications requiring styli longer than 40mm, the Renishaw range of lightweight 'GF' styli and extension pieces are recommended.

These are available individually or as a boxed kit (Part No. A-5003-2310). See the Renishaw stylus catalogue (Part No. H-1000-3200) for further information.

Extension bars and adaptors

Probe reach may be extended, with minimal loss of accuracy using extension bars. These are available in M8 – M8 or autojoint - M8 connector versions according to the type of probe head in use.

See the Renishaw catalogue 'Probing systems for co-ordinate measuring machines' (Part No. H-1000-5050) for details.

Module storage rack

For manual stylus changing applications the MSR1 storage rack is recommended. The rack holds and protects up to 6 stylus modules carrying pre-qualified stylus arrangements.

The rack is available with a bracket for wall mounting or with a leg and base for mounting on the CMM table.

MSR1 (wall mounted)	A-1371-0330
MSR1 (CMM table mounted)	A-1371-0347

Renishaw plc,
New Mills, Wotton-under-Edge,
Gloucestershire, GL12 8JR,
United Kingdom.
National **Tel** 01453 524 524
[07000 RENISHAW]
Fax 01453 524 901
International **Tel** +44 1453 524 524
Fax +44 1453 524 901
Telex 437120 RENMET G
email genenq@renishaw.com
Internet http://www.renishaw.com

Renishaw Latino Americana Ltda.,
Calçada dos Crisântemos 22,
C.C. Alphaville, C.e.p. 06453-000,
Barueri SP,
Brazil.
Tel +55 11 7295 2866
Fax +55 11 7295 1641

Renishaw (Hong Kong) Ltd.,
Unit 4A, 3/F, New Bright Building,
11 Sheung Yuet Road,
Kowloon Bay,
Hong Kong.
The Peoples' Republic of China.
Tel +852 2753 0638
Fax +852 2756 8786

Renishaw S.A.,
15 rue Albert Einstein, Champs sur Marne,
77437 Marne la Vallée, Cedex 2,
France.
Tel +33 1 64 61 84 84
Fax +33 1 64 61 65 26

Renishaw GmbH,
Karl-Benz Strasse 12,
72124 Pliezhausen,
Germany.
Tel +49 7127 9810
Fax +49 7127 88237

Renishaw S.p.A.,
Via dei Prati 5, 10044 Pianezza, Torino,
Italy.
Tel +39 011 9 66 10 52
Fax +39 011 9 66 40 83

Renishaw KK,
Across City Nakano-Sakaue,
38-1, Chuo 1-chome,
Nakano-ku, Tokyo 164-0011,
Japan.
Tel +81 3 5332 6021
Fax +81 3 5332 6025

Renishaw Iberica S.A.
Edificio Océano, Calle Garrotxa 10-12,
Parque Más Blau, 08820 Prat de LLobregat,
Barcelona,
Spain.
Tel +34 93 478 21 31
Fax +34 93 478 16 08

Renishaw A.G.,
Poststrasse 5, CH 8808 Pfäffikon,
Switzerland.
Tel +41 55 410 66 66
Fax +41 55 410 66 69

Renishaw Inc,
623 Cooper Court, Schaumburg, Illinois
60173,
U.S.A.
Tel +1 847 843 3666
Fax +1 847 843 1744

Renishaw's Representative Offices

Australia **Tel** +61 3 9553 8267
Melbourne **Fax** +61 3 9592 6738

The Peoples' Republic of China
Beijing. **Tel** +86 10 6410 7993
Fax +86 10 6410 7992

Indonesia **Tel** +62 21 428 70153
Jakarta. **Fax** +62 21 424 3934

Singapore **Tel** +65 897 5466
Fax +65 897 5467

South Korea **Tel** +82 2 565 6878
Seoul **Fax** +82 2 565 6879

Renishaw's Liaison Office

India **Tel** +91 80 509 5419
Bangalore **Fax** +91 80 509 5421

Ref: UG TP200 (E) 5c 0200
Part No. H-1000-5014-01-A

RENISHAW®